High quality, license-free, ultra-tiny vtx

Revision 2019-01-24

The **TBS UNIFY PRO32** is a successor to the most popular line of video transmitters (TBS UNIFY PRO). We have improved the robustness, decreased the size and power consumption, added capability for insane features and perfected the way it is installed in your multirotor. In a nutshell, it's the most comprehensive, future proof, highest quality and overall best VTx line made to date.

Key features: Main features across all Unify Pro32 models

- World's lightest 37ch video transmitter line (custom channels via smartaudio and CRSF)
- Power to Channel calibration for each channel - extremely consistent output power
- 25mW (more power available, requires HAM license*)
- One button frequency and power setup
- OSD configuration using TBS SmartAudio 2.1 (via Flight controller, TBS Crossfire or PNP PRO OSD)
- LUA support for CRSF users
- u.FL connector, selected models with strain-relief mounting holes
- 5V input or 2-6S input with 5V output versions available
- Improved noise filtering
- Optimized heat dissipation
- OTA firmware update capability (using CRSF - coming soon!)
- Solder-on module dimensions available on request

Specifications

	TBS UNIFY PRO32 5G8 nano	(more coming soon?)
Input voltage:	Regulated 5V *(Only use 5V DCDC converter with proper LC filtering! Example: PNP25/PNP50/PNP PRO)*	
Power Output	None	
Extra features:	CleanSwipe PitMode (incl. Support for team racing) Full CRSF capability	
Software protocol	SmartAudio V2.1 CRSF	
Output Power	14dBm (25mW) 20dBm (100mW*) 26dBm (400mW*)	
Pit mode	**Activate:** Press power during startup or use Smart Audio V2.1 LED flashes red when enabled **Disable / Deactivate:** Press power for 5 seconds during runtime Or use Smart Audio V2.1	
Pit mode -> flight mode	On-board button, SmartAudio 2.1 or CRSF Command	
Channels:	Band A (8ch), B (8ch), E (5ch) Fatshark 8ch, Race Band 8ch	
Audio on 6.5MHz	No	
Power consumption	25mW: 210mA 100mW: 280mA 400mW: 390mA	
Range:	2km	
Antenna connector:	u.FL high strength	
Port connector	Through-holes, 2mm pitch	
Dimensions:	14.5(H) x 13(W) x 3(D) mm	
Weight:	1g	
Special Connections:	5V output filtered for Camera	
Kit contents:	TBS UNIFY PRO32 NANO u.FL Antenna Silicon Cables pre- tinned	

* requires HAM license, special unlocking procedure, available on selected models only!

Table of Contents

Button menu control

The menu consists of categories and settings. Pressing the button for 3 seconds will toggle between categories, pressing it for a short time toggles between settings. To enter the menu, hold the button for 3 seconds. LED colors will signal the state of the menu, for an overview see the menu table.

Channel select mode

Enter menu by pressing the button for 3s. Red LED will flash 1 time. Select channels by simple short presses.

Band select mode

Press button for an additional 3s. Red LED will flash 2 times. Select band by simple short presses.

Unlock & power select mode

(FOR HAM USERS ONLY!) Press button for 20 to 25 seconds. The Red LED will flash 3 times to confirm. You have unlocked the video transmitter for use with all frequencies (see frequency table below).
NOTE: Unlock only works if you are inside the band selection menu

The power select mode is now accessible. Once unlocked, you can select the power level according to the table below. To lock the transmitter, go back into band select menu and press the button for 20 to 25 seconds again.
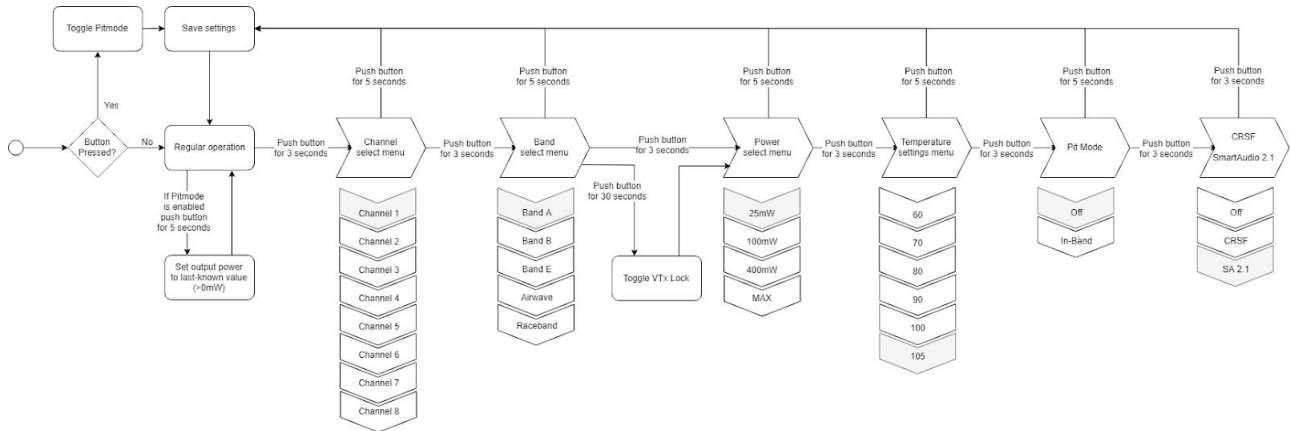
PitMode

