Hyperion 7-channel Stabilized Receiver

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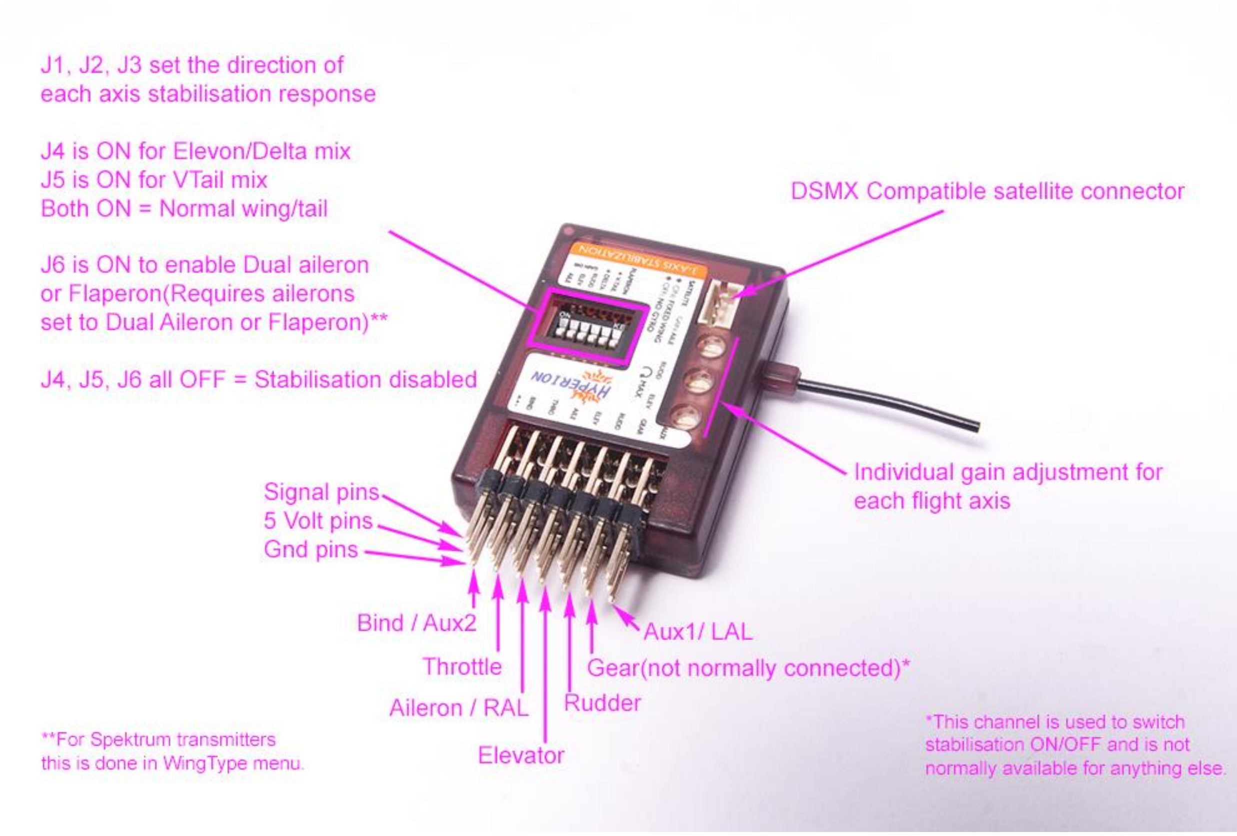


The Hyperion DSMX™ Compatible Receiver with Integrated Stabilizer

The Hyperion 7-channel stabilized receiver, shown above, is expressly designed as a "simple" integrated, full range, DSMX™ compatible receiver and rate-gyro stabilizer for electric models. This receiver is not an autopilot or self-leveling device. It will not fly the plane for you. It is designed simply to smooth out flight and thus make flying in wind and turbulence a pleasure rather than a risk. The Hyperion stabilizer is very small and light. Despite its low cost, it offers both high quality and high performance. A Hyperion DSMX™ compatible satellite receiver can be added to further improve performance. A dual antenna "diversity" version is also available. The unit is compatible transmitter of five channels or more, including the basic DX4e™ and DX5e™ units, as well as computer transmitters such as DX6™, DX7™, DX8™ and DX9™. It can also work with open source transmitters such as Taranis using a DSMX™ compatible module. The unit provides mixing capability for elevon (delta) and V-tail, and supports dual aileron and flaperon functions. The first part of this document provides **basic instructions** for installing and adjusting the Hyperion stabilizer. For many users, the Basic Instructions section should supply all necessary information. The second part of the document provides more **detailed information** on various aspects of operation and should be consulted as necessary.

Basic Instructions for Using the Hyperion Stabilized Receiver

NOTE: These basic instructions assume you are using a Spektrum™ transmitter.

1. Set up the transmitter

If using a computer transmitter, set up a new model. Disable any elevon (delta) or V-tail mixing – if these mixes are required, they must be done in the stabilizer (see page 13). Make sure control throws (end points/limits) are set to 100% (80% for open source firmware transmitters, FRSky Taranis, and etc)

2. Bind the receiver

Bind the receiver to the transmitter in the normal way. If you are using a satellite it must be connected during this process. Completion of the bind is indicated by solid lights on the receiver (and satellite if used). Be sure to turn off both receiver and transmitter and remove

3. Test the receiver in non-stabilized mode

Check that all stabilizer switches are in the OFF position. 2 Turn on the transmitter and then the receiver. Check that both green and red LEDs next to the connectors are on, indicating that the receiver is operating properly in non-stabilized mode.

