



## **Flight Systems**

including the  
**FS Receiver for Aircraft**  
and  
**FS Receiver Viewer Software**

## Getting started

Everything you need to know about the FS Receiver and the FS Receiver Viewer Software is provided in these pages.

The FS Receiver offers unique features not found in other receivers. It's not complicated, but **you will need to learn a few new concepts and procedures before you can use the receiver effectively.**

Start by reviewing the [features](#) available in the FS Receiver and its companion Viewer Software. Then work your way through the topics as they are listed in the contents (the "Previous" and "Next" buttons at the bottom of each page take you through all topics in sequence).

**Tip:** Take time to learn how the FS Receiver operates. Work with it on the bench, before you install it in your aircraft.

**"But I don't like to read instructions!"**

Okay, but you have to read a few. Condensed instructions are provided in [FS Receiver quick start](#) and [Viewer Software quick start](#).

## Features

FMA's Flight System products protect your investment before you take off, while you're flying, and after you land.

### FS Receiver for Aircraft

- Universal operation: works with both negative shift (Futaba, Hitec) and positive shift (JR, Airtronics) PPM transmitters.
- For aircraft (72MHz) installations.
- Full range, full performance. Can be used in aircraft ranging from park flyers to IMAA-legal aircraft to helicopters.
- Frequency-Clear feature tells you whether another transmitter is using your channel.
- Digital Signal Recognition eliminates nearly all interference (see [How the FS Receiver works](#)).
- Set any channel for a failsafe position using your transmitter (see [Setting up the FS Receiver](#)).
- On loss of signal, failsafe channels move to preset positions, other channels hold last good frame position (see [About FS Receiver modes](#)).
- LED blinks battery voltage, number of failsafes and number of bad frames received.
- Better range checking: receiver records signal loss (if any) during range check, then displays result (see [Checking radio system range](#)).
- Includes remote button/LED for programming and feedback from outside aircraft.

### FS Receiver Viewer Software

- Real-time display of FS Receiver data (see [Using the Viewer Software](#)).
- Graphically shows servo positions for all channels.
- Graphically shows failsafe preset positions.
- Built-in recorder/player: record receiver data, play back for analysis, add notes.
- Unique Help Wizard describes exactly what receiver is doing, and interprets receiver data for you (see [Using the Help Wizard](#)).
- Runs on PCs having Windows 98 or later and a serial port.
- Use with a laptop computer for radio system analysis at your flying field.

**Note:** The Viewer Software is not required for FS Receiver setup and operation, however, it is a great tool for helping you set up a FS Receiver. It provides a convenient way to view and interpret what the receiver is doing, and permits data recording and playback.

**Note:** The Viewer Software requires the FMA Interface Module to display and record data from the FS Receiver.

## Safety precautions

Radio controlled models are not toys! Please observe these general safety precautions:

- Follow all instructions provided here to assure safe operation.
- If you have not assembled and operated a radio controlled model before, obtain help from an experienced modeler. You will need guidance to successfully assemble, test and operate radio controlled models. One of the best ways to obtain help is to join your local radio control club.
- Never fly radio controlled aircraft near people, buildings, telephone or power lines, cars, trees or other objects on the ground or in the air.
- Never allow a helicopter to fly within 20 feet of you or another person. If a helicopter flies toward you or another person, stop the engine immediately to prevent personal injury.
- Keep your radio controlled models and equipment away from children. Do not allow unauthorized people of any age to operate radio controlled models without proper supervision from an experienced modeler.
- In some areas of the country, you cannot legally operate radio controlled models except at approved fields. Check with local authorities first.
- Observe frequency control. If someone else is operating a radio controlled model on the same channel as your transmitter, **do not turn on your transmitter—even for a short time.** Your transmitter has a channel number marked somewhere on its case. **When a model receives signals from two transmitters on the same channel at the same time, it cannot be controlled and will crash—possibly causing personal injury or property damage.** For safety, most RC flying fields have formal frequency control rules. Follow them carefully.
- Do not operate your radio control transmitter within 3 miles of a flying field. Even at a distance, your transmitter can cause interference.
- Do not operate radio controlled models and equipment in the rain, or at night.
- Protect all electronic equipment from exposure to rain, water, high humidity and high temperatures.
- FMA Direct recommends that you join the AMA. They can help you find a club in your area.

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Web: [www.modelaircraft.org](http://www.modelaircraft.org)

## What's included (and the other things you'll need)

### The FS Receiver bundle includes:

- FS Receiver.
- Viewer Software CD-ROM (not required for setting up and operating the receiver).

### To use the receiver, you must supply:

- Crystal: FMA Quantum or Fortress series dual conversion, or Hitec dual conversion (on same channel as your transmitter).
- FMA External Switch/LED Module (part number FSRES1, for interacting with the receiver from outside the aircraft).
- Battery pack: typically 4- or 5-cell NiCd. (Do not use alkaline batteries!)
- Radio on/off switch harness.
- Servos.

