Spektrum™ DX6G2, DX7G2, DX9 (includes Black), DX10t, DX18, DX18QQ, DX18 G2 (includes Stealth), and DX18t. The older DX8, and the original DX18 Futaba/Hitec or JR/ Airware PowerBox FrSky are registered trademarks and are only mentioned to provide the customer with a description of the compatibility of the product.

Instructions

Hyperion DSMX™-Compatible 7-Channel Full-Range Integrated Telemetry Receiver

Full Range with Diversity Antenna and PPM

The Hyperion 7-Channel Integrated Telemetry Receiver combines in a single compact package the functions of a high performance DSMX™-compatible radio control receiver and a full-range telemetry unit that supports Spektrum™ telemetry-enabled transmitters.

Contents

PART 1. Overview

– Both the radio control receiver and the telemetry transmission functions of the Hyperion unit are classified as full range. This is achieved using dual antennas and diversity switching to ensure maximum signal reliability in both directions. Note, however, that while the receiver has control signal range well beyond the normal limits of visibility, the lower power of the return telemetry signal means that the telemetry display may occasionally freeze while the model is still under full control.

– The low noise amplifier (LNA) in the receiver ensures maximum sensitivity to detect weak radio frequency (RF) signals. Users should experience a noticeable improvement in range compared to the previous generation of Hyperion receivers and to other brands of DSMX™ receivers and compatibles. Independent testing has shown this receiver to have significantly more range in a standard reduced power range test than several other comparable receivers that were tested under identical conditions.

– The unit has antennas of the extended type for versatile placement in many types of application. The active receiving/transmitting element is the last 32mm of the antenna cable, which has semitransparent white PVC shield.

– In addition, a DSMX™ satellite receiver can be attached to enhance signal security. Satellites with and without diversity antennas are available from Hyperion.

– Telemetry from the unit can both be displayed on-screen and spoken by current Spektrum™ telemetry-enabled transmitters: DX6G2, DX7G2, DX9 (includes Black), DX10t, DX18, DX18QQ, DX18 G2 (includes Stealth), and DX18t. The older DX8, and the original DX18, can display data on-screen, but lack voice capability and therefore cannot speak alarms. [1]

– Built-in sensors provide receiver voltage, internal temperature and RSSI (signal strength). The included external sensors add flight pack battery voltage (when connected to the positive connection of the flight battery) and a more accurate external temperature probe that automatically replaces the internal value.

 An optional voltage/current (V/I) sensor is available that measures up to 30V and 60A (see the Hyperion website under Accessories).

 A true RSSI (Received Signal Strength Indicator) presents values on a scale of 100 to 0 as signal declines; the value is displayed as parameter "A" on the transmitter’s Flight Log page.

 RSSI Out for support of an on-screen display (OSD) is also available from the receiver (using the supplied lead) in the form of an analog voltage ranging from 3V (=100%) to 0V.

 The unit requires a power supply of 4.5V to 7.4V. **It is important to note the minimum voltage**, which is higher than required by most Hyperion receivers. In particular, this receiver cannot be operated from a single LiPo cell.

 The pins labeled Bind/AUX2 do double duty as bind pins as well as Channel 7 (AUX2); when a bind plug is present the receiver shuts down servo output. Either the servo can be connected after binding or it can be attached to one branch of a Y-cable, with the bind plug inserted into the other branch and then removed after binding.

 No separate stand-alone telemetry unit is required with this receiver. Nor can such a unit, Hyperion or other, be connected, as the second data stream would interfere with that of the integrated unit.

 User Preset Failsafe on all channels can be set by the press of a single button on the receiver. If failsafe is not set, the unit defaults to emitting no pulses on loss of signal.

[1] Unlike the Hyperion stand-alone telemetry unit, this receiver does not work with the now obsolete Spektrum™ TR1000STi Telemetry Interface for iPad and iPhone.

- The receiver can be set to output either individual PWM signals for each channel or a combined PPM (cPPM) signal (in either Futaba/Hitec or JR/Spektrum™ channel order) carrying information for all channels on a single wire.
- LED lights indicate the receiver status as follows:
  - RED: SOLID – successful bind RF link to transmitter; FLASHING RAPIDLY – bind mode;
  - GREEN: OFF – no pulse on signal loss; SOLID – preset failsafe;
  - BLUE: OFF – PWM servo mode; FLASHING – PPM-F mode; SOLID – PPM-J mode;

Figure 1.1 What you get in the package.

The pack voltage/current sensor shown on the left is not included with the receiver as standard. It is an additional accessory and is the same as used with the Hyperion stand-alone telemetry unit.

Figure 1.2 The Hyperion 7-channel Receiver/Telemetry Unit removed from its case.

This shows what the receiver looks like without its case and identifies the various connections. The three white connectors for the Satellite and the two telemetry leads are identical and not all oriented the same way. Nor are the wires all color-coded. Take special care to follow the labels on the case when plugging them in, particularly the voltage sense wire. Connecting the pack voltage to the wrong pin will almost certainly cause damage.