Temporarily plug a servo into each of the Ail, Ele, and Rud outputs and check that they operate normally in response to the correct transmitter Sticks. Power off.

4. Test the receiver in stabilized mode

Set switches J4 and J5 to the ON position. Power on the transmitter and receiver. Check that the green LED is ON and that the red LED goes OFF when you move the Gear switch. The stabilizer is operating when only the green LED is ON (i.e., red LED ON = stabilizer OFF). Power off.

HINT: *For troubleshooting, plug a servo into the Gear pins (channel 5) on the stabilizer. Theservo should move through about 80-90° when the Gear switch is toggled.*

5. Mount the receiver in the plane

Install the stabilizer flat in the fuselage, aligned with the center line and with the pins at either back or front. The bottom of the stabilizer should be mounted firmly to the aircraft using the supplied double-sided tape. If using a satellite, mount it away from the stabilizer, with the antenna wires straight and at right angles to the main receiver antenna (see page 11). If using the dual antenna diversity version of the stabilizer, ensure that the active portions of the two antennas (the silver section about 31mm long) are approximately at right angles to each other. Take care not to kink the cable. Make sure you can access the three gain pots on the receiver, as you will need to adjust them, perhaps repeatedly.

Note that the receiver can be mounted upright or inverted with the servo connectors at front or back. It will not work properly if mounted across the fuselage, on edge, tilted forward or backward, or at an angle to the center line. This receiver, unlike many other stabilizers, does not need to be mounted very close to the center of gravity of the model. Both receiver and satellite (if used) must be firmly attached.

6. Connect servos and speed control (ESC), set switches and wing type

Plug the servos and ESC into the appropriate slots on the receiver. Normally, the Gear slot (channel 5) will be empty, as it is used internally by the receiver to turn stabilization on/off. Set switches J4, J5 and J6 on the receiver as indicated below.
For Spektrum™ transmitters, set wing type on the transmitter as shown; in all cases, the tail type is Normal. Note that mixing for elevons or V-tail is done in the receiver; the transmitter must NOT be programmed for V-tail or elevons. By default the switches on the stabilizer are OFF. This means the stabilizer is inactive and the receiver operates as a normal unstabilized 7-channel receiver.

Conventional controls with single aileron servo or two servos and a Y-cable:
Channels: 1 –THR, 2 – AIL, 3 – ELE, 4 – RUD, 5 – XXX.
Switches: J4 – ON, J – 5 ON, J6 – OFF. Wing type: Normal.

Conventional controls with aileron servos on separate channels:
Channels: 1 – THR, 2 – R-AIL, 3 – ELE, 4 – RUD, 5 – XXX, 6 – L-AIL.
Switches: J4 – ON, J – 5 ON, J6 – ON. Wing type: Dual Ail or Flaperon.

Elevon (Delta wing) control configuration:
Channels: 1 – THR, 2 – R-ELEV, 3 – L-ELEV, 4 – RUD3, 5 – XXX.
Switches: J4 – ON, J – 5 OFF, J6 – OFF. Wing type: Normal (NOT Delta).

V-tail control (single aileron servo or Y-cable):
Channels: 1 – THR, 2 – AIL, 3 – R-TAIL, 4 – L-TAIL, 5 – XXX.
Switches: J4 – OFF, J – 5 ON, J6 – OFF. Wing type: Normal. Tail type: Normal (NOT V)

V-tail control (separate aileron servos):
Channels: 1 – THR, 2 – R-AIL, 3 – R-TAIL, 4 – L-TAIL, 5 – XXX, 6 – L-AIL.
Switches: J4 – OFF, J – 5 ON, J6 – ON. Wing type: Dual Ail or Flaperon. Tail type: Normal.

Important safety warning: Leave the motor unconnected or remove the propeller when testing or programming. Electric models can cut you. Summary of the Settings for Various Control Configurations

Summary of the Settings for Various Control Configurations

Model Type	Channel Assignments								Wing Type	Stabilizer Switches		
	1	2	3	4	5	6	7*	8*		J4	J5	J6
Conventional (one ail channel)	Thr	Ail	Ele	Rud	On/ Off	?	?	Master Gain	Normal	✓	✓	X
Conventional (two ail channels)	Thr	RAil	Ele	Rud	On/ Off	LAil	?	Master Gain	Dual Ail/ Flaperon	✓	✓	✓
Elevon/ Delta Wing	Thr	RElev	LElev	Rud	On/ Off	?	?	Master Gain	Normal	✓	X	X
V-Tail (one ail channel)	Thr	Ail	RTail	LTail	On/ Off	?	?	Master Gain	Normal	X	✓	X
V-Tail (two ail channels)	Thr	RAil	RTail	LTail	On/ Off	LAil	?	Master Gain	Dual Ail/ Flaperon	X	✓	✓

