SPEKTRUM®

▌AR7100/AR7100R User Guide

SPEKTRUM®

Introduction

Spektrum's AR7100 series receivers offer the ultimate system for high-performance nitro or 500-class and larger electric helicopters. Combining the bullet proof radio link of Spektrum's DSM2 technology with a built-in regulator for the Rudder, Aux2, Gear and Throttle channels and an integrated RevLimit limiter (AR7100R only), the AR7100 series receivers make installation of these normally complex devices clean and simple.

The AR7100 features a Fail-On soft switch to ensure reliability and heavy 16AWG low resistance input power leads for uninterrupted power even under the most demanding high-current draw applications. The newly developed backplate rpm sensor makes this integrated receiver, limiter and regulator system the easiest and neatest possible to install with only one external rpm sensor lead for the limiter. Designed and developed by helicopter experts, the all-in-one integrated design of the AR7100 takes the hassle out of installing and properly setting up separate receivers, regulators and limiters.

Applications

All sizes of nitro powered helicopters
500-class and larger electric helicopters
Compatible with all Spektrum™ and JR® DSM2™ full range transmitters including:

> Spektrum DX6i (RevLimit function not available as only six channels are present)
> Spektrum DX7
> JR X9303 2.4
> JR12X

Note: Not compatible with Spektrum's DX6 parkflyer system (DSM)

Features

- Regulated 5.2-voltage output to the Rudder, Gear, Aux 2 and Throttle channels allowing the cyclic servos to be powered at high voltage for increased performance while the gyro and throttle servos are powered by the necessary compatible lower voltage (5.2V).
- AR7100R incorporates an integrated RevLimit limiter with backplate rpm sensor offering the cleanest, easiest installation available.
- Easy-to-mount backplate RevLimit rpm sensor—with a single lead that plugs into the receiver, eliminates the hassle of mounting magnets and brackets as is the case for typical rpm sensors.
- Heavy-duty 16AWG input leads pre-wired with EC3 connector.
- Dual outputs on the Throttle and Aux 2 channels (regulated to 5.2 volts/ unregulated).
- One internal receiver and up to two remote receivers.
- Soft switch fails-on if the switch is damaged.
- Optional charge ON/OFF adaptor lead (included) allows charging, battery monitoring and ON/OFF through one easily accessible lead.
- Two types of failsafe—SmartSafe (throttle only) and conventional failsafe (all servos).
- Quick Connect - If a power interruption (brown out) occurs the system reconnects in less than .25 seconds.
- Flight Log compatible.
- Compatible with all Spektrum and JR DSM2 full range radio systems.
- 2048 Resolution

Note: The AR7100/AR7100R uses a specifically designed switch. Conventionally wired switches are not compatible with the AR7100.

Features (continued)

Important
The AR7100 and AR7100R require that at least one remote receiver (included) be plugged into port B or R to operate.

Specifications
AR7100/ AR7100R
Voltage input - 6.0 to 10.0 volts/ 5 to 7 cell NiMH or 2-cell LiPo*
Minimum receiver operational voltage - 3.5 volts
Minimum regulator operational voltage - 5.5 volts
Output voltage - Rudder, Aux 2, Throttle 2, Gear 2 = 5.2 volts/
        all other channels unregulated (for high voltage
        compatible servos only)
Max regulated channel current - 2 amp continuous
Resolution - 2048
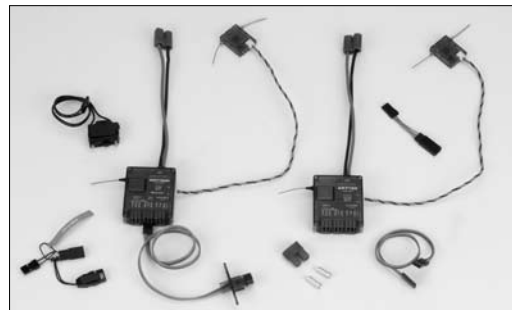Dimensions LxWxH - 47.3x40.2x14.2mm/ 1.86x.1.58x .56 in
Weight - 1.1 oz / 32.5 g
Switch - Soft Switch (Switch port can also be used with charge
       adaptors (included))
Connector type - EC3

Note: When the battery is connected to the AR71000/AR7100R a low current drain of less than 1mA occurs even when the soft switch is turned off. If the system is going to be stored for any length of time

it's important that the battery be disconnected from the AR7100 to prevent overdischarge.

Remote Receiver
Dimensions LxWxH - 25.8x20.2x6.8mm/ 1.02x.80x.27 in
Weight - 0.1 oz / 5.0 g

Items Included
AR7100/AR7100R Receiver
Remote Receiver - SPM9545
9" Remote Extension Lead - SPM9011
Soft Switch - SPM6820
Charge ON/OFF Adaptor Lead - SPM6821

Features (continued)

Backplate Rpm Sensor (AR7100R only) - SPM6823
Bind Plug - SPM6803
Instruction Manual

Optional Items
• Batteries:
    LiPo Receiver Pack 1350mAh - SPMB1350LP*
    LiPo Receiver Pack 2000mAh - SPMB2000LP*
    LiPo Receiver Pack 4000mAh - SPMB4000LP*
    LiPo Receiver Pack 6000mAh - SPMB6000LP*
    1650mAh 6.0V NiMH Receiver Pack - SPMB1650NM
    2150mAh 6.0V NiMH Receiver Pack - SPMB2150NM
    2700mAh 6.0V NiMH Receiver Pack - SPMB2700NM
    4500mAh 6.0V NiMH Receiver Pack - SPMB4500NM
• Flight Log Data Recorder - SPM9540
• Additional Remote Receiver - SPM9545
• 6" Remote Receiver Extension - SPM9010
• 9" Remote Receiver Extension - SPM9011
• 12" Remote Receiver Extension - SPM9012
• 24" Remote Receiver Extension - SPM9013