PART 2. Using the Hyperion Receiver/Telemetry Unit

A. Basic Requirements and Setup

Transmitter

To provide both radio control and telemetry, this receiver requires a Spektrum™ DSMX™ telemetry-enabled
transmitter

It will function as a receiver only (no telemetry) with a wide range of other Spektrum™ transmitters and modules, as well as with various compatible transmitters and modules.

The receiver operates only at 22mS frame rate and will output 22mS frames even if the transmitter frame rate has been forced into 11mS mode. With a DSM2™ transmitter, or a DSMX™ transmitter in DSM2™ mode, the receiver will automatically switch to DSM2™ when it detects the bind signal.

Installation

The receiver should be installed using normal good practices for 2.4 GHz equipment. Particular attention should be paid to the location and orientation of the active portion of the dual antennas (the last 32mm of the cable, from which the outer sheath has been removed to expose the white inner cable). The two antennas should be routed so as to achieve wide separation with the active portions at right angles to each other. The active portions of the antennas should be reasonably straight for optimum receiving and transmitting performance, but the rest of the cable can be curved gently as required. The coaxial cable used for antennas is fragile and must not be kinked or allowed to flop around or vibrate excessively.

The active portions of the antennas should not be immediately adjacent to conductive items such as wiring, ESC, battery or carbon fiber that could block the signal (note that non-conductive materials like most foam, balsa, ply, etc. pose no problem[2]). The antennas should be located so that regardless of the attitude of the aircraft, at least one of them has a clear line of sight to the transmitter. For example, it is important to avoid locating the active portions of the antennas where both can be blocked simultaneously by the battery from receiving a good signal.

It is important to conduct a rigorous reduced power range test before the first flight. The model should be placed on a wooden table or similar non-conductive support. Put the transmitter into Range Test mode (see transmitter manual). With the receiver turned on, walk away about 25m (30 paces) and then circle the model while testing control. If there are any angles at which control is reduced or lost, go back and review the installation.

If telemetry is functional, the RSSI value should be monitored during the range test; this will help to identify any problems with the installation (see section 3B, page 9, for additional information on RSSI).

At the beginning of each subsequent flying session, do a brief reduced power test at 25m to check that all is working properly. There is no need to repeat the circling of the model.

2 Some foam plastic and heat shrink tubing is conductive and can interfere with reception. To test a material, zap it in a microwave oven for a few seconds. If it warms up, it should not be used near the receiver or antennas.

Power Requirements

This receiver requires a higher voltage power supply than most other Hyperion receivers, although it will recover well from brief low voltage brownouts. Ensure that under load your BEC or receiver battery does not fall below the 4.5V minimum at any time.

Be aware that some cheap “3A” BECs, including those in ESCs, are optimistically rated and can easily be overloaded by multiple servos and other high drain devices such as are found in some modern park flier size “Ready to Fly” aircraft equipped with retracts, flaps, lights, sound systems, etc. Some 4.8V NiMH receiver packs also have limited current capability and may drop voltage significantly under load; be sure to use cells that can deliver adequate current for the load placed on them.

B. Binding

Binding requires that the receiver be put into bind mode first and that the transmitter then be powered up in its bind mode (see your transmitter manual for specific instructions).

Procedure

1. Insert the bind plug into the first set of pins (labeled Bind/AUX2) with no power connected (Figure 2.1). If a satellite is to be used it must be connected while binding.

Figure 2.1 – Bind plug inserted with power disconnected.

2. Provide power via ESC, BEC or separate receiver pack (here the ESC is connected to channel 1). Once the battery is connected, a rapidly flashing RED LED beneath the receiver (and on the satellite if used) indicates bind mode. Do not proceed to step 3 unless the light is flashing correctly.

Figure 2.2 – Solid red light on bottom of receiver indicates successful binding.

3. Turn on the transmitter in bind mode approximately 2 meters away from receiver. The receiver LED should change to slowly flashing, then to steady RED indicating successful bind (see Figure 2.2). If you don’t get a solid red light on the receiver (and satellite if used), see the advice below.

4. For **normal operation** of the receiver, remove the power and bind plug at this point; **OR** To set **Failsafe** (Section 2C) or **PPM mode** (Section 3A), leave power connected and bind plug in place.

Binding Problems

It is not unusual to encounter difficulties binding DSM-type receivers, with the receiver either continuing to flash rapidly or starting the bind process but never attaining the solid light that indicates a link. Being very sensitive the Hyperion Telemetry Receiver may be a little fussier than usual about bind conditions. Bind problems can usually be overcome by simply increasing the distance between transmitter and receiver during bind. Even then, more than one try may be needed to achieve success. For each try, repeat the entire sequence, starting with both receiver and transmitter powered down. If binding fails at 2 meters, start again, moving further away before turning on the transmitter in bind mode, and have your body between the transmitter and receiver to attenuate the signal further. When binding, stay away from metallic objects (such as cars, wire fences and steel tables), as well as damp ground and other conductive surfaces. Wireless routers and other WiFi sources can also inhibit binding.

C. Failsafe

Failsafe will be activated whenever the receiver is unable to receive a signal from its bound transmitter for about one second. Once a valid signal is again received the receiver will resume transmitter control. The default failsafe action if Preset Failsafe is not used is for the receiver to cut off pulses on all channels.

