Introduction

The Tandem dual-band receivers are unlike any other FrSky 2.4Ghz or 900Mhz receivers, they work simultaneously at both 2.4Ghz and 900Mhz frequencies. That means Tandem receivers provide not only the low latency signal and long-range control but also benefit from the enhanced level of high reliability and anti-interference performance.

The Tandem series receivers adopt the triple antenna design that provides multi-directional wide coverage for the remote signal. The data (Power & Signal related) under unusual status during the flight can be recorded by Tandem receivers through a built-in black box module.

The configurable 10 channel ports are a big feature of TD R10 & TD SR10, each channel port can be assigned as PWM, SBUS, FBUS, or S.Port. With the FBUS protocol, the TD receivers can open up the possibility of seamlessly pairing with multiple telemetry devices (Neuron ESC, Advance Sensors, etc.) as well as simplifying the build setup.

ADV Stabilizer (TD SR10)
The TD SR10 offers an ADV Stabilizer function which is an upgrade over the original classical gyroscope stabilization modes. The ADV Stabilizer offers an advanced mode that provides more programmable stabilized channels and flexibility.

The classical stabilization mode has been enhanced with 5 additional stabilization channels, providing pin mapping to each channel in the multiple flight modes like Stabilization, Auto-Level, Hover, and Knife-Edge with an airplane model.

In the advanced stabilization mode, all the output pins are configurable for stabilization and additional advanced features such as Stab file sharing, programmable parameters, developer access, etc.

The advanced stabilizer feature incorporates high-precision telemetry sensors to monitor altitude, vertical speed, etc. This ADV feature is an additional benefit compared to using a regular S series stabilization receiver.

Overview
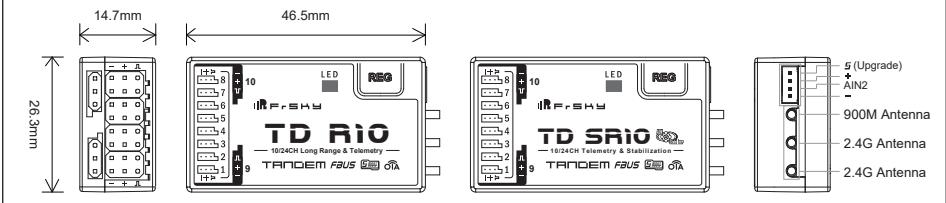
Specifications

- Frequency: 2.4GHz & 900MHz
- Dimension: 46.5×26.3×14.7mm (L×W×H)
- Weight: 16.6g
- Operating Voltage: 3.5-10v DC
- Operating Current: ≤180mA@5V
- Compatibility: Tandem series transmitter & TD protocol capable RF module
- Voltage Measurement Range via AIN2 (External device): 0-35V (Battery Voltage Divider Ratio: 1:10)
- Triple 2.4G/900M Antenna
  - 2×External 2.4G antenna (IPEX1)
  - 1×External 900M antenna (IPEX1)

Features

- Simultaneous working dual-band TD mode
- Triple antenna design for multi-directional coverage
- Built-in Advanced Stabilization Functions (TD SR10)
- Built-in High-Precision Telemetry Sensor (Altitude, Vertical Speed, etc.) (TD SR10)
- Black Box function
- Built-in voltage sensor
- 4ms Race Mode with Telemetry
- Long control range (Range varies based on the RF Power settings.)
- Over-The-Air (OTA) FW update
- Supply current range (every single port)
  - Instantaneous current: 5A
  - Continuous current: 3A
- 10 Configurable Channel Ports
  - CP1: PWM / SBUS Out / FBUS / S.Port / SBUS In
  - CP2-10: PWM / SBUS Out / FBUS / S.Port

LED State

Green LED (2.4G)	Blue LED (900M)	Red LED	Status
On	Off	On	Register
Flash	Off	Flash	Register successfully
On	Off	Off	Bind
On	Flash	Off	Bind successfully
On	Flash	Off	Working normally
Off	Off	On	Failsafe

Yellow LED	State (Calibration of Accelerometer)
ON	exceeding limits (0.9G,1.1G)
OFF	In normal status
Flashing	Calibration is completed

Yellow LED	State (Self-check)
ON	Center detection of channel in progress
Flashing	Max & Min of channels in detecting
OFF	Self-check is completed