**Tip:** Crystals, servos, aileron extension cables, switch harnesses, Y-harnesses, battery packs, chargers and many other accessories are available from your local FMA dealer or from FMA Direct ([www.fma.com](http://www.fma.com)).

### To use the FS Receiver Viewer Software, you must supply:

- Desktop or laptop computer with:
  - Windows 98 or a later Windows version.
  - Serial port.
  - CD-ROM drive.
  - Microsoft .NET Framework software (if this is not already installed on your computer, you can install it from the Viewer Software CD).
- FMA Failsafe Interface Module (part number FSIM1), which includes a 9-pin to 9-pin serial cable.

## How the FS Receiver works

The FS Receiver combines the error catching advantage of PCM with the speed and interference tolerance of PPM. (See [PPM versus PCM](#) for descriptions of these two approaches.)

A **frame** contains one set of data about your transmitter's stick, switch and control positions. A radio control receiver decodes this data and uses it to position the servos in your model. Unlike most receivers, when the FS Receiver detects bad frames, it moves the servos to the last known position or moves them to failsafe positions you preset, depending on the [mode](#) you set for each channel.

**Digital Signal Recognition** provides extensive error detecting and correcting to clean up the PPM signal. The FS Receiver learns about your transmitter. When power is applied to the receiver, it determines the transmitter type (positive or negative shift) and number of channels. If there is a power interruption in flight, transmitter data is recalled from the receiver's memory. Glitches, for example, add false channels to those already present in frames. By knowing the number of channels, the FS Receiver can throw out frames that were shifted down one or more channels during a glitch. When the channel count is correct, bad frames are detected when a servo position pulse is out of range. Valid servo pulses are 1 to 2 milliseconds wide. If a channel commands the servo to move to 1/2 millisecond, for instance, the FS Receiver throws out that frame.

When the receiver detects bad frames for about 1 second, it takes over control of the servos. This is called a **failsafe**. You can judge how the radio system performed if you know how many failsafes and bad frames occurred during a flight. After a flight, the receiver's LED blinks the number of failsafes since the receiver was turned on. Then press the FS Receiver's button 3 times: the LED blinks the number of bad frames (up to 99). If the Viewer Software is available, its **History** box lists the number of failsafes and bad frames since the receiver was turned on.

The FS Receiver continuously performs 20 internal checks for memory and I/O problems. This checking repeats 100 times per second. If the receiver detects any corruption, it performs a system reset (which takes less than 1/10 second) to restore operating parameters. This enables the FS Receiver to tolerate low voltage brownouts without locking up. The Viewer Software lists and explains resets, if any.

As you can see, this tiny receiver is very powerful!

See also

[PPM versus PCM](#)

[About FS Receiver modes](#)

Digital Signal Recognition paper in the Support section at [www.fmadirect.com](http://www.fmadirect.com).

## About FS Receiver modes

As long as power is applied, the FS Receiver keeps the servo outputs energized. Unlike most receivers, when the FS Receiver detects bad frames, it moves the servos to the last known position or moves them to failsafe positions you preset, depending on the mode you set for each channel.

In **Last Frame Hold Mode**, the FS Receiver maintains the servo positions in the last valid frame from the transmitter. This mimics the approach used in standard PPM receivers, except the servos maintain their full torque. As delivered from the factory, all channels are set to Last Frame Hold Mode. You can also reset the receiver to this state at any time.

In **Failsafe Mode**, loss of valid frames moves some or all the servos to positions you preset. The FS Receiver enters Failsafe Mode after receiving statistically bad frames for about 1 second. At that time, all channels with failsafe positions move to their preset positions, while channels without failsafe positions stay where they are (as in Last Frame Hold Mode). When the FS Receiver detects 5 good frames in a row, the receiver leaves Failsafe Mode and returns to Normal Flight Mode.

In **Setup Mode**, you tell the FS Receiver what to do when it receives bad frames. Using a simple procedure (see [Setting up the FS Receiver](#)), you can set any channel to move to a preset position during Failsafe Mode. Channels not set up for Failsafe Mode remain in Last Frame Hold Mode. The FS Receiver stores setup information for each channel. It keeps this information even when power is turned off.