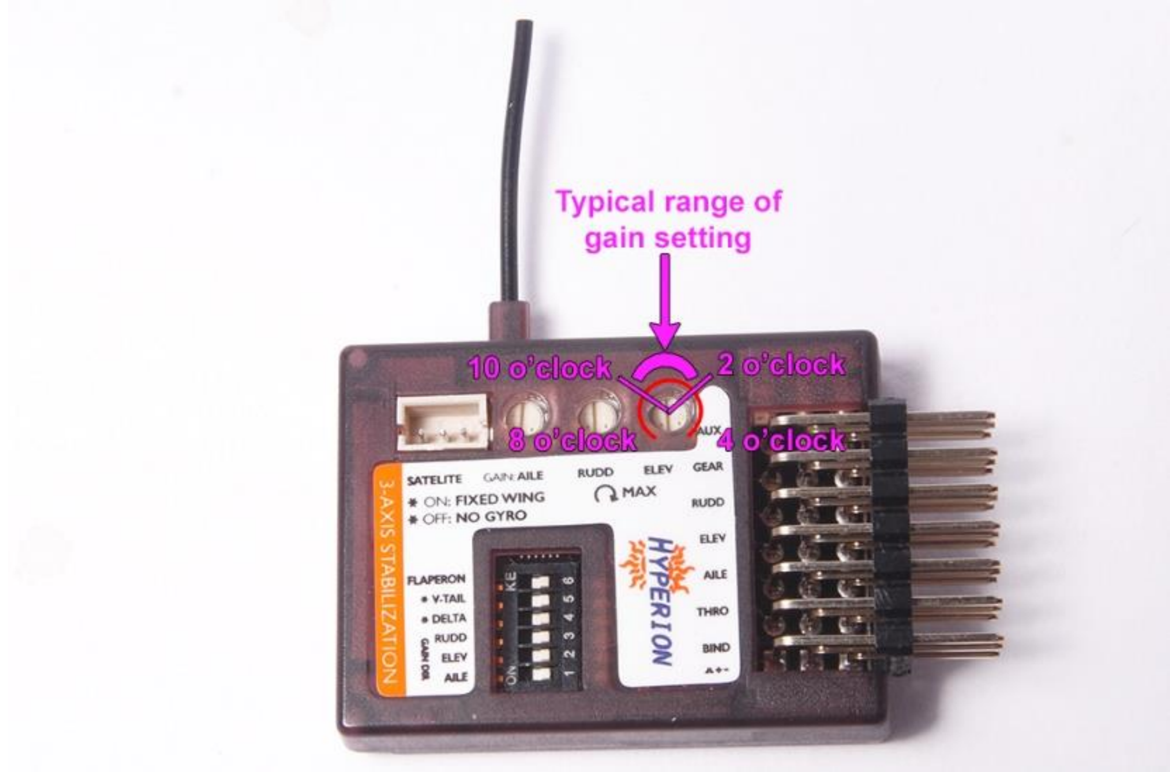
* Use of Channels 7 and/or 8 requires a transmitter with more than six channels.

7. Verify control directions, adjust centering and servo throws

a. Power on. Use the Gear switch to turn the stabilizer OFF (green ON, red ON).[4]
b. If you wish to change the switch direction, reverse the channel in the transmitter. Make a note of how it works so you can switch stabilization OFF quickly if necessary!
c. Adjust transmitter reversing so that all servos work in the correct direction in response to the Sticks. Note that where elevon, V-tail or flaperon mixing is involved it may be Only used if the model has a separate vertical rudder. It is necessary to interchange the two servo connectors and/or reverse controls to get the correct action.
d. With trims in neutral, adjust servo arms and linkages to align your control surfaces. Use only a minimum of subtrim on the transmitter for fine tuning. Servo arms should be at right angles to push rods to ensure equal movement in both directions.
e. With end points (limits) and control rates at 100%, check that control surface throws are at the recommended maximums for the model and adjust linkages if necessary. Note that adjusting throws in the transmitter will not affect stabilization, so throws need to be set mechanically to give the stabilizer enough control; the exact amount is not critical, as gain will later be used to adjust stabilization.

8. Test stabilization response and direction

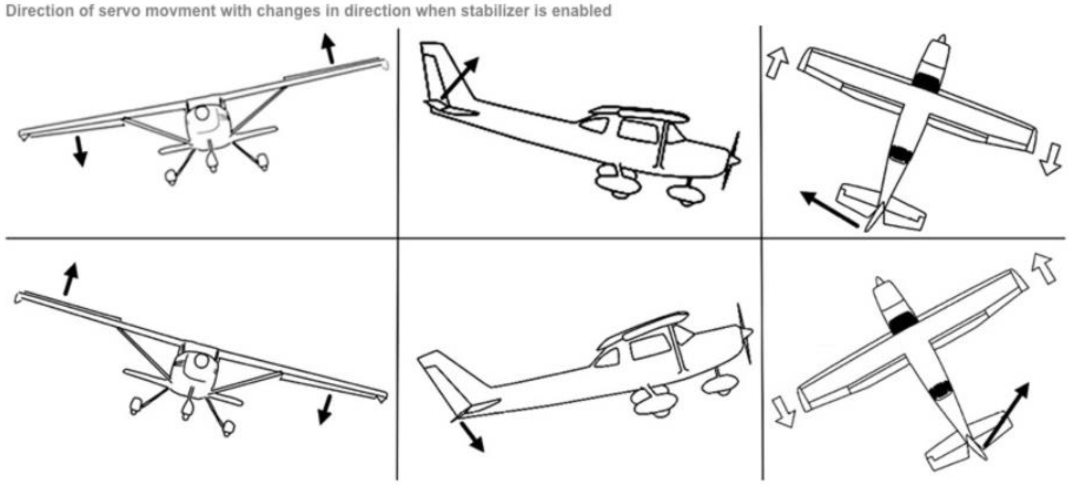
Turn the three onboard gain adjustment pots fully clockwise (maximum). Switch the stabilizer ON using the Gear switch (lights: green ON, red OFF). Sharply move the plane in each of the three flight axes and check that the control surfaces move vigorously to oppose the disturbance. See diagram below. The diagram shows how the surfaces should respond to movement of the model about each axis. When the model is rolled sharply to the right, the right aileron should go down and the left aileron up to resist the displacement.



Likewise, when the model pitches nose-down, the elevator should go up to compensate. And when it yaws nose-right, the rudder should go left.

Note that the control surfaces will only be displaced while the model is being disturbed; as soon as angular motion stops they will return to neutral. So look for quick twitches of the control surfaces in the right directions, not prolonged control offsets.

