TBS TANGO FPV Remote

Revision 2017-01-12

All-in-one Remote Control System for FPV

The TBS TANGO FPV remote control is an all-in-one system made for FPV enthusiasts. It features built-in video receiver and a slot for JR-compatible radio modules. Input controls are provided by quality quad ball-bearing gimbals and camera operation is possible using smooth spring-loaded dials and rocker-switch. A huge display shows the video stream right on the remote, with an option to connect external goggles.

Key features

- All-in-one FPV remote control with R/C radio and video receiver built-in
- JR-compatible slot for any R/C radio module
- Large 4.2-inch display for live video stream
- Quality ball-bearing gimbals for control and spring-loaded dials for smooth camera operation
- High capacity built-in Lithium-ion cells, charges via USB
- External port for goggles
- Channel mixing for flying wings

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Specifications

Type:	All-in-one FPV Remote Control
RC system:	JR-compatible expansion module required (not included)
FPV system:	5.8GHz VRX receiver, 40CH
Antenna:	R/C: JR-module specific VTX: 5G8 5dBi patch antenna, optional external SMA port
FPV Channels:	Boscam A, B, E, Fatshark, Raceband
Display:	LCD 4.2-inch, 640x480p
Models:	15 different models (incl. flying wings/V-tail)
R/C module compatibility:	JR-compatible RF module with CRSF, PPM or PXX (FrSky) stream (absolute max. ratings: -0.3V to 15V), e.g. Crossfire, JR, FrSky and similar radio modules
Battery:	Li-Ion 18650 (2x) 3.7V 6000mAh internal battery cells, USB-charging, approx. 3 hours usage time, upgradable
Operating range:	Variable depending on output power and radio environment
Ports:	RJ45 connector for connecting and powering video goggles, e.g. FatSharks DSC-jack for trainer connection Micro-USB for software updates and charging
Controls:	2x Quad ball-bearing gimbals 2x Two-position switches 2x Three-position switches 2x Spring-loaded dials 2x Digital trims 3x Video RX buttons 1x Rocker switch
Working temperature:	0 - 40°C
Size:	240 x 170 x 55 mm
Weight:	340 grams, without R/C radio module
Kit contents:	1x TBS Tango Remote Controller 1x TBS Tango Neckstrap 1x RJ45 Audio/Video cable

Attention

These Long Range Systems are capable to use 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 with 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.

Overview

The following diagrams indicates the essential input controls (green) and features (red) of the radio.

Detailed overview

JR-module slot, DSC, micro-USB, TBS-port (for goggles), power button and speaker

Display and neck-strap connector

Left gimbal for throttle and yaw, and digital pad for trims

Right gimbal for aileron and elevator, and digital pad for trims

Three-position (A/L2), two-position (B/L1) switch, spring-loaded dial (SW E) and video receiver bay

Two-position (C/R1) switch, three-position (D/R2) switch and spring-loaded (SW F) dial

Powering up

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

Power up

Press and hold the Power-button for half a second to turn on the remote. The TBS TANGO screen will welcome you and the power button starts to flash green.

Factory mode

Press the Power-button and Down-button for 2 seconds to enter the factory mode (not factory reset), a confirmation tone will sound. This is where you can calibrate control inputs, change test settings, read ADC and PPM values, and change LCD display settings.

No-JR Module mode

Press the Power-button and Scan-button for 2 seconds to disable JR module power, a confirmation tone will sound. This is handy when you want to conserve battery while watching your friends fly using the display.

PitMode

Press the Power-button and Rocker-button for 2 seconds to enter the PitMode, a confirmation tone will sound. This will set the video receiver to 5584 Mhz, which is the TBS PitMode frequency. For more information about PitMode, please consult the TBS UNIFY PRO manual.

USB Joystick

Plug-in a micro-USB cable, and press and hold the Scan-button on power up to activate the USB joystick mode. The video receiver and screen turn off when this mode is activated. This mode will work with the most common simulators available.

Remote Control Channel Mapping

The channel arrangement of the PPM output to the RF module is dependant on the kind of flight controller that is hooked-up on the receiver side.

In the configuration menu, you can change the mapping by changing the model type to match your particular setup.

PPM/ Serial Channel	Flight control channel mapping type				
	DJI Naza	**3DR**	**Tiny Whoop/ BLADE**	**Beta-/ Cleanflight**	**OP/Taulabs**
1	AIL	AIL	THR	AIL	AIL
2	ELE	ELE	AIL	ELE	ELE
3	THR	THR	ELE	THR	THR
4	RUD	RUD	RUD	RUD	RUD
5	Tuner L (E)	3-Pos Right (D)	3-Pos Right (D)	3-Pos Right (D)	3-Pos Right (D)
6	Tuner R (F)	Tuner R (F)	2-Pos Right (C)	2-Pos Right (C)	2-Pos Right (C)
7	3-Pos Right (D)	2-Pos Right (C)	2-Pos Left (A)	2-Pos Left (A)	2-Pos Left (A)
8	2-Pos Right (C)	2-Pos Left (A)	3-Pos Left (B)	3-Pos Left (B)	3-Pos Left (B)
9	3-Pos Left (B)	Tuner L (E)	Tuner L (E)	Tuner L (E)	Tuner L (E)
10	2-Pos Left (A)	3-Pos Left (B)	Tuner R (F)	Tuner R (F)	Tuner R (F)

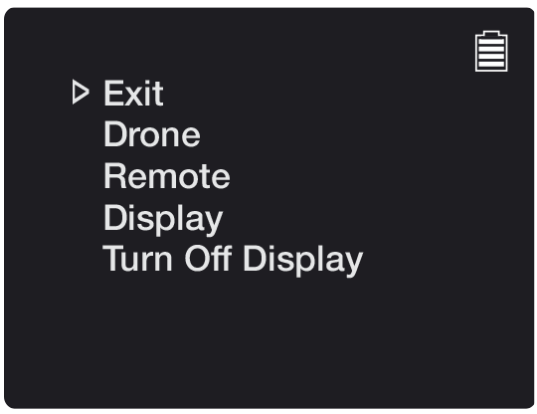
Configuration menu

Changing settings on the TBS TANGO is done using the LCD display and controlled using the rocker-switch and VRX buttons.