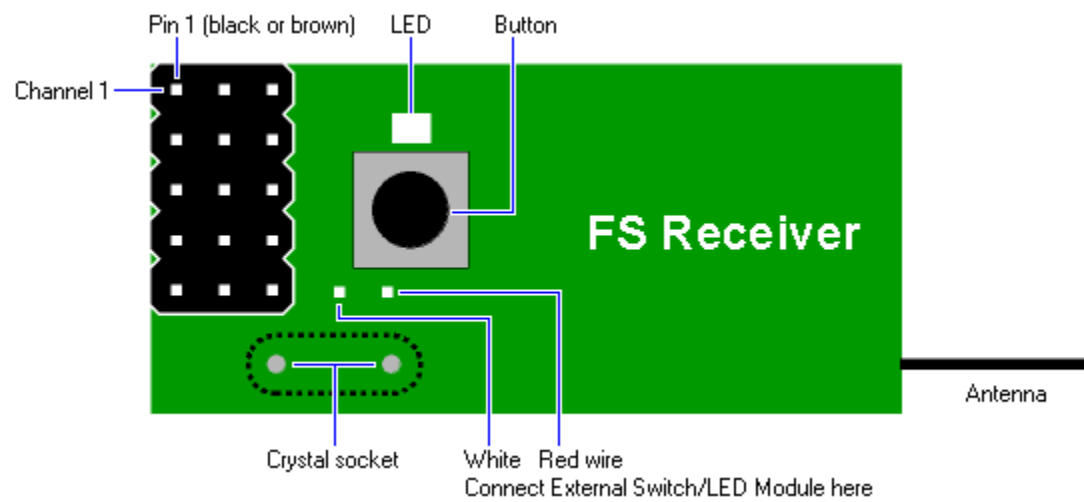
**Normal Flight Mode** is the receiver's regular operating mode. Use Normal Flight Mode for testing, range checking and flying your aircraft. If the receiver detects invalid frames, it automatically applies Last Frame Hold or Failsafe presets to each channel. When valid frames are again received, the FS Receiver returns to Normal Flight Mode.

See also

[Setting up the FS Receiver](#)

[Operating the FS Receiver](#)

## Parts of the FS Receiver



See also  
[Installing the FS Receiver](#)

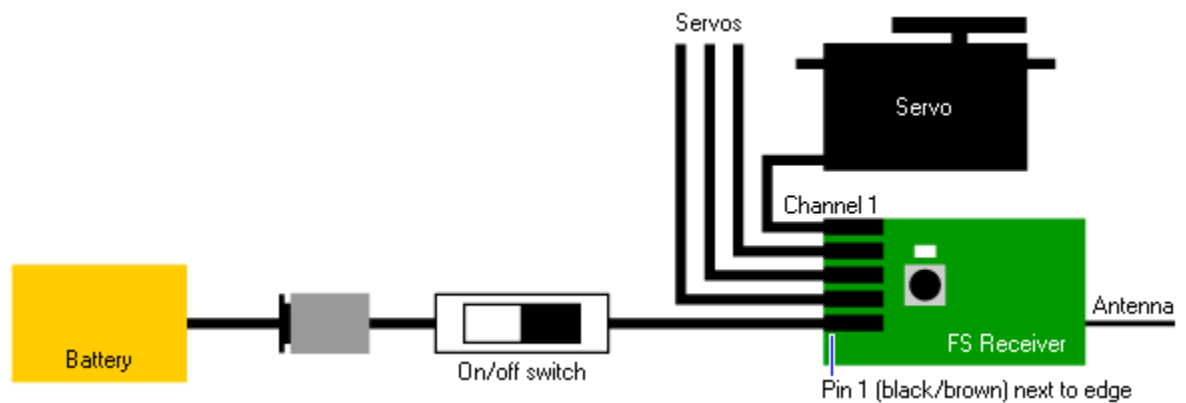


## Installing the FS Receiver

To use the receiver, you must supply:

- FMA Quantum or Fortress series dual conversion crystal (on same channel as your transmitter).
- Battery pack.
- Radio on/off switch harness.
- Servos.

1. Insert the FMA Direct Quantum dual conversion crystal into the receiver's crystal socket (see [Parts of the FS Receiver](#)). Secure the crystal with tape or the included channel sticker.
2. Connect the FS Receiver just like any other receiver. **Failure to observe correct servo/battery polarity voids warranty. Damage may result to both receiver and servos.**



### Servo connector orientation

Servo brand	Pin 1	Pin 2	Pin 3
Futaba	Black	Red	White
Hitec	Black	Red	Yellow
JR	Brown	Red	Orange

**Note:** You cannot use "old style" (pre-"Z-type") Airtronics servo connectors with the FS Receiver. Use an adapter (FMA Part Number 217AJ) or convert "old style" Airtronics connectors to industry standard configuration using FMA Part Number SEASSYJ.

**Tip:** Servos, aileron extension cables, switch harnesses, Y-harnesses, battery packs, chargers and many other accessories are available from your local FMA dealer or from FMA Direct ([www.fma.com](http://www.fma.com)).

