

Lemon RX Stabilizer PLUS 7-Channel Receiver Essential Instructions

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Further Information

For more detailed information see the *Reference Guide to the Lemon RX Stabilizer PLUS*, available at:

<https://www.rcgroups.com/forums/showpost.php?p=29478801&postcount=4>

A number of short instructional videos for the Stabilizer PLUS are available on the same RCGroups post.

To offer comments or raise questions about the Stabilizer PLUS or the instructions, please go to *The Official Lemon STABILIZER PLUS thread* on RC Groups:

<https://www.rcgroups.com/forums/showthread.php?2800238-The-official-Lemon-STABILIZER-PLUS-thread-New-Users-read-first-6-posts-%29>

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Introducing the Lemon StabPLUS

Building on the success of its basic 7-channel Stabilized Receiver, Lemon RX has developed the Stabilizer PLUS with the following additional features and capabilities:

- Seven fully usable channels (when using Always-ON feature or with stabilization switched OFF)
- Flexible installation, including inverted and on-edge mounting
- Gyro mode for rate-stabilization to smooth response and counteract turbulence
- Autolevel mode with restricted bank and pitch, also provides emergency recovery
- Level Reset feature to compensate for out of level effects
- Trim Reset feature to correct for trim and subtrim offsets
- Hardware Reset capability
- Dual aileron, plus elevon and V-tail mixing capability
- Usable with simple transmitters such as DX5e, as well as fully programmable ones
- DSMX/DSM2-compatible
- Available with either single antenna or dual diversity antennas:
 - Single antenna, top pin: LM0042
 - Dual diversity antenna, top pin: LM0043
 - Dual diversity antenna, end pin: LM0044

The StabPLUS does not replace the basic Lemon Stabilized Receiver; each has its advantages and limitations:

Lemon Stabilizer PLUS

- Provides Autolevel mode, in addition to rate (Gyro) stabilization.
- Does not support a remote receiver, but is available in dual diversity antenna version.
- Seven channels available for flight control when in Always-ON mode (six channels in normal mode).
- Allows mounting upright, inverted or on edge.
- Fairly complex to setup and adjust.

Basic Lemon Stabilized Receiver

- Provides only rate (Gyro) stabilization. Does not support Autolevel function.
- Relatively simple to setup and adjust.
- Available in single and dual diversity antenna versions; also supports a remote receiver (satellite).
 - Single antenna, top pin: LM0005
 - Single antenna, end pin: LM0032
 - Dual diversity antenna, end pin: LM0033
- Six channels available for flight control (channel 5 dedicated to on/off).
- Limited flexibility in mounting (does not support on-edge installation).

Thus the basic Lemon Stabilizer is quicker and easier to install and set up, whereas the StabPLUS offers greater flexibility and capability for those willing to invest the time in these more complex instructions.

Warning: The Autolevel feature of the LemonPLUS should not be seen as a substitute for adequate basic flying skills. Safely setting up the StabPLUS requires the pilot to fly the model with stabilization OFF, as well as in both Gyro and AutoLevel modes.

The StabPLUS is not a substitute for Spektrum SAFE Technology® or other advanced stabilization systems such as the Eagletree Guardian®. Used within its capabilities, it can improve the smoothness and stability of a wide range of models, and can help to recover from difficult situations, but to function correctly it must be properly set up for the specific model.

Instructions

These *Essential Instructions* cover information that most people will need to get the Lemon Stabilizer PLUS up and flying.

The separately available *Reference Guide* not only provides additional information on the functioning of the Stabilizer PLUS, but also covers in more detail such topics as transmitter programming and using Delta Wing (elevon), V-tail and Flaperon mixes.

These documents are prepared by jj604 (John) and Daedalus66 (Nigel). We have worked closely with the people at Lemon RX but are not paid by, or associated with, the manufacturer.

Functions

As it arrives, the StabPLUS has all DIP switches (J1-J6) set to **OFF**. In this configuration it behaves as a fully functional, unstabilized, seven channel, DSMX/DSM2-compatible receiver.

When activated by setting J4 and/or J5 to ON, the unit becomes a receiver with six usable channels (1-4 and 6-7) having **three stabilization modes**, controlled by channel 5 (Gear):

1. **OFF**: No stabilization.
2. **Gyro**: Rate stabilization counteracts turbulence for smoother flight.
3. **Autolevel**: Limits pitch and bank angles and returns the model to level if the sticks are released.

The StabPLUS can also be set to **Always-ON** in either Gyro or Autolevel mode, allowing all seven channels (including channel 5) to be used for flight functions.

Transmitter Requirements

The Lemon Stabilizer PLUS requires a Spektrum® or other transmitter using Spektrum DSM2® or DSMX® technology. Examples include DXe,¹ DX4e, DX5e, DX6, DX6i, DX7s, DX8 and DX8G2, DX9, DX18 and JR 9303.²

A three-position switch controlling channel 5 (Gear) is required if all three stabilization modes (OFF, Gyro, Autolevel) are to be available in flight. Recent DX4e and DX5e transmitters provide such a switch, while more advanced transmitters can generally be programmed to output the necessary 100%/ 0%/-100% on channel 5 (Gear). See the *Reference Guide* for detailed information.

Transmitters with only a two-position switch on channel 5, such as the older examples of DX4e and DX5e, as well as programmable ones that lack the ability to assign a suitable three-position switch, can be set to access either Gyro or Autolevel, but not both, as explained under Changing Mode Order (see page 9). Alternatively, many such transmitters, including specifically the DX6i, can be programmed to control the three modes by means of two two-position switches (see note on page 17 and in the *Reference Guide*).

Servos and Power Sources

The Stabilizer PLUS works well with a wide range of servos, both analog and digital. For optimum stabilization, servos with relatively fast response times are preferred. Metal-gear servos may be used for their shock resistance but they too are optional.