* Consult your servo manufacturer's specifications for maximum allowable voltage.
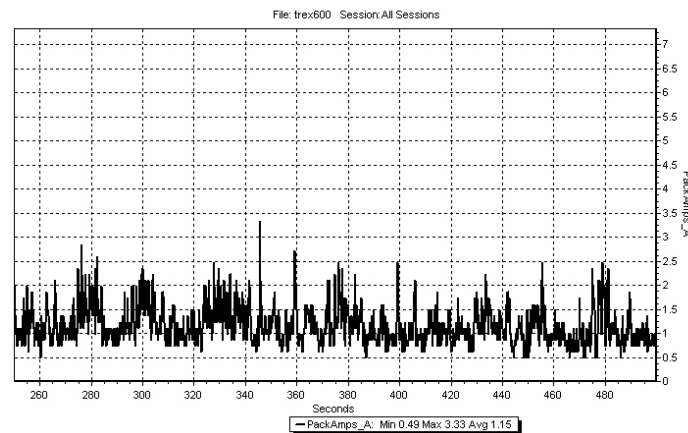
Battery Requirements

IMPORTANT: Do not use a 4-cell 4.8-volt battery to power the AR7100/AR7100R.

Because of the built-in regulator the AR7100/AR7100R has a minimum recommended operational battery voltage of 5.5 volts and is designed to use 6-volt 5-cell NiMH, 7.2-volts 6-cell NiMH or 7.4-volt 2-cell LiPo batteries. (Higher voltage should be used only if the servos are compatible.) While the AR7100 will continue to operate down to 3.5 volts, the AR7100/ AR7100R features a built-in 5.2-volt regulator for the Rudder, Aux 2, Gear 2, Throttle 2 channels output. A 4-cell 4.8-volt battery will not provide sufficient headroom (voltage margin) to maintain a 5.2 regulated voltage. Regulated outputs are provided to allow the gyro, gyro gain and throttle to be operated at the necessary lower voltage while the cyclic servos (aileron, elevator and pitch) are powered directly by the pack voltage (typically 5-cell 6-volt NiMH or if high voltage compatible servos are used 2-cell 7.4-volt LiPo batteries).

It is important to select a battery that has more than adequate capacity to provide the necessary flight time. Our staff has been recording in-flight data to determine typical current consumption of aircraft in flight. The following graph illustrates a T-REX Nitro 600 during aggressive 3D flight.

Helicopter -T-REX 600N
Servos - 3-JR8717's, 1-8900G (rudder), 1-8317 (throttle)
Batteries - 1- 2100mAh 2-cell 7.4-volt LiPo
Engine - YS50
Flight envelope - Aggressive 3D
Average current - 1.15 amps
Peak current - 3.33 amps
Milliamps used per 8 minute flight- 173mAh

File: trex600   Session:All Sessions
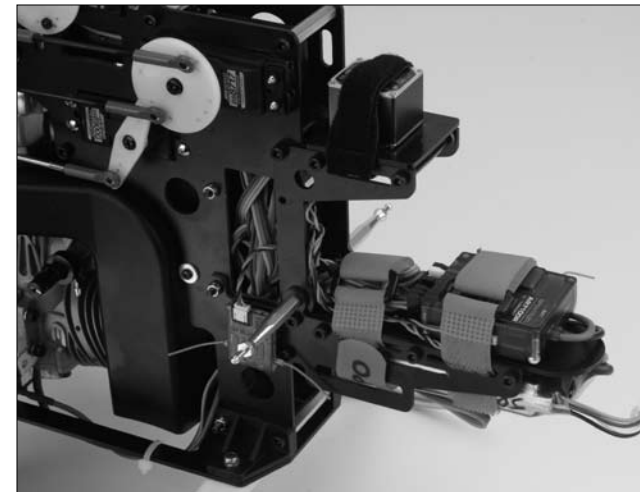
PackAmps_A: Min 0.49 Max 3.33 Avg 1.15

In the above example the average current was 1.15 amps, which calculates to 153mAh per 8 minutes (typical flight length). It's recommended that only 60% of the available capacity be used to ensure plenty of reserve battery capacity. In this example using 2000mAh batteries 2000 x 60% = 1200mAh (available usable capacity) divided by the capacity used per 8 minute flight, 153mAh would allow up to 7 flights of 8 minutes each.
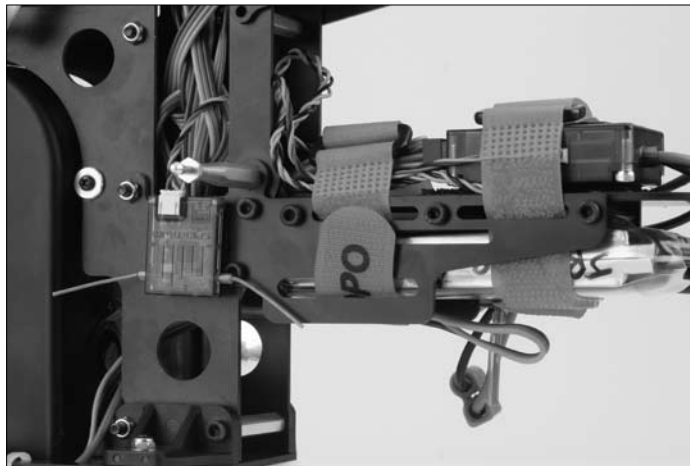
For 50-size electric and glow powered helicopters a minimum capacity of 2000mAh is recommended. For 90-size helicopters a minimum of 3000mAh is recommended. Our staff uses 2000mAh LiPos in 50-size helis and 4000mAh LiPos in 90-size machines and typically flies 4 or 5 flights then recharges.