3. You must be able to press the receiver's button and see the LED. If the receiver is mounted inside the fuselage, you have two options:
  - Access the receiver by removing the wing or a hatch. While possible, this is inconvenient, and hinders preflight setup and post-flight feedback.
  - or
  - Use the External Switch/LED Module. This accessory enables you to set up the receiver and "read" the LED from outside the airplane.

To install the External Switch/LED Module:

- a. Drill two holes, as shown at right, in the fuselage near the receiver (on the side

opposite the engine exhaust).

- b. Remove the button, nut and washer from the switch.
- c. Insert the switch and LED into the fuselage holes.

**Tip:** It will be easier to see the LED if it is above the button.

- d. Secure the switch with the washer and nut.
- e. Press the button on the switch shaft.

**Tip:** Put a tiny drop of glue inside the button to secure it to the shaft. *Be sure not to glue the shaft to the housing!*

- f. Attach the External Switch/LED Module connector to the two pins between the crystal and the button (shown in [Parts of the FS Receiver](#)).

- 4. Wrap the receiver in 3/8" or 1/2" foam rubber to protect it from vibration.

**Note:** Failure to use foam rubber to protect the receiver will void your warranty.

- 5. Place the receiver in the fuselage and secure it to prevent movement.
- 6. Route the antenna so it is fully extended. Do not coil antenna, as this substantially reduces range. You may cut antenna to as short as 18" without de-tuning the receiver. However, range will be reduced. Be sure to range test and cut off a little bit at a time until antenna reaches desired length. (When installing the receiver in a small airplane or a helicopter, see [Special antenna installations](#).)

**Note:** Do not coil the antenna. Coiling will reduce the receiver's range.

## Setting up the FS Receiver

To do this...	Do this...
Enter Setup Mode	<ol style="list-style-type: none"> <li>1. Turn on transmitter.</li> <li>2. With FS Receiver off, press and hold FS Receiver button.</li> <li>3. Turn on FS Receiver.</li> <li>4. Release receiver button.</li> </ol> <p>Receiver LED “twinkles” in Setup Mode. Servos set for Last Frame Mode move slowly back and forth, servos set for Failsafe Mode move to failsafe positions.</p>
Set failsafe position for one channel	<p><i>While in Setup Mode:</i></p> <ol style="list-style-type: none"> <li>1. On transmitter, move stick/control for that channel to desired failsafe position (watch control surface or throttle).</li> <li>2. LED blinks the selected channel(s).</li> <li>3. On FS Receiver, press button 1 time to save failsafe position.</li> <li>4. Return transmitter stick/control to neutral (or to idle for throttle) before LED turns on.</li> </ol> <p><b>If mixing is programmed in your transmitter for the stick or control, then this procedure sets failsafe positions for all channels in that mix.</b></p>
Set failsafe positions for multiple channels	<p><i>While in Setup Mode:</i></p> <ol style="list-style-type: none"> <li>1. On transmitter, move sticks/controls to desired failsafe positions.</li> <li>2. LED blinks the selected channel(s).</li> <li>3. On FS Receiver, press button 1 time.</li> <li>4. Return transmitter sticks/controls to neutral (or to idle for throttle) before LED turns on.</li> </ol>
Erase failsafe position for one channel	<p><i>While in Setup Mode:</i></p> <ol style="list-style-type: none"> <li>1. On transmitter, move stick/control for channel you want to erase.</li> <li>2. Return stick/control to neutral (or idle for throttle).</li> <li>3. <b>Do not press button.</b></li> <li>4. When LED turns on, the channel operates in Last Frame Hold Mode.</li> <li>5. LED blinks channel numbers just erased.</li> </ol>
Erase all failsafe positions for all channels	<p><i>While in Setup Mode:</i> Press and hold FS Receiver button for 2 seconds.</p> <p><i>All channels now operate in Last Frame Hold Mode.</i></p>
Determine a channel's mode	<p><i>While in Setup Mode:</i></p> <p>Watch servos, control surfaces and throttle:</p> <ul style="list-style-type: none"> <li>■ Servos set for Last Frame Hold mode move slowly back and forth.</li> <li>■ Servos set for Failsafe Mode are in preset failsafe positions (and don't move slowly back and forth).</li> </ul>
Leave Setup Mode	<ol style="list-style-type: none"> <li>1. Turn off receiver.</li> <li>2. Turn off transmitter.</li> </ol>

## Checking radio system range

Range checking the FS Receiver is easier than other receivers. A failsafe condition will occur at the limit of the range. The FS Receiver's LED shows whether a failsafe occurred during the range check. Just check the LED after you return to the model.

**Note:** The usual way of finding the range limit by looking for servo glitches does not work with the FS Receiver. Since the FS Receiver actively responds to noisy or missed frames, servo glitches don't occur.

