15035
Printed 1-09

SPEKTRUM®

AR12100 PowerSafe™ User Guide

SPEKTRUM®

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 AR12100 PowerSafe™ 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 AR12100 PowerSafe can provide peak current of up to 50 amps and offers true dual battery redundancy and a fail-on soft switch for the ultimate in reliability. By locating up to four 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. For models high in carbon fiber content the SPM9546 Carbon Fiber Remote Receiver is compatible with the AR12100.

- True dual battery redundancy—each battery is isolated and if one fails/shorts the other takes over.
- Utilizes up to four remote receivers for the ultimate RF link in even the most demanding applications.
- Up to 35 amps continuous and 50 amps peak current handling capability
- Fail-on soft switch in case the switch is damaged
- 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 16AWG dual battery leads with pre-wired E-flite® EC3 connectors
- Compatible with all Spektrum™ and JR® full range radio and module systems
- 2048 resolution

Important

The PowerSafe main unit is not a receiver. The PowerSafe's main unit is a power distribution center that provides up to 35-amps continuous and 50-amps peak 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 AR12100 PowerSafe uses up to four (a minimum of three are required) 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 10.0 volts *Note: Consult your servo manufacturer's specifications for maximum allowable voltage.*
Minimum operational voltage - 3.5 volts
Continuous current - 35 amps
Peak current - 50 amps
Resolution - 2048
Main unit dimensions LxWxH - 46.5 x 52 x 15.3mm
Weight - 72 g
Connector type - EC3
Regulator - None

Remote Receiver

Dimensions LxWxH - 25.8 x 20.2 x 6.8mm
Weight - 3 g

Items Included

- PowerSafe Main Unit - SPMAR12100
- Three Remote Receivers - SPM9545
- Soft Switch - SPM6820
- 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
- Two EC3 Battery Connectors, Female - EFLAEC302
- Two JR-type Charge Receptacles

Optional Items

- 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
  LiPo Receiver Pack 1350mAh - SPMB1350LP
  LiPo Receiver Pack 2000mAh - SPMB2000LP
  LiPo Receiver Pack 4000mAh - SPMB4000LP
  LiPo Receiver Pack 6000mAh - SPMB6000LP
- VR6010 Voltage Regulator 10A, 6V - SPMVR6010
- 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
- 36" Remote Receiver Extension - SPM9014
- SPM9546 Carbon Fiber Remote Receiver
- 12" EC3 Extension - SPMEXEC312
- 24" EC3 Extension - SPMEXEC324
- EC3 Battery Connector, Female (2) - EFLAEC302

Battery Requirements

Using One Battery

The PowerSafe 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). Be sure to secure the unused battery connector. Note that the open contacts of the unused battery are not back powered (not electrically hot), however, the unused connector should be secured to prevent it from entangling during flight. When the system is powered using one battery, a single blue LED will constantly emit when the system is powered on.

Using Two Batteries

The PowerSafe offers a true redundant dual battery system. 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 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%). Because of this it's normal for only one blue LED (Batt 1 or Batt 2) to be on when the system is not under a heavy current load depending on which pack is providing more power.

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: 12- and 24-inch EC3 battery extensions are available for installations where the battery is located a distance from the main PowerSafe unit.

Using Dual Voltage Regulators

Spektrum offers a 10-amp (16-amp peak) 6.0-volt regulator (SPMVR6010) specifically designed for use with the AR12100 PowerSafe.

Important: When using two batteries powered through two regulators, each regulator operates independently and it's common for one battery to be discharged at a slightly higher rate depending on the condition of the battery (internal resistance, voltage, etc.) and the tolerance of the regulators. This causes one battery to discharge before the other and it's important to check each battery using a loaded battery tester (HAN171) at a recommended 1-amp load before each flight monitoring the voltage of each pack and recharging when the weakest pack reaches 40% capacity. (See Battery Capacity pg. 5)

