Stabilizer 3D

1. FOREWORD

The *Stabilizer 3D* is a completely innovative electronic device, so please read the whole manual before installing and using it.

Thank you for purchasing the ***Stabilizer 3D***! The ***Stabilizer 3D*** is warranted to be free of manufacturing defects for 2 years from the date of purchase. Also anyone who is dissatisfied with it or is unable to make it work and has bought the unit directly from **GENERAL LASER** will be cheerfully refunded the purchase price, if the ***Stabilizer 3D*** is returned to us within 30 days of the purchase date.

Stabilizer 3D is a patented, compact, lightweight, easy to install 2-axis flight stabilization system (Roll- and Nick-function) developed for modell helicopters and is based on the analysis of infrared datas in a spectral area, where the composition of the ground (grass, water, asphalt, snow etc.) and the solar radiation are almost not relevant. ***Stabilizer 3D*** gets connected between the rc-receiver and the Nick- und Roll-servos.

The *Stabilizer 3D* functions only outdoor properly, an indoor-use is impossible.

Stabilizer 3D works in almost all weathers, on day and night. Light or direct solar radiation into the sensors have no influence. The system does not perform well (or even at all!!!) in low stratus, smog, when it is raining or in snow shower. The infrared horizon has to be straight / near to straight or simmetrical. In even or in a slightly hilly site, also in a valley between two mountains it will perform well. Among building or in a forest between the trees the ***Stabilizer 3D*** will work after the helicopter is above the houses / trees (usable infrared horizon). If the helicopter is above inclined plane, or in a flat country site, but close to high hill/ big building, the infrared horizon is not symmetrical and the helicopter will drift from the hill/building away. The wind direction has no influence on the stabilization, but the helicopter will drift with the wind, if the pilot does not control against the wind.

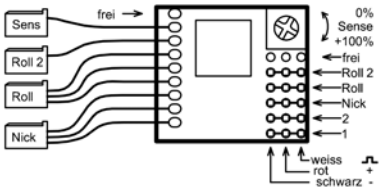
2. FEATURES

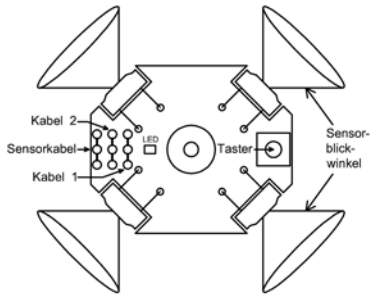
- Stabilizes Normal and Inverted Flight.
- For helicopters with and without flybar, also for multi-bladed systems, for aerial photography helicopters, as learning aid for beginers, as assistance for advanced and as „emergency switch“ for specialist.
- Compatible with all **PPM**-receiveres, all **Futaba PCM 1024** and **Futaba PCM 2048 G3**-receivers and all **JR/Graupner SPCM**-receivers.
- Compatible with analog and digital servos.
- Sensibility can be set from the transmitter or from the control-unit trimmer.
- Compatible with **2-Servos-90°** and **3-Servos-120°** swashplates, mechanically and electronically mixed, recognizes automatically the swashplate type, for 2 or 3 servos. 90° swashplates with 3 or 4 servos **are not supported**, trying to control such systems will cause mechanical or electronic damages!!! (A new H4 90° 4-servos-swashplate ***Stabilizer 3D***-version is available).
- Only for outdoor use.
- Compact and lightweight.
  - Control unit 22 x 25 x 8mm, 11g
  - Sensor unit 28 x 34 x 9mm, 20g
- Current draw max. 20 mA, operating voltage 4V to 10V.

3. SCOPE OF DELIVERY

- Control unit with ca. 10cm long servo cables.
- Sensor unit with ca. 25cm. long servo cables, pushbutton, LED, 5 sensors and the 3D sensor unit with one more sensor.