### Initial range check and range troubleshooting

1. Place the receiver on a non-metallic surface (a cardboard box, for example) to elevate it about 2 feet (60cm) off the ground.
2. Fully extend the receiver antenna and position it vertically above the receiver (tape the antenna to a wooden dowel, for example).
3. Connect one servo to receiver channel 1.
4. Fully collapse the transmitter antenna.
5. Turn on the transmitter.
6. Connect a battery pack directly to the receiver. Do not use a switch harness for this test, since a switch harness may reduce range.
7. Walk away from the receiver about 200 feet (60m) while moving the transmitter stick for channel 1.
8. KEEPING THE TRANSMITTER ON, return to the receiver and watch the LED:
  - If the LED is still continuously on: there were no failures during the range test.
  - If the LED is blinking, the range is less than 200 feet (60m).
9. Disconnect the receiver from the battery.
10. Turn off the transmitter.

**Note:** Over time, all RC transmitters are susceptible to detuning, frequency drift and power reduction. If you suspect your radio system's performance has degraded, carry out the rigorous range check with the receiver out of the aircraft. If, under these conditions, the radio system experiences failures, there may be a problem with the transmitter, the FS Receiver or another part of the radio system. If you suspect the transmitter is out of tune, FMA can tune it for you. With proof of purchase for an FMA receiver, FMA will tune your transmitter (any brand) at no charge. The only cost is for shipping.

### Checking radio system range at the field

1. Fully collapse the transmitter antenna.
2. Turn on the transmitter, then turn on the receiver.
3. Walk 50 paces (about 150 feet or 45m) away from the model.
4. KEEPING THE TRANSMITTER ON, return to the model and watch the LED:
  - If the LED is still continuously on: there were no failures, and the model remained under your control during the range test.
  - If the LED is blinking, the range is less than 50 paces. *Find and fix the problem before flying!*

## Operating the FS Receiver

To do this...	Do this...
Check for interference on your frequency	<ol style="list-style-type: none"> <li>1. Turn on FS Receiver (leave your transmitter off).</li> <li>2. Watch LED: <ul style="list-style-type: none"> <li>■ One blink = frequency clear.</li> <li>■ Continuous blinks = interference on your frequency.</li> </ul> </li> </ol>
Enter Normal Flight Mode	<ol style="list-style-type: none"> <li>1. Turn on transmitter.</li> <li>2. Turn on FS Receiver.</li> </ol>
Check receiver input voltage	<p><i>While in Normal Flight Mode:</i></p> <ol style="list-style-type: none"> <li>1. While moving all transmitter sticks (to load radio system), press FS Receiver button 1 time.</li> <li>2. Count LED blinks: <ul style="list-style-type: none"> <li>■ Each long blink = 1 volt.</li> <li>■ Each short blink = 0.1 volt.</li> </ul>                     (Example: 4 long blinks + 9 short blinks = 4.9 volts.) </li> </ol>
Check radio system range	<p><i>While in Normal Flight Mode:</i></p> <ol style="list-style-type: none"> <li>1. Collapse transmitter antenna.</li> <li>2. Walk 50 paces (about 150 feet or 45m) away from model.</li> <li>3. KEEP TRANSMITTER ON and return to model.</li> <li>4. Watch FS Receiver LED: <ul style="list-style-type: none"> <li>■ Continuously on: no failures.</li> <li>■ Blinking: failures occurred.</li> </ul> </li> </ol> <p>For details, see <a href="#">Checking radio system range</a>.</p>
Check failsafe count after a flight or range check	<ol style="list-style-type: none"> <li>1. Keep transmitter on, keep receiver on!</li> <li>2. Count LED blinks: each blink = 1 failsafe (maximum report is 9 failsafes). No blinks = perfect signal.</li> </ol>
Check bad frame count after a flight or range check	<ol style="list-style-type: none"> <li>1. Keep transmitter on, keep receiver on!</li> <li>2. Press FS Receiver button 3 times.</li> <li>3. Count LED blinks: <ul style="list-style-type: none"> <li>■ Each long blink = 10 bad frames.</li> <li>■ Each short blink = 1 bad frame.</li> </ul>                     (Example: 2 long blinks + 4 short blinks = 24 bad frames; maximum report is 99 bad frames) </li> </ol>
Change between 1X and 2X LED flash rate (1X = 1 flash per second, 2X = 2 flashes per second)	Press FS Receiver button 5 times.
Clear failsafe count and bad frame count (failsafe positions are retained)	Turn off receiver.