Following is a picture of a typically recommended installation.

- Mount the Receiver unit in the position recommended by the helicopter manufacturer. Foam or thick double-sided tape is recommended to isolate the receiver from vibration.

- Mount the switch and insert the switch plug into the port in the main unit marked SWITCH. Note: The AR7100/AR7100R uses a specifically designed switch. Conventionally wired switches are not compatible with the AR7100.

- Using the battery capacity guidelines select the battery system that best fits your application and install the battery in your heli. Connect the battery to the receiver's EC3 connector. Spektrum batteries are pre-wired with an EC3 connector and plug directly in. If using another brand of battery it will be necessary to solder EC3 connectors to the battery leads.

- Using double-sided foam tape and tie wrap, mount a minimum of 1 and up to 2 remote receivers in your aircraft and plug them into the receiver ports. NOTE: It's necessary that one receiver be plugged into port B or R in order to operate. The receiver should be mounted at least 2" away from the main receiver with the antennas perpendicular.

- If using the RevLimit Limiter (AR7100R only) mount the rpm sensor and bracket to the backplate under two backplate screws of your engine as shown.

Important: Normally, the pickup is mounted touching the backplate of the engine. If your system is not limiting RPM in flight, re-position the sensor .5 to 1mm away from the back plate. This can be easily accomplished by loosening the 2-56 button head screw on the sensor mount, re-adjusting the position, and then tightening. This should resolve the issue.

Note: Threadlock must be used on the screws. The rpm sensor bracket is adjustable for 50-size or 90-size engines by extending or retracting the rpm sensor and fastening the screw in place.

Bracket adjusted for 90-size engine   Bracket adjusted for 50-size engine

- Plug the servo leads and rpm sensor into the appropriate ports in the receiver.

- You are now ready to bind the system.

Note: In order for the system to operate, one remote receiver must be plugged into receiver port B or R.

Connections
Note: The throttle and gear channels have two outputs. Output 1 is unregulated and the pack voltage is provided at this port. Throttle and Gear outputs 2 are regulated to 5.2 volts when a throttle servo and gyro are used that are not compatible with high voltage. (Most gyros require less than 6 volts.)

Binding

It is necessary to program the receiver to the transmitter so that the receiver will only recognize that specific transmitter, ignoring signals from any other sources. If the receiver is not bound to the transmitter, the system will not operate. During binding the servo's failsafe positions are stored.

How To Bind
1. With the system hooked up and at least one remote receiver attached to port B or R as described previously, insert the bind plug in the DATA/BIND port.
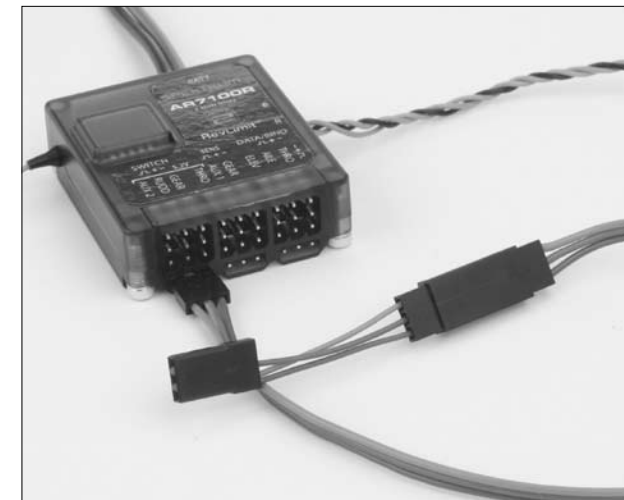

2. Power the receiver by plugging a battery into the battery lead and turning on the soft switch (if being used). Note that the LEDs on all receivers should be flashing indicating that the receiver is ready to bind.

3. Establish the desired failsafe stick positions: normally low throttle, low pitch and cyclic controls neutral.   Please see the Failsafe Functions section for more information about setting SmartSafe and PreSet Failsafe functions.

4. Follow the procedures of your transmitter to enter it into bind mode. The system will connect within a few seconds. The LEDs on all receivers should go solid, indicating the system has connected.

5. Remove the bind plug and store it in a convenient place. A blue light on the main unit and an amber light on the remote receiver should turn on indicating the system is powered. Check servo operation.

6. After you've programmed your model, it's important to rebind the system so the true low throttle and neutral control surface positions are stored in the receiver.

Optional Charge ON/OFF Adaptor Lead

Included with the system is an optional charge, ON/OFF adaptor lead. Some heli pilots may prefer to use this adaptor lead instead of the included Soft Switch. When plugged into the receiver's switch port this adaptor lead allows the following:

• The battery can be charged through the adaptor lead.
• The system can be turned off by inserting the bind plug. Removing the bind plug turns the system on.
• Battery voltage can be monitored through the adaptor lead using a Flight Log or voltmeter. If the voltmeter is plugged directly into the male-male extension, the system is active and voltage under load (system operational) is displayed. If plugged into the charging lead, the at-rest battery voltage is displayed.

Install the adaptor lead as shown to the right.

The AR7100/AR7100R feature two types of failsafe: SmartSafe™ and Preset Failsafe.

SmartSafe

This type of failsafe is recommended for most types of helicopters. When the transmitter and receiver are turned on the receiver connects to the transmitter and normal control of all channels occurs. If loss of signal occurs, SmartSafe drives the throttle servo only to its preset failsafe position (low throttle) that was set during binding. All other channels hold their last position. When the signal is regained, the system immediately (less than 4 ms) regains control.

