



Applications

Giant-scale aircraft / Jets with multiple high-current draw servos

Scale aircraft with multiple high-current draw servos and accessories (e.g. lights, ESCs, air valves, etc.) / Scale helicopters

Features

Spektrum's AR9200 PowerSafe™ Evolution offers the ultimate solution for powering high-current draw radio systems. In aircraft with multiple high-current draw servos (e.g. giant-scale aircraft, jets, etc.), the AR9200 PowerSafe Evolution can provide peak current of up to 20 amps (Each battery input is regulated independently to 5.9 volts, and each regulator is capable of handling 10 amps (2 x 10 A)) and offers true dual battery redundancy and a fail-on soft switch for the ultimate in reliability. By locating three remote receivers throughout the aircraft, the RF link can be optimized in even the most demanding aircraft installations that have significant conductive materials like carbon, stainless steel bypass tubes, tuned exhausts, etc.

- True dual battery redundancy—each battery is isolated and if one fails/shorts the other takes over.
- Utilizes three remote receivers for the ultimate RF link in demanding applications.
- Up to 20 amps peak current handling capability
- SensorSwitch fails-on if the switch is damaged or disconnected
- SensorSwitch indicates battery condition.

- Minimum voltage memory indicates any voltage drops that occur during flight.
- Dual Regulated output voltage (5.9V)
- Large heat sink area for high performance.
- Three voltage indicator LED's per battery input and three battery voltage indicator LED's on the SensorSwitch.
- Support for three battery types: LiPo, NiMH / NiCd, and LiFePo.
- Suppression of any servo feedback currents which might occur.
- Two types of failsafe - Smartsafe (throttle only) and preset failsafe (all servos)
- QuickConnect - if a power interruption (brownout) occurs the system reconnects in less than 1/2 second
- Flight Log compatible
- Heavy-duty dual battery inputs with MPX connectors. (Adapters to EC3 connectors and Deans Ultra connectors are available separately.)
- Compatible with all Spektrum™ and JR® full range radio and module systems
- 2048 resolution

Important

The PowerSafe Evolution main unit is not a receiver. The PowerSafe Evolution's main unit is a power distribution center that provides up to 20-amps current to power your system. Through extensive testing our engineers discovered that mounting the receiver in the typical location in sophisticated aircraft (an aircraft with many high-current draw servos and/or conductive materials), at the end of the servo and battery leads, is not the optimum location to provide the clearest RF signal. The AR9200 PowerSafe Evolution uses three remotely mounted receivers that can be optimally placed in your aircraft providing the best possible RF link in the most demanding conditions.

Specifications

PowerSafe Main unit

Voltage input - 6.0 to 9.0 volts

Minimum operational voltage - 3.5 volts

Peak current - 20 amps Note: Each battery input is regulated to 5.9V, and are each capable of 10 amps output, for 20 amps combined current.

Resolution - 2048

Main unit Dimensions LxWxH - 3.9 x 2.43 x .78 in (99 x 61.7 x 19.9mm)

Note: Includes mounting lugs and base plate

Weight - 3.0 oz (85 grams)

Connector type - MPX (MPX to EC3 connector and MPX to Deans Ultra connector adapters are available separately.)

Regulator - Dual isolated 10 amp, 5.9V regulators

Remote Receiver

Dimensions LxWxH - 1.02 x .80 x .27 in (25.8 x 20.2 x 6.8mm)

Weight - .2 oz (3 g)

SensorSwitch

Dimensions LxWxH - 2.55 x .91 x .71 (65 x 23 x 18.1mm) Note: Includes mounting base

Weight - .7 oz (19.8 g)

SensorSwitch



Main unit

Items Included

- PowerSafe Evolution Main Unit - SPMAR9200
- Three Remote Receivers - SPM9545
- SensorSwitch - PBS9050
- One 24" Remote Receiver Extension - SPM9013
- One 12" Remote Receiver Extension - SPM9012
- One 9" Remote Receiver Extension - SPM9011
- Instruction Manual
- Male/female Bind Plug-SPM6803

Optional Items

- 2150mAh 6.0V NiMH Receiver Pack - SPMB2150NM
- 2700mAh 6.0V NiMH Receiver Pack - SPMB2700NM
- 4500mAh 6.0V NiMH Receiver Pack - SPMB4500NM
- LiPo Receiver Pack 1350mAh - SPMB1350LP
- LiPo Receiver pack 2000mAh - SPMB2000LP
- LiPo Receiver Pack 4000mAh - SPMB4000LP
- LiPo Receiver Pack 6000mAh - SPMB6000LP
- Flight Log Data Recorder - SPM9540
- 6" Remote Receiver Extension - SPM9010
- 9" Remote Receiver Extension - SPM9011
- 12" Remote Receiver Extension - SPM9012
- 24" Remote Receiver Extension - SPM9013