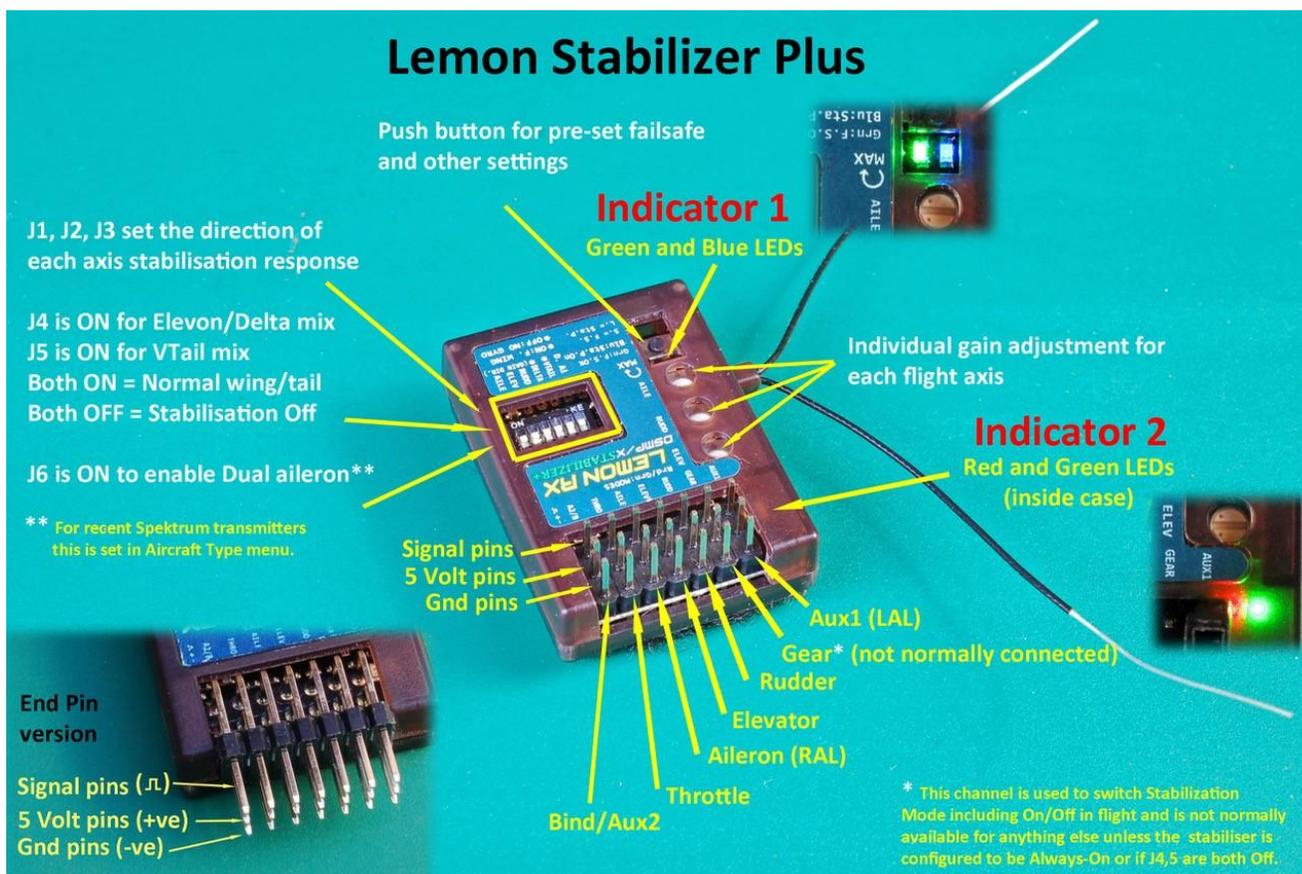
Be sure to use an ESC (speed control), BEC (battery eliminator) or battery with ample current capacity to power the radio. Stabilization makes the servos work harder than unstabilized flight and thus generates

¹ To work with the StabPLUS, the DXe may require programming using a PC or smartphone, cable and dedicated app.

² The Lemon Stabilizer PLUS may not work properly with the Spektrum® DM8 and DM9 modules or with certain non-Spektrum equipment, including most OrangeRX® transmitter modules.

significantly higher current drain. A good rule to follow is to choose a BEC, whether internal to the ESC or separate, that has at least 50% more capacity than you would use for a similar but unstabilized model. An adequate power supply is vital because although the Stabilizer PLUS is highly resistant to short power interruptions (<1s), several seconds are needed for a reset after a longer power loss.

If possible, use a switching-type BEC (SBEC), either in the ESC or as stand-alone unit, for its ability to deliver power without overheating and to cope with higher battery voltages. Linear BECs can also be satisfactory as long as you stay within their voltage and servo limits.



Setting up the StabPLUS

Installation

These instructions are intended to explain the basic steps in setting up the Lemon Stabilizer PLUS for a conventional model (no elevons or V-tail). The following channel assignments are used:

- CH1 - Throttle
- CH2 - Ailerons (or Right Aileron if dual servos on separate channels are used)
- CH3 - Elevator
- CH4 - Rudder
- CH5 (Gear) - Dedicated to selection of Stabilizer Mode (unless Always-ON is used)
- CH6 (Aux1) - Left Aileron (only if dual servos on separate channels are used), or other function
- CH7 (Aux2) - Available for other function (also used for Bind)
- CH8 (Aux3) - Dedicated to Master Gain, not usable for any other purpose, not accessible via pins

Lemon RX Stabilizer PLUS Receiver – Essential Instructions v.1.2

For details on other configurations, see the *Reference Guide*. **Note that Elevon (Delta) or V-tail mixing in the transmitter must NOT be used.** See also the note on page 14.

Basic Setup

Start by creating a new model in the transmitter or do a reset on the chosen model memory. For a recent Spektrum transmitter, if your model has a single aileron servo or dual servos on a Y-cable, choose **Normal Wing Type** in the Aircraft Type menu. Set receiver **switches J4 and J5 to ON**. Use a pin to change switch settings; make sure the switch snaps over completely.

For a model with two aileron servos on separate channels, select **Dual Aileron Wing Type**. In this case, also set switch **J6 ON** to activate aileron stabilization on channel 6 (Aux1).³ For a DX6i, select WingTailMix, Dual Aileron.

To control **Stabilization Mode**, Channel 5 (Gear) should be assigned to a three-position switch if possible.⁴ On recent Spektrum programmable transmitters, go to Channel Assign and select a three-position switch (such as B or D). For a DX6i, see Annex D (page 17).

