TBS TRACER 2.4GHz R/C System

Revision 2021-02-03

High speed drone control system based on TBS Crossfire engine

The TBS TRACER (XF) system is a R/C link system made for FPV enthusiasts. It features unheard of latency and performance without any of the clutter of choosing RF modes, link profiles. It just works. Two-way communications includes telemetry functionality and support for 3rd party autopilots.

Key features

- Low latency, high bandwidth, great range
- Constant 250Hz uplink & downlink rate for super low latency
- Immune to on-board noise
- Two-way communication link with real-time link vitals and telemetry
- Self-healing frequency hopping link
- Super easy binding and configuration via OpenTX LUA, Agent X or TBS TANGO remote
- Free output mappable outputs & antenna diversity
- No issues when flying with multiple friends at the same time
- Dynamic or selectable RF power (local restrictions apply)
- Transmitter LED shows link health

Table of content

- Attention
- Getting ready
  - FAQ
  - Note
- Updating
- Hardware overview
    - Micro transmitter module (MICRO TX):
    - Nano transmitter module (NANO TX):
    - Nano receiver (NANO RX):
    - Nano receiver pwm version (NANO PWM):
  - Why two antennas on the receivers?
  - Radio connection
    - JR-bay radios (TBS Tango)
  - Adapter boards
- General functions
  - Binding
    - General note on model match
    - When do i need to bind again
    - Binding issue - Double green flashing
    - Binding issue - OpenTx 2.3.10
    - Transmitter
    - Receiver
    - Receiver Update (OTA)
    - Auto Bind & OTA
    - Multi bind
      - How to set it up
  - Failsafe setup
    - General setup
    - Cut
    - Failsafe position
  - Transmission power

- Transmitter LED status indicator
- Receiver LED status indicator
- MyVTX
- RC over MAVLink

Receiver functions

- Output map
  - CRSF
  - Serial
  - SBUS
  - N.i. SBUS
  - MAVLink
  - PWM (Ch X)
  - PPM
  - DSMX
  - LQ
  - RSSI
  - RSSI/LQ
  - Smart Audio
- Channel number
  - Available sensors with OpenTX
- Missing sensors
  - In-built Voltage monitoring
- BST connection

Additional information

- TBS CLOUD
  - Menu
  - Initiate the WiFi module
  - Connection to a WiFi hotspot
  - OTA update of the WiFi Module
- OpenTX setup for TRACER
- LQ warning in OpenTX
- Model-match in OpenTX
- VTx connection by CRSF

Vtx connection by SmartAudio

Smart Audio or CRSF for the VTx?

VTx button is not working

Connection to an FC

- General wiring
- CRSF with BetaFlight and similar firmwares
- CRSF with KISS/ FETTEC

BST to Eagletree Vector

Mavlink with MAV FC's

Wireless configuration with ArduPilot/ PX4 by WiFi

Wireless telemetry

- WiFi telemetry with BetaFlight/ INav

Signal strength in Betaflight - BF < 4.1 and DJI OSD

Signal strength in Betaflight - BF 4.1 and later

- CLI commands

Signal strength in INav

Link States

- LQ - Link quality
- RSSI - Relative signal strength indicator
- SNR - Signal-to-Noise ratio
- Warning levels
- What should i use in my OSD or radio

Racing environment

Factory reset

Emergency Update

FCC statement

Additional FCC statement for TBS TRACER MICRO TX:

FCC ID of TBS TRACER Products

Specifications

Type:	Two-Way Remote Control System
Band:	2.4GHz band
RF power	FCC: 25mw - 1000mW selectable
Modulation:	GFSK
Antenna:	TX: 1x omnidirectional dipole antenna RX: 2x flexible t-style antenna
R/C Channels:	up to 12-channel digital stream outputs, standard 2.54mm servo connectors
Radio compatibility:	Any radio with JR-style bay or Mini-module bay. OpenTX recommended
Interface:	TX: RGB LED light, push button, configuration via CSRF (TBS TANGO, OpenTX ect.), WiFi
Failsafe:	Pre-set servo positions or stops outputting servo pulse - selectable in configuration menu or via push button
Operating range:	15mi+/25km+
Input power:	MICRO TX: +6 to 13V NANO TX: +5 to 9V NANO RX: +4.5V to 8.4V (down to 3.3V possible, but not recommended) All reverse-polarity protected, compatible for 2s Lipo direct
Power consumption:	TX: 1.1W, at 25mW Rx: 1W at 5V
Ports:	NANO RX: 2x Pin-headers for 1x BST and 2x CSRF or 4x Servo NANO PWM version: 6x Servo connector
Working temperature:	0 - 40°C
Size:	MICRO TX: 73 x 56 x 35 mm NANO RX: 11 x 8
Weight:	Tx: 38g Rx: 3.2 grams incl. antennas

Attention

Please always check your local RF legislation to set the 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. To bind, place your TRACER MICRO TX or NANO TX into bind mode by pushing the button on the back of the device, then connect power to your receiver. It will enter bind mode automatically the first time. If you see a blue LED, please push the button once to confirm the start of the OTA firmware update and wait about 1 minute. When bind is complete, the LED on the back of the TRACER transmitter will indicate green.

FAQ

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

Note

This manual is written based on *TRACER FW 4.35*. There may be minor variations depending on the version that is available at this moment.

Updating

In order to update and configure your TRACER, you need the TBS Agent X, which you can download from the TBS shop.

To update your TRACER, connect it by USB and run the update by Agent X. The receiver will automatically get the update on the next bind (more information in the receiver update section)

For detailed instructions on how to use the Agent X, have a look at the Agent X manual.

Hardware overview

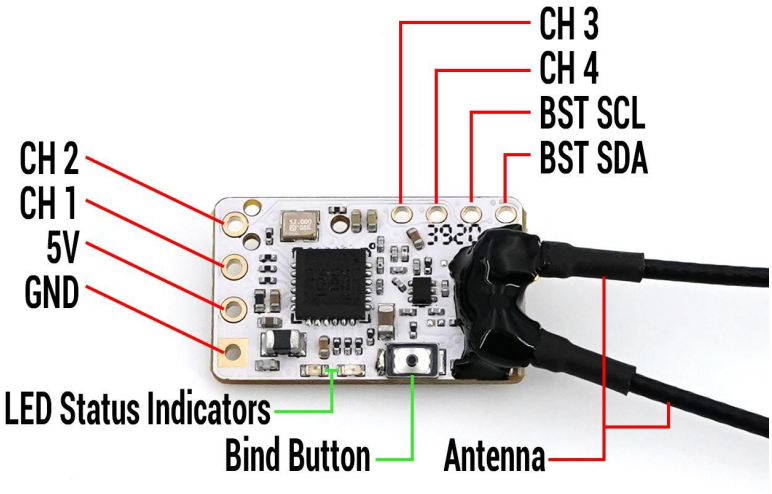
The following diagram indicates the essential inputs and features of the transmitters and receivers.

Micro transmitter module (MICRO TX):

Nano transmitter module (NANO TX):

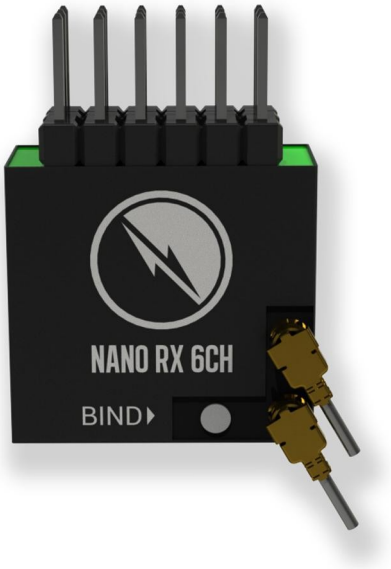
The NANO transmitter includes the same internals and functions as the MICRO TX. It is designed to fit into the mini-modul bay of newer FrSky radios, Tango 2 modul bay and any other radio with the mini-modul bay.

Nano receiver (NANO RX):



Nano receiver pwm version (NANO PWM):

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.



Why two antennas on the receivers?

The TRACER receivers come with two antennas on each receiver. These antennas will give you antenna-based diversity (switching to the best antenna) as it is easy to block the small 2.4GHz antenna with your battery or any part of your drone. The end result is a more reliable link and better range over a single antenna receiver.

Radio connection

JR-bay radios (TBS Tango)

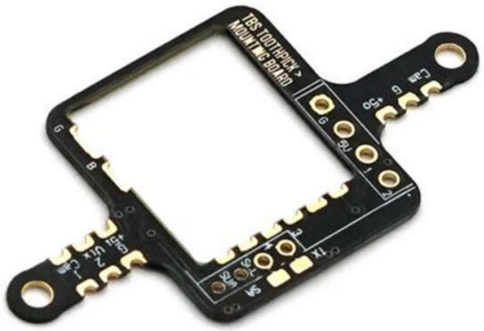
The TRACER MICRO TX has a standard JR-form factor, the module fits perfectly on the back of the TBS TANGO FPV remote. It clips easily in place and can use the telemetry compatible CRSF-format between the module and radio.

Potential JR-bay issues

When you have set up everything properly but your module still stays off, the radio pins did not slide into the TRACER TX. In this case you may need to nudge the pins in the JR bay just a little bit to the right or left side and plug the module back in. The JR bays also have manufacturing tolerances - if the fit is too loose for your taste, you may want to place a small piece of soft foam inside the JR bay before fitting the JR module.

Adapter boards

There are many ways of installing the TRACER RX into a model like these mounting boards. Most mounting boards will be advertised for Crossfire NANO RX, however the TRACER NANO RX are pin-compatible and will therefore work with both!



Every adapter board or solder on fc that is designed for the Crossfire NANO RX will also work with the TRACER receivers!

