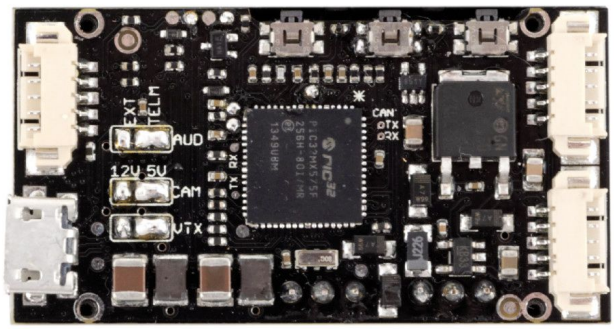
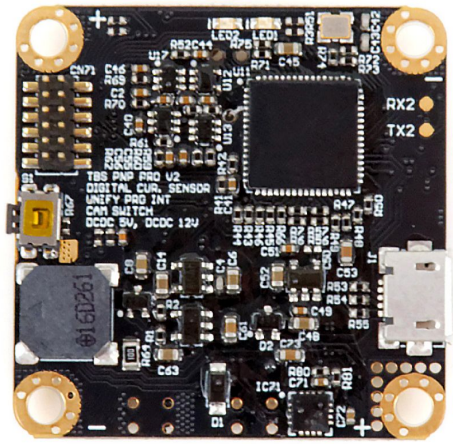
TBS CORE PRO

The all-in-one FPV power supply and flight OSD

Revision 2017-03-09

The TBS CORE PRO is the progression of our CORE PNP system. It supports GPS to help navigation and a new range of TBS telemetry modules to take your FPV experience to the next level. We are leveraging some of the same core components we used in the earlier CORE series and our multirotors. Making this the most advanced CORE PNP system available. It also comes with the same easy-to-connect cables - no soldering required to install this unit. The CORE PRO is also an integral part of the TBS FPVision on the TBS POWERCUBE and our TBS VENDETTA quadrotor.





In a nutshell, the TBS CORE PRO is a lightweight OSD and filtered power supply, feeding the video transmitter and pilot camera, all in one compact package. It makes FPV setups super-easy and is a safety feature every FPV aircraft should have. Suitable for any airplane and multirotor of any size. The simplified wiring reduces points of failure and lets you focus on flying instead of worrying.

Key features

- Dual 2S to 6S input voltage - additional input for backup (2S only)
- Constant 5V max. 2A and 12V max. 600mA - individually
- OSD with GPS, battery voltage, current consumption, signal strength, callsign and timer display
- Telemetry audio downlink or video input and mono audio pass-through
- Very high switching efficiency
- Extremely low ripple and low RF noise, two stage filtered and shielded casing
- Supports 1W VTX with only minor airflow
- All necessary cables included
- Software upgradable and configurable
- Small size, 27mm x 47mm x12mm, only 15.6 grams

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Important

To keep the system stable and in a healthy condition, make a note of the following.

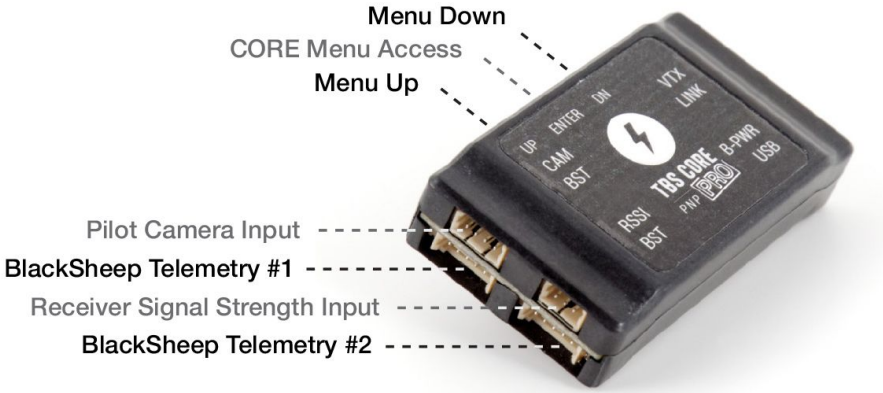
- Do not hot-plug the system - disconnect battery power when setting up or reconfiguring the system
- Backup power 2S only - a separate backup LiPo battery pack should not exceed 2S
- Calibrate on the field before your first flight - the signal strength indicator and compass is best calibrated in conditions similar to the flight environment

Specifications

Functions:	Voltage regulator, on-screen display, current sensor, flight location data
Input voltage:	2S to 6S (7.4 to 26V DC) - backup battery max. 2S
Output voltage:	5V @ 2A, 12V @ 600mA - individually, not combined (max. 8-10W load)
Switching efficiency:	>85% at nominal load
Audio source:	External left/right channel pass-through or telemetry audio
Video signal:	1.0Vp-p 75 Ohm video signal
Flight controller compatibility:	CleanFlight, BetaFlight, PX4, and APM - get OSD status of armed/disarmed, flight mode type, etc., and change settings on FC
RSSI signal:	Analog voltage, digital PWM signal, PPM (POWERCUBE), EzUHF OSD Link and CROSSFIRE (BST).
Current sensor:	100A max., high accuracy, digital interface, power tap for regulators
GPS/compass sensor:	uBlox 6H based sensor, 5Hz update rate, HMC5883L 3-axis digital compass
Interfaces:	1x micro-USB port, 2x BST BlackSheep Telemetry (I2C) ports, 1x EzUHF Link port, 1x RSSI port
Port connectors:	Molex PicoBlade 1.25 mm pitch, Molex SL 2.54 mm (NAZA connectivity cable)
Working temperature:	0 - 40°C
Dimensions:	27 (H) x 47 (W) x 12 (D) mm
Weight:	15.6 grams
Kit contents:	1x TBS CORE PNP PRO, 1x TBS current sensor module, 2x BST cables, 1x EZUHF Link cable, 1x 3-pin RSSI cable, 1x Camera cable, and 1x VTx pigtail cable
Optional Accessories:	1x TBS GPS/COMPASS module, 1x TBS BLACKBOX

TBS CORE PNP PRO

Overview diagram of the CORE PRO showing the controls and different ports.



The TBS CORE PNP PRO filters EMI and other sources of interference and protects your sensitive FPV electronics. The end result of this is increased video range. It also sports two new BST (BlackSheep Telemetry) ports which are future proofed, which means new modules can be added at later time to extend the life and usability of the product. The on-board micro USB connector lets you upgrade the software when new firmwares are announced. The unit is shielded to let you use it in long range situations, e.g. for UHF.

Pilot camera and video transmitter connect to their corresponding designators on the unit - necessary cables normally included with the camera/vtx. All connectors are plug&play, requiring no soldering to get the product running.

The included 100A current sensor module is an ideal companion for your R/C airplane or multirotor. It senses the current consumptions whilst the model is in operation, letting you know how much of the battery capacity has been used. The current sensor is now digital which means it provides a very accurate read-out. It can be calibrated from the OSD if needed, but comes pre-calibrated out of the box.

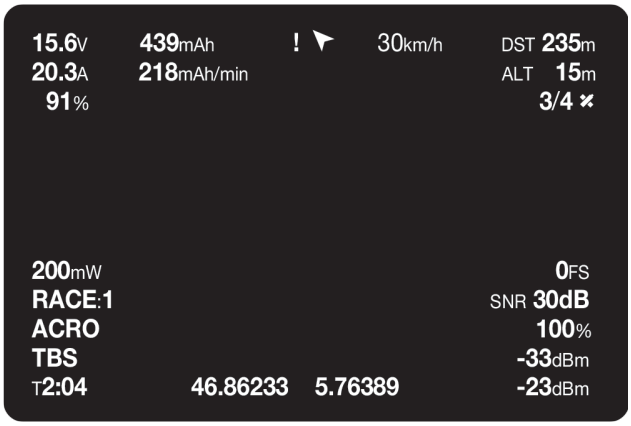
As always, the OSD provides real-time information to the pilot about the battery voltage, current consumption, flight time and control signal/RSSI. If your setup is sporting an EzUHF 8ch receiver (diversity or lite), the extended link information can be displayed on the OSD.

CORE On-Screen Display (OSD)

In FPV, simple is better. Wire clutter from many different devices all connected together creates a sophisticated conglomeration of ground-loops and “antennas” that can have significant impact on the reliability of your FPV system and your FPV experience.

For this reason, we made wiring simple and the OSD will detect which modules are connected and only display the information which is absolutely necessary - this keeps the screen layout simple and clean. Helpful telemetry information, indicators and warning messages will show only when needed.

Standard OSD

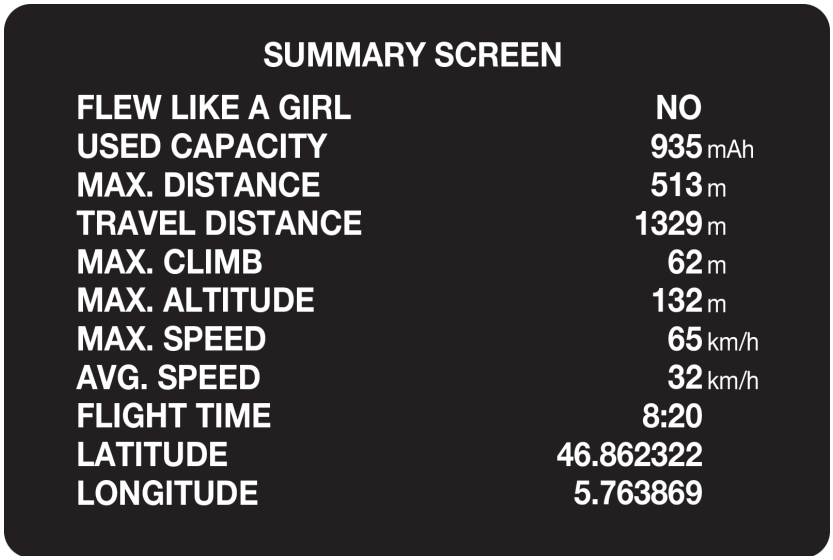


Race OSD

A complete read-out of all the available OSD telemetry is annotated in the image below.