- 36" Remote Receiver Extension - SPM9014
- 12" EC3 Extension - SPMEXEC312
- 24" EC3 Extension - SPMEXEC324
- EC3 Battery Connector, Female (2) - EFLAEC302
- MPX to EC3 adapters - SPM6828
- MPX to WS Deans Ultra Adapter - SPM6829
- External LED's - PBS9070

Battery Requirements

Using One Battery

The PowerSafe Evolution allows the option of using one or two battery packs. When using one battery simply plug the battery into either one of the two battery connectors (BATT 1 or BATT2).

Using Two Batteries

The PowerSafe Evolution offers a true redundant dual battery system with built in dual voltage regulation. When using two battery packs, each pack functions independently and is isolated from the other, so that if one pack should fail (open circuit, short circuit, or become discharged), the other battery will provide power to operate the system.

When using dual batteries it's important that both batteries be of the same capacity, number of cells and ideally of the same age and condition. Note: It's normal for one battery to discharge slightly more than the other. This is the nature of a truly redundant isolated battery system. The battery that has the higher voltage or lower internal resistance will discharge at a faster rate. Generally the difference is negligible (less than 10%).

When using two batteries, the total available capacity equals the sum total of both batteries e.g., BATT1—2000mAh + BATT2- 2000mAh = a total capacity of 4000mAh.

Note: MPX to EC3 and Deans Ultra connector adapters are available separately.

Battery Capacity

It's important to select a battery(s) 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.

Following are two graphs that illustrate the in-flight current draw of the radio system.

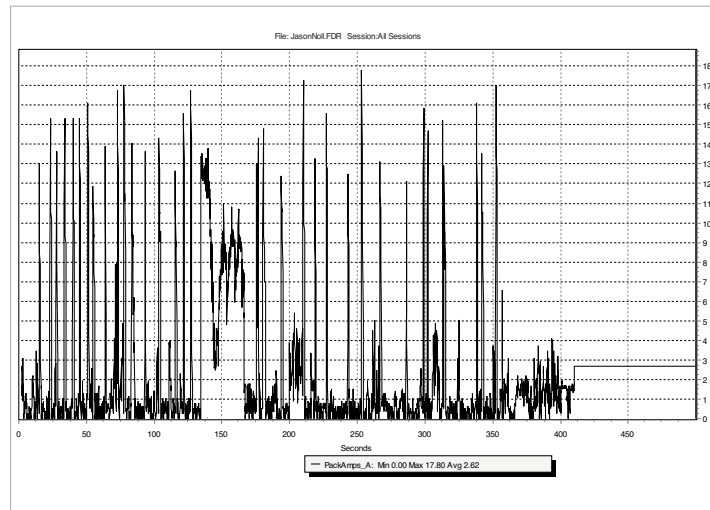
Note: Current draws may vary depending on your servos, installation and flying style.

The following setup is shown as a worst-case scenario indicative of some aerobatic pilots' setups. It is not recommended to use this setup without proper voltage regulation for your servos.

Airplane - 40% YAK
Servos - 9-JR8711's 1-8317 (throttle)
Batteries - Two 4000mAh 2-cell 7.4-volt LiPo's
Regulator - None

Note: JR8711's and 8317's are rated at a maximum of 6-volt 5-cell use. Using higher voltages will void the warranty.

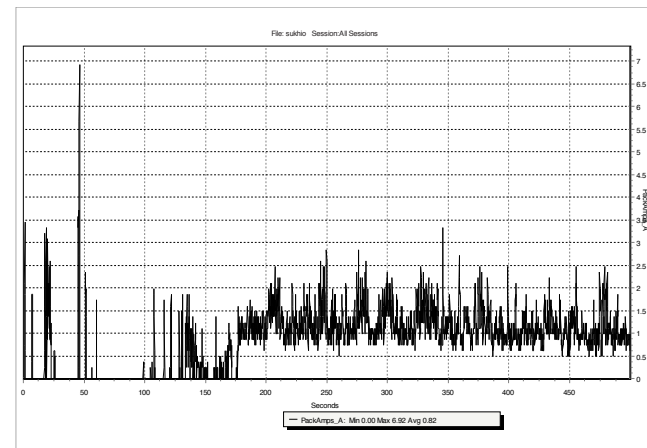
Engine - DA150
Weight - 40 lbs
Flight envelope - Hard 3D
Average current - 2.62 amps
Peak current - 17.8 amps
Milliamps used per 10-minute flight - 435mAh