This will cause most modern speed controls (ESCs) to shut down the motor and will leave servos wherever they happen to be at the moment. In this mode, the green light is OFF.

***WARNING**: Default failsafe is unsatisfactory for IC (fuel) powered models, as the engine will continue to run at the power set by the throttle servo when the signal was lost.*

The optional User Preset Failsafe, indicated by green light ON, provides specific outputs on each of the seven channels in the event of signal loss. Preset Failsafe is activated as follows:

1. For electric models, remove the propeller(s) or otherwise ensure that the model is safe.
2. Follow the bind steps from 1 to 3. DO NOT remove the bind plug or power at this point.
3. Adjust the transmitter sticks, switches, etc. for all channels to the desired failsafe outputs. For most powered models the critical failsafe action is to ensure that throttle goes to zero.
4. Press the Failsafe/Mode button briefly (less than 1 second). A GREEN light indicates that failsafe positions have been memorized and Preset Failsafe is enabled. Pressing the button again briefly will disable preset failsafe and cause the green light to turn off.
5. Test failsafe by turning off the transmitter and verifying that all controls go to the desired positions. Use care, as an error in setting failsafe could cause the motor to start, retract gear to activate, etc. Turn the transmitter back on, but note that the receiver will not recover from failsafe until the transmitter is again fully operational, which may take some time (so don't do this test in the air!).

Note: Holding the button for more than about a second will activate PPM mode, as indicated by a blue LED (see Section 3A, page 9). Unless PPM mode is required, long press the button again and repeat until the blue LED is OFF. Then repeat steps 3 and 4 of the preset failsafe procedure.

Normally, failsafe status and channel settings are retained by the receiver until deliberately reset. However it is possible to change the setting unintentionally if an error is made while calibrating the receiver or setting PPM mode. Always check the failsafe setting after such operations.

D. Telemetry

The receiver will automatically transmit telemetry to a Spektrum™ transmitter with telemetry capability**.**

To monitor the various parameters, the transmitter's telemetry option must be enabled:

- **Receiver voltage**. Automatic, no external sensor or lead required.
- **RSSI** – signal strength. Automatic. Displayed on transmitter under parameter "A".
- **Temperature.** Automatic transmission of internal temperature. For maximum accuracy, however, the provided external temperature sensor should be connected.
- **Battery voltage**. Requires a connection to the battery positive using the voltage sensing wire provided. As supplied this is already calibrated. For recalibration of Battery voltage. The battery voltage wire is not needed if a V/I sensor is used.

HINT: A simple way to monitor flight pack voltage without modifying the high current power wiring is to attach the voltage measuring wire to the most positive pin of the LiPo balance connector.

- **Battery current**. Requires the optional V/I sensor connected in the main power lead. This sensor must be purchased separately. The V/I sensor plugs in place of the simple voltage sensing wire and provides both current and voltage information.
- **RSSI out** – RSSI is automatically displayed on the transmitter screen, but for use with an OSD (On Screen Display) used with an FPV (First Person View) setup the RSSI value is available on the

spare wire of the external temperature sensor cable. The analog voltage output varies in proportion to RSSI from 3.0V down to 0V as the signal diminishes.

WARNING: Do not plug the voltage sensor cable into the temperature sensor socket! If a battery is attached this is almost certain to damage the receiver.

Enabling telemetry involves selecting each field you want to display in the Telemetry setup screen on the Spektrum™ transmitter. The fields available on the transmitter screen vary a little depending on which

version of Airware the transmitter is running. Volts, Amps, Temp and RxV (plus RSSI, which will automatically appear in the "A" field) are the only parameters that can be displayed using this receiver. Note that the Powerbox fields are not active and this receiver therefore does not display mAh consumed.

On the Spektrum™ Telemetry setup screen there is a list of numbered fields. The name of the field indicates the telemetry parameter to be displayed in that field (or indicates it is Empty). Use the scroll wheel to move between the fields and click to select one. You can then choose what is displayed. For this receiver the relevant choices are Volts, Amps, Temp and RxV. Clicking after selecting the display while the frame is still flashing will take you to a second screen where various parameters can be set. For example with Volts you can choose whether the display is Active, whether a Minimum and/or Maximum voltage alarm is set and what type of alarm it is. The options available may depend on the version of Airware your transmitter is running.

E. Connecting Servos or Flight Controller

The receiver is shipped in Servo Mode with the signal for each channel available at the corresponding pin, as marked on the case. This allows servos to be plugged directly into the receiver in the usual way. To support a number of third party flight controllers, the receiver can be set to output a Combined PPM signal (cPPM), also known as just PPM, that carries all channels on a single wire connected to the AUX1/PPM pins. See Section 3A, below for details on setting PPM Mode.

PPM Mode is indicated by a BLUE light, either flashing or solid. Servo Mode has no blue light.

PART 3. Additional Information for Advanced Users

A. PPM mode

There are two PPM modes, providing different channel orders:

- PPM-J mode provides cPPM in JR/Spektrum™ TAER channel order (SOLID BLUE LED)
- PPM-F mode provides cPPM in Futaba/Hitec AETR channel order (FLASHING BLUE LED)

The cPPM signal provided by the receiver includes channels 1 to 7 and is available on the AUX1/PPM pins. When the receiver is in PPM mode, PWM signals are not available for individual servos.