Direction of servo movment with changes in direction when stabilizer is enabled



THIS IS VITALLY IMPORTANT:
If stabilization moves the surfaces the wrong way (i.e., to increase the disturbance) your model may be uncontrollable (until you switch off stabilization)! To correct this, change the appropriate switch: J1 (aileron), J2 (elevator) or J3 (rudder).

Just as experienced RC pilots check stick directions before the first flight of the day, so a pilot using a stabilizer should check that the surfaces move correctly in response to a disturbance. If you are using channel 8 for Master Gain, set it to the middle of its range

9. Set dual rates and expo in the transmitter

You should already have the control surfaces set up to move in the correct directions and with the full throws recommended for your model. Now you should adjust the response to transmitter inputs by setting dual rates (D/R) and expo. A good starting point for D/R is to set High Rate at 100% and Low Rate at 65-75% for each axis.[6] Expo of 20-30% softens response around neutral and can make smooth flying easier. Stabilization settings also affect the response of the model to the transmitter sticks, typically reducing sensitivity with an expo-like effect. To achieve your preferred response, you may need to adjust your rates and expo once you find out how the model reacts. Note that the dual rate and expo settings determine Stick feel but don't affect how the stabilization works. That is entirely done within the receiver.

10. Adjust the stabilizer gain pots

Set the three gain pots at about the 10 o'clock position. This is a good conservative starting point that will produce noticeable stabilization. For most models, at least one or two gain settings will need to be increased or decreased during flight testing to achieve optimum stabilization. As delivered the stabilizer gains are normally at the 12 o'clock position. Many models fly with gains between 10 o'clock and 2 o'clock but some may require minimum gain (< 8 o'clock) and some maximum gain (> 4 o'clock) on a particular channel. There is no hard rule and gains can only be fine-tuned by observing the behavior of the model at various speeds during flight testing.

11. Prepare for flying

Plug in the motor and/or install the propeller as necessary. Check the control directions and stabilization functions one more time. Do a reduced power range test (should give at least 25m/27 yards range with full control). Check that the Gear switch is operating correctly to turn stabilization ON (green light only) and OFF (green and red lights). Make sure you know which way is which! Test failsafe operation by running the model (well secured) at about half throttle and turning off the transmitter. The motor should stop after a couple of seconds and the control surfaces should stay in their current positions. For more on failsafe, see page 10. If you have Master Gain on channel 8, set it to the middle of its range.

12. Perform a test flight

Before taking off, starting in the OFF position, toggle the Gear (stabilizer) switch back and forth twice quickly (within 1 second) to store the neutral positions of the controls. This "double toggle" should be done before each flight if any of the trims and/or subtrims are far from zero. If little trim/subtrim is used, this step can be omitted. Check that the stabilizer is turned OFF. Take off and fly around, adjusting trim as necessary. Make sure the model flies properly without stabilization. If you make major trim adjustments, do a double toggle to enable the stabilizer to store the new neutral positions. At a safe height, use the Gear switch to turn the stabilizer ON. If the model rolls, dives or turns suddenly, at least one of the gyro direction switches (J1, J2, J3) is incorrectly set. Switch OFF the stabilizer immediately! Land and fix. Likewise if you encounter major oscillation, land and reduce gain in the axis/axes involved. Assuming the model does nothing scary, continue flying to explore the action of the stabilizer. Do a shallow dive to pick up speed and watch for oscillation on one or more axes. If it happens, just throttle back and slow down (oscillation is quite different from control surface flutter and is generally not destructive). Notice how the model handles with the stabilizer turned on. It may be less responsive on one or more axes. Experiment with dual rate settings. Turn stabilization off and on to get familiar with its effects.

13. Fine tune stabilizer gain

Now make a series of flights to optimize the individual gain settings. This will involve repeated landings to adjust each pot on the receiver, followed by retesting in flight, but the basic job can be done relatively quickly. It's a good idea to keep notes.

If you encountered oscillation on any axis during the initial flight, turn down the gain a little for that axis. Then go through the following steps:
– Increase the Rudder pot setting by about an "hour" (15°).
– Take off with stabilization OFF. Turn ON at a safe height with the model in level flight. Watch for oscillation on the yaw axis ("tail wag"). Do a shallow dive to pick up speed and again watch for oscillation.
– Land and adjust the rudder pot as required. If there was no oscillation, even when diving, turn the pot up another "hour" or so. If there was oscillation, turn the pot down roughly "half an hour".
– Take off and retest. You're aiming to set the pot fairly close to the gain that just produces oscillation in normal flying.
– When satisfied, go through the same procedure for the elevator pot.
– Finally follow the same procedure to set the aileron gain pot.
Many people find that on typical models the rudder gain can be quite high, while aileron and elevator end up in the range of 9 o'clock to 2 o'clock. However, the settings vary with factors such as model design, flight speed and control setup.
Note: It's best to do the initial setup and tuning in fairly calm conditions to avoid confusing stabilizer-induced oscillation with buffeting caused by turbulence.
Once you have things adjusted, test the effectiveness of stabilization by flying in windier weather, turning stabilization on and off. You should see a noticeable improvement in smoothness with stabilization turned on.
Note: If you have an eight or more channel transmitter you can use Master Gain to help speed up the process of adjusting the individual gains.

A More Detailed Look at the Stabilized Receiver and its Use

What a Rate Stabilizer Does.

