# TBS CROSSFIRE R/C System

Revision 2022-08-08

*Adaptive Long Range Remote Control System*

The TBS CROSSFIRE (XF) system is an R/C link system made for FPV enthusiasts. It features unheard-of range without sacrificing basic functionality such as being immune to interference from onboard equipment, low latency control, or two-way communications including telemetry functionality.

## Key features

- Long-range, adaptive, and robust remote control system for your aircraft
- Immune to on-board noise
- Two-way communication link with real-time link vitals and telemetry
- Self-healing frequency hopping link
- Receiver beacon mode to recover your downed aircraft
- Super easy binding and configuration via built-in OLED display, OpenTX LUA, or TBS TANGO remote
- Low latency control for perfect immersive feeling
- Free output mappable outputs diversity
- Ability to fly with multiple friends at the same time (10 or more)
- Dynamic self-selecting or selectable RF power (local restrictions apply)
- Dedicated head-tracking input option for full FPV immersion (Standard/ Lite TX only)
- Transmitter LED shows link health, OLED display for built-in configuration (Standard/ Lite TX only)

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# Specifications

| | |
|---|---|
| **Type:** | Long Range Two-Way Remote Control System |
| **Band:** | Europe: 868 MHz SRD Band (860 - 885MHz)<br>America: 915 MHz ISM Band (902-927MHz FCC, 915-928 AU) |
| **RF power<br>Radio Signal &<br>Telemetry downlink:** | Micro TX V1: Selectable 25mW to 250mW, V2: Selectable 25mW to 1W<br>Standard/ Lite TX: Selectable 10mW to 2W<br>diversity, Micro, Nano RX: 40mW<br>Nano RX pro: up to 500mW |
| **Receiver sensitivity:** | Up to -130dBm |
| **Antenna:** | TX: 1x omnidirectional dipole antenna<br>RX: depends on the receiver type (U.fl or SMA) |
| **R/C Channels:** | 8 (diversity/ Nano diversity)/ 4(6) (Micro/Nano RX) PWM (freely mappable ) or up to 12-channel serial stream outputs, standard 2.54mm servo connectors |
| **Radio compatibility:** | Any radio with PPM stream output (Standard/ Lite TX only)<br>Any radio with a JR-style bay. OpenTX recommended |
| **Interface:** | Micro TX: RGB LED light, push-button, configuration via CRSF (TBS TANGO, OpenTX ect. ), WiFi<br>Standard TX: 1.3-inch OLED display and joystick for configuration, binding and link stats, Bluetooth, WiFi |
| **Recovery mode:** | (Nano) diversity RX: Beacon-mode, receiver backup LiPo battery - operating time of approx. 2 days |
| **Failsafe:** | Pre-set servo positions or stops outputting servo pulse - selectable in configuration menu or via push button |
| **Antenna connector:** | TX: Standard SMA, Standard diversity RX: RP-SMA, U.fl (Micro/ Nano receiver) |
| **Operating range:** | Variable depending on output power and radio environment |
| **Input power:** | Standard/ Lite TX: +3.5 to 12.6V via RC/ module bay or HT 3-pin input connector, External 2S to 3S LiPo via XT30 connector (Standard TX only)<br>MicroTX V1: 3.5 - 13V, V2: 6.0 - 13V<br>diversity RX: +4.5V to 8.4V<br>Micro, Nano RX: +3.3V to 8.4V<br>All reverse-polarity protected, compatible for 2s Lipo direct<br>Sixty9: 5.5 - 36V |
| **Power consumption:** | TX: 1.1W, at 25mW<br>TX: 3.2W, at 2000mW<br>diversity RX: 1.5W / Micro/Nano RX: 1W<br>Sixty9: 4.8W at 800mW VTX power (up to 800mA on power-up) |
| **Ports:** | diversity RX: 1x BST, 8x Servo connectors<br>Micro RX: V1: 1x Servo, 1x BST / V2: 4x Servo, 1x BST -<br>Nano, pic RX: 2x Pin-headers for 1x BST and 4x Servo<br>Nano div. RX: 2x Pin-headers for 1x BST and 8x Servo |
| **Working temperature:** | 0 - 40°C |
| **Size:** | Standard TX: 150 x 80 x 20 mm, Micro TX: 73 x 56 x 35 mm<br>diversity RX: 30 x 50 x 12 mm, Micro RX: 40 x 14 x 9.5mm |
| **Weight:** | Micro TX: 38g, Standard TX: 340g, diversity RX: 25 grams, Micro RX: 3.2 g |

# Attention

These Long Range Systems are capable of radio frequency transmissions and output power that may be not allowed in your country.

**Please always check your local RF legislation to set the frequency and output power according to the regulation.**

A general rule for RC aircrafts is that they must be controlled always under sight of view, check your RC regulation to keep up to date with regulations.

# Getting ready

Getting set up and ready to fly is a quick and simple task. In most cases plug&play when using TBS equipment.

## FAQ

If you got any questions after reading this manual you should visit the TBS FAQ section

## Note

This manual is written based on *CROSSFIRE FW 6.16 and WiFi 2.04*. If some functions are not available for you, please update your CROSSFIRE to this (Beta) or a later version.

# Updating

In order to update and configure your CROSSFIRE, you need the TBS AGENT DESKTOP or WEB.

To update your CROSSFIRE, connect it to the USB port of the transmitter and run the update by AGENT DESKTOP or WEB.

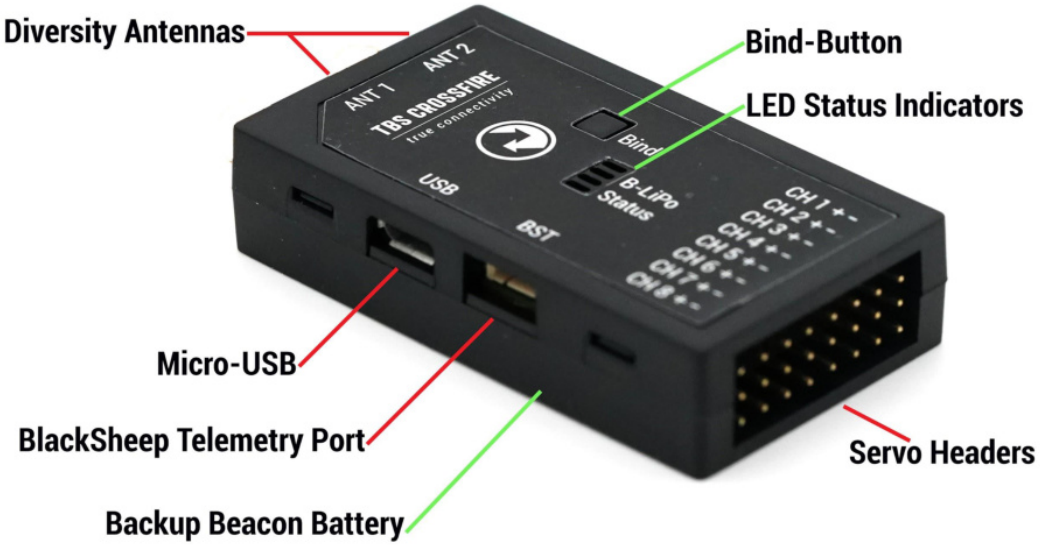
The receiver will then get the update while the next binding (details can be found in the receiver update section)

# Hardware overview

The following diagram indicates the essential inputs and features of the transmitters and receivers.

**Standard/ Lite transmitter module:**

**diversity receiver unit:**



**Micro transmitter module (V1 + V2):**

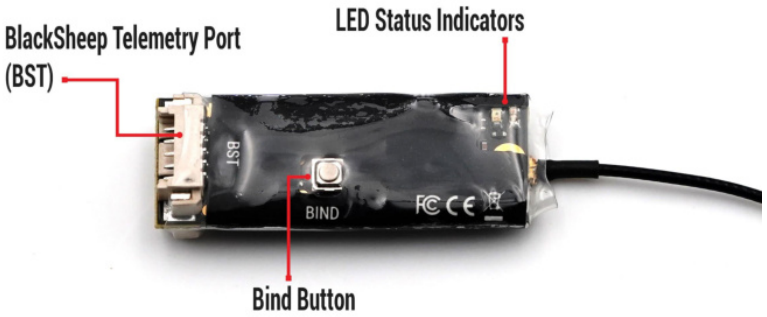
*The Micro TX V2 has the same features and layout as the V1 but with a USB-C connector*

**Nano transmitter module :**

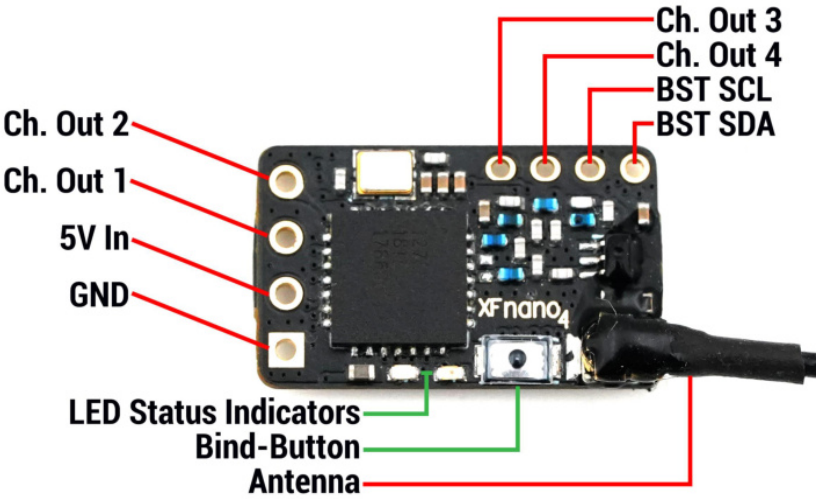
*The Nano transmitter includes the same internals and functions as the Micro TX V2. It is designed to fit into the mini-module bay of newer FrSky radios, TANGO 2 module bay, and any other radio with the mini-module bay.*

**If you already own a Micro TX V2 you can get a retro-fit set to change the housing from JR-style to Mini module style. The internals remain the same. [Get yours at TBS]**

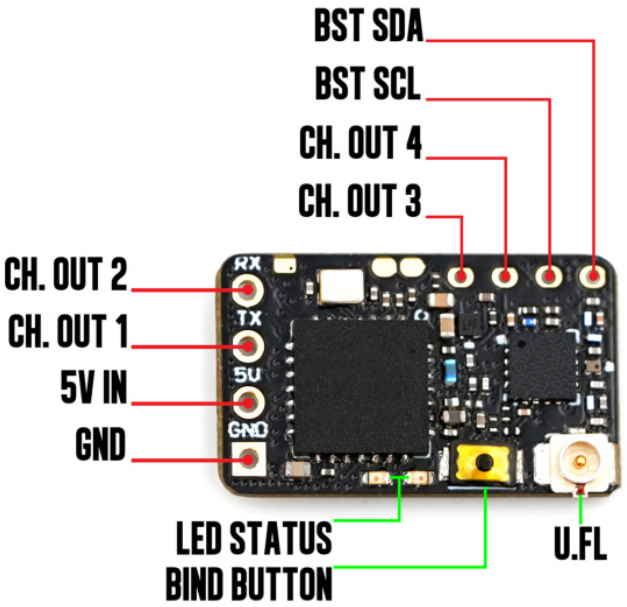
**Micro receiver:**



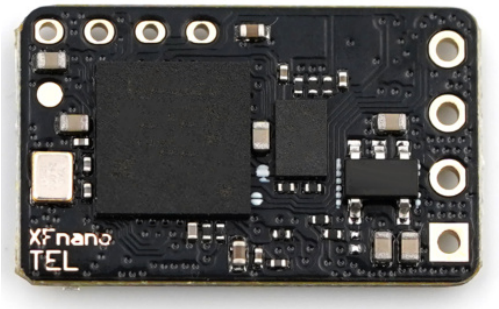

**Nano receiver:**



**Nano receiver PRO (up to 500mW telemetry power, FW 6.14 or later required:**




**Back:**



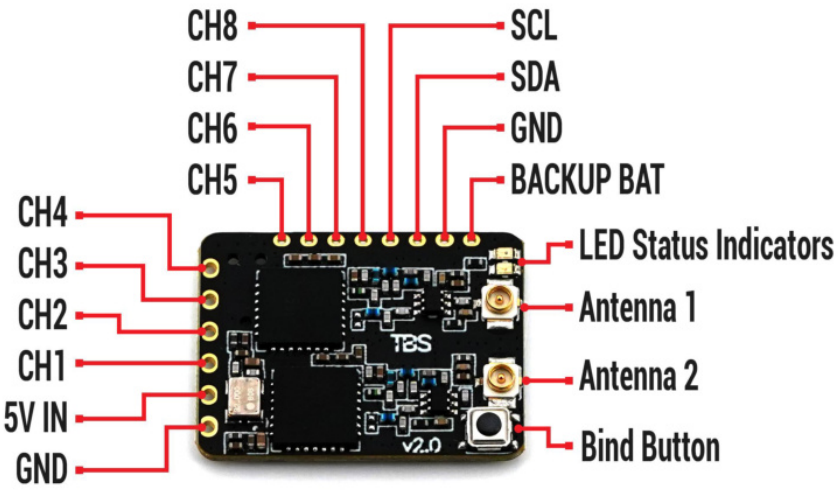

The Nano Pro is labeled *XF Nano PRO* or *XF Nano TEL* (on the first few units)

In the receiver settings you can adjust the telemetry power under *XF Nano RX Pro/ General/ Power* to one of the three power levels (Min - 25mW, Mid - 100mW, Max - 500mW)

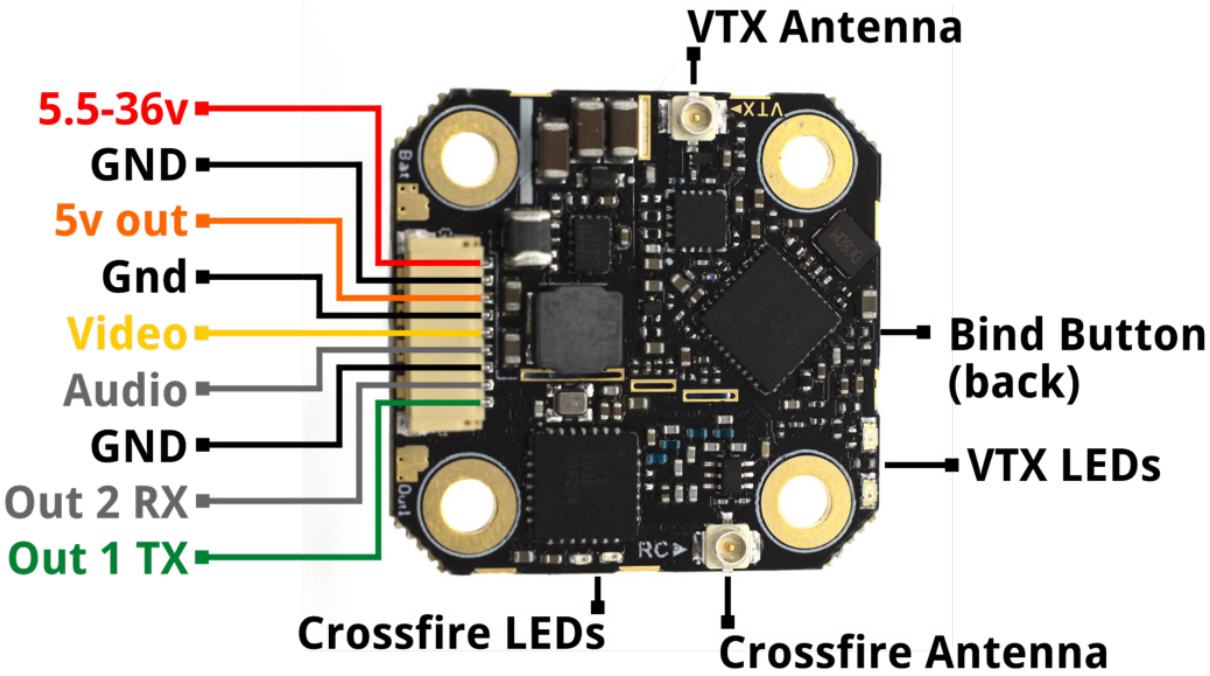
**Nano receiver PWM version:**

This RX is the same as the Nano RX but with 6 servo connectors installed. This Saves you the need for the PWM adapter board.

