

# Stabilizer 3D-H4

## 1. FOREWORD

The **Stabilizer 3D-H4** is a completely innovative electronic device, so please read the **whole** manual before installing and using it.

Thank you for purchasing the **Stabilizer 3D-H4!** The **Stabilizer 3D-H4** 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-H4** is returned to us within 30 days of the purchase date.

**Stabilizer 3D-H4** is a patented, compact, lightweight, easy to install 2-axis flight stabilization system (Roll-cyclic and Pitch-cyclic-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-H4** gets connected between the rc-receiver and the Pitch-cyclic- and Roll-cyclic-servos.

The **Stabilizer 3D-H4** functions only outdoor properly, an indoor-use is impossible.

**Stabilizer 3D-H4** 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, heavy fog, 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-H4** 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.

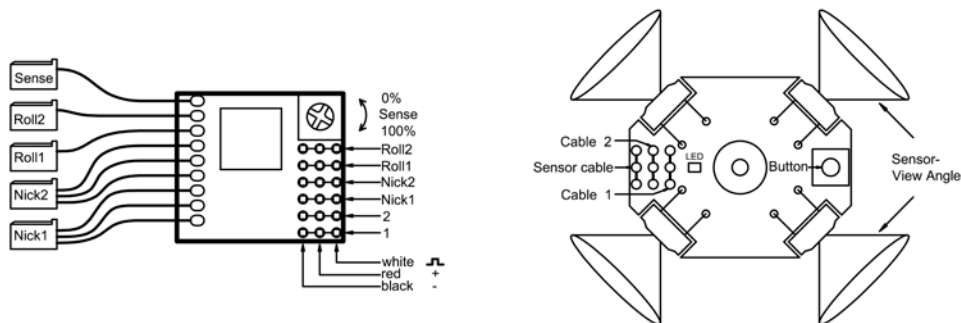
## 2. FEATURES

- Stabilizes Normal and Inverted Flight.
- For helicopters with and without flybar, also for multi-bladed systems, for aerial photography helicopters, as learning aid for beginners, as assistance for advanced and as „emergency switch“ for specialist.
- Compatible with all **Futaba PPM**-receivers, all **Futaba PCM 1024** and **Futaba PCM 2048 G3**-receivers, with all **JR/Graupner PPM**-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.
- For **4-Servos-90° H4** CCPM swashplates. Not compatible with 2-Servos-90° and 3-Servos-120° swashplates. Swashplates with 2 or 3 servos **are not supported**, trying to control such systems will cause mechanical or electronic damages!!! (For H1-90° and HR3-120° swashplates with 2 or 3 servos there is another **Stabilizer 3D** -version available since 2005).
- 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



Note: „Nick-“ stays for „Elevator-“ or „Pitch-cyclic-“; „Roll-“ stays for „Aileron-“ or „Roll-cyclic-“; „Sense“ stays for the sensitivity.

1. The model helicopter must be mechanically and electronically rightly set, before you install the **Stabilizer 3D-H4**.
2. Disconnect the two pitch-cyclic servos and the 2 roll-cyclic servos from the receiver.
3. Connect the control unit cables with the receiver according the markings – Nick1 on the place of the first "Pitch-cyclic"-servo, Nick2 on the place of the second "Pitch-cyclic"-servo, Roll1 on the place of the first Roll- servo, Roll2 on the place of the second Roll- servo, Sense on another free channel, if available. Pay attention to the **table for the channel use** at the end of the manual.
4. Connect the swashplate servos according the markings with the control unit: the first pitch-cyclic-servo on the Nick1 place of the control unit, the second pitch-cyclic-servo on the Nick2 place of the control unit, the first roll-cyclic-servo on the Roll1 place of the control unit, the second roll-cyclic-servo on the Roll2 place of the control unit.
5. Mount the sensor unit on the boom (tail pipe) horizontally, parallel to the main rotor plane (Pic. 1.):
  - a) If your swashplate (SP) is not turned\* (0°) or turned\* under exactly +45° or -45°, the sensor unit (SU) must be mounted unturned (0°), the outgoing cables 1 and 2 will point directly forward, the push button will point backward. The **Stabilizer 3D-H4** recognizes these three standard positions automatically.
  - b) If your swashplate is turned\* under an angle from -22° to +22°, then mount the sensor unit turned the same way, under the same angle. That means  $SPangle^\circ = SUangle^\circ$ .