To enter and navigating the configuration menu system:

- Enter configuration menu - long press on the rocker-switch, 3 seconds
- Menu navigation - scroll back and forth using the rocker-switch
- Select/enter change - short press the rocker-switch
- Back/confirm change - long press the rocker-switch

Main menu

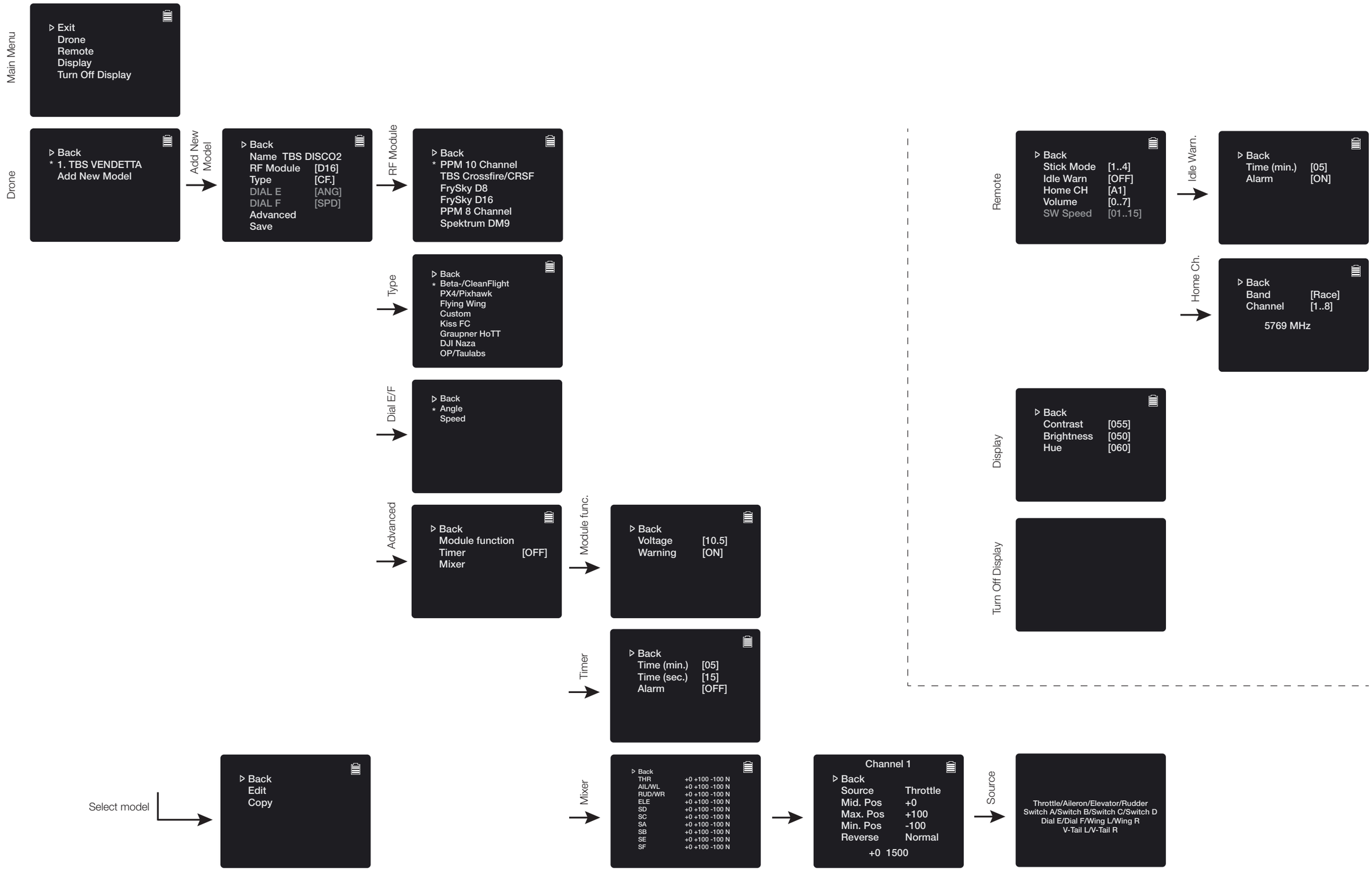


Main configuration menu when entering the system

- **Exit** - Leave menu system
- **Drone** - Models and details about the remote flight system (name, flight control, switch map)
- **Remote** - Everything related to the remote (stick mode, RF module, idle alarm, default channel)
- **Display** - Fine tune the visual parameters
- **Turn Off Display** - Save power/less distraction
- **Battery indicator**- The battery icon is permanently shown to indicate how much battery capacity is left, 0 to 4 bars - see battery