4. INSTALLATION





1. The model helicopter must be mechanically and electronically rightly set.
2. The control unit cables must be connected with the receiver according the markings – Nick on the place of the Nick servo, Roll on the place of the Roll servo, Roll2 on the place of the second Roll servo for 120° swashplates, Sense on another free channel, if available. For 90°-swashplates only one roll- and only one nick-servo have to be connected, the roll2 cable stays unused and free.
3. Connect the swashplate servos according the markings with the control unit.
4. Mount the sensor unit on the boom (tail pipe) horizontally, parallel to the main rotor plane (Pic. 1.). The sensor on the 3D sensor unit (small board) must look vertically downwards and no parts (pipes, antenna, etc.) should be in its angle of view, ca. 70° (Pic. 2.).
5. On helicopters with combustion engines the sensor units must be mounted in such position, that no direct view from the sensors to the exaust pipe is possible. Also no fuel and oil rests should reach and pollute the sensors!!! Polluted sensors must be cleaned with cotton-sticks or cotton tissue and alcohol.
6. Connect the senor unit with the two cables 1 and 2 with the control unit. The ca. 25cm long cables of the sensor unit can be extended up to 100cm. There are 1,2 marks on the control unit, which correspond with the 1,2 cables from the sensor unit.

Pic. 1.

Pic. 2.

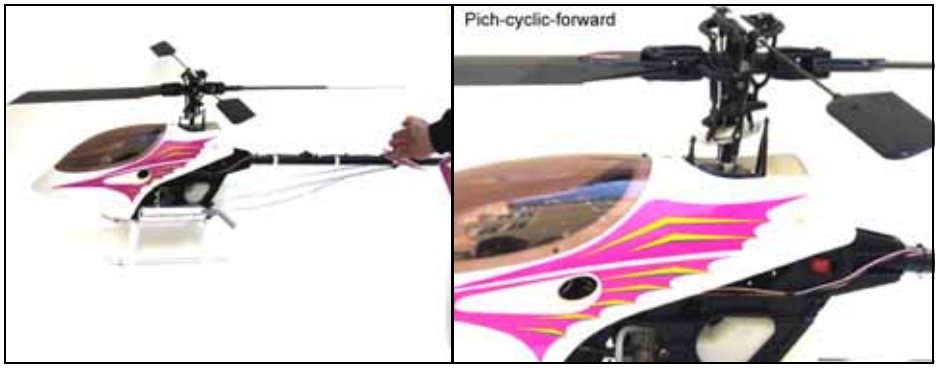
The ***Stabilizer 3D*** recognizes automatically, if your helicopter has a 90° or a 120° swashplate type (2 or 3 servos) and if the sense-chanel has to be read from the transmitter or from the on-board trimmer.

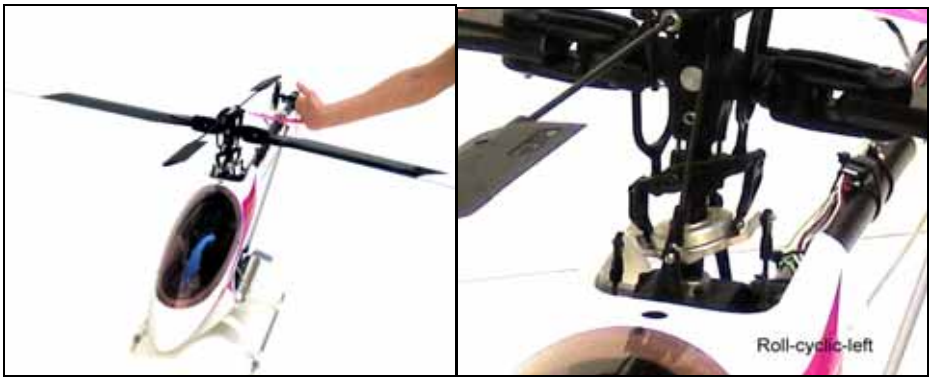
5. SETTINGS

5.1. Servo Reverse

If the servo directions are correct, the swashplate will tilt only to the "pitch-cyclic-forward" of the helicopter, when you hold your warm hand behind sensor unit (Pic.2.). If you hold your hand or something hot in front of the sensor unit, the swashplate must tilt only to the "pitch-cyclic-backward". Holding your warm hand in front of the left side of the sensor unit will cause a tilt of the swashplate only to the "roll-cyclic-right" (Pic.3.). If you cover the right side of the sensor unit, the swashplate will tilt only to the "roll-cyclic-left". For all swashplates **only pitch-cyclic- and roll-cyclic-corrections** will occur, if the ***Stabilizer 3D*** is correctly set, **never occur pitch-collective-corrections**. Only in case that works this way you may fly!!!