Battery Capacity

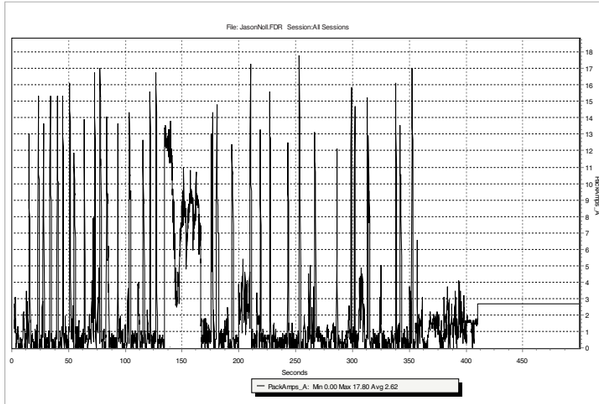
It's important to select a battery(s) that has more than adequate capacity to provide the necessary flight time. Our staff has been recording in-flight data to determine typical current consumption of aircraft in flight. Following are two graphs that illustrate the in-flight current draw of the radio 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 LiPos
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.

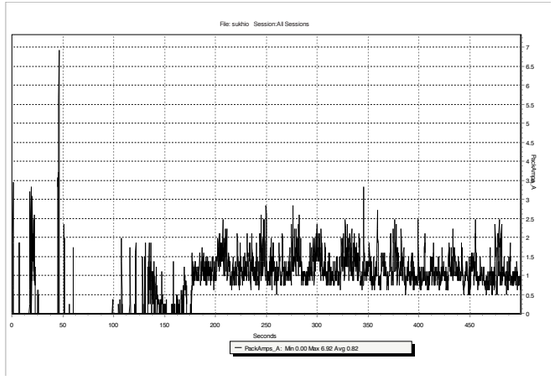
Engine - DA150
Weight - 40 lb
Flight envelope - Aggressive 3D
Average current - 2.62 amps
Peak current - 17.8 amps
Milliamps used per 10-minute flight - 435mAh



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 volts
Engine - DA100
Weight - 26 lb
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.

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 is capable of handling voltages from 6.0 to 10.0 volts. The voltage limitations are generally the servos. Most servos are compatible with 5-cell 6-volt packs. Five-cell 6-volt NiMH packs have become the standard for many giant-scale applications.

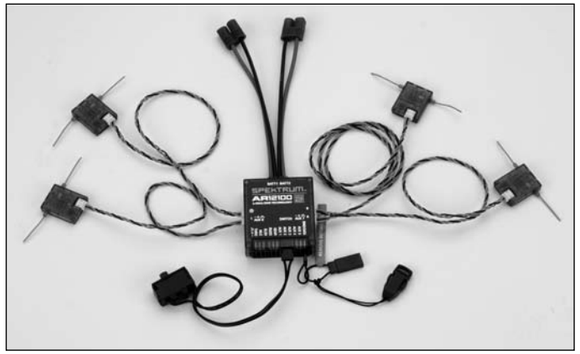
Be aware that NiMH batteries have a tendency to false peak when being fast charged. Be especially careful when using NiMH batteries that they are fully charged and have not false peaked.

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. Before using LiPo batteries, please check the voltage specifications of your servos. Use of a voltage regulator, such as the Spektrum VR6010 (SPMVR6010), might be necessary.

Note: When a battery is connected to the PowerSafe, 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 to prevent over discharge.

Installation

The PowerSafe requires a minimum of three remote receivers to operate, and one receiver must be plugged into the A receiver port. Four remote receivers are included and, in most cases, it is recommended that three or four receivers be used. Each receiver functions independently and additional receivers (up to four) offer a more secure RF link in difficult environments. The added security of redundancy should a failure occur will outweigh the slight additional penalties of cost and weight.



Installing the PowerSafe Main Unit

1. Using foam or thick double-sided foam tape and tie wraps, secure the main PowerSafe unit in the position where you would normally mount the receiver.

2. Mount the switch on the side of your aircraft and insert the switch plug in the port in the main unit marked SWITCH.

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

Installing the Batteries

Using the given guidelines 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. 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 (two are included with the AR12100) to the battery leads. If using a regulator, install it per the guidelines included with the regulator.

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. If three antennas are used, 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. An optional fourth antenna can be added at an intermediate angle offering even greater RF link security and system redundancy.