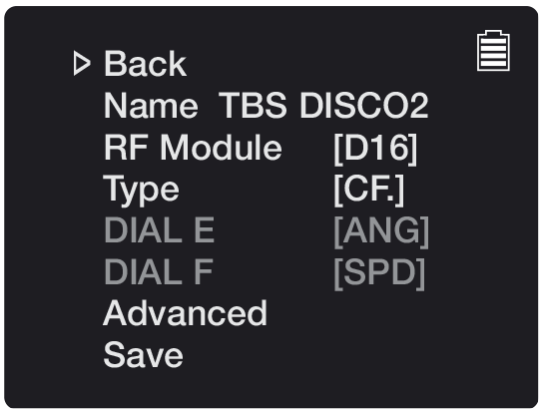
TBS TANGO Radio - Menu Overview

Jan. 2017 - by ivc.no/tbs



protection section

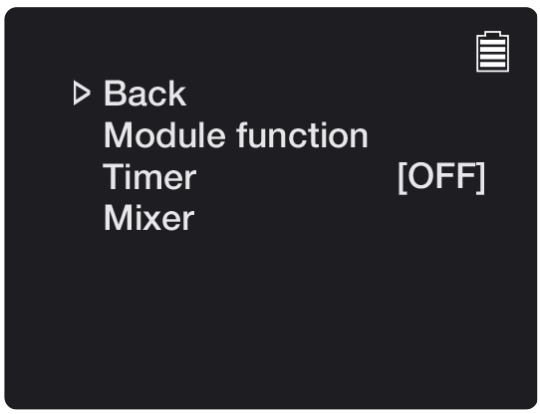
Drone menu



Specific profile for the model you are controlling

- **Back** - Return to previous menu
- **Name** - Unique name for the model profile
- **RF Module** [Standard PPM (10Ch), TBS Crossfire CRSF serial (10Ch), FrSky D8, FrySky D16, PPM 8 Channel, Spektrum DM9] - Specify the radio module plugged into the radio, dictates the communication protocol and/or PPM channel size
- **Type** [Beta-/CleanFlight, PX4/Pixhawk, Flying Wing, Custom, Kiss FC, Graupner HoTT, DJI NAZA, OP/Taulabs] - Flight controller used on the specific model, allows further switch/dial mapping and setup on supported FCs
- **Dial E** [ANG, SPD] - Specify the function mapped to the SW E dial on the remote, angle (ANG) or speed (SPD)
- **Dial F** [ANG, SPD] - Specify the function mapped to the SW F dial on the remote, angle (ANG) or speed (SPD)
- **Save** - Finish editing the model

Advanced menu



Advanced settings for the module and mixing (wing)

- **Back** - Return to previous menu
- **Module function** - Set module specific settings, e.g. low battery warning level
- **Timer** - Adjust the flight timer that starts when the throttle is above 20%
- **Mixer** - Specify the channel mixing, e.g. min., mid., max. position and reverse settings

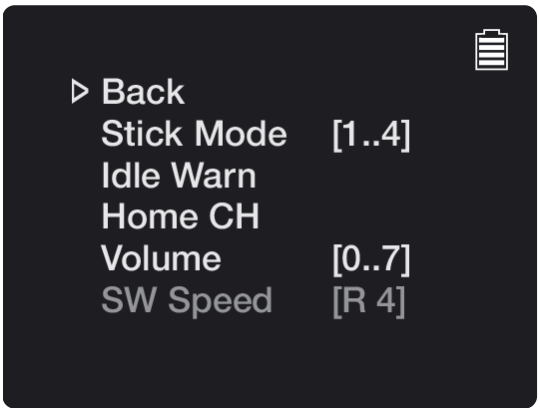
Mixer menu

The mixer settings can be used to change the inputs-to-channel arrangement.

- **Back** - Return to previous menu
- **Channel** [1 to 10] - Select the control channel to edit, changes depending on the model type you specified in the model screen

- **Source** - Edit the channel to specific input source/stick
- **Mid. Pos** [-50 to +50] - Specify source mid-point
- **Max. Pos** [+0 to +100] - Specify source max. end-point]
- **Min. Pos** - [-0 to -100] - Specify source min. end-point]
- **Reverse** [Normal/reversed] - Change source direction

Remote menu



Specifics about the remote itself

- **Back** - Return to previous menu
- **Stick Mode** [1 to 4] - Stick allocation mode, maps throttle, yaw, pitch and roll to the gimbals - Mode 2 is most common
- **Idle Warning** [ON, 5 to 30min, OFF] - When the remote is left powered on without any input after a specific amount of time, sound an alarm
- **Home Channel** [Band, Channel (1 to 8)] - Default video channel to tune into after long pressing the UP-button (VRX controls)
- **Volume** [0 to 7] - Adjust the beeper volume
- **SW Speed** [1 to 15] - Set the speed of SW E and SW F dial, if SW is set to angle (ANG)

Display menu

Adjust the video display parameters on the remote

- **Back** - Return to previous menu
- **Contrast** [055, 0 to 99] - Tune the contrast
- **Contrast** [050, 0 to 99] - Tune the brightness
- **Hue** [060, 0..99] - Tune the color hue
- **Turn Off Display** - Shut off the display when using goggles or just the remote control, not the video receiver portion. Can be switched back on by long pressing the UP-button (VRX controls).