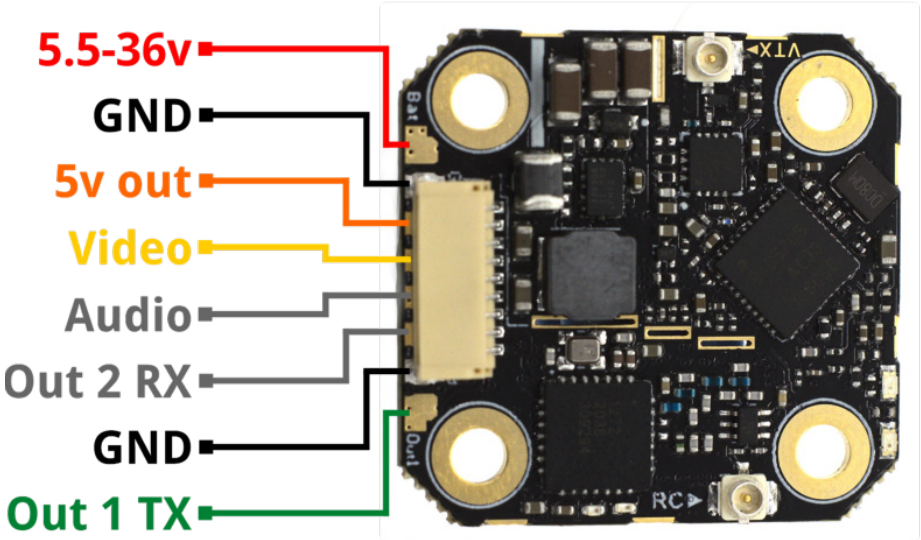
**Nano diversity RX:**

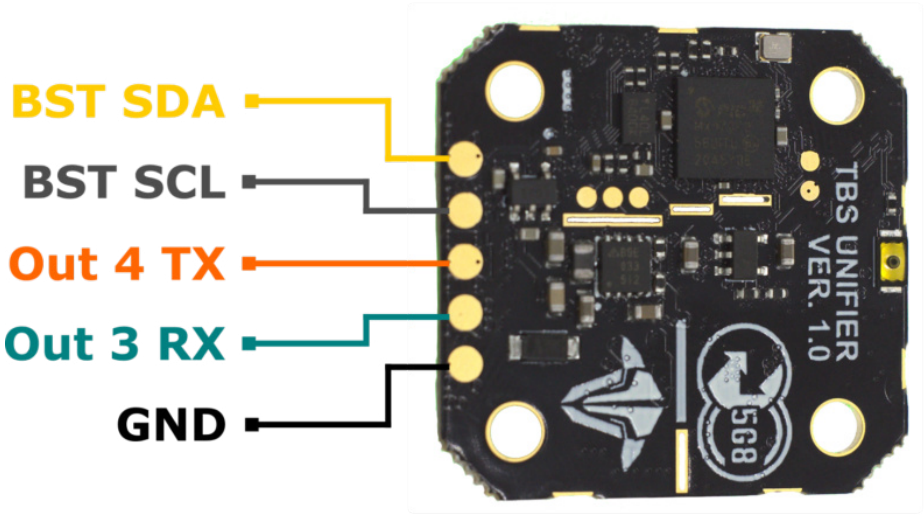


**Sixty9:**

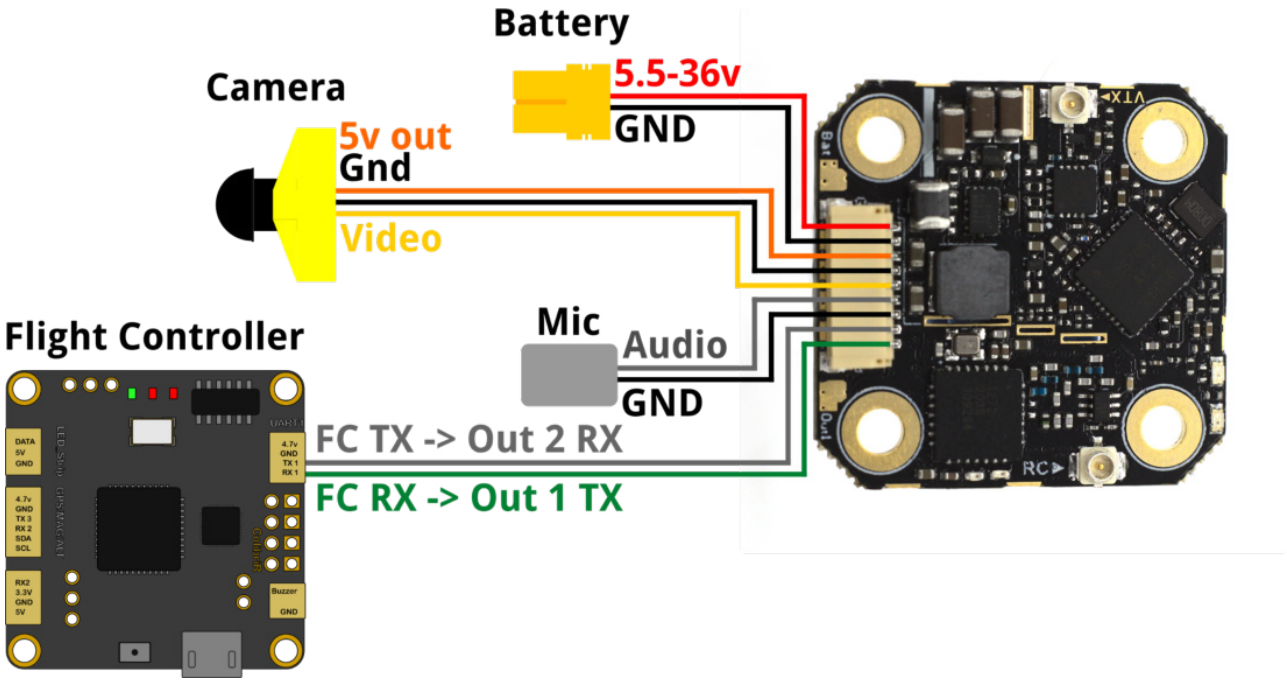



**Solder pads:**

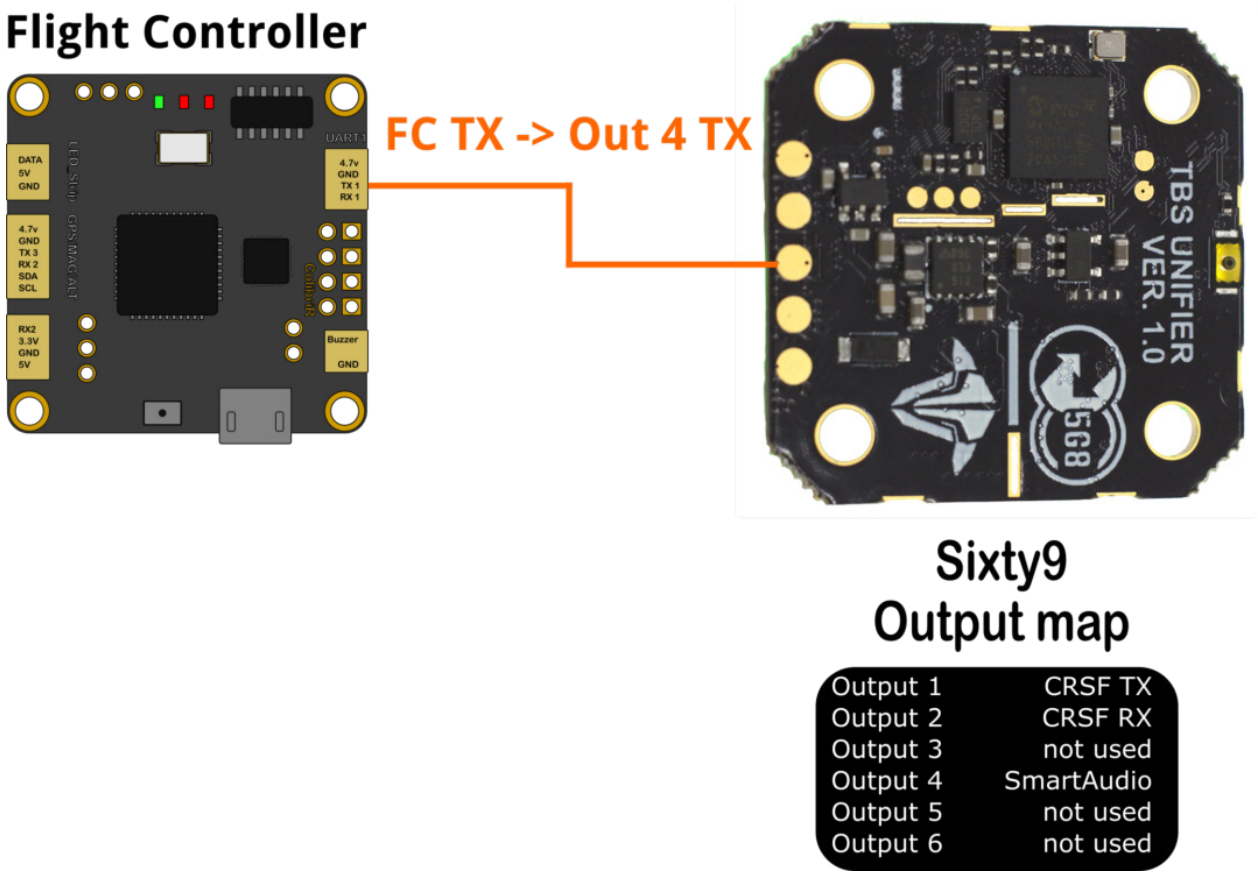





**Wiring example:**



**SmartAudio setup (for FC control)**




In BetaFlight, set up the UART as with any SmartAudio VTX and use the [TBS PRO32Nano VTX tables]

**Limitations:**

When you set your region to *CE*, the VTX max power will be limited to *25mW* and the available channels are limited (selections in orange are not available)

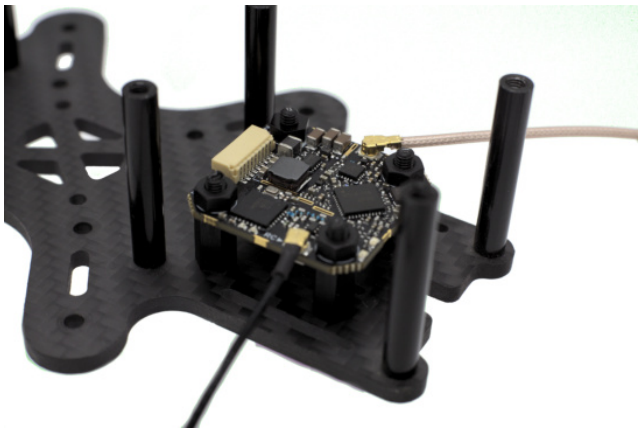
| Channel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
|---|---|---|---|---|---|---|---|---|---|
| **Band A** | 5865 | 5845 | 5825 | 5805 | 5785 | 5765 | 5745 | 5725 | MHz |
| **Band B** | 5733 | 5752 | 5771 | 5790 | 5809 | 5828 | 5847 | 5866 | MHz |
| **Band E** | 5705 | 5685 | 5665 | 5645 | 5885 | 5905 | 5925 | 5945 | MHz |
| **Airwave** | 5740 | 5760 | 5780 | 5800 | 5820 | 5840 | 5860 | 5880 | MHz |
| **Race Band** | 5658 | 5695 | 5732 | 5769 | 5806 | 5843 | 5880 | 5917 | MHz |

In *FCC/AU* mode the output power is limited to *1W*, no channels are blocked.

**Mounting:**

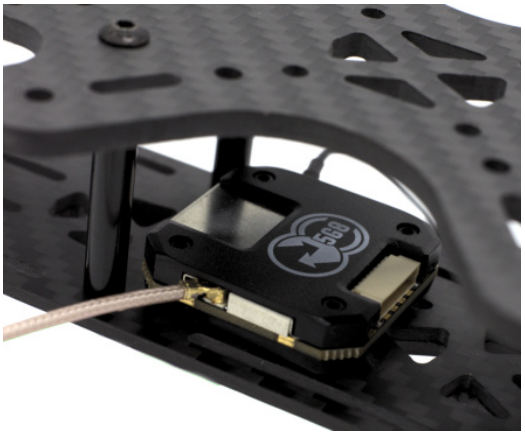
**30.5x30.5**

**20x20**



**Direct-mount, double-sided tape**

Be sure to fasten with an additional zip tie, or bolt down the case with provided Phillips screws.



## Standard TX pinout

## Radio connection

### JR-bay radios

If you use a radio with a standard jr-bay style module bay, you can easily plug the CROSSFIRE transmitters into them.

## JR-bay issue

When you have set up everything properly in OpenTX but your module still stays off, the radio pins did not slide into the CROSSFIRE TX. In this case, you can bend all the pins in the JR bay just a little bit to the right or left side and plug the module bag in.

## Other radios

If you own a radio without a  JR-bay, you need to use the Standard/ Lite transmitter with their input pins for many trainer-port connectors, which you then connect to the RC In plug.

*Note: by this connection, you can not use CRSF between your radio and the CROSSFIRE TX. If your radio supports CRSF, you need to feed the signal wire in the plug on the right. Check the TX pinout for details.*

**Hitec/Graupner/JR-cable**

**Futaba-cable**

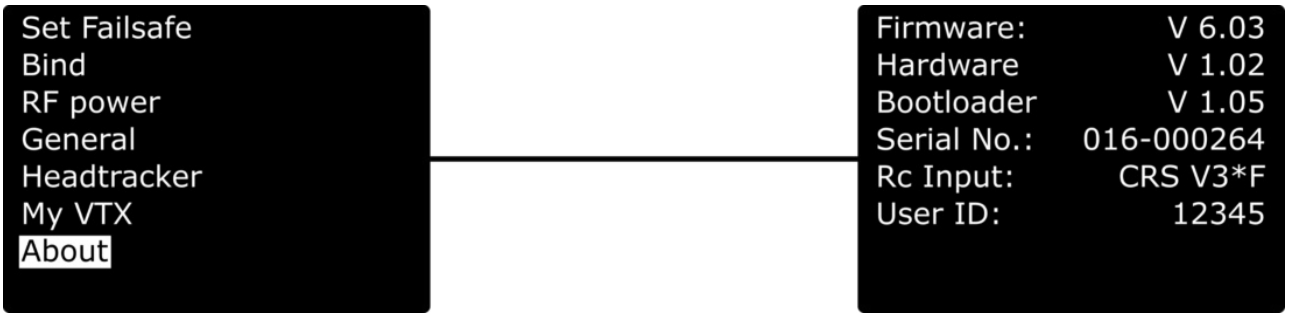
**Custom PPM cable**

## RC input Signals

Depending on the remote and firmware you use, there are different input protocols available:

- PPM
- CRSF V1/ 2/ 3/ CRSFShot

In AGENT DESKTOP or WEB/ Lite the detected signal can be found under *Transmitter/ About/ RC Input*




**PPM**

PPM should only be used with radios not supporting CRSF. It got a high latency and no telemetry

**CRSF V1/ 2**

CRSF enabled telemetry since version 2 and runs with low latency.

**CRSF V2s**

The *s* indicates that the lower communication speed has been enabled in the radio. Details can be found in the mod section.

**CRSFShot**

CRSFShot is CRSF V2, including the synchronization between the radio and the transmitter to eliminate the variable latency. This results in a mode locked-in feeling with your drone.

**CRSF V3**

CRSF V3 is the latest revision of the CRSF protocol. It includes CRSFShot and reduces the latency between the radio and the transmitter even more. CRSF V3 was introduced with CROSSFIRE FW 6.03.

**CRSF V3***

The * indicates a full-speed connection. As CRSF V3 raised the speed, even more radios require the hardware mod.

With CROSSFIRE FW 6.09 (or later) and BF 4.2.9 (or later), you must install the telemetry wire between the receiver and the FC!

## Antennas

You got a big variety of antennas for your transmitter and receiver. The antennas that come with your devices work fine and don't need to be replaced in general. Depending on your environment, your drone, and your purpose, you can change them anyway. Here are some of them:

Flexible antenna

MicroVee antenna

PCB Race antenna

Other antennas can be found at the [TBS webshop] or premium antenna suppliers such as [VideoAerialSystems].

## Antenna cover

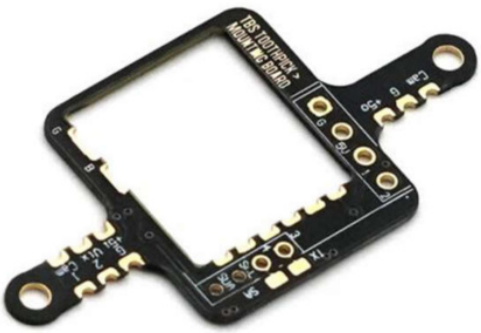
If you order your CROSSFIRE transmitter after mid-2020, you will notice a cover over the antenna.

The antenna can be turned by 90° (both directions) to align it with your receiver antenna. If you want to use a different one or just detach it after the flight, you need to unscrew the cover and break it.

This will not void your warranty

## Adapter boards

There are many ways of installing the CROSSFIRE RX into a model like these mounting boards:

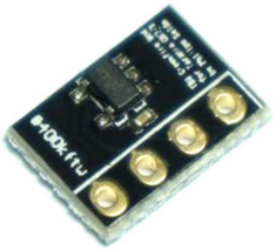


On some of them, you can connect a Unify Nano32 with the CROSSFIRE receiver and use the CRSF connection to control the VTX.

## FrSky inverter mod

When you receive your CROSSFIRE transmitter, there is a small inverter chip included. This chip is a hardware mod that you can build into your FrSky radio to use the full communication speed between your radio and the CROSSFIRE TX as some of them only have a slow transistor instead of an inverter chip included.

This mod is not necessary for the CROSSFIRE to operate properly with your radio but it helps with “Sensor lost” messages on certain radios as well as not properly working LUA scripts.



This modification requires a good soldering skill and will void your radio’s warranty. If you don’t feel comfortable with this, use the software mod instead.

### Which transmitter is affected by this?

The older QX7 radio from FrSky with the S-Port pin at the bottom of the radio.

Newer ACCESS radios and older radios than the QX7 (with bottom S-Port pin) don't need this hardware mod.

### How to install the inverter mod

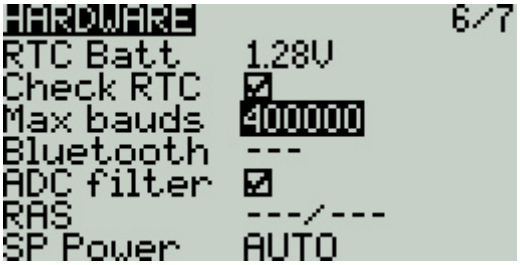
There is a detailed how-to available at [phillip seidels blog]

### Software mod

Instead of installing the hardware mod, you can simply lower the speed at which the radio communicates with your radio.

Navigate in your radio settings to the *Hardware* tab and set the *Max Baud* setting from **400000** to **115000.**

**If your radio is known to not need this soft/ hardware mod, the BaudRate setting is not available**




## CROSSFIRE with EdgeTX

If you are using EdgeTX on your radio and the AGENT Lite LUA or other related LUA does not load any data, you need to change the Baudrate setting for each model with CROSSFIRE. With FW 6.XX, you can set the Baudrate to the maximum available speed. With older firmware, set it to 400000Baud.

# General functions

## Binding

Binding a receiver to your CROSSFIRE is an easy task and does not require 3 hands or any special jumpering.

**Make sure to power your drone with a lipo. In some cases, just USB power to the FC is not strong enough to properly power the receiver while bind mode is active**

### General note/ model match

You will notice that you can control any r/c model, even if you changed the model in your radio*. This is caused by the fact that the CROSSFIRE does not monitor the radio model. This means you have to make sure that you selected the right model in your radio before you power up the receiver.

If you are used to FrSky, it's the same behavior as when you set your receiver number to 00 in the mode settings (with FrSky receivers)

***Model matching with the CROSSFIRE and OpenTX is available since OpenTX 2.3.10**

### When do I need to bind again

There are a few cases when you need to rebind your transmitter to the receiver:

- You changed the region/ frequency setting*
- You updated your transmitter firmware
- You enabled Multi-bind*
- You did a factory reset on the receiver
- You changed your model id/ receiver number in OpenTX

** you can avoid rebinding if you change these settings while the receiver is bound and powered up.*

### Binding issue - Double green flashing

If you get a double green flashing pattern on the receiver for several seconds after updating or binding, you got an authentication error. To solve this issue:

- Shut down the receiver
- Set the TX in bind mode
- Power up the receiver
- Push the *Bind* button on the RX

After the binding, the pattern may return but should be gone after a few seconds.

## Binding issue - OpenTX 2.3.10 or later

When you update your radio to OpenTX 2.3.10 or later you might find that all your receivers are now unbound. In that case, check the model match number. Due to the way OpenTXhandles this feature, it might have set up a model number. In this case, just change it back to 00 and your receiver should be bound again.

## Transmitter

First, you need to set your transmitter in bind mode. For this, you got a variety of options, depending on the radio and transmitter type you use:

**Agent L (OpenTX radio only):**

1. Turn on your radio
2. Navigate to the AGENT LITE Lua script and execute it
3. Open the *CROSSFIRE Transmitter*
4. Scroll down to *Bind* and hit enter

**AGENT DESKTOP or WEB:**

1. Connect your transmitter to AGENT DESKTOP or WEB by USB
2. Open the CROSSFIRE Transmitter (*Manage*)
3. Navigate to the *Configure* tab
4. Under *Device*, click on *Bind*

**Oled Display (Standard/ Lite TX):**

1. Hold the joystick down till the menu opens up
2. Open the *CROSSFIRE Transmitter*
3. Navigate to *General*
4. Scroll down to *Bind* and click on the joystick

**TBS TANGO 1:**

1. Turn on your radio
2. Hold the rocker switch to enter the main menu
3. Scroll down to *Devices*
4. Under *CROSSFIRE Transmitter*
5. Click on *Bind*

**Button (Micro TX):**

1. Power up the transmitter
2. Push the button of the Micro TX once

## Receiver

After your transmitter is in bind mode, you need to do the same with the receiver. This procedure is the same for all receiver types available:

1. Power up the receiver
2. Within 1 minute, push the bind button on the receiver

## Receiver Update (OTA)

Depending on the firmware on your transmitter and the receiver, you might need to update your receiver.

With the transmitter and the receiver both in bind mode, you then will get a message on the radio/ AGENT DESKTOP or WEB, telling you that the receiver needs to be updated. Follow the instructions shown there. The firmware will be sent to the receiver over the air (OTA). When the transmission is finished, the receiver flashes itself. After this, they are bound and ready to be used.

## Auto-bind

When you update your transmitter firmware, you need to rebind the receiver to run the OTA update. In this case, you don't need to hit the bind button on the receiver again, when he was bound before:

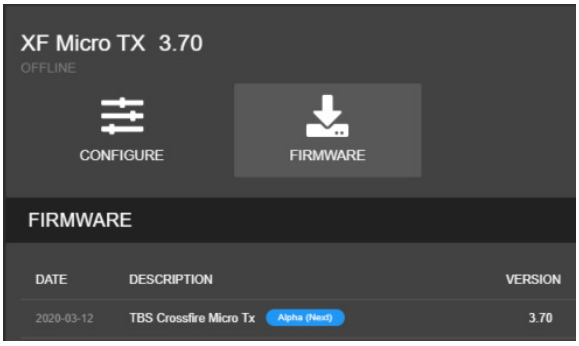
1. Power up your transmitter
2. Set it in bind mode
3. Power up the receiver
4. Wait a few seconds
5. Now you should get the update prompt without pressing the receiver bind button again

## Multi-bind

Since FW 3.71 you can use all your transmitters on all your receivers without rebinding them each time. This is useful if you own more than one transmitter module or an external module and a TANGO II etc.

**Make sure you initiated your WiFi module before!**

How to set it up

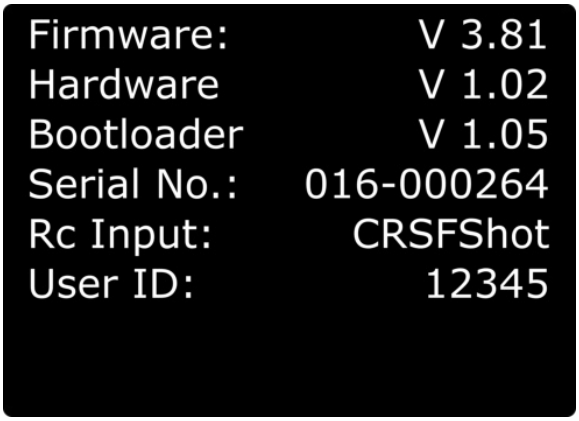



Update your CROSSFIRE TX to FW 3.71 (or later) by AGENT DESKTOP or WEB. If you can't see the required FW version, click on the 3 dots in the top right corner and check *"include beta releases".*

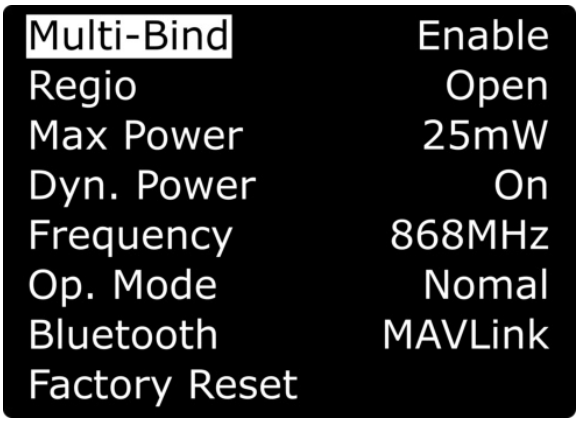
Make sure that the WiFi module is powered up as well (Standard TX).

After the update wait for AGENT DESKTOP or WEB to synchronize the device with your TBS account. This is done when the dot on the top of the device turned green

Connect your CROSSFIRE to the internet via the built-in WiFi module. You can provide access point information from your nearest WiFi hotspot, or create a temporary one on your phone. Wait for it to switch to “Online” under *XF WiFi/ About*




After a few seconds, you can navigate back to *XF Transmitter/ About*. Now you should see your user id. This user ID will be the unique binding ID. Each transmitter with this user ID can now bind to your receivers on the same firmware version.




Enable the Multi-bind option under *XF Transmitter/ General*

Repeat this step for every CROSSFIRE transmitter that you own (e.g. TX module, TANGO 2, etc)

**Binding**

- If you've got a bound receiver, just bind/ update it with Multi-bind turned off, and while it's connected turn Multi-bind on. Wait for a few seconds, then the link will come back again.
- On a new receiver, you can just bind it by the button as usual.

- On the other CROSSFIRE TX, just enable "Multi-bind". When the first TX is shut down, you can power up the second transmitter. It should bind to this receiver within a few seconds.

**Disable Multi-bind**

- To disable the Multi-bind option you just need to set the "*Multi-bind*" option to "disable". If the link is running, just switch it off and wait a moment till the link regains.
- Otherwise, rebind the receiver by the button.

**Wrong ID/new ID**

- You may need a "new" id. To get a new ID, simply connect your CROSSFIRE to AGENT DESKTOP or WEB with the new/correct user account and let it synchronize with the TBS CLOUD.
- The next time the WiFi module connects to the internet it will get the new id after a few seconds.