On some of them you can connect a Unify Nano32 with the TRACER receiver and use [the CRSF connection]() to control the VTx.

General functions

Binding

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

General note on model match

You will notice that you can control any r/c model, even if you changed the model in your radio*. This is due to the TRACER not performing a model match the radio model. 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).

If you want to make sure that a certain OpenTX model only binds to a specific receiver, you can change the model number to a unique ID before binding. In this case, having the wrong model selected in OpenTX will mean the model will not bind. This is a safety precaution that we recommend for models that do not have a flight controller governing the electric power drive.

***Model matching with the TRACER and OpenTX is available since OpenTx 2.3.10**

When do i need to bind again

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

- You updated your transmitter firmware
- You enabled multi-bind*
- You did a factory-reset on the receiver
- You are using a different TRACER TX with your receiver, without multi-bind
- You changed the model id/ receiver number in Opentx*

** you can avoid a rebind, 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

When you update your radio to OpenTx 2.3.10 you might find all your receivers are now unbound. If this is the case, check the model match number. Due to the way OpenTx handels 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:

Lua script (OpenTX radio only):

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

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 *TRACER Transmitter*
5. Click on *Bind*

Agent X:

1. Connect your transmitter to the Agent X by USB
2. Open the TRACER Transmitter (*Manage*)
3. Navigate to the *Configure* tab
4. Under *Device*, click on *Bind*

Button:

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

Receiver

Vanilla receivers that have never been bound before will automatically accept a bind and do not need to be placed into bind mode. Receivers that have been bound to the same transmitter also do not need to be bound again. Placing the Transmitter into bind mode is sufficient. If a bind doesn’t work for some reason, you can force the receiver into bind mode. This procedure is the same for all receiver types available:

1. Power up the receiver
2. After 1 second, but within 1 minute, push the bind button on the receiver

Note: Do not press the bind button while powering up the receiver. It will not activate bind mode!

Receiver Update (OTA)

Depending on the firmware on your transmitter and the receiver, a firmware update may be required.

With the transmitter and the receiver both in bind mode, you then will get a message on the radio/ Agent X, telling you that the receiver needs to be updated. The firmware will be sent to the receiver over the air (OTA). When the transmission is finished, the receiver and transmitter automatically bind and are ready to be used.

Auto Bind & OTA

When you update your transmitter firmware, you need to rebind the receiver in order 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:

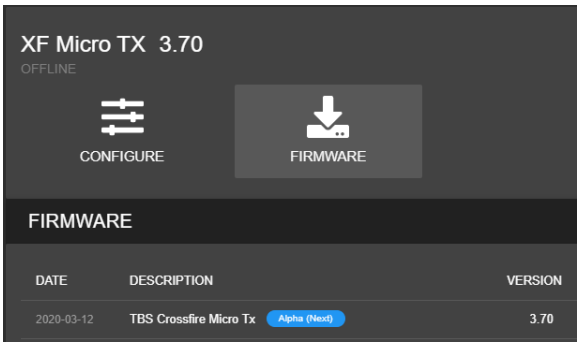
1. Power up your transmitter
2. Set it in bind mode
3. Power up the receiver
4. Wait a few seconds
5. Now you should get the update prompt without pressing the receiver bind button again

Multi bind

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.

Make sure you initiated your WiFi module before!

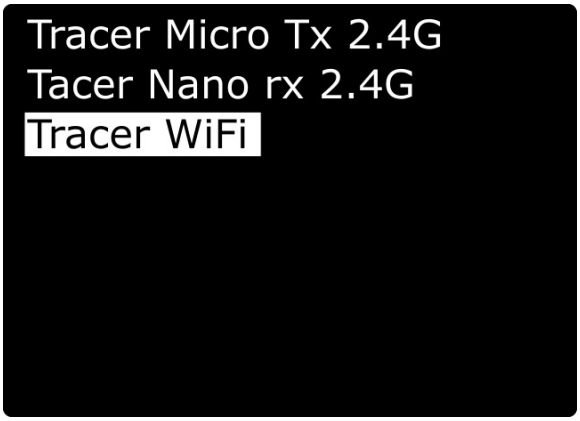
How to set it up



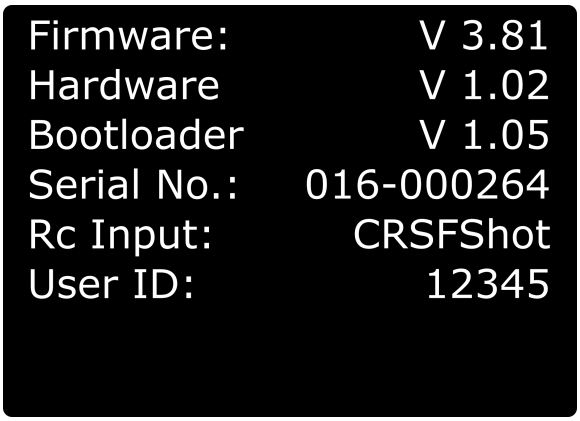
Update your TRACER TX to FW 3.71 (or later) by Agent X. If you can't see the required FW version, click on the 3 dots in the top right corner and check *"include beta releases".*

Make sure that the WiFi module is powered up as well (standard tx).

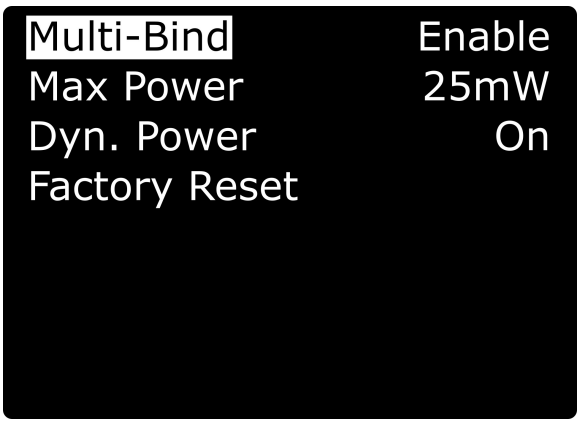
After the update wait for Agent X to synchronize the device with your TBS account. This is done when the dot on the top of the devices turned green



Connect your TRACER 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 TRACER 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 TRACER 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

- It may occur that you need a “new” id. To get a new ID, simply connect your TRACER to Agent X with the new/correct user account and let it synchronice 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 governs multi-bind behavior. If the model id is not the same in both radios, the devices will not bind. If model-match is not enabled on a receiver, it will assume model ID “00”.

Model Id radio 1		Model Id radio 2
00	✓	00
01	✗	00
03	✗	01
./.	✓	./.
00	✓	./.

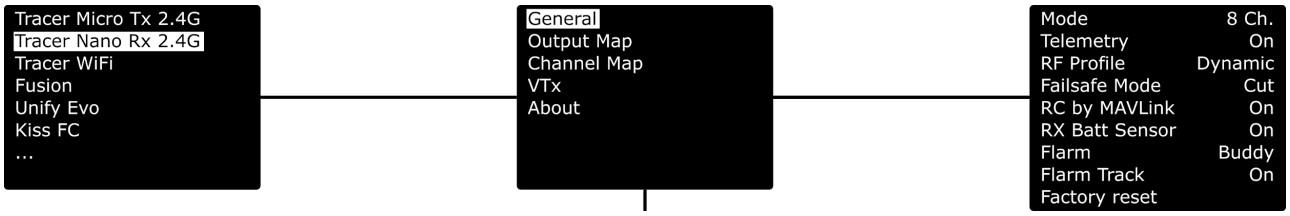
Failsafe setup

The TBS TRACER 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 receivers menu. To change the behavior:

1. Navigate in the receiver menu by your radio/ Lua script/ Agent X
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 have a flight controller that is capable of handling failsafe behavior in your aircraft. When the link breaks up, the receiver will output no signal, which will be detected by your flight controller (e.g. Betaflight, KiSS, Flight One, iNav, Ardupilot, etc).

Failsafe position

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

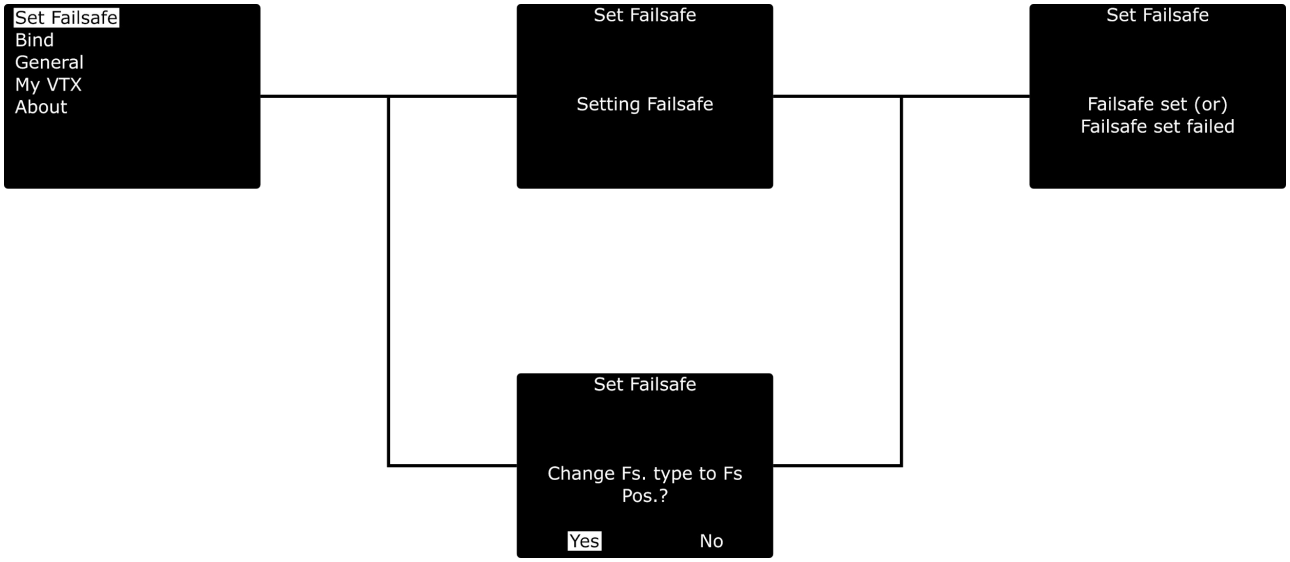
With this setting, the receiver will output a previously taught position for all channels.