If for some reason the CORE processor stops working, the camera video feed will still be relayed to the video transmitter without interruption. But the opposite is not true, the OSD will only work when there is a camera/video feed connected to the VTX port.

When the aircraft has landed, a summary screen will automatically be displayed showing vital information about the flight. Great for competitions, gatherings and long range flights.



The above summary screen is explain in detail below.

- **Flew like a girl** - Yes/No - Built-in TBS flight scoring system giving you our instant judgement
- **Used capacity** - mAh - Total battery power consumed for the flight
- **Max. distance** - m, ft - Furthest point away from launch/home location
- **Travel distance** - m, ft - Cumulative distance covered
- **Max. climb** - m, ft - Altitude difference between max. altitude and launch
- **Max. altitude** - m, ft - Highest ASL point reached during the flight
- **Max. speed** - km/h, mi/h, kts/h - Top speed reached during the flight
- **Avg. speed** - km/h, mi/h, kts/h - Average speed during the flight
- **Flight time** - mm:ss - Total duration of the flight
- **Latitude, Longitude -** GPS coordinates, updated every 30 seconds (summary screen only, in-flight update rate is 1Hz)

Connecting TBS equipment

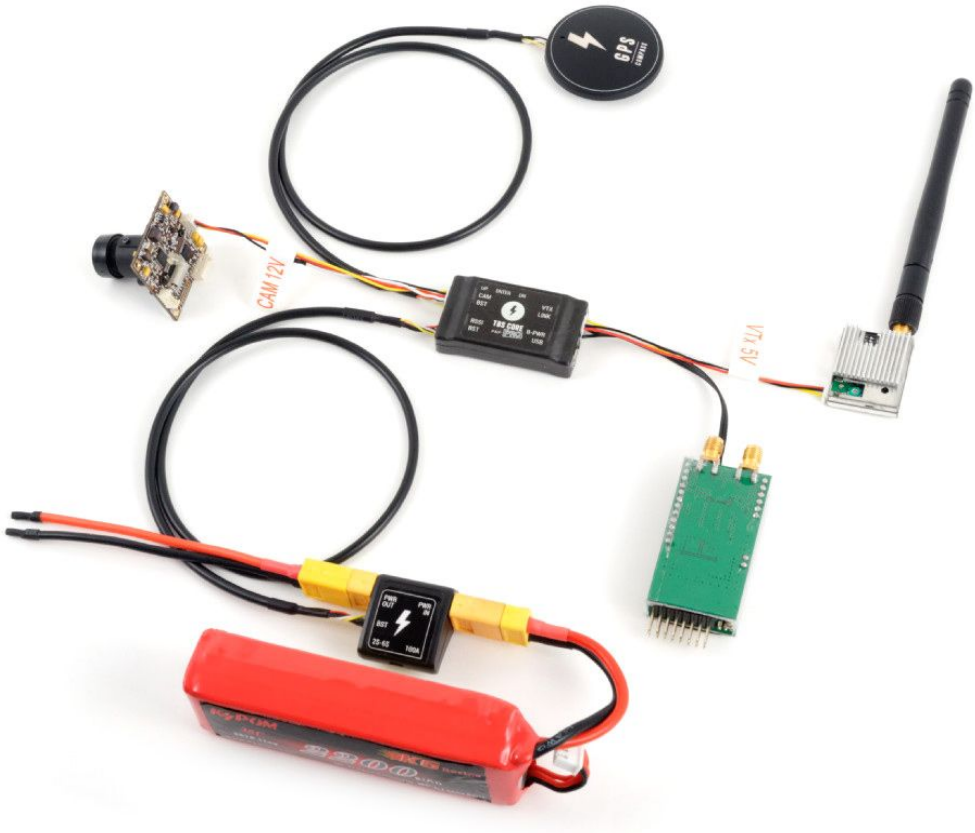
There is an issue when you want to run BST devices like the GPS or BLACKBOX direct without a CORE PRO. Most of the BST devices needs 5V which the CORE PRO provides. The CROSSFIRE RX does not power the BST line when 5V is applied to the servo connectors.

The following explains the required power needs:

- TBS BLACKBOX - Can be powered by the BST 5V or by the Flight Controller over the ext. FC port
- TBS GPS - Can only be powered by the BST 5V
- TBS CURRENT SENSOR - Provides VBatt but needs BST 5V to run itself
- TBS CROSSFIRE RX - Can be powered over one of the eight servo connectors or by BST 5V
- TBS CORE PRO / FPVISION - This is only device is providing 5V on the BST line

Power type:	BST 5V	VBATT	ESC BEC 5V	FC 5V
TBS CROSSFIRE	✔ PWR IN		✔ PWR IN	
TBS BLACKBOX	✔ PWR IN			✔ PWR IN
TBS GPS	✔ PWR IN			
TBS CORE PRO / FPVISION	✔ PWR OUT	✔ PWR IN		
TBS CURRENT SENSOR	✔ PWR IN	✔ PWR OUT		
TBS BULLETPROOF ESC (SET)			✔ PWR OUT	

Setup and installation



The photo above shows a common setup for an airplane or multirotor. A diagram to install the TBS CORE PNP PRO on the TBS DISCOVERY PRO quadcopter is included on the next page.

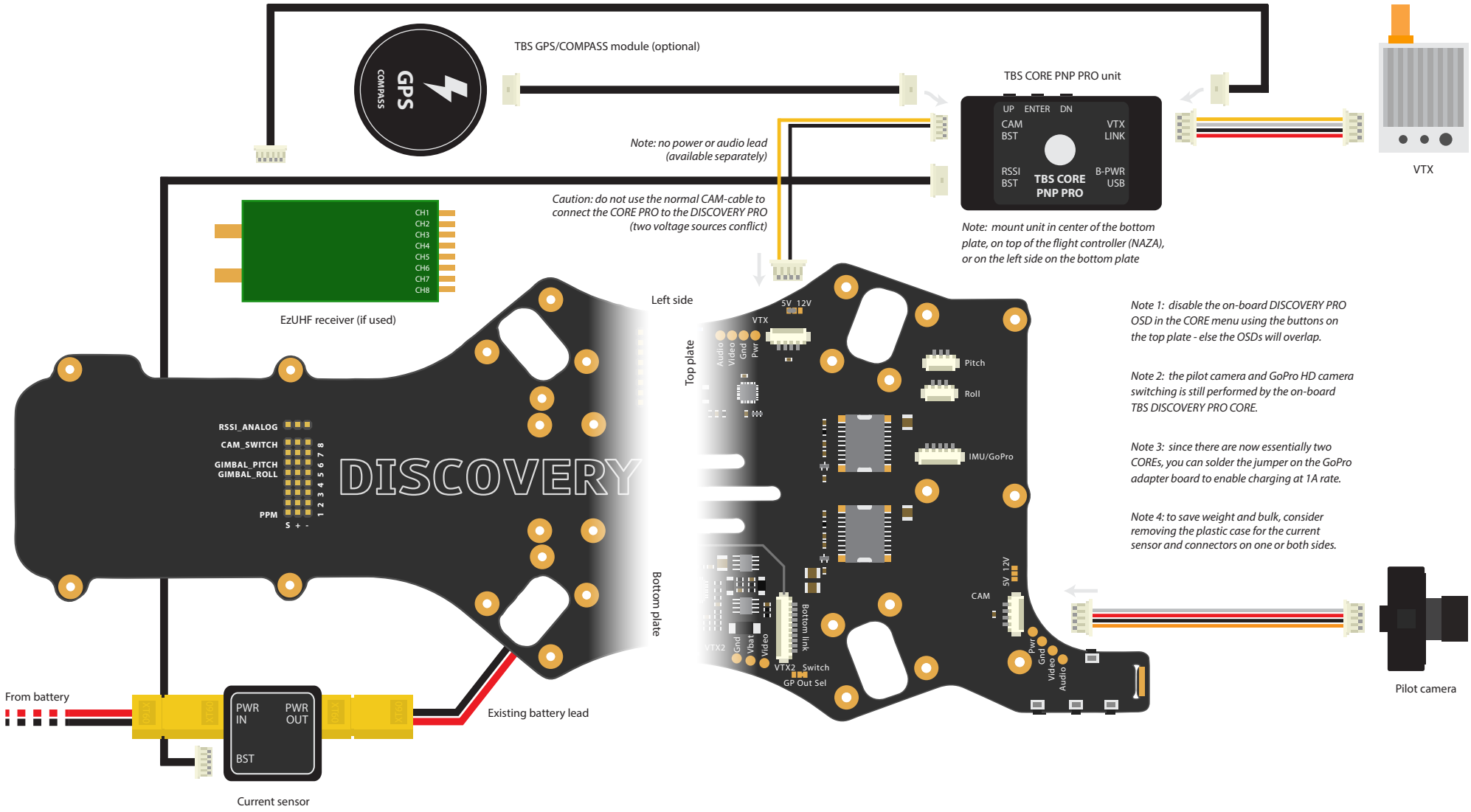
Installation is fool proof, just plug your camera and video transmitter into the corresponding sockets and connect the current sensor module between your model and battery pack. All your plane's electronics should be powered normally after the current sensor XT60 connector. If your receiver supports RSSI (Receiver Signal Strength Indicator) output, hook it up to get additional telemetry data on the R/C link displayed on the OSD.