- c) If your swashplate is turned\* under an angle from  $-44^\circ$  to  $-23^\circ$ , then the sensor unit according the formula  $SPangle^\circ + 45^\circ = SUangle^\circ$ . For example, if the swashplate is turned under  $-42^\circ$ , the sensor unit should be mounted under  $-42^\circ + 45^\circ = +3^\circ$ .
- d) If your swashplate is turned\* under an angle from  $+23^\circ$  to  $+44^\circ$ , then the sensor unit according the formula  $SPangle^\circ - 45^\circ = SUangle^\circ$ . For example, if the swashplate is turned under  $+31^\circ$ , the sensor unit should be mounted under  $+31^\circ - 45^\circ = -14^\circ$ .
6. Mount the 3D sensor unit. The sensor of the 3D sensor unit (small board) must look vertically downwards and no parts (pipes, antenna, etc.) should be in its angle of view, ca.  $70^\circ$  (Pic. 2).
7. On helicopters with combustion engines the sensor units must be mounted in such position, that no direct view from the sensors to the exhaust 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.
8. Connect the sensor 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-H4** recognizes automatically, if the sense-channel has to be read from the transmitter or from the on-board trimmer.

\* For the **Stabilizer 3D-H4** the swashplate is:

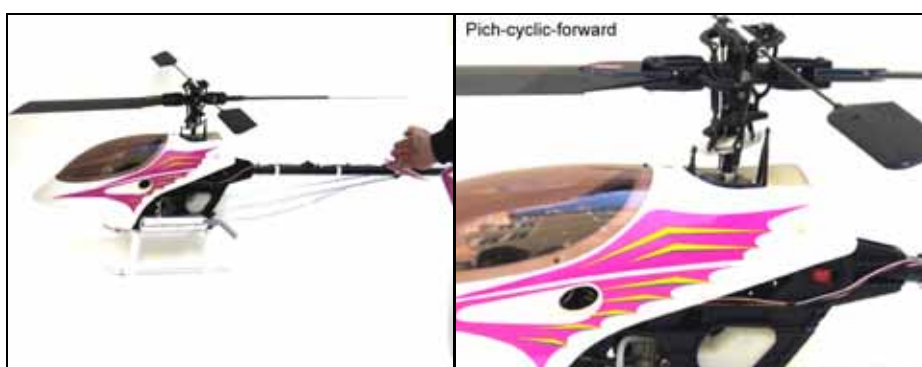
- a) Not turned (turned under  $0^\circ$ ), if when giving a Pitch-cyclic (=Elevator) only two servos are moving (these are Nick1=Pitch-cyclic1 and Nick2=Pitch-cyclic2), and the other two servos (Roll1 and Roll2) do not change their positions.
- b) Turned under  $\pm 45^\circ$ , if all four servos move the same distance, when giving a Pitch-cyclic (=Elevator). Two of the servos will move upward, the other two downward. If you give only a Roll-command, all the servos will move the same distance again, two of them upward, two of them downward. The servos of swashplates turned under  $\pm 45^\circ$  have the same Pitch-cyclic- and Roll-cyclic- proportions mixed.
- c) Turned somewhere between  $-45^\circ$  and  $0^\circ$  or  $0^\circ$  and  $+45^\circ$ . In that case, when giving only a Pitch-cyclic or only a Roll-cyclic, all the four servos will move, but with different ways. Two of the servos have bigger Pitch-cyclic- proportions, the other two have bigger Roll-cyclic- proportions.