Status	Green LED	Blue LED	Red LED
2.4G in working	On	-	Off
900M in working	-	Flash	Off
Failsafe	Off	Off	On

Registration & Automatic Binding

Follow the step below to finish the registration & binding procedure:
1. For TANDEM X20 as an example, enter into the Model, select RF System, turn on the internal module, select status [ON] and TD MODE(Type). Then determine the antennas (internal or external) and choose the RF power according to the actual usage, then select [Register].
2. Connect the battery to the receiver while holding the button on the receiver. The RED LED and GREEN LED on the receiver will be on, indicating into the [Reg] status.
3. When it shows the Register ID, RX name and UID, click [Register]. The RED LED and GREEN LED on the receiver will flash, and the transmitter displays [Registration OK].

4. Power off the receiver.
5. Move the cursor to select any one of the 3 receivers [Bind].
6. Connect the battery to the receiver.
7. Select the RX, the GREEN will keep lit, and the BLUE will flash. Then the transmitter displays [Bind successful].

Note: Once the receiver is registered, the button is not needed anymore in the binding process.

IMU Mode (TD SR10)

Note: Please move to the [DOWNLOAD] section from the product page to download the functional Lua scripts of Stabilization (Place the decompressed folder in the root directory of the [Scripts] folder on the memory card to use.)

The devices with ADV features offers three modes below to setup the stabilization module.
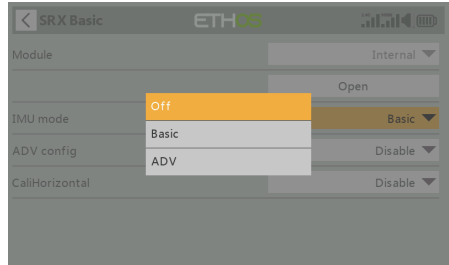
- OFF mode: The stabilization module is not activated in the mode.
- BASIC mode: The mode is enabled by default can do the basic configurations directly on radio.
- ADV: The mode supports full configuration of stabilization mode with RBmixer programmer on PC.

Note: Selecting the BASIC mode for the normal stabilization usages. For accessing more flexiablities of ADV stabilizaition feature, please use the RBmixer program to configure the stabilization module.
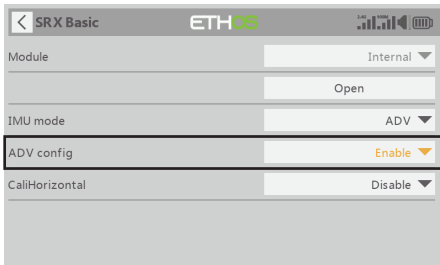
Set the IMU mode to ADV mode and change the ADV config option from Disable to Enable, which supports parameter setting for ADV self-stabilizing mode through the Upgrade/S.Port interface.

Note: If you do not use the ADV advanced self-stabilizing mode of the receiver, this option must be kept disabled.

⚠ **Please ensure the [ADV config] is set to Disable from the SRX Basic script before the flight.**

CaliHorizontal Function (TD SR10)

Enable the CaliHorizontal mode can do the calibration for the horizontal plane.

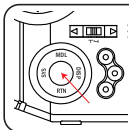| ‹ SRX Basic	ETHOS
Module	Internal ▼
	Open
IMU mode	ADV ▼
ADV config	Disable ▼
CaliHorizontal	Disable ▼
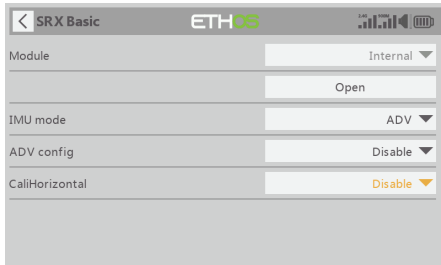
Note: This "CaliHorizontal" function is only activated for ADV mode horizontal calibration. It doesn't work while using the basic mode.

Two independent stabilizing functions (TD SR10)

Option 1: The "Stable System 1" allows turning on/off the first group of stabilization channels (CH1-6);
Option 2: The "Stable System 2" allows turning on/off the second group of stabilization channels (CH7-11);.