Positioning the TBS CORE PNP PRO in your model requires some planning. Please keep adequate separation between unit and your R/C receiver. The TBS CORE series includes two very powerful switching-regulators which can interfere with your UHF receiver when placed in close proximity. This is not something that is unique to this product but rather to all devices with switching regulators. The noise decreases exponentially with distance, so every centimeter or inch helps get more range out of your system. A UHF R/C system can fly to about 15 km (approx. 10 miles) with the TBS CORE PNP PRO sitting in close proximity on a small multirotor frame. It is essential to keep a good distance between the GPS antenna (passive) and VTx antenna (active) to get a proper GPS lock.

Since the unit is based on switching regulators, it does not need to be ventilated or exposed and can be tucked away in your aircraft for maximum durability.

TBS CORE PNP PRO installation diagram for TBS DISCOVERY PRO

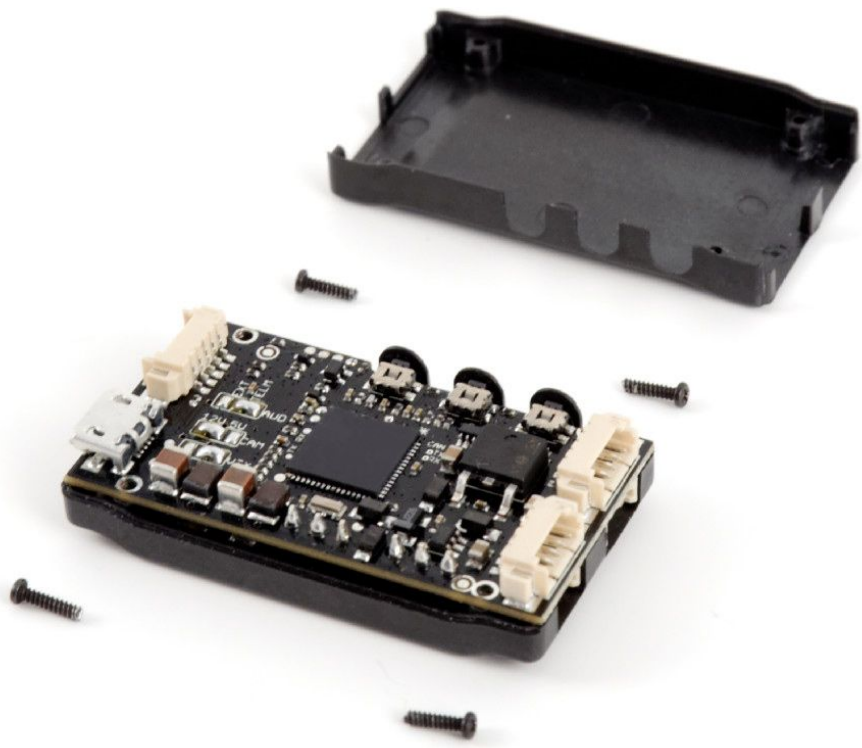
Dec. 2014 - by ivc.no/tbs



Pre-configuration

Before connecting any device to the TBS CORE PNP PRO, the unit has to be configured to output the correct voltage for your specific pilot camera and video transmitter. The audio source, which is transmitted down via the video transmitter, can also be changed to carry either telemetry data or just pure audio.

To do the change, remove the 4 Philips screws on the bottom of the unit and remove the bottom cover.



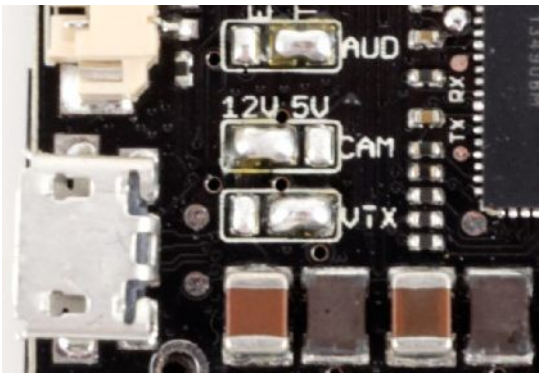
Voltage selection

The default voltage out of CAM socket is **12V** and the VTX socket is **5V**. For powering 5V cameras (e.g. FPV CCD cameras) or 12V transmitters, open the unit by removing the rear 4 screws and change the solder jumpers on the left side of the internal board. The solder pads are conveniently labelled. Solder a bridge between the center solder pad and the left (12V) or the right (5V) of the VTX and CAM pads, respectively - do NOT short-circuit all three pads.

Switches and pin-jumpers are a very frequent point of failure in many FPV systems. Therefore, we have decided to use solder-pads for maximum security and durability.

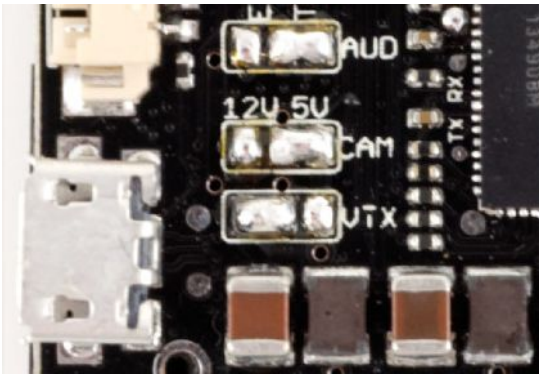
Configuration for:

- **12V** Pilot camera
- **5V** Video transmitter



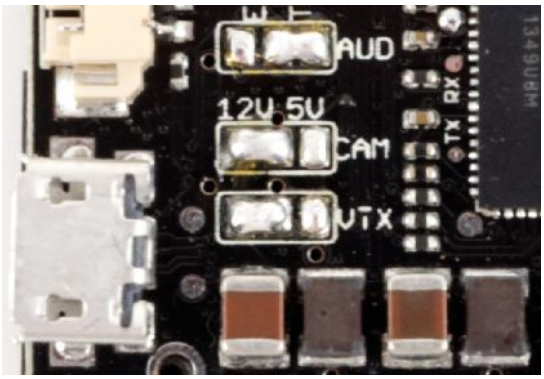
Configuration for:

- **5V** Pilot camera
- **12V** Video transmitter



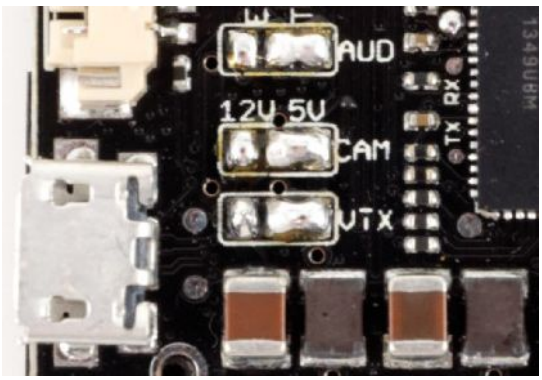
Configuration for:

- **12V** Pilot camera
- **12V** Video transmitter



Configuration for:

- **5V** Pilot camera
- **5V** Video transmitter



Important: when using video transmitters with on-board voltage regulators (e.g. IMRC VTx), it is recommended to connect the positive and ground lead directly to the main power leads instead to maintain good switching efficiency and stability.

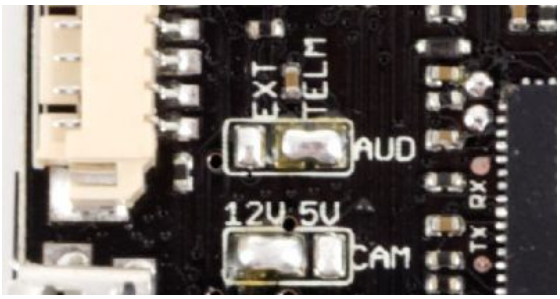
Audio source

Audio source is by default configured for **TELM** to route telemetry data from the CORE processor to the video transmitter downlink and also change settings on the TBS UNIFY PRO VTX using our SmartAudio protocol.

External audio can be connected via the CAM-port. The audio in is the white wire on the camera cable. To enable external audio, open the unit by removing the 4 screws, as shown above. On the AUD solder pads, solder a bridge between the center pad and EXT-pad. To change it back to telemetry, undo the bridge and join center pad and the TELM-pad.