For a receiver in Servo mode (blue light OFF), PPM mode is selected as follows:

1. Follow the normal bind procedure from step 1 to step 3 (see section 2B, page 6 above). DO NOT remove the bind plug or disconnect power at this point.
2. Press the receiver button for about 2 seconds, until the FLASHING blue LED comes ON, indicating PPM-F mode (AETR channel order). To change to PPM-J mode (TAER channel order) press the button again for about 2 seconds, until the SOLID blue LED comes ON.
3. When the appropriate status is achieved, disconnect the power source and remove the bind plug.

The receiver (even if re-bound) remembers the setting until it is deliberately changed.

If the receiver is already in PPM Mode (blue light ON or FLASHING) the mode can be changed or cancelled by following the above process until the desired state is achieved.

Note that a satellite receiver cannot be used when the main receiver is in PPM mode.

B. RSSI

The RSSI (Received Signal Strength Indicator) number is sent back from the model by telemetry and displayed in the "A" field on the transmitter screen. It represents the strength of the radio control signal available from the receiver front end for control of the model. It should read close to 100 when the receiver is next to the model and will drop with distance until, at a value typically around 30, the telemetry signal is not strong enough and the display freezes. The receiver has excellent sensitivity and will continue to operate reliably well beyond this point. Indeed, Hyperion recommend an RSSI reading of no lower than 20 for safe operation, giving an idea of the margin of safety involved.

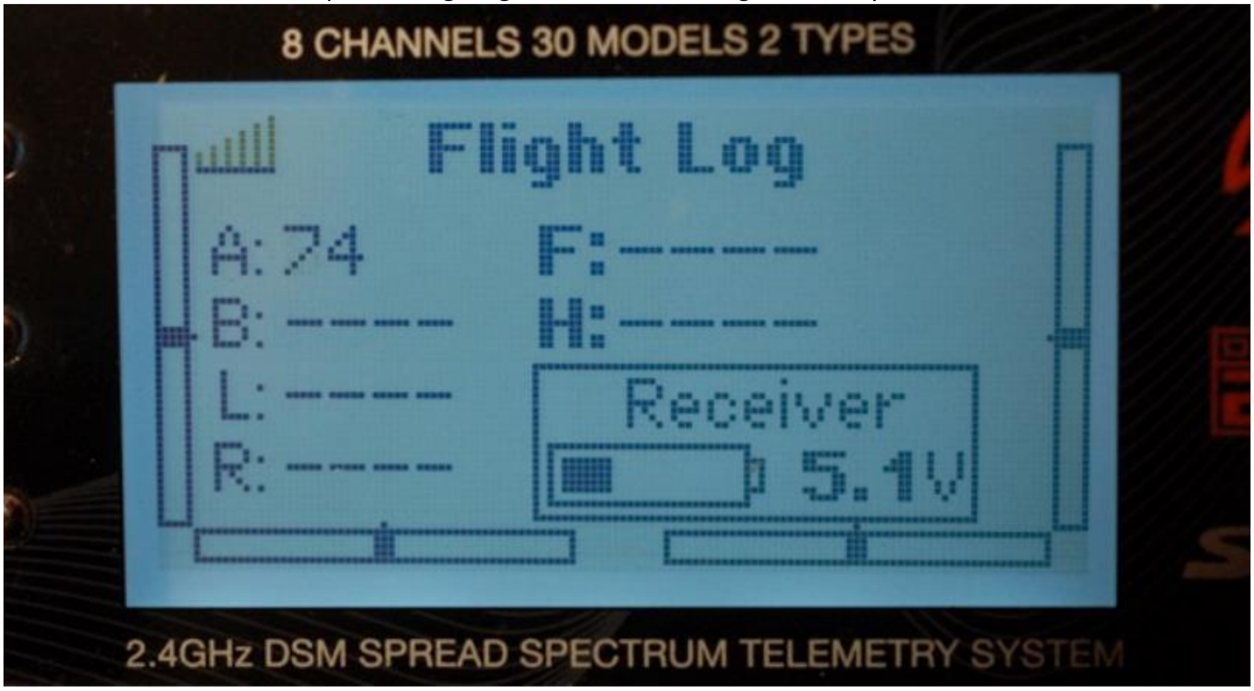

Figure 3.1 – An RSSI value of 74 displayed on a DX8 screen in the "A" field.

The vertical bar symbol in the top left shows that telemetry is live and is being received.

While RSSI values below about 30 are unlikely to be seen on the transmitter telemetry screen, the RSSI voltage displayed on an OSD (On-Screen Display) may continue to be valid at much lower levels, as this form of display does not rely on the relatively low power telemetry transmission from the receiver.

Changes in the RSSI reading can be conveniently explored with the transmitter in Range Test mode. Note that putting a Spektrum™ transmitter into Range Test mode attenuates output power enough to reduce range by a factor of about 30.[3] Thus effective control at 35m (120 feet) in Range Test mode should translate to about 1 km (3600 feet) range at full power. There are, however, many variables involved, so treat this as only a rough guide. There is a very good probability that you will get much greater range.