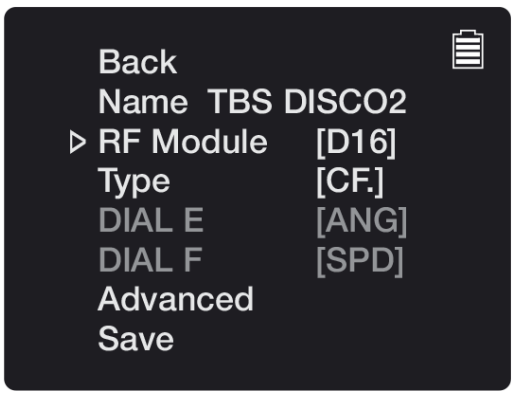
Setup

Installing R/C radio module

A JR-compatible radio module needs to be installed in the slot of the back of the remote. The CROSSFIRE transmitter module is recommended, as it utilizes the latest CRSF-protocol, but any transmitter module with PPM or PXX (FrSky XJT) stream will work as well.

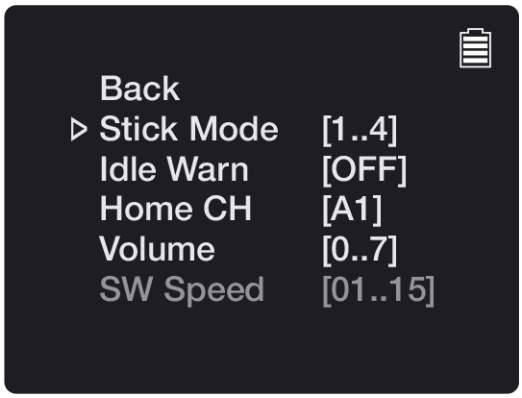
Check the TBS CROSSFIRE transmitter module manual for further details on setting up and configuring it.

Next, to make the radio recognizes the module (it does not auto-detect), you need to enter the configuration menu (press and hold rocker-switch for 3 sec.) and change the model to the correct RF module type, to either regular PPM, TBS Crossfire or FrSky XJT.

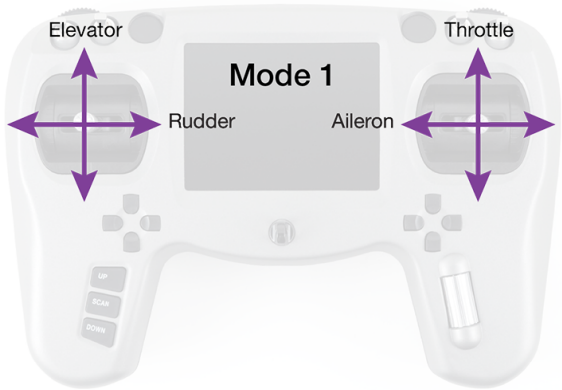


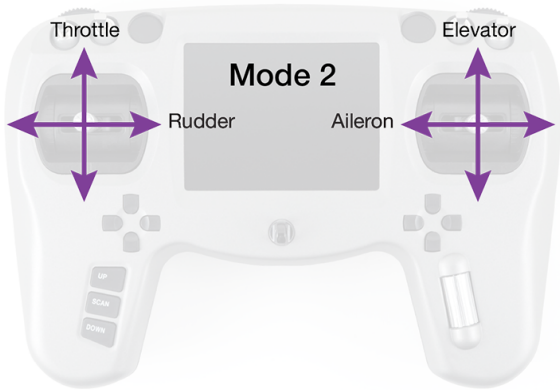
Stick mode

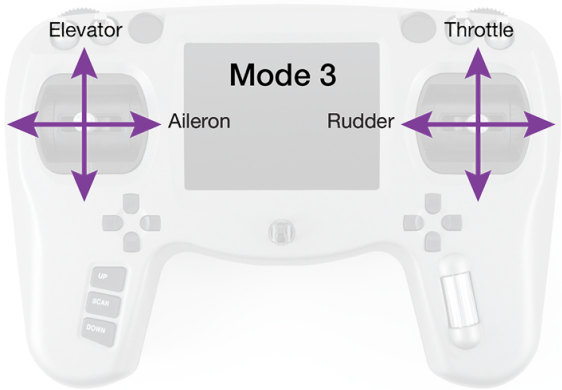
When talking about stick modes we are referring to how the remote is configured to control the airplane i.e. which sticks operate which controls on the aircraft. You can swap the stick gimbals by opening up the remote, covered later on in the manual.

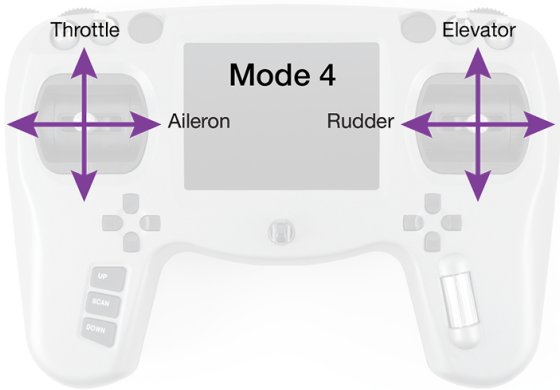


By default the remote is set up with mode 2, which is the most common type used.









Connecting goggles

If you like to use FPV goggles, these can be connected to the remote using a special custom flat CAT5 goggle-cable (provided). The cable carries both video and power to compatible Fatshark-video goggles.

If you like to turn off the LCD display while using the goggles, enter the configuration menu and go to the LCD Display → Turn Off Display option. You can turn on the display again for spectators by long pressing the UP-button (VRX controls).