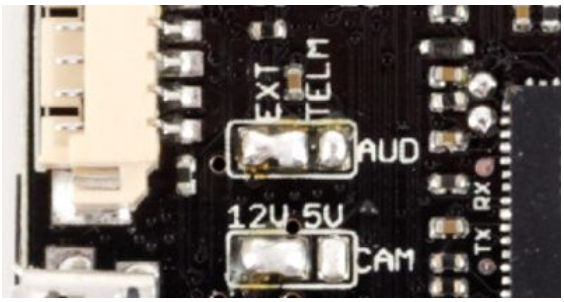
Configuration for:

- **TELM**etry audio source



Configuration for:

- **EXT**ernal audio source (via CAM port/mic)



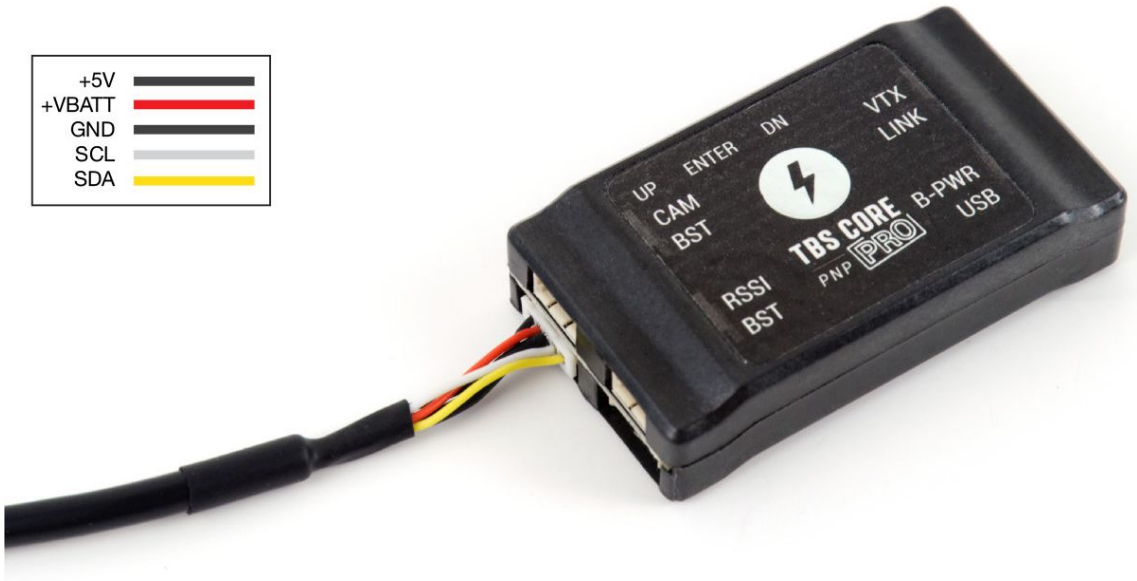
The TBS CORE PNP PRO has no on-board microphone to keep the size down, but can still be connected externally via the CAM-port.

Power draw

The following table shows typical 12V loads and the corresponding max. allowed 5V loads within the 10W envelope. Exceeding these figures will put the CORE in overload/shutdown mode.

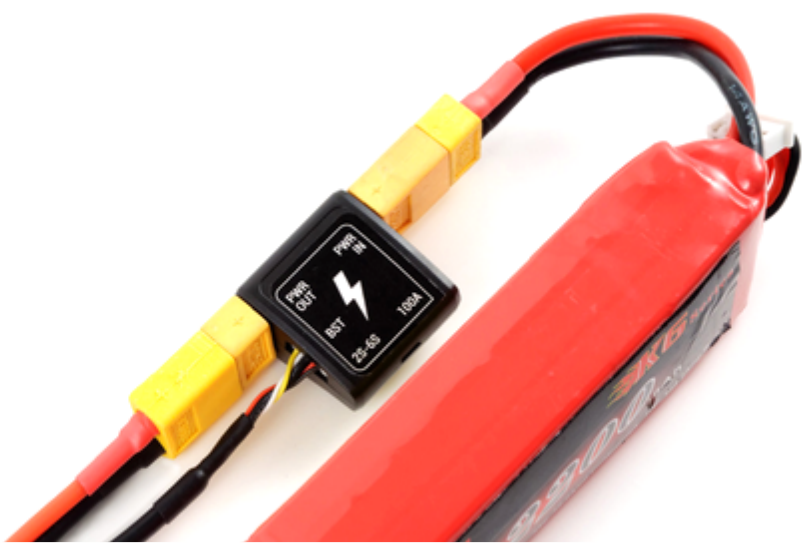
	12V (CAM/VTX)	**5V (CAM/VTX)**	**Load**
Scenario #1	100mA typ.	1.76A max.	10W total
Scenario #2	300mA typ.	1.28A max.	10W total
Scenario #3	500mA typ.	800mA max.	10W total

BST BlackSheep Telemetry ports (2xBST)



There are two BST (I2C) ports on the left side of the unit. These can be used to connect a range of compatible modules for the TBS CORE PNP PRO to provide telemetry data. This modular system allows you to custom fit your model depending on your exact needs and weight budget. This is a shared bus, meaning all BST ports use the same physical communication lines. The pin-out is the same for all BST modules.

Connectivity to TBS Digital Current sensor (BST device)



The current sensor comes with a protective plastic casing (the photo above is from the prototype). It is rated for maximum 100A, which should cover even the biggest aircrafts. The sensor's digital interface provides the most accurate current sensing yet. A blue light indicates on the front of the casing shows that battery power is connected. In addition to current sensing, it supplies power to the main CORE processing unit.

The module comes with XT60 male/female connectors to make it easy to put in-line between the model and battery pack. The connectors can be replaced with any connector or wire, if preferred.

Connectivity to TBS GPS/COMPASS module (BST device)

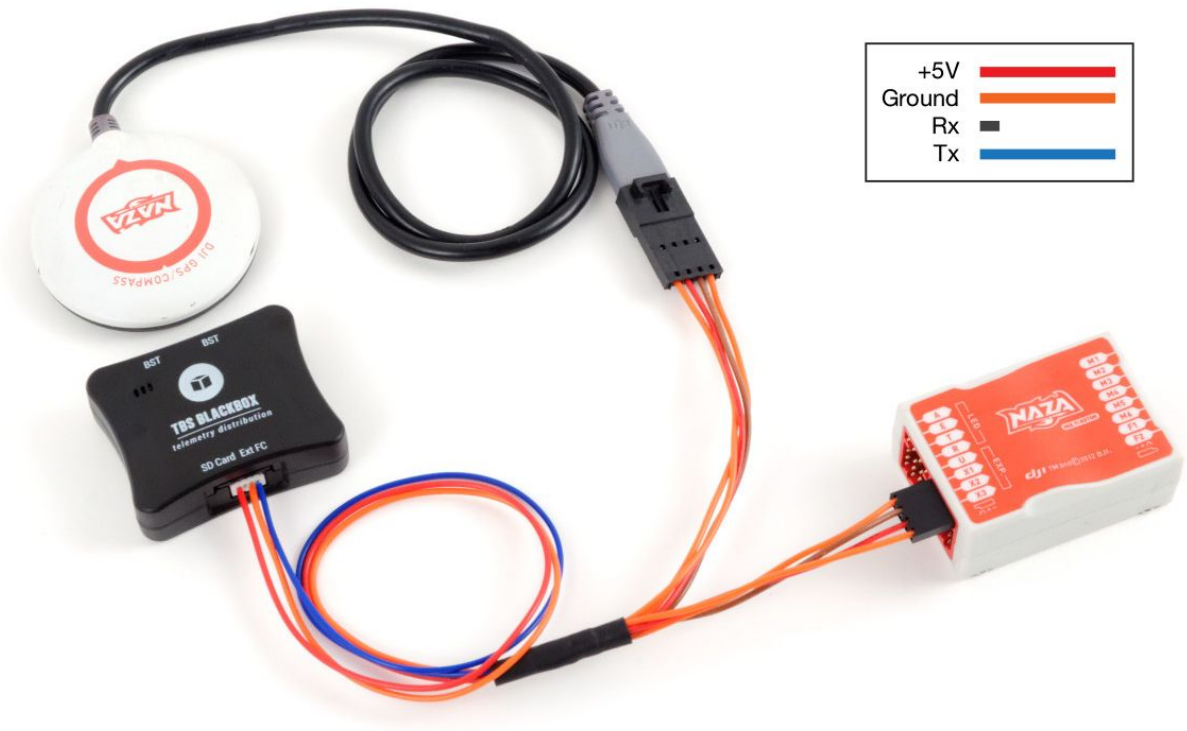
The TBS GPS/COMPASS module (available separately) for the TBS CORE PNP PRO is based on the reliable uBlox GPS sensor and gives you real-time location information in the OSD. It displays an arrow indicating home location (where power was applied), speed (km/h), distance (m) and altitude (m).

When power is first applied, the GPS will start to search for minimum 4 satellites to get a lock. A blinking blue light means that it is searching for satellites, a solid blue light means the GPS is locked and ready.

The module comes in a protective plastic casing with a mounting pole to keep it away from noise electronics (the photo above is from the prototype). It is recommended that you install the pole/module away from powerful video transmitters. The mounting location is not critical and can be mounted away from the center of the platform. The orientation is not important as long as the top of the GPS antenna/case is exposed to the sky.

On a mutirotor (e.g. TBS DISCOVERY series), it is sufficient to install the GPS module in the rear next to or on top of the R/C receiver - away from transmitting devices (e.g. VTX.)

Connectivity to TBS BLACKBOX telemetry distribution and logging (BST device)



The BLACKBOX (available separately) acts as a central recipient for telemetry data from the TBS Current Sensor, TBS GPS/COMPASS, or DJI NAZA flight control. It forwards that information to the TBS CORE PRO live OSD and continuously logs it all on a SD card. This makes keeping a flight logbook easy.

It can act as an intermediary in place of a secondary TBS GPS/COMPASS on your aircraft, by sharing the GPS data from your flight control, e.g. DJI NAZA GPS puck or APM GPS.

The recorded data can be loaded by the TBS AGENT software for further analysis, processing (Google Earth path, FlyTrex upload, DashWire overlay) and archiving.

Further details can be found in the TBS BLACKBOX manual,
http://www.team-blacksheep.com/tbs-blackbox-manual.pdf

Connectivity to TBS BLACKBOX and TBS GPS/COMPASS

Pick a suitable length BST cable for your setup and connect the TBS GPS/COMPASS module to any BST port on either the BLACKBOX or CORE PRO unit (shared bus).

The current sensor can be connected to either CORE PRO or BLACKBOX, as shown in the image beneath.