‹ SRX Stable	ETHOS		‹ SRX Stable	ETHOS
Stable System 1	1/2		Stable System 2	2/2
Stabilizing	ON ▼		Stabilizing	ON ▼
Self Check	Disable ▼		Self Check	Disable ▼
Quick Mode	Enable ▼		Quick Mode	Enable ▼
WingType	Normal ▼		WingType	Normal ▼
Mounting Type	Horizontal ▼		Mounting Type	Horizontal ▼
CH5 Mode	AIL2 ▼		CH10 Mode	AIL4 ▼

Note: Pressing the center button of the left navigation menu buttons, users can switch to the second configuration page of stabilization channels.

Note: The settings for Stable System 1 and 2 are independent, Stab calibration and self-check should be completed for both stab systems.

Basic Step Guides-Stabilization Function (TD SR10)

a. Model Creation & Make sure the connected receiver is bound to the radio;
b. Ensure stabilization is enabled & Calibrate the gyroscope sensor of the device;
c. Servo connection & Build the stabilization device to the model;
d. Set up the mixer channel and radio switches;
e. Determine the [Wing Type] & [Mounting Type];
f. Check the stabilized channel outputs of the receiver in the Auto-Level mode;
g. Check the stick control of the transmitter in the manual mode;
h. Self-Check of the receiver;
I. Failsafe setting.

Gyroscope Sensor Calibration (TD SR10)

Ensure the TD SR10 stabilization function is enabled.
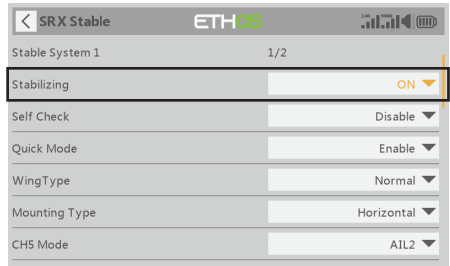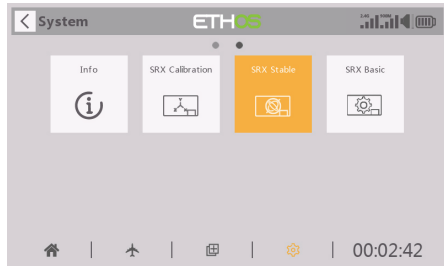
[System] → [SRX Stable]

[SRX Stable] → [Stabilizing] → [On]

Move to [SRX Calibration] tool and calibrate the gyroscope sensor

1. The gyroscope of device (6 surfaces) must be calibrated before mounting into the model. Please place the device on a flat ground or a table, and follow the instruction steps below to calibrate the gyrosope sensor;

2. Make sure the stabilization device with the Logo label side facing upwards laying on the desktop, move to the radio and enter the [SRX Calibration] tool, and select "click to confirm". At this moment, the yellow LED light will flash until it lits off, then follow the prompts to calibrate the sensor;

3. Complete the calibration of all the device surfaces. Ensure the values of each axis (X, Y, Z, Mod) is about 1.000 while placing the device in the corresponding direction, and the deviation could be within ±0.1;

4. The calibration is completed if all the steps above are done.
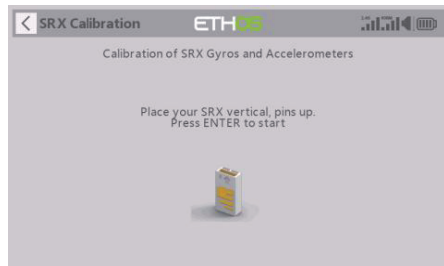
Servo connection & Build the device to the model (TD SR10)

Connect the servos to the ports of the stabilization device according to the Channel List.
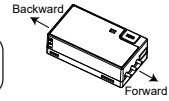
Backward / Forward

> **Note: Please make sure the receiver antenna forwards the nose direction, and with receiver pins backward.**

Number of Channel	Corresponding parts on the model	Full name
CH1	AIL 1	Aileron
CH2	ELE 1	Elevator
CH3	THR	Throttle
CH4	RUD	Rudder
CH5	AIL 2	Aileron
CH6	ELE 2	Elevator
CH7	AIL 3	Aileron
CH8	ELE 3	Elevator
CH9	RUD 2	Rudder
CH10	AIL 4	Aileron
CH11	ELE 4	Elevator
CH12	User-defined	
CH13	User-defined	Gyro gain adjustment
CH14&CH15	User-defined	Flight modes

Gyro gain adjustment of CH13: When the the value of CH13 is in the center, the gain is zero. The gain increases as the value get bigger. Until the value is ±100%, the gain reaches maximum.