The Hyperion RSSI number is a relative value and cannot be directly compared to other signal indicators such as antenna fades reported by Spektrum™ or the FrSky RSSI number. Hyperion has stated that the maximum signal measured after the LNA front end when the transmitter and receiver are right next to one another is displayed as a value of 100. A drop in "RSSI" by one unit corresponds to a drop in signal strength of approximately 0.6dBm. At the Hyperion recommended minimum reading of 20 the signal is therefore 0.6 x 80 = 48dB down. While the receiver has a lot of reserve sensitivity and should continue to work even beyond that point, it is not recommended that this be taken for granted.

Tests in practical situations show a fair bit of fluctuation in the RSSI value (caused presumably by changing model and transmitter orientation among other factors), but it appears the value falls fairly steadily and approximately linearly from 100 to 50 then drops off more slowly but still in a linear fashion with distance until telemetry cuts out at a value around 30.

C. Antennas and Satellites

This Hyperion receiver is described as full range for both control and telemetry. In fact this receiver has a particularly sensitive Low Noise Amplifier (LNA) front end and should better the range of other comparable DSMX™ receivers under the same conditions. However range is affected by the number of aerials (antennas) and their orientation, as well as by the installation in the model.

This receiver has two active aerial (antenna) wires (the last 32mm of the cables) connected to a switch that selects the stronger available signal. The receiver will switch antennas very quickly if the one it is using starts to drop in signal strength below the other antenna. The switch will occur within 300mS and no signal is lost during the switching period. This antenna switching strategy is commonly called in the RC world "Diversity".

The receiver also has a connector to allow the use of a satellite for additional signal robustness. A satellite does not increase the maximum possible range. Rather, as a separate stand-alone receiver it increases the probability that a reliable signal will be obtained no matter the orientation of the model. The main receiver selects the stronger of its own best signal or that of the satellite. Note that satellites with diversity antennas are now available, giving up to four separate signal sources for the receiver/satellite combination.

The antennas we use for radio control radiate (and receive) in all directions, but the signal is much weaker off the ends of the antenna (the active portion of the cable) than "broadside" to it. Think of an

[3] Since range is related to the square of power, to reduce range by a factor of 30 requires a cut in power by a factor of about 900. Range test power is thus typically around 0.1 mw.

ancient naval battle where the ships had very little firepower fore and aft because most of their cannon were pointed out the sides.

To achieve the most reliable possible link to the model, therefore, what we want to avoid are situations in which the transmitter and receiver antennas are end-on to each other. For the transmitter, the advice to the pilot is simple: don't point the antenna at the model. For the receiver, things are more complicated because the model is constantly changing its orientation in relation to the transmitter. A single receiver antenna will inevitably be pointed at the transmitter some of the time.

This is where diversity comes in. If the receiver has two active antennas positioned at right angles to each other, they can never both be pointed at the transmitter simultaneously. The receiver just has to select the antenna that is giving the better signal right now. That's what diversity switching does.

Diversity improves the reliability of the RF link in other ways. If the two receiver antennas are well separated, at least one should have a clear view of the transmitter, minimizing the risk of signal blanking.

As well, with antennas at right angles one of them should be roughly parallel to the transmitter antenna, thus aligning polarization for a stronger signal.

Conductive materials such as foil coverings, batteries, metal components and carbon fiber can absorb and shield the incoming radio signal. 2.4GHz systems have a very short wave length and are susceptible to this. Receiver aerials need to be placed so that this effect is minimized.

What all this means for the installation of the receiver is simple. Make sure its two antennas are separated as far as practical from each other and from conductive stuff like battery, wiring and carbon fiber, and keep the active portions (the last 32mm) reasonably straight and at right angles to each other. If a satellite is connected for additional diversity, it should be well away from the main receiver, not right next to it. Align it so the satellite aerial(s) and at least one main receiver aerial are at right angles.

Don't get paranoid. The installation doesn't have to be perfect to support an adequately strong RF link. Our modern receivers do a remarkably good job of picking up the signal, even with just a simple single antenna, so diversity can be thought of as extra security for when the going gets tough.

D. Power Considerations

This telemetry-integrated receiver draws approximately 75 mA with no servos connected, a somewhat higher current than a normal receiver. For comparison, the Hyperion DSMX™ Compatible 7 Channel Stabilized Receiver draws about 55 mA. More importantly, the minimum operating voltage of the Telemetry
receiver is 4.5V compared to 3.45V for other Hyperion receivers. This means that this receiver cannot be operated directly from a single LiPo cell as used in some DLG applications but must use either a voltage booster or a higher voltage pack.
Given Hyperion's recommended upper limit of 7.4v, the receiver should not be powered by a 2s LiPo battery (8.4V fully charged). A four or five cell NiMH battery or a 2s LiFe battery can be used.

E: Voltage Recalibration

The receiver is pre-calibrated for voltage sensing and a voltage sensing wire is provided as a standard item. If the optional V/I sensor is used, the voltage sensing wire is not required (see Section 3F, below). Re-calibration of the external voltage sensing of the receiver is normally not required, but if it becomes necessary, please follow the procedure listed below.