Pic.3





Pic. 4.

The servo-reverse is made in the setup-mode by pitch-cyclic- and roll-cyclic-commands from your transmitter. If the Sensor unit is not "normally" mounted (that means on/above the boom or the horizontal stabilizer, the cables point to the front, the push button to the rear side) the Setup points **5.** and **7.** change, look at the description below.

1. Switch the transmitter on.
2. Set the Pitch-colllective joystick in middle position, Pitch-cyclic and Roll-cyclic should be from alone in their middle position.
3. Push the button on the sensor unit and hold it pushed down.
4. Switch on the receiver, hold for min. 5sec the button pushed and than release it. The LED will flash twice 3-times (two triplets) with pauses and then will light up permanently. You are now in the setup mode for the servo reverse.
5. Give a full "pitch-cyclic-forward" command and let the joystick return to the neutral position.
6.The LED will flash 2-times and will light up permanently.
7. Give a full "roll-cyclic-right" command and let the joystick return to the neutral position.
8.The LED will flash 2-times and will no more light .
9. Switch off the receiver, the settings will be permanently saved.
10. Switch the transmitter on, switch the receiver on, set the Sense to +100% from the transmitter or from the on board trimmer, activate the ***Stabilizer 3D*** by giving a short Pitch-cyclic- or Roll-cyclic- command and test, if the Servo-Reactions are right .

The servos must react, as in the first paragraph of 5.1. described.

!!! If the Sensor unit is not "normally" mounted (that means on/above the boom or the horizontal stabilizer, the cables point to the front, the push button to the rear side) the Setup points **5.** and **7.** change.

If the Sensor unit is turned around the vertical axis on 180°, the cables will point backward, the push button points forward. In that case the right side of the Sensor unit becomes left, the front side becomes rear, and in the Setup the commands under 5. - "pitch-cyclic-forward" and 7. -"roll-cyclic-right" become 5. - "pitch-cyclic-backward" and 7. -"roll-cyclic-left". So the right servo reverses are set.

The Sensor unit of the ***Stabilizer 3D*** may not be turned upside down, the system deactivates the inverted flight stabilisation every time after it is switched off and this requires the Sensor unit to be mount upside up.

5.2. Sense

1. If there is a free channel on transmitter and receiver, you can connect the sense cable to this channel and change the sense of the ***Stabilizer 3D*** during the time you are flying (0% - channel middle, no stabilisation; +100% - max. stabilisation.) The area from -100% to 0% is used for horizon calibration in the air and have to be used only if desired, no corrections from the ***Stabilizer 3D*** are mixed to the commands of the pilot in that sense range. This is a good way to set the proportion of the influence of ***Stabilizer 3D*** during the flight.
2. For 3D flight the sense of the ***Stabilizer 3D*** must be reduced from the set value (for example +65%) with increasing roll- and/or nick- commands. Otherwise the electronics will always try to keep the helicopter in horizontal position. This is achieved with programming of two mixers in the transmitter, so with greater roll- and nick- commands the sense gets reduced to 0% (!!!Attention, not negative values allowed! At under -75% you get a new horizon calibration!). If the inverted flight mode is activated, this two mixer must be programmed (look at 5.1.) For Normal-Flight-Mode this two mixers are not obligate, but recommended.
3. If the sense cable is not connected, the sense will be read from the on board trimmer. In this case you should fly only in Normal-Flight-Mode (look at 5.1.)
4. Like well known from the Gyros, if the sense is set too high you can get an over-reaction of the stabilisation. In that case just reduce slightly the sense. Especially models without flybar have a direct control and need in the most cases much lower corrections than helicopters with flybar (with Bell-Hiller-Mixer). In these cases the sense shouldn´t vary up to 100% (for example only from 0% to 50%). It is recommended to start with Sense 10% and step by step set it higher, till you achieve the wished stabilisation.