A rate-gyro stabilizer compensates for external disturbances on all three flight axes: pitch, roll and yaw. If your plane is disturbed by an external force (such as a thermal or wind gust) then the gyro sends out a "shot" of opposite control on the appropriate axis using ailerons, elevator or rudder (or elevons or V-tail if used). This will "even out" the flight path and make flying in turbulent conditions much easier. The 7-channel stabilizer is designed to stabilize while keeping interference with normal control to a minimum. To achieve this, the amount of correction is automatically reduced for large Stick excursions. However, the balance between on-board stabilization and transmitter control is a compromise. There is always some stabilizing effect whenever the stabilizer is active. Consequently, if you need maximum airborne response to stick inputs, the stabilizer should be turned off using the Gear (stabilization) switch. It's important to understand that the 7-channel Hyperion stabilizer, unlike some more complex and costly units, does not contain any accelerometers or other sensors to establish an absolute level or direction. The Hyperion does just what most people need – smoothing out flight while leaving the pilot fully in control.

Number of Transmitter Channels

The minimum number of transmitted channels required to use the stabilizer with a conventionally configured, electric-powered, three-axis plane is five. That covers the four flight channels: Throttle (channel 1), Aileron (channel 2), Elevator (channel 3) and Rudder (channel 4); plus Gear (channel 5) to switch the stabilizer on and off in flight. All full range Spektrum™ transmitters have at least five controllable channels and thus can be used with the Hyperion stabilizer. The computer transmitters offer the following possibilities. With a DX6i™ or DX6™, Aux1 (channel 6) can be used to control one of three main possibilities:

(1) retracts or (2) flaps or (3) a second aileron servo (as in a dual aileron or flaperon setup).

A DX7™10 or DX7s™ enables the use of Aux2 (channel 7); for a v3 receiver, this channel only works when stabilization is OFF, but for a v4 or 4.5 receiver Aux2 is available whether stabilization is ON or OFF. A 7-channel transmitter enables any two of the above three possibilities.

A DX8™ or higher transmitter enables internal use of Aux3 (channel 8), giving Master Gain control on a v3 or v4 receiver. It does not provide an additional free channel.

Gear (channel 5) is operated by the ACT/Aux switch on a DX4e™ and the Ch 5 switch on a DX5e™. The new DX6™ introduced in 2014, not the old one from 2006, which is not compatible. Either the old DX7™ from 2007 or the new one for 2015.

Note that no amount of transmitter mixing can change the receiver's use of Gear (channel 5) or Aux3 (channel 8). These channels are permanently committed within the receiver to stabilizer ON/OFF and Master Gain respectively. You can on some transmitters adjust which switches, knobs or sliders actually direct those channels, or you may be able to use mixes from other channels for this purpose, but these channel assignments within the receiver cannot be altered. It follows from all this that you cannot on a conventional powered model have all three of: dual ailerons **and** independent flaps **and** independent gear, even with an 8-channel transmitter. There are simply not enough channels available in the Hyperion receiver. Hyperion do provide Gear (channel 5) output pins on the receiver. But to use that option for flaps or retracts you would have to accept stabilization being turned on and off as the flaps or gear are deployed or retracted. Not very practical.

To summarize, practical arrangements for a powered plane, using a seven or more channel transmitter, include:

– A single Aileron servo (or two servos on a Y-cable) on Ail (channel 2), with Flaps on Aux1 (channel 6) and Retracts on Aux 2 (channel 7);

– Separate Aileron servos on Ail (channel 2) and Aux1 (channel 6), with Retracts **OR** flaps on Aux 2 (channel 7); this arrangement would allow use of the flaperon function.

Binding

The stabilizer is bound just like any regular DSMX™ compatible receiver, Hyperion or other. Binding is the process of "locking" the receiver to the transmitter so that it ignores any others. Binding is the first step in setting up any receiver and is most easily done on the bench, rather than in the model. Ensure that the transmitter and receiver are separated by 3-6ft/1-2m or the transmitter may "swamp" the receiver. Occasionally it may be necessary to have as much as 10ft/3m separation to achieve binding. Generally you should only need to bind once, unless you change transmitters, and, after binding normal link-up should not require more than 2-3 feet/1m of separation.

Step 1. Power up the receiver in bind mode

Put the bind plug on to the Bind/Aux2 pins. Connect the plug from a suitable power source to any of the receiver servo outputs. The power source can be:

– A receiver pack battery (3.45 - 7.2v); or

– A stand-alone BEC (battery eliminator circuit); or

– The throttle connection from an electronic speed control (ESC) with built-in BEC.

If using a speed controller as the power source, and it is installed in a model, make sure the motor is unplugged or the propeller is removed for safety. If you are using a satellite with the stabilizer, then binding must be done with the satellite connected. Binding can be done with or without servos. Servos plugged in the wrong way round may prevent binding, so check this if you have difficulty. The LEDs on the receiver (and satellite, if used) will flash rapidly to indicate bind mode. If they don't, you have a problem (such as a reversed power connector). Don't go any further until you get rapid flashing.

Step 2. Turn on transmitter in bind mode

On some transmitters entering bind mode requires holding the Bind or Trainer button/switch while powering up. Others require opening a menu to enable bind mode. If appropriate, continue to hold the switch/button until the receiver LED stops flashing. Release it at that point and the bind process will complete. A solid green or green and red light indicates a successful bind. Some transmitters will display on-screen (and/or announce) the type of bind DSMX™ and the frame rate. If a successful bind is not achieved, remove power from the receiver and repeat the whole process with the transmitter at a greater distance. Avoid trying to bind in close proximity to large metal objects such as chain link fences, vehicles or a furnace.

Step 3. Power down and test

Remove power from the receiver, **remove the bind plug**, and switch the transmitter off. If you didn't use servos while binding, plug in one or more now to channel 2, 3 or 4. Turn the transmitter back on, then apply power to the receiver. Check that the receiver is operating properly and that servos respond to the transmitter controls. Check that the Gear switch turns stabilization on (green light only) and off (green and red lights).