Preset Failsafe

When the transmitter and receiver are turned on and after the receiver connects to the transmitter and normal control of all channels occurs, if loss of signal occurs preset failsafe drives all servos to their preset failsafe positions. Some pilots prefer this method but normally SmartSafe is recommended for helicopters. When the signal is regained, the system immediately (less than 4 ms) regains control.

Programming SmartSafe

During the binding process the bind plug is left in throughout the process and is removed only after the receiver connects to the transmitter. After the connection is made, confirmed by operating the servos, the bind plug can be removed. The receiver is now programmed for SmartSafe.

Programming Preset Failsafe

During the binding process the bind plug is inserted in the bind port, and then the receiver is powered up. The LEDs in each receiver should blink, indicating that the receiver is in bind mode. Now before binding the receiver to the transmitter and with the receiver in bind mode, remove the bind plug. The LEDs will continue to blink. With the control sticks and switches in the desired failsafe positions, bind the transmitter to the receiver by putting the transmitter/module into bind mode. The system should connect in less than 15 seconds. The receiver is now programmed for preset failsafe.
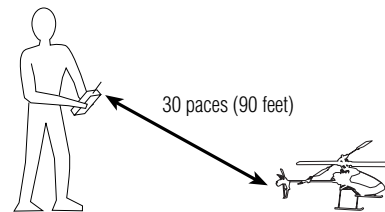
Note: Failsafe positions are stored via the stick and switch positions on the transmitter during binding.

Before each flying session, and especially with a new model, it's important to perform a range check. All Spektrum aircraft transmitters incorporate a range testing system which reduces the output power, allowing a range check.

Range Testing
1. With the model resting on the ground, stand 30 paces (approx. 90 feet) away from the model.
2. Face the model with the transmitter in your normal flying position and put your transmitter into range test mode. This causes reduced power output from the transmitter.
3. You should have total control of the model while in range check mode at 30 paces (90 feet).
4. If control issues exist, call the Horizon Product Support department at 1-877-504-0233 for further assistance.

30 paces (90 feet)

The following advanced range check will confirm that internal and remote receivers are operating optimally and that the installation (position of the receivers) is optimized for the specific aircraft. This Advanced Range Check allows the RF performance of each receiver to be evaluated and to optimize the locations of each individual remote receiver.

Advanced Range Testing

1 Plug a Flight Log (SPM9540 - optional) into the data port in the AR7100 and turn on the system (Tx and Rx).
2. Advance the Flight Log until F- frame losses are displayed by pressing the button on the Flight Log.
3. Have a helper hold your helicopter while he observes the Flight Log data.
4. Standing 30 paces away from the helicopter, face the model with the transmitter in your normal flying position and put your transmitter into range test mode. This causes reduced power output from the transmitter.
5. Have your helper position the model in various orientations (nose up, nose down, nose toward the Tx, nose away from the Tx, etc.), while your helper watches the Flight Log noting any correlation between the aircraft's orientation and frame losses. Do this for 1 minute. The timer on the transmitter can be used here.

6. After one minute, a successful range check will have less than ten recorded frame losses. Scrolling the Flight Log through the antenna fades (A, B, R) allows you to evaluate the performance of each receiver. Antenna fades should be relatively uniform. If a specific antenna is experiencing a high degree of fades then that antenna should be moved to a different location.

7. A successful advanced test will yield the following:
   H - 0 holds
   F - less than 10 frame losses
   A, B, R, - Antenna fades will typically be less than 100. It's important to compare the relative antenna fades and if a particular receiver has a significantly higher number of fades (2 to 3X) then the test should be redone. If the same results occur, move the offending receiver to a different location.

Flight Log (SPM9540 Optional)
The Flight Log is compatible with the AR7100/AR7100R. The Flight Log displays overall RF link performance as well as the individual internal and external receiver link data. Additionally it displays receiver voltage.

Using the Flight Log
After a flight and before turning off the receiver or transmitter, plug the Flight Log into the Data port on the AR7100/AR7100R. The screen will automatically display voltage e.g. 6v2= 6.2 volts.
Note: When the voltage reaches 4.8 volts or less, the screen will flash indicating low voltage.

Press the button to display the following information:
A - Antenna fades on the internal antenna
B - Antenna fades on the left external antenna
L - Not used
R - Antenna fades on the right external if used
F - Frame loss
H - Holds
Antenna fades—represents the loss of a bit of information on that specific antenna.

Typically it's normal to have as many as 50 to 100 antenna fades during a flight. If any single antenna experiences over 500 fades in a single flight, the antenna should be repositioned in the aircraft to optimize the RF link.

Frame loss—represents simultaneous antenna fades on all attached receivers. If the RF link is performing optimally, frame losses per flight should be less than 20. A hold occurs when 45 consecutive frame losses occur. This takes about one second. If a hold occurs during a flight, it's important to evaluate the system, moving the antennas to different locations and/or checking to be sure the transmitter and receivers are all working correctly.

Note: A servo extension can be used to allow the Flight Log to be plugged in more conveniently without having to remove the helicopter's canopy. On some models, the Flight Log can be plugged in, attached and left on the model using double-sided tape. Mounting the Flight Log conveniently to the side frame is common with helicopters.

RevLimit Instructions (AR7100R only)

The Spektrum AR7100R features an integrated RevLimit limiter. The RevLimit functions as a digital rpm limiter preventing the main rotor from over-speeding. When the rotor speed is at or below the programmed rpm, throttle position is controlled via the radio (i.e. throttle curves). The RevLimit only engages when the rotor rpm exceeds the programmed rpm reducing the throttle position preventing over-speed.