In the example above, the average current was 2.62 amps, which calculates to 435mAh per 10 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 two 4000mAh batteries (8000mAh total capacity) x 60%= 4800mAh (available usable capacity) divided by the capacity used per 10-minute flight, 435mAh would allow up to 11 flights, of 10 minutes each.

Battery Capacity (continued)

Airplane - 33% Sukhoi
Servos - 7-JR8611's 1-8317 (throttle)
Batteries - 1- 4000mAh 2-cell 7.4-volt LiPo
Regulator - 6 volt
Engine - DA100
Weight - 26 lbs
Flight envelope - Moderate 3D
Average current - .82 amps
Peak current - 6.92 amps
Milliamps used per 10-minute flight - 137mAh



Recommended Guidelines for Battery Capacity

40-45% Aerobatic aircraft w/ 9-12 high-current servos: 4000-8000mAh

33-35% Aerobatic aircraft w/ 7-10 high-current servos: 3000-6000mAh

25% Quarter Scale Aerobatic aircraft w/ 5-7 high-current servos:
2000-4000mAh

Jets - BVM Super BANDIT, F86, Euro Sport, etc.: 3000-6000mAh

Giant-Scale Jets - BVM Ultra Bandit: 4000-8000mAh

Scale aircraft - The varieties of scale aircraft and the accessories they use vary tremendously making it difficult to give capacity recommendations for these types of aircraft. Using the previously mentioned aerobatic guidelines relative to the size and number of servos used will provide a conservative capacity for your scale aircraft. As always, check battery charge condition before each flight.

Battery Voltage

IMPORTANT: DO NOT use a 4-cell 4.8-volt battery to power the PowerSafe Evolution.

Four-cell 4.8-volt batteries do not provide enough voltage headroom (additional margin needed) necessary to power the system when heavily loaded. Under load the system voltage can drop below the voltage system's minimum operating voltage threshold (3.5 volts) and cause loss of control.

The PowerSafe Evolution is capable of handling voltages from 6.0 to 10.0 volts. The voltage limitations are generally the servos. The output voltage to the servos is regulated to 5.9V. Each voltage regulator is capable of handling 10 amps, for a total of 20 amp maximum current capability.

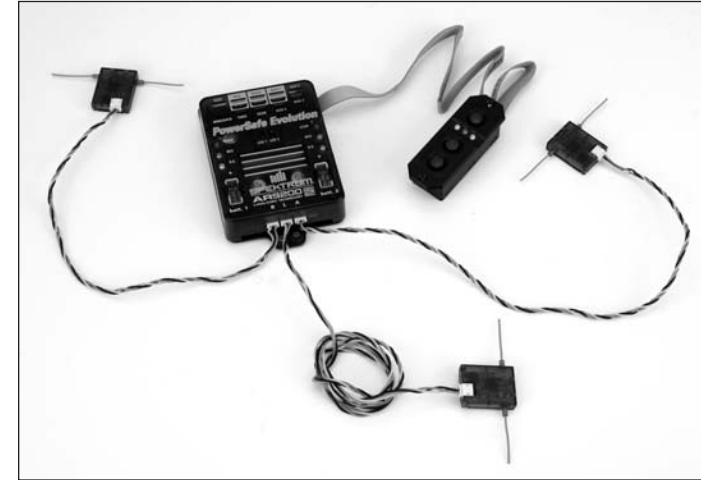
Be aware that NiMH batteries have a tendency to false peak when being fast charged. Be especially careful when using NiMH batteries that they are fully charged and have not false peaked.

Many pilots are using 2-cell LiPo batteries to power their aircraft. LiPo's offer greater capacity for their size and weight, and are easier to manage when charging.

Note: When a battery is connected to the PowerSafe Evolution, a low current drain of less than 1mA occurs even when the switch is turned off. If the system is going to be stored for any length of time, it's important that the battery(s) be disconnected from the PowerSafe Evolution to prevent over discharge.