Failsafe

It's important to note that the Hyperion stabilizer, unlike some other receivers, does not use preset failsafe. Instead, on loss of signal the pulses for all channels stop completely. The speed control (ESC), after a brief delay, shuts down the motor, and all servos simply stay where they were when signal was lost. Control is quickly restored when the signal returns. This is a satisfactory arrangement for electric powered models such as those for which the Hyperion stabilizer is intended. One advantage is that, unlike other failsafe arrangements, it doesn't rely on the operator to ensure that the throttle is set correctly at bind time. It does, however, make the unit unsuitable for use in fuel-powered models where the throttle servo must be driven to a preset safe position (low) on loss of signal. Note that a few very old ESC designs may not shut down when pulses are removed. This unsafe behavior makes them unsuitable for use with the Hyperion stabilizer (and most other systems). Be sure to test failsafe for any new setup.

Orientation of the Receiver Unit

The most common arrangement is to mount the stabilizer level and upright, aligned with the center line of the fuselage, with the connector pins toward the tail. The stabilizer can, however, be flipped 180˚ on any of the 3 axes. A common arrangement that presents no problems is mounting the stabilizer upside down for access from the bottom of the model. The stabilizer will not work properly if rotated 90˚ on an axis. This means that with normal channel assignments you cannot fasten it to the flat side of a profile aircraft. Nor can you mount it across the fuselage. It must align with the matching aircraft axes. The receiver can be mounted in certain other orientations, but doing so requires switching channel assignments.

What the LEDs mean – in more detail

Status			Lights		
Transmitter	**Receiver**	**Stabilizer**	**Green LED**	**Red LED**	**Internal LED**
Normal Operation					
OFF	ON	-	✖	✖	✖
ON	ON	ON	✔	✖	✔
ON	ON	OFF	✔	✔	✔
DSM2 only	"Brownout"[13]				Flashing
Binding					
ON or OFF	BIND MODE	-	Rapid Flash	Rapid Flash	Rapid Flash
BIND MODE	BINDING	-	Flashing	Flashing	Slow Flash
BIND MODE	BOUND	ON	✔	✖	✔

Bottom line: A properly bound, active stabilizer will show only a solid green LED. The red LED will come on when you turn the stabilizer OFF using the gear channel or the DIP switches.

The 7-channel stabilizer has three LEDs: red and green ones on the top near the connectors, and a red one on the back of the PC board, inside the case. This single internal LED can normally be ignored as it mostly just mirrors some of the actions of the green LED.

Status Lights

Bottom line: A properly bound, active stabilizer will show only a solid green LED. The red LED will come on when you turn the stabilizer OFF using the gear channel or the DIP switches.

Aerials, Satellites and Range Checking

All Hyperion receivers, including the stabilizer, are "full range". This means that they have ample range for all normal visual flying (as opposed to long range FPV flying). Modern 2.4 GHz receivers work very well indeed but under some conditions the radio link can be interrupted by factors such as nearby metal fencing or conductive objects within the model. The reliability of the link for a given range is affected by the number of aerials (antennas) and their orientation, as well as by the installation of the receiver in the model. The base Hyperion stabilizer has one aerial wire. For the strongest and most reliable reception, the wire should stick straight out from the stabilizer; an aerial bent along the stabilizer case

may reduce reliable range. Likewise, locating the aerial wire very close to motor wiring, the battery or other conductive objects may reduce reliable range. A satellite (remote receiver) enhances reliability by adding signal diversity. It provides a second independent receiver that can be well separated from the main receiver, thus sampling a different part of the radio transmission field. From moment to moment, the main receiver selects the stronger of its own signal or that of the satellite. If a satellite is connected, most reliable reception is obtained when its aerial and that of the stabilizer are at right angles. The two wires of the satellite aerial should be in a straight line. The satellite should be mounted so that it cannot move around in the model.
Note: The brownout warning will be triggered if you turn the receiver off and back on again without also power cycling the transmitter.

To verify a new installation or to check radio operation before the first flight of the day, use the range check function on your transmitter. This temporarily attenuates transmitter power so that range is reduced by a factor of about 30. With Spektrum™ and similar transmitters, full control at "30 paces" (roughly 27yds/25m) with the transmitter in range check mode indicates ample range for normal visual flying. In many cases the receiver will show considerably more range than this, but the important thing for safe flying is that it meet the 30 paces go/no go standard.

Master Gain Control

If the transmitter has eight channels or more, then Aux3 (channel 8) controls the overall Master Gain of the stabilizer system. The Master Gain function multiplies the setting of the individual gain pots by a factor that can range from 0 to 2. In other words, with Master Gain turned full up the gain setting of each individual axis will be roughly doubled. If turned full down, there will be little or no stabilization on any axis, regardless of the setting of the pots. For Master Gain to be useful it is best controlled by a knob, slider or lever on the transmitter. To check operation, make sure stabilization is ON (green LED on, red off) and set the Master Gain control to one end of its travel. Move the model rapidly about the yaw, pitch and roll axes. If the control surfaces respond vigorously when the model is disturbed, you have identified the full gain setting. Test again with the control at the other end of its travel. If nothing much happens either way, make sure stabilization is turned on and the individual pots on the receiver are somewhere around middle setting or higher.
You can use channel reverse in the transmitter to reverse the operation of the knob/slider/lever controlling the Aux 3 channel. Most people intuitively think of clockwise as increase for a knob and upwards as increase for a slider or lever.