The RevLimit limiter is designed to limit engine speed between 9,500 and 20,500 rpm. Engine rpm = Rotor rpm * Main gear ratio

Servo Requirements

All common three-wire servos (analog and digital) are compatible and can be used for the throttle servo. Note that two throttle channel outputs are available: unregulated and regulated. The unregulated throttle operates at the battery voltage. The regulated throttle is regulated to 5.2 volts and is to be used when a high-voltage compatible servo is not being used for throttle control.

Connections

The RevLimit is totally integrated and the target rpm is adjusted via the Gear channel (channel 5). The only external connection needed is to mount the backplate rpm sensor to the backplate of your engine using two backplate screws. Note that the rpm sensor mount has two positions: extended for .90-size engines and retracted for .50-size engines. When installed correctly, the rpm sensor should just contact the backplate. On some engines and specifically the YS .50 and .90, the sensors must be spaced .5 to 1mm from the backplate. No additional magnets or brackets are needed. The rpm sensor picks up the magnetic effect of the crankpin as it passes the rpm sensor.

If your system is not limiting RPM in flight, re-position the sensor .5 to 1mm away from the backplate. This can be easily accomplished by loosening the 2-56 button head screw on the sensor mount, re-adjusting the position, and then tightening. This should resolve the issue.

Install the servos in their appropriately labeled ports. *Note: The throttle and gear channels have two outputs. Output 1 is unregulated and the pack voltage is provided at this port. Throttle and Gear outputs 2 are regulated to 5.2 volts when a throttle servo and gyro are used that are not compatible with high voltage. (Most gyros require less than 6 volts.)*

Modes of Operation

The RevLimit target rpm is adjusted thru the Gear channel (channel 5) output.
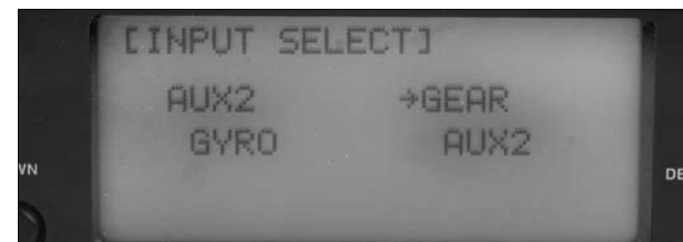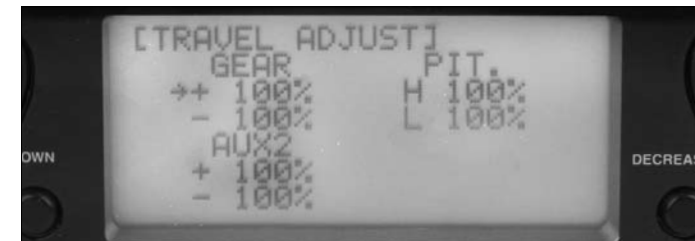
DX7
If using the DX7, the following is recommended.

In system setup mode program AUX2 to GYRO and GEAR to AUX2, the RevLimit will be controlled and adjusted via the AUX2 switch, and all the target rpm's will be adjusted using the GEAR channel travel adjust.

Note: The Gyro Gain channel will plug into the AUX2 channel and the gyro screen will be used to adjust the gyro gain (see the DX7 manual for more detail on gyro gain settings).

In the travel adjust screen two values can be selected that will correspond with the desired rpm. *Note that two different rpms can be selected, or if one value is programmed to zero, the RevLimit will be turned off when the AUX2 switch is in that position.*
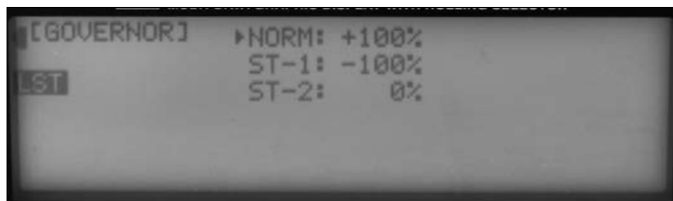**Important:** When calibrating the system the AUX2 channel must remain at 100% in both directions.
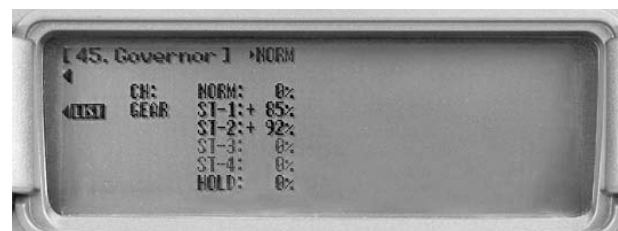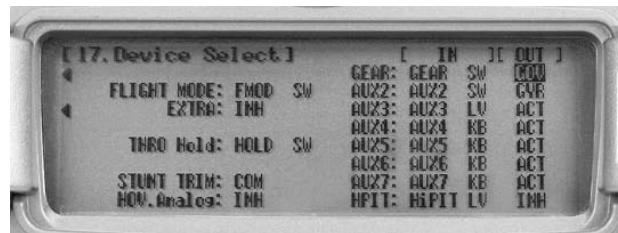
JR® X9303 2.4GHz

If using the JR X9303 2.4GHz, the following is recommended.

In System mode under device, activate the limiter program by selecting GOV under the Gear channel. The RevLimit will then be controlled and adjusted via the Limiter screen located in function mode. A target rpm is available for each flight mode. 0% turns off the limiter, while the larger value the higher the target rpm.

Note: The Gyro Gain channel will plug into the Gear channel and the gyro screen will be used to adjust the gyro gain. (See the X9303 manual for more detail on Gyro Gain settings.)