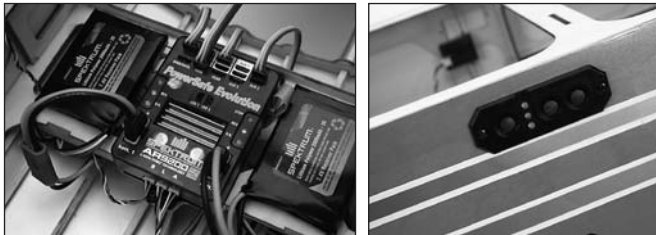
Installation

The PowerSafe Evolution requires all three remote receivers to be plugged in for the system to operate. Each receiver functions independently and offers a more secure RF link in difficult environments. The added security of redundancy should a failure occur outweighs the slight additional weight and cost penalties.



Installing the PowerSafe Evolution Main Unit and SensorSwitch

1. Using four #2 x 1/2" screws or similar(not included), drill 4 1/16" pilot holes into a ply or hardwood mount, secure the main PowerSafe unit in the position desired.



2. Mount the switch on the side of your aircraft and insert the switch plug in the SensorSwitch port in the main receiver unit. Make sure to install the connector as shown with the ribbon cable facing up. In models with severe vibration, it is recommended to secure the ribbon lead by at least one additional point to avoid the connector coming loose. If the connector does fall out in flight, it would have no effect on the PowerSafe Evolution, but would prevent you from turning the PowerSafe Evolution off.

Note: The PowerSafe Evolution uses a specifically designed switch. Conventionally wired switches are not compatible with the PowerSafe Evolution.



3. To turn the PowerSafe Evolution receiver on with the SensorSwitch, press and hold the SET button on the SensorSwitch until the central LED glows red. Now press buttons 1 and 2 one at a time to turn each on. If you have only 1 battery installed, you only need to press the button for that battery.
4. To turn the PowerSafe Evolution off with the SensorSwitch, repeat the procedure for turning the receiver on, by pressing and holding the SET button until the central LED glows red, then press button 1 and/or button 2.

Note: Once the PowerSafe Evolution has been turned on, it can only be turned off again by using the SensorSwitch. Intermittent contacts or interruptions in the battery power cannot cause the PowerSafe Evolution to be switched off permanently.

Installing the Batteries

Using the guidelines mentioned earlier, select the battery system that best fits your application and install the battery(s)/regulator(s) in your aircraft. Connect the battery to the PowerSafe Evolution. Spektrum PowerSafe batteries are pre-wired with an EC3 connector and require an EC3 to MPX adapter to plug into the PowerSafe Evolution. It is absolutely essential to maintain the correct polarity, connecting a battery with reversed polarity will instantly damage the PowerSafe Evolution's internal regulators and will prevent the PowerSafe Evolution from working. The + (positive) mark can be seen on the PowerSafe Evolution case.

The default battery type setting is for Lithium Polymer, LiPo, 2 cell packs. If you wish to use 2 cell (7.4V) LiPo packs, you need to make no changes to the battery type setting. For all other battery types, the battery type must be set using the following procedure

1. Turn the PowerSafe Evolution on with both batteries if so equipped.
2. Hold the SET button and watch the central LED on the SensorSwitch.
3. The LED will light up, then go out again after a short time.
4. After a few seconds, the LED will emit a short red flash. If using 2 cell LiPo batteries, and you release the button now, the LiPo battery type will be selected.
5. If using 5 cell NiMH or NiCd batteries, continue to hold the button until the LED flashes twice. After the LED flashes twice, release the button to select NiMH or NiCd battery type.

6. If using 2 cell LiFePo batteries, continue to hold the button until the LED flashes 3 times. After the LED flashes 3 times, release the button to select LiFePo battery type.

This process generally only takes a few seconds, and is designed to prevent the danger of accidental changes to the battery type setting. Once selected, the battery type is permanently stored in the PowerSafe Evolution, and can only be changed by following the previous procedure.

External LED's

Optional ultra-bright external LED's are available (PBS9070) and can be connected to the PowerSafe Evolution. When mounted externally on the fuselage side, they will light up and can be seen in flight. The LED's will allow you to detect battery problems while the model is in flight.

Mounting the Remote Receivers

Antenna Polarization

For optimum RF link performance it's important that the remote antennas be mounted in an orientation that allows for the best possible signal reception when the aircraft is at all possible attitudes and positions. This is known as antenna polarization. This allows the greatest exposed visual cross section of the antennas from all aircraft orientations. It is recommended that one antenna be mounted vertically, one horizontally in-line with the fuselage and one horizontally perpendicular to the fuselage (see illustrations on pages 11-12). This covers the X,Y and Z axis offering superb cross section visibility in all aircraft orientations.