The +/- directions of different transmitters may be different, in some cases you may have the full Sense at -100% and the horizon calibration at +100%. In that case you can make a servo-reverse to set the desired + direction correctly.

5.3. Swich between Normal- and Normal- and Inverted-Flight-Stabilisation.

1. Switch the transmitter on.
2. Switch on the receiver, the LED on the sensor unit will blink in single-pulse mode. This means, that you are in only Normal-Flight-Stabilisation.
3. Push the button on the sensor unit and hold it for min. 5sec pushed, than release it.
4. The LED on the sensor unit will blink in double-pulse mode. This means, that you are in Normal- and Iverted-Flight-Stabilisation, that is 3D mode.
5. If you want to change the mode again– push the button for 5sec. or longer.

The LED will change its blinking every time from single-pulse to double-pulse or from double-pulse to single-pulse, showing that you have changed the mode. Point 5 can be repeated, as long as you want.

After switching the receiver off and switching it on again the ***Stabilizer 3D*** will go every time to Normal-Flight-Stabilisation automatically. You have to activate every time the Normal+Iverted-Flight-Mode, if desired. The Normal+Iverted-Flight-Mode is only for advanced pilots and not for beginners!

!!! If you fligh in normal- and inverted-flight mode, you have implicitly to program two mixers, to avoid exceeding the max. servo ways when the helicopter turns from normal- to inverted-flight and reverse. The two mixers have to reduce the Sense of the ***Stabilizer 3D***, when having bigger Nick- and/or Roll-commands, from the value you are flying with (for example +65%) to 0% (when Nick- and/or Roll is on +/- max.). Be careful to have always the Sense between 0% and + 100%, and never to have negative values, if not explicitly desired!!! When the Sense reaches -75% to -100% you configure the horizon line!!! Only this way you can fly realy 3D and have the stabilisation when you need it and fly without it, when you don´t need it (at bigger nick- or roll-commands).

The +/- directions of different transmitters may be different, in some cases you may have the full Sense at -100% and the horizon calibration at +100%. In that case you can make a servo-reverse to set the desired + direction correctly.

Why so?
Let us say, you are flying with Sense +100% and the helicopter goes through nick over 90°. At that moment, the ***Stabilizer 3D*** begins to correct from normal- to inverted flight and will add to your nick command also its nick correction, to bring the helicopter in inverted horizontal position. This may exceed the set maximal servo ways and may cause in some cases mechanical problems.

6. CALIBRATION AND FLYING

A horizon and contrast calibration is necessary before the first flight, after mounting the ***Stabilizer 3D*** on your helicopter. For the next flights you have to calibrate only if the whether sensibly changes (warm – cold, sunny – shadow). You can fly with an old calibration, if the temperature varies up to 15°C from the day of calibration to the present day. A new calibration at the beginning of each day you are flying on is recommended.

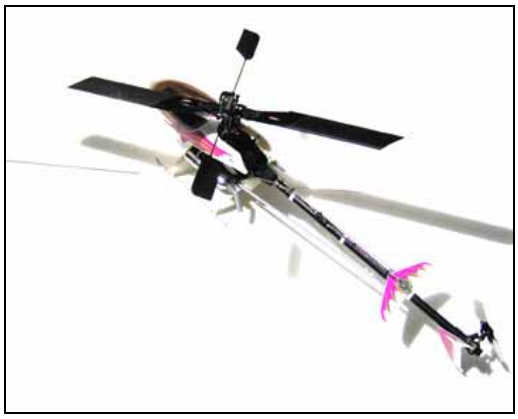
6.1. Pre-Flight Check

1. Test before every flight with sense set to 0%, if your commands to the swashplate are right.
2. Set the sense to the position you want to fly with (min 25%) and check with your hand, if the corrections of the ***Stabilizer 3D*** are right. If you have inversed-flight stabilisation activated, the 5th sensor which looks vertically upwards must have a free sight to the sky.