Important:
If you have set failsafe to “Position” and did not teach a position afterwards, the receiver will output the last known position. This may lead to unwanted behavior!

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

1. Power up your bound receiver and your radio with the TRACER 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 TRACER will change the type to position if you accept the request.



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 in to certain position (no FC)
4. Shut down your radio
5. Depending on the failsafe type and model, verify that the behavior is correct

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)	25mW (14dBm)
RC radio power input (+6.0 to +13.0V)	25mW (14dBm), 100mW (20dBm), 1000mW (30dBm)

To change RF power:

1. Enter the configuration menu/ LUA script select "General"/ "Tracer 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

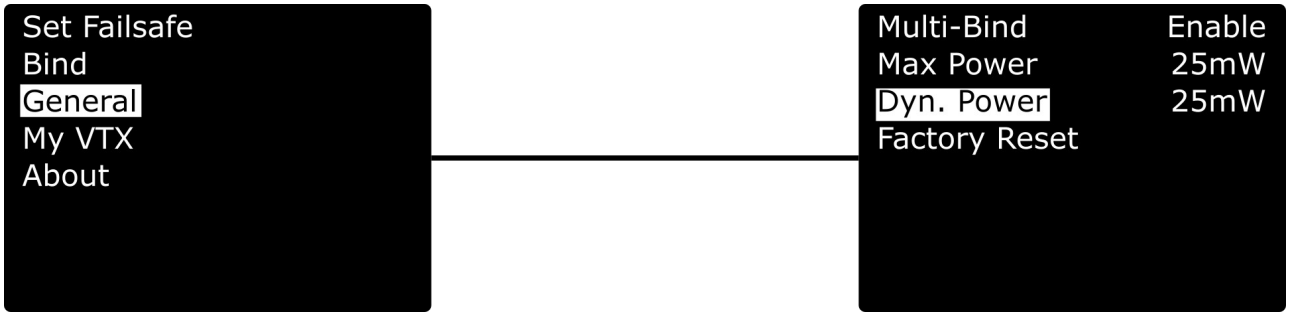
Every 6 dBm increase in output power results in a doubling of the theoretical possible distance that is achievable.

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.

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.



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 receiver or no down-link established
Green	Solid link
Blue	OTA Update of the receiver is running
Slow blue blinking	Update confirmation required
Fast green flashing	Transmitter bootloader active
Fast red flashing	Warning, a message is shown on the LUA Script

Receiver LED status indicator

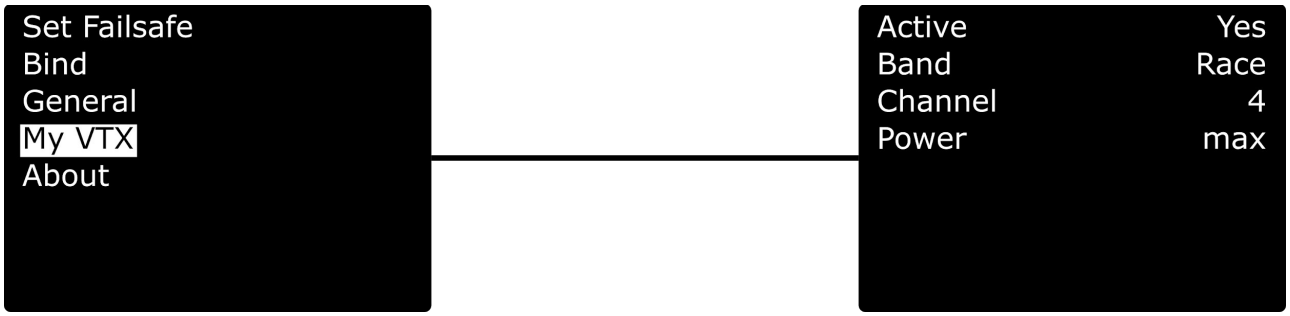
Receiver LED indicators	Description
Solid green	Link is up and running OK
Solid red	No packages received from the transmitter and receiver is in failsafe mode
Fast red blinking	Receiver needs a update, confirmation on the tx is required
Slow green blinking	Receiver is in binding mode
Fast green blinking	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 error. Rebind your receiver - more details

MyVTX

With the new MyVTX menu you can set all your VTx 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. The channel will be set immediately as your drone powers up and binds to your transmitter.

If you enable MyVtx, all other vtx settings will be overridden temporarily, until you disable it again.

Connect your vtx to the TRACER Rx by CRSF or Smart Audio, activate MyVtx and set the it up*



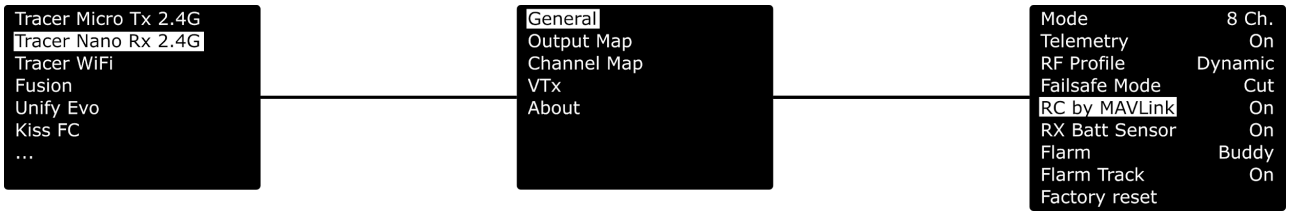
Settings	Description
Active	activate/ deactivate the global vtx settings
Band	Band settings, Race/ Low/ A/ B/ E/ Airwave/ User Frequency
Channel/ Frequency	1 - 8/ 5620 - 5920
Power	VTx power level, 25/ 100/ 400/ max mW

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

RC over 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).



Things to note:

- The RC data will not stop being sent if the TRACER telemetry link breaks up
- Latency wise, it’s as fast as SBus

Receiver functions

Output map

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

Receiver pin	Output type NANO RX/ 6Ch NANO PWM RX	Default value
1	PWM Ch1 to 12, PPM, RSSI, LQ, RSSI/LQ, SBUS, n.i. SBUS, CRSF TX, MAVLink TX, SmartAudio, DSMX	CRSF TX
2	PWM Ch1 to 12, PPM, RSSI, LQ, RSSI/LQ, CRSF RX, MAVLink RX	CRSF RX
3	PWM Ch1 to 12, PPM, RSSI, LQ, RSSI/LQ, CRSF RX, MAVLink RX	PWM Ch. 3
4	PWM Ch1 to 12, PPM, RSSI, LQ, RSSI/LQ, SBUS, n.i. SBUS, CRSF TX, MAVLink TX, SmartAudio, DSMX	Smart Audio
5 (BST)	PWM Ch1 to 12, RSSI, LQ, RSSI/LQ, BST SDA	BST SDA
6 (BST)	PWM Ch1 to 12, RSSI, LQ, RSSI/LQ, BST SCL	BST SCL

CRSF

CRSF is a protocol designed by Team BlackSheep and championed through the TBS Crossfire and now TBS TRACER remote control system. It has been integrated into most popular remote controls, 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. It is by far the most advanced R/C protocol available to date.

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 a F4 FC you need to use a pad with a built-in signal inverter. Those pads are mostly label 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 marshalling library for air vehicles. Most of the common flight controllers support 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 57600 baud. 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 TRACER 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 you FC supports MAVLink V2, this includes up to 12 channels, with V1 up to 8 channels.

PWM (Ch X)

If you select CH 1-12, the TRACER will output a standard 50Hz PWM signal, that can be used for all servos and FC’s 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 TRACER as a backup system for Spektrum receivers.

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. It is the most reliable indicator for knowing your signal quality, and we recommend configuring warning levels to 50% for the TBS TRACER.

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

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

Smart Audio

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 Smart Audio are supported.

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

Excample:

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.