Locating the Remote Receivers

While Spektrum 2.4GHz systems are far more resistant to interference caused from internal RF generating sources, the remote receivers should be mounted as far away as practical (typically 4" or greater if possible) from the following:

- Fuel tanks
- Metal bypass tubes
- High-temperature components like exhaust systems
- Any significant metallic conductive components
- High-vibration areas

The remote antennas should be mounted a minimum of at least 2" apart from each other as greater antenna separation gives improved path diversity (RF link performance) in critical environments. In large aircraft where space is not an issue it is highly recommended that the antennas be mounted throughout the aircraft as illustrated. Spektrum offers remote receiver extensions ranging from 6" to 36" allowing the receivers to be mounted in the most optimum locations throughout the aircraft.

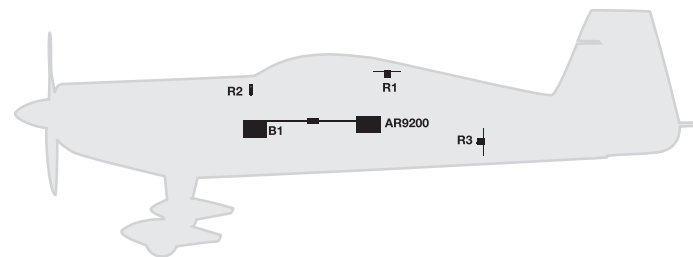
Using double-sided foam tape and tie wraps, mount a minimum of 3 remote receivers in your aircraft as per the illustrations and plug them into the receiver ports.

The following are illustrations of typically recommended installations. Note the remote receiver orientation.

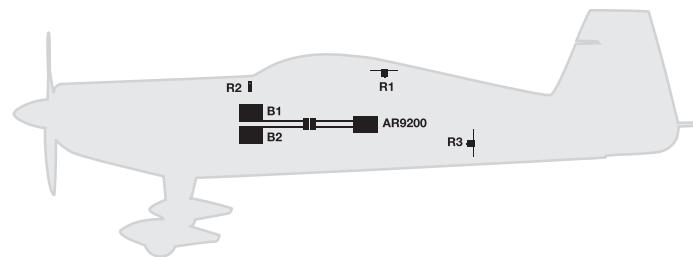
- Ignition systems
- Ignition batteries
- Ignition switches
- Engines
- ECU's pumps
- Electric motors
- Receiver batteries

Mounting the Remote Receivers (continued)

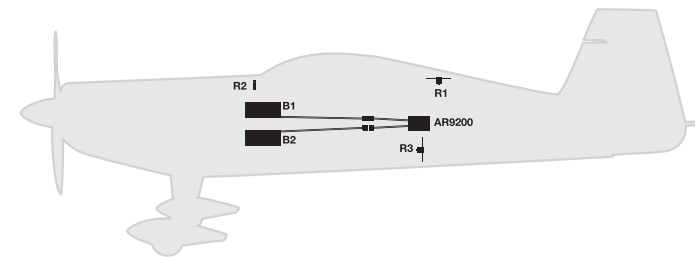
- 35% aerobatic plane with single NiMH battery and three remote receivers



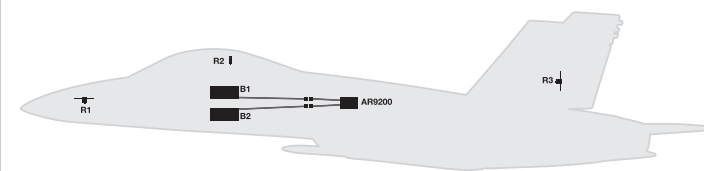
- 35% aerobatic plane with dual NiMH batteries and three remote receivers



- 40% aerobatic plane with dual LiPo batteries and three remote receivers



- Jet with dual LiPo batteries and three remote receivers



Plugging in the Servos

Plug the servo leads into the appropriate ports in the PowerSafe Evolution. You are now ready to bind the system.

The PowerSafe Evolution has dual aileron, rudder, and aux 1 channels available to operate 2 separate ailerons, rudders, or aux 1 or flap servos. The dual channels use a linear mix to be used when 2 servos are not ganged on a single control surface such as 2 servos per aileron. Using dual servos on a single control surface requires the use of either a matchbox, program mixing with an open channel/s, or mechanical throw matching. Failure to match ganged servos throughout the range of motion on a control surface will result in high amperage drawn by the servos, and will lead to servo failure. Using an inline current meter such as HAN172 is recommended to minimize the current draw of the system.