Understanding Master Gain

Think of the three stabilized channels as the three inputs of a three-channel audio mixer. The on-board rotary controls or pots (potentiometers) are like the three individual volume controls. The Master Gain is the overall volume control. It modifies the levels of all three channels and turns them up or down together. The individual gain values are all **multiplied** by the value of the Master Gain, controlled by Aux3 (channel 8).
– With the Master Gain in the center (Aux3 = 0%) the gain value is 1 and the individual gain values as set by the pots are unaffected.

– If Aux3 is at -100%, Master Gain is very low and the individual gains become very small.
– If Aux3 is at +100%, the Master Gain is nearly 2x and the individual gains have almost twice their usual effect.
To turn the stabilizer completely off with Master Gain, the low end of Aux 3 must be -150% on a Spektrum™ or JR™ transmitter. In practice many people initially set Aux3 at 0% (middle position) so that the Master Gain multiplier is 1x, then, as explained in Basic Instructions, they adjust the individual gains to give good stabilization without any oscillation. Master Gain can greatly help in this process and can subsequently be used to turn the overall gain up or down to suit changing flight conditions.

If your transmitter has seven channels or fewer, Master Gain will default to a value of 0.8. This is a practical compromise erring on the side of Safety so that the individual pots have a good range of control but are less likely to induce oscillation if set too high.

Using an Open Source Transmitter (Taranis, 9XR, etc.)

The Hyperion stabilized receiver can be used with a transmitter other than Spektrum™, provided it has a DSMX™ compatible module installed.
Transmitters such as the FrSky™ Taranis, and FlySky™
with Er9x all use open source firmware that can be easily programmed to emulate the output of a Spektrum™ transmitter, including such functions as flaperon mixing. While the programming steps are slightly different for the various transmitters, the following suggested setup can be applied to any of them:
– Channels 1-4 set up as a simple four channel model with channel order TAER
– Channel 5 set up to give +/- 100% in response to a suitable two-position switch.
– Channel 6 is available for dual aileron, flap or gear, as required.
– Channel 7 is available for dual aileron, flap or gear, as required (v4 receiver).
– Channel 8 set up to provide +/- 100% in response to a knob, slider or lever.
Set limits of 80% on all channels to match Spektrum™ 100% pulse width.
Reverse channel 2 (aileron) and channel 4 (rudder) to match Spektrum™. This will give you a transmitter that works very much like a DX8™ and that provides a good basis for setting up the stabilizer according to the Basic Instructions provided earlier.

Mixing and the Hyperion Stabilized Receiver

Step 6 in the Basic Instructions should give you the information you need to set up elevon, V-tail or flaperon mixing with the Hyperion Stabilizer. The purpose of this section is to explain further how all this works. The key point to understand is that the Hyperion stabilizer only recognizes and corrects for movement in the three standard flight axes. Consequently, the stabilizer expects the transmitter to provide the conventional “pure” inputs: roll (aileron), pitch (elevator) and yaw (rudder). Any processing (mixing) needed to turn these inputs into servo commands for a non-standard control arrangement such as elevon or V-tail has to take place in the stabilizer itself, NOT in the transmitter. By contrast, flaperon mixing takes place in the transmitter.

What is mixing?

In a simple control setup, each axis has a dedicated control surface (or pair of surfaces in the case of aileron). Each axis is controlled by a separate channel passed from the transmitter through the receiver (and its integrated stabilizer) and on to the servo that moves the control surface. For the Hyperion receivers, channels 2, 3 and 4 are used, respectively, for the three basic controls, aileron, elevator and rudder.

Mixing is the process of combining transmitter inputs to provide the servo output(s) required for control. For many purposes, the mixing is done in the transmitter. For example, throttle can be mixed to elevator so that as power is increased, a small amount of down is added to the elevator signal in order to counter the model's tendency to climb. Another common mix couples aileron and rudder to aid in coordinating turns. The important thing about such mixes for our purposes is that they don't affect the basic arrangement of allocating one channel to each control axis or function. Consequently, they still provide the separate inputs required by the stabilizer. The V-tail and elevon mixes we are concerned with are different in that they involve two separate and independently driven control surfaces working together to provide a single aerodynamic function. For example, a pair of elevons must work in unison to produce pitch and in opposition to generate roll. To achieve this, the mixing MUST be done on board, since the stabilizer cannot interpret inputs in the form of "mixed" control commands; it only understands roll, pitch and yaw. Any V-tail or elevon mixing in the transmitter must therefore be disabled. Flaperon is another case where two inputs (aileron and flap) are involved, but here the mixing is done in the transmitter. Let's take a look specifically at how these three types of control setup are dealt with in relation to the Hyperion Stabilized Receiver. The terms "J" and "DIP" refer to the six small white slide switches on the receiver.

V Tail

In this arrangement, the functions of elevator and rudder are managed by tail control surfaces that move up or down together for **pitch**, right or left together for **yaw.**
In the transmitter **tail type** (if available) is set to Normal; this ensures that separate (not mixed) elevator and rudder signals are sent to the stabilizer. In the receiver, DIP switch J4 (elevons) is OFF and DIP switch J5 (V-tail) is ON, thus activating on-board mixing. The setting of DIP switch J6 depends on the aileron configuration. The tail servos are plugged into channels 3 and 4.

Elevon / Delta Wing

This arrangement is generally used for a tailless aircraft, such as a flying wing or delta, in which the wing control surfaces (elevons) are used to control both **pitch** (elevator) and **roll** (aileron). The elevons move up or down together for pitch and in opposite directions for roll. In the transmitter **wing type** is set to Normal. In the receiver, DIP switch J4 (elevons) is ON to activate mixing. DIP switches J5 (V-tail) and J6 (flaperon) are OFF. The elevon servos are plugged into channels 2 and 3.