Available sensors with OpenTX

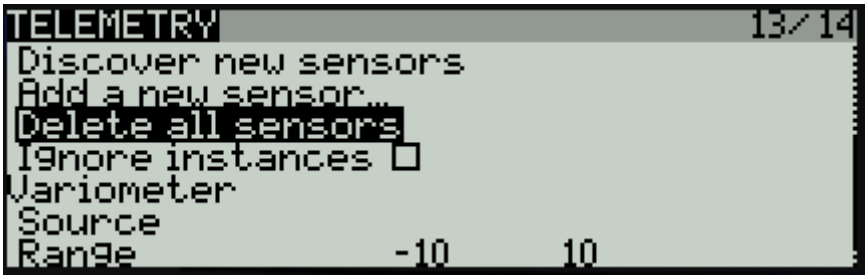
With a OpenTX based radio you can receive the following sensors, depending on your connected hardware:

Datapoint	Description	Data source
1RSS	Uplink - received signal strength antenna 1 (RSSI)	TBS TRACER RX
2RSS	Uplink - received signal strength antenna 2 (RSSI)	TBS TRACER RX
RQly	Uplink - link quality (valid packets)	TBS TRACER RX
RSNR	Uplink - signal-to-noise ratio	TBS TRACER RX
TPWR	Uplink - transmitting power	TBS TRACER TX
TRSS	Downlink - signal strength antenna	TBS TRACER TX
TQly	Downlink - link quality (valid packets)	TBS TRACER TX
TSNR	Downlink - signal-to-noise ratio	TBS TRACER TX
ANT	Sensor for debugging only	TBS TRACER 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/ TRACER Rx/ Core
Curr	Current draw	TBS GPS / FC/ TRACER Rx/ Core
Capa	Current consumption	TBS GPS / FC/ TRACER Rx/ Core
Ptch	FC Pitch angle	TBS GPS / FC
Roll	FC Roll angle	TBS GPS / FC
Yaw	FC Yaw angle	TBS GPS / FC
FM**	Flight mode	TBS GPS / FC

** Source: FC means all FC's with MAVLink or CRSF connection. Core means Core Pro, FPVision, Unify Evo*
*** in OpenTx 2.3.10 the FM sensor does not work correct - it will show "---" in your radio*

Missing sensors

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



In-built Voltage monitoring

The TRACER receivers are capable of measuring the voltage of their power supply . This becomes handy when you use a 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.

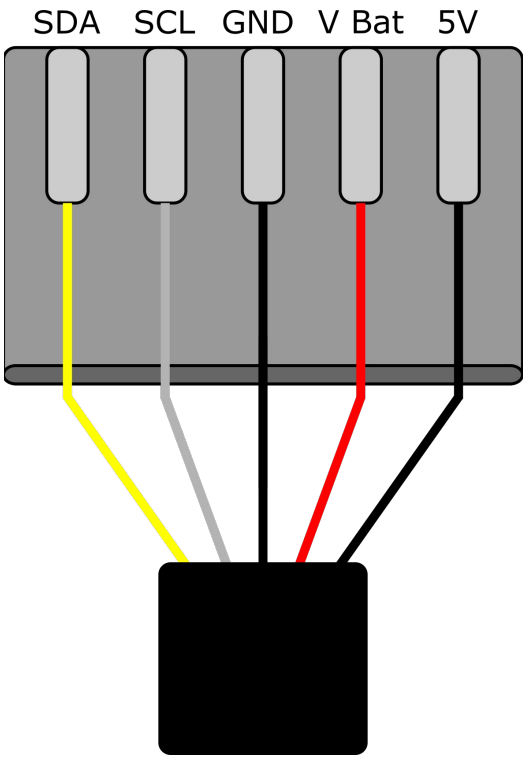
If you experience issues with a other voltage sensor in your system, you can disable the TRACER sensor in the settings under *Receiver/General - Voltage Sensor*

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 TRACER	✔ 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, they don't work on the BST bus!

Additional information

TBS CLOUD

All the TBS TRACER transmitters and the Fusion video receiver includes a built-in WiFi module which allows you a connection with all your gear through the TBS Cloud. This allows for features like VTx follow*, dynamic VTx power* and other upcoming features.

Note: at the moment all the Cloud features require a hotspot with internet access.
**TBS Fusion video receiver required*

Menu

- **WiFi Client**
  - **AP Mode:** enables/ disabled the WiFI module
  - **Default SSID:** enables/ disables the SSID broadcast
  - **SSID:** SSID/ name of the connected/ selected network
  - **Password:** enter the password for the network
  - **Connect:** manually connect to the network. Only necessary when a new network is chosen under *SSID*
  - **Scan:** scans for WiFI networks. Found networks can be chosen under *SSID*, manual reconnect by *Connect* is required
  - **Forget WiFi:** erases all saved networks and there password
  - **Upgrade:** starts the self update for the WiFI firmware. **Disabled at the moment**
- **UDP**
  - **MAVLink:** enables/ disables the sending of MAVlink data over the wifi
  - **Port:** change the UDP port where the telemetry will be send
- **WebUI**
  - **Login:** enables/ disables the login with or without a password
  - **Password:** set up a password for the WebUI login
- **About**
  - **WiFi:** name of the network your TRACER is connected to
  - **IP:** IP address the module got
  - **Server:** connection status
  - **Firmware:** version number of the WiFI firmware
  - **Hardware:** hardware revision of the WiFI module
  - **Bootloader:** version number of the Bootloader firmware
  - **Serial Number:** serial number of the WiFi module

Initiate 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 TRACER Tx to your radio and power it up
- 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 this**
- Now you can see the WiFI module in your TRACER menu/ LUA script and Agent X

Here you can find the whole process as video

Connection to a WiFi hotspot

Once your WiFI module is initiated, you now can connect to your hotspot. The easiest way is to connect it by the **Web-ui**:

- Connect the TRACER Tx to your radio and power it up
- 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 networks
- Click on the name of the found network you want to connect to - the name will be entert for you
- Enter your password and hit Connect/ Disconnect
- When you refresh the page after a few seconds, you can see the IP address of the module
- Done

LUA script or the CRSF menu work as well:

- Connect the TRACER Tx to your radio and power it up
- Navigate in the TRACER menu to *WiFI/ General*
- Hit *Scan* to search for available networks
- Under *SSID* you can select the found network
- Insert the password under *Password*
- Click on *Connect* to start the manual connection
- Done

OTA update of the WiFi Module

When your WiFi module is on FW 1.25 (not yet available), you can use the self-update feature:

- Connect your WiFi module to a hotspot with internet access
- Open the TRACER WiFI device by Agent X, Lua script or CRSF menu
- Under *General* you find *Update*
- Hit Update and follow the instructions on the screen
- When the message disappears, the module is successfully updated

At the moment the self-update check will result in your *module is up to date* message no matter which version you use!

OpenTX setup for TRACER

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

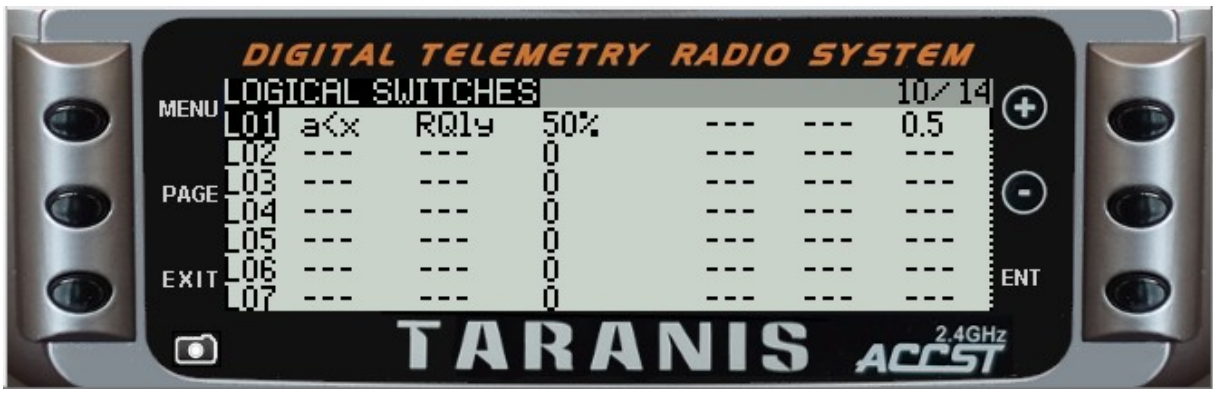
Internal RF: off and **External RF: CRSF**

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

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:



The small delay (0.5s) avoids warnings when the signal is only bad for a short moment.

With the logical switches the voice alerts will be triggered every time they are active.

What they mean:

SF1: when L01 is active, plays the selected track ones
For the sound files you can create your own by any TTS website.

Model-match in OpenTX

Model match enables you to make sure that a specific receiver and drone with it only binds 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!

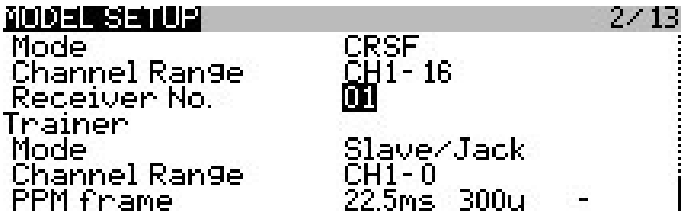
Model Id radio 1		Model Id radio 2
00	✔	00
01	✖	00
03	✖	01
./.	✔	./.
00	✔	./.

Note:

Model Match with the TBS TRACER is available on OpenTx since V2.3.10

In OpenTX your model number in the memory will be set as default Model ID when you create a new model. If your receivers are no longer bound after upgrading the OTx version, just set the Receiver number back to 00.