If the ***Stabiliser 3D*** reactions are correct, the swashplate will tilt only to the front of the helicopter, when you hold your hand behind the 2 rear sensors or cover them with 2 fingers (Pic.3.). If you cover the front 2 sensors, the swashpalte must tilt to only the tail of the helicopter. Covering the 2 left sensors or holding your warm hand in front of them will cause a tilt of the swashplate only to the right (Pic.4.). If you cover the right 2 sensors, the swashplate will tilt only to the left. Generally, if you hold the helicopter in the air above your head and tilt it, the swashplate must always try to stay horizontal. No pitch-corrections should occur, the ***Stabiliser 3D*** makes only nick- and roll-corrections. Only in case that works you may fly!!!

6.2. Horizon and contrast calibration on the ground, especially for beginners

1. The helicopter must be horizontally on the ground, houses, trees and cars must be at least 10m away from the helicopter. The 5th sensor must have free sight to the sky. (Pic.5.)
2. Switch the transmitter on.
3. Switch the receiver on.
4. The red LED must blink single pulsed for normal-flight mode and double pulsed, if you have activated the 3D normal- and inverted-flight mode.
5. Push shortly the button on the sensor unit and release it.
6. The red LED will blink 10 sec. In this time you have to go away from the helicopter to min. 5m and stay exactly behind it or exactly in front of it. In this way you are staying between the sight fields of the sensors and allow a precise calibration.
7. Right after the last LED blinking the system calibrates. The values get permanently saved in the memory and the LED lights permanently.
8. The ***Stabilizer 3D*** is ready for use, you can fly.



Pic. 5.

Another possibility to calibrate is, instead of doing the points 5,6 and 7, just to go away from the helicopter and set the sense channel to -100% shortly – that's it. In that case you make only a horizon calibration, no contrast measurement is provided. The horizon calibration happens only once in the moment when the Sense has reached -100%. To make a new horizon calibration you need to set the sense to 0% back and than again to -100%.

Notes:

Low contrast: the LED is blinking another 10 sec. long after the calibration (6.2.7.). During this time you cannot control the servos. Make a new calibration in such case. If you still get a bad calibration, that means the contrast is very low and the ***Stabilizer 3D*** will work only limited. You can although fly, can set the sense to 0% and just fly also without the aid of the electronic.

If on your landing field you have an asphalt – beton – grass – snow ground, it is better to calibrate over the coldest surface (above is the gradiation from warm to cold).

Tip: In normal hoover position the helicopter is (mostly) slightly inclined, because the rear rotor is mostly not in the plane of the main rotor. To calibrate on the ground under the same angle you hover, you can do the following:

1. Incline slightly the helicopter on the ground (~2°) on the side it is inclined when hovering, try to reach the same angle as in flight.
2. You can let the helicopter horizontally on the ground, but trim the roll to the opposite side as hovering. After you calibrate, set the trimmer in neutral position.
3. If you do not follow these tips, the helicopter will drift slightly in flight and you must trim against that. A rightly set helicopter must hover with and without stabilisation without retrimming.

6.3. Horizon calibration in the air, during the flight

1. Control the helicopter in stabile hover position, not away from you and in height 2-4m, so you can see the aircraft is not drifting and also see the ground as reference.
2. Move the sense channel to -100% shortly.
3. In the moment you have reached Sense -100%, the horizon position is saved.
4. Put the sense to the position you want to fly with.

You can repeat the points 2. to 4. as long as you want.

6.4. Flying without calibration

1. Switch the transmitter on.
2. Switch the receiver on.
3. The red LED must blink single pulsed for normal-flight mode and double pulsed for the 3D normal- and inverted-flight mode (look at 5.3.)
4. Wait for 5 sec. (systemcheck) and than give a roll or nick command. The last saved calibration values get adopted.
5. The red LED starts lighting continuously.
6. The system is ready, after the Pre-Flight-Check you can fly.