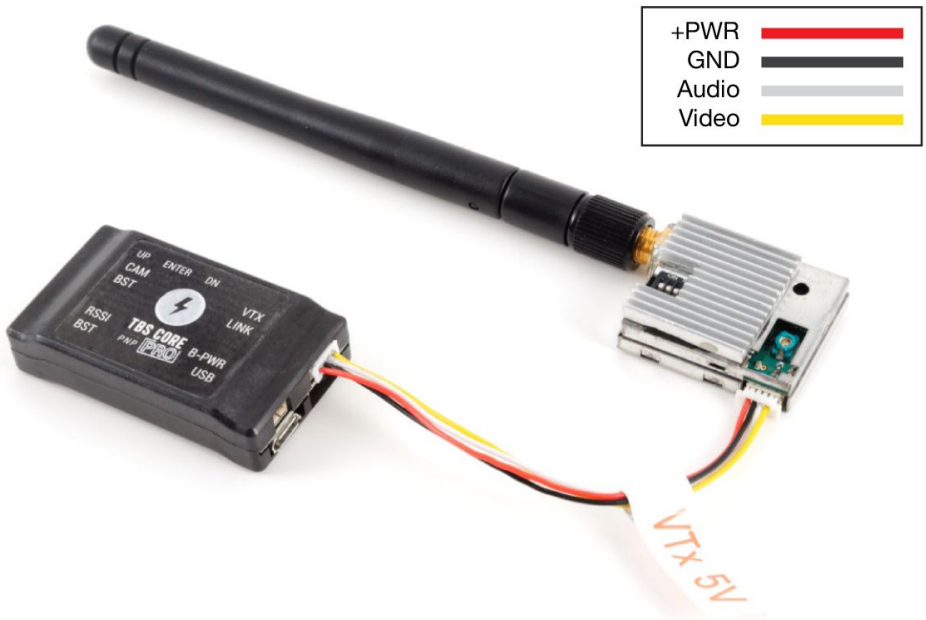
Connectivity to TBS CROSSFIRE

For details on how to use the CORE PRO with the CROSSFIRE radio system, see the TBS CROSSFIRE manual:
http://www.team-blacksheep.com/tbs-crossfire-manual.pdf

Connectivity to TBS POWERCUBE / COLIBRI

The settings on the BetaFlight/CleanFlight flight controller (COLIBRI) can be changed via OSD. This requires a BST connection and a RC data calibration step. This is described in the TBS CORE PRO manual:
http://www.team-blacksheep.com/tbs-core-pro-manual.pdf

Video transmitter port (VTX)



A video transmitter can be installed on the VTX port. The TBS CORE PNP PRO can power any video transmitter up to 1W. You can customize the included cable to suite your particular VTx, but be cautious of the voltage selection and wire polarity.

Using SmartAudio VTX or built-in VTX

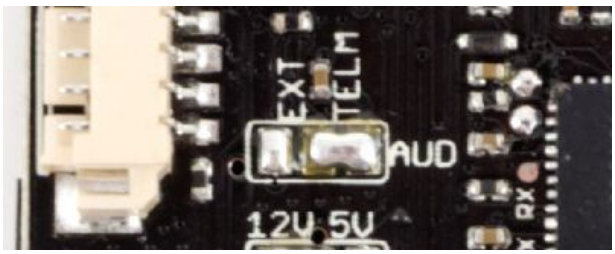
The latest TBS UNIFY PRO video transmitters have a feature on the audio line called SmartAudio. SmartAudio technology provides UART and I2C control for your entire video transmitter. Parameters such as output power, bands, channels and frequency can be freely controlled. This enables remote channel control directly from a smart device (TBS CROSSFIRE, external bluetooth or wifi module required), from your radio (TBS TANGO with TBS CROSSFIRE or OpenTX compatible remote), or from the OSD (e.g. TBS CORE PRO).

For SmartAudio to work on the TBS CORE PRO, the audio-jumper inside the CORE PRO has to be set to TELM audio source. This is how it comes from the factory and no change is normally required.

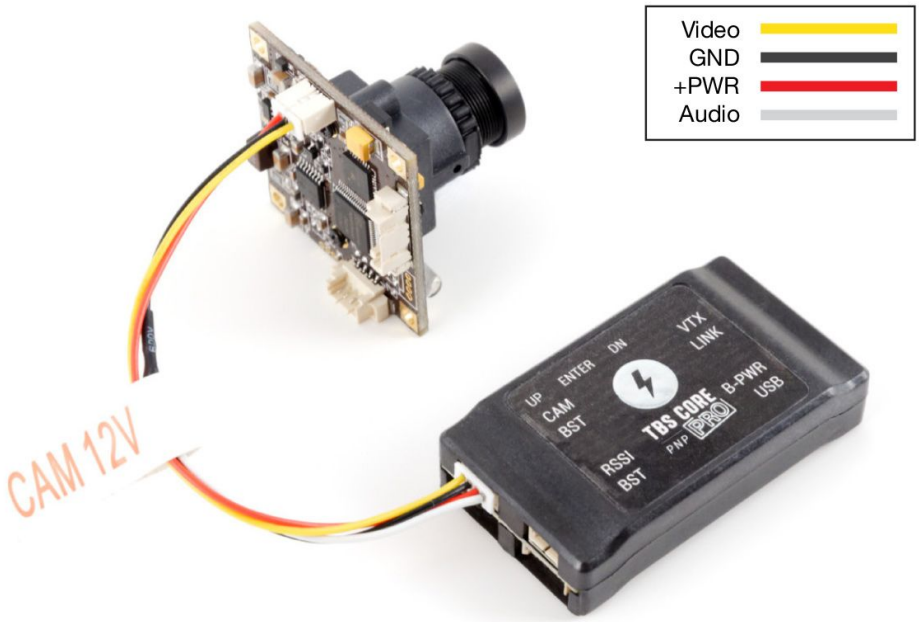
For OSD configuration of the video transmitter via SmartAudio, see the “Configuration menu” chapter. Also check the TBS UNIFY PRO manual, http://www.team-blacksheep.com/tbs-unify-pro-5g8-manual.pdf

SmartAudio configuration:

- AUD: **TELM**etry audio source



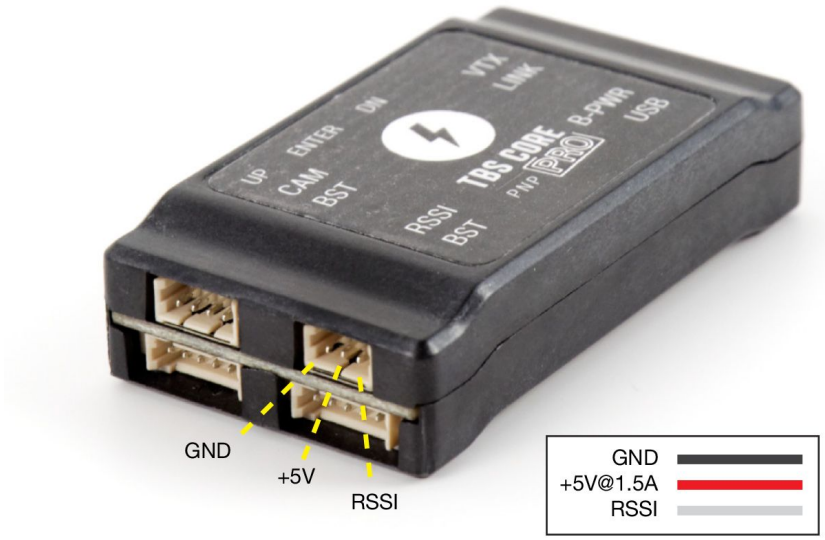
Camera port (CAM)



A pilot camera can be installed on the CAM port. The port has input for both video and audio - if external audio jumper is enabled inside the unit. An external microphone can be connected to the white (audio) and black (-) wires.

RSSI port

The R/C receiver signal strength (RSSI) of the control link can be displayed as part of the OSD screen. The RSSI port supports analog voltage and digital PWM input. After being calibrated, the value will change from 0% to 100% depending on how far away the receiver (model) is from the transmitter 0% means no signal, 100% means full signal. It is a good rule of thumb to return when the figure approaches 60% to ensure good operational conditions.



If your R/C receiver supports RSSI output, connect a cable from the receiver output to RSSI port on the TBS CORE PNP PRO. Both analog voltage and digital PWM signal types are supported, and must be configured in the CORE menu before it is displayed properly. Additionally, there is a handy +5V 1.5A dedicated regulator available on the middle RSSI pin, to power R/C receiver, flight controllers, some Servos etc. The +5V 1.5A regulation are only available if there is a 2S backup battery connected to the B-PWR connector (please refer to Backup Power port chapter for more details).

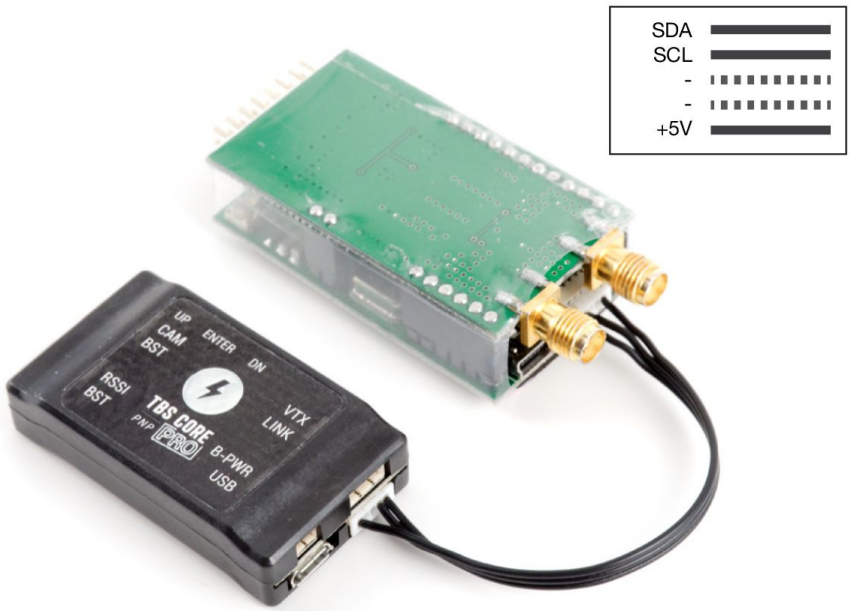
Some receivers are generating a digital PWM signal with too high frequency - this requires a low-pass filter to convert the signal to analog voltage. The RSSI port is not needed when using a EzUHF receiver via the EzLink port, see the next section.