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:

- Ignition systems
- Ignition batteries
- Ignition switches
- Engines

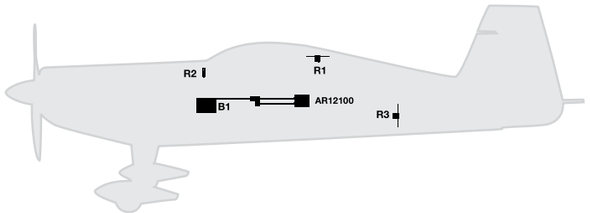
- ECU pumps
- Electric motors
- Receiver batteries
- Fuel tanks
- Metal bypass tubes
- High-temperature components like exhaust systems
- Any significant metallic conductive components
- High-vibration areas

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.

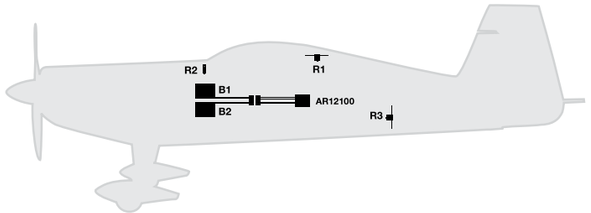
Using double-sided foam tape and tie wraps, mount a minimum of three and up to four remote receivers in your aircraft as per the illustrations and plug them into the receiver ports.

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

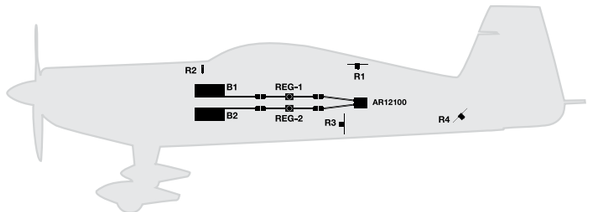
- 35% aerobatic plane with single NiMH battery and three remote receivers



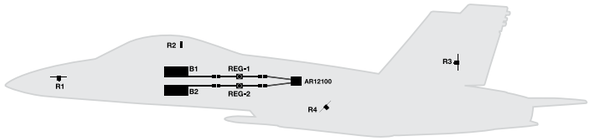
- 35% aerobatic plane with dual NiMH batteries and three remote receivers



- 40% aerobatic plane with dual LiPo batteries, dual regulators and four remote receivers



- Jet with dual LiPo batteries, dual regulators and four remote receivers



Plugging in the Servos

Plug the servo leads into the appropriate ports in the PowerSafe. You are now ready to bind 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 AR12100 and should not be used.

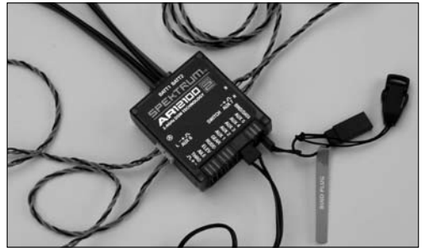
Binding

Note: In order for the system to operate, one remote receiver must be plugged into receiver port A and two more receivers must be plugged into any other ports. When binding the PowerSafe with three remote receivers, if a fourth remote receiver is added, the system must be re-bound to recognize the additional remote.

It's necessary to bind the AR12100 to the transmitter so that the AR12100 will only recognize that specific transmitter, ignoring signals from any other sources. If the PowerSafe 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

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.



2. Turn on the soft switch. Note that the LEDs on all receivers should be flashing indicating that the receivers are 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.

The AR12100 PowerSafe features two types of failsafe: SmartSafe™ and Preset Failsafe.

SmartSafe Failsafe

This type of failsafe is recommended for most types of giant-scale aircraft. Here's how SmartSafe works:

Receiver Power Only

When the receiver only is turned on (no transmitter signal is present), all servos except for the throttle are driven to their preset failsafe positions, normally all control surfaces at neutral and the landing gear down. These failsafe positions are stored in the receiver during binding. At this time the throttle channel has no output, to avoid operating or arming an electronic speed control (if used). In glow-powered models, the throttle servo receives no input so it remains in its current position.

Note: Some analog servos will coast (move when powered up) slightly even though there is no signal present. This is normal.

The receivers remain in standby mode with the blue battery LEDs lit. When the transmitter is turned on, the receiver locates the signal (GUID), connects and normal control resumes. When connected, the amber LEDs on all attached remote receivers will be on.

After Connection

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, SmartSafe drives the throttle servo 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 regains control.

SmartSafe:

- Prevents unintentional electric motor response on start-up.
- Establishes low-throttle failsafe and maintains last-commanded control surface position if the RF signal is lost. Note: Failsafe positions are stored via the stick and switch positions on the transmitter during binding.