Model Id (Receiver No.) in OpenTX

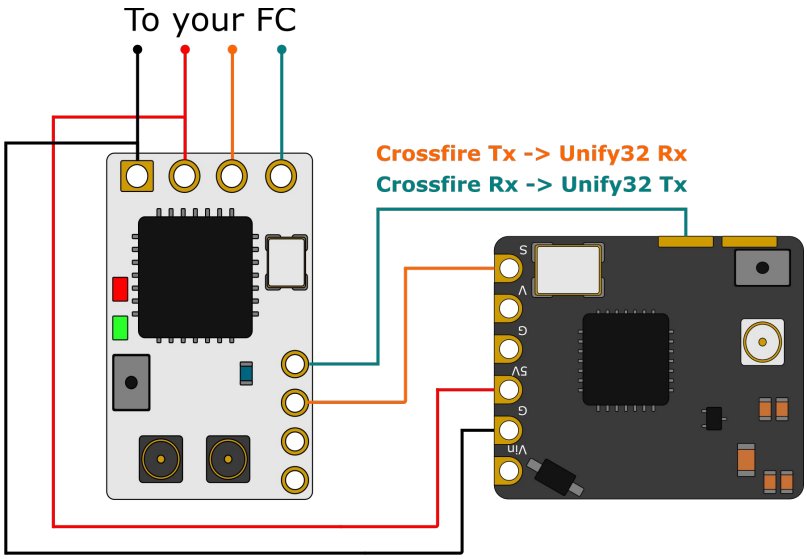


VTx connection by CRSF

All Unify32 and Evo line VTx from TBS are capable of using CRSF to communicate with the TRACER 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 (TRACER Tx to VTx Rx, TRACER Rx to Unify Tx)

Wiring example:



Tarcer RX output map

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

Unify Nano32 configuration

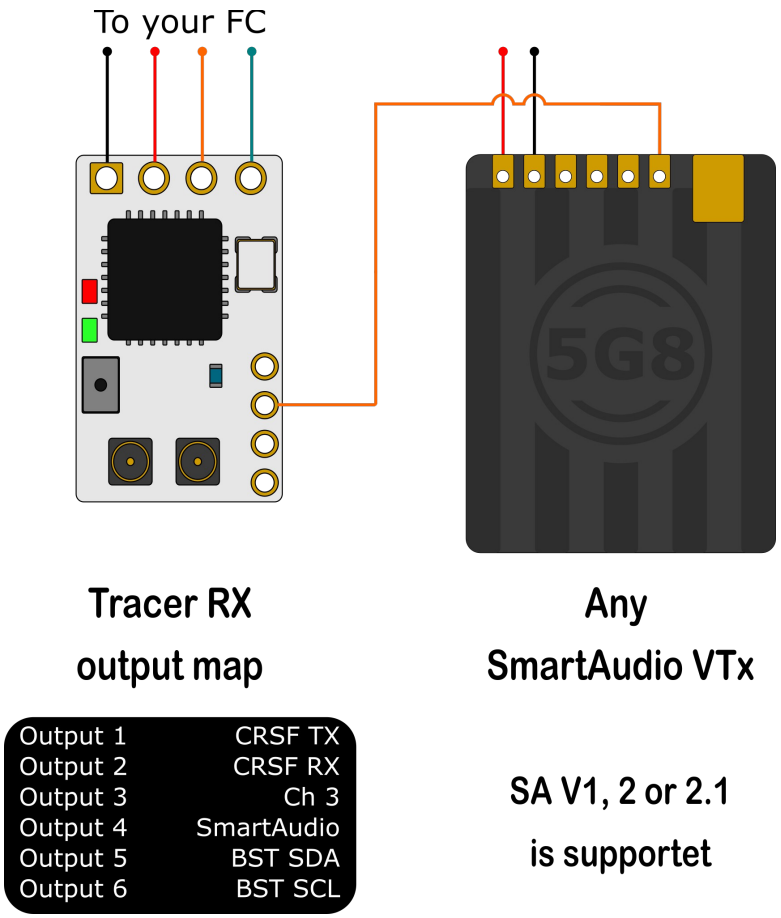
6x Blue

2x Red

Vtx connection by SmartAudio

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

- Select a free output pin capable for SA (check the output map section for available outputs)
- Connect them (TRACER Tx to VTx Rx/ SmartAudio pad)



Smart Audio or CRSF for the VTx?

Both protocols had their advantages and disadvantages:

- **SmartAudio**
  - Single wire connection. Saves one PWM output (useful on a wing)
- **CRSF**
  - Full y configurable by LUA, FUSION, Agent X, etc.
  - CRSF readout - let you use PITMode on a switch or navigate through the Unify Evo OSD without the need for a fc, link stats readout with the Unify EVO OSD

VTx button is not working

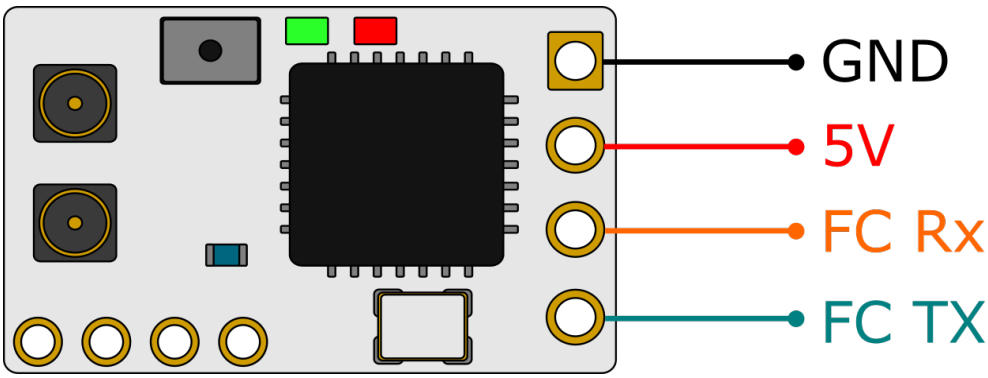
When the Unify32 detects a signal on the SmartAudio Signal-in pad, it will disable the button.

To change the VTx to CRSF or SA, you can unsolder the wire or force your TRACER rx to not output any signal.

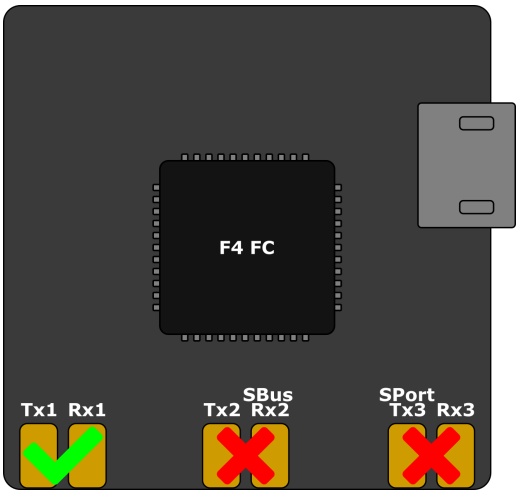
- Set the output of the TRACER Rx to CH X (PWM) for the pin where the VTx is connected to
- Shut down the TRACER Tx and Rx
- Power up just the drone with the TRACER Rx and the Unify32
- Change the Unify32 settings by the button
- Turn the transmitter back on
- Set the output map back to CRSF or SmartAudio

Connection to an FC

General wiring



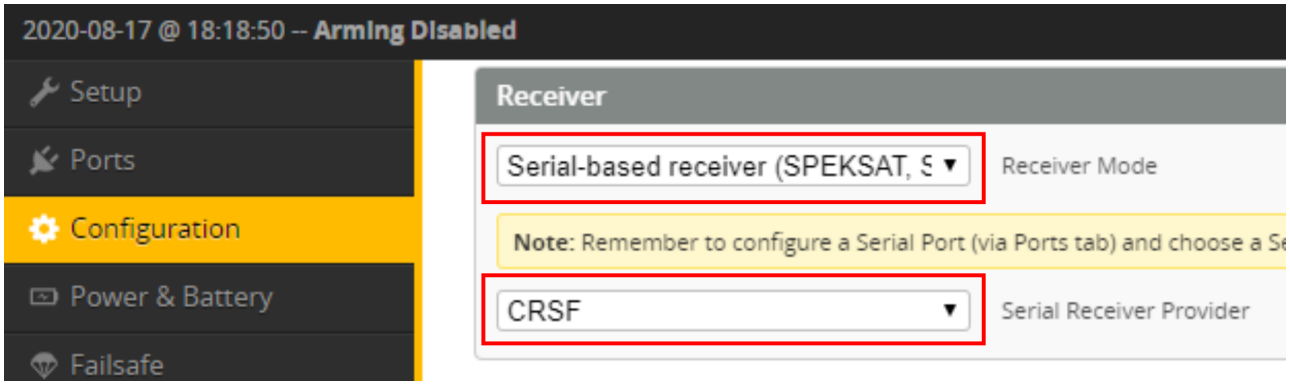
If you use SBus or any other protocol beside CRSF or MAVLink, you only need to connect the receivers Tx line to your FC. Use CRSF whenever possible to get the best experience with your TRACER.



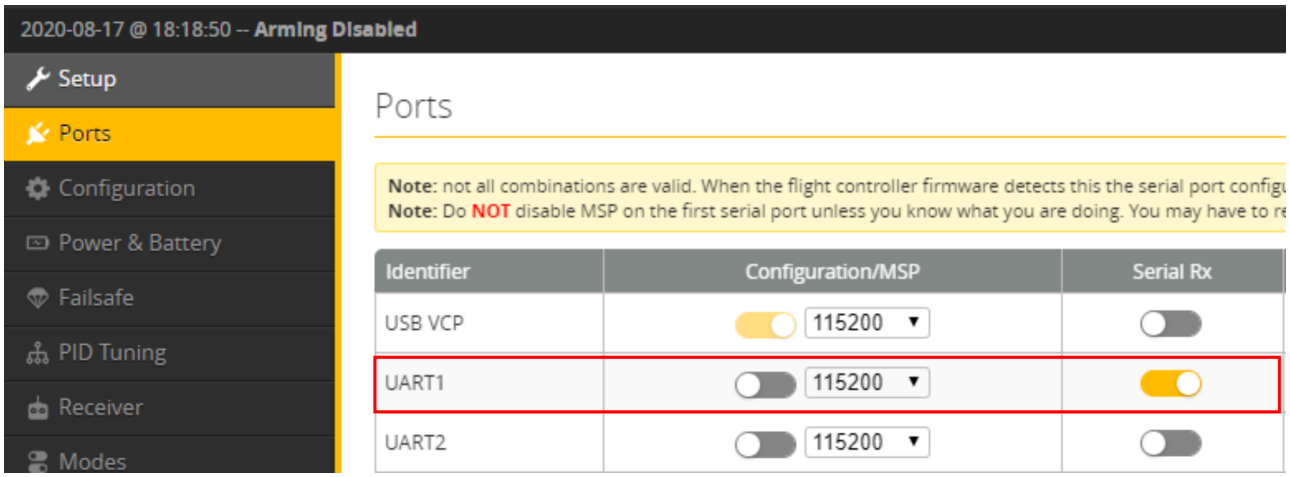
If you use a **F4 FC**, make sure you don't use UART's with labels with *SBUS* or *S-PORT*. Those UART's got a hardware-inverter installed which does not work with CRSF.