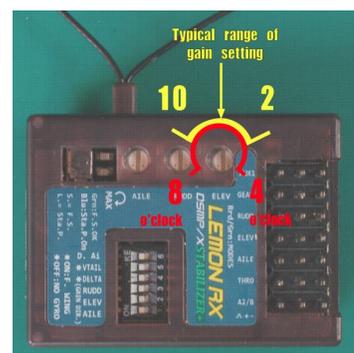
If your transmitter has eight or more channels, set up a knob or slider for channel 8 (AUX3) to control **Master Gain**. On recent Spektrum transmitters, this is done in Channel Assign by setting AUX3 to be controlled by a knob (RKnB). If desired, the direction of increasing gain can be changed by reversing the channel (look at the Monitor screen to determine which way is increasing). Note that channel 8 has no pins and must not be used for any function other than Master Gain.

Installation

The most common installation has the Stabilizer PLUS **upright** in the aircraft (i.e., flat on a surface that is horizontal when the model is in normal level flight attitude). The long axis of the unit must be aligned with the flight direction and the servo connectors should be to the rear of the aircraft.⁵ For other possible orientations and advice on mounting the StabPLUS, see page 14 and the *Reference Guide*.

Because the Stabilizer PLUS uses accelerometers as well as gyros (so is sometimes called a “6-axis” stabilizer), for best performance it should be located reasonably close to the center of gravity of the model.

Check that the **three gain pots are set to the mid-point – 12 o'clock** (straight up – see picture) as a starting point.



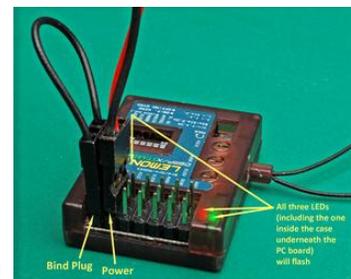
³ Flaperon Wing Type should only be used if you take precautions to prevent the use of the flaperon mix in Autolevel mode. Likewise, Aileron Differential must not be used in Autolevel mode. See page 14.

⁴ See discussion of using a two position switch on page 14.

⁵ Lemon RX have not tested the receiver with the pins oriented towards the front of the model, but some users have reported installing it this way without problems.

Binding

1. Insert a **bind plug into the Bind/channel 7 slot.**
2. With the transmitter turned OFF, apply power to the receiver. The Red and Green lights of Indicator 2 (and the Red internal light) should flash rapidly to indicate that receiver is in **Bind Mode**.⁶
3. **Turn ON the transmitter in Bind Mode** (see the instructions for your transmitter). The transmitter should be separated from the receiver by 1-2m (3-6 feet). In some cases, even more separation may be needed for binding.
4. Wait until the transmitter indicates “**bind complete**” or the rapid Red/Green flashing stops. If your bind process involves holding a button or switch, hold for a couple of seconds more, then release.
5. Wait up to 20 seconds or so for the **initialization process to complete**, as indicated by: Indicator 1 (Green/Blue) lights no longer flashing, Indicator 2 (Red/Green) lights signaling stabilizer mode (see below), and the transmitter acquiring control of the servos.
6. Power down the receiver and transmitter. **Don't forget to remove the bind plug.**



To test the bind, turn on the transmitter and then the receiver. Wait for initialization to complete. Verify control of stabilization by placing the channel 5 (Gear) switch in each of its positions. A three-position switch should cause the receiver to display the following:

Position 0: **OFF** – Red/Green solid (or flickering very slightly); no servo movement when model is rotated.

Position 1: **Gyro** – Green ON solid, Red OFF; servos move briefly when model is rotated.

Position 2: **Autolevel** – Red and Green lights flashing alternately; aileron and elevator servos stay deflected when model is not level, rudder servo moves briefly when model is rotated (yawed).

With a two-position switch for channel 5, only OFF and Autolevel mode will be available by default. This can be changed to OFF and Gyro, as explained under Changing Mode Order (see page 12).

Setting Failsafe

No-pulse failsafe: By default, the receiver will, on loss of signal⁷, stop sending pulses to the servos and ESC. This should cause the ESC to cut power to the motor within a second or two, while the servos stay where last commanded. This achieves the basic failsafe requirement for most electric models – stopping the motor.⁸

Pre-set Failsafe is also available. Using this, the receiver will, on loss of signal, go to the previously chosen pre-set positions on all channels. To enable Pre-set Failsafe:

1. With receiver and transmitter powered down, insert a **bind plug in the bind/channel 7 slot.**
2. Power up the receiver. Indicator 2 lights should be flashing rapidly to signal **Bind Mode**.
3. Power up the transmitter in **Bind Mode** (see instructions for your transmitter).
4. Allow bind to complete, until Indicator 1 lights (Green/Blue) have stopped flashing and Indicator 2 lights are signaling the current stabilization mode. This may take up to 20 seconds or more.
5. **Move the relevant transmitter sticks and switches to the desired failsafe positions.**
6. **Press the receiver button briefly (<1s) and release. Indicator 1 Green light ON** shows failsafe is set.⁹

⁶ If this rapid flashing of Indicator 2 does not happen, there is no possibility of binding. Low power supply voltage, reversed plugs or a defective bind plug are among the possibilities to check.

⁷ Note that loss of power is quite different from loss of signal (though the results may be similar).

⁸ IC (fuel powered) models must use correctly set up Pre-set Failsafe to shut down the engine on loss of signal.

7. **Remove the bind plug** and power cycle the unit.

The failsafe settings will be retained even when the receiver is powered off.

To cancel Pre-set Failsafe settings, repeat the above procedure and again press the button briefly.

Always test failsafe by switching the transmitter OFF (with propeller removed or the model restrained).

Test Flying

Preparing to Fly (assuming stabilizer is mounted upright in the model)

Always remove the propeller or disconnect the motor when working with the battery plugged in.

1. With the receiver already bound, power up first the transmitter and then the receiver.¹⁰
2. Wait for the receiver to complete its initialization (up to 20 seconds).
3. With the stabilizer mode set to **OFF** (Indicator 2: Red and Green ON solid), verify that all **control surfaces travel in their correct directions when the transmitter sticks are moved**. If necessary, change the relevant Reverse settings in the transmitter. At this time check that all control surfaces are centered.

Note: If using a Transmitter with two-position Gear switch, skip step 4 or step 5, as appropriate.