Flaperons (dual aileron servos)

The flaperon arrangement enables the ailerons not only to move in the usual opposite directions to produce **roll**, but also to move together downward to produce flap action (and possibly upward to produce spoiler action), thus controlling **lift and drag.**
This dual function capability requires that each aileron servo have its own channel: normally channel 2 for right aileron (RAil) and channel 6 for left aileron (LAil). The stabilizer passes the control inputs sent by the transmitter through to the two aileron channels. The inputs can include not only flaperon mixing but also differential aileron (more up than down to compensate for adverse aileron drag). Unlike V-tail and Elevon, where the mixing happens in the stabilizer, aileron/flaperon mixing takes place in the transmitter. For the stabilizer to apply corrections to both ailerons in response to wind gusts, etc., switch J6 must be ON. (If it is OFF, only the right aileron (CH2) will have stabilizer action.) In the transmitter, **wing type** should be set to Dual Aileron or Flaperon, as appropriate. If flaperon is used, then Flap mixing must be applied; this usually includes mixing to the elevator channel to compensate for the pitch effects of flap action. Also, differential aileron can be applied if required. In the receiver, DIP switch J6 (flaperon) is ON to enable stabilization on the second aileron channel. DIP switches J4 and J5 are ON (except for a model with a V-tail, when J4 must be OFF) . The right and left aileron servos are plugged into channels 2 and 6 respectively.

Reversing Controls and Corrections

The direction of response of the control surfaces to the transmitter inputs must be checked and corrected, if necessary, **AFTER** any mixing is set up for V-Tail, Elevons and Flaperons. To avoid distracting control surface motions, stabilizer action should be turned OFF with the Gear switch during this process (mixing occurs whether the stabilizer is on or off). Note that it may be necessary not only to use channel reversing in the transmitter but also to interchange the plugs of the two servos involved in the control mixing. For example, if both V-tail surfaces move sideways when the elevator Stick is moved, interchange the plugs in channels 3 and 4. Then use channel reverse in the transmitter to adjust the direction. When all control settings and mixing are completed, and the control directions are correct, the direction of the stabilizer's response to a flight disturbance must be set for each axis. Checking must be done with the stabilizer turned ON and in accordance with the instructions provided earlier (see page 5). To change the direction of response for an axis, use the appropriate DIP switch: J1 (aileron), J2 (elevator) or J3 (rudder).

Recalibrating the Gyros

The stabilizer as supplied is fully calibrated and normally requires no further adjustment. A problem in manufacturing, or a situation such as operation in temperatures far from the nominal 25 degrees Celsius (77F), might require recalibration of the gyros to avoid control surface offset when stabilization is turned on.

What causes the problem?

The stabilizer reads gyro values and multiplies them by the gains set by the potentiometers; this creates output values used to generate corrections that drive the servos. Every gyro has an inherent offset that is calibrated out when the stabilizer is manufactured. Normally, this initial calibration lasts for the life of the stabilizer, but if for some reason it is not done correctly in the first place or things change later, there will be an offset on one or more channels. This will show up as control surface deflection when stabilization is turned on, followed by a return to neutral when stabilization is turned off. Correcting this issue requires recalibration of the gyros.

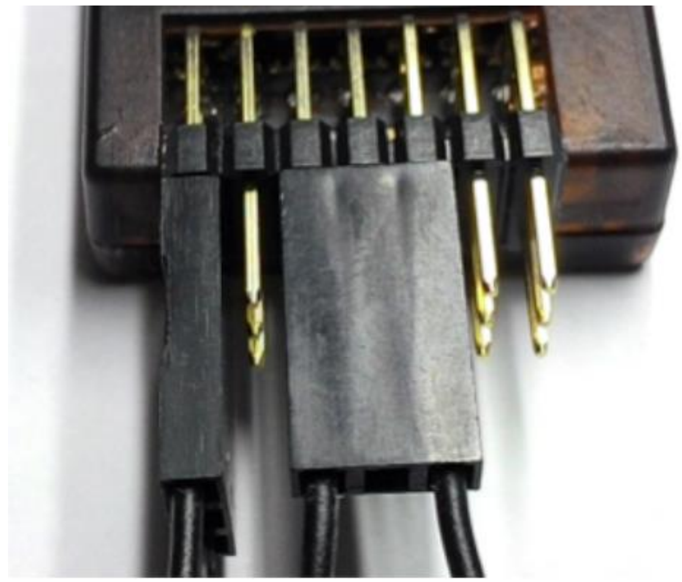
Recalibration is only needed if a control surface moves from neutral and stays there when the stabilizer is turned ON, then returns to its previous position when the stabilizer is turned OFF.

Please note: Gyro recalibration has nothing to do with the “double toggle” gesture mentioned. The purpose of that feature is to allow the stabilizer to identify the current neutral positions of the Sticks.

How to recalibrate the gyros.

Stabilizers can be recalibrated by the user,

Recalibrating (green flashes only at power-on)



1) Unplug any power source for the stabilizer.
2) Connect two bind plugs as shown in the photo.
3) Provide power for the stabilizer. Make sure the gyro does not move. It must experience absolutely no vibration or movement. The green LED will flash 3 times to indicate the beginning of gyro calibration.
4) After 1 second the green LED will again flash 3 times to indicate gyro calibration complete.
5) Remove the two bind plugs.
6) Power cycle the unit and test operation.
7) If the offset problem is not solved, repeat the above steps and make sure there is no movement or vibration of the unit. Even a tiny, invisible movement will prevent proper calibration.

Note: It should not be necessary to re-bind the receiver to the transmitter after this procedure.

NOTICE

for more details visit www.Hyperion-World.com. In using this manual, you agree that you accept all responsibility.