**General note:**

Model match affects Multi-bind behavior. If the model ID is not the 00 in both radios, devices will not bind.

If model-match is not available on your transmitter, it will assume model ID "00".

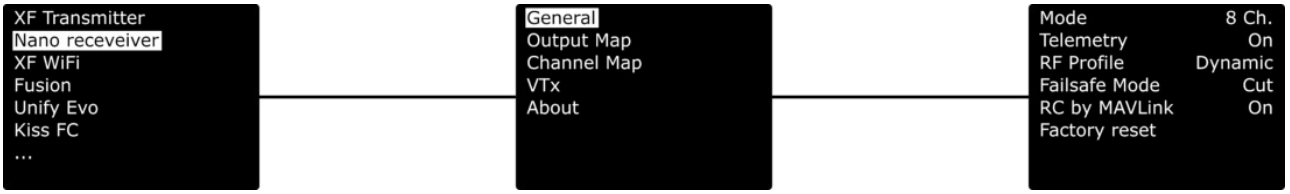
## Failsafe setup

The TBS CROSSFIRE supports two failsafe behaviors: cut and failsafe position. Setting them up correctly is crucial for the safety of your model.

### General setup

The failsafe setting is located in the *receiver* menu. To change the behavior:

1. Navigate in the receiver menu by your radio/ Lua script/ AGENT DESKTOP or WEB
2. Open the General menu
3. Change the FS. Mode setting to what you need it to be




### Cut

This is the setting that you need to use if you got a flight controller in your aircraft, that handles a failsafe routine like RTh for you. If the link breaks up, the receiver will output no signal, which will be detected by your FC.

### Failsafe position

If you use a model without FC or with an FC that requires a special stick position (e.g. DJI NAZA), failsafe-position is what you need.

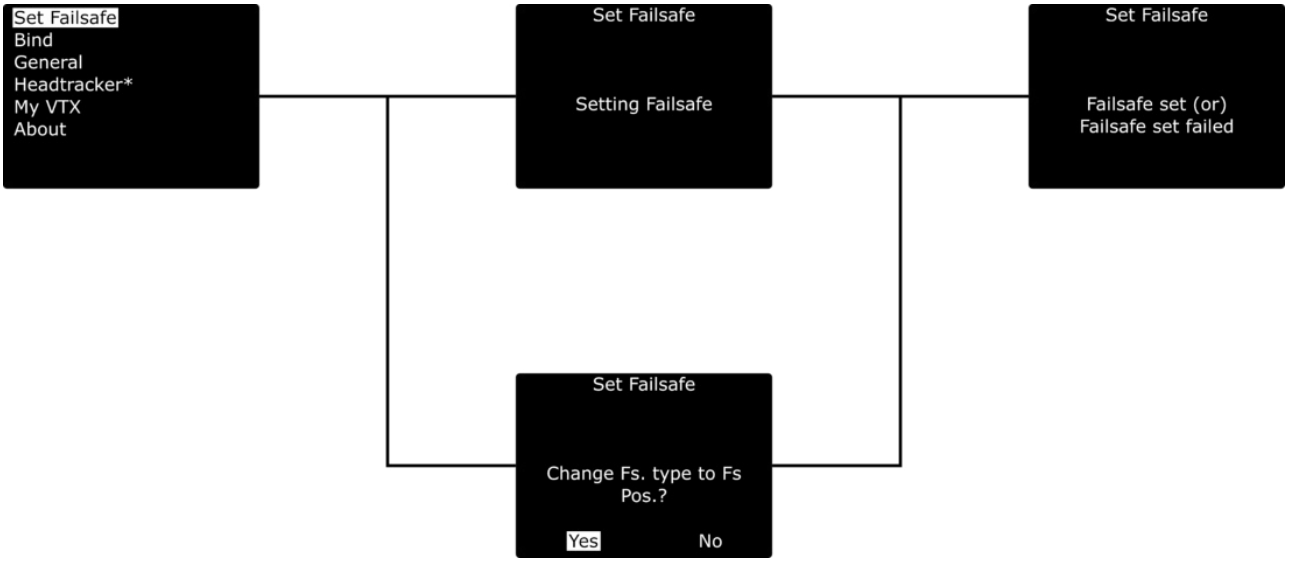
With this setting, the receiver will output a previously taught position for all channels.

**Important:**
*If you have set up a failsafe position and did not teach a position afterward, the receiver will output the last position before the link broke up.*

**Teaching a position**
*This may require the help of a second person, as it can be tricky to hold the sticks and hit the teach button.*

1. Power up your bound receiver and your radio with the CROSSFIRE transmitter in it
2. Open your *transmitter* menu
3. Hold the sticks and switches in the position you want them to be in a failsafe situation
4. Click on *Set fs. Mode and wait for the confirmation for the set position*

If your failsafe setting was set to cut and you entered the teaching mode, the CROSSFIRE will change the type to *position* if you accept the request.




**Standard/ Lite TX shortcut**

For these two transmitters you can run a shortcut to set the failsafe position:

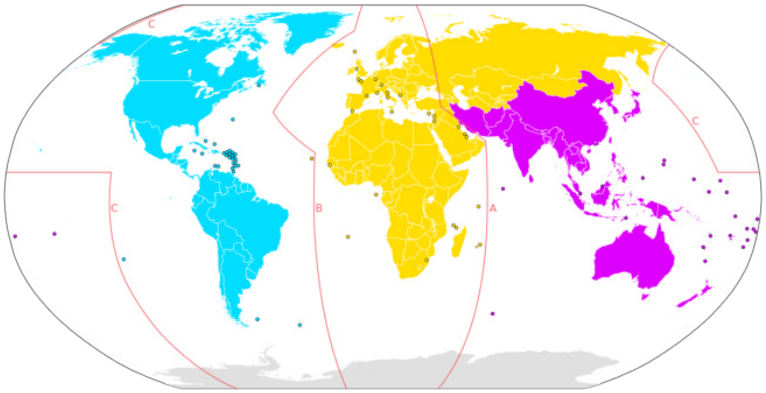
- Set the sticks and switches, in the position you want them
- Push the joystick down
- Push and hold it up for a few seconds
- *Failsafe Set* will appear

**Failsafe test**

When you have set up or changed the failsafe behavior, it's important to test the correct function on the ground. To test it:

1. Remove the propeller of your aircraft
2. Power up the radio and the model
3. Arm the model (with FC) or move your sticks into a certain position (no FC)
4. Shut down your radio
5. Depending on the failsafe type and model, check if the behavior is correct

## Transmission frequency



*CC Wikipedia*

The TBS CROSSFIRE supports two different frequency bands, depending on your local regulation.

Below is a general overview of the primary frequency segmentation.

| General area | Frequency |
|---|---|
| ITU Region 1 - Europe/Africa/Middle East (yellow) | 868 MHz SRD band |
| ITU Region 2 - America/Greenland (blue) | 915 MHz ISM band |
| ITU Region 3 - Asia/Oceania (purple) | 915 MHz ISM band |

You can choose between several frequencies:

| Frequency Setting | Frequency | Max. power level | Settings locked | Operating frequency |
|---|---|---|---|---|
| 868 | 868MHz | No limitations | no | 860 - 885MHz |
| 915 | 915MHz | No limitations | no | 902 - 928MHz |
| 868CE | 868MHz, LBT technique | No limitations | no | 860 - 885MHz |
| 915C-Tic | 915MHz | No limitations | no | 915 - 928MHz |
| 915FCC | 915MHz | No limitations | no | 902 - 927MHz |
| 868 Race | 868MHz | No limitations | no | 860 - 885MHz |
| 915 Race | 915MHz | No limitations | no | 902 - 928MHz |

**868CE/ 915FCC/ 915 C-Tic:** same as CE/ FCC mode but with no limitations in the power level etc
**868 Race/ 915 Race:** uses the band in a different way to avoid a failsafe during bigger race events with many pilots. Use only in race/ race-like scenarios!

**To change the frequency band:**

1. Power up your transmitter
2. Open the *CROSSFIRE Transmitter* menu
3. Navigate to the *General* menu
4. Change the *Frequency* setting according to your location

The frequency change is instant and affects the transmitter and receiver. It can even be changed in-flight if necessary. If you change the frequency or region setting without the receiver being powered up you need to rebind the receiver.

**Region settings:**
In the region settings, you can set your CROSSFIRE according to your local laws. The region and the frequency setting will disappear after this, as well as not allowed setting for this region. The CROSSFIRE then will limit the output power and the used band according to the law and enables LBT (CE mode only)

| Region setting | Frequency | Max. power level | Settings locked |
|---|---|---|---|
| Open | Not limited | Not limited | no |
| CE | 868 MHz, LBT technique | 25mW | yes |
| FCC | 915 MHz | 1W | yes |
| C-Tick | 915 MHz | 1W | yes |

## Transmission power

The transmitter's RF output power is highly configurable and can be selected dynamically via the menu. With 100mW you can achieve 15 km of safe range in rural conditions.

It is recommended to use the dynamic power option. This will allow you to fly at very low power and the system will increase the power automatically (faster than you can hit the power switch yourself) if you are about to lose the link.

Some output power restrictions apply depending on the available power source:

| Power source | Available output power |
|---|---|
| USB power input (+5V) | 10mW (10dBm) |
| RC/HT radio power input (+3.5 to +12.6V) | 10mW (10dBm), 25mW (14dBm), 100mW (20dBm), 250mW 500mW (27dBm) 1W (30dBm)*, 2W (33dBm)* |
| External LiPo power input (+3.5V to +12.6V) | 10mW (10dBm), 25mW (14dBm), 100mW (20dBm), 500mW (27dBm), 1W (30dBm), 2W (33dBm) |

** 250mW is the maximum output power of the Micro TX V1. It is also only available on the Micro module. Micro TX v2 can go up to 1W*
***Please check if your Radio is capable of providing enough power for the 1/ 2 W option. Otherwise, you might break the electronics inside of your radio. The TBS TANGO can handle these power levels, the TANGO II can only be used up to 500mW (Standard TX) or 1w (Micro TX v2/ Nano TX).*

**To change RF power:**

1. Enter the configuration menu/ LUA script select "General"/ "CROSSFIRE TX" and "Max Power"
2. Pick the RF output power you require and exit the menu to confirm
3. The change is instant if the required input power is available and can be done at any moment

Every 6 dBm increase in output power results in a doubling of the theoretical possible distance that is achievable.

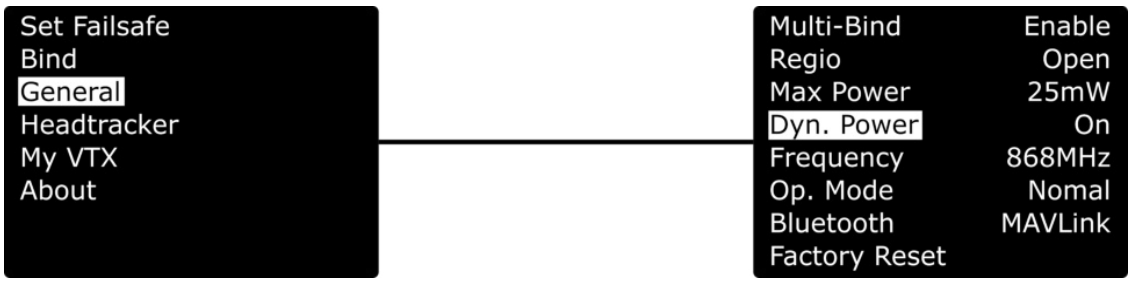
If you set a power level that is outside the connected power source, it will still be remembered for later but the output power will be limited according to the table above.

You may hear a subtle buzzing or humming sound on some radios or nearby speakers on higher power levels. This is completely normal and non-harmful. In the case of the Taranis, it is an issue of the remote itself and can be fixed by following [this guide by boltrc.com](#).

## Dynamic transmission power

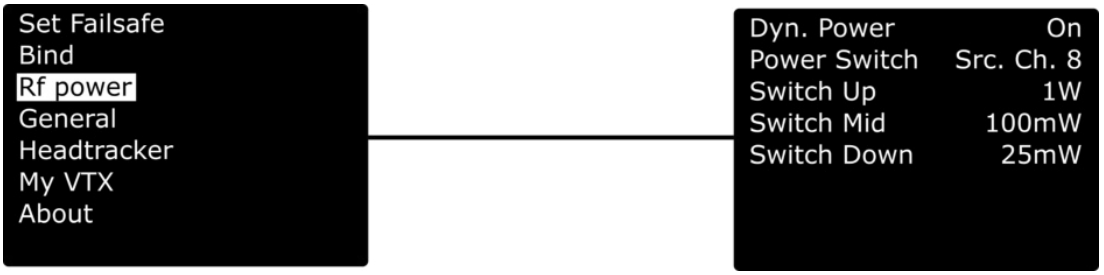
The system can automatically choose the power level most suitable for the situation at hand. For instance, if you fly close to the transmitter you normally only require minimal TX power and the system will therefore switch to the lowest possible TX power level required to maintain a good up-link.

The maximum TX power level the system is allowed to use can be defined by changing “Max Power” in the configuration menu.




## RF power switch

Since FW 6.03 you can select the max. Rf power level by a 2/3 position switch.




How does “Power Switch” work:

- Dynamic Off: the output power is the setup-up the power on the switch position
- Dynamic On: the max. output power the CROSSFIRE can use is the setup up power on the switch position

The power level selected by the switch acts the same way as when the *max power* setting got changed.

## Operating modes

Operation mode is where you can set the CROSSFIRE in an ultra-low update rate, high range mode. Normally the CROSSFIRE switches from 150Hz to 50Hz, depending on the link quality. With *Forced Telemetry* enabled, it will now only switch between 50Hz and **4Hz** mode. Only enable it if you know what you are doing. This mode is designed for autonomous flights where you need telemetry but (mostly) no RC

*Note: Forced Telemetry is not meant to be used in normal conditions. The best practice is to not use it.*

## Transmitter LED status indicator

The RGB LED on the transmitter gives you at any moment an indication of your link status.

| Transmitter LED sequence | Description |
|---|---|
| Pulsing | Ready, trying to connect to a receiver or no down-link established |
| Green | Solid link, 150Hz or 50Hz link mode active |
| Blue | OTA Update of the receiver is running |
| Slow blue blinking | Update confirmation required |
| Fast green flashing<br>Fast blue flashing | Transmitter bootloader active<br>Green till 6.17, blue since 6.18 |
| Fast red flashing | Warning, a message is shown on the OLED display/ LUA Script |
| Red/ blue flashing | Transmitter firmware corrupted, reload FW by AGENT DESKTOP or WEB |
| Purple | Find-mode engaged (Standard/ Lite TX),<br>Firmware validation before OTA update (Tango II) |
| Blue | Race mode active (150Hz locked, 25mw), if no update is running! |
| Teal | Race mode active (150Hz locked, 100mw) |

## Receiver LED status indicator

There are three (Standard diversity RX) or two (any other receiver) LEDs on the receiver giving you an indication of link- and backup-battery status.

| Receiver LED indicators | Description |
|---|---|
| Solid green | The link is up and running OK |
| Solid red | No packages received from the transmitter and receiver is in failsafe mode |
| Slow red blinking | The receiver needs an update, confirmation on the TX is required |
| Slow green blinking | The receiver is in binding mode/ Find mode active (div. RX only) |
| Fast green blinking | Receiver bootloader active or firmware upgrade running |
| Green is flashing | diversity RX is in Find-mode (up to 1 min. delay between flashing) |
| Double green blinking | Authentication running/ error. Rebind your receiver if it remains longer than a few seconds - more details |
| Red/ Green blinking,<br>any pattern | firmware issue, run the emergency update for the receiver, then rebind it |

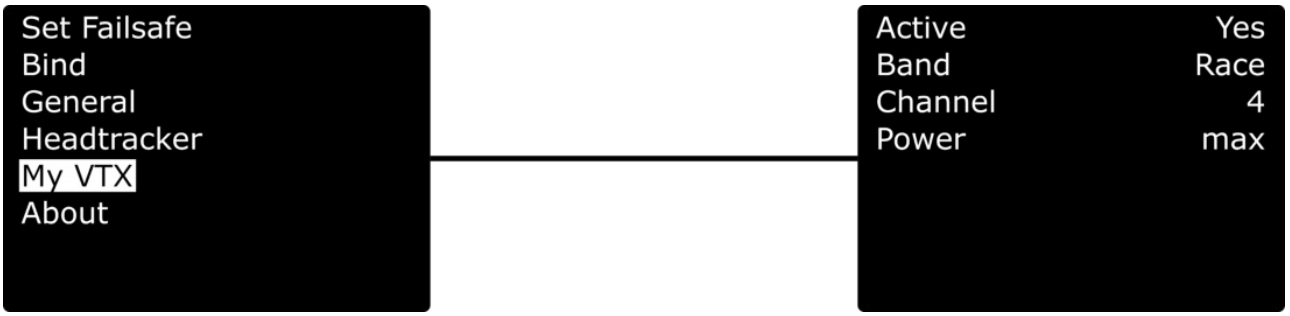
*Find mode is only available with the diversity receivers.*

## MyVTX (available up to FW 4.XX)

With the MyVTX menu, you can set all your VTXs to the same channel, band, and output power without accessing all of them. This is useful if you are on a race with multiple drones and have to set them all to the same channel.

<u>If you enable MyVTX, all other VTX settings will be overridden temporarily, till you disable it again.</u>

Connect your VTX to the CROSSFIRE RX by CRSF or SmartAudio, activate MyVTX, and set it up*
(not required with KISS FC's)



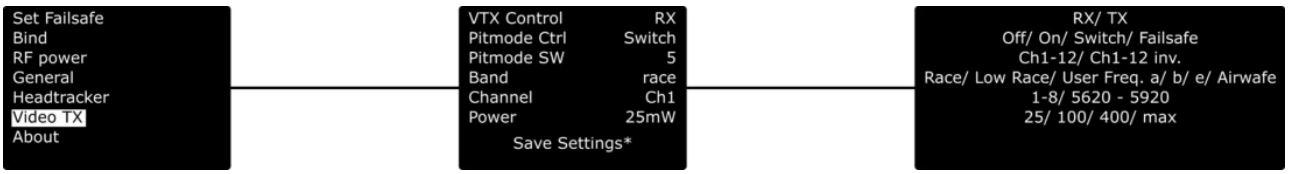

| Settings | Description |
|---|---|
| Active | activate/ deactivate the global VTX settings |
| Band | Band settings, Race/ Low/ A/ B/ E/ Airwave/ User Frequency |
| Channel/ Frequency | 1 - 8/ 5620 - 5920 |
| Power | VTX power level, 25/ 100/ 400/ max mW |

**the available pins for the connection can be found in the [output map section](#) for the receiver*

## VideoTX (Since FW 6.03)

The *Video TX* menu is the successor of *MyVTX*. The function behind it remains the same: it allows for a global VTX setup without the need to set up each drone by itself. As soon as the drone powers up, the settings will be applied to the VTX.

As with *MyVTX*, the VTX must be connected directly to the CROSSFIRE receiver by SmartAudio, CRSF, or by a KISS FC.




| Settings | Description |
|---|---|
| VTX Control | RX (off) or TX (on) |
| PIT mode Ctrl | How to control PIT mode<br>On: PIT mode is active<br>Off: PIT mode is inactive<br>Switch: Turn PIT mode on/ off by a switch<br>Failsafe: PIT mode is off, will be on when failsafe happens |
| PIT mode SW | Switch channel to switch PIT mode, Ch1-12, incl. Inverted direction<br>Visible when PIT mode Ctrl is set to *Switch* |
| Band | Band settings, Race/ Low/ A/ B/ E/ Airwave/ User Frequency |
| Channel | 1 - 8/ 5620 - 5920 |
| Power | VTX power level, 25/ 100/ 400/ max mW |
| Save Settings | Saves the new settings to the CROSSFIRE |

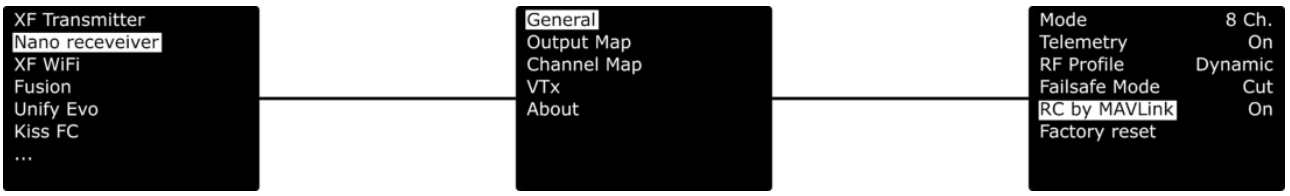
On a (team) race, PIT mode control set to *failsafe* is what you want. If you crash, shut down your remote, the VTX activates PIT mode and the next pilot of your team can start his flight.

If you fly on your own and get stuck in a tree, simply switch the model in your radio to a new model with a different receiver number and continue flying with the next drone.

## RC by MAVLink

If you use MAVLink to connect to your FC, you can send your RC data over the same connection.

Depending on the MAVLink version used in your FC, you can send up to 12 channels by this (MAV V2) or 8 (MAV V1, used on CROSSFIRE FW below 3.8).