See also  
[FS Receiver button summary](#)

## FS Receiver button summary

### Button functions in Setup Mode

Do this...	And this happens...
Press and hold button, turn on receiver	Receiver enters Setup Mode (LED “twinkles”). <b>Do not turn off transmitter during Setup Mode.</b>
Move transmitter stick(s) to servo failsafe position for channel(s), press button, return transmitter stick(s) to neutral (or low for throttle)	Receiver sets servo to failsafe position(s) for channel(s). <b>For mixed channels, this sets failsafe positions for all channels in mix.</b>
Press and hold button for 2 seconds	Receiver sets all channels to Last Frame Hold Mode (this removes Failsafe Mode servo presets from all channels).

See also [Setting up the FS Receiver](#)

### Button functions in Normal Flight Mode

Do this...	And this happens...
Don't press button	LED blinks number of failsafes (up to 9) since receiver was turned on. No blinks = perfect signal.
Press button 1 time	LED blinks battery voltage (each long blink = 1 volt, each short blink = 0.1 volt).
Press button 3 times	LED blinks number of bad frames (up to 99) since receiver was turned on (each long blink = 10 bad frames, each short blink = 1 bad frame). (Less than 30 bad frames indicates very clean signal during typical flight.)
Press button 5 times	Change between 1X and 2X LED flash rate (1X = 1 flash per second, 2X = 2 flashes per second).

**Tip:** When check for bad frames or changing blink rate, make each button press before LED turns on.

See also [Operating the FS Receiver](#)

## Installing the Viewer Software and Interface Module

To use the Viewer Software, you must supply:

- Desktop or laptop computer with:
  - Windows 98 or a later Windows version, and Internet Explorer 6.0 or later.
  - Serial port.
  - CD-ROM drive.
  - Microsoft .NET Framework software (if this is not already installed on your computer, you can install it from the Viewer Software CD).
- FMA Failsafe Interface Module (part number FSIM1).
- 9-pin to 9-pin serial cable (recommended, but not required).

**Note:** For reliable operation, install the latest Windows updates. Critical updates are on the Viewer Software CD, but Windows Update is better.

### A. Install the software

1. Insert the FMA Direct Viewer Software CD into the computer's CD drive.
2. Use Windows Explorer to view the contents of the CD.
3. If Microsoft .NET Framework software is not already installed on your computer:
  - a. In Windows Explorer, double-click *dotnetfx.exe*.
  - b. Follow the on-screen instructions.
  - c. For Windows 98 installations, reboot the computer.
4. Install the Viewer Software:
  - a. In Windows Explorer, double-click *setup.exe*.
  - b. Follow the on-screen instructions.

**Note:** Free software updates are available on the FMA Direct Web site. See [Software updates](#) for details.

### B. Install the Interface Module

The Interface Module connects the FS Receiver to your PC, and is required for using the Viewer Software to view and record receiver data. (The Interface Module is not required for *playing* data files. For example, you can play the demo data file using the Viewer Software to see what the program does. If you don't already have an Interface Module, this demo file may help you decide to add one.)

1. For an FS5 receiver: Remove the servo connector from channel 1 of the receiver. Attach the Interface Module servo connector to channel 1 of the receiver. **Do not use a Y connector** to attach the adapter and servo at the same time.
2. Connect the Interface Module to the computer's serial port using the serial cable included with the Module.

**Note:** When you are finished using the Viewer, disconnect the Interface Module from the receiver, and reconnect the servo to channel 1.