Important - Y-Harnesses and Servo Extensions

When using Y-harnesses or servo extensions, it's important to use standard non-amplified Y-harnesses and servo extensions as this can/will cause the servos to operate erratically or not function at all. Amplified Y-harnesses were developed several years ago to boost the signal for some older PCM systems and should not be used with Spektrum equipment. Note that when converting other models to Spektrum be certain that all amplified Y-harnesses and/or servo extensions are replaced with conventional, non-amplified versions.

The JR PCM Y-Harness with Amplifier (JRPA133) is not compatible with the AR9200 and should not be used.

Binding

Note: In order for the system to operate, all three remote receivers must be plugged into the receiver in order for the receivers to bind and link to a transmitter.

It's necessary to bind the AR9200 to the transmitter so that the AR9200 will only recognize that specific transmitter, ignoring signals from any other sources. If the PowerSafe Evolution is not bound to the transmitter, the system will not operate. During binding the servo's failsafe positions are stored.

How To Bind the PowerSafe Evolution

1. With the system hooked up and all remote receivers attached as described previously, insert the bind plug in the DATA/BIND port in the PowerSafe Evolution.



2. Turn on the PowerSafe Evolution with the SensorSwitch. 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 and flight controls neutral.
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.
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 programmed.

Failsafe Functions

The AR9200 PowerSafe Evolution features two types of failsafe programming: SmartSafe™ and Preset Failsafe.

SmartSafe

SmartSafe is automatically selected during the standard binding procedure and is ideal for electric aircraft as well as most gas- and glow-powered aircraft.

How SmartSafe Works

When the Receiver is Powered On without a Transmitter Signal

If you turn on the R291 before you turn on the transmitter, SmartSafe prevents the throttle from functioning and drives all other channels to their preset positions.

When there is a Loss of Signal in Flight

If the receiver loses the transmitter's signal in flight, or any other time after a successful connection has been made, SmartSafe sets the throttle to the position it was in during the binding process. All other channels hold the positions they were in at signal loss.

How to Program the Receiver for SmartSafe

Simply move the throttle to a desired in-flight failsafe position (typically this is all the way back) and bind the receiver to the transmitter. Leave the bind plug in the receiver during the entire binding process. Remove the bind plug only after a connection has been made and the controls are functioning normally.

Preset Failsafe

Preset Failsafe allows you to set the specific control positions for all channels to go to should you encounter signal loss in flight or at any other time after a successful connection has been made. Preset Failsafe is typically used to prevent “fly aways” in high-performance models by deploying spoilers in sailplanes or putting gas- and glow-powered models into a slight turn at reduced throttle.

How to Program Preset Failsafe Settings

Insert the bind plug and power on the receiver. When the receiver's LED lights begin to blink indicating it is in bind mode, remove the bind plug before binding the transmitter to the receiver. The LED lights on the receiver continue to blink. Move your transmitter's control sticks and switches to the desired Preset Failsafe positions then turn it on in bind mode. The system should connect in less than 15 seconds.

Standard Range Testing

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.

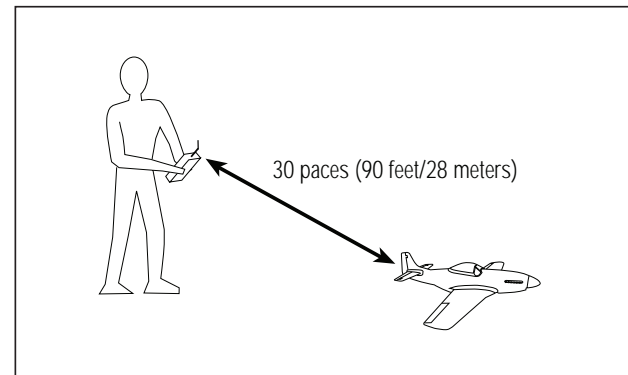
Range Testing

1. With the model resting on the ground, stand 30 paces (approx. 90 feet/28 meters) 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 in range test mode at 30 paces (90 feet/28 meters).
4. If control issues exist, call Horizon Product Support for further assistance.