Attentions
CH1~CH12 should be connected to the corresponding servos.

Set up the mixer channel and radio switches

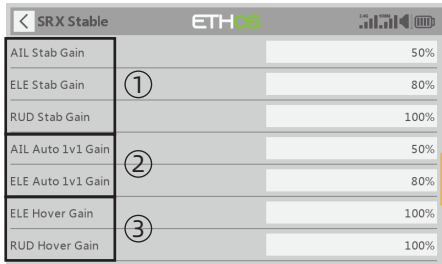| Name	Source	Channels	+
Ailerons	Aileron	1, 5, 7, 10	
Elevators	Elevator	2, 6, 8, 11	
Throttle	Throttle	3	
Rudders	Rudder	4, 9	
Gain	Pot1	13	
Flight Mode	SC	14	
Flight Mode	SD	15	

Type: Active condition
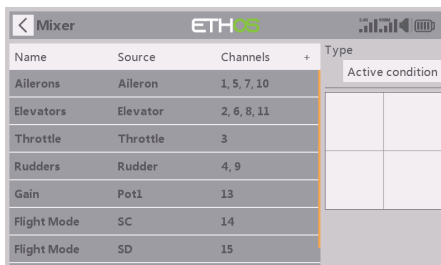
Refer to the Channel List to set the channel and switches. The switch setting of CH13-15 on the picture is for reference.

Move to the [SRX Stable] tool, determine the [WingType] & [Mounting Type];

SRX Stable	ETH 08	
Stable System 1	1/2	
Stabilizing	ON ▼	
Self Check	Disable ▼	
Quick Mode	Enable ▼	
WingType ①	Normal ▼	
Mounting Type ②	Horizontal ▼	
CH5 Mode	AIL2 ▼	

① Wing Type
② Mounting Type

[Gain] and [Offset] configurations of flight modes

SRX Stable	ETH 08	
AIL Stab Gain		50%
ELE Stab Gain ①		80%
RUD Stab Gain		100%
AIL Auto 1v1 Gain		50%
ELE Auto 1v1 Gain ②		80%
ELE Hover Gain		100%
RUD Hover Gain ③		100%

① Gain - Stab Mode
② Gain - Auto-Level Mode
③ Gain - Hover Mode

| SRX Stable	ETH 08	
AIL Knife Gain		50%
RUD Knife Gain ①		100%
AIL Auto 1v1 Offset		0%
ELE Auto 1v1 offset ②		0%
ELE Hover Offset		0%
RUD Hover Offset ③		0%
AIL Knife Offset ④		0%

① Gain - Knife Mode
② Angle Offset - Auto-Level Mode
③ Angle Offset - Hover Mode
④ Angle Offset - Knife Mode

Check whether the reaction of the wing servo is in line with the flight attitude caption below in the [Auto-Level] mode. If not, please try to invert the corresponding channel output in the [SRX Stable] tool.

| SRX Stable	ETH 08	
CH5 Mode	AIL2 ▼	
CH6 Mode	ELE2 ▼	
AIL Direction	Invers ▼	
ELE Direction	Invers ▼	
RUD Direction	Invers ▼	
AIL2 Direction	Invers ▼	
ELE2 Direction	Invers ▼	
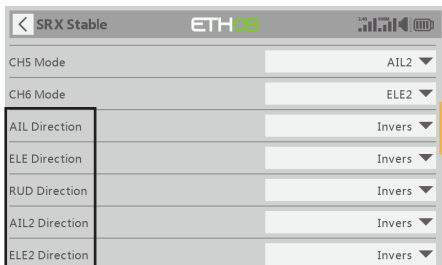
Inspection of flight attitude