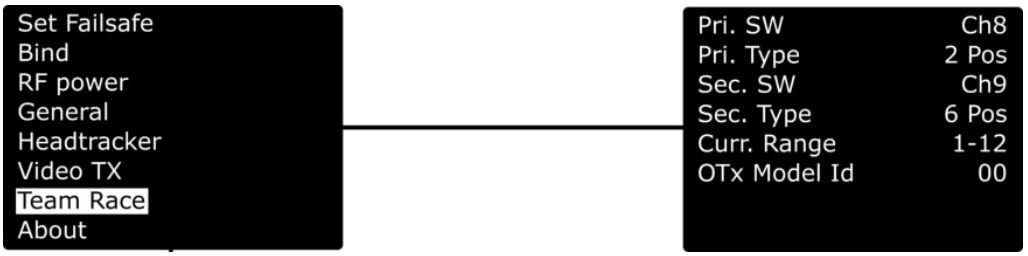



As there are some rumors around:

- The RC data will not stop being sent if the CROSSFIRE telemetry breaks up
- It's as fast/ a bit faster than SBus

## Team Race

When on a team race or using multiple drones on the same run, you can use the team race menu. It lets you switch your drone without the need to shut it down or switch the model in your remote. In combination with the VideoTX menu setting for PIT mode, this is the easiest way to do so.




- **Prim. Switch:** switch channel for the first switch (8-12)
- **Switch Type:** 2/3/6 pos. switch
- **Sec. Switch:** same as Prim. Switch
- **Switch Type:** same as Switch Type prim.
- **Current range:** min. model id - max. Model id
- **OTX Model id:** model id coming from OpenTX

## Encryption

Your CROSSFIRE is capable of Military-strength encryption of telemetry and PPM data (when enabled, binding will be exclusive to one receiver!) done simply by the transmitter menu under *CROSSFIRE TX/ Radio Settings/ Encryption*

**Note:** changing the encryption requires you to rebind your receivers again (by the bind button). Also, it disables Multi-binding.

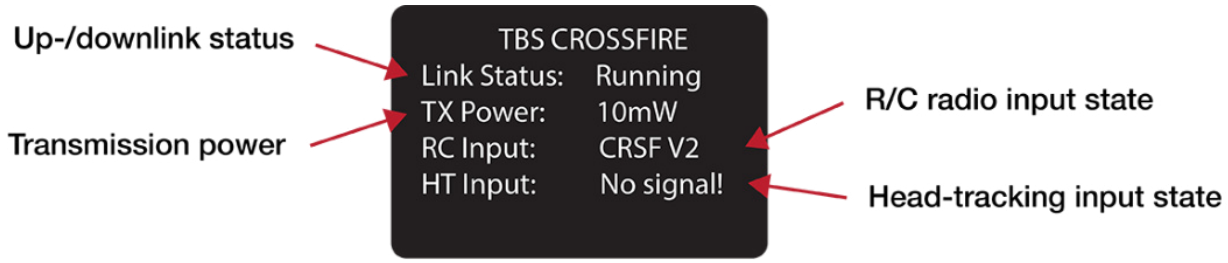
# Special functions - Standard/ Lite TX only

## External power

Your Standard/ Lite TX can go up to 2W transmission power. If your Radio can not handle the current for this or you don't want to drain your radio battery as fast you need to attach an external battery to the XT30 connector. You can use any 2(1) - 3S LiPo for this. To make sure the CROSSFIRE uses the external battery, the voltage needs to be higher than the voltage in the JR bay. Mostly the supply voltage in the bay is the same as your radio battery. The CROSSFIRE uses the source with the higher voltage.

## Status display

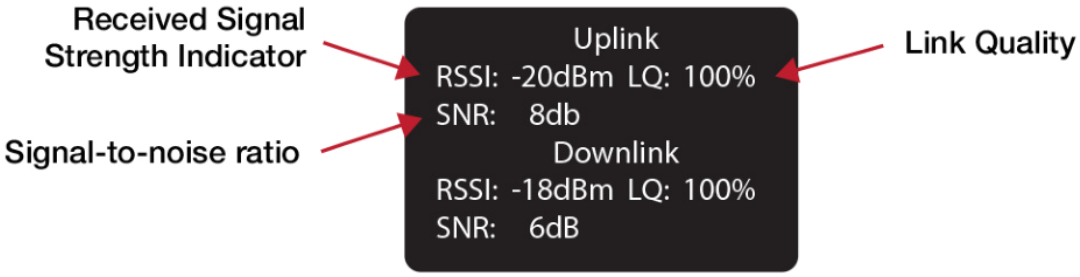
After power-on, the main screen shows the current state of the transmitter, i.e. link status, transmission power, R/C- and head-tracking input signal state.




- **Link Status** - State of the wireless link [Connecting, Running]
- **TX Power** - Output transmission power [10mW, 25mW, 100mW, 500mW, 1W, 2W]
- **RC Input** - Radio R/C PPM signal input status [No signal, PPM, CRSF V1/V2]
- **HT Input** - Head-tracking PPM signal input status[No signal, Signal OK]

## Up- and downlink status

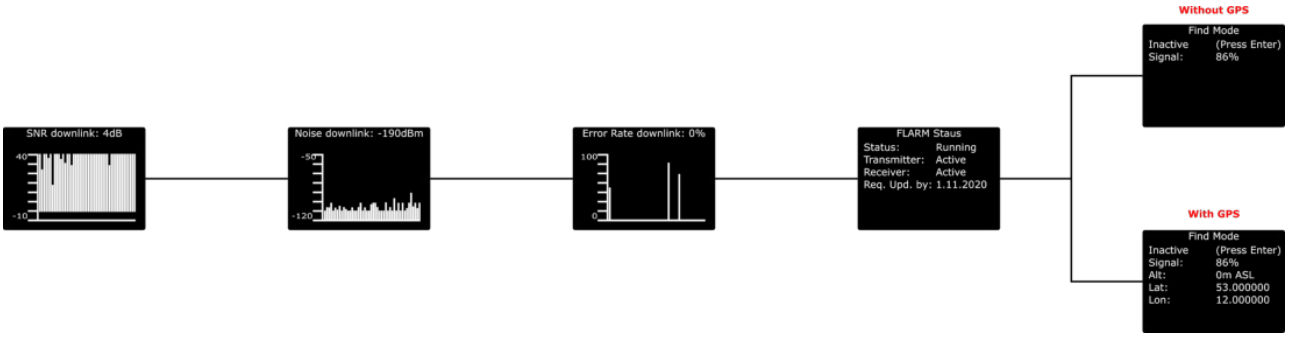
Toggle the joystick to the right to show the status of the up-and downlink.




- **RSSI** - Received signal strength indicator, measurement of the power present in a received radio signal [typ. -1dBm (good) to -130dBm (bad), logarithmic scale]
- **LQ** - Link Quality, based on the percentage of signal data received at the end-point [0 to 300%]
- **SNR** - Signal-to-noise ratio, compares the level of the desired signal to the level of background noise

## Oled Menu

When you scroll to the left/ right, you can see the other diagnostic screens, showing you information of your link, etc:

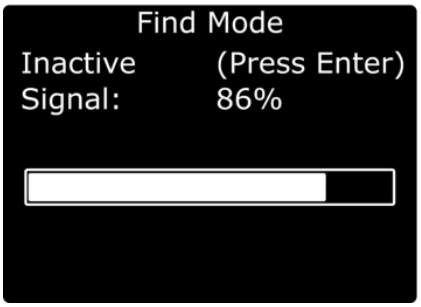



## Find mode

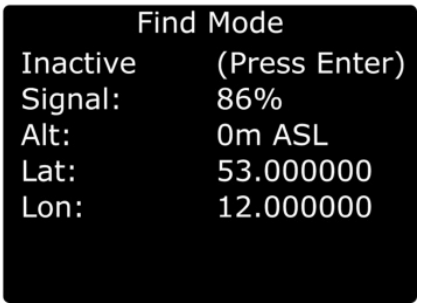
The Find-mode provides you with a way to locate a downed aircraft. A GPS signal is currently required to use this mode. Install our TBS GPS module by BST or any other GPS, connected to a flight controller.

In normal use, the GPS coordinates are continuously updated and the latest data is displayed on the “Find mode” screen. If the model loses power you can review the last known coordinates to locate your model.

**Without GPS**




**With GPS**




- **Inactive (Press Enter) / Active** - Enable/disable the Find-mode, which shows on-board LiPo voltage
  Do NOT enable it during the flight!
- **Signal** - Receiver signal strength, makes it possible to triangulate the location [0 to 100%]
- **Alt** - Altitude above Sea Level, GPS required
- **Lat** - Latitude, GPS required
- **Lat** - Longitude, GPS required

The Standard div. Receiver has an onboard LiPo battery to operate in beacon-mode, on the Nano div. Receiver you got solder pads for a 1s lipo with BMS. This allows the transmitter to send the last known GPS coordinates to the display on the transmitter after certain trigger events have happened. See the operation flow diagram attached on the following page.

**Direction finder**

Using the transmitter antenna, you can estimate the heading of the receiver by looking at the signal strength indicator.  Use this option only if the GPS position is inaccurate or you don't have a GPS connected.

**How does Find mode work?**

Please see the flowchart to see when the receiver decides to shut down or enter Find mode. In short, the receiver shuts down if the transmitter and receiver are close to each other or the receiver never got a signal from the TX, In any other case, it enters the Find mode if there is a power-down event. If the main battery is still powering the system after a crash the receiver will not enter the Find mode and keep running in the selected operation mode.

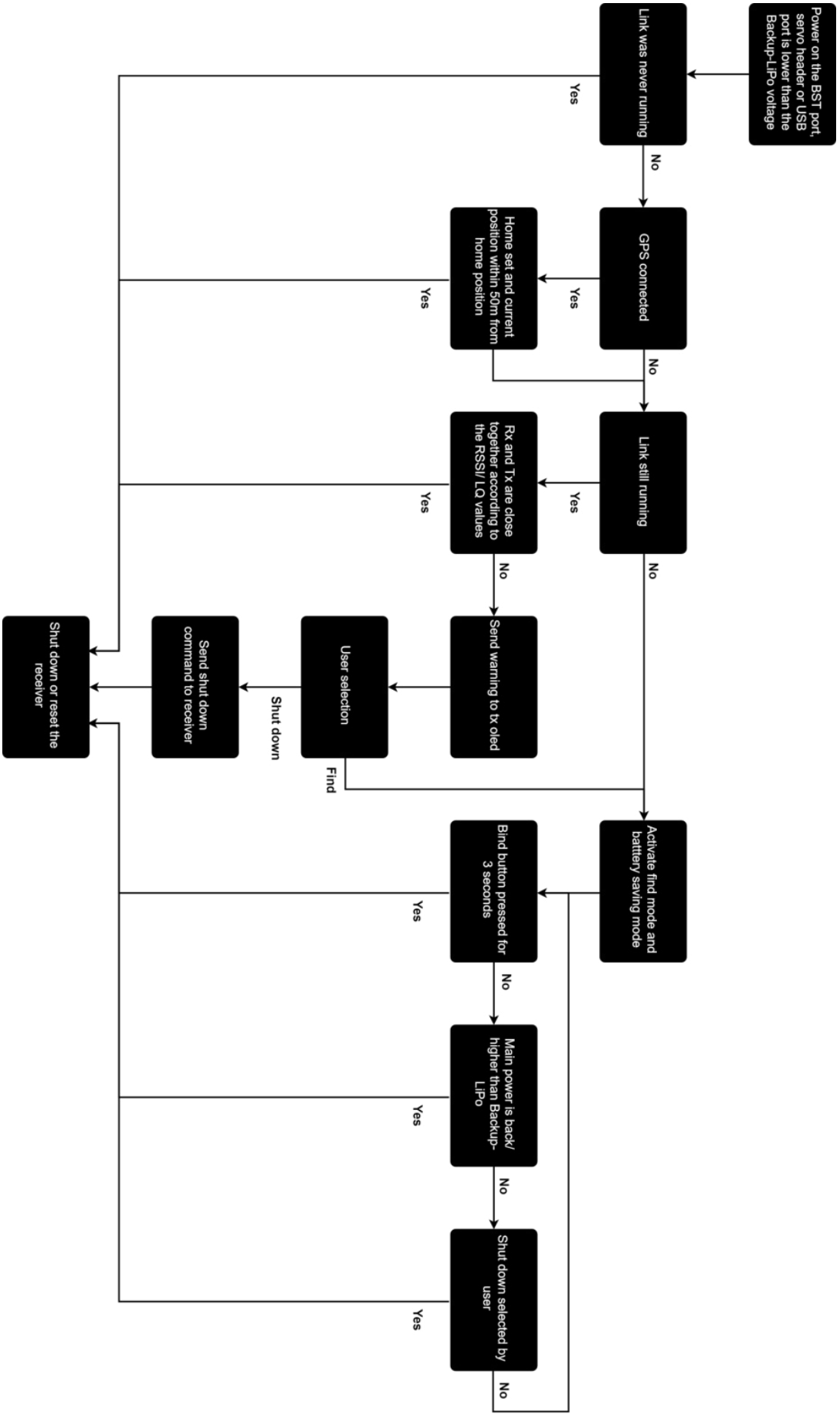
Once the receiver enters the Find mode also a power-saving mode will be activated. This power-saving mode will decrease the beacon signal interval over time. It stays for 10 beacon signals on the same interval level and remains on the slowest once reached. The interval levels are 1s, 5s, 10s, 15s, 30s, and 60s. This means it can take up to 60s for your transmitter to pick up a beacon signal. This is required to make the

receiver run as long as possible. Once the transmitter receives a beacon signal and sends an acknowledgment the receiver will switch back to the fastest interval until the link is lost again.

Once a connection is established the receiver will share the GPS information with the transmitter if a GPS source is connected or RSSI values to find the receiver with signal strength

**Testing Find mode**

It is highly recommended to go through a crash scenario first so that you are fully aware of all the neat things we have packed into the Find mode or Beacon Mode of the TBS CROSSFIRE system.


Power on the BST port, servo header or USB port is lower than the Backup-LiPo voltage
Link was never running
Yes
No
GPS connected
Yes
Home set and current position within 50m from home position
Yes
No
Link still running
Yes
Rx and Tx are close together according to the RSSI/ LQ values
Yes
No
Send warning to tx oled
User selection
Shut down
Send shut down command to receiver
Shut down or reset the receiver
Find
Activate find mode and battery saving mode
Bind button pressed for 3 seconds
Yes
No
Main power is back/ higher than Backup-LiPo
Yes
No
Shut down selected by user
Yes
No

**Preparations**

The Find mode needs to be armed before it will take any action.

- Receiver only:
    - Power up the receiver and transmitter and make sure they are connected.
- Receiver with GPS:
    - Make all steps above and ensure the GPS is having a solid sat lock.
- Receiver with GPS and TBS CORE PRO:
    - Make all steps above and simulate a takeoff. This can be done throttle above 3A or walking your receiver until you see the takeoff message on the OSD.

**Simulating flight**

The Find mode is armed now and you need to simulate a flight. Just separate the transmitter and receiver by more than 50 meters.

**Simulating a crash**

A crash can happen in different ways. Let's simulate it only :) Here are some scenarios.

- Turn off your transmitter ( failsafe ) and move your plane to another spot (scenario: flying behind a mountain, with a subsequent crash )
- Power down the battery (scenario: battery eject on crash)
- Just let it sit there (scenario: landing in a tree)

**Search and rescue**

The copter/plane is lost - now we'll start the S&R mission. It's important to get the link back to either get the latest GPS coordinates or have the ability to point in the direction based on the signal strength.

- In some cases, the link is not even lost. Skip below and move to "Link regained" chapter
- Read the coordinates from your OLED and go to the place of the latest coordinates. If you don't have a GPS try to go as close as possible to the last known position.
- Get yourself to an exposed position as close to the target as you remember from the crash or based on OLED coordinates
- Toggle between Find mode (greater range, less telemetry) and full link (less range, full telemetry). If you have lost main power your quad will respond in Find mode. For all other scenarios, you should be able to regain control. When you see "Find mode activated" on your LCD, give it more than a minute before you deactivate it again ( beacon timing, see description above ). If you use the DIY reflector point and hold in different directions until you get your link back.

**Link regained**

Once you got your link back to your copter/plane you can now try to find it. It's recommended to keep the mode you got your signal back no matter if it's in Find mode or selected operation mode.

- GPS source attached to a receiver
  - The receiver will share the latest coordinates with the transmitter and display them on the OLED.
  - For Droidplanner app select Bluetooth ( CROSSFIRE App link mode needs to be set to MAVLink emulator ) to locate your copter/plane
  - Write down the coordinates use any GPS to find the location

- No GPS source attached
  - Make your transmitter antenna a directional one. This can be done by the DIY reflector or you can use your body to lower the signal strength from one direction ( works for emergencies )
  - Turn yourself slowly in a circle and try to figure out the direction the signal strength is the strongest. Walk this direction and repeat this until you find the copter/plane. For this practice, some exercise is recommended.

**Disable Find mode on the receiver**

If the receiver is in Find-mode it can be canceled by pressing the "Bind"-button 3x. So if you are back home and the receiver still thinks it got lost, you can turn it off by this.  Or check the OLED screen to deactivate the Find-mode from the transmitter (Standard/ Lite TX).

The (on-board) LiPo battery in the diversity receiver is automatically charged every time the receiver is used. On the Standard diversity RX, you got a third LED indicator on the front face displays the current state of the battery.

| LiPo LED indicator | Status |
|---|---|
| Red blinking | Backup battery is charging |
| Solid red | Backup battery is fully charged |

**Find mode with other transmitters**

When using any transmitter besides the standard/ standard lite TX, find mode does not work. Anyway, the battery of the receiver will keep the link running while the main battery got ejected.

To leave find mode on the receiver, shut it down by the bind button.

## Real-time telemetry by Bluetooth

The Standard TX (not the Lite version) got a built-in Bluetooth module that you can use for real-time telemetry or wireless configuration of your FC. Depending on the incoming data, the CROSSFIRE selects the Mode for the Bluetooth module for you.

**Note: This menu is available till FW 6.09. In 6.13 the MAVLink menu was introduced, which combines WiFi and Bluetooth settings**

For this, you got different operation modes you can set it up to

- **OFF**
  - Bluetooth module is completely disabled and won't show up if you search for devices
- **MAVLink Emulator (MAV Emu)**
  - This mode is recommended if you have any kind of GPS source attached over BST ( TBS GPS, DJI NAZA over TBS BLACKBOX, ET Vector, BetaFlight, etc). If this mode is selected an FC is emulated inside the TBS CROSSFIRE transmitter. This gives you the ability to track your copter/plane in real-time with any MAVLink capable app on your phone (e.g. Droidplanner app ) or GCS on your PC or MAC (e.g. QGroundControl)

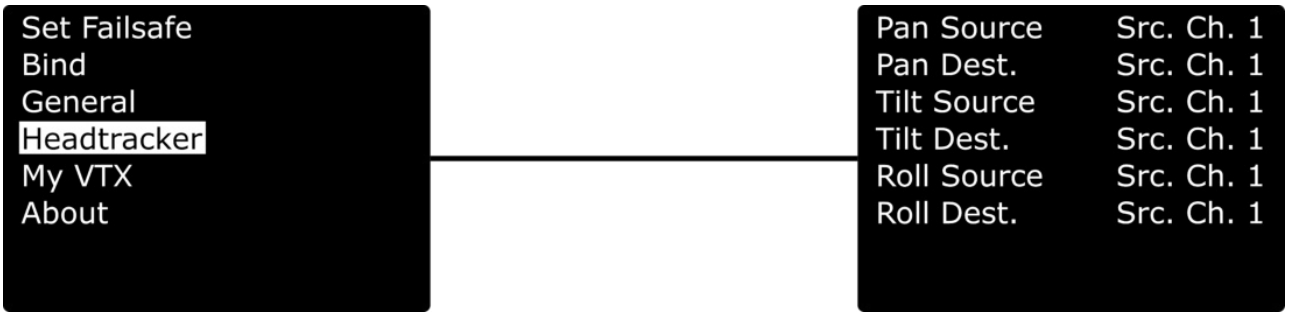
- **Serial Bridge**
  - This mode is used for a serial bridge between your connected device and the receiver
  - It can be used to wirelessly configure your FC
  - If serial data are registered from the receiver, the module will switch to this mode
  - As soon as the CROSSFIRE switches to 50Hz mode, the transmission will be stopped
- **MAVLink**
  - This mode is used to pass MAVLink messages back and forth. Use this mode if you have a MAVLink FC connected to the receiver.
  - If MAVLink packages are detected by the CROSSFIRE receiver, the module will switch to this mode
  - You can use the same applications as for MAVEmulation
  - With a MAVLink FC, you can wirelessly configure your FC (more details can be found in the MAVLink over Bluetooth section

## Head-tracking

The standard TBS CROSSFIRE transmitter supports standard head-tracking input via the right 3-pin HT port. Solder the included pigtail cable to suit your particular head-tracking setup. Only a two-wire connection between TBS CROSSFIRE and the head-tracker is required. The PPM feed from the head-tracker needs to be connected to the PPM pin of the PPM pin and ground needs to be connected to ground of the 3-pin PPM cable.

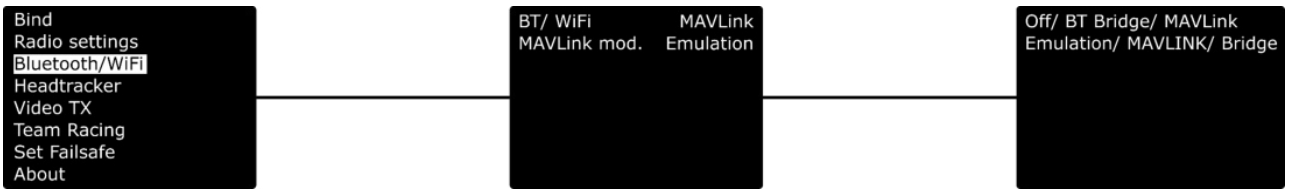
The status display will indicate if the signal has been recognized properly. Inside the menu under *Headtracker*, three functions for pan, tilt, and roll are freely mappable. Each function has a source and destination selection. The selected channel under source will replace the channel selected under destination. This gives you the ability to map your head tracker channels from any channel of the *Headtracker* input to the RC link frame.

Src. Ch. XX: the channel number where the signal for this axis is incoming.