Pin-out of the cable, for repairs or customization:

TBS GROUNDSTATION RJ45 Pin-out

1. +5V filtered
2. GND for +5V
3. Video signal
4. GND for video
5. Audio signal
6. Not connected
7. Cable OK return line (yellow LED)
8. +12V (LiPo) after diode drop

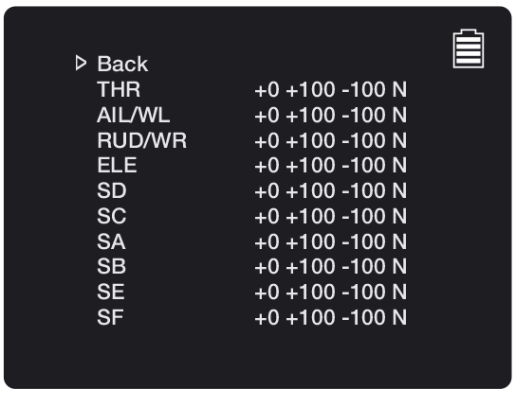
Channel mixing and end-points

For detailed channel mixing, rates, and end-point settings, it is recommended to set up these on the flight controller side (CleanFlight, BetaFlight, RaceFligut, APM, PX4, Pixhawk, etc.), for anything else than flying wings.

The TBS TANGO is a FPV remote and meant to be simple to set up and easy to use.

Flying Wings

The TBS TANGO supports channel mixing for flying wings (normal and V-tail). The mixing, end-point, and reverse settings can be configured in the “Advanced” menu, after you have set up your new flying wing model.



Usage

Changing video receiver frequency

Use the “SCAN”, “UP”, or “DOWN” buttons on the left-hand side to change the video receiver frequency.

UP-button

- Long press - Reset the video RX channel to the Home-channel (changed in the configuration menu)
- Short press - Jump to the next video RX channel, sequence Band A → Band B → Band E → Airwave → Race

SCAN-button

- Long press - Automatically scan the current video RX band for active channels
- Short press - Automatically scan all video RX bands for active channels

DOWN-button

- Long press - Bring up a menu to specifically set a MHz frequency to be on.
- Short press - Jump back to the previous video RX channel, sequence Race → Airwave → Band E → Band B → Band A

The receiver frequency bands are listed in the following table.

Band	Channel (MHz)							
	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
Band A (Bosecam A)	5865	5845	5825	5805	5785	5765	5745	5725
Band B (Bosecam B)	5733	5752	5771	5790	5809	5828	5847	5866
Band E (Lumenier/DJI)	5705	5685	5665	5752	5885	5905	5925	5866
Airwave (FatShark/IMRC)	5740	5760	5780	5800	5820	5840	5860	5880
Race (Raceband)	5658	5695	5732	5769	5806	5843	5880	5917

Remote LED status indicator

When the remote is powered on, the LED behind the button will flash green. The built-in LiPo battery is charged every time a 5V power source is connected to the micro-USB connector.

Button LED indicator	Status
Green blinking	Remote powered on
Red	Backup battery is charging

Battery protection

The battery protection in the remote is based on the nominal voltage, as follows:

Battery voltage	Condition
3.81V and over	Battery level 4, fully charged
3.71V	Battery level 3
3.61V	Battery level 2
3.41V	Battery level 1, beep tone and battery icon flashing
3.38V	Power on allowed, critical level, beep tone and battery icon flashing
3.34V	Shutdown voltage, 20 seconds countdown prompt, recharge as soon as possible

Alert prompts

The remote will raise an alert when one of the following events happen:

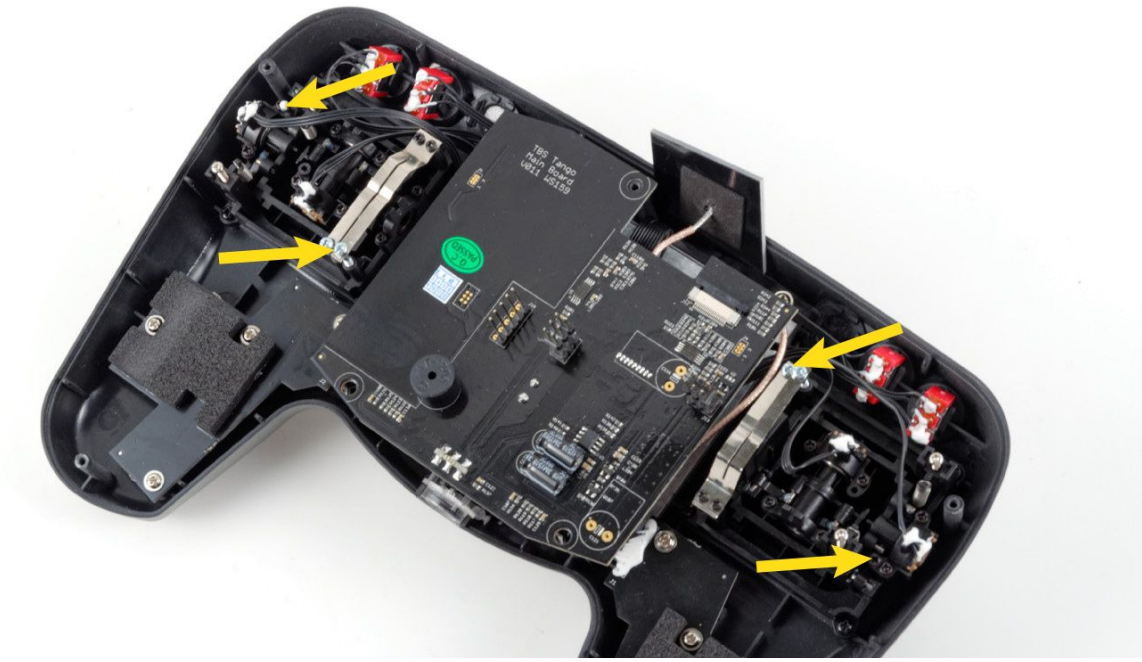
- Battery low alert - described in the previous section
- Telemetry data about the low RSSI, for RF module is set to XJT
- Telemetry data about the low battery voltage, for RF module is set to XJT
- Idle warn is activated and the timer is expired

Opening up the remote

To change the stick mode or changing the throttles tick ratchet, you will need to open up the remote control. First remove the seven (7) screws on the backside and locate the area shown in the photo below. If you can't open up the remote control, you probably forgot the 7th screw, located inside the JR module.