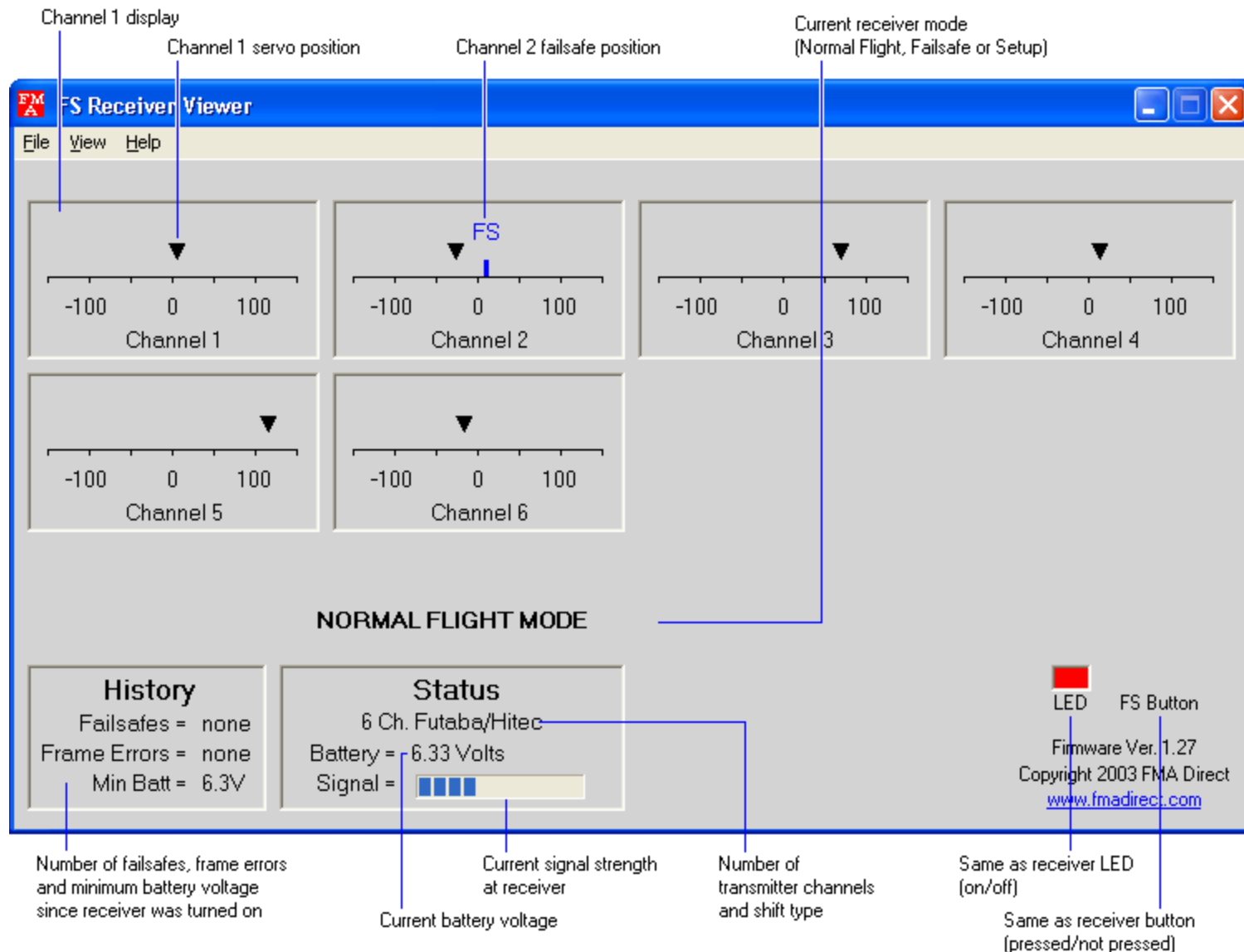
## Using the Viewer Software

1. Connect the FS Receiver to your computer's serial port using the Interface Module (see "[Install the Interface Module](#)").
2. Turn on the transmitter, then turn on the FS Receiver.
3. Launch the Viewer:
  - Double-click the Viewer icon on the computer's desktop.  
or
  - **Start > Programs > FS Receiver Viewer.**

The program polls all the serial ports on your computer to find the one connected to the FS Receiver. If you don't see the display below after a few seconds, there is a problem in the connections between the computer and the receiver. Check the cabling and connections. Make sure the black connector from the Serial Adapter is in the proper orientation (black wire to the outside) on the channel 1 pins. See [Parts of the FS Receiver](#).

The Viewer provides real-time information about receiver operations. Here's what's in the Viewer window:

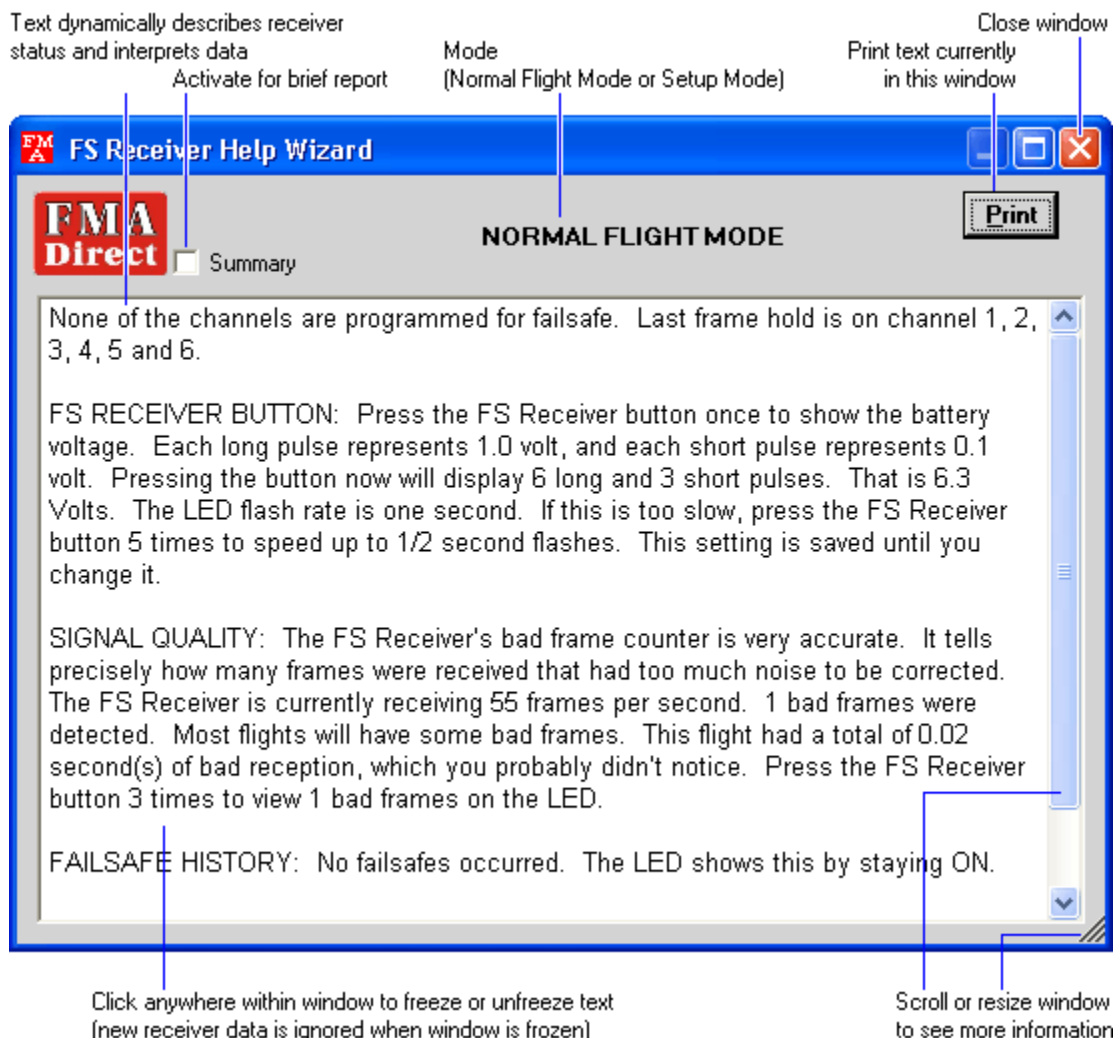




## Using the Help Wizard

The unique Help Wizard provides a running description of what the FS Receiver is doing at any particular moment. Additionally, the Wizard interprets the receiver's data for you, making it easy to understand what the receiver is telling you.

To open the Help Wizard: **Help > Help Wizard**, or press F1. Here's what's in the Help Wizard window:

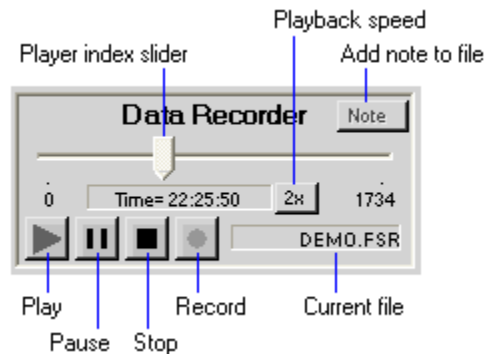


**Tip:** Before printing the Help Wizard, use the **File > Print Setup** command to select a printer and set printer properties.

**Tip:** While the Help Wizard text is frozen, it ignores receiver data, so you might miss critical events. Instead, you can record receiver operation (see [Recording and playing a data file](#)), then play back the data file. During playback, open the Help Wizard for data interpretation. Instead of freezing the Wizard, click the Pause button. This enables you to read all operating details.

## Recording and playing a data file

The Viewer Software has a built in Recorder/Player that records real-time data from your FS Receiver and stores it in a file. The Recorder logs all incoming data and adds time information. The Player plays back, or steps through, the entire file.



Recording can be helpful for range checking. It will play back exactly what the receiver was doing during the range check. Since the FS Receiver doesn't respond to glitches like a conventional receiver, you can't tell where the transmitter's range ends by looking at the model's control surfaces. Recording can also be helpful in getting technical support. You can send the recorded data file to FMA Direct for analysis by attaching it to an e-mail message (see [Sending a data file for analysis](#)).

**Recording** logs all incoming data from the FS Receiver. Recording can be paused or stopped. If you record to an existing file, the new data is appended to the end of that file.

**Playing** recreates FS Receiver operation from a data file. Time is shown in the Recorder time index window. During playback, data sent by the FS Receiver to the serial port is ignored. The **2x/1x** button changes the playback speed (however, some computers may play back in only one speed).

**Pausing** stops the Viewer on one line of data. Data from the FS Receiver is ignored during this time. Playback remains paused until you move the play index slide bar, or resume play. To step through the data file one line at a time, click the index bar, then press the left/right arrows.

**Tip:** Load and play the demo file to see how notes are used to identify what the Viewer is doing.

To do this...	Do this...
Prepare for data recording	<ol style="list