## MAVLink (since FW 6.13)

With FW 6.13 the new MAVLink menu was introduced. It includes Bluetooth (Standart TX only) and WIFi settings.




The transmitter will detect the incoming data and switch to *MAVLink* (If MAVLink data are detected) or *Emulation* (if non-MAVLink sources are detected).

If you select *Bridge* the Bluetooth module of the Standard TX will pass the data coming from the receiver (Serial TX/ RX must be selected on the output pins) while the link is in 150Hz mode.

# Receiver functions

## Output map

On all receivers, you can select what it should output on which pin. The available options for each differ for the receivers:

Note: since FW 6.0 the PWM output map has changed. The older options are in brackets:

| Receiver pin | Output type diversity RX (standard) | Default |
|---|---|---|
| **1** | PWM CH1 (PWM Ch1 to 12), PPM, RSSI, LQ, RSSI/LQ | PWM Ch. 1 |
| **2** | PWM CH2 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ | PWM Ch. 2 |
| **3** | PWM CH3 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, SBUS, n.i.SBUS, Serial TX, MAVLink TX, CRSF TX, SmartAudio, GPS TX | PWM Ch. 3 |
| **4** | PWM CH4 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, Serial RX, MAVLink RX, CRSF RX, GPS RX | PWM Ch. 4 |
| **5** | PWM CH5 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ | PWM Ch. 5 |
| **6** | PWM CH6 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, Serial RTS, GPIO | PWM Ch. 6 |
| **7** | PWM CH7 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, Serial RX, MAVLink RX, CRSF RX | PWM Ch. 7 |
| **8** | PWM CH8 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, SBUS, n.i.SBUS, Serial TX, MAVLink TX, CRSF TX, DSMX, SmartAudio | PWM Ch. 8 |

| Receiver pin | Output type diversity RX (Nano) | Default |
|---|---|---|
| **1** | PWM CH1 (PWM Ch1 to 12), PPM, RSSI, LQ, RSSI/LQ, CRSF TX | PWM Ch. 1 |
| **2** | PWM CH2 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, CRSF RX | PWM Ch. 2 |
| **3** | PWM CH3 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, SBUS, n.i.SBUS, Serial TX, MAVLink TX, CRSF TX, DSMX, SmartAudio, GPS TX | PWM Ch. 3 |
| **4** | PWM CH4 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, Serial RX, MAVLink RX, CRSF RX, GPS RX | PWM Ch. 4 |
| **5** | PWM CH5 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, Serial RTS | PWM Ch. 5 |
| **6** | PWM CH6 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, Serial RTS, GPIO | PWM Ch. 6 |
| **7** | PWM CH7 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, Serial RX, MAVLink RX, CRSF RX | PWM Ch. 7 |
| **8** | PWM CH8 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, SBUS, n.i.SBUS, Serial TX, MAVLink TX, CRSF TX, DSMX, SmartAudio | PWM Ch. 8 |

| Receiver pin | Output type Micro V2/ Nano RX/ 6Ch Nano Pwm RX/ Sixty9 | Default |
|---|---|---|
| **1** | PWM CH1 (PWM Ch1 to 12), PPM, RSSI, LQ, RSSI/LQ, SBUS, n.i. SBUS, CRSF TX, MAVLink TX, SmartAudio*****, DSMX | CRSF TX |
| **2** | PWM CH2 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, CRSF RX, MAVLink RX | CRSF RX |
| **3** | PWM CH3 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, CRSF RX, MAVLink RX, Serial RX, GPS RX | PWM Ch. 3 |
| **4** | PWM CH4 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, SBUS, n.i. SBUS, CRSF TX, MAVLink TX, Serial TX, SmartAudio*****, DSMX, GPS TX | SmartAudio |
| **5 (BST)** | PWM CH5 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, BST SCL | BST SCL |
| **6 (BST)** | PWM CH6 (PWM Ch1 to 12), RSSI, LQ, RSSI/LQ, BST SDA, GPIO | BST SDA |

**SmartAudio **input** on Sixty9, available since FW 6.09*

## CRSF

CRSF is a protocol designed by Team BlackSheep and championed through the TBS CROSSFIRE remote control system. It has been integrated into the most popular remote controls, and is an incredibly high bandwidth (low latency) full-duplex, serial data transmission protocol. It comes with native functionality such as OTA (over the air) firmware upgrades, localized configuration menus, and a smart routing protocol.

CRSF can be selected on multiple outputs at the same time to connect several devices at once

## Serial

The bridge feature gives you the ability to pass any kind of serial UART data from any device connected to the receiver to any device connected to the transmitter. If you selected “Bridge TX” on a capable pin the following pin will be set to “Bridge RX” and the following to “Bridge RTS” (if not used by any other Serial protocol). Please connect your device according to this information. The baud rate is set to 57600 8N1 and the voltage level is 3.3V only. The RTS pin will change to logical high when the internal FIFO is almost full and low if the FIFO is almost empty. There is no hardware flow control for the uplink as the wireless close-range telemetry module does not support it.

## SBUS

SBus is the signal that is used by FrSky and other brands. The signal is inverted, which means on an F4 FC you need to use a pad with a built-in signal inverter. Those pads are mostly labeled with “SBus” on your FC

### N.i. SBUS

Not inverted SBUS is the same as SBUS except that the signal is not inverted. This can be used for FCs that have no signal inverter built in and require SBus as input signal.

### MAVLink

MAVLink is a very lightweight, header-only message marshaling library for air vehicles. Most of the common flight controllers support the MAVLink message format. For specific message documentation please refer here: MAVLink Messages

If you select “MAVLink TX” on one of the available outputs the corresponding output will be set to “MAVLink RX”. There is no hardware flow control required as we support software flow control (RADIO_STATUS message) on both ends. You can connect it to any telemetry port of a MAVLink compatible FC. The MAVLink baud rate is set to 115200 baud (since FW 6.xx, 57600 baud before 6.xx). The MAVLink TX pin needs to be connected to the FC telemetry RX pin and the MAVLink RX pin needs to be connected to the FC telemetry TX pin. The CROSSFIRE supports MAVLink V1 and V2, which will be selected automatically by the incoming messages.

You use the MAVLink connection to send your RC data as well. If your FC supports MAVLink V2, this includes up to 12 channels, with V1 up to 8 channels.

### PWM (Ch X)

If you select CH X, the CROSSFIRE will output a standard 50Hz PWM signal, that can be used for all servos and FCs without digital RC input.

### PPM

Sends up to 12 channels by PPM. Only use it on old-style flight controllers with no serial RC input.

### DSMX

DSMX is designed to use the CROSSFIRE as a backup system for Spektrum receivers.

### RSSI

Translates the RSSI from 0 - -130dBm to PWM signal from 2000µs to 1000µs. This can be used for old-style OSDs with only analog RSSI input

### LQ

Translates the Link Quality from 0 -100% to a PWM signal from 1000µs to 2000µs. This can be used for old-style OSDs with only analog RSSI input.

In 150Hz mode, the LQ indicator will remain at 100% as it’s not relevant to monitor it in the mode.

### RSSI/LQ

Combines the LQ and RSSI and translates them from 0 -100% to a PWM signal from 1000µs to 2000µs. The RSSI/LQ value will always show the worse value of both

### SmartAudio

SmartAudio is a protocol developed by TBS for OSD to VTX communication. SmartAudio is a single-wire UART protocol, running over the (Audio)-wire. All versions of SmartAudio are supported.

### GPS

Connect any UBLOX GPS receiver directly to your CROSSFIRE RX to get GPS-related telemetry without the need for an FC. #todo link

### GPIO (out)

Use the Output as GPIO to control relays etc. The high level is 3.3V, low level is 0V. Make sure not to exceed 5mA. The output will be high when the channel exceeds 30%.

## Channel map

The channel map menu is almost like the output map, except that you can change the channel order which also affects the channel order for any serial protocol. If you own a radio without flexible channel mapping, you can do it here.

This is also used to inject the LQ sensor for your FC. An example can be found in this section.

The possible settings:

- **Channel 1-12**: Any channel coming from the remote
- **LQ**: same as the output map setting
- **RSSI**: same as the output map setting
- **RSSI/LQ**: same as the output map setting

Example:

| | |
|---|---|
| Dst. Ch. 1 | CH1 |
| Dst. Ch. 2 | CH2 |
| Dst. Ch. 3 | CH3 |
| Dst. Ch. 4 | CH4 |
| Dst. Ch. 5 | CH5 |
| Dst. Ch. 6 | CH6 |
| Dst. Ch. 7 | CH7 |
| Dst. Ch. 8 | LQ |

## Channel number

The transmitted number of channels. Can be set to **8** or **12** channels.

Use the 8 channels setting whenever you can. This ensures the best performance for your RC link.

## RF Profile

Lock the CROSSFIRE to a fixed frequency or let it select it by the quality of the link.

- **Dynamic**: The CROSSFIRE selects the RF profile due to the internal algorithm based on the quality of the link. It will switch between 150Hz under ideal conditions and 50Hz when the link is no longer perfect. This happens many times per second. This is the best setting for most cases. When you disable the telemetry or the telemetry breaks up, the CROSSFIRE will switch to 50Hz mode.
- **50Hz**: Locks the CROSSFIRE to 50Hz mode. Use this setting if you encounter issues with your link
- **150Hz**: Locks the CROSSFIRE in 150Hz mode. This is useful if you are on a race and want low latency during the flight. In this mode, the range is limited so only use it in a race or a race-like situation.

## Telemetry

**Enables** or **disables** the telemetry for the receiver.

When you should disable the telemetry:

- On a race. This frees the band for other pilots.
- When you got black lines in your video feed. Make sure your cables are shielded or twisted to avoid this issue in general

If you disable it, dynamic rf, dynamic power, and the telemetry will no longer work. This means you CROSSFIRE TX will send with the maximum set up power level and switch to 50Hz mode.

The LUA scripts are not affected by this. The CROSSFIRE re-enables the telemetry for the time the data are sent and then turns it back off.

## Available sensors with OpenTX

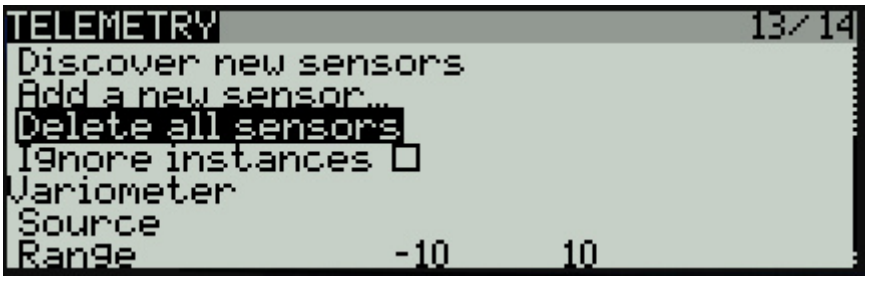
With an OpenTX based radio you can receive the following sensors, depending on your connected hardware:

| Datapoint | Description | Data source |
|---|---|---|
| 1RSS | Uplink - received signal strength antenna 1 (RSSI) | TBS CROSSFIRE RX |
| 2RSS | Uplink - received signal strength antenna 2 (RSSI) | TBS CROSSFIRE RX |
| RQly | Uplink - link quality (valid packets) | TBS CROSSFIRE RX |
| RSNR | Uplink - signal-to-noise ratio | TBS CROSSFIRE RX |
| RFMD | Uplink - update rate, 0 = 4Hz, 1 = 50Hz, 2 = 150Hz | TBS CROSSFIRE RX |
| TPWR | Uplink - transmitting power | TBS CROSSFIRE TX |
| TRSS | Downlink - signal strength antenna | TBS CROSSFIRE TX |
| TQly | Downlink - link quality (valid packets) | TBS CROSSFIRE TX |
| TSNR | Downlink - signal-to-noise ratio | TBS CROSSFIRE TX |
| ANT | Sensor for debugging only | TBS CROSSFIRE TX |
| GPS | GPS Coordinates | TBS GPS / FC |
| Alt | GPS Altitudes | TBS GPS / FC |
| Sats | GPS Satellites acquired | TBS GPS / FC |
| Hdg | Magnetic orientation | TBS GPS / FC |
| RXBt | Battery voltage | TBS GPS / FC/ CROSSFIRE RX/ CORE |
| Curr | Current draw | TBS GPS / FC// CORE |
| Capa | Current consumption | TBS GPS / FC/ CORE |
| Ptch | FC Pitch angle | FC |
| Roll | FC Roll angle | FC |
| Yaw | FC Yaw angle | FC |
| FM | Flight mode | FC |
| VSPD | Barometer | FC |

** Source: FC means all FC's with MAVLink or CRSF connection. CORE means CORE PRO, FPVision, Unify EVO*

### Missing sensors

If you got issues finding sensors or only a few appear, make sure to disable *Ignore Instances* in the telemetry settings page of your radio




### In-built Voltage monitoring

The CROSSFIRE receivers are capable of measuring the voltage of their power supply. This becomes handy when you use an RC glider where space matters.

This feature works on up to a 2s LiPo (max. Operation voltage for all receivers!) for almost all receivers, except for the Nano RX rev 43 and lower.

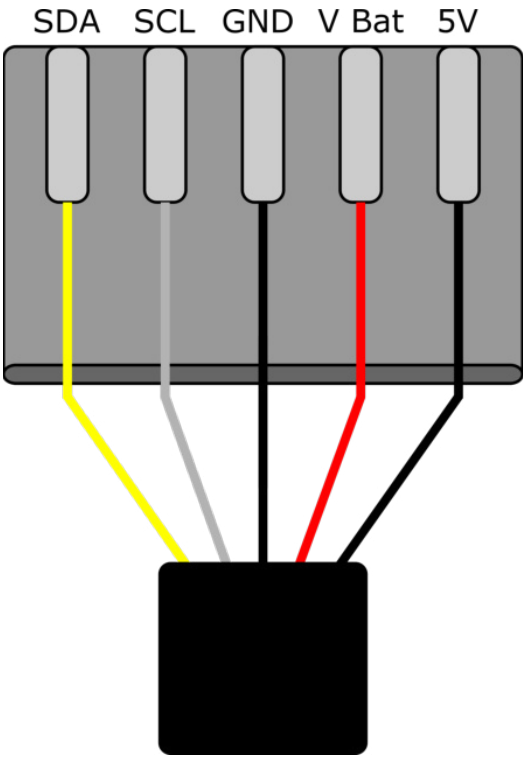
If you experience issues with another voltage sensor in your system, you can disable the CROSSFIRE sensor in the settings under *Receiver/General - Voltage Sensor*

## BST connection

BST (Blacksheep telemetry) is a bus system used by TBS to connect your gear like the TBS GPS puck, CORE PRO, etc. All devices are connected in parallel. The BST bus needs to get clean 5v to power up the connected devices:

| Power type: | BST 5V | VBATT | BEC 5V | FC 5V |
|---|---|---|---|---|
| **TBS CROSSFIRE** | ✔ PWR IN | | ✔ PWR IN | |
| **TBS BLACKBOX (discontinued)** | ✔ PWR IN | | | ✔ PWR IN |
| **TBS GPS** | ✔ PWR IN | | | |
| **TBS CORE PRO / FPVISION** | ✔ PWR OUT | ✔ PWR IN | | |
| **TBS CURRENT SENSOR** | ✔ PWR IN | ✔ PWR OUT | | |

If you own a Nano RX, there is no longer the complete BST plug available on it. In this case, just connect SCL to SCL and SDA to SDA  on all devices. The Pinout of the plug in general:




*Note: even if the BST bus got the same labels as your non-TBS GPS or compass (SCL and SDA), they don't work on the BST bus!*

# Additional information

## TBS CLOUD

All TBS CROSSFIRE transmitters and the FUSION video receivers include a built-in WiFi module that allows you to connect all your gear through the TBS CLOUD. This allows using features like VTX follow, dynamic VTX power with a FUSION module, and other upcoming features.

### Menu

- **WiFi Client**
  - **AP Mode:** enables/ disables the WiFi module
  - **Default SSID:** enables/ disables the SSID broadcast of CROSSFIRE TX hotspot
  - **SSID:** SSID/ name of the selected external hotspot
  - **Password:** password for the externally selected hotspot
  - **Connect:** manually connect to the network. Only necessary when a new network is chosen in the *SSID* option
  - **Scan:** scans for WiFi networks. Found networks can be chosen under *SSID*, manually reconnecting by *Connect* is required
  - **Forget WiFi:** erases all saved networks and their passwords
  - **Upgrade:** starts the self-update for the WiFi firmware (Internet connection required). **FW 2.03 or later required**
- **MAVLink (UDP/ TCP)**
  - **MAVLink:** select the protocol (UDP or TCP) or turn the MAVLink stream off.
  - **Port:** change the UDP/ TCP port where the telemetry will be sent (WiFi 2.03 sues TCP)
  - **UPLINK CNT etc:** Status of the MAVLink stream, works only with TCP
- **WebUI**
  - **WEB UI:** enables/ disables the WEB UI
  - **AP Lock:** enables/ disables password authentication for CROSSFIRE TX internal WiFi hotspot
  - **Password:** set up a password for CROSSFIRE TX internal WiFi hotspot
  - **Login:** enables/ disables password authentication for CROSSFIRE TX internal Web Ui
  - **Password:** set up a password for CROSSFIRE TX internal Web Ui
- **PRO**
  - **WiFi Power:** power level of the WiFi module
  - **TBS CLOUD:** enables/ disables the TBS CLOUD connection
  - **Autoscan:** enables/ disables the scanning for previously bound Hotspots

- **About**
  - **WiFi:** name of the WiFi hotspot/ Network your CROSSFIRE is connected to
  - **IP:** IP address the CROSSFIRE module was assigned by the WiFi network
  - **Server:** connection status
  - **firmware:** the version number of the WiFi firmware
  - **Hardware:** hardware revision of the WiFi module
  - **Bootloader:** the version number of the WiFi Bootloader firmware
  - **Serial Number:** serial number of the WiFi module

## Initiate and update the WiFi module

To use the CLOUD functions, you need to initiate the WiFi module first:

- Download and unpack the firmware files for the WiFi module from TBS
- Connect the CROSSFIRE TX to your radio and power it up
- On your PC or phone search for a new WiFi network like "TBS_XF_AP_xxxxxx"
- Connect your pc with this network. On Windows machines, this can take up to one minute
- Open your browser and enter IP in the address bar: 192.168.4.1
- Click on *Select file* and search for the unpacked firmware files you downloaded before

- Hit *Update* and wait for the website to reload
  - **Do not shut down your radio during the WiFi module updating process**
- Now you can see the WiFi module of your CROSSFIRE TX in the *menu/ LUA script and AGENT DESKTOP or WEB*

*Here you can find the whole process as video*

### Connection to a WiFi hotspot

Once your WiFi module is initiated, you can now connect to an external hotspot. The easiest way is to connect it by the **Web-UI**:

- Connect the CROSSFIRE TX to your radio and power it up
- On your PC or phone search for a new WiFi network like “TBS_XF_AP_xxxxxx”
- Connect your pc/ phone with this network. On Windows machines, this can take up to one minute
- Open your browser and enter IP in the address bar: 192.168.4.1
- Open the *WiFi* tab
- Click on Scan to search for available WiFi hotspot/ networks
- Click on the name of the found network you want to connect to - the name will be entered for you
- Enter your password and hit Connect/ Disconnect
- When you refresh the WebUI page after a few seconds, you will see the IP address assigned by the WiFi network for CROSSFIRE TX

**Note: if WiFi hotspot/ network has no internet connection, CLOUD-based features will not work.**

**AGENT DESKTOP or WEB/ Lite menu works as well:**

- Connect the CROSSFIRE TX to your radio and power it up
- Navigate in the CROSSFIRE menu to *WiFi/ General*
- Hit *Scan* to search for available networks
- Under *SSID* you can select the found network
- Enter the password for the selected WiFi hotspot/ network in the *Password* option
- Select *Connect* to start the manual connection to the selected WiFi hotspot/ network
- Done

## OpenTX setup for CROSSFIRE

If you own an OpenTX radio, you need to set up your model like this:

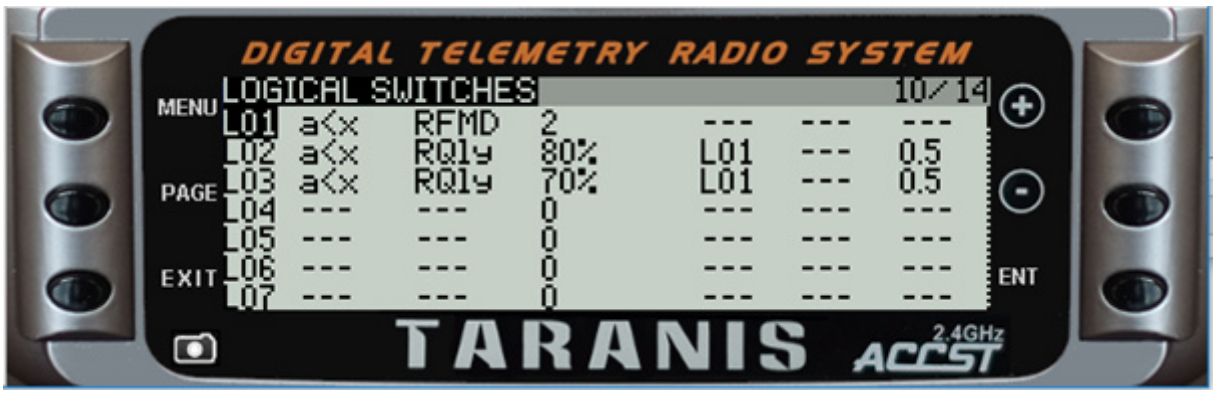
**Internal RF: off** and **External RF: CRSF**

Note: those settings need to be done on all models where you use your CROSSFIRE.

Using CRSF will give you the lowest possible latency from your stick to the drone and full telemetry back to your radio.