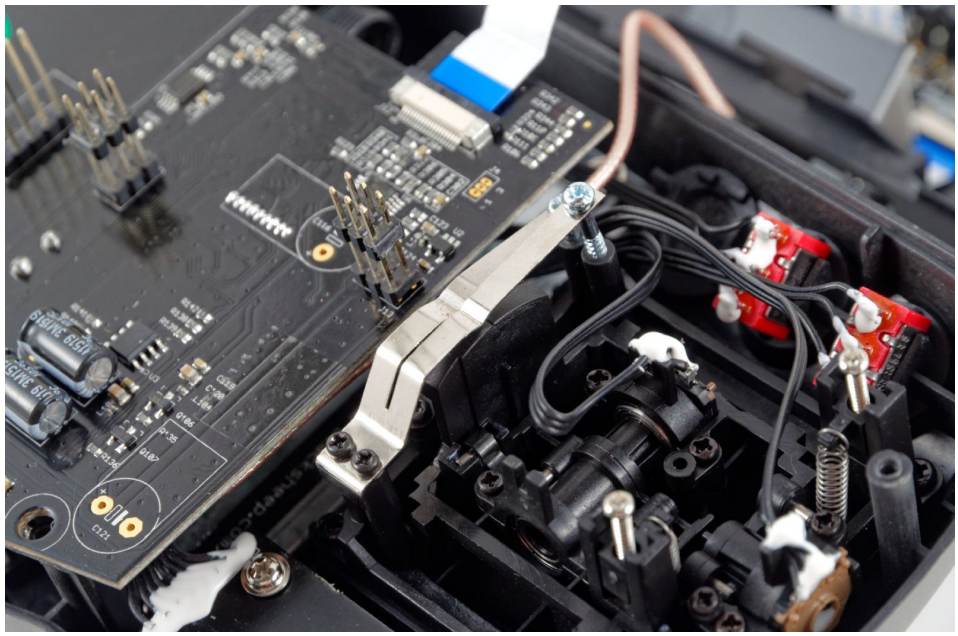
Changing the flight stick mode

Depending on your stick preferences/flight mode, your throttle stick will be non-sprung. Modifying it is a matter of screwing in a screw on one end, and removing the screw on the other end. The hardness of the sticks and the ratchet is controlled by the silver metal piece and the two control screws, see the next section.



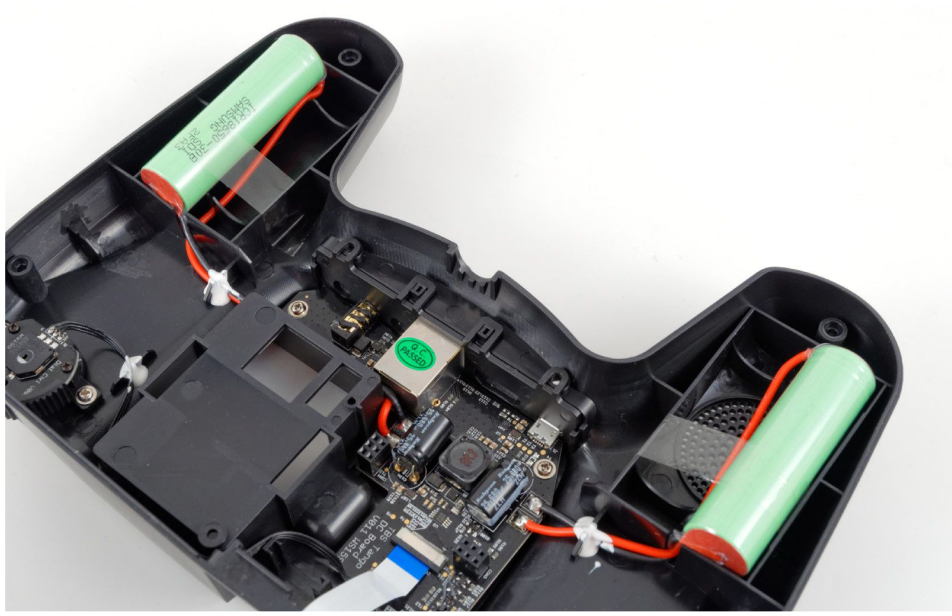
Adjusting throttle ratchet strength

Use a screwdriver to adjust the right-most screw; counter-clockwise to decrease the tension and clockwise to increase the tension. If you rather prefer a smooth sliding stick, increase the tension of the other metal bracket.



Replacing or upgrading battery

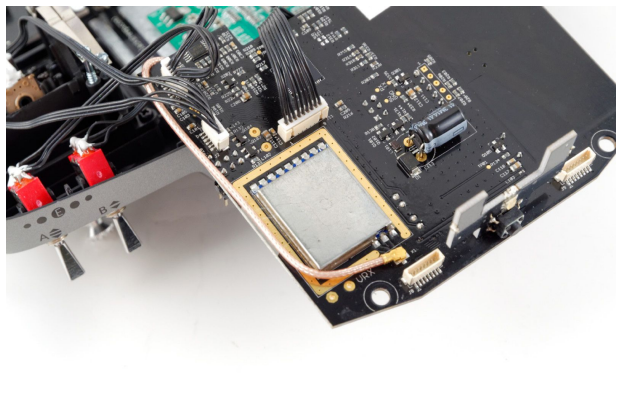
The battery in the radio uses a regular XT30-connector to make it easy to replace or upgrade the stock battery. It uses two Lithium-Ion 18650 battery cells (Samsung ICR18650-30B 3000mAh) in parallel, one on each side of the remote with two spare compartments. The stock batteries provide 6000mAh for approx. 3 hours of usage.