Preset Failsafe

Preset Failsafe is ideal for sailplanes and is preferred by some modelers for their glow and gas powered aircraft. Here's how Preset Failsafe works.

Receiver Power Only

When the receiver only is turned on (no transmitter signal is present), all servos except for the throttle are driven to their preset failsafe positions, normally all control surfaces at neutral and the landing gear down. These failsafe positions are stored in the receiver during binding. At this time the throttle channel has no output, to avoid operating or arming an electronic speed control (if used). In glow-powered models, the throttle servo has no input so it remains in its current position. The

receiver remains in standby mode with the blue battery LEDs lit. When the transmitter is turned on, the receiver locates the signal (GUID), connects and normal control resumes. When connected, the amber LEDs on all attached remote receivers will be on.

After Connection

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. For sailplanes it's recommended that the spoilers/flaps deploy to dethermalize the aircraft, preventing a flyaway. Some modelers prefer to use this failsafe system to program a slight turn and low throttle to prevent their aircraft from flying away. When the signal is regained, the system immediately (less than 4 ms) regains control.

Preset Failsafe:

- Prevents unintentional electric motor response on start-up.
- Drives all servos, except for the throttle to their preset failsafe positions, if the receiver only is powered and no signal is present.
- Establishes preset failsafe servo positions for all channels if the signal is lost.

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, 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 into bind mode. The system should connect in less than 15 seconds. The receiver is now programmed for preset failsafe.

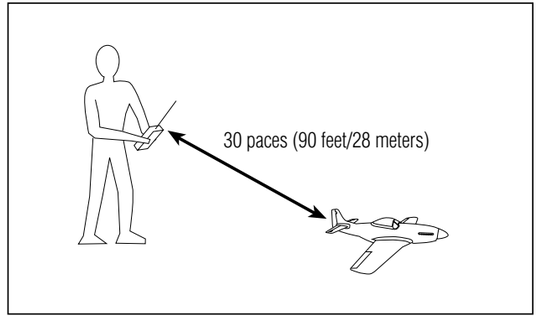
Note: Failsafe positions are stored via the stick and switch positions on the transmitter during binding.

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.
   United States: 1-877-504-0233
   European Union: +44 1279 641 097 (United Kingdom)
   +49 4121 46199 66 (Germany)



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 data port in the AR12100 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, 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, 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. If the same results occur, move the offending receiver to a different location.

Flight Log

Spektrum's Flight Log (SPM9540) is compatible with the AR12100 PowerSafe. 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
R - Antenna fades on the right 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 remote receivers now included with the AR12100 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 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 in 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.

Tips on Using 2.4GHz Systems

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: Which do I turn on first, the transmitter or the receiver?

A: It doesn't matter if the receiver is turned on first, the throttle channel doesn't put out a pulse position at this time, 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 turned on, the receiver scans the 2.4GHz band looking for the previously stored GUID. 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.

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

A: In order for the system to connect (after the receiver is bound), the receiver must receive a large number of continuous (one after the other) uninterrupted perfect packets from the transmitter. 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 than 4 feet) or if the transmitter is located near metal objects (metal transmitter case, the bed of a truck, the top of a metal work bench, etc.) connection will take longer. 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 up again will cause a connection to occur. This only happens during the initial connection. Once connected the system is locked, and should a loss of signal occur (failsafe), the system connects immediately (4ms) when signal is regained.

Tips on Using 2.4GHz Systems (continued)

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 9.6 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 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 start-up process of scanning the band and finding the transmitter) and this can take several seconds.

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 put 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 unknowlingly) causing the transmitter to no longer recognize the receiver.

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. If a regulator is used the voltage should never drop below the rated voltage (6.0 volts) even under a heavy load. When using direct batteries the loaded voltage should never drop below 5.0 volts.

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 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 or from the regulator (if used). The PowerSafe 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.

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.

Limited Warranty

(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).

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

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

Horizon Product Support
4105 Fieldstone Road
Champaign, Illinois 61822

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

United Kingdom:

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.

Germany

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

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.

CE 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.

CE

Declaration of Conformity

(in accordance with ISO/IEC 17050-1)

No. HH2008123101

Product(s):	Spektrum AR12000 Receiver
Item Number(s):	SPMAR12000, SPMAR12100
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 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. 31, 2008

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