To ensure flight safety, checking the compensation direction of the model is strongly recommended.
Activating auto level mode will produce a strong deflection on AIL and ELE, which is used to check the response of aileron and elevator. Also, activating Knife-edge and Hover mode will have the same reaction on the rudder.
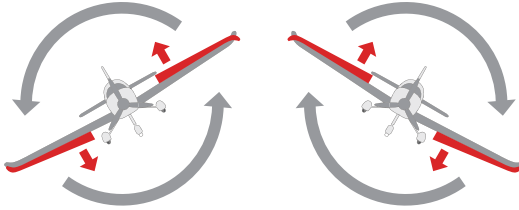
When the plane is rotated left or right (Roll), ailerons should have the correcting actions as illustrated.
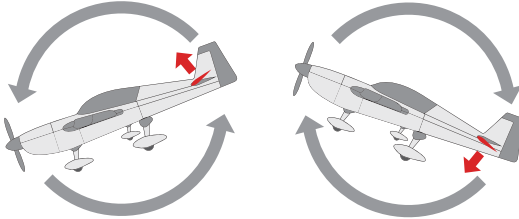
When the plane is rotated up or down (Pitch), elevators should have the correcting actions as illustrated.
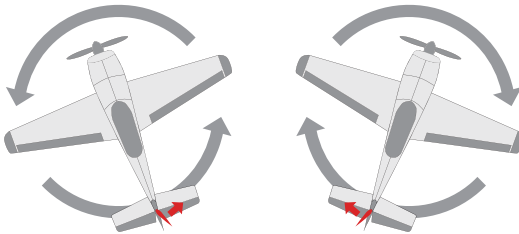
When the plane is rotated to left or right (Yaw), rudders should have the correcting actions as illustrated.

⚠ **After changing the compensation direction, make sure to check it again on the actual model.**

Note: If the compensation direction is incorrect, please reverse the corresponding channel as illustrated above through the [SRX Stable] tool.

Check whether the reaction of the wing servo is in line with the radio stick operation in the [Manual] mode. If not, please try to invert the corresponding channel output by pressing the channel bar in the [Output] tool.
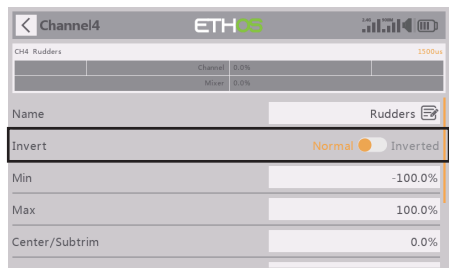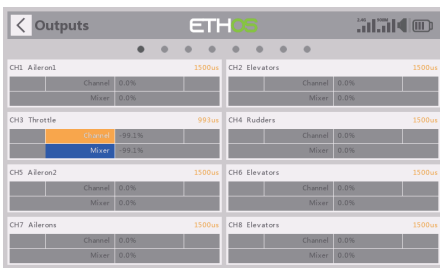
Self Check (TD SR10)

1. Make sure the model is in a horizontal position on the ground, then put the throttle to 0, and keep the other channels in the center position.
2. Move to [System] and enter the [SRX Stable] tool to turn on [Self Check], then the Yellow LED light turns on. Once the Yellow LED starts flashing, we can calibrate the maximum travel of stick channels (excluding the throttle channel).
3. If the calibration is completed, the LED turns off and the servos react left and right to indicate that the calibration process is completed.

‹ System	ETH:OS	⋮⋰⋮⋰⋪ ▥
	● ●	
Info	SRX Calibration	SRX Stable	SRX Basic
ⓘ	⟋	◌	⚙
🏠 | ✈ | ⊞ | ⚙ | 00:02:42

‹ SRX Stable	ETH:OS	⋮⋰⋮⋰⋪ ▥
Stable System 1		1/2
Stabilizing		ON ▼
Self Check		Disable ▼
Quick Mode		Enable ▼
WingType		Normal ▼
Mounting Type		Horizontal ▼
CH5 Mode		AIL2 ▼

Do the Self-Check in the [SRX Stable] tool.   [System] → [SRX Stable] → [Self-Check]

Note: To do the Self-Check of the stabilization device, please ensure the stabilization function is enabled. Enter the [SRX Stable] tool and turn On the [Stabilizing], then quit the [SRX Stable] tool and back into this tool again, now the [Self-Check] function is capable to enable.

How to set the flight modes (TD SR10)

Quick Mode

It supports stabilization mode, auto-level mode, and manual (Gyroscope is off) mode and configured through CH14.