**!!! Please disconnect now mechanically one of the four servos from the swashplate! Otherwise the swiching on of the system will cause a mechanical or an electronic damage!!! After you have rightly made the Servo-Reverse settings you may connect this servos with the swashplate again.**

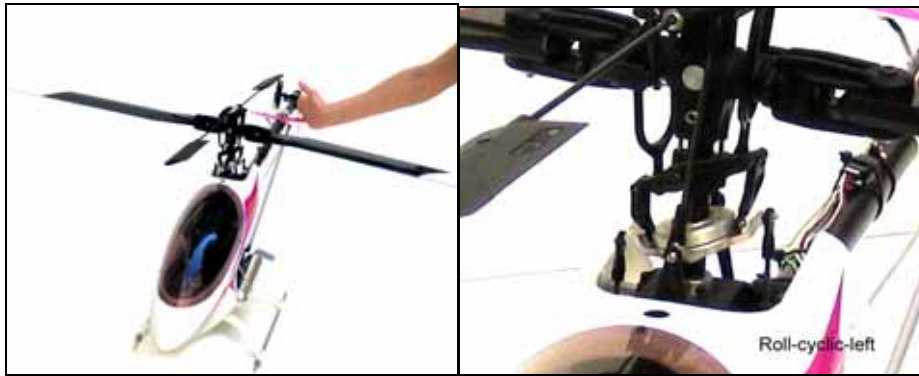
## 5. SETTINGS

### 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.3.). 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.4.). 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-H4** 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.

1. Your transmitter must be programmed for unturned swashplates (0°) or for swashplates turned under -45° or +45°. In case your swashplate is turned under another angle, than -45°, 0° or +45°, you have to program nevertheless the transmitter for -45°, 0° or +45° for the time you make the servo-reverse. After the setting is done, you must reprogram the transmitter again for the actual angle your swashplate is turned on. If your swashplate is turned under -45° to -23°, than program the transmitter for -45°. If your swashplate is turned under -22° to +22°, than program the transmitter for 0°. If your swashplate is turned under +23° to +45°, than program the transmitter for +45°.
2. Switch the transmitter on.
3. Set the Pitch-collective joystick in middle position, Pitch-cyclic and Roll-cyclic should be from alone in their middle position.
4. Push the button on the sensor unit and hold it pushed down.
5. 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.
6. Give a full "pitch-cyclic-forward" command and let the joystick return to the neutral position.
7. The LED will flash 2-times and will light up permanently.
8. Give a full "roll-cyclic-right" command and let the joystick return to the neutral position.
9. The LED will flash 2-times and will no more light .
10. Switch off the receiver, the settings will be permanently saved.
11. Reprogram the right swashplate angle values in the transmitter, in case your swashplate is turned under another angle, than -45°, 0° or +45°.
12. 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-H4** by giving a short Pitch-cyclic- or Roll-cyclic- command and test, if the Servo-Reactions are right . If so – you may now mechanically connect the disconnected servo to the swashplate.

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

### 5.2. Sense (the sensitivity)

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-H4** 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 explicitly desired, no corrections from the **Stabilizer 3D-H4** 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-H4** during the flight.
2. For 3D flight the Sense of the **Stabilizer 3D-H4** must be reduced from the set value (for example +65%) with increasing Roll- and/or Pitch-cyclic-commands. Otherwise the electronics will always try to keep the helicopter in horizontal position. This is achieved by programming of two mixers in the transmitter, so with greater Roll- and Pitch-cyclic- 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 in the transmitter to set the desired + direction correctly.

### 5.3. Switch between Normal- and Normal+Inverted- Flight-Stabilisation.

1. Switch the transmitter on.
2. Switch on the receiver, the LED on the sensor unit will flash 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 flash in double-pulse mode. This means, that you are in Normal- and Inverted-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 flashing 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-H4** will go every time to Normal-Flight-Stabilisation automatically. You have to activate every time the Normal+Inverted-Flight-Mode, if desired. The Normal+Inverted-Flight-Mode is only for advanced pilots and not for beginners!