JR® 12X 2.4GHz

If using the JR 12X, the following is recommended:

In System mode in code 17 Device Select, Assign the GOV to the gear channel. This will activate the governor programming code 45 in the function mode. The RevLimit will then be controlled and adjusted via the Governor screen code 45 located in function mode. A target rpm is available for each flight mode. 0% turns off the limiter, while the larger value the higher the target rpm.

Important: When calibrating the system, the limiter percentages must be adjusted to 100% normal and -100% in ST1.

During calibration the RevLimit stores the output limits of the Gear channel. It's necessary to adjust the Gear channel output to 100% in both directions during calibration.

1. Adjust the throttle operation so that the servo travel is near 100% in both directions at full throttle and at full idle. This may require lengthening or shortening the servo horn.

2. Make sure that the Gear channel is traveling 100% in both directions when the switch that controls the limiter is flipped (flight mode on the X9303 2.4GHz or Aux 2 on the DX7). The servo monitor is helpful here.

3. Set the throttle trim to the low (off) position.

4. With the throttle stick at low throttle, turn on the transmitter then turn on the receiver; within three seconds toggle the switch that will control the limiter. The ACT LED on the receiver will flash green indicating that the calibration mode is successfully entered.

5. Raise and lower the throttle stick throughout its full range. The throttle endpoint will be stored.

6. Exit the calibration mode by toggling the controlling switch twice. The ACT LED will stop flashing, indicating a successful calibration was achieved.

7. To verify correct calibration, lower the throttle stick below the 25% position and the ACT LED should turn off. Above 25% the ACT LED (green) should be on.

Note: Calibration only needs to be performed when first setting up the RevLimit, or when changing throttle servo throws, or if the unit is installed in another helicopter.

To Verify the RPM Sensor is Functioning

With the system calibrated and turned on, rotate the engine over by hand and note the SENS LED on the receiver. When the crankpin passes the rpm sensor, the SENS LED will light red indicating the rpm sensor is working properly.
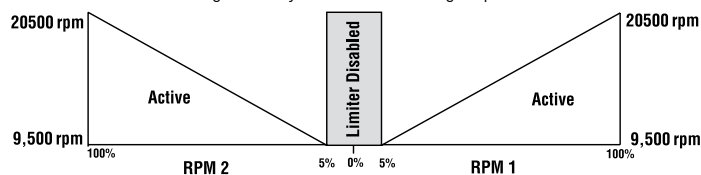
Calibration (continued)

Setting a Target RPM

The Gear channel's output sets the target rpm. See the diagram below. Note that the limiter is turned off from 0% to 5% and the target rpm is increased as the travel adjust/limiter setting is increased. Also note that the rpm increases above and below 5%. Using the servo monitor is a helpful way of verifying adjustment.

Adjust the gear channel's travel adjust (DX7) or the limiter program to select the desired target rpm's.

Fig: Auxiliary Channel ATV to Target Speed.

Example: Engine RPM / Travel Adjust

ATV	Spektrum/JR
10	9480
20	10140
30	10620
40	11280
50	11900
60	12720
70	13500
80	14700
90	16080
100	17340

Adjusting Throttle Curves

During the initial flights, a slightly elevated throttle curve that will give a headspeed of approximately 50 rpm above the target rpm is recommended. After operation is verified, some pilots use a 100% throttle curve in stunt mode and allow the RevLimit to fully regulate the engine rpm. Remember that flipping into normal mode and low throttle will deactivate the limiter should an issue occur.

How the Limiter Works

The RevLimit waits for the engine to reach the target rpm set by the Gear channel output. When the target rpm is exceeded, the limiter will smoothly take over the throttle channel regulating the engine directly. If the rpm drops below the target speed then normal control will be transferred to the throttle channel.

The RevLimit will only limit the throttle if all of the following conditions have been met:
1. The rpm sensor, throttle and gear channel are adjusted and operating correctly
2. The RevLimit has been calibrated
3. The throttle is above 25%
4. The gear channel output is greater than 5%
5. The target rpm has been reached

How the Limiter Works (continued)

The RevLimit will pass control back to the throttle channel (controlled by the throttle curves) if any of the following occurs:
1. The throttle stick (output) is below 25%
2. The Gear channel output is less than 5% (travel adjust or limiter setting)
3. The rpm sensor fails

The Spektrum AR7100R RevLimit feature employs technology exclusively licensed to Horizon Hobby, Inc. from Model Avionics.

QuickConnect with Brownout Detection

The remote receiver included with the AR7100 and AR7100R feature QuickConnect with Brownout Detection. Should a power interruption occur (brownout), the system will reconnect immediately when power is restored and the LEDs on each connected receiver will flash indicating a brownout (power interruption) has occurred. Brownouts can be caused by an inadequate power supply (weak battery or regulator), a loose connector, a bad switch, an inadequate BEC when using an electronic speed controller, etc. Brownouts occur when the receiver voltage drops below 3.2 volts thus interrupting control as the servos and receiver require a minimum of 3.2 volts to operate.

How Brownout Detection Works

When the receiver voltage drops below 3.2 volts the system drops out (ceases to operate). When power is restored, the receiver will immediately attempt to reconnect to the last two frequencies that it was connected to. If the two frequencies are present (the transmitter was left on), the system reconnects typically in about 4ms. The receiver will then blink indicating a brownout has occurred. If at any time the receiver is turned off then back on and the transmitter is not turned off, the receiver will blink as a power interruption was induced by turning off the power to the receiver. In fact this simple test (turning off then on the receiver) will allow you to determine

if your system's brownout detection is functioning. Note: If a brownout occurs in flight it is vital that the cause of the brownout be determined and corrected. QuickConnect and Brownout Detection are designed to allow you to safely fly through most short duration power interruptions. However, the root cause of these interruptions must be corrected before the next flight to prevent catastrophic safety issue.