7. GENERAL INFORMATION

1. On **Futaba PCM** and **JR/Graupner SPCM-receivers**, the **Sense** must be on channel 7 or 8, when using **Futaba PCM G3 and 3 servos** (120° swashplate) the Roll2 channel (6) must be copied on channel (7) and the Roll2 cable from the control unit must be connected with channel (7) on the receiver.
2. For 3D flying you can program in the transmitter two mixers for the Sense, look above.
3. In critical situations you can just let roll and nick on neutral, just control pitch, the rest makes the ***Stabilizer 3D***, the sense should be on 40% or more.
4. Some advanced pilots can use the ***Stabilizer 3D*** just as an emergency exit in case of gyro failure, motor failure, lost sight to the model and so on.
5. The sense can be set also on a three position switch (instead of trimmer). For example:
-1- position – calibration in the air, -100% sense
-2- position – 0% sense, the pilot commands are just conducted to the servos
-3- position – stabilisation needed for flying, from 0% to +100%
6. Some pilots use also two-position switch for the sense:
-1- position – calibration in the air, -100% sense.
-2- position – 0% sense, the pilot commands are just conducted to the servo.
The pilot takes off with 0% sense, when the helicopter is hovering horizontally, the pilot switches shortly to sense -100% and back to 0% and than lands. Than the pilot programs the two-position-switch in the transmitter again:
-1- position – 0% sense
-2- position – the % sense you want to fly with.
7. Cleaning of the sensors: with cotton-sticks or cotton tissue and alcohol.
8. It is recommended to make the first few flights only in normal flight mode with sense ca. 50% for helicopters with flybar to get familiar with the ***Stabilizer 3D.*** For helicopters without flybar are 20% for the beginning recommended.

RC Type	**Receiver Output Channels**											
	Swashplate Type											
	Stabilizer and ***Stabilizer 3D***							***Stabilizer H4*** and ***Stabilizer 3D-H4***				
	H1 - 90°			HR3 - 120°				H4 – 90°				
	Nick	Roll	Sense	Nick	Roll1	Roll2	Sense	Nick1	Nick2	Roll1	Roll2	Sense
JR/Graupner PPM	3	2	7,8	3	2	1	7,8	3	5	2	1	7,8
JR/Graupner SPCM	3	2	7,8	3	2	1	7,8	3	5	2	1	7,8
Futaba PPM	2	1	7,8	2	1	6	7,8	2	8	1	6	7
Futaba PCM1024	2	1	7,8	2	1	6	7,8	2	8	1	6	7
Futaba PCM2048	5	4	7,8	5	4	7	8	4	6	3	7,8	8,9
Multiplex Royal Evo 7,9 und 12	Leave 1 channel or more unused between Nick, Roll1, Roll2 and Sense, for example, use only even channels. For example right is: 1,4,6,9. Example for wrong: 1,3,6,7.							Not supported.				
Another PPM	Each combination is possible.							Not supported.				

8.FAILSAFE

1. Trim the helicopter in stable hover position.
2. Calibrate the horizon.
3. The helicopter should hoover without your aid.
4. Trim the motor so, that the helicopter is slowly sinking and landing.
5. Chose from the transmitter the function Failsafe and save all the datas for Nick, Roll, Tail, Pitch, Motor, Gyro and ***Stabilizer 3D*** Sense.
6. On the most transmitters you just have to push SET.
7. In case of Failsafe, your helicopter will sink slightly and land.

9. WARNING

A model helicopter is not a toy, it can cause serious injuries and property damages. Mistakes in building and piloting of the helicopter can lead to extremely dangerous situations.

We can not control our customers for the proper use of the ***Stabilizer 3D*** and do not carry any responsibility for any damages of property and material, and also for any injuries of persons and animals.

Stabilizer 3D **is a product of**

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