## LQ warning in OpenTX

The setup for the radio is relay simple:




What they mean:

L01: Monitors the CROSSFIRE frequency mode, activated when it's not in 150Hz mode
L02: Active when the Link quality drops below 80% (pre-warning) AND 50 or 4 Hz mode is active
L03: Same as L02 but with the critical warning level at 70%

L02 and L03 also got a small delay (0.5s) to avoid warnings when the signal is only bad for a short moment.

***Note: since CROSSFIRE FW 2.93, the RFMD no longer needs to be compared as the LQ sensor will stay at 100% while in 150Hz mode (RFMD = 2)***

**<u>When you use the 150Hz locked mode of the CROSSFIRE, the levels are 40% for L02 and 30% for L03</u>**

With the logical switches, the voice alerts will be triggered every time they are active. What they mean:

SF1: when L02 is active, plays the selected track ones -but not at the startup
SF2: same as SF1 for the critical warning

For the sounds, you can create your own with a free TTS creator on the internet.

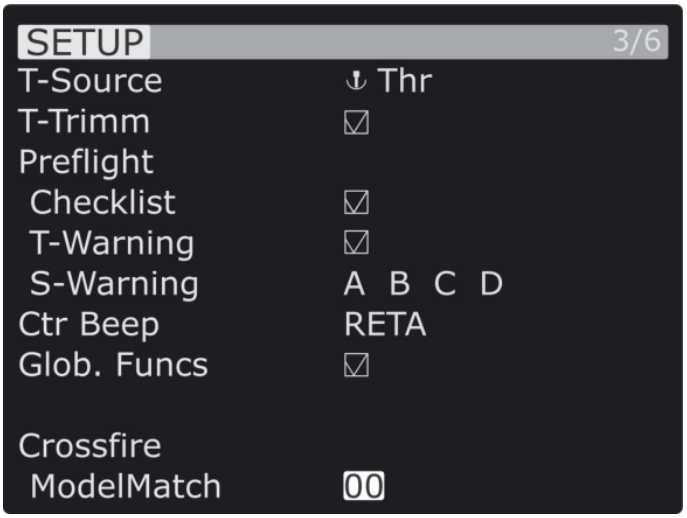
## Model match in OpenTX, EdgeTX and FreedomTX

Model match enables you to make sure that a specific receiver and drone with it only bind if the correct radio model is selected. In case you switched from a drone to a wing and forgot to change the model, the RX will simply not bind (unless you start the bind procedure).

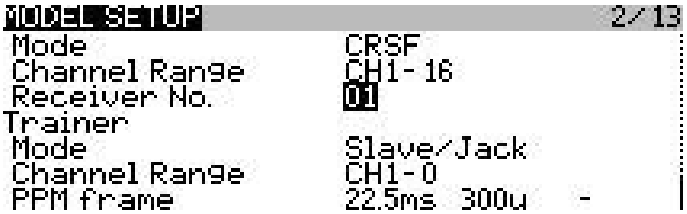
You need to make sure that you don't use an id twice in different models. In this case, the RX will bind to both of them!

In OpenTX your model number in the memory will be set as the default Model Id when you create a new model. If you want to use Multi-bind on another radio with no Model Id option, make sure you have set it to 00 before

**Model Id (Model Match) in FreedomTX (TANGO 2)**




**Model Id (Receiver No.) in OpenTX**

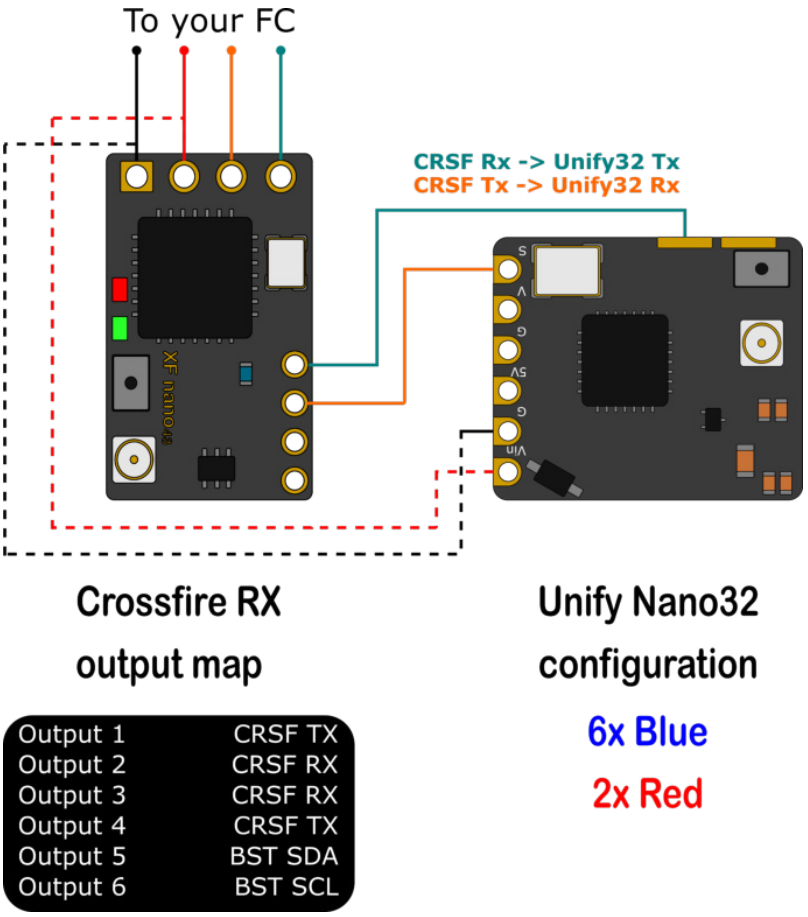


## VTX connection by CRSF

All Unify32 and EVO line VTX's from TBS FC are capable of using CRSF to communicate with the CROSSFIRE ecosystem.

- Select a free output pin capable for CRSF (check the output map section for available outputs)
- Set the Unify32 to CRSF by button or USB (EVO and Unify32 HV)
- Connect them (CROSSFIRE TX to VTX RX, CROSSFIRE RX to Unify TX)

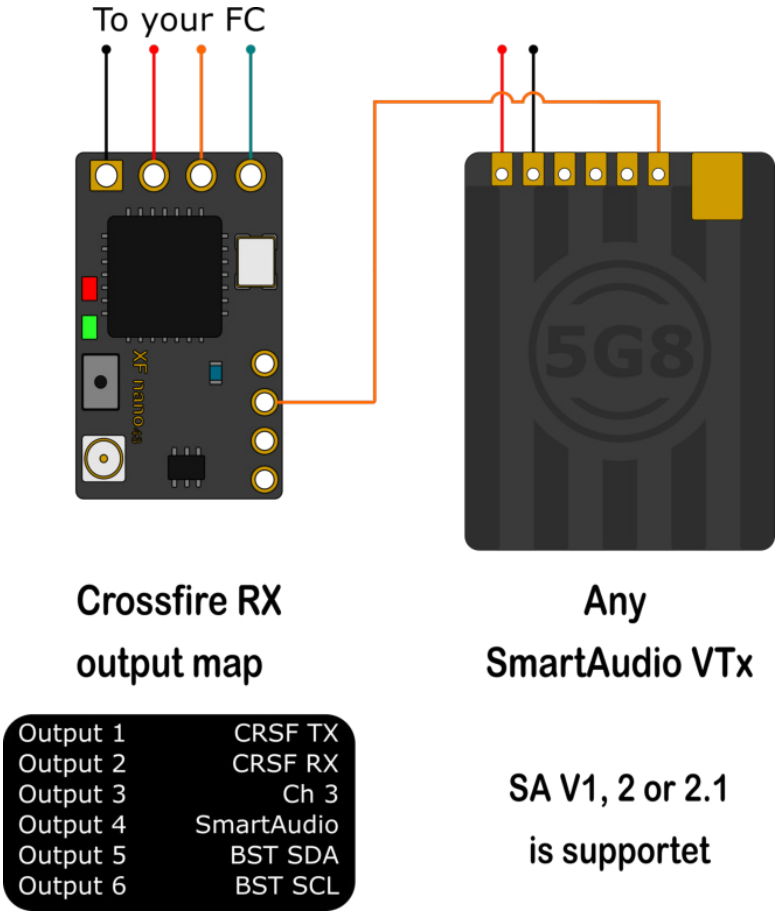
Wiring example:



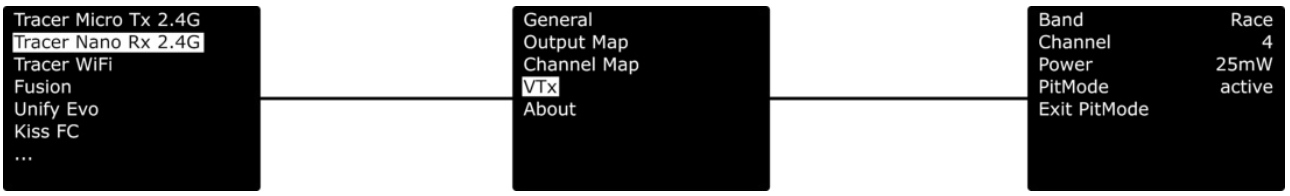
## VTX connection by SmartAudio

If you own any Unify or any other VTX with SmartAudio capability, you can connect it to your CROSSFIRE receiver as well.

- Select a free output pin capable for SA (check the output map section for available outputs)
- Connect them (CROSSFIRE TX to VTX RX/ SmartAudio pad)




When the VTX is found by the receiver, a new *VTX (not VideoTX !)* menu will show in the LUA/ CRSF menu of the transmitter



### SmartAudio or CRSF for the VTX?

Both protocols had their advantages and disadvantages:

- **SmartAudio**
  - Single wire connection. Saves one PWM output (useful if you got a wing and use the BST pins for BST)
- **CRSF**
  - OTA Updates (upcoming)
  - Fully configurable by LUA, CROSSFIRE OLED, FUSION, etc.
  - CRSF readout - let you use PIT mode on a switch or navigate through the Unify EVO OSD without the need for an FC, link stats readout with the Unify EVO OSD

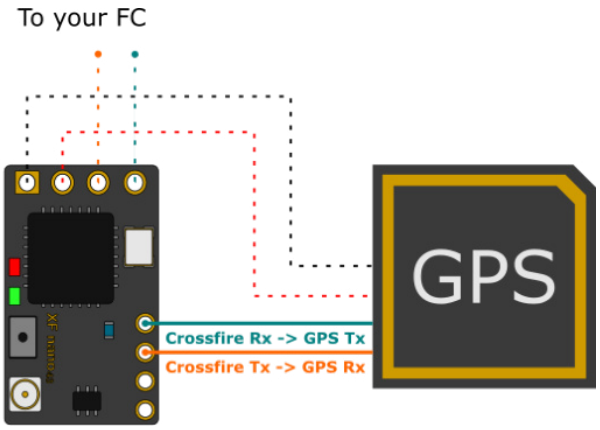
## VTX  button not working

When the Unify32 detects a signal on the SmartAudio Signal-in pad, it will disable the button. To change the VTX to CRSF or SA, you can unsolder the wire (FC connection) or force your CROSSFIRE RX to not output any signal.

- Set the output of the CROSSFIRE RX to CH X (PWM) for the pin where the VTX is connected to
- Shut down the CROSSFIRE TX and RX
- Power up just the drone with the CROSSFIRE RX and the Unify32
- Change the Unify32 settings by the button
- Turn the transmitter back on
- Set the output map back to CRSF or SmartAudio

## GPS connection (non-BST GPS)

You can direct wire your UBlox GPS to pin3/4 of your CROSSFIRE receiver to get GPS based telemetry data back to your remote and into your drone (currently only supported by KISS FW). The receiver will adjust its baud rate to work with the GPS.

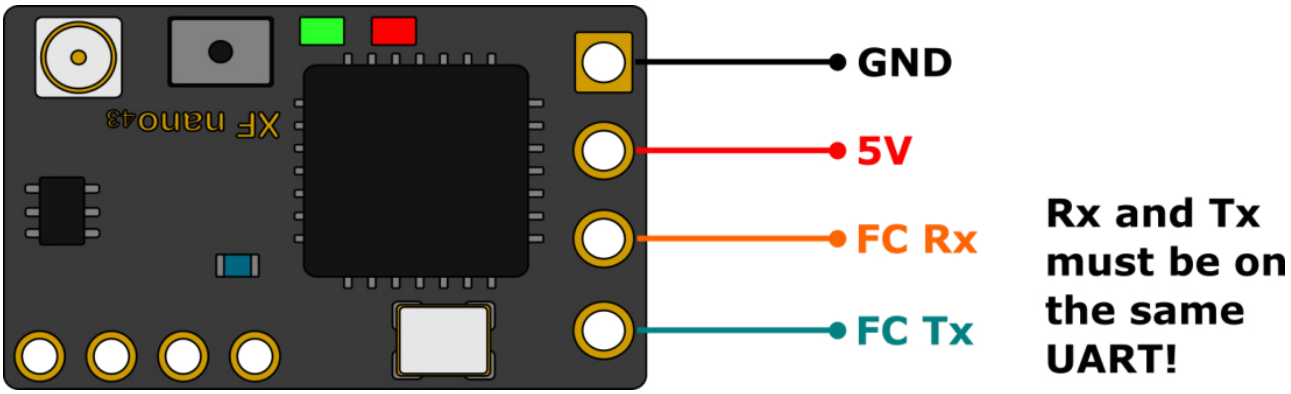



Crossfire RX output map

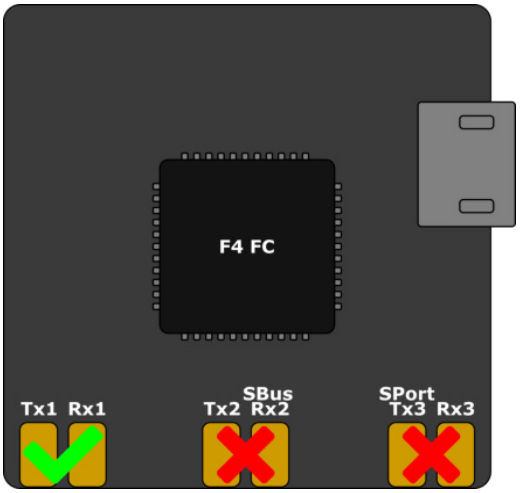
| | |
|---|---|
| Output 1 | CRSF TX |
| Output 2 | CRSF RX |
| Output 3 | GPS RX |
| Output 4 | GPS TX |
| Output 5 | BST SDA |
| Output 6 | BST SCL |

## Connection to an FC

### General wiring



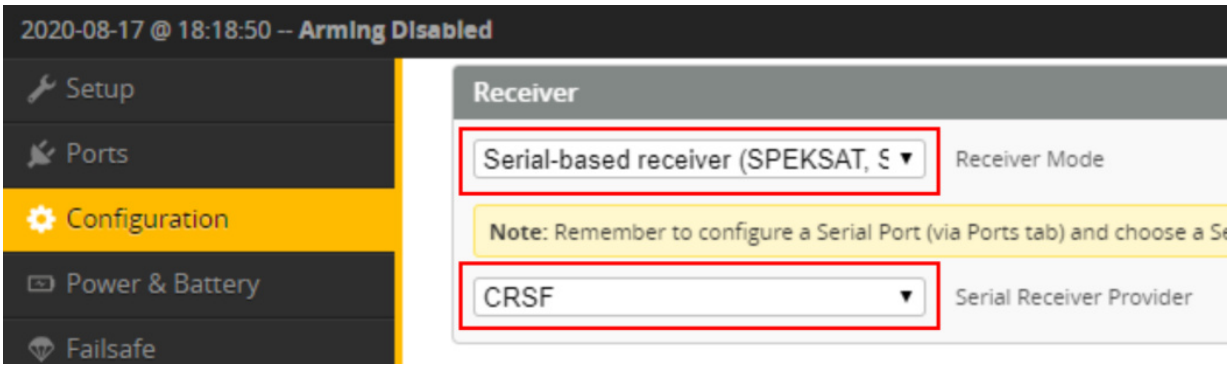

If you use SBus or any other protocol besides CRSF or MAVLink, you only need to connect the receiver's TX line to your FC. Use CRSF whenever possible to get the best experience with your CROSSFIRE.



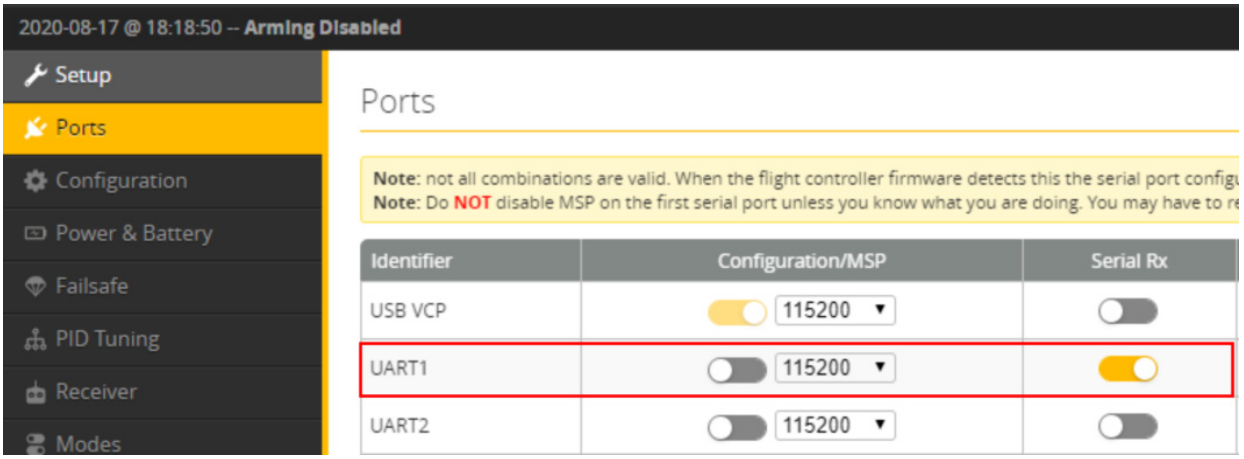

If you use an **F4 FC**, make sure you don't use UARTs with labels with *SBUS* or *S-PORT*. Those UART's got a hardware-inverter installed which does not work with CRSF.

## CRSF with BetaFlight and similar firmware

In the BateFlight configurator, navigate to the *Configuration* tab and select *Serial-based receiver* and *CRSF*




In the Ports tab, enable Serial RX for the UART where your receiver is connected




**<u>CRSF does not work on Soft Serial ports!</u>** In INAV 4.1 they are enabled by default. If you experience issues, disable the feature

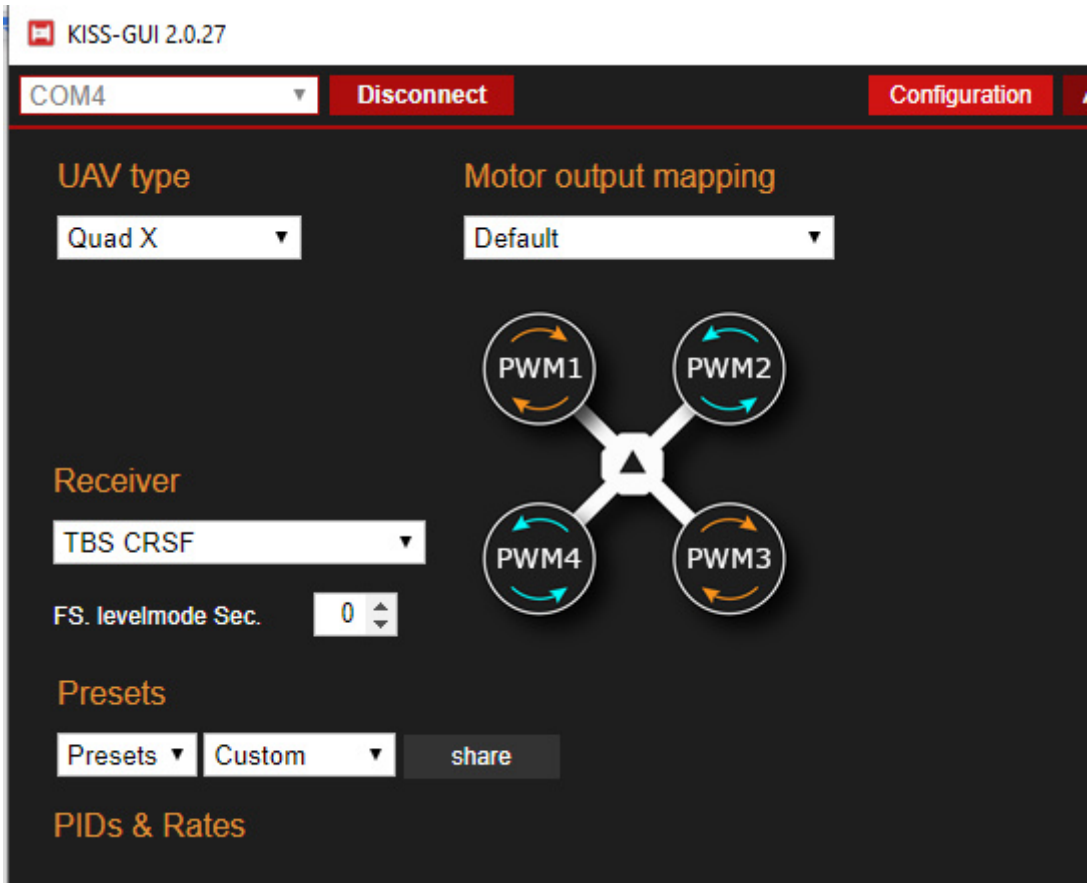
CLI command

**set failsafe_recovery_delay = 1**

## CRSF with KISS/ FETTEC

Depending on the KISS Fc you are using, connect the CROSSFIRE by CRSF to the Fc's RC input port.