CRSF with BetaFlight and similar firmwares

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



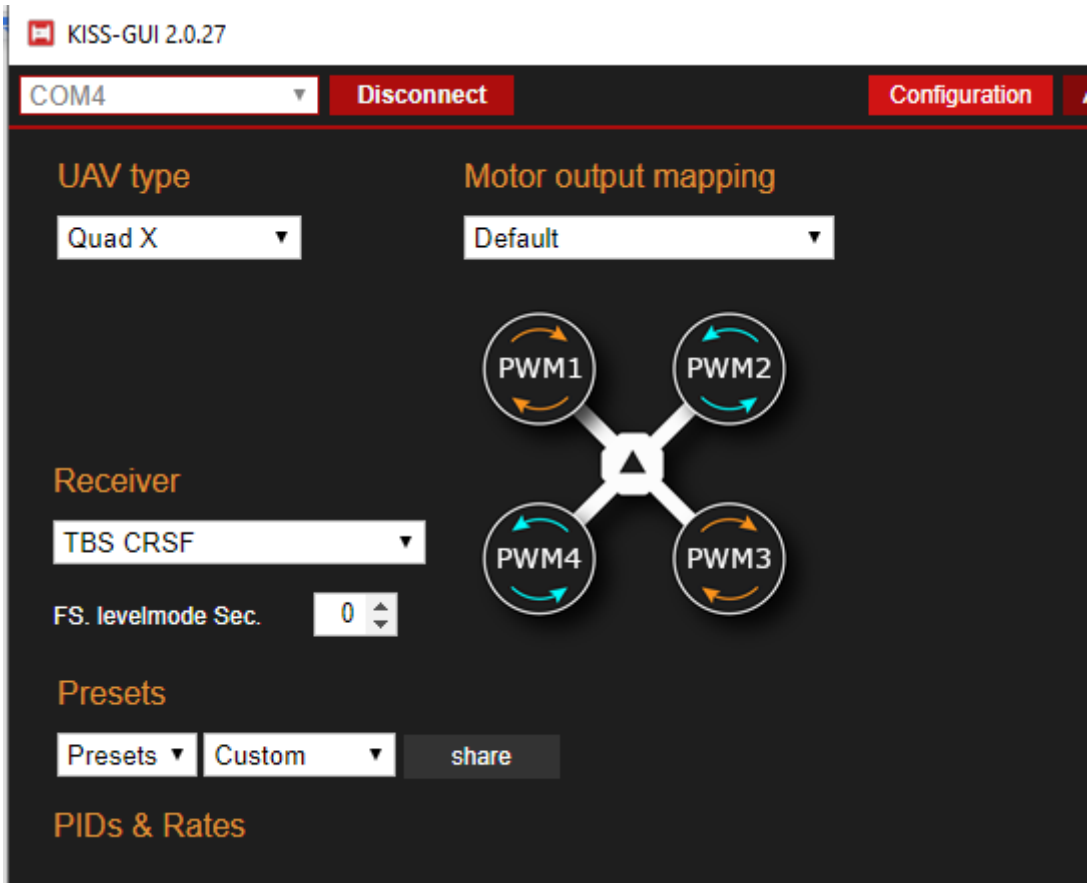
In the Ports tab, enable Serial Rx for the UART where your receiver is connected



CRSF with KISS/ FETTEC

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

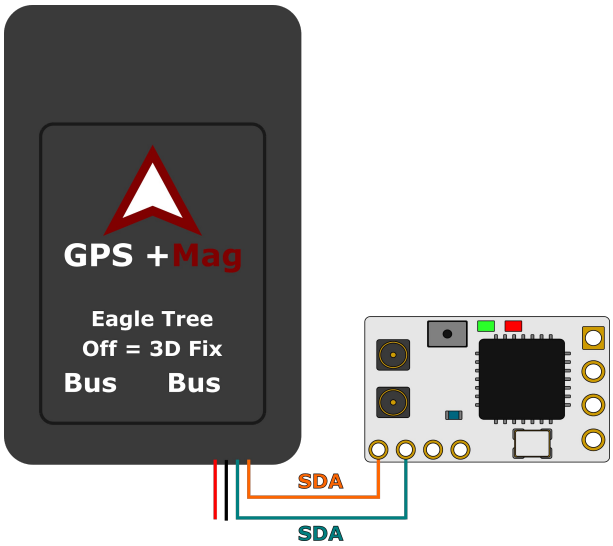
In the configurator, enable CRSF as RC Type:



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 TRACER.

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.

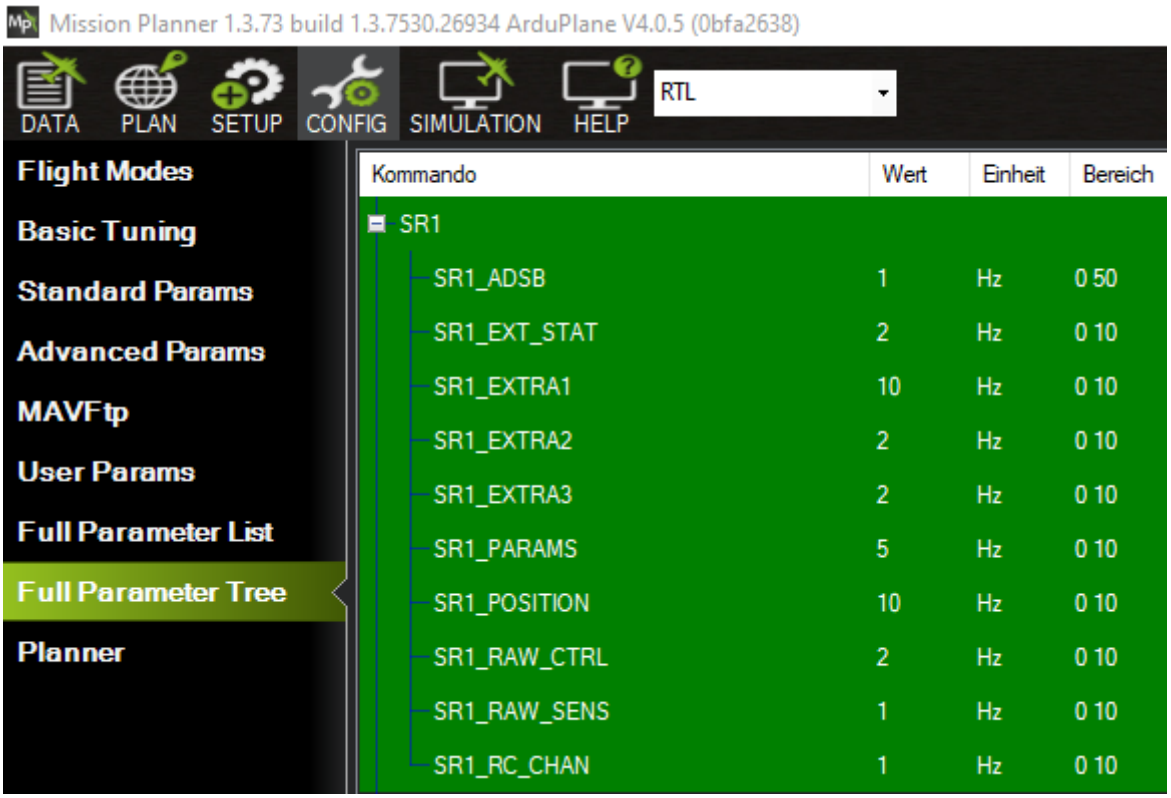


Mavlink with MAV FC's

If you use a FC with MAVLink like ArduPilot/ PX4, you can use the MAVLink capabilities of the TRACER. 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 TRACER 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 TRACER 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.