Pit mode function explained HERE

Save and exit

Press button for 3 seconds. Blue LED will turn on, settings are saved and it will exit the menu.

Button menu structure

LED Flash Codes for Channel, Band and Power

The TBS UNIFY PRO32 5G8 signals selected channel, band and power levels using a startup sequence of LED codes. The same sequence is also repeated in the menu to make it unified. First the RED LED flashes to indicate the item being shown. One flash for channel, two flashes for band, three flashes for power level. Subsequently, the BLUE LED will indicate the value.

Red LED:	Indicate item - Channel, band or power setting
Blue LED:	Indicate value

For example, Channel 6, Band B, Power of 400mW, will have the following startup LED code:

- 1x Red and 6x Blue = Channel, 6
- 2x Red and 2x Blue = Band, 2 (=B)
- 3x Red and 3x Blue = Power, 3 (= 400mW)

Once the Video transmitter has successfully booted up, it will show a constant BLUE for locked state, and a constant RED + BLUE for unlocked state. If the TBS UNIFY PRO32 5G8 is in pit mode, the red light will flash.

For reference, see the menu table on the next page.

Installation / Mounting

When installing the Unify Pro32, please ensure adequate airflow and - most importantly - heat transfer. This means mounting the Unify Pro32 with a bit of pressure against a flat piece of carbon will give you the best results. Proper mounting will allow the video transmitter to run for extended periods of time while sitting on the ground and without reducing output power. TBS UNIFY PRO32 automatically reduces output power before it reaches critical heat levels.

Menu Table

RED LED		BLUE LED							
		1x	2x	3x	4x	5x	6x	7x	8x
1x	Channel	1	2	3	4	5	6	7	8
2x	Band	A	B	E	Airwave	Race			
3x	Power Level	25mW	100mW	400mW					
4x	Limit Temp.	60	70	80	90	100	105		
5x	PIT Mode	OFF	IN-BAND						
6x	CRSF/ SA	OFF	CRSF	SA					

Frequency Table

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
PowerLevel	25	100	400						mW

Grey fields are the default factory setting.

The selections in orange requires HAM license to operate legally. Black selections are only available on special request (custom firmware for large events with prior legal body approval). The video transmitter ensures that you cannot select illegal channels or power levels by accident:

- When controlled by the push button, you will need to confirm having a HAM license by following the steps described above to unlock your video transmitter
- Through the CORE PRO, you are required to enter your HAM license number under the "Callsign" menu before you can access the high power transmission settings and the locked out channels

## OSD control via Flight Controllers

Using any Smart Audio V2.1 compatible flight controller simply connect the Smart Audio data pin to a free and supported port on your FC (see pinout below).

For Betaflight users, you can then configure the connected port in Betaflight configurator to Smart Audio V2.1 protocol. You can then start controlling your VTx using any on-board OSD or using LUA scripts on your OpenTX remote control.

Video transmitter pinout

TBS UNIFY PRO32 5G8 nano
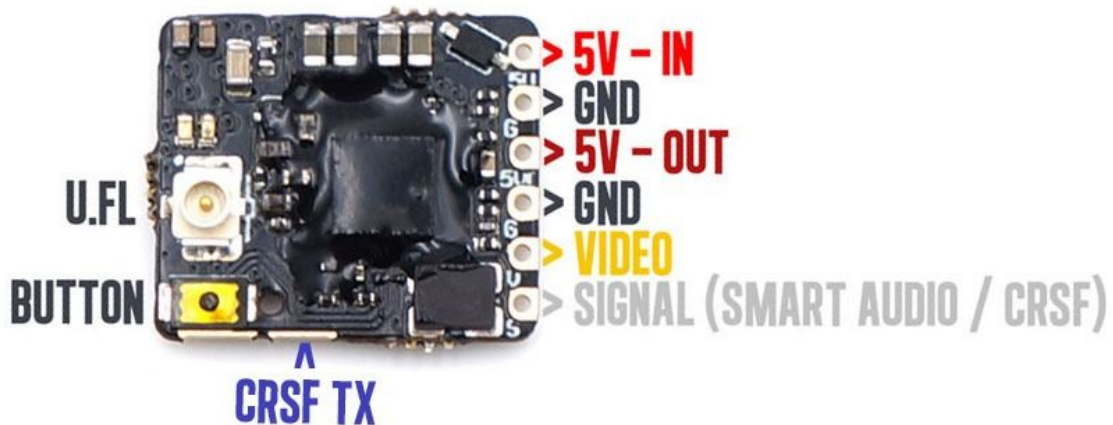
The UNIFY PRO32 5G8 nano comes with pre installed silicon wires for easy installation in your build. There is a filtered 5V input with a 5V output for your camera.