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Advanced Range Testing Using a Flight Log

The Standard Range Testing procedure is recommended for most sport aircraft. For sophisticated aircraft that contain significant amounts of conductive materials (e.g. turbine powered jets, some types of scale aircraft, aircraft with carbon fuselages, etc.), the following advanced range check will confirm that all 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 remote receiver to be evaluated and to optimize the locations of each individual remote receiver.

Advanced Range Testing

1. Plug a Flight Log into the Bind/Data port in the AR9200 and turn on the system (Tx and Rx).
2. Advance the Flight Log until frame losses are displayed by pressing the button on the Flight Log.
3. Have a helper hold your aircraft while observing the Flight Log data.
4. Standing 30 paces away from the model, 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. For giant-scale aircraft it's recommended that the airplane be tipped up on its nose and rotated 360 degrees for one minute then the data recorded. Next place the airplane on its wheels and do a second test rotating the aircraft in all directions for one minute.

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, L,) 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, L - Frame losses will typically be less than 100. It's important to compare the relative frame losses. If a particular receiver has a significantly higher frame loss value (2 to 3X) then the test should be redone and if the same results occur, move the offending receiver to a different location.

Flight Log

Spektrum's Flight Log (SPM9540) is compatible with the AR9200 PowerSafe Evolution. 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 PowerSafe. 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 antenna A

B - Antenna fades on antenna B
L - Antenna fades on the left antenna
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. The antenna fades that caused the frame loss are recorded and will be added to the total antenna fades.

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 reevaluate the system, moving the antennas to different locations and/or checking to be sure the transmitter and receivers are all working correctly. The frame losses that led to the hold are not added to the total frame losses.

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

QuickConnect™ with Brownout Detection

The AR9200 Evolution features 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 receivers will immediately attempt to reconnect to the last two frequencies they were connected to. If the two frequencies are present (the transmitter was left on) the system reconnects, typically about 4ms. The receivers 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 receivers will blink as a power interruption was induced by turning off the power to the receiver. In fact this simple test (turning the receiver off then on) 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 issues.

The AR9200 PowerSafe Evolution features a minimum voltage memory that can be used to evaluate your aircraft and the battery packs. The minimum voltage memory shows you the extent to which the battery voltage dropped during the last flight due to the control surfaces jamming, the model has stiff linkages, or it has batteries that fade under load. It is a good idea to make it part of your routine to check the minimum voltage memory after every flight, this allows you to find problems with the model or batteries before the next flight. To check the minimum voltage, after a flight, press both SensorSwitch battery 1 and 2 buttons. The 3 battery LED's will indicate the lowest voltage level that occurred during the flight. The minimum voltage memory does not record short duration voltage drop outs, only those voltage drops which last longer than one second.

Frequently Asked Questions on Spektrum 2.4GHz

Your DSM2 equipped 2.4GHz system is intuitive to operate, functioning nearly identically to FM systems. Following are a few common questions from customers:

Q: After I've bound the receiver to my transmitter, which do I turn on first when I want to fly?

A: Either one. Every DSM 2.4GHz transmitter has a GUID (Globally Unique Identifier) code imbedded in its signal. When you bind a DSM receiver to your transmitter, this GUID code is stored in the receiver. If you turn the receiver on before the transmitter, you don't have to worry about it responding to another transmitter. The receiver will inhibit throttle output and drive all controls to preset positions while it waits for a signal from the transmitter with the same GUID code it has stored.

If a DSM transmitter is turned on first you can expect it to connect within 6 seconds of powering on the receiver.

Q: Sometimes the system takes longer to connect or doesn't connect at all. Why?

A: In order for a DSM system to connect, the receiver must receive a large number of uninterrupted signal packets from the transmitter. This process takes just a few seconds, but if the transmitter is too

close to the receiver (within 4 feet) or near metal objects it may detect its own reflected 2.4GHz energy as "noise". This can delay or prevent connection.

If this happens make sure you are a sufficient distance from metal objects and the receiver itself before you power up and try again.

Q: Is it true that DSM systems are less tolerant of low voltage?

A: All DSM receivers require at least 3.5V to operate normally. Most servos cease to operate below 3.8V. Using multiple high-voltage servos, however, with an inadequate power supply can allow voltage to momentarily drop below 3.5V. This will cause the receiver to "brown out" and reconnect.

All recently manufactured JR and Spektrum DSM receivers feature QuickConnect technology that will reconnect the system within a quarter of a second should a brown out occur. In addition, the receiver's LED will flash, indicating a brown out has occurred. If after landing you notice your DSM receiver's LED is flashing make sure you have adequate power before you fly again.