4. Set the stabilizer mode to **Autolevel** (Indicator 2: Red and Green alternately flashing slowly). Rotate the model about the pitch and roll axes and watch for the ailerons and elevator to deflect and stay deflected when it is not level. Rotate the model sharply by 20-30 degrees about the yaw axis and watch for a momentary pulse of rudder deflection followed by a return to neutral.

The **directions of this stabilizer action** on each axis MUST be as follows:

- If the model is **rolled to the right: right aileron goes DOWN** and the **left UP** to counter the motion.
- If the nose of model is **pitched down: elevator goes UP** to restore the model to level flight.
- If model is **yawed (rotated) to the right**, the **rudder pulses LEFT momentarily** to resist the displacement (as in Gyro mode – see Step 5).

If any response is incorrect, use the appropriate switch J1, J2 or J3 to reverse the travel and test again.

5. Set the stabilizer to **Gyro** mode (Indicator 2: Green ON, Red OFF) and test the stabilizer action on each of the control axes. Directions of movement should be as above, except that this time what you are looking for on all three axes is **a pulse of movement of the control surface** which occurs while the model is starting to move from stationary.

For example, when you roll the model sharply to the right, the right aileron should for a moment go DOWN and the left UP (to oppose the displacement), then they should return to neutral. Note that if the direction of stabilization movement for aileron and elevator is correct for Autolevel mode it will also be correct for Gyro mode.

If the stabilizer motion in Gyro mode is hard to interpret, turn the three gain pots fully clockwise to increase gain (or turn up Master Gain, if available). Note that it is often easier to feel the direction of deflection with your finger on the control surface hinge than to see it. Additional information on stabilizer response is provided in the *Reference Guide*.

6. **Carefully recheck the directions of BOTH control movement AND stabilizer action – a mistake here can have serious consequences!**

⁹ If the BLUE light comes on, you have held the button too long and selected Always-ON. Press the button again for more than 1 second to cancel this, then to set failsafe, press briefly (<1s) while holding the desired control inputs.

¹⁰ The general rule is transmitter FIRST ON, LAST OFF.

7. Check that the **three gain pots on the receiver are set close to 12 o'clock** as a starting point.
8. If available, set **Master Gain to the midpoint** (0% on the transmitter's monitor screen). If your transmitter has less than eight channels, Master Gain is fixed at 1 and you can skip this step.
9. Check that the flight control **trims are set to zero**. If necessary, use Sub-trim to align the servo arms at right angles to the pushrods. **Adjust mechanical settings** to center the control surfaces.
10. **Test failsafe** by turning off the transmitter with throttle well above zero (make sure your prop is removed or the model is restrained). The motor should stop within a second or two. Turn the transmitter back ON and it should restart. (Do this failsafe test on the ground, not in flight!).
11. Make sure you know how to find the Stabilizer Mode switch without having to look down at the transmitter and that you know how to turn it OFF quickly if there is a problem with the settings.
12. It is recommended that you set up **Dual Rates** on the transmitter with Low Rate being about 70% and High Rate 100%. Use mechanical adjustments and/or servo travel (called Travel, ATV or End Point Adjust depending on the transmitter) to set control throws to those recommended for the model.
13. You may also wish to add 20% Expo, or somewhat more, to soften control responses around neutral, but keep in mind that stabilization has an expo-like effect.

First Flight

1. Power up first the transmitter and then the receiver.
2. Wait 20 seconds or so until initialization is complete, and the transmitter has control of the servos.¹¹
3. Once again check the directions of control and of stabilization movement (especially aileron).
4. Set **Stabilizer Mode** switch (channel 5/Gear) to the desired mode, preferably OFF.¹²
5. Take off and climb to a safe height.
If you have a two-position switch giving access only to Off and Autolevel, go to step 8 below.
6. Turn ON **Gyro mode** (Position 1 on a three-position switch). Expect Gyro mode to cause the model to fly more smoothly, resist wind gusts, and be somewhat less sensitive to control inputs than with the stabilizer OFF. If there are any unexpected reactions, immediately turn OFF the stabilizer (Position 0) and land to trouble-shoot.
7. If you see **oscillation** on any axis, slow down and land (or turn down Master Gain slightly). Turn the relevant gain pot(s) down (CCW) by an "hour" ie. or so. See *Reference Guide* for further advice on adjusting gain.
8. Switch to **Autolevel mode** (Position 2). In Autolevel mode, you should find the model much more docile, with a strong tendency to return to level when you neutralize the sticks. You will still have control, but turns may require significantly more input and maximum bank and pitch will be limited. To increase control authority, you can use High Rate and/or change to Advanced Autolevel mode, which allows steeper bank angles (see page 12). Be ready to switch to OFF or Gyro if you encounter a problem.
9. If the model (with throttle set appropriately) does not maintain level flight, switch to OFF or Gyro mode, land and reset Stabilizer Level and Stick Neutrals, as explained below.

If you are a beginning flier looking to use the Lemon Stabilizer PLUS to assist you in developing your piloting skills, we recommend enlisting the help of an experienced pilot for the first flights.

¹¹ A flashing orange light in DSM2 mode indicates that there has been an interruption of receiver power. This could be because receiver power was reconnected without first cycling transmitter power. This "Brown-out Detection" feature is not present for DSMX mode. To stop the flashing, power down both receiver and transmitter and repeat power-up.

¹² Only use stabilization for the initial takeoff if you are confident that you have set the response directions correctly.

Adjusting Gain

The above instructions will get the StabPLUS working quite well, but they will not ensure that the optimum gain settings are achieved. Whether optimizing gain matters to you is a personal decision, but you should at least understand why gain matters and how to adjust it if necessary.

Gain is a measure of the amount of feedback involved in the stabilization loop. Using the receiver pots, it is set separately for each of the three stabilized channels (A, E, R). If gain for a channel is set too low, the stabilization effect will be weak or non-existent. If it is set too high, the model will display oscillation at higher speeds. The maximum allowable gain for a channel may vary between Gyro mode and Autolevel mode: gain for each channel should be set to the lower of the Gyro or Autolevel value.

Using a Transmitter with 7 or Fewer Channels (no Master Gain)

The aim here is to set each of the three stabilized channels (A, E, R) just below its maximum gain for Gyro mode or Autolevel mode, whichever is lower. This can only be done in flight.