Link port/EzLink (LINK)

If you own a EzUHF long range receiver, you can connect the EzUHF to the TBS CORE PNP PRO to make use of the extra telemetry data available. The EzUHF 5-pin (3 wire) Link cable is required to connect your EzUHF 8ch Diversity or Lite receiver to the TBS CORE PNP PRO. The EzUHF 4ch receiver does not provide the EzUHF OSD Link. Connect the EzUHF Link cable to the Link port on the unit. In the CORE menu, change the RSSI setting to LINK to enable the communication. No further calibration or setup is needed.

In the OSD, the following telemetry information will be displayed:

- The received signal strength (RSSI) for each antenna on the diversity model and a single read-out on the lite model
- The overall signal quality (in percentages) which include packet loss



A good rule of thumb is to return when the RSSI value on the EzUHF reception dips below -90 or link quality below 80%, whichever comes first.

Backup Power port (B-PWR)

This port allows you to connect an extra battery for safety on airplanes and wings. This provides a fully-redundant secondary backup battery to power your FPV system and your receiver if a 3 pin RSSI cable it connected to it. If the main battery pack is depleted complete or disconnects for some reason, the backup battery kicks in so you can glide to safety while keeping FPV up and running to locate the aircraft.

Note: Backup power is not recommended, or needed, on a multirotor, since the multirotor will unfortunately fall out of the sky if the main battery fails.

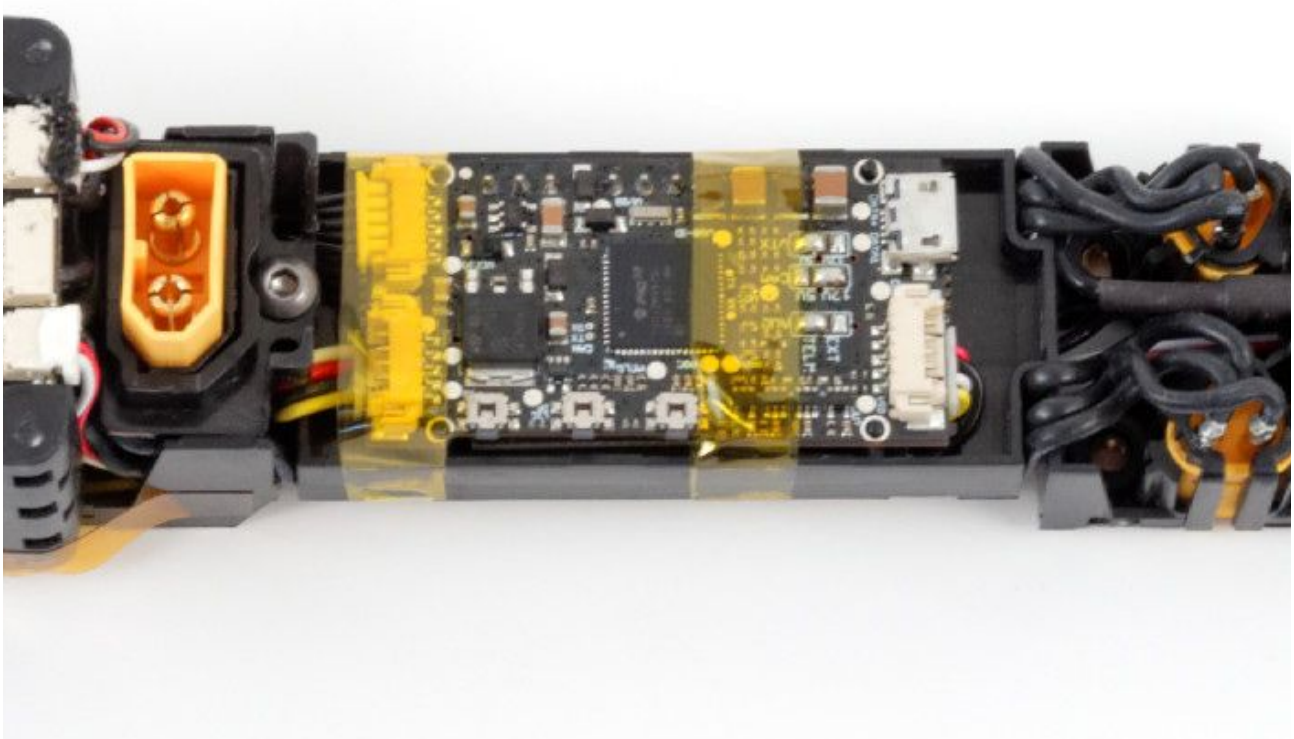
The backup power port is selected when the voltage of the main battery is lower than the backup battery. To add backup power to the system, connect an 2S (7.4V) battery (max. allowed) to the B-PWR port using a 2-pin Molex PicoBlade 1.25 cable (available separately).

The ground lead (-) is the one closest to the side of the unit and the positive (+) toward the middle/Link port.

Micro-USB config/update port

To make the firmware upgrades and (point&click) configuration easy, we have developed an application which faces directly with the CORE via a micro-USB connector. No additional drivers are required to use the application. See the following section for how to upgrade the firmware and configure the CORE.

TBS CORE PRO on the TBS VENDETTA quadcopter



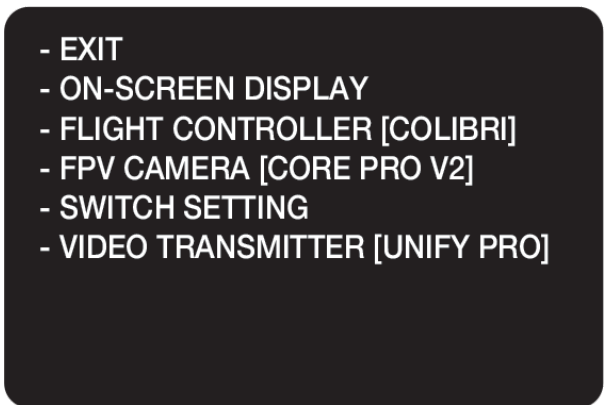
The TBS VENDETTA quadcopter has a full CORE PRO installed at its core. It powers the system camera, VTX and BST line, establishes the link to the TBS COLIBRI RACE flight controller, displays/manages the stick-navigation of the OSD, and performs the SmartAudio configuration of the UNIFY PRO 5G8 VTX.

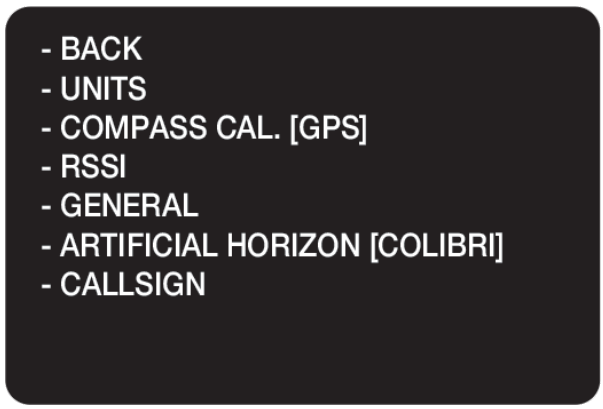
The instructions for the TBS VENDETTA can be found at:
http://www.team-blacksheep.com/tbs-vendetta-manual.pdf

Configuration menu

When power is supplied to the system, a boot screen will display detected the video format (NTSC/PAL), any connected BST modules and the battery type (2S-6S). The battery type detection is only available if the voltage warning is set to Auto.

Configuring and calibrating the TBS CORE PRO is incredibly simple. Either use our TBS Agent software which interacts with the the unit via USB, or use the built-in OSD configuration menu. To use the OSD menu, power up your FPV system and hold the ENTER-button for 3 seconds to bring up the OSD menu. It is easily navigated using the up-, down- and enter buttons.