Frequently Asked Questions on Spektrum 2.4GHz (continued)

Q: Sometimes when I power on my DSM system I notice the receiver won't connect and it needs to be rebound to the transmitter. Can this happen in flight?

A: No. A DSM receiver cannot be unbound from its transmitter without specific action by the user.

You can accidentally unbind a receiver by inadvertently pressing the bind button on your transmitter when you turn it on. This will cause the transmitter to go into bind mode. If this happens and the transmitter doesn't detect a binding signal from the receiver it can cause the receiver to be unbound. Some transmitter stands can cause the bind button to be depressed during power up, but these instances are extremely rare.

If your system fails to connect, chances are much greater that it's the result of one of the following conditions and not because the receiver is unbound.

1. You've selected the wrong model memory.
2. The transmitter is too close to conductive material to connect (see FAQ #2).

Q: How important is it that I test my system using a Spektrum Flight Log?

A: All 2.4GHz signals, not just DSM, are affected by proximity to conductive materials such as carbon fiber or metal. Few RTF and ARF sport airplanes or helicopters use enough of these kinds of materials for it to be an issue. If, however, you're flying a sophisticated model that uses a lot of conductive materials in its construction, a Flight Log can be helpful. The information it collects when you fly will help you determine the optimum location for your receiver(s) so you can minimize the effects of these materials on your signal performance. For more details on the Flight Log and how it works, visit SpektrumRC.com.

Tips for Getting the Most from your PowerSafe System

Flight Log

The optional Flight Log is highly recommended. The Flight Log can be used to test the battery system using the built-in voltmeter and applying a load to the servos/control surfaces. The voltage should never drop below the rated voltage (5.9 volts) even under a heavy load.

When the system is first installed it is highly recommend that an advanced range check be performed. (See advanced range check on page 18.) If any receiver is performing less than optimally (higher than normal fades) that receiver should be repositioned and the advanced range test repeated until low fades are recorded.

During first flights with sophisticated airplanes (significant conductive materials onboard, many high-current draw servos, carbon construction, etc.), it's a good practice to keep your first flight in close then confirm the RF link performance using the Flight Log to determine the performance of each attached receiver. Extend the distance on subsequent flights and record the Flight Log data confirming that all systems are performing properly.

Storing Your System

If the system will be stored for more than two weeks, it's important that the battery be disconnected from the PowerSafe Evolution. The PowerSafe Evolution draws a small amount of current (less than 1ma) even when the switch is turned off and the battery will drain and could become damaged if left

attached for an extended period. This is especially important when using LiPo batteries as irreversible damage could occur to your batteries.

Using Nickel-Metal Hydride Batteries

The latest generation of NiMH batteries incorporates a new chemistry mandated to be more environmentally friendly. These batteries, when charged with peak detection chargers have tendencies to false peak (not fully charge) repeatedly. These include all brands of NiMH batteries. If using NiMH packs be especially cautious when charging making absolutely sure that the battery is fully charged. It is recommended that a fast charge with a meter that monitors the input mAh be used and that the expected charge capacity is reached during charge.

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.

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 PRODUCTION 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).

Warranty Services

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 Product Support representative.

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.

Country of Purchase	Horizon Hobby	Address	Phone Number/ Email
United States	Horizon Service Center (Electronics and engines)	4105 Fieldstone Rd Champaign, Illinois 61822 USA	877-504-0233 productsupport@horizonhobby.com
	Horizon Product Support (All other products)	4105 Fieldstone Rd Champaign, Illinois 61822 USA	877-504-0233 productsupport@horizonhobby.com
United Kingdom	Horizon Hobby Limited	Units 1-4 Ployters Rd Staple Tye Harlow, Essex CM18 7NS United Kingdom	+44 (0) 1279 641 097 sales@horizonhobby.co.uk
Germany	Horizon Technischer Service	Hamburger Str. 10 25335 Elmshorn Germany	+49 4121 46199 66 service@horizonhobby.de
France	Horizon Hobby SAS	14 Rue Gustave Eiffel Zone d'Activité du Réveil Matin 91230 Montgeron	+33 (0) 1 60 47 44 70

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



No. HH20100323

Product(s): Spektrum AR9200 Receiver
Item Number(s): SPMAR9200

Equipment class: 1

The object of declaration described above is 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, 301 489-17 General EMC requirements for Radio equipment

Signed for and on behalf of:
Horizon Hobby, Inc.
Champaign, IL USA
March 23, 2010

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



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.