First test Gyro mode. If oscillation is observed on one or more axes, land and turn down the gain on the related pot(s) (counter-clockwise). Adjust the pot in small increments (about one “hour” at a time). Fly and adjust repeatedly until no oscillation is observed on any axis. Then do the same in Autolevel mode. You may find that no further adjustment is needed, but if you see oscillation, reduce the gain on the relevant pot(s).

To achieve optimum gain, it is necessary to increase the gain for any axes(s) that did not show oscillation in the above test. Increase the gain in small increments, testing both Gyro and Autolevel mode, always looking for oscillation at increased airspeed. When you encounter oscillation, reduce the gain by one “hour”.

When the process is completed, the three pots may have significantly different settings.

Using an 8+ Channel Transmitter (supports Master Gain)

If your transmitter has eight or more channels, channel 8 (Aux3) is devoted to Master Gain and should be controlled by a knob, lever or slider. The central position of this control (0%) corresponds to a gain of 1X. In other words, at this position Master Gain will have no effect on the gains set by the individual pots. When the Master Gain control is set to -150% travel, gain will be zero and there will be no stabilization. When the control is set to 150% travel, the gain on each of the pots will be multiplied by two. In practice, it is usually best to leave travel at +/-100%.

To use Master Gain to aid in achieving optimum gain, test one axis at a time. On the ground, start with the Master Gain knob on the transmitter and the Aileron pot on the receiver both at 12 o’clock; turn the other two receiver pots fully counter-clockwise (minimum gain). Take off in Gyro mode and adjust Master Gain until oscillation in the roll axis just occurs during a shallow dive. This may require either an increase or a decrease in Master Gain. Now repeat for Autolevel mode and reduce gain further if necessary. You want to be on the verge of causing oscillation, whether for Gyro or Autolevel mode, then to back off one hour.

Land and adjust the receiver. Let’s say you found that Master Gain at 2 o’clock was the best setting, just short of oscillation. So set the receiver Aileron pot to 2 o’clock and return Master Gain to its mid-position (0% on the transmitter monitor). Record the position of the Aileron pot for future use.

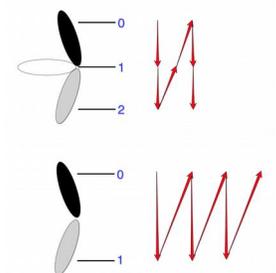
To adjust the pots for the other axes, start by setting the Aileron pot to minimum gain (full counter-clockwise). Repeat the above process for the Elevator axis, then for Rudder, to find the “just short of oscillation” settings for each. Finally set all three pots to the positions you have noted.

This procedure ensures that setting the Master Gain to the mid-position will always give a reasonable setting for gain on all axes, even if you have more than one model using a Lemon Stabilizer or StabPLUS. You may want to turn down Master Gain by an hour to make sure you avoid oscillation.

Resetting the Stabilizer

Resetting Level and Alignment (Toggle during initialization)

By default, the Stabilizer PLUS uses its built-in settings when initialized, based on the assumption that the receiver is mounted upright and level and accurately aligned with the flight direction. To compensate for any variations, the receiver can be reset by performing a **“toggle gesture”** during the initialization process. This is also required if the stabilizer is mounted inverted or on edge (e.g., on a profile fuselage), or if the unit is mounted not quite level. All these cases require toggling.

<p>Toggle Gesture</p> <p>Move the Stabilizer Mode switch on your transmitter back and forth as quickly as possible through its full range for 2-3 seconds. This procedure applies to both 2- and 3-position switches. At a minimum the stabilizer needs to see six changes of switch position (see diagram) within 2 seconds, but a few more changes are desirable to guarantee a successful reset.</p>	 <p>The diagram shows two types of mode switches. The top one is a 3-position switch with positions labeled 0, 1, and 2. Red arrows indicate a sequence of movements: 0 to 1, 1 to 2, 2 to 1, 1 to 0, 0 to 1, 1 to 2, 2 to 1, 1 to 0, 0 to 1, 1 to 2. The bottom one is a 2-position switch with positions labeled 0 and 1. Red arrows indicate a sequence of movements: 0 to 1, 1 to 0, 0 to 1, 1 to 0, 0 to 1, 1 to 0.</p>
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To reset level as seen by the stabilizer:

1. Set the model up in level flight position on the bench.¹³
2. Turn on the transmitter and apply power to the receiver (bind plug not required if previously bound).
3. When Indicator 1 (Green/Blue) starts flashing, immediately (within 8 seconds) perform the **toggle gesture** explained above, flipping the switch back and forth continuously for 2-3 seconds.
DO NOT MOVE OR DISTURB THE MODEL during the initialization period.
4. The **Red LED of Indicator 2 should now come on for a few seconds**. After a further wait, the **Green LED of Indicator 2 should flash four times** to confirm initialization.
If you do not see this confirmation, repeat the whole process until you do. This is necessary to ensure correct initialization. A possible reason for failure is movement of the model during initialization.
5. Power down the receiver.

If you observe any unexpected responses from the model, on the ground or in the air, perform a Level Reset as described above. Also, don't forget to also reset the stick neutrals, as described in the next section, as their setting, while not usually critical, can sometimes have an important impact on the model's behavior.

The Stabilizer retains the values generated, even when powered down, so the procedure doesn't need to be repeated unless you want to adjust Autolevel attitude or you change the stabilizer's position in the plane.

If you perform this procedure, it's REALLY important to verify that the “toggle gesture” is successful, as it resets the Stabilizer's orientation and Autolevel values. Be sure you see **four Green flashes** on the Indicator 2 LED (near the pins). **No flashes = no fly!**

¹³ Some models may need to be slightly nose-up (typically 1-3°) to maintain level flight at a normal throttle setting.

Resetting Stick Neutrals (Toggle after initialization)

To ensure optimum stabilizer performance, after any major adjustment of the trims or subtrims you should use the toggle gesture (as defined above) to reset the stabilizer's values for the stick neutral positions. This is an entirely separate process from resetting level and can be done at any time AFTER the stabilizer has completed its initialization. During the reset, the aileron, elevator and rudder sticks and the corresponding trims must **not** be moved.

With the transmitter and receiver ON, and leaving the sticks and trims untouched, move the Stabilizer Mode (Gear) switch as quickly as possible back and forth for about 2 seconds.