‹ SRX Stable	ETH:OS	⋮⋰⋮⋰⋪ ▥
Stable System 1		1/2
Stabilizing		ON ▼
Self Check		Disable ▼
Quick Mode		Enable ▼
WingType		Normal ▼
Mounting Type		Horizontal ▼
CH5 Mode		AIL2 ▼

Note: The default mode of TD SR10 is Quick Mode.
 - If Quick Mode is applied, there is no Knife Edge or (3D) Hover Mode.
 - CH15 is not used when using Quick Mode.

Enable the Quick Mode in the [SRX Stable] tool.

| Channel	Position		Flight Mode
CH14 (3 pos SW)	SW Down	🎮	None
	SW Mid	🎮	Stabilization Mode
	SW Up	🎮	Automatical Level Mode

Conventional Mode

It supports stabilization mode and manual (Gyroscope is off) mode and configured through CH14&15. The precise configuration is Written below.

Flight mode	Stabilization	Automatic level	Hover	Knife-Edge	Off
CH14 (3 pos SW)	CH14 SW Down & CH15 SW Mid	CH14 SW Down & CH15 SW Down	CH14 SW Down & CH15 SW Up	CH14 SW Up & CH15 SW Mid	CH14 SW-Mid
CH15 (3 pos SW)					

Model Configuration Reference (TD SR10)

Conventional Model

Layout
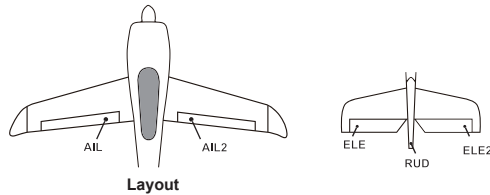
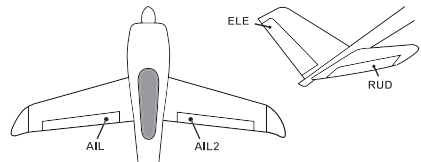| Flight mode	Stabilization	Automatic level	Hover	Knife-Edge	Off
CH14 (3 pos SW)	CH14>M+H (CH14 SW Down)	CH14>M+H (CH14 SW Down)	CH14>M+H (CH14 SW Down)	CH14<M-H (CH14 SW Up)	CH14 SW-Mid
CH15 (3 pos SW)	M-H<CH15<M+H (CH15 SW Mid)	CH15>M+H (CH15 SW Down)	CH15<M-H (CH15 SW Up)	M-H<CH15<M+H (CH15 SW Mid)	

Note: M: represents a neutral signal period (1500µs)
   H: represents the time of required signal change to activate the mode (50µs). When the factory settings are selected, the switch position shown above represents the required modes.

Delta wing & Flying wing & V-tail
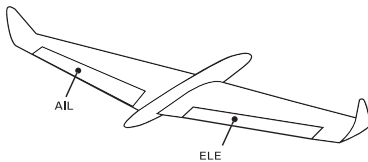
Layout of Delta wing / Flying wing   **Layout of V-tail**

The available flight modes can be assigned to CH14 with a three-position switch.

Flight mode	Stabilization	Auto Level	Off
CH14	CH14>M+H (CH14 SW Down)	CH14<M-H (CH14 SW Up)	CH14 SW-Mid

1. When Delta wing/Flying wing is selected, the signal produced by the transmitter should be without active mixes on the channels related to AIL and ELE. TD SR10 will mix the AIL (CH1) and ELE (CH2) input signal with a fixed mix percentage automatically.

2. When V-tail type is selected, the signal produced by the transmitter should be without active mixes on the channels related to ELE and RUD. TD SR10 will mix the ELE (CH2) and RUD (CH4) input signal with a fixed mix percentage automatically.

Stabilization: When the model is activated, TD SR10 will compensate with external forces (wind) as soon as receiving commands from the transmitter. This function is used to enhance the stability of the model on three axis (Pitch, Roll, YAW). CH13 could be used to adjust gyro gain by assigning a knob or a slider, changing the sensitivity of the counteracting signal produced by the internal three-axis gyroscope.

Automatic level: When the mode is activated, TD SR10 will make the model return to level orientation with internal three-axis accelerometer and three-axis gyroscope on AIL and ELE channels after the sticks being released to neutral. RUD channel works in stabilization mode only.