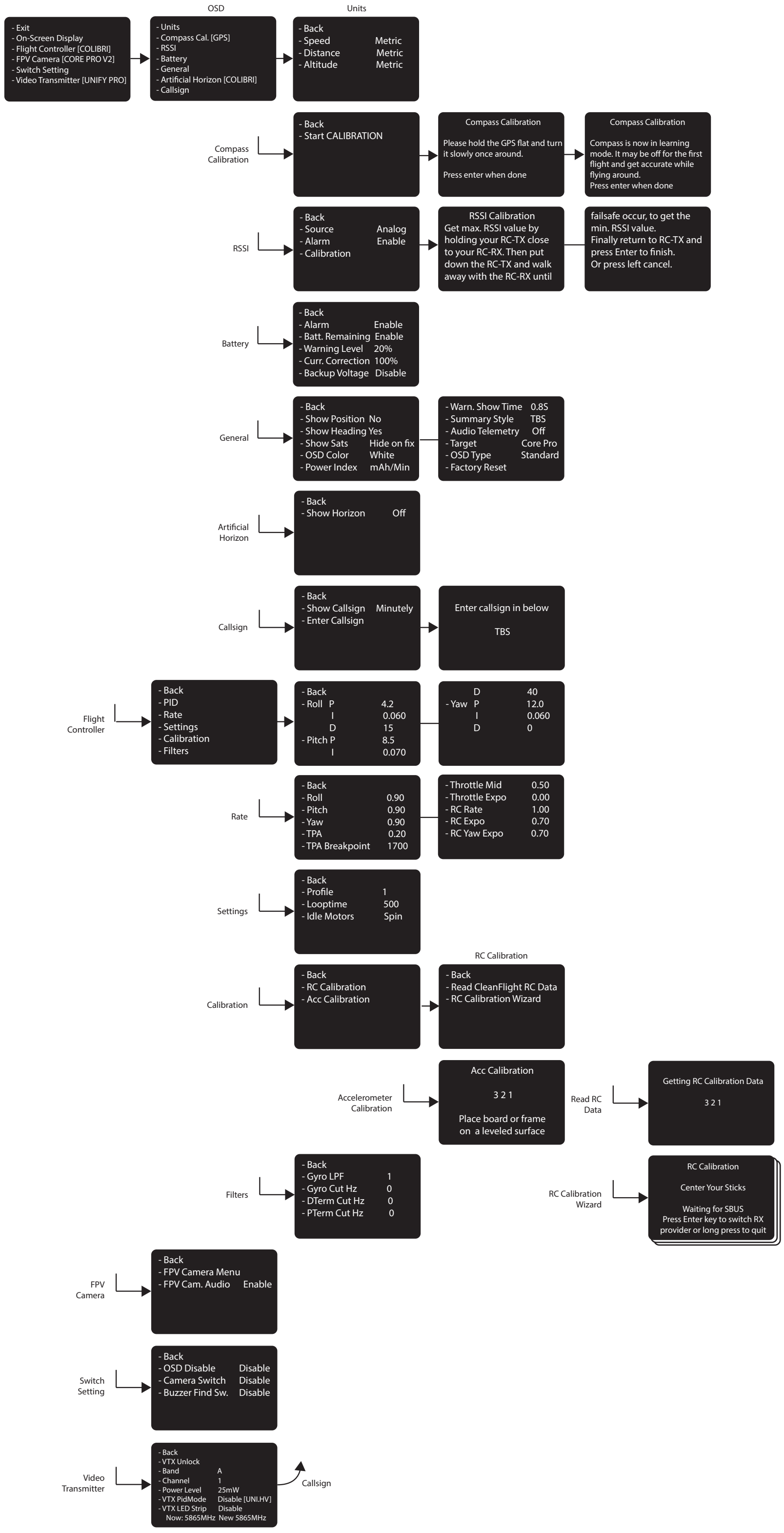




The configuration menu is laid out in groups where each section has specific settings and calibration steps. Additional menus for modules (POWERCUBE/COLIBRI, UNIFY PRO, GPS) will appear when detected during the boot-up. The default value is listed as the first option in the following pages.

TBS CORE PRO - Menu Overview

March 2016 - by ivc.no/tbs



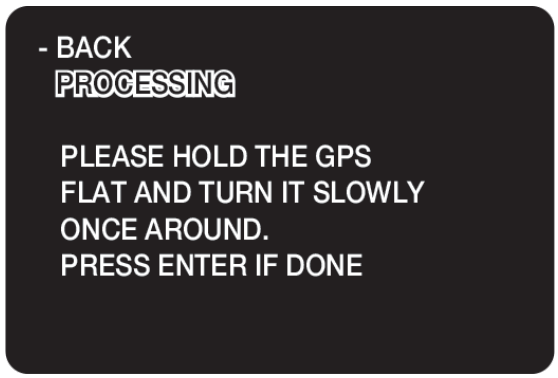
Units

The units used to display the speed, distance and altitude can be changed individually to either Metric, Imperial or Knots.

- **Speed** - Metric (km/h), Imperial (mi/h), Knots (kts/h)
- **Distance** - Metric (m), Imperial (ft)
- **Altitude** - Metric (m), Imperial (ft)

Compass calibration

When the GPS module is connected, the home direction arrow will only display properly after a 360 degree rotation calibration has been performed. The calibration sets the offset value for the compass. To get the best accuracy, do this outdoors at the field.

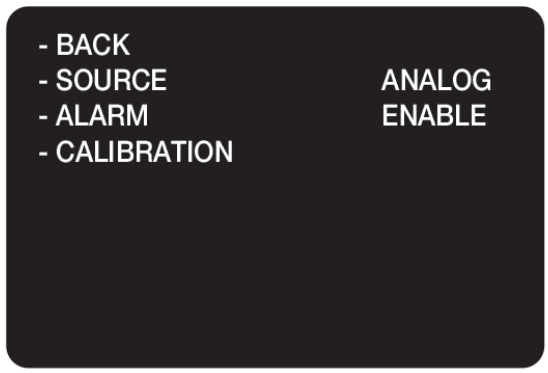


- **Step 1** - Move the GPS module away from other electronics and magnets, select Start Calibration
- **Step 2** - With the GPS module level in your hand, rotate it one full 360 degree turn and press Enter
- **Step 2** - For the first flight the calibration will capture additional data to fine tuned the calibration
- an "!" will be displayed next to the home arrow indicating that it is in learning mode

This is only necessary to do this once, but it may be necessary to recalibrate the compass if you have moved a significant distance away from the initial calibration - the magnetic north will probably be significantly off.

RSSI

The source of the RSSI read-out on the OSD can be one of three types. If analog (voltage) or digital (PWM) is used, the maximum and minimum signal strength has to be recorded using the calibration routine.



- **Source** - Off/CrossFire/EzUHF OSD Link/Digital (PWM)/Analog (voltage) - RSSI signal source type POWERCUBE BST Bonus: It is also possible to use RSSI sent via a PPM channel from the transmitter
- **Alarm** - Enable/Disable - Display a textual warning and the RSSI read-out will blink when the signal is critical
- **Calibration** (for digital and analog) - Used to set the max. (100%) and min. (0%) value for the signal source

Calibration:

- **Step 1** - Turn on the R/C transmitter and move the radio 1-2 meters away from the R/C receiver, select Calibration and press Enter to set the Max. value (best signal)
- **Step 2** - Turn off the R/C transmitter and press Enter to set the Min. value (no signal)

EzUHF OSD Link receives and displays the numeric values directly from the EzUHF Rx, no calibration needed.

Battery

The system will detect the voltage of battery (2S-6S) during the boot process. By default, a textual warning will be displayed when the battery dips below a critical level (default 3.5V per cell).

- BACK	
- ALARM	ENABLE
- BATT. REMAINING	ENABLE
- WARNING LEVEL	20%
- CURR. CORRECTION	100
- BACKUP VOLTAGE	DISABLE

- **Alarm** - Enable/Disable - Show warning when battery voltage crosses critical level
- **Batt. Remaining** - Enable/Disable - Estimate the percentage of battery capacity left
- **Warning Level** - 0 to 100% - Set the threshold when a low voltage alarm should trigger
- **Curr. Correction** - 50 to 250% - Calibrate your current sensor if it is a little off. e.g. your fly a battery and the OSD shows you you used 1000mAh but your charger let you charge 1200mAh, so you can set this value to 120% and the reading will match on the next flight
- **Backup Voltage** - Disable/Enable - Enables the backup battery, if connected, so the OSD/GPS can run while the rest of the system is down, e.g. to recover a downed aircraft

General

Change how the HAM callsign is displayed, either Off, Always or Minutely. The exact GPS coordinates can be displayed on the bottom screen to make it easy to locate a downed model by looking at any ground station recordings.

- BACK	
- SHOW POSITION	NO
- SHOW HEADING	NO
- SHOW SATS	HIDE ON FIX
- OSD COLOR	WHITE
- POWER INDEX	MAH/MIN
- WARN. SHOW TIME	0.8S
- SUMMARY STYLE	TBS
- AUDIO TELEMETRY	OFF

- **Show Position** - No/Yes - Display the GPS coordinates on the bottom of the screen, update rate 1Hz - useful while watching a DVR recording to recover a downed aircraft
- **Show Heading** - No/Yes - Show heading arrow pointing towards “home” base
- **Show Sats** - Hide on fix/Always - Number of GPS satellites available and locked
- **OSD Color** - White/Black - Color of text and outline, i.e. white core and black outline/glow
- **Power Index** - Off / mAh/Min / mWh/Km mWh/Mi / mAh/Km mAh/Mi - Running indicator of power economy, energy consumed per unit

- **Warn. Show Time** - 0.5 to 60.0 Seconds - Duration of how long warnings stay on the screen, default for racers target is 0.8s and 2.5s for every other target
- **Summary Style** - TBS/PAO/Off - End of flight summary screen layout, TBS style with judgement or without (PAO)
- **Audio Telemetry** - Off/ImmersionRC - When you don't use TBS UNIFY, the TELM solder bridge closed and ImmersionRC decoder is attached to the VRX
- **Target** - CORE PRO/VENDETTA/QQ190 - Select model specific profile
- **OSD Type -** Standard/Race - Changes the amount of data displayed on the screen, full or race specific
- **Factory Reset** - Reset all CORE PRO settings to default

Artificial Horizon

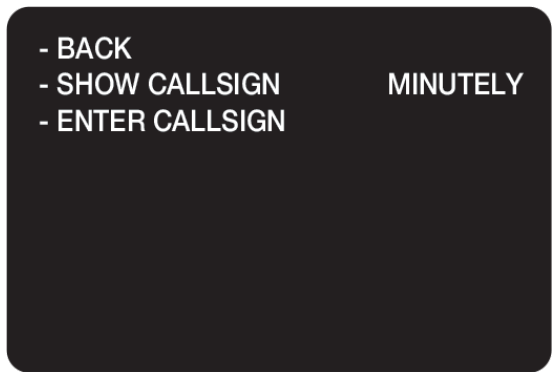
This option will only shown when the TBS COLIBRI (part of the TBS POWERCUBE stack) is detected during the boot up. It uses the gyro and accelerometer to estimate level plane.