!!! If you fly 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 back. The two mixers have to reduce the Sense of the **Stabilizer 3D-H4**, when giving bigger Nick- and/or Roll-commands, from the Sense value you are flying with (for example +65%) to Sense 0% (when Nick- and/or Roll is on its +/- 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 really 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).

Why should you do this? - Let us say, you are flying with Sense +100% and the helicopter goes through nick over 90°. At that moment, the **Stabilizer 3D-H4** 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.

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.

## 6. CALIBRATION AND FLYING

A horizon and contrast calibration is necessary before the first flight, after mounting the **Stabilizer 3D-H4** on your helicopter. For the next flights you have to calibrate only if the weather 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.

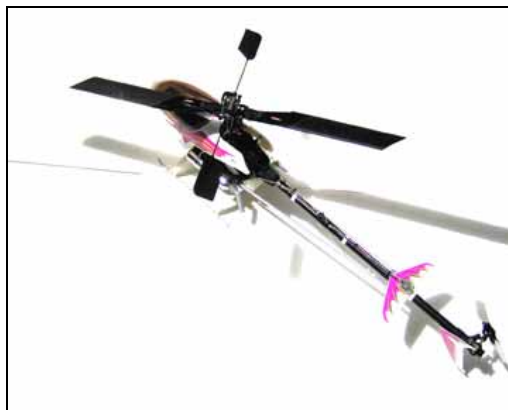
### 6.1. Pre-Flight Check

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-H4** are right. If you have inverted-flight stabilisation activated, the 5<sup>th</sup> sensor which looks vertically upwards must have a free sight to the sky.

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.3.). 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.4.). 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-H4** is correctly set, **never occur pitch-collective-corrections**. Only in case that works this way 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 5<sup>th</sup> 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 flash 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 flash 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 up permanently.
8. The **Stabilizer 3D-H4** 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-H4** 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 gradation from warm to cold).

Tip: In normal hover position the helicopter is (mostly) slightly inclined, because the rear rotor of the most helicopter models is 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 and make the calibration.
2. You can also 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 again.
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. To calibrate the horizon again you just need to set the Sense back to 0% and again to -100%.

#### 6.4. Flying without calibration

1. Switch the transmitter on.
2. Switch the receiver on.
3. The red LED must flash single pulsed for normal-flight mode and double pulsed for the 3D normal- and inverted-flight mode (look at 5.1.)
4. Wait for 5 sec. (systemcheck) and then give a Roll- or a Pitch-cyclic- command. The last saved calibration values get adopted.
5. The red LED starts lighting up continuously.
6. The system is ready, after the Pre-Flight-Check you can fly.

### 7. GENERAL INFORMATION

1. On **Futaba PPM** and **Futaba PCM 1024** the **Sense** must be on channel 7. When using **Futaba PCM 2048 (G3)** the Roll2 channel (originally 5) must be copied on channel 7 or 8. That means the Roll2 cable from the control unit must be connected with channel 7 or 8 on the receiver, the **Sense** must be connected with channel 8 or 9. On **JR/Graupner PPM and SPCM-receivers**, the **Sense** must be on channel 7 or 8.

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 Pitch-cyclic- on neutral, just control Pitch-collective, the rest makes the **Stabilizer 3D-H4**, the Sense should be on 40% or more.

4. Some advanced pilots can use the **Stabilizer 3D-H4** 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 then lands.

Then the pilot programs the two-position-switch in the transmitter again:

-1- position – 0% Sense

-2- position – the % Sense you want to fly with, from 0% to +100%.

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-H4**. For helicopters without flybar are 20% for the beginning recommended.

9. On our homepage [www.general-laser.at](http://www.general-laser.at) you can find under FAQ and Newsletter tips, updates and additional information about our products.

RC Type	Receiver Output Channels											
	Swashplate Type											
	<i>Stabilizer and Stabilizer 3D</i>							<i>Stabilizer H4 and Stabilizer 3D-H4</i>				
	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 hover 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-H4** 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, set up 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-H4** and do not carry any responsibility for any damages of property and material, and also for any injuries of persons and animals.

**Stabilizer 3D-H4 is a product of**



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