Hover: When the mode is activated, TD SR10 will make the nose of the model straight up with internal three-axis accelerometer and three-axis gyroscope on RUD and ELE channels (ELE and RUD inputs are not required). Under this mode, AIL is used to control the rotation of the model and THR adjust the altitude. AIL channel works in stabilization mode only.

Knife-egde mode: When the mode is activated, TD SR10 will roll the plane on a certain side (wing points up) with internal three-axis accelerometer and three-axis gyroscope on RUD and AIL channels.Thus, AIL inputs are not required. While the mode steering is done with ELE, altitude will be maintained with THR/RUD. ELE channel operates in stabilization mode only.

Off: When the mode is activated, TD SR10 will transmit the received commands produced by the transmitter to the model without compensating.

Configuration for the Movement Range of the Roll and Pitch Angle in Stab Mode (TD SR10)

⚠ **Make sure the [SRX Stable] script tool has been downloaded and placed in the [Scripts] folder of the storage card. The tool can be found under the [System] menu page after rebooting the ETHOS system.**

‹ SRX Stable	ETHOS	▁▂▃ ◀ 🔋
ELE Auto 1v1 offset		0%
ELE Hover Offset		0%
RUD Hover Offset		0%
AIL Knife Offset		0%
RUD Knife Offset		0%
Roll Degree		0 degree
Pitch Degree		0 degree

Ensure the receiver is bound to the radio and its Stab data is readable through Lua script. The movement angle of Roll and Pitch for Stab mode can be configured up to 80 degrees.

⚠ **This feature will not be activated if the degree value is set to 0-9. The setting with the Roll/Pitch degree between 10 to 80 can have the feature work, and it's not recommended to be set with the degree values too small.**
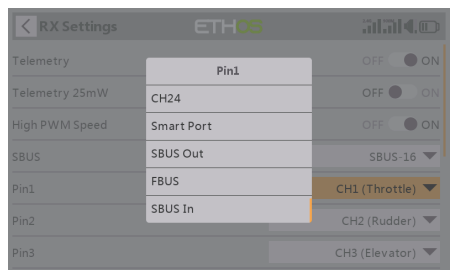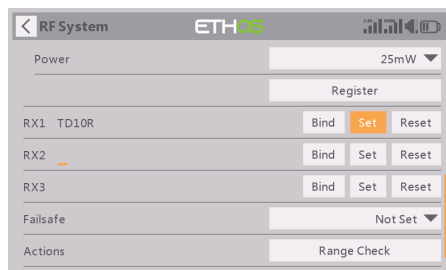
How to Switch High PWM Speed mode

1. The factory default setting is OFF .
2. To go to the receiver [Options], select On to active high speed mode .

Warning: High PWM speed mode is only applied for digital servos. Turn off High PWM Speed mode when using analog servo, otherwise servos will get hot and may burn out.
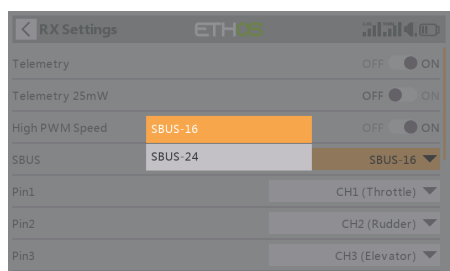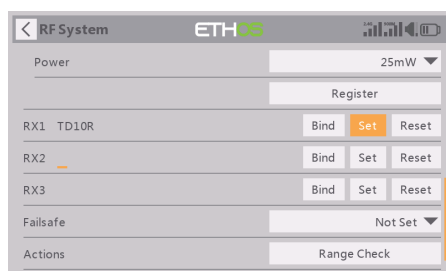
How to switch the S.Port/SBUS OUT/SBUS IN/FBUS

Enter into the [Set] of receiver.

Select the FBUS/S.Port/SBUS Out/SBUS In for the channel ports.

How to switch SBUS channel mode


Enter into RX Settings.

Click [SBUS], then select SBUS-16 mode or SBUS-24 mode.

How to enter into the Race mode (down to 4ms)

Enter into Model-RF system, select the Channel Range as CH1-CH8. Click [Switch Positions] and select a switch to start the race mode.