Swapping antenna

The remote comes with a 5G8 5dBi patch antenna, hidden underneath the cover on the top. You can change the antenna or connect an external SMA connector by un-hooking the IPEX/IPX32/Hirose U.FL antenna connector and swap to another cable.

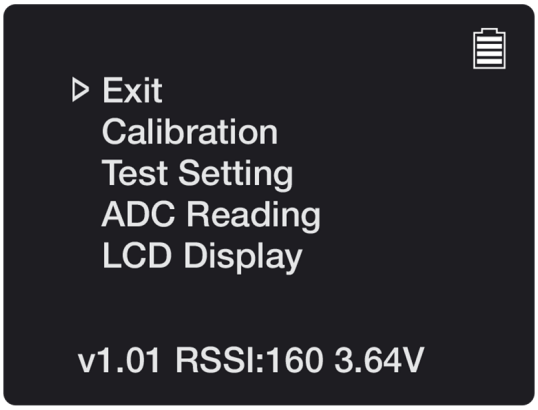
If you do not intend to swap the antenna, it is recommended to keep the cover on.



Factory mode

The factory mode is only needed when fine-tuning or troubleshooting the remote.

Main menu



Main menu for the factory mode

- **Back** - Exit out of the factory mode
- **Calibration** - Calibrate the end-points of the sticks, dials and switches
- **Test Setting** - Menu display update rate and discard accelerated rocker-switch behaviour
- **ADC Reading** - Raw values of the input sensors and PPM output
- **LCD Display** - Change the boot screen and check the display characters

Calibration

Re-calibrate the end-points for all the physical inputs on the remote.

Center all the sticks. You usually only need to center the throttle stick.

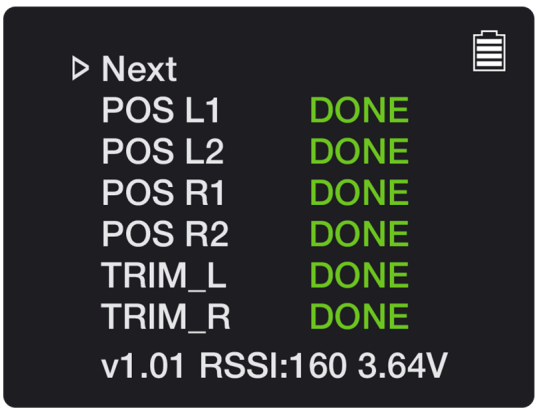
- **Next** - To to the next step in the procedure

Move both sticks to their extreme ends until the max. and min. value turns green for each input. The “TunL” and “TunR” presents the spring-dials E and F.

- **Next** - To the next step in the procedure

Flip all the switches to their up-position.

- **Next** - To the next step in the procedure



Now, now all the switches through their range until each one turns to green. If a few does not register, try flipping it back to up-position and then move it down again.

- **Next** - To complete the procedure

FrSky XJT

Despite being one of the most popular R/C systems, FrSky's RF modules and even receivers are notorious for interfering with 5.8GHz receivers, video transmitters or other 2.4GHz R/C systems. When designing the TANGO we have taken every precaution possible to ensure a interference-free operation also with FrSky's devices, but it is all at the limits. This is a problem in the engineering and design of FrSky, and NOT a TBS problem. We can assure the TANGO can work problem-free with the FrSky XJT module, but a few things will need to be in place:

1) The internal 5.8GHz patch antenna needs to be as far away from the RF module as possible. From the factory, the patch antenna will have been installed and secured in the proper location. If you do experience video issues such as vertical "flashing" lines, please open up the front antenna cover and ensure that the antenna is installed properly.
2) If despite proper antenna installation you are still seeing issues in the video, you can additionally cover your FrSky XJT module with copper- or aluminum-tape. Be sure to leave plenty of space around the pin holes. Grounding the tape is NOT necessary, or recommended! Alternatively you can also cover the inside of the JR module bay with copper- or aluminum-tape, instead of placing tape on the XJT module.
3) Should both the mods above fail, please contact our customer support. If possible, please document the problem with a quick video so that we can assist you faster and better.