In the configurator, enable CRSF as RC Type:



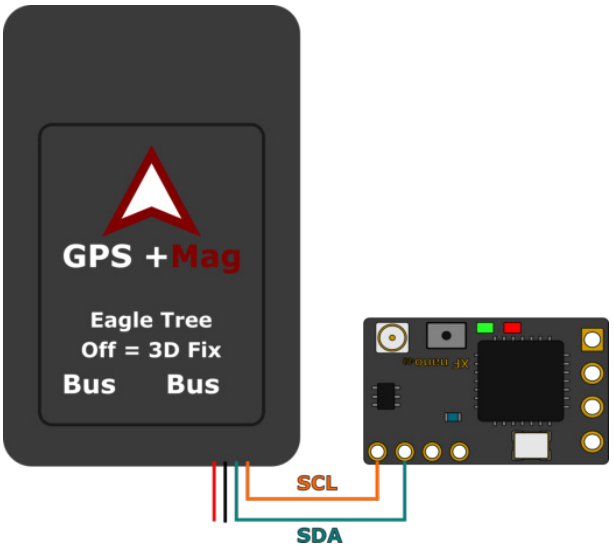

## Any other FC

Depending on your FC, set the output map according to the protocol that it can use.

## BST to Eagletree Vector

If you use an EagleTree vector Fc, you can connect the ET bus to the BST bus to get LQ and RSSI in the osd as well as telemetry from the FC back into the CROSSFIRE.

To wire it up, just connect *SCL to SCL* and *SDA to SDA.* A common ground should already exist by the RC connection to the FC.

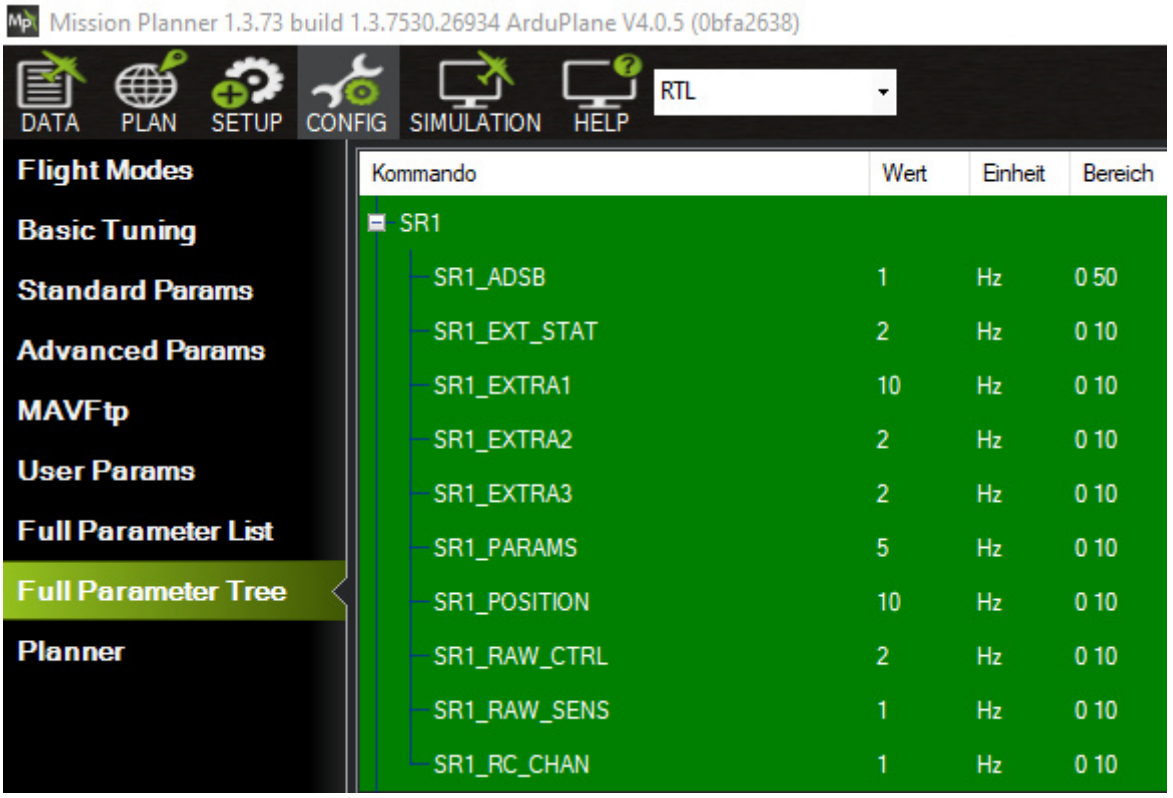



## MAVLink with MAV FCs

If you use an FC with MAVLink like ArduPilot/ PX4, you can use the MAVLink capabilities of the CROSSFIRE. Connect a MAVLink capable output to the Telemetry port of your FC. On PIX FC's it's mostly the TELEM1 port and set the CROSSFIRE RX output map to MAVLink TX and RX.

| | |
|---|---|
| Output 1 | CRSF TX |
| Output 2 | CRSF RX |
| Output 3 | MAVLink Rx |
| Output 4 | MAVLink TX |
| Output 5 | BST SDA |
| Output 6 | BST SCL |

On the FC you need to configure the telemetry port. Otherwise, the CROSSFIRE will not be able to receive telemetry data from the FC until you connect it to Mission Planner. Your *TELEM1* can be found as *SR1*



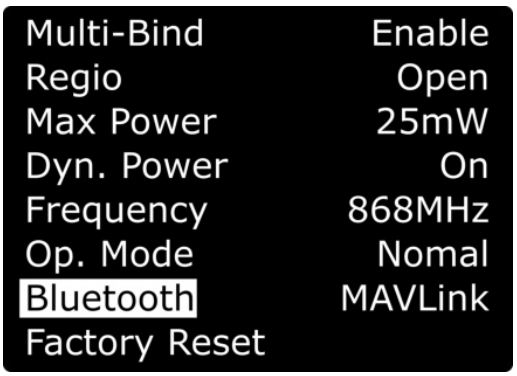

If you use MAVLink, you can also use the *RC over MAVLink* option to save the extra wiring. The details can be found in this section.

If you use the PX4 firmware, you don't need to configure the telemetry port to get it running.

**For the best experience, you should use ArduPilot 4.10 CROSSFIRE 6.1X and WiFi 2.04 or later. There the Baud Rate must be set to 115200 Baud (SERIALx_BAUD = 115200, SERIALx_PROTOCOL = 2)**

## Wireless configuration with ArduPilot/ PX4 by Bluetooth

As soon as the receiver receives valid MAVLink packages, the Bluetooth module switches to MAVLink as well. If you encounter issues, you can check the module settings in the *Transmitter/ General* settings:




In Mission Planner, QGroundControl, or any other app, set the Baud Rate of your PC's Bluetooth module to **57600baud.**

Make sure your CROSSFIRE RF profile is set to dynamic or forced 150Hz!

## Wireless configuration with ArduPilot/ PX4 by WiFi

Over the built-in WiFi module, you can get MAVLink data to your pc or mobile device for live telemetry as well as full MAVLink data transmission (as with the Bluetooth module).

You need to set up your WiFi module for that to work before.

You can connect to your CROSSFIRE in two ways:

- Both are in the same WiFi network
- Straight connection to the CROSSFIRE access point

When you are connected, you need to use the following settings:

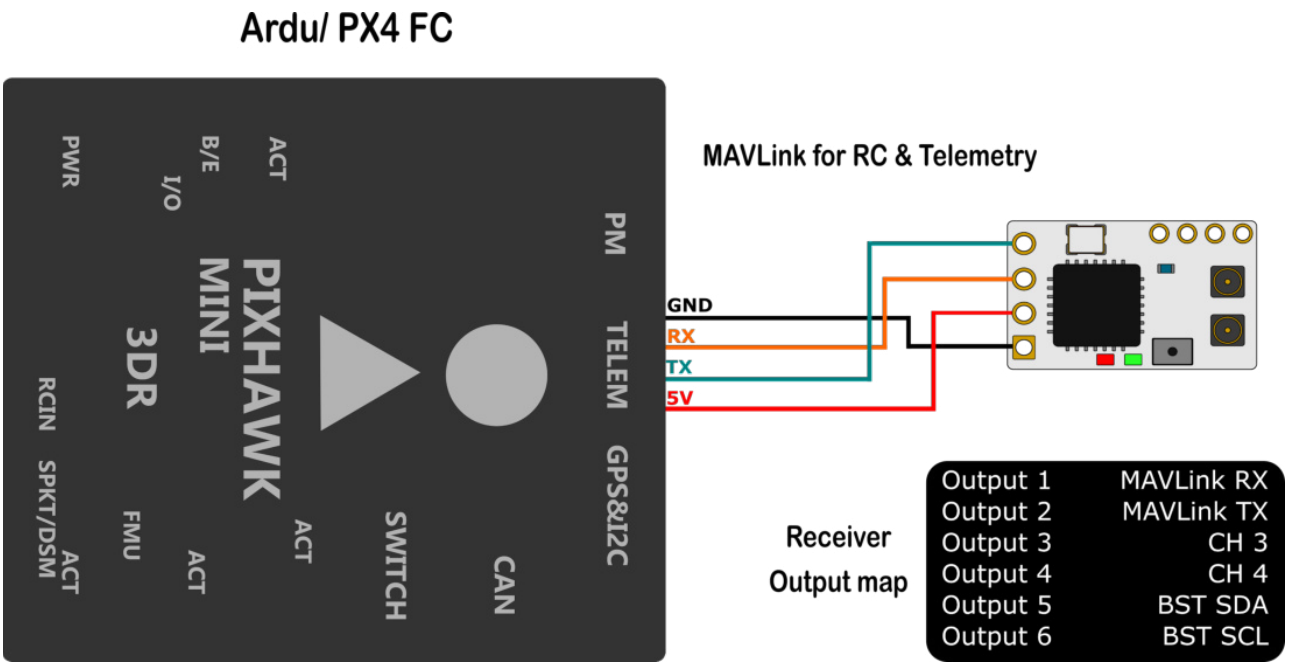
- **Connection type:** UDP (WiFi up to 2.02) or TCP (since WiFi 2.03)
- **IP (TCP only):** 192.168.4.1 (when connected straight to the WiFi module)
- **Port:** 8888 (can be changed in the CROSSFIRE WiFi settings)

The port can be changed in the settings of the WiFi module if you need to.

In the WiFi settings, you can enable or disable the MAVLink data. To change this, navigate to and set *MAVLink* to *on*.

Make sure your CROSSFIRE is in RF mode *dynamic* or *forced 150Hz.*

**Wiring diagram**




## Wireless telemetry

### Bluetooth

Depending on the FC firmware you use, you have to set your Bluetooth module to MAVEmu or MAVLink.

Use MAVEmu if you use non-MAVLink FC firmware. Otherwise, the CROSSFIRE will set the Bluetooth module to MAVLink by itself (if MAVLink data are incoming to the receiver).

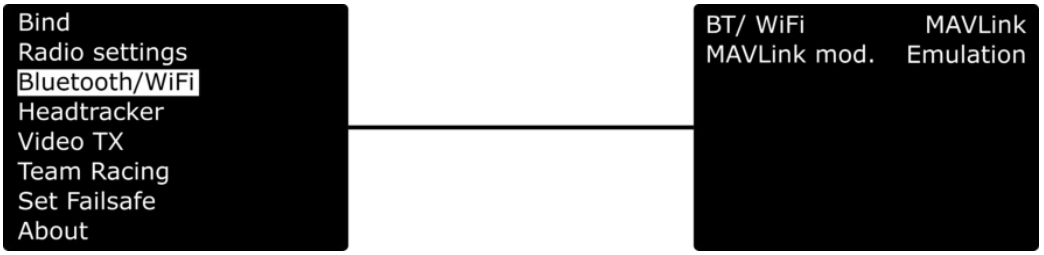
Then connect your mobile device to the CROSSFIRE Bluetooth module. The connection speed must be set to **57600baud**
Depending on the app you are using, you might not need to be in 150Hz mode at the beginning.

### WiFi

Getting real-time telemetry data from your CROSSFIRE by WiFi works almost the same as with Bluetooth.

You can find the WiFi details here. Depending on the app you are using, you might not need to be in 150Hz mode/ dynamic rf mode at the beginning.

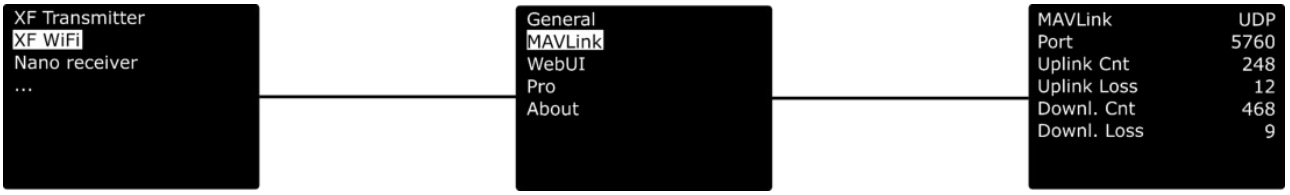
In the WiFi settings, you enable the MAVLink stream first:



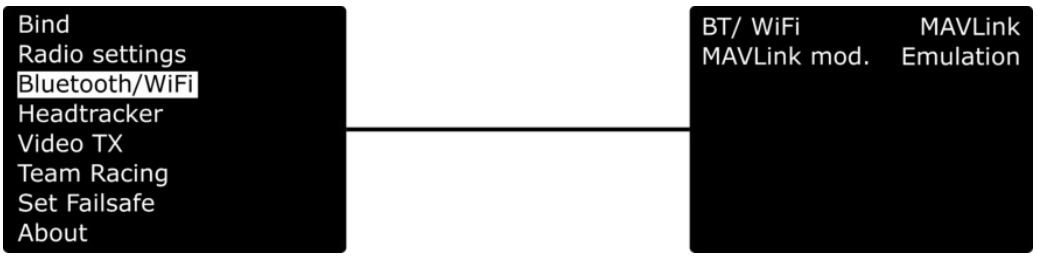

## WiFi telemetry with BetaFlight/ INAV

With WiFi FW 2.04, MAVLink emulation is available. As with the Bluetooth module, it packs the telemetry data into a MAVLink header that can be used by ground control software like MissionPlanner or QGround.

Enable MAVLink TCP or UDP (TCP recommended) in the WiFI settings



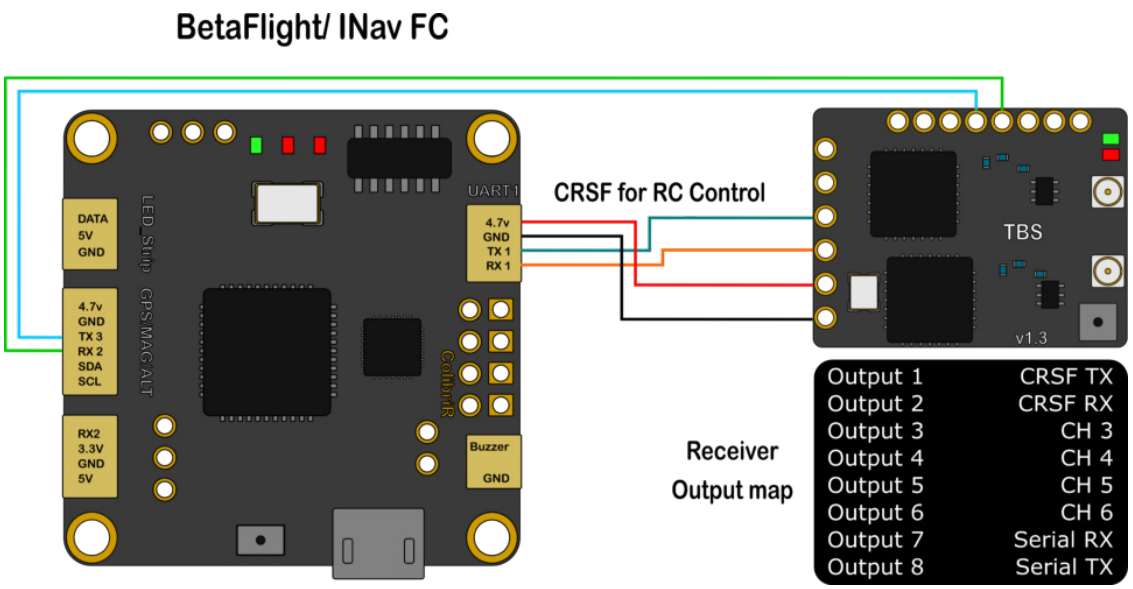

Enable telemetry in the *XF TX/ Bluetooth/WiFi* menu by setting the BT/WiFi setting to *MAVLink*




Connect your phone or PC to the CROSSFIRE WiFi AP or Bluetooth module with your ground control software with *57600baud*.

## Wireless configuration with BetaFlight/ INAV by Bluetooth

With the serial passthrough function of the Bluetooth module (Standard TX only), you can connect to your BetaFlight/ INAV Fc without a USB connection. For this to work, you need to connect a second connection between the CROSSFIRE RX and the FC

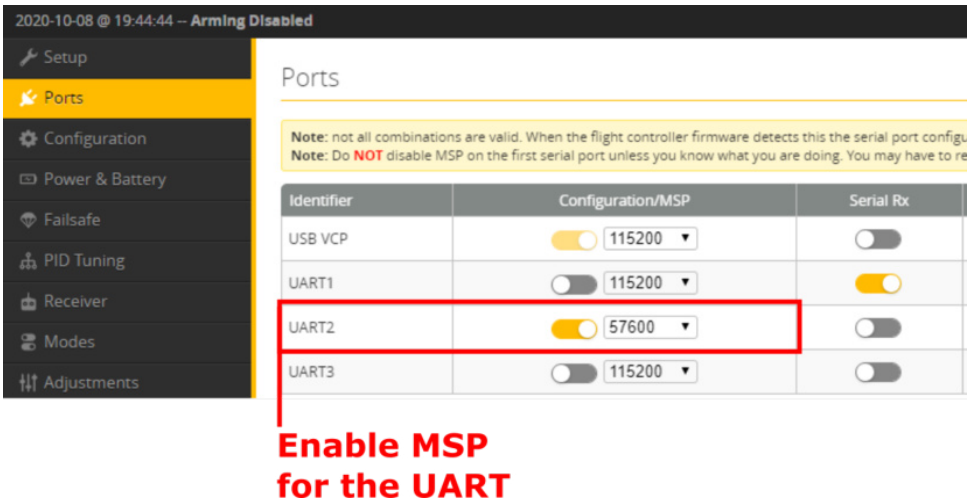



*Note:*

*This will only work while your CROSSFIRE is in the 150hz mode. As soon as the link switches to 50Hz, the Bluetooth module stops sending serial data*

### BetaFlight/ INAV setup

Enable MSP for the UART and set the Baud Rate to 57600. When you want to connect to the BetaFlight/ INAV configurator, select the Com port of your pc and set the Speed to 57600baud as well.



## Signal strength in BetaFlight - BF < 4.1

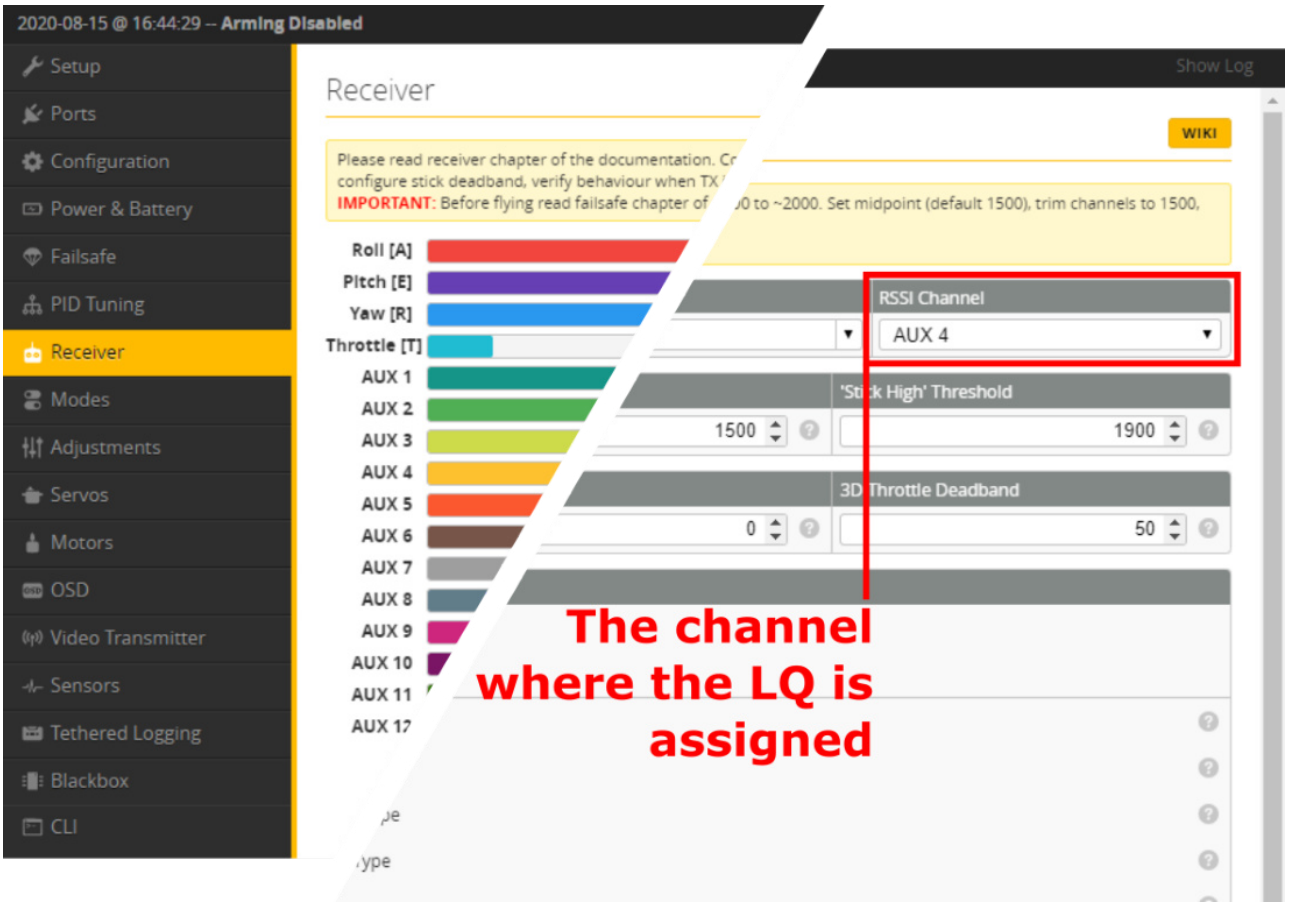
If you use an older BetaFlight version or a new one, you need to assign the LQ sensor to a channel.