Tips on Using 2.4GHz Systems

While your DSM equipped 2.4GHz system is intuitive to operate, functioning nearly identically to 72MHz systems, following are a few common questions from customers:

1. Q: Which do I turn on first, the transmitter or the receiver?
A: If the receiver is turned off first—all servos except for the throttle will be driven to their preset failsafe positions set during binding. At this time the throttle channel doesn't output a pulse position preventing the arming of electronic speed controllers or in the case of an engine powered aircraft the throttle servo remains in its current position. When the transmitter is then turned on the transmitter scans the 2.4GHz band and acquires two open channels. Then the receiver that was previously bound to the transmitter scans the band and finds the GUID (Globally Unique Identifier code) stored during binding. The system then connects and operates normally. If the transmitter is turned on first—the transmitter scans the 2.4GHz band and acquires two open channels. When the receiver is then turned on for a short period (the time it takes to connect) all servos except for the throttle are driven to their preset failsafe positions while the throttle has no output pulse. The receiver scans the 2.4GHz band looking for the previously stored GUID and when it locates

the specific GUID code and confirms uncorrupted repeatable packet information, the system connects and normal operation takes place. Typically this takes 2 to 6 seconds.

2. Q: Sometimes the system takes longer to connect and sometimes it doesn't connect at all?
A: In order for the system to connect (after the receiver is bound), the receiver must receive a large number of consecutive uninterrupted perfect packets from the transmitter in order to connect. This process is purposely critical of the environment ensuring that it's safe to fly when the system does connect. If the transmitter is too close to the receiver (less that 4 ft) or if the transmitter is located near metal objects (metal TX case, the bed of a truck, the top of a metal work bench, etc.) connection will take longer and in some cases connection will not occur as the system is receiving reflected 2.4GHz energy from itself and is interpreting this as unfriendly noise. Moving the system away from metal objects or moving the transmitter away from the receiver and powering the system again will cause a connection to occur. This only happens during the initial connection. Once connected the system is locked in and should a loss of signal occur (failsafe) the system connects immediately (4ms) when signal is regained.

3. Q: I've heard that the DSM system is less tolerant of low voltage. Is this correct?

A: All DSM receivers have an operational voltage range of 3.5 to 9 volts. With most systems this is not a problem as in fact most servos cease to operate at around 3.8 volts. When using multiple high-current draw servos with a single or inadequate battery/power source, heavy momentary loads can cause the voltage to dip below this 3.5-volt threshold thus causing the entire system (servos and receiver) to brown out. When the voltage drops below the low voltage threshold (3.5 volts), the DSM receiver must reboot (go through the startup process of scanning the band and finding the transmitter) and this can take several seconds. Please read the receiver power requirement section as this explains how to test for and prevent this occurrence.

4. Q: Sometimes my receiver loses its bind and won't connect requiring rebinding. What happens if the bind is lost in flight?

A: The receiver will never lose its bind unless it's instructed to. It's important to understand that during the binding process the receiver not only learns the GUID (code) of the transmitter but the transmitter learns and stores the type of receiver that it's bound to. If the transmitter is placed into bind mode, the transmitter looks for the binding protocol signal from a receiver. If no signal

is present, the transmitter no longer has the correct information to connect to a specific receiver and in essence the transmitter has been "unbound" from the receiver. We've had several DX7 customers that use transmitter stands or trays that unknowingly depress the bind button and the system is then turned on losing the necessary information to allow the connection to take place. We've also had DX7 customers that didn't fully understand the range test process and pushed the bind button before turning on the transmitter also causing the system to "lose its bind."

If the system fails to connect, one of the following has occurred:
• The transmitter is near conductive material (transmitter case, truck bed, etc.) and the reflected 2.4GHz energy is preventing the system from connecting. (See #2 above)
• The transmitter was put into bind mode knowingly (or unknowingly), causing the transmitter to no longer recognize the receiver.

Warranty Period
Exclusive Warranty- Horizon Hobby, Inc., (Horizon) warranties that the Products purchased (the "Product") will be free from defects in materials and workmanship for a period of 1 year from the date of purchase by the Purchaser.

1 Year Limited Warranty
Horizon reserves the right to change or modify this warranty without notice and disclaims all other warranties, express or implied.

(a) This warranty is limited to the original Purchaser ("Purchaser") and is not transferable. REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. This warranty covers only those Products purchased from an authorized Horizon dealer. Third party transactions are not covered by this warranty. Proof of purchase is required for warranty claims. Further, Horizon reserves the right to change or modify this warranty without notice and disclaims all other warranties, express or implied.

(b) Limitations- HORIZON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR

PURPOSE OF THE PRODUCT. THE PURCHASER ACKNOWLEDGES THAT THEY ALONE HAVE DETERMINED THAT THE PRODUCT WILL SUITABLY MEET THE REQUIREMENTS OF THE PURCHASER'S INTENDED USE.

(c) Purchaser Remedy- Horizon's sole obligation hereunder shall be that Horizon will, at its option, (i) repair or (ii) replace, any Product determined by Horizon to be defective. In the event of a defect, these are the Purchaser's exclusive remedies. Horizon reserves the right to inspect any and all equipment involved in a warranty claim. Repair or replacement decisions are at the sole discretion of Horizon. This warranty does not cover cosmetic damage or damage due to acts of God, accident, misuse, abuse, negligence, commercial use, or modification of or to any part of the Product. This warranty does not cover damage due to improper installation, operation, maintenance, or attempted repair by anyone other than Horizon. Return of any goods by Purchaser must be approved in writing by Horizon before shipment.