There is no verification but the process is extremely simple and reliable.

The Stabilizer PLUS performs best, especially in Autolevel mode, when trim and subtrim settings are kept to a minimum. Where possible, use mechanical adjustments to eliminate the need for large trim offsets, then reset the stick neutrals as described above.

Calibration of the Sensors (no action normally needed)

Calibration of the sensors is a totally separate process from resetting stabilizer level or stick neutrals. Calibration is seldom needed; when it is, the indication is a jump in servo position on one or more axes when the Stab is switched back and forth between OFF and Gyro (with no movement of the Stab).

The StabPLUS attempts to calibrate its sensors automatically every time it is powered up, provided the receiver remains absolutely stationary, with no vibration, for 2 or 3 seconds at the beginning of the process. No special effort is needed to enable this, unless signs of calibration error are seen.

Special Options

Stabilizer Always-ON (Rebind)

By default, channel 5 (Gear) is dedicated to controlling Stabilizer mode (OFF, Gyro, Autolevel), so its pins are not generally usable for other functions. The Stabilizer Always-ON function, however, allows channel 5 to be used to control landing gear or for other functions. Because Always-ON cannot be changed or canceled in flight, it should normally be used only with Gyro mode. To verify the setup, it is a very good idea to fly your model at least once with an off switch available before setting Always-ON.

To enable Stabilizer **Always-ON**:

1. With receiver and transmitter powered down, insert a bind plug into Bind/channel 7.
2. Power up the receiver. Indicator 2 lights (Red/Green) should be flashing rapidly to signal Bind Mode.
3. Turn on the transmitter in Bind Mode (see instructions for your transmitter).
4. Wait for Indicator 1 (Green/Blue) to stop flashing and Indicator 2 (Red/Green) to show stabilizer mode. This may take 20 seconds or more. Be patient.
5. Set the **channel 5 (Gear) switch on the transmitter to Gyro mode** (Green ON, Red OFF). Autolevel mode (Red/Green alternately flashing slowly) is not recommended in conjunction with Always-ON. .
6. Press and hold the button (>1s) until the **Indicator 1 Blue LED is ON**, showing that **Always-ON** has been selected. In this condition, channel 5 (Gear) no longer controls stabilizer mode and can be reassigned for another purpose.
7. Power off and remove the bind plug.

The Always-ON setting will be retained even when the receiver is powered off.

Note that even with Always-ON active, the toggle gesture still works to reset level or stick neutrals.

Changing Mode Order and Autolevel Setting (Bind Plug across channels 4, 5, 6)

A bind plug inserted across the signal pins of channels 4, 5 and 6 will cause the Stabilizer PLUS to use the blue/green **Indicator 1** lights to display the current **Stabilization Mode Order**:

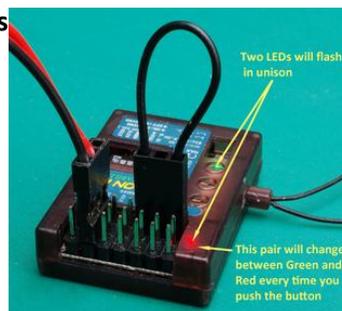
- **Default** order: **OFF/Gyro/Autolevel** – **Indicator 1 Green** flashing
- **Alternate** order: **OFF/Autolevel/Gyro** – **Indicator 1 Blue** flashing

In this state, the Stabilizer uses the **Indicator 2** lights to signal the **Autolevel setting**:

- **Beginner** setting (default) severely limits bank and pitch angles – **Indicator 2 Green** flashing
- **Advanced** setting gives the pilot a greater degree of control – **Indicator 2 Red** flashing.¹⁴

The Mode Order and Autolevel settings can be changed as follows:

1. **With the Stab PLUS powered OFF, insert a bind plug across the signal pins for channels 4, 5 and 6** (i.e., the last three – see picture and Annex A). Power is connected to any other available set of pins. The transmitter is not required.
2. Power up the receiver.
3. **Press the receiver button:**
 - for more than 1 second to change the **Stabilization Mode Order**.
 - for less than 1 second to change the **Autolevel setting**.¹⁵
4. When the desired changes have been made, power OFF the receiver and remove the bind plug.



To check the settings, simply power up the receiver with the bind plug across channels 4, 5 and 6 and observe the configuration of Indicator 1 and Indicator 2 lights. See above for the meaning of the lights.

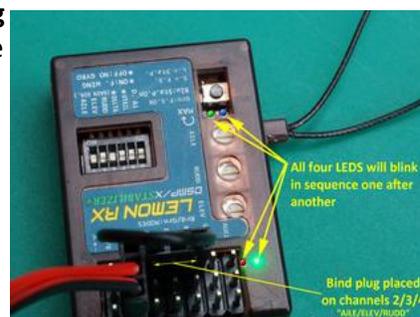
The settings will be retained even when the receiver is powered off. To reverse a change, repeat the procedure described above.

Hardware Reset (Bind Plug across channels 2, 3, 4)

To reset the Stabilizer PLUS to factory default settings, insert a **bind plug on the signal pins of channels 2, 3, and 4**, as shown in the picture. Note that channel 2 (Aileron) is the third set of pins from the left.

Connect the ESC, BEC or battery to any available set of pins. The transmitter is not required.

When power is applied for a second or two, the lights on the receiver will blink in sequence, indicating that all internal settings have been returned to default. This includes any stabilizer offsets, orientation settings, failsafe presets, mode order changes, etc.



To complete the reset, you may wish to set the stabilizer pots back to the 12 o'clock position and return all DIP switches to OFF, but this is not required.

A good practice if you encounter unexpected behaviors from the stabilizer is to perform a hardware reset, followed by rebinding of the receiver. Then start afresh with stabilizer settings.

¹⁴ For many pilots, the Beginner setting will probably seem relatively unresponsive. We suggest the use of Advanced setting in most cases.

¹⁵ To change both settings, press the button twice, once for more than 1 second and once for less than 1 second.