Figure 3.2 – Voltage sensor wire connected to battery V+. First bind plug is in normal vertical location, second is inserted horizontally between the top (signal) pins of Aileron and Rudder channels. The device with a screen is a Wattmeter, which measures voltage and current and is used to confirm the battery voltage.

Figure 3.3 – Battery now plugged in. Note voltage sensor wire. Voltage sensor is calibrated at 8.43V, as shown on Wattmeter.

Procedure

1. First, verify that both blue and green lights on the receiver are OFF. If necessary, go back to the instructions for Failsafe or PPM Mode and reset.
2. With no power connected, insert a bind plug vertically at bind location, as in the normal bind procedure. Insert a second bind plug horizontally between aileron and rudder signal pins (top ones).
3. Connect the voltage sensing wire to an 8.4V source. A fully charged two-cell lithium-polymer (LiPo) battery will provide an adequately accurate reference voltage.

4. With the two-cell battery disconnected, connect a speed control (ESC) with integral BEC to the receiver.[4] Any available servo pins can be used (center pin is positive, lower pin is ground).
5. Connect the ESC to the two-cell LiPo battery. The RED light should be flashing rapidly beneath the receiver to indicate bind mode.
6. Turn on the transmitter in bind mode approximately 1-2 meters away from the receiver. The receiver should change from slowly flashing to steady red, indicating a successful bind. Make sure transmitter telemetry is set up to display battery voltage.
7. Press the receiver button briefly (less than 1 second). A GREEN light means that the voltage reading is calibrated. The transmitter should display 8.3V or 8.4V as battery voltage.[5]
8. Press and hold the receiver button for about 1.5 seconds, until the BLUE light is turned on. This indicates to the receiver that current sensing is not available.[6]
9. Turn off the receiver and remove both bind plugs to complete voltage calibration. [7] If necessary, reset Failsafe and/or PPM Mode to suit your setup.

F: Calibrating the Optional V/I Sensor

The Hyperion V/I sensing module provides both battery voltage and current sensing. The receiver is NOT pre-calibrated for use with the V/I module. The following calibration procedure needs to be done once with any new V/I sensor before use. An adequate calibration can be performed with a two-cell LiPo battery and Wattmeter.

Figure 3.4 – V/I sensor connected to battery V+ with two bind plugs inserted. The device with a screen is a
Wattmeter to confirm the actual battery voltage and current.

4 A stand-alone battery eliminator (BEC/UBEC) or suitable battery can also be used to provide the necessary 4.5 to 7.4v power for the receiver.

5 Note that 8.39v will display as 8.3v because of the lack of a second decimal digit in the Spektrum™ transmitter display. The more precise value, however, is used internally and can be logged on the SD card.

6 If the button is released before the blue LED comes on, briefly press the button a few times until the blue light is OFF. Then start setup again at step 7.

7 If current measurement is required, it is necessary to purchase the optional V/I sensor (see Section 3F).

Figure 3.5 – V/I sensor calibrated at 8.4V and 4A, as shown on the Wattmeter.

Procedure

1. First, verify that both blue and green lights on the receiver are OFF. If necessary, go back to the instructions for Failsafe (page 7) or PPM Mode (page 9) and reset.
2. With no power connected, insert a bind plug vertically on the bind pins. Insert a second bind plug horizontally between aileron and rudder signal pins.
3. Connect the V/I sensor to a fully charged two-cell LiPo battery to provide the necessary 8.4V source.[8] Figure 3.5 shows the meter connected in series. It must be able to measure current of at least 5A.
4. To draw an appropriate current for calibration of the sensor, connect the ESC to a brushless motor that is known to draw more than 4 amps. It may be necessary to install a propeller on the motor to create the necessary load – be VERY careful if this is done to ensure that the motor is safely mounted. Be sure to disconnect the motor when finished calibration.
5. Connect the ESC to the receiver throttle channel pins. If the ESC lacks an internal BEC, a separate BEC can be used to provide receiver power.
6. Connect the ESC (and separate BEC if used) to the battery. Check that the RED LED beneath the receiver is flashing rapidly to indicate bind mode.
7. Turn on transmitter in bind mode approximately 1-2 meters away from the receiver with the throttle stick at low. The receiver should change from slowly flashing to steady red, indicating successful bind (see page 6 for details). Make sure transmitter telemetry is set up to display battery voltage and current.
8. Press the receiver button briefly (less than 1 second). A GREEN LED means the voltage reading is calibrated and current sensing bias is set at 0A. The transmitter telemetry page should display either 8.3V or 8.4V as battery voltage[9] and 0A for current.

8 The battery needs to be able to supply a 4A current without undue voltage drop. It is recommended that the battery be at least 1000 mAh with at least 20C rating.

9. Move the throttle stick to start the motor (be careful!) and adjust until the current draw shown on the meter is as close as possible to 4.0A.
10. Press and hold the receiver button until the BLUE LED turns on, indicating that current sensing is calibrated.[10]
11. With the system still drawing 4A, check that the transmitter telemetry page shows a current reading of 3 or 4A.[11]
12. Turn off the receiver and remove both bind plugs to complete voltage and current calibration. If necessary, reset Failsafe and/or PPM Mode to suit your setup.