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 TRACER in two ways:

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

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

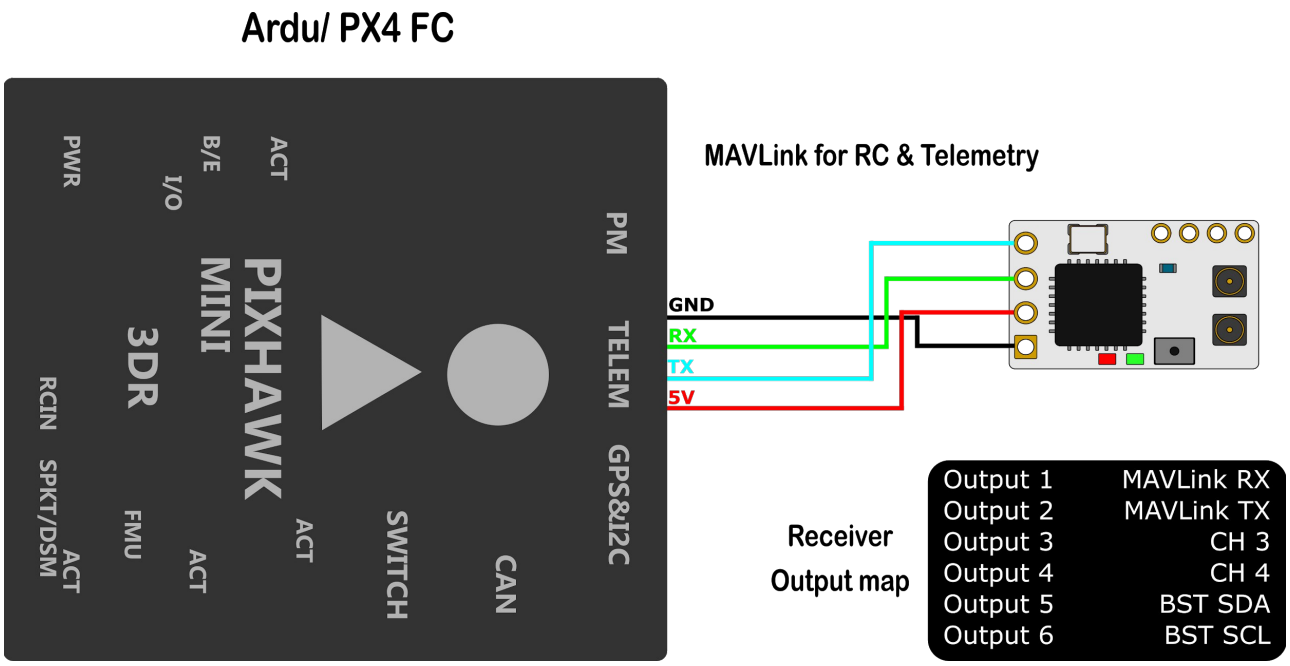
- **Connection type:** UDP
- **Port:** 8888

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

With WiFi FW 1.17 you can enable or disable the MAVLink data. To change this, navigate to and set *MAVLink* to *on*.

Note: in 1.17 there is a bug which turns the Mavlink option off everytime time you shut your transmitter down

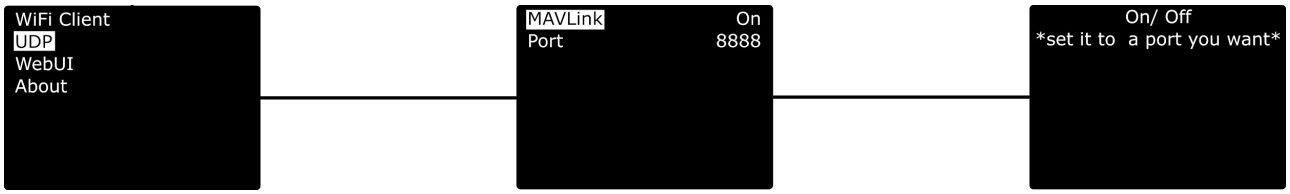
Wiring diagram



Wireless telemetry

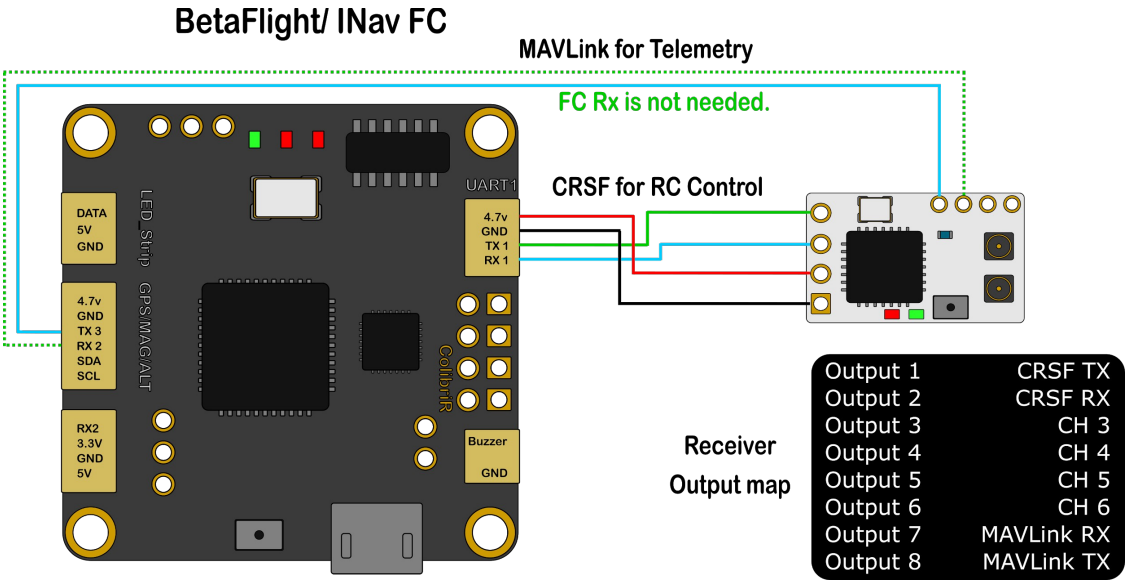
Getting real-time telemetry data from your TRACER by WiFi works almost the same as with Bluetooth.

You can find the WiFI details here. In the WiFi settings, you you enable the MAVLink stream first:



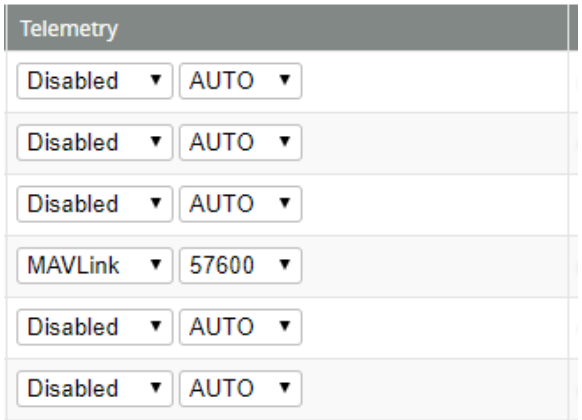
WiFi telemetry with BetaFlight/ INav

For the WiFi telemetry, you need to wire up your FC with a extra MAVLink connection, as the MAVLink emulation is not (yet) supported by the WiFi firmware:



Settings in BetaFlight/ INav

On the port where you got your extra MAVLink connection installed, enable **MAVLink** with **57600Baud** in the *PORTS* tab for that UART.



Note: You need to cancel the "loading parameter" dialog in MissionPlanner etc, as it will not get past this dialog. The important telemetry data will be sent anyway.

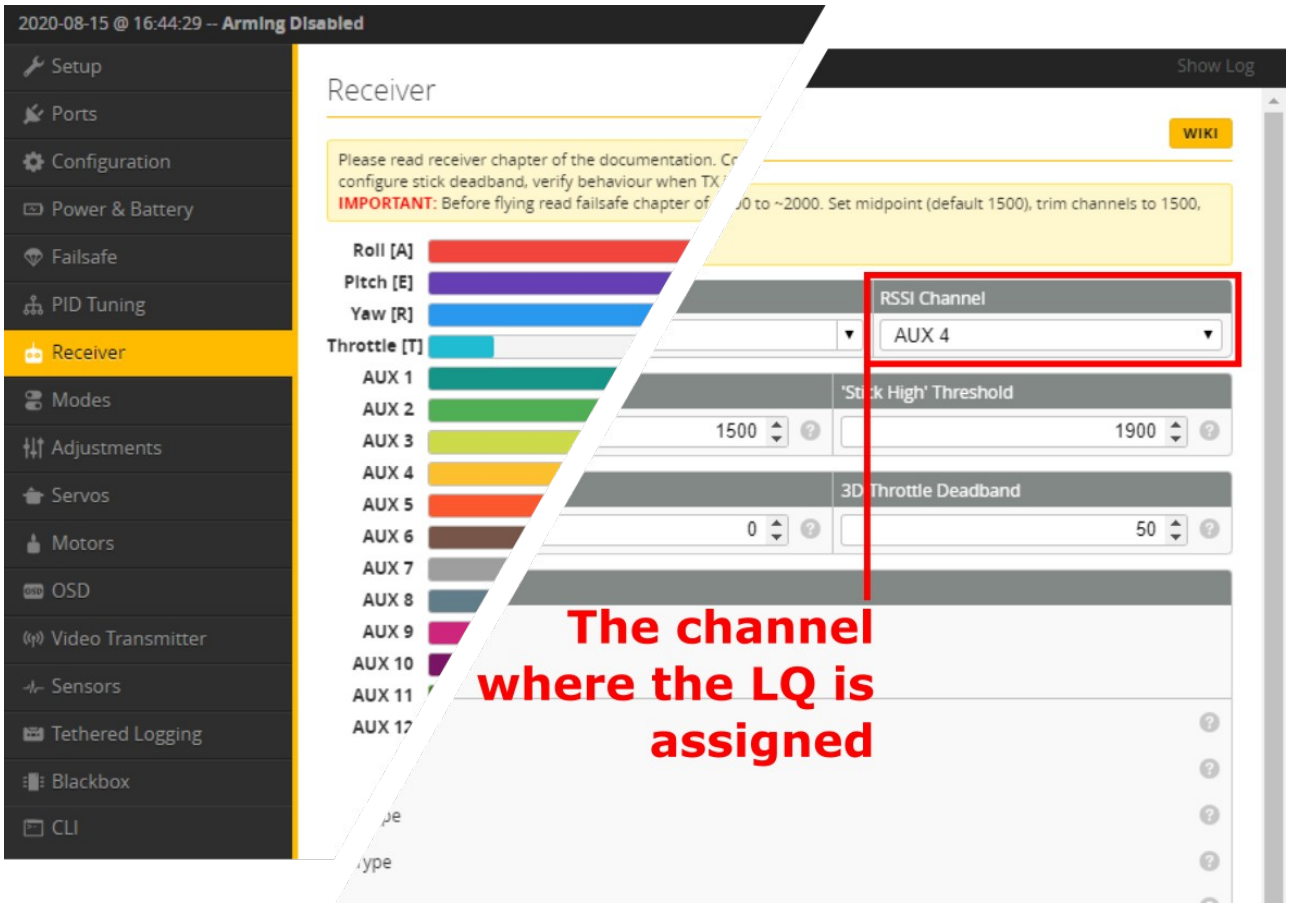
Signal strength in Betaflight - BF < 4.1 and DJI OSD