The ideal camera for this VTX is the TBS TINY CAMERA. This Camera is able to supply 5V to the VTX which is required for any 1S Setup.

ATTENTION!

- Please take care when soldering to the tabs, do not solder with temperatures higher than 350°C for more than 3-5sec.
- For remote control the VTX channels we suggest to use SmartAudio or CRSF interface. The tactile button is very fragile, do not use hard and pointy objects such as needles to change channels to prevent permanent damage to the button.

Technology showcase

PitMode

PitMode is a mode where the video transmitter only runs on an incredibly low output power. This prevents interference with others at events, while still allowing a minimum of visibility for emergency last-minute setting changes.

With the TBS UNIFY PRO32 line, Pit Mode has been slightly modified in behavior. The main button on the video transmitter is used to toggle pitmode flag at power-up, and SmartAudio / CRSF can modify this flag as well. Smart Audio / CRSF can enter also enter pit mode during runtime using the power setting 0mW, which will not modify the flag (the VTx will never power up at the 0mW power setting). To leave pitmode during operation, simply set your desired power setting using Smart Audio, CRSF or the button menu.

SmartAudio 2.1

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 newer generation OSDs at TBS, and all UNIFY PRO series VTX, and all modern flight controllers support SmartAudio!

With the UNIFY PRO32 line we have launched SmartAudio V2.1. Over the regular SmartAudio, it changed control for PitMode in operation to a switch(on / off) rather than a flag that is refreshed on reboot.

If you are a OSD or VTx developer interested in adding support for SmartAudio, please check our [SmartAudio specification](#). SmartAudio is a free-to-use protocol. If you'd like to use "TBS SmartAudio" in your marketing, you may contact us for licensing options:

- http://team-blacksheep.freshdesk.com/

CRSF

CRSR is a protocol designed by Team BlackSheep and championed through the TBS Crossfire remote control system. It has been integrated into most popular remote controls, is a 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.

With the advent of the TBS UNIFY PRO32, for the first time in FPV history does a VTx now support this functionality. We can configure channel, output power and pitmode settings. Additionally, software updates via the TBS Crossfire platform are now possible.

CleanSwitch

A new feature introduced with the TBS UNIFY PRO 5G8 is CleanSwitch. When video transmitters power up or change frequency, they usually send a burst across the entire band which disturbs fellow flying pilots.

All UNIFY PRO32 5G8 video transmitters will remain in their lowest power output (less than 0.1mW) while changing channels and powering up. This ensures interruption-free racing, even with multiple video transmitters changing channels, or powering up. Despite all this, TBS UNIFY PRO & EVO are still the fastest video transmitter on power up - thus ensuring it is the perfect choice for any application where quick channel changes are a necessity!

Declaration of Conformity

EU - DECLARATION OF CONFORMITY

We affirm that the electrical equipment manufactured by us complies with the requirements of the R&TTE Directive 1999/5/EC

Manufacturer:

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Kwun Tong, Hong Kong

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Description of the appliance:
5G8 System

Trade name and model of appliance:
TBS Unify Pro32 Nano 5G8 (A-TBSS-UPN32)
SNR 0741587432661

Applicable Standard (s):

- EN 300 440-1 V1.6.1; EN 300 440-2 V1.4.1 Article 3.2
- EN 301 489-1 V1.9.2; EN 301 489-3 V1.6.1 Article 3.1b
- EN 62311:2008 Article 3.1(a) - Health
- EN 60950-1:2006+A11:2009+A1:2010+A12:2011+A2:2013 Article 3.1a Safety

Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.

January 24th, 2018

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Raphael Pirker, CEO
TBS Avionics Co Ltd.

TEAM BLACKSHEEP
SERIOUS TOYS

5G8 TBS UNIFY
VTX PRO32

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 designed by ivc.no, written by TBS and ivc.no.