Other Issues

IMPORTANT: *Don't use Autolevel with Flaperons or Aileron Differential*

Autolevel mode on the StabPLUS is intended to help you stay within safe limits and recover from difficult situations. In using it, however, you must accept some limits on your options. In particular, **Autolevel is incompatible with both Flaperons and Aileron Differential.**

The Flaperon function when activated causes dual servos to lower or raise both ailerons, thus giving a flap or spoiler effect. This action involves a significant shift in the neutral settings of the two aileron channels, something the stabilizer in Autolevel mode cannot properly interpret. As a result, selecting Autolevel while flaperons are deployed may cause the model to behave erratically. Hence, **flaperons must NOT be deployed when the stabilizer is in Autolevel mode.**

Likewise, Aileron Differential may improve coordination of turns by reducing servo travel for the down-going aileron, which limits adverse aileron drag. For example, in a right turn, 50% differential will cause the left aileron to go DOWN only half as much as the right aileron goes UP. Unfortunately, this can conflict with Autolevel roll correction and may cause erratic aileron response. Consequently, the **differential function must not be used in Autolevel mode.**

Solutions

Flaperons can be used safely only when the StabPLUS is OFF or in Gyro mode. We have provided mixes on RCGroups for Spektrum transmitters to ensure that Autolevel is not available when flaperons are active.¹⁶

There's no problem using two servos on separate channels in Dual Aileron Wing Type, or a Y-cable driving both servos in Normal Wing Type. It's when the Wing Type is set to Flaperons that special care is needed.

Similarly, **Differential** can be blocked in Autolevel mode but allowed in OFF of Gyro mode. To do this, use the same three-position switch to select Differential as you use for Stabilizer Mode; simply ensure that the Differential amount corresponding to the switch position for Autolevel (normally Position 2) is set to 0%.

Note that Autolevel provides Gyro-type stabilization on the yaw (rudder) axis, thus helping to ensure coordinated turns, even without aileron differential. In addition, some models might benefit from a small amount of aileron-to-rudder mixing, either full-time or only when in Autolevel mode. Alternatively, "old-fashioned" mechanical aileron differential is very effective and is often easy to incorporate by offsetting either the servo arms or the aileron control horns.

Using Other Mixes with Autolevel

While mixes other than Flaperon and Aileron Differential don't generally clash directly with Autolevel, they should be used with care because the combination can cause significant unexpected reactions.

For example, a throttle-to-elevator mix intended to prevent excessive climb at high throttle may work correctly in Gyro mode but cause the model to dive suddenly when switched to Autolevel. This is because Autolevel is already set to keep the model flying level, so the down elevator generated by the mix at high throttle is interpreted as a command to push the nose down further. A high speed dive is the result.

Accordingly, some mixes should not be allowed when the StabPLUS is in Autolevel mode. The technique to prevent use of Flaperons in Autolevel mode explained in the footnote above can be adapted to any mix to achieve this.

¹⁶ For details on these mixes, please go to the *Lemon Stabilizer Plus configurations thread*:
<https://www.rcgroups.com/forums/showthread.php?2818371-Lemon-Stabilizer-Plus-configurations>

IMPORTANT: *Elevon and V-tail Mixing are NOT permitted in the Transmitter*

Like other stabilizers, the StabPLUS absolutely requires that **any elevon (delta wing) or V-tail mixing MUST take place in the stabilizer and NOT in the transmitter**. Use of any such transmitter mixing will almost invariably cause a crash immediately after takeoff! This is true even when the stab is turned OFF by the transmitter, using channel 5 (Gear). Even in this case, Elevon and V-tail mixing MUST be controlled by switches J4 and J5, as shown in the illustration on page 4.

Use of elevon or V-tail mixing in the transmitter is permitted only if stabilization is permanently turned OFF at the receiver (i.e., switches J4 and J5 are OFF). The StabPLUS then functions as a plain 7-channel receiver.

Using a Two-Position Switch to Control Stabilization

Many older transmitters, such as the DX6i have only a two-position switch (-100/100%) for channel 5 (Gear). One way to deal with this limitation is to set the Mode Order to allow one desired type of stabilization. In the default Mode Order (OFF/Gyro/Autolevel), a two-position switch will select **OFF or Autolevel**. The alternative order (OFF/Autolevel/Gyro) will allow the switch to select **OFF or Gyro**.

Another way is to reduce the switch travel (end point) on the -100% side to 0%. The switch will then deliver 100% (**Autolevel** mode) or 0% (**Gyro** mode). It is important to recognize that this provides no way to turn stabilization OFF, unless the transmitter supports Master Gain on channel 8.

Finally, Annex D tells how to use two two-position switches for control of stabilizer mode.

Alignment and Mounting of the StabPLUS

The Lemon Stabilizer PLUS MUST be mounted in alignment with the flight axis of the model. It can be mounted upright, inverted or on either edge. The servo connectors should be to the REAR of the model.

Only if the StabPLUS is mounted fully upright can the built-in default values be used for level. If mounted in any other orientation, or if fine tuning of stabilizer level is needed, the Reset “toggling” process described earlier (page 10) must be used. For best results with Autolevel, the unit should be located close to the center of gravity of the model. These issues are discussed in more detail in the *Reference Guide*.

Mounting

All stabilizers must be protected from vibration and shock, yet attached securely enough to follow the movements of the model without wobbling or coming loose. The double-sided mounting tape provided with the Lemon StabPLUS offers the simplest solution. Use it to attach the receiver in the appropriate attitude to a flat surface in the model. Make sure the surface is clean, the attachment is secure and the receiver case is not touching any part of the model. Good quality servo-mounting tape or 3M (Scotch) Permanent Outdoor Mounting Tape is also suitable for this purpose. Do not use the common indoor white foam mounting tapes for this purpose.

Mounting with adhesive tape can make subsequent removal of the unit difficult. Accordingly, Velcro®-type tape can be used. Cover the whole bottom of the receiver with the fuzzy (loop) side of the material. Use a patch of the hook-side material at least as big as the case to avoid the possibility of the stabilizer wobbling.

Be careful when removing the receiver, as the case is only held together by two small screws and two pegs. To provide reinforcement, you can apply transparent tape to the case sides.