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

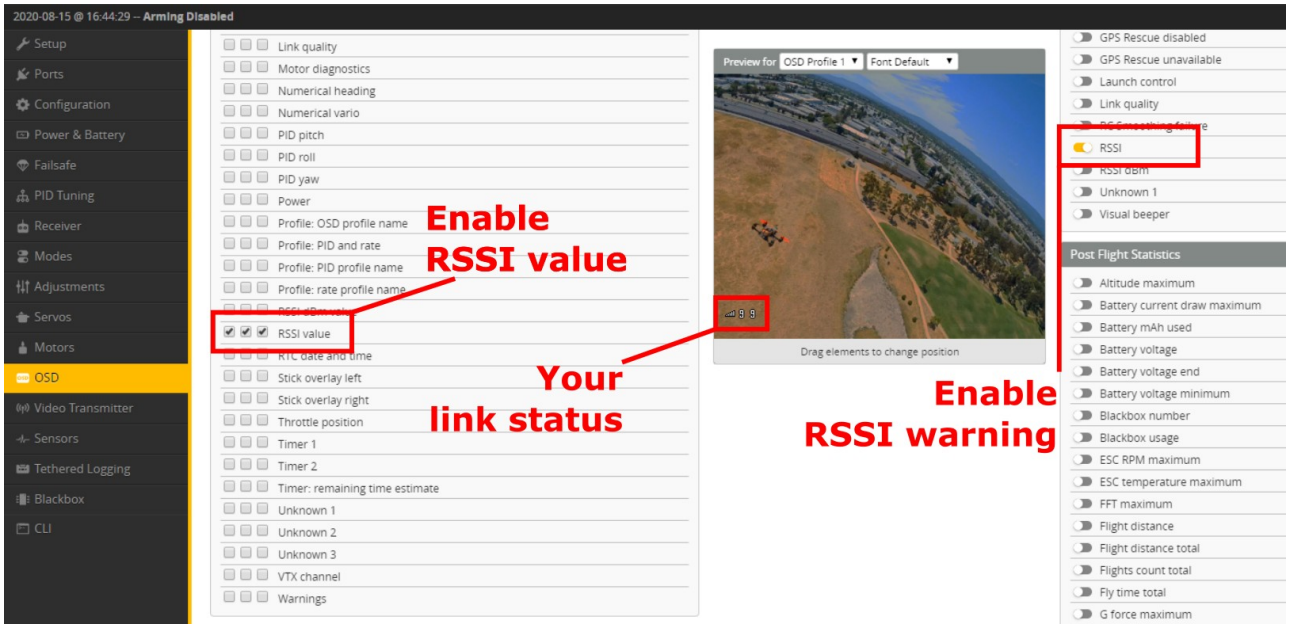
Dst. Ch. 1	CH1
Dst. Ch. 2	CH2
Dst. Ch. 3	CH3
Dst. Ch. 4	CH4
Dst. Ch. 5	CH5
Dst. Ch. 6	CH6
Dst. Ch. 7	CH7
Dst. Ch. 8	LQ

In the TRACER 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 TRACER.

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



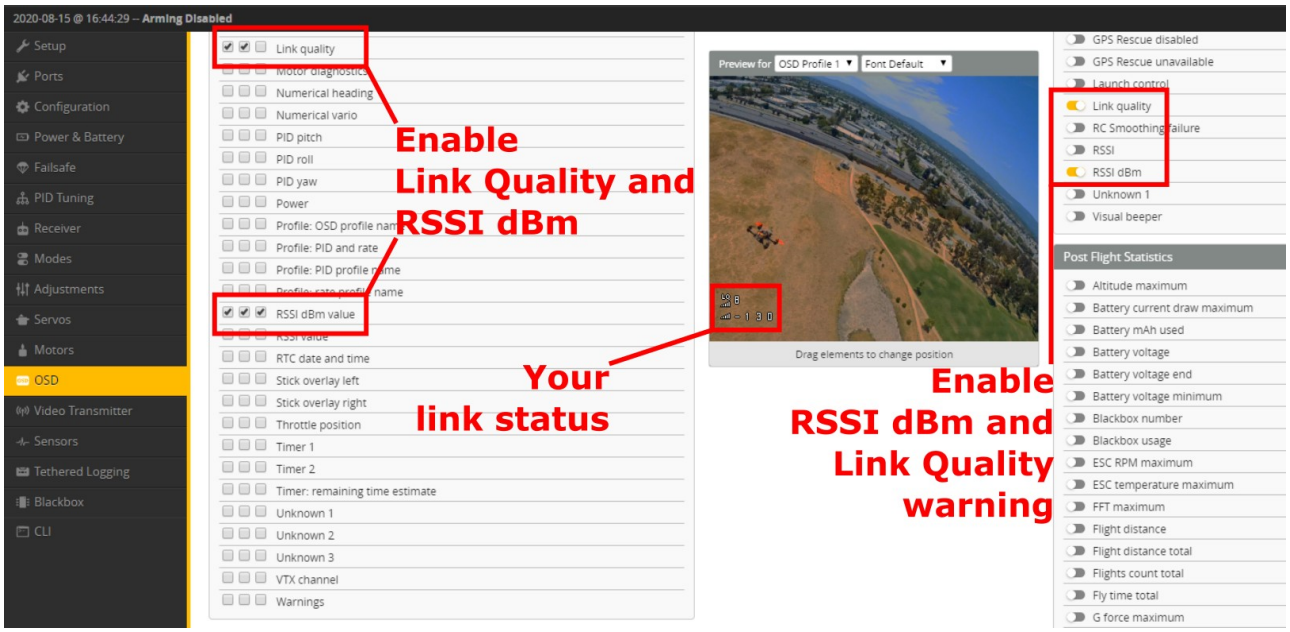
For the OSD tab, set it up like this:



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)



CLI commands

set osd_link_quality_alarm = 50

Signal strength in INav

In INAV it’s almost the same as with the old BetaFlight methode, 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).

Link States

LQ - Link quality

The number of packages that arrive correctly. If the number starts to drop, more packages are lost. On the TBS TRACER, it scales from 0 to 100% linearly.

RSSI - Relative signal strength indicator

A very technical indicator meant for professionals. It signals how “loud” the frequency is (this may also include noise!)

The RSSI is logarithmic which results in a massive drop at the beginning and slows down the lower it gets. Rule of thumb: doubling the range will result in a drop of -6dBm. An example:

- RSSI at 1m = -10dBm
- RSSI at 2m = -16dBm
- Rssi at 4m = -22dBm

The TRACER can go down to the noise floor before the link breaks up. The elevation above the noise floor is indicated by SNR (see below).

If you use RSSI as sensor by the channel/ output map menu or as 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 noise floor and your TRACER signal.

To judge RSSI properly you need to know the SNR and compare it with your RSSI value. The TRACER can receive signals in the noise down to 0dB, as the SNR is already scaled to offset the modulation requirement of 6dB.

Example:

A RSSI of -80dBm is fine. But with a SNR of 2dBm it’s really bad. This means the noise floor is at -82dBm

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

Warning levels

Sensor	Prewarning	Critical
RSSI	Use SNR	Use SNR
LQ	None	50%
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 of the people, while RSSI has a logarithmic scaling which makes it drop rapidly at the beginning and then slower the further you go.

Racing environment

When racing try to unify the power output across your peers.

Recommended settings:

- **Max output power:** 100mW
- **Dynamic power:** off

Factory reset

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

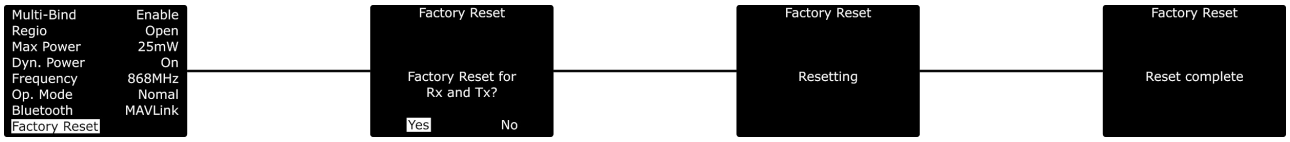
The process is the same for all transmitters and receivers:

- Power up your device
- Navigate in to the transmitter or the receiver menu
- Under “General” 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

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

- 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 bind mode. Now you can power up your transmitter, start the binding and run the OTA update again

Manual written and designed by Kamikatze-fpv in cooperation with TBS

FCC statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

MODIFICATION: Any changes or modifications not expressly approved by the grantee of this device could void the user’s authority to operate the device.

Additional FCC statement for TBS TRACER MICRO TX:

RF Exposure Information:

FCC RF Exposure requirements: The highest SAR value reported under this standard during product certification for use next to the body with the minimum separation distance of 10mm is 1.537W/Kg. This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.

This product is compliance to FCC RF Exposure requirements and refers to FCC website https://apps.fcc.gov/oetcf/eas/reports/GenericSearch.cfm

search for FCC ID: QOS-TCMICROTX

RF Exposure Warning Statements for TBS TRACER NANO RX:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment shall be installed and operated with minimum distance 20cm between the radiator & body.

FCC ID of TBS TRACER Products

TBS TRACER MICRO TX - FCC ID: QOS-TCMICROTX

TBS TRACER NANO RX - FCC ID: QOS-TCNANORX