*Keep in mind that the LQ will remain at 100% while the CROSSFIRE is in 150Hz mode!*

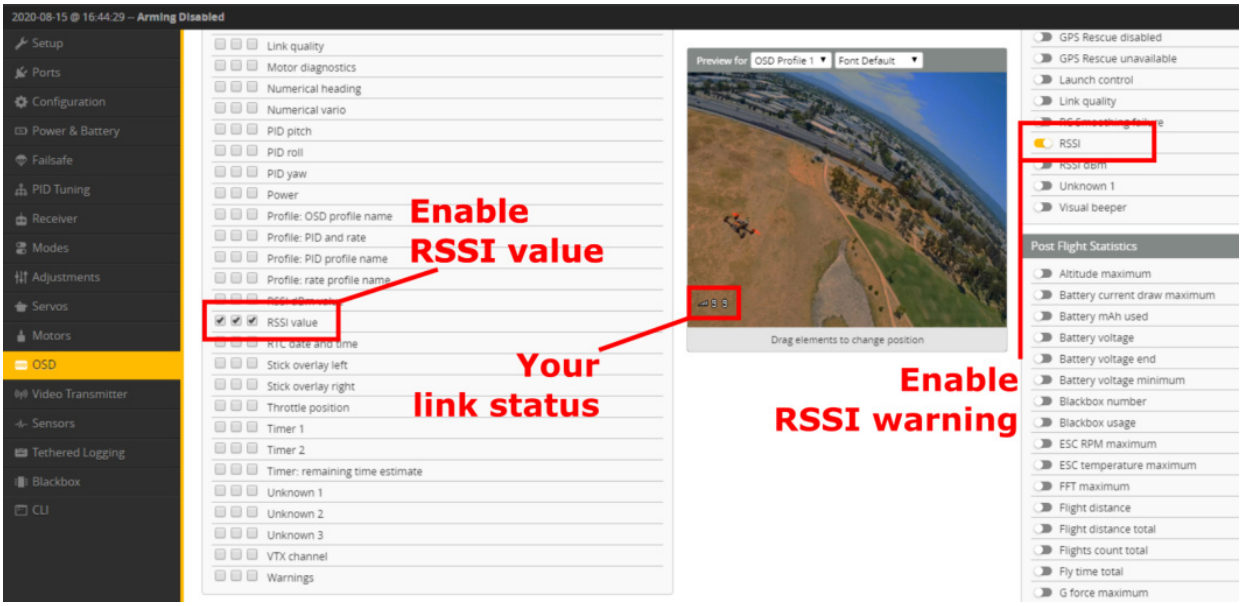
| | |
|---|---|
| Dst. Ch. 1 | CH1 |
| Dst. Ch. 2 | CH2 |
| Dst. Ch. 3 | CH3 |
| Dst. Ch. 4 | CH4 |
| Dst. Ch. 5 | CH5 |
| Dst. Ch. 6 | CH6 |
| Dst. Ch. 7 | CH7 |
| Dst. Ch. 8 | LQ |

In the CROSSFIRE receiver channel mapping, assign LQ to an unused channel. If you set it up by LUA, you can assign it to channel 1, even when you use the 8 channel mode of the CROSSFIRE.

In BetaFlight, set the assigned channel as *RSSI Channel* (AUX1 = channel 5, etc)



**For the OSD tab, set it up like this:**

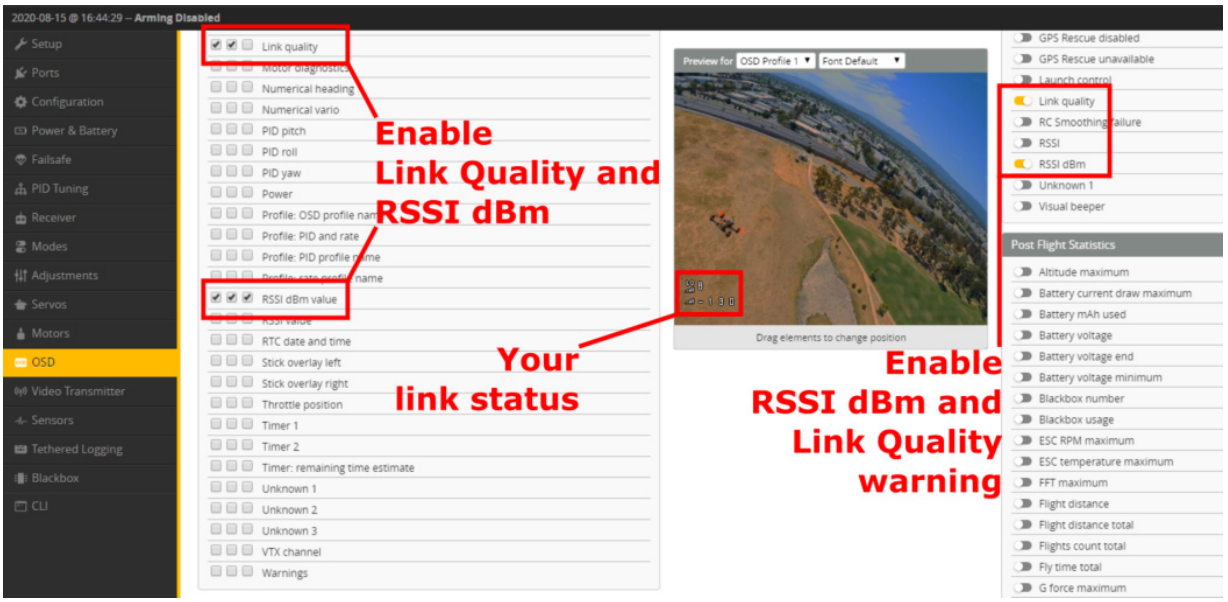



## Signal strength in BetaFlight - BF 4.1 and later

Since version 4.1 BetaFlight can read the link information from the CRSF stream. This will give you the RSSI reading in dBm (0 - -130) and the LQ reading similar to the TBS OSD (300 - 0 %).

To use this new method, you need to disable the RSSI channel setting in the receiver tab and activate the following elements in the *OSD* tab. Also, make sure that the *RSSI_ADC* option is disabled (general BetaFlight settings).

**With DJI, LQ does not work. There you need to enbale "RSSI" in the OSD tab. LQ does not need to be assigned to a CRSF channel.**



### CLI commands

**Rf mode dynamic or forced 50Hz:**

set osd_link_quality_alarm = 70
set osd_RSSI_dbm_alarm = -100

**Rf mode forced 150Hz:**

set osd_link_quality_alarm = 40
set osd_RSSI_dbm_alarm = -100

**DJI/ older BF versions:**

set osd_RSSI_alarm = 70

## Signal strength in INAV - INAV < 3.xx

In INAV, it's almost the same as with the old BetaFlight method, except that you don't need to assign LQ to a channel in the channel map menu.

INAV reads the LQ from the CRSF stream and outputs it automatically on **Channel 17** (from INAV).

## Signal strength in INAV - INAV 3.xx and later

With INAV 3 the LQ readout can be set up the same way as for BF 4.1 and later. The CLI commands are not necessary.

## Link States

### LQ

Link quality

The number of packages that arrive correctly. If the number starts to drop, more packages are lost.

In the TBS OSD's the LQ is scaled from 0-300%:

- **0-100%:** 50/4 Hz mode
- **170-300%:** 150Hz mode

If you use LQ as a sensor by the channel/ output map menu or as an OpenTX telemetry sensor, it behaves like this:

- **150Hz mode**: 100%
- **50/4Hz mode:** 0-100%

## RSSI

Relative signal strength indicator

How “loud” the signal is, that the receiver “hears”. But this also includes noise.

The RSSI is exponential which results in a massive drop at the beginning and slows down the lower it gets. In general: double the range will result in a drop of -6dBm. An example:

- RSSI at 0m = -10dBm
- RSSI at 1m = -16dBm
- RSSI at 2m = -22dBm

The CROSSFIRE can go down to -130dBm before the link breaks up. If you use RSSI as a sensor by the channel/ output map menu or as an OpenTX telemetry sensor, it will be shown like this:

- **-0.1dBm** = 100%
- **-130dBm** = 0%

## SNR

Signal-to-Noise ratio

It shows you the ratio between the received noise and your CROSSFIRE signal.

To judge RSSI properly you need to know the SNR and compare it with your RSSI value. The CROSSFIRE can receive signals in the noise down to -6dB.

Example:

An RSSI of -80dBm is fine. But with an SNR of -2dBm, it’s really bad.

Positive numbers mean the CROSSFIRE signal is “louder” than the noise,
negative Numbers mean the noise is louder than the CROSSFIRE

## Warning levels

| Sensor | Prewarning | Critical |
|---|---|---|
| **RSSI** | 30% / -100dBm | 20% / -106dBm |
| **LQ (dynamic or forc. 50Hz)** | 70% (BF: 1:70) | 60% (BF: 1:60) |
| **LQ (fixed 150Hz)** | 40% (BF: 2:40) | 30% (Bf: 2:30) |
| **RSSI/ LQ** | 30% | 20% |
| **SNR** | 4dB | 0dB |

## What should I use in my OSD or radio

The easiest way to set up your OSD or radio warning is by **using LQ**. It is linear which makes it easier to monitor for most people, while RSSI got a logarithmic scaling which makes it drop rapidly at the beginning and then slower the further you go.

## Racing environment

When using TBS CROSSFIRE control link, it is a requirement that all pilots use the same power output. The use of CROSSFIRE has the same requirement as the management of video transmission power output when it comes to racing.

Recommended settings:

- **Max output power:** 100mW/ 25mW (depending on your local laws)
- **Dynamic power:** off
- **RF profile:** dynamic or forced 150Hz
- **Telemetry:** off (saves bandwidth for other pilots)
- **Frequency:** 868/915 RACE

If you use forced 150Hz, your race director can see your power output on the LED color of your transmitter.

The available color codes can be found here.

## Factory reset

If you experience a strange behavior with your CROSSFIRE, a factory reset can help solve them.

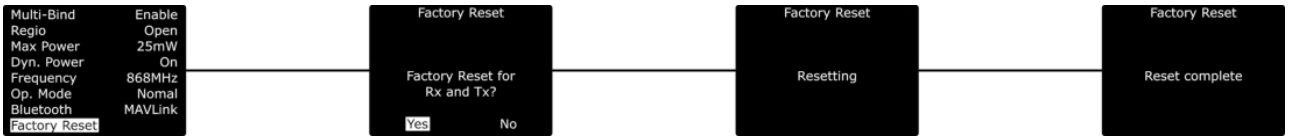
The process is the same for all transmitters and receivers:

- Power up your device
- Navigate into the transmitter or the receiver menu
- Under “Aboutl” you can find the “Factory reset” option
- When you started it, follow the instructions on your display/ radio
- When the reset is finished, **you need to power cycle your device**

If you did the reset for the receiver you need to rebind it by pushing the *Bind* button.

**Check and adjust your settings after the power cycle. Everything will be set to default.**

**<u>On the receiver, the failsafe position must be taught again if you want to use it!</u>**



## Emergency Update

When the update for the receiver fails, it will no longer work. In this case, you need to use the built-in emergency update feature:

**Standard diversity RX**

The standard diversity receiver comes with an onboard USB connection. Therefore you can connect the receiver with your TBS AGENT DESKTOP or WEB and update him straight away.

**Micro/ Nano/ Nano diversity RX**

Since FW 2.24 the CROSSFIRE receivers stores a specific, “golden” firmware inside, which can be restored by the following steps:

- Hold the bind button
- Power up the receiver
    - The led on the RX starts to flash rapidly
- Release the button
- Push and hold the button again
    - The led will start to blink in a double-patter
- As soon as the led switches to rapid flashing again, you can release the button
- When the pattern changes back to slow, single blinking the emergency update is finished

Now the receiver is working again and automatically turned on the binding mode. Now you can power up your transmitter, start the binding and run the OTA update again

## FLARM

FLARM is a collision-avoidance system developed in swiss and mainly used by sailing planes and helicopters. With the TBS CROSSFIRE, you can send and receive the FLARM track signal and make the airspace a bit safer.

### What you need

The needed license and hardware base depends on what you want to do. In general, you need the TBS GPS puck (the one in the black enclosure, not the cheap small m8n GPS!) and a standard diversity receiver (the Nano diversity receiver is not yet supported).

Besides this, you need to make sure that you use up-to-date CROSSFIRE firmware as the FLARM license expires and gets updated with the CROSSFIRE updates. As an example, FW  4.05 will expire on 01.06.2021

**Just send**

If you want to just send your FLARM track to other pilots and the FLARM capable ground stations, no license is needed.  Just the TBS GPS connected by BST to the CROSSFIRE RX

**Receive**

If you want to receive the position of other pilots, you need a license. There are two licenses available:

- **Buddy**: See other CROSSFIRE pilots that got their FLARM active
- **Aviation**: Receive and see other CROSSFIRE pilots, as well as real airplanes and helicopters

**Show on the OSD**

To see other pilots in your OSD you need to get a TBS CORE PRO or FPVision OSD besides the above-mentioned licenses.

**Note:**

If you purchased and activated a license, you can see the other pilots in Mission Planner without the need for an OSD. They will be displayed as airplanes. This in general is useful if you got a spotter watching the sky and air traffic for you.

### Getting a license

You can purchase your license and some bundles at the TBS shop. After the purchase, you will receive an email with your code to unlock the feature.

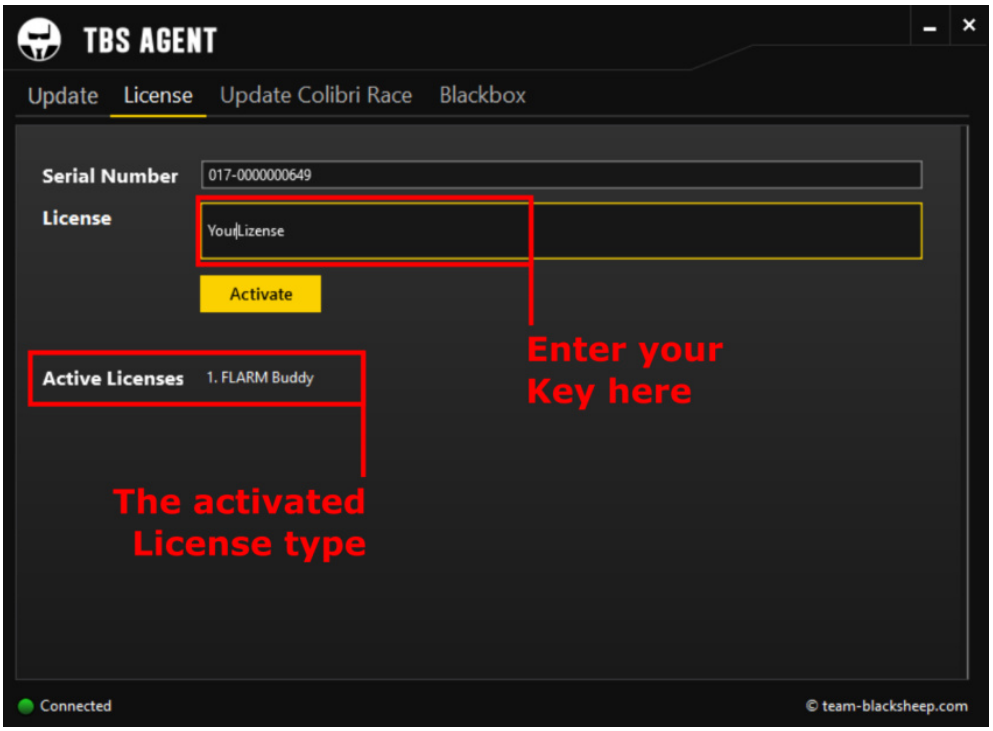
Each license is bound to the receiver and can not be transferred to another receiver! If you lose or sell your receiver, the license is also gone!

If you lost the email with the key, open a ticket, including the receiver serial number.

## Activation of a license

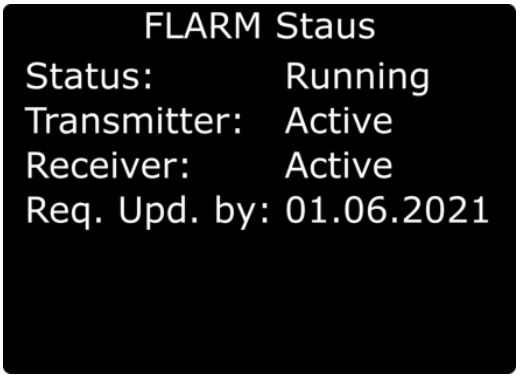
When you receive your email with the code, you need to get the old TBS Agent . After the installation:

- Connect the CROSSFIRE diversity RX via USB with your Pc
- Open the Agent
- Ignore the message from the Agent (Device not recognized. Update now?)
- Navigate to the *License* tab
- Enter the license in the desired field and hit enter
- Now you should see *Activated Licenses: 1. FLARM Buddy (or aviation)*



## Status display

If you own a Standard or Lite TX, you can see the actual status of your FLARM set up in one of the main screens of the OLED display:




**Status:** no Sat Fix/  Fix - are enough satellites found by the GPS
**Transmitter:** Active/ Inactive - Position transition is enabled (to other airplanes)
**Receiver:** Active/ Inactive - Active if a license is installed
**Req. Upd. by**: XX.XX.XXX - Will be updated by the CROSSFIRE updates

## Settings

You can find the FLARM settings under *diversity Receiver/General:*

**FLARM**

Here you can set up which pilots you want to see (OSD and Mission Planner) and if you want to send your position to other pilots as well:

- Off: No FLARM data will be sent or received
- Pulse: Just send out your position
- Buddy: Send your position and show CROSSFIRE pilots (only available with active license)
- Aviation: Send your position and show CROSSFIRE pilots and airplanes and helicopters (only available with active license)

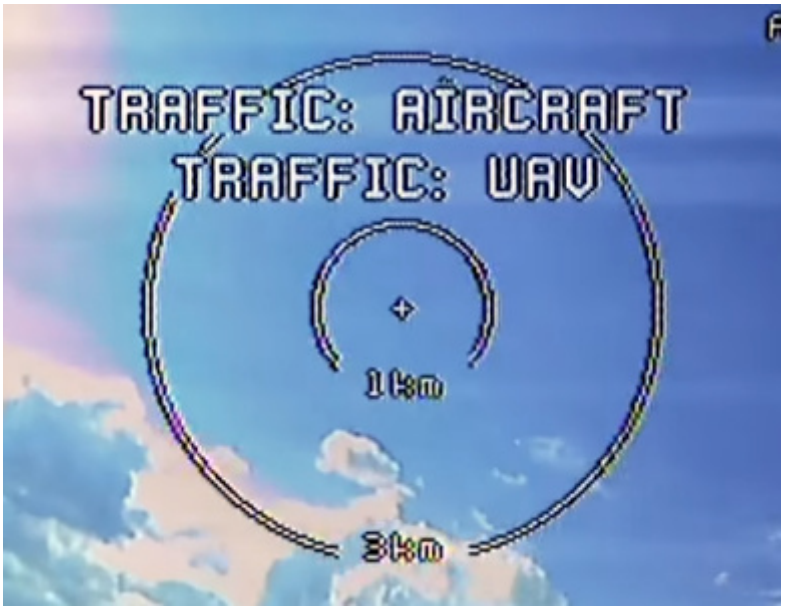
**Flarm Track**

- Off/ On - Send your data to the ground stations. If activated you can be seen on maps like the one from OpenGliderNetwork.

## OSD

If you own a TBS CORE PRO or an FPVision OSD, they can show you the received pilots in a radar that scales by itself. If no other pilot is found, the radar will disappear and come back when a new pilot is found.

The shown Types depend on your license and the FLARM setting you have set up before.




Your aircraft is the center of the radar. Each airplane type got there own symbol so you know what is spotted:

**Arrow**: CROSSFIRE pilots
**Airplane**: manned Airplane
**Helicopter**: manned Helicopters

## Flarm in action

We made a video showing you how the FLARM integration of the TBS CROSSFIRE works:

**FLARM Showcase**

# FAQ

Some common and some special outlier questions for the CROSSFIRE system.

- TBS CROSSFIRE Seems not to work with Futaba T18SG
    - It required you to use an external battery to power the TBS CROSSFIRE
    - Go to Trainer port settings and select ACT, Student, and 8 Ch. or 12 Ch.

- Does the transmitter forget the receiver when I bind a new receiver
    - No - the receiver stores the serial number of the transmitter. Everything is based on this. So you can bind as many receivers to your transmitter as you want.

- What happens if I have more than one receiver running at the time
    - We recommend running only one receiver at the time but if you like to, you can run more than one receiver at the time. As the system is not designed for this use case some features need to be disabled to make it work properly. Make sure both receivers run in the same operation mode, 8 or 12 channel mode and both have telemetry disabled.

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Manual written and designed by ivc.no in cooperation with TBS, redesigned and maintained by kamikatze-fpv.de