Damage Limits
HORIZON SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUC-TION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCT, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY. Further, in no event shall the liability of Horizon exceed the individual price of the Product on which liability is asserted. As Horizon has no control over use, setup, final assembly, modification or misuse, no liability shall be assumed nor accepted for any resulting damage or injury. By the act of use, setup or assembly, the user accepts all resulting liability.

If you as the Purchaser or user are not prepared to accept the liability associated with the use of this Product, you are advised to return this Product immediately in new and unused condition to the place of purchase.

Law: These Terms are governed by Illinois law (without regard to conflict of law principals).

Safety Precautions
This is a sophisticated hobby Product and not a toy. It must be operated with caution and common sense and requires some basic mechanical ability. Failure to operate this Product in a safe and responsible manner could result in injury or damage to the Product or other property. This Product is not intended for use by children without direct adult supervision. The Product manual contains instructions for safety, operation and maintenance. It is essential to read and follow all the instructions and warnings in the manual, prior to assembly, setup or use, in order to operate correctly and avoid damage or injury.

Questions, Assistance, and Repairs
Your local hobby store and/or place of purchase cannot provide warranty support or repair. Once assembly, setup or use of the Product has been started, you must contact Horizon directly. This will enable Horizon to better answer your questions and service you in the event that you may need any assistance. For questions or assistance, please direct your email to productsupport@horizonhobby.com, or call 877.504.0233 toll free to speak to a service technician.

Inspection or Repairs
If this Product needs to be inspected or repaired, please call for a Return Merchandise Authorization (RMA). Pack the Product securely using a shipping carton. Please note that original boxes may be included, but are not designed to withstand the rigors of shipping without additional protection. Ship via a carrier that provides tracking and insurance for lost or damaged parcels, as Horizon is not responsible for merchandise until it arrives and is accepted at our facility. A Service Repair Request is available at www.horizonhobby.com on the "Support" tab. If you do not have internet access, please include a letter with your complete name, street address, email address and phone number where you can be reached during business days, your RMA number, a list of the included items, method of payment for any non-warranty expenses and a brief summary of the problem. Your original sales receipt must also be included for warranty consideration. Be sure your name, address, and RMA number are clearly written on the outside of the shipping carton.

Warranty Inspection and Repairs
To receive warranty service, you must include your original sales receipt verifying the proof-of-purchase date. Provided warranty conditions have been met, your Product will be repaired or replaced free of charge. Repair or replacement decisions are at the sole discretion of Horizon Hobby.

Non-Warranty Repairs
Should your repair not be covered by warranty the repair will be completed and payment will be required without notification or estimate of the expense unless the expense exceeds 50% of the retail purchase cost. By submitting the item for repair you are agreeing to payment of the repair without notification. Repair estimates are available upon request. You must include this request with your repair. Non-warranty repair estimates will be billed a minimum of ½ hour of labor. In addition you will be billed for return freight. Please advise us of your preferred method of payment. Horizon accepts money orders and cashiers checks, as well as Visa, MasterCard, American Express, and Discover cards. If you choose to pay by credit card, please include your credit card number and expiration date. Any repair left unpaid or unclaimed after 90 days will be considered abandoned and will be disposed of accordingly. Please note: non-warranty repair is only available on electronics and model engines.

United States:
Electronics and engines requiring inspection or repair should be shipped to the following address:

Horizon Service Center
4105 Fieldstone Road
Champaign, Illinois 61822 USA

All other products requiring warranty inspection or repair should be shipped to the following address:

Horizon Product Support
4105 Fieldstone Road
Champaign, Illinois 61822 USA

Please call 877-504-0233 or e-mail us at Productsupport@ horizonhobby.com with any questions or concerns regarding this product or warranty.

European Union:
Electronics and engines requiring inspection or repair should be shipped to the following address:

Horizon Hobby UK
Units 1-4 Ployters Rd
Staple Tye,
Harlow, Essex
CM18 7NS
United Kingdom

Please call +44 (0) 1279 641 097 or e-mail us at sales@horizonhobby.co.uk with any questions or concerns regarding this product or warranty.

Horizon Technischer Service
Hamburger Str. 10
25335 Elmshorn
Germany

Please call +49 4121 46199 66 or e-mail us at service@horizonhobby.de with any questions or concerns regarding this product or warranty.

FCC Information
This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This product contains a radio transmitter with wireless technology which has been tested and found to be compliant with the applicable regulations governing a radio transmitter in the 2.400GHz to 2.4835GHz frequency range.

Compliance Information for the European Union

Instructions for Disposal of WEEE by Users in the European Union

This product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.

Warranty (continued)

Declaration of Conformity (in accordance with ISO/IEC 17050-1)
No. HH20091208U3

Products: Spektrum AR7100 7-Channel DSM2 Heli Receiver
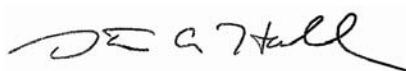   AR7100R 7-Channel DSM2 Heli Receiver with RevLimit

Item Number(s): SPMAR7100, SPMAR7100R

Equipment class: 1

The objects of declaration described above are in conformity with the requirements of the specifications listed below, following the provisions of the European R&TTE directive 1999/5/EC:

EN 301 489-1 v.1.6.1   General EMC requirements for Radio equipment
EN 301 489-17 v.1.2.1

Signed for and on behalf of:
Horizon Hobby, Inc.
Champaign, IL USA
Dec 08, 2009

Steven A. Hall
Vice President
International Operations and Risk
Management
Horizon Hobby, Inc.