- **Show Horizon** - Off/Basic - Shows a line in the middle of the display to indicate level position

Callsign

Personal HAM licence number, required for usage of regulated VTX output power levels.

- **Show Callsign** - Minutely/Always/Off - Display the HAM callsign and mm:ss timer on the lower-left corner
- **Enter Callsign** - “TBS”, 0 to 10 characters - Enter your personal callsign



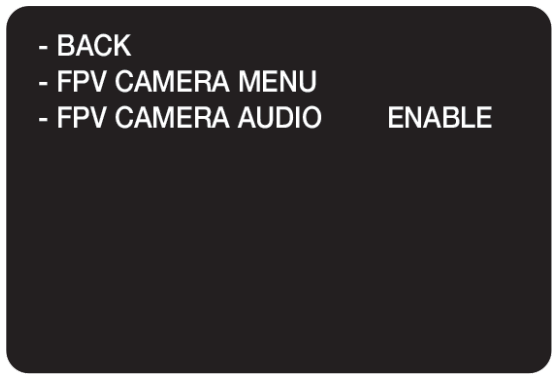
Flight Controller

This option will only shown when the TBS COLIBRI (part of the TBS POWERCUBE stack) is detected during the boot up. This makes it possible to change CleanFlight/BetaFlight configuration data directly from the OSD.

- **PID** - Detailed Proportional–Integral–Derivative controller values for Roll, Pitch and Yaw
- **Rate -** Stick sensitivity multiplier values
- **Settings** - Profile, Looptime and Idle Motors settings

- **Calibration** - RC Calibration wizard for setting up the receiver and sticks. This can also be pre-setup in CleanFlight and the data read back to the CORE PRO. Run the accelerometer calibration on a leveled surface.
- **Filters** - Advanced setup of Gyro and PD Cut Frequency settings

FPV Camera control



The settings on the FPV camera can be changed via the OSD on supported cameras (ZEROZERO V2, HS1177, RunCam Owl+ / Swift, and cameras based on the same interface).

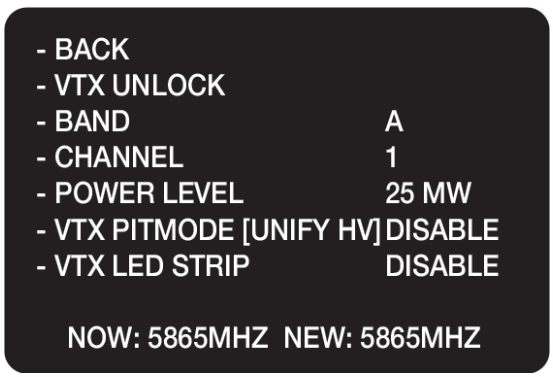
- **FPV Camera Menu** - Enter the FPV camera menu, long press left to exit back to CORE PRO OSD
- **FPV Camera Audio** - Enable/disable - Whether to enable the audio line-in from the camera

Switch Setting

To turn off or on the OSD by a radio switch, you can specify the channel in this setting.

- **OSD Disable** - Disable/Ch.5-10 Normal/Reverse - Specify the radio switch to trigger the OSD
- **Camera Switch [FPVision]** - Disable/Ch.5-10 Normal/Reverse - Switch to trigger between the two camera inputs on the TBS FPVision
- **Buzzer Find Switch** - Disable/Ch.5-10 Normal/Reverse - Switch to engage the buzzer on the FPVision

Video Transmitter



This option will only be shown when the TELM-solder bridge on the CORE PRO is joined and a TBS SmartAudio compatible VTX is connected to the VTX port (audio wire required).

- **VTX Unlock** - Brings you directly to Callsign menu to change the id from the default “TBS”
- **Band** - A/B/Race/E/Airwave/User - Video transmitter frequency band
- **Channel** - 1 to 8 - Channel number (frequency) within the selected band, see UNIFY PRO manual
- **Power Level** - 25/200/500/800mW - Transmitter output power level
- **VTX LED Strip** - Disable/Enable - Changes color depending on the frequency used, rainbow color from lowest (red) to highest (violet)

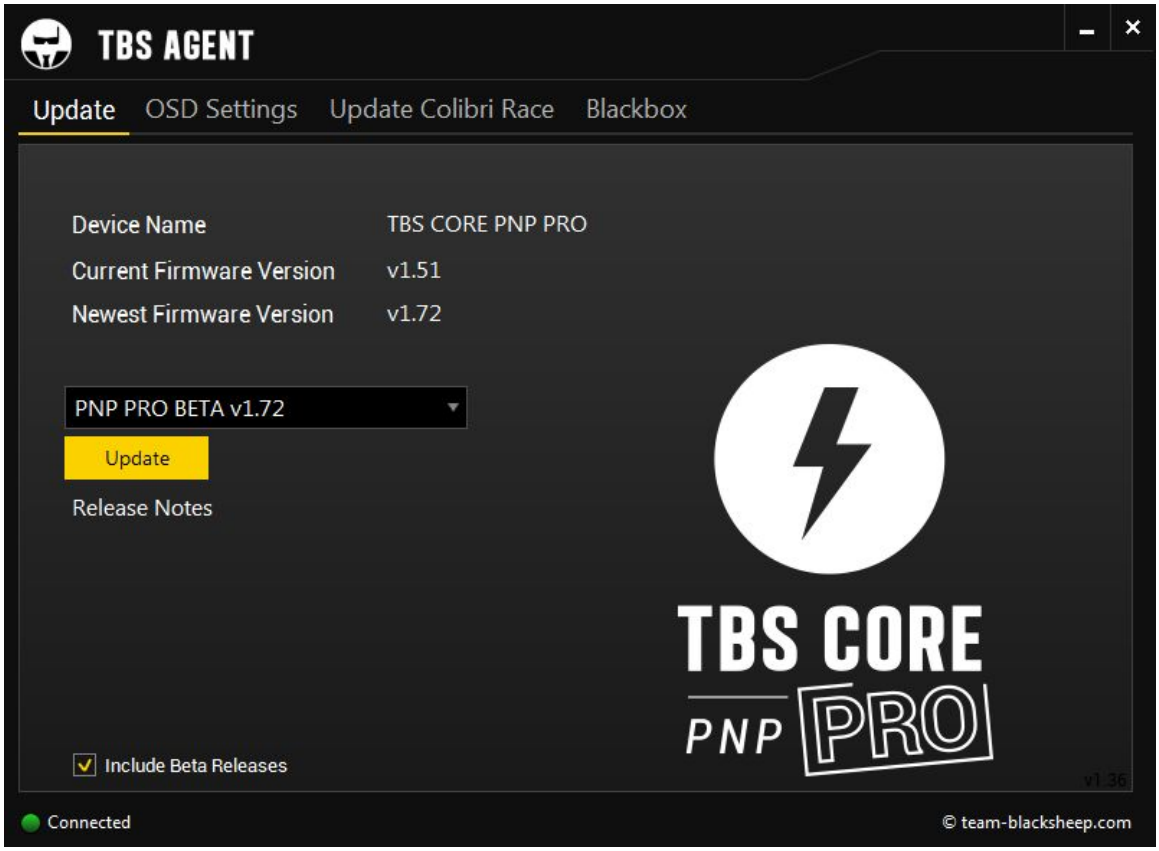
TBS AGENT configuration software

We have made a special software package to interact with the TBS CORE PNP PRO. This makes upgrading the firmware easy and configuration a blast - just point&click to change a setting. Importing anad managing flight logs from the TBS BLACKBOX (available separately) is also possible.

Installation

Download the installer from http://www.team-blacksheep.com/corepro/agent (Windows7/8, 64-bit required) - no drivers needed to use the application, but an Internet connection is required to download the latest firmware.

Disconnect the flight battery and any backup battery power from the unit and plug in a micro USB cable on the right side. The software will automatically detect the unit and offer you the option to upgrade the firmware if a newer version is available. If you like beta versions, press F1 and enable the checkbox.



When the status indicator is green and says 'Connected', you can upgrade, downgrade or change any of the OSD settings.

To upgrade the firmware, select the latest version from the drop-down menu and click Update. Make sure that the current sensor and GPS module are connected. The blue light on the current sensor will start to blink rapidly, followed by rapid blinking on the GPS module - indicating that the module is being upgraded. The process will take about 1 minute. All previous settings are kept and reused.

Configuration

It is possible to change any of the settings found in the OSD configuration menu using the TBS Agent - with the exception of the calibration of the compass and analog/digital RSSI levels, these still has to be performed with the model and unit powered from the main flight battery.

The CORE PRO V2 configuration is shown in the image below.

One additional feature found in the TBS Agent is ability to change the HAM callsign to suit your own preference. It can be 0 to 10 characters long (A-Z 0-9 ? ! . - allowed.)

Troubleshooting

- **Issue: GPS does not seem to lock**
  Solution: Try to move the GPS module as far away from switching power regulators, UHF transmitters, pilot cameras and video transmitters. Leave the GPS to initialize for 30 seconds before moving the model.

- **Issue: Firmware update failed and the device is not showing any OSD anymore**
  Solution: Disconnect any power supply and USB cable. Press and hold the enter button and plug-in the USB cable. This will boot the TBS CORE PNP PRO in a emergency mode. You can now upload a working firmware to the device by the TBS Agent software.

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.