HINT: Calibration can be done in two parts. The receiver remembers the current calibration value even if

you do the voltage calibration subsequently.
First calibrate the current value with a constant 4A load. Any battery from 2s to 6s that is compatible with the motor and ESC can be used. Go through steps 1 to 6, skip step 7, then complete steps 8 to 10.
Next do the voltage calibration as in step 7, using either a 2s battery or a variable voltage supply.
Finally go to step 11 to complete the calibration process.

G. Creating and Reading Telemetry Log Files

Spektrum™ telemetry-enabled transmitters can record a log file of the data sent to the transmitter from the receiver. This is controlled entirely by the transmitter; no setup is required on the receiver.
The options available at the transmitter specify whether recording is enabled, if so, how it is to be started, and the name of the resulting file. Refer to your transmitter manual for specific instructions.
You may want to assign a switch to start and stop logging, or you may prefer to have it start automatically as soon as the throttle is advanced.
The log files are saved on the SD card in the transmitter, along with the various model setup files. The log files have the same name as the model files but an extension of *.TLM* rather than *.SPM*. To read Spektrum™ log files you need a program specifically designed for the purpose. You currently have two choices:
1) The official Spektrum™ approved and supported *Spektrum™ Telemetry Viewer* software written by ROBO Software. It is available for both Windows and Mac (OS X) and is available as a 30 day trial and to purchase for US$19.99 here: http://www.robo-software.com
2) The excellent *Tlmviewer* program written by modeler Mike Petrichenko. This is a free Windowsonly program and available at: http://www.tlmviewer.com
Here is an example of a flight log from the Hyperion receiver, read and graphed by *Tlmviewer*, showing the
pack voltage and current during a 9-minute flight of a 1.8m span electric glider.

[9] Note that 8.39v will display as 8.3v because of the lack of a second decimal digit in the Spektrum™ transmitter display. The more precise value is used internally and can be logged.
[10] If the button is released before the blue LED comes on, briefly press the button a few times until the blue LED is off, and then start PPM setup again at step 7.
[11] Note that 3.9A will display as 3A because of the lack of a second decimal digit in the Spektrum™ display; this 1A precision is ample for most purposes. The more precise value is used internally and can be logged.

Figure 3.6 – Tlmviewer graph of voltage (green) and current (orange) in flight.

This is the graph of RSSI values for the same flight, which was out to a reasonable visual range limit.

Figure 3.7 – Tlmviewer graph of RSSI from a properly installed receiver.

Note how there are occasional places where the RSSI drops to zero. This will be where the telemetry link was momentarily lost. However the RSSI value rarely falls below 50 when the data is available.
Finally here is the same type of graph from a similar flight where the receiver was poorly installed with the two antennas lying alongside the LiPo and easily blanked.

Figure 3.8 – Tlmviewer graph of RSSI from a poorly installed receiver.

This time the overall RSSI values are lower and there are not only zero values but significant periods where the data is obviously missing and the graphing program has simply joined the values at each end of the gap. An example is between 5:00 and 5:30 min. Although there are periods where the telemetry transmission back to the transmitter has failed, the actually RSSI at the receiver is still strong as can be seen from the values just before and just after the telemetry gap. The weaker telemetry connection from receiver to transmitter has been affected much more by the poor installation than the control connection from transmitter to receiver. This is further evidence of the sensitivity of the receiver and the robustness of the control link.

Finally, Figure 3.9 shows exactly the same data exported from *Tlmviewer* as a .csv file and then imported into Microsoft Excel (which allows you to manipulate the presentation format easily) and displayed as a point scatter graph. Note that displaying the data this way shows up the gaps in the telemetry data feed when the model was at extreme range. A couple of examples of such gaps are highlighted in blue on the x-axis (which Excel has plotted in units of 1/100 sec rather than minutes).

Figure 3.9 – Excel graphic display of poor RSSI readings (same data as Fig 3.8).

H. Servo Output Timing

Most users can ignore this section. This is technical information for those who need it.

This section is about how the receiver puts out the information for the control channels: all seven at once, one after the other, or in some different manner.

PWM

In normal PWM (Pulse Width Modulation) mode, where the output for each servo is present on separate pins, the Hyperion receiver puts out channel pulses in two batches:

First Channels 4, 5 and 6 – that is Rudder, Gear and Aux1 – are output simultaneously.

Then 2.4mS later Channels 1, 2, 3 and 7 – Throttle, Aileron, Elevator and Aux2 - are output together.

This can be seen in the logic trace display shown in Figure 3.10. Note that Channel 0 on the logic trace is channel 1 from the receiver and so on. The varying width of the pulses that represents control information is clearly visible, with the first channel neutral, the second at maximum, and so on.