Black Box

Black box records flight data, e,g, RX Reset Case, RSSI, VFR and so on. For TANDEM X20 as an example, to get flight data, please go to RF System-[Set]-[Flight Data Record].
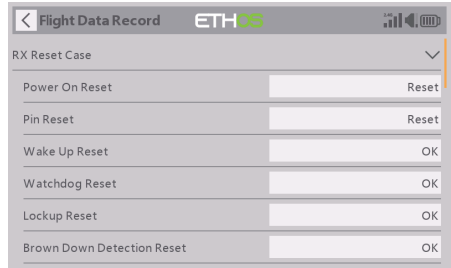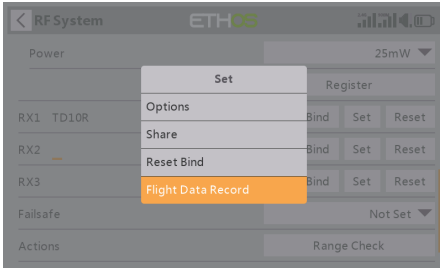
About OTA function

Go to the [File manager], and select the FW, press the enter button, select [Flash RX by int.OTA]. Power on the receiver, select the RX, go to the [ENTER], complete the flash process, the transmitter will display [Success]. Wait for 3 seconds, the receiver works properly at the moment.

> Note: Please do not do the binding operation in the near range while the firmware upgrading in progress.

> Note: Update the firmware after the receiver getting registered (OTA).

Range Check

A pre-flight range check should be done before every flight, in case the signal loss is caused by the reflection of the signal by the nearby metal fence or concrete, and the shading of the signal by buildings or trees during the actual flight.

1. Place the model at least 60 cm (2 feet) above the non-metal contaminated ground (such as on a wooden bench). The receiving antenna should be in a vertical position.
2. Ener the ETHOS system, move to the "RF System", scroll the Encoder to select "RANGE" mode and press Encoder. In range check mode, the effective distance will be decreased to 1/30.
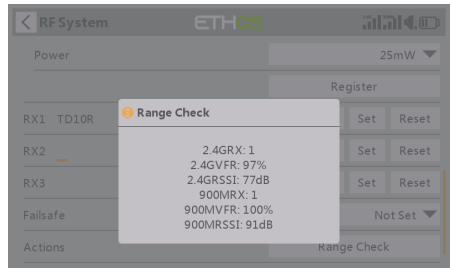
How to set Failsafe

There are 3 failsafe modes when the setting is enabled: No Pulse, Hold, and Custom mode.
- No Pulses Mode: On loss of signal, the receiver produces no pulses on any pwm channel. To use this mode, select it in the menu and wait 9 seconds for the failsafe to take effect.

- Hold Mode: The receiver continues to output the last positions before the signal was lost. To use this mode, select it in the menu and wait 9 seconds for the failsafe to take effect.

- Custom Mode: Pre-set to required positions on the lost signal. Move the cursor to the failsafe mode of the channel and press Encoder, then choose the Custom mode. Move the cursor to the channel you want to set failsafe On and press Encoder. Then rotate the Encoder to set your failsafe for each channel and short-press the Encoder to finish the setting. Wait 9 seconds for the failsafe to take effect.
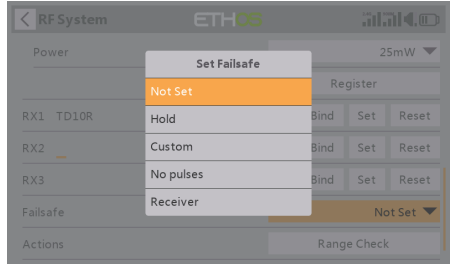
Note:
- **If the failsafe is not set, the model will always work with the last working status before the signal is lost. That could cause potential damage.**
- **When the failsafe is disabled on the RF module side, the receiver defaults to Hold mode.**
- **When in No Pulses Mode, do not set the Failsafe to No Pulses Mode for the SBUS port as it will keep the signal output continuously，Please set "Hold" or "Custom" mode for the SBUS port.**

FCC STATEMENT

1. 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.
   2) This device must accept any interference received, including interference that may cause undesired operation.
2. 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 transmitter frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to transmitter communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to transmitter 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 transmitter/TV technician for help.

FrSky is continuously adding features and improvements to our products. To get the most from your product, please check the download section of the FrSky website www.frsky-rc.com for the latest update firmware and manuals

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