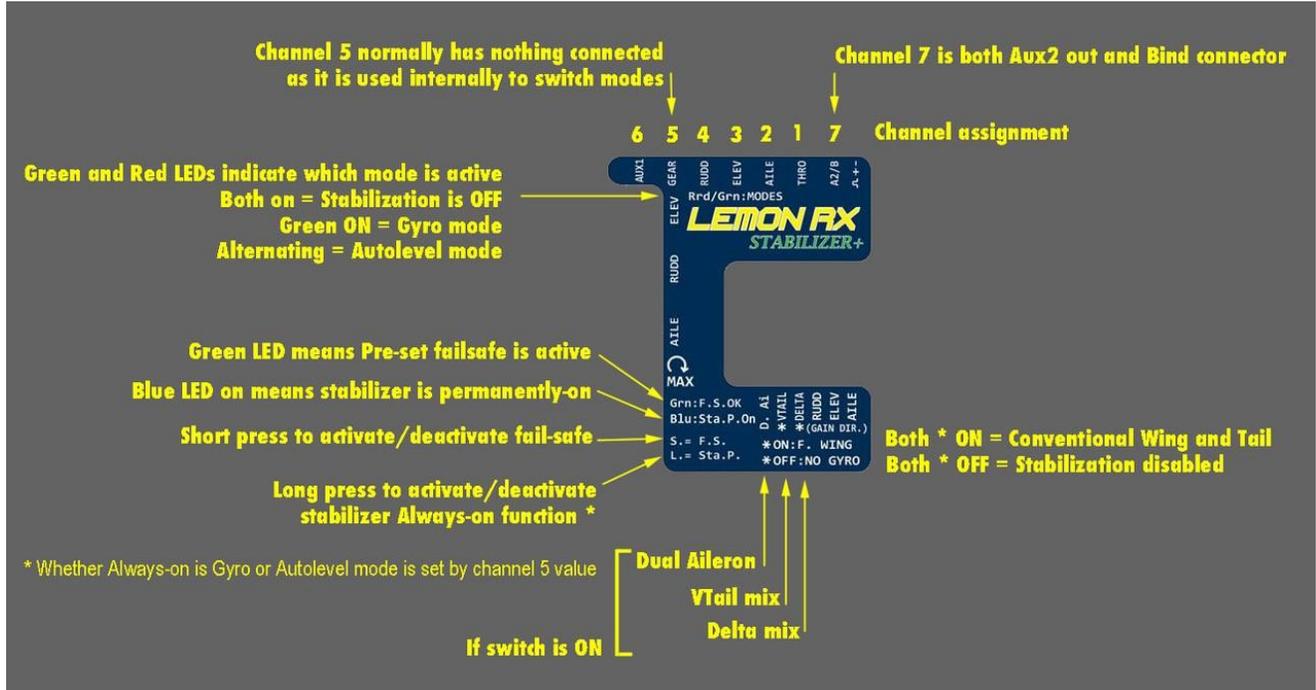
These methods are suitable for electric-powered models, but may not provide sufficient isolation in the harsher environment of a fuel-powered (IC) model. For further information, see the *Reference Guide*.

Minimizing Vibration

Autolevel stabilizers are particularly susceptible to vibration. One symptom is deviation from level flight over time in Autolevel mode. It is therefore very important, even for an electric model with a properly mounted receiver, to eliminate sources of vibration. Balance the propeller and check for any out-of-true running of the motor shaft or bearings. A well-balanced electric model should show no noticeable vibration in any part of its speed range.

Annexes

Annex A: What do those tiny cryptic letters on the label mean?



Annex B: Stabilizer Mode Settings

The inputs required by the Stabilizer PLUS on channel 5 (Gear) do not need to be exact. The following ranges will be recognized as defining the three Stabilization modes:

- Any value below -36% (pulse length 1356us) will put the unit into Autolevel mode.
- Any value between -35% (1360us) and +35% (1640us) will invoke Gyro mode.
- Any value above +36% (1644us) will turn the Stabilizer OFF.

Annex C: Setting up a current generation Spektrum Transmitter for the StabPLUS

The following is based on a DX8G2 but should apply with minor adjustments to other such recent transmitters as the DX6, DX6e, DX7s, DX9, and DX18.

1. Select a new model (or do a reset on a previously used model memory) and name it appropriately.
2. For a single aileron servo, or two servos on a Y-cable, set Aircraft Type to Normal Wing, Normal Tail. For two servos on separate channels (2 and 6), set Aircraft Type to Dual Aileron.
3. Under Channel Assign, leave Rx Port Assignments as is.
4. Under Channel Assign (second page), set Channel Input Config to a suitable 3-way switch (such as D) for channel 5 (Gear) and to RKnB for channel 8 (Aux3), if available. Inhibit any unused channels.
5. Set up D/R and Expo as required on a suitable switch.
6. Set up Throttle Cut to -130% on a suitable switch (usually A). Set Throttle Trim to minimum. OR, set Throttle Cut to -100% and throttle trim to neutral.

For further examples of transmitter setups, go to:

<https://www.rcgroups.com/forums/showthread.php?2818371-Lemon-Stabilizer-Plus-configurations>

Annex D: Setting up a DX6i for the StabPLUS

The Spektrum DX6i is no longer available, but as one of the most popular transmitters of recent years there are still vast numbers of them in use. The DX6i has two-position switches on channel 5 (Gear/F-Mode), channel 6 (Flap/Gyro) and on Mix Ail D/R and Elev D/R. It has two programmable mixes.

The methods explained earlier can be used to work around the DX6i's switch limitations, or the Gear switch, a programmable mix and a second switch (such as Mix), can be used to simulate a three-position switch:

```
MIX 1  
GEAR →GEAR ACT  
RATE D 0% U -100%  
SW MIX TRIM INH
```

Note that the Elevator D/R switch can be substituted for Mix.

If the GEAR channel is set to **Reverse**, this mix will produce -100%/0%/100% output, functioning as follows:

- Gear switch in Position 0: Gives Stabilization OFF (100%) for either position of the Mix switch.
- Gear switch in Position 1:
 - Mix switch in Position 0 gives Autolevel mode (-100%).
 - Mix switch in Position 1 gives Gyro mode (0%).

Since the StabPLUS is usually ON in flight, this allows easy switching between Gyro and Autolevel.

If the GEAR channel is left in **Normal**, the mix will have the following result:

- Gear switch in Position 0: Gives Autolevel (-100%) for either position of the Mix switch.
- Gear switch in Position 1:
 - Mix switch in Position 0 gives OFF (100%).
 - Mix switch in Position 1 gives Gyro mode (0%).

This allows Autolevel to be reached easily from either OFF or Gyro.

Which way you set it up is your choice.