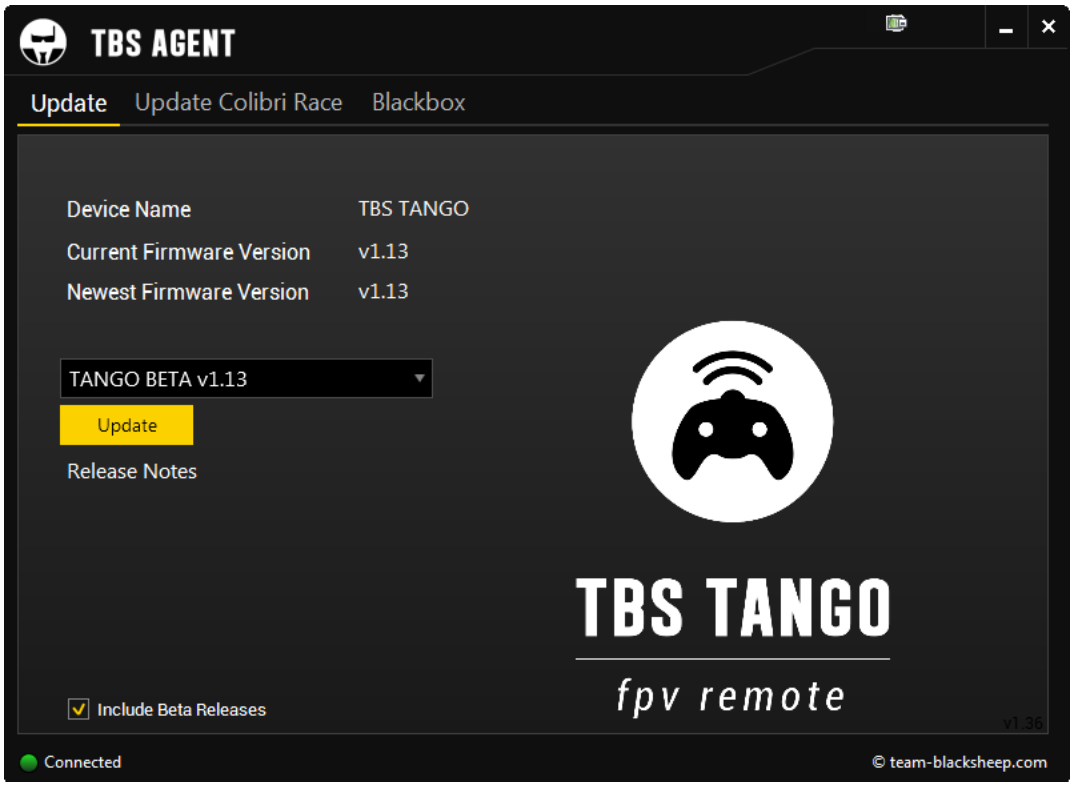
Firmware upgrade

Updates to the remote is applied using our TBS AGENT software. This takes care of all the downloading of the latest firmware, verification- and upgrade process. Plug in the remote control, start the TBS Agent, and wait for the latest firmware to download. Then click on “UPDATE” to proceed.

Installing TBS Agent

Download the installer from http://www.team-blacksheep.com/corepro/agent (Windows7/8/10, 64-bit required) - no drivers needed to use the application, but an Internet connection is required to download the latest firmware versions. Press F1 if you like to include beta releases in the available updates.

Turn off the radio, plug in a micro-USB cable on the radio. Power for the update is provided via USB. The software will automatically detect the device and offer you the option to upgrade the firmware if a newer version is available.



When the status indicator is green and says “Connected”, you can upgrade or downgrade the firmware.

To upgrade the firmware, select the latest version from the drop-down menu and click Update. Rapid blinking indicates that the process is working and being updated. The process will take about 1 minute. Check all settings after the process is finished.

Good practices

We have compiled a list of all of practices which have been tried and tested in countless environments and situations by the TBS crew and other experienced FPV pilots.

Follow these simple rules, even if rumors on the internet suggest otherwise, and you will have success in FPV.

- Start with the bare essentials and add equipment one step at a time, after each new equipment was added to proper range- and stress tests.
- Do not fly with a video system that is capable of outperforming your R/C system in terms of range.
- Do not fly with a R/C frequency higher than the video frequency (e.g. 2.4GHz R/C, 900MHz video).
- Monitor the vitals of your plane (R/C link and battery). Flying with a digital R/C link without RSSI is dangerous.
- Do not use 2.4GHz R/C unless you fly well within its range limits, in noise-free environments and always within LOS. Since this is most likely never the case, it is recommended to not use 2.4GHz R/C systems for longer range FPV.
- Do not fly at the limits of video, if you see noise in your picture, turn around and buy a higher-gain receiver antenna before going out further.
- Shielded wires or twisted cables only, anything else picks up RF noise and can cause problems.
- When using powerful R/C transmitters, make sure your groundstation equipment is properly shielded.
- Adding Return-To-Home (RTH) to an unreliable system does not increase the chances of getting your plane back. Work on making your system reliable without RTH first, then add RTH as an additional safety measure if you must.
- Avoid powering the VTx directly from battery, step-up or step-down the voltage and provide a constant level of power to your VTx. Make sure your VTx runs until your battery dies.
- Do not power your camera directly unless it works along the complete voltage range of your battery. Step-up or step-down the voltage and provide a constant level of power to your camera. Make sure your camera runs until your battery dies.
- A single battery system is safer than using two dedicated batteries for R/C and FPV. Two batteries in parallel even further mitigate sources of failure.
- For maximum video range and “law compatibility”, use 2.4GHz video with high-gain antennas.
- When flying with R/C buddies that fly on 2.4GHz, or when flying in cities, it is perfectly possible to use 2.4GHz video provided you stick to the channels that do not lie in their band (CH5 to CH8 for Lawmate systems, available from TBS).
- Do not use diversity video receivers as a replacement for pointing your antennas, diversity should be used to mitigate polarization issues.

- Improving the antenna gain on the receiver end is better than increasing the output power (except in RF-noisy areas). More tx power causes more issues with RF on your plane. 500mW is plenty of power!
- Try to achieve as much separation of the VTx and R/C receiver as possible to lower the RF noise floor and EMI interference.
- Do not buy the cheapest equipment unless it is proven to work reliably (e.g. parts falling off, multitudes of bug fix firmware updates, community hacks and mods are a good indicator of poor quality and something you do NOT want to buy for a safe system). Do due diligence and some research before sending your aircraft skyward.

Manual written and designed by ivc.no in cooperation with TBS.