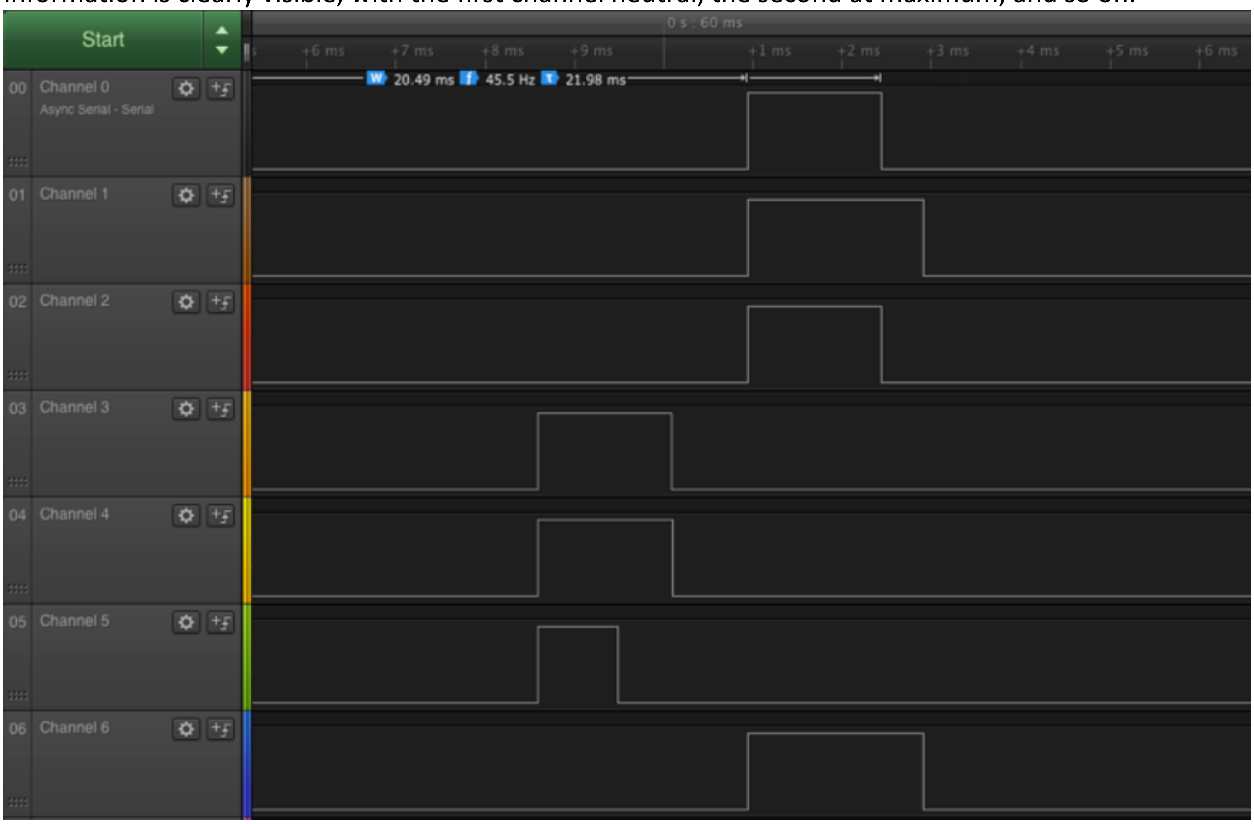

Figure 3.10 – Logic traces of the 7 output channels from the Hyperion Telemetry receiver.

This output scheme is different from many other receivers. The majority of low cost DSM2™/DSMX™ receivers output the channels one after another (sometimes described as “round robin”), but some higher end receivers synchronize all or some of the pulses to ensure simultaneous signals for servo actions that should occur at the same time.

The advantage of simultaneous synchronized pulse outputs is that all servo actions are initiated together.

The result may be noticeable in demanding precision applications, particularly helicopter rotor movements. However there may be a down side, depending on the servos used. Analog and digital servos load the power supply in a different way. Digital servos are refreshed at fixed intervals, with no reference to the timing of incoming pulses. The power pulses are sent at high frequency compared with the incoming control pulses. So they always draw power, but at a fairly consistently rate.

By contrast, analog servos only drive the motor when they get a pulse, and they do it as soon as they get that pulse. If the control pulse requires the servo to move significantly, the result may be a demand for full current. During aggressive flying it's possible for several servos to be called on to change position at the same time, creating a huge demand on the power supply at that instant.

The result of this difference in functioning is that on average the total current for analog servos might be lower than for equivalent digitals, but the instantaneous current draw could be very high. It is this peak current that can depress the voltage and "brown-out" the receiver.

In practice, pulse timing can be ignored by most users. However, for those seeking simultaneous control action or setting up analog servos in large models and others with heavy servo loads it is important to understand the implications of different output timing schemes.

cPPM

By definition, a cPPM stream conveys the control pulses in sequence. The Hyperion Telemetry receiver offers a choice of JR/Spektrum™ channel order (TAER) or Futaba/Hitec (AETR).

Figure 3.11 shows the cPPM stream at the Aux1/PPM pin on the receiver. The example here is in Futaba/Hitec channel order and has channels 1, 5 and 6 approximately at neutral, channel 2 at minimum and channels 3, 4 and 7 at maximum.

The Hyperion Telemetry receiver outputs only 7 channels on the PPM stream. Some other PPM receivers
output more channels on cPPM than they actually have PWM pins.

Figure 3.11 – Oscilloscope trace of cPPM output.

Note: This graph is included solely to show the number of channels and displays some signal distortion due to measurement limitations. Disregard the voltage levels seen here, as well as the noise and overshoot. A clean, noise-free high/low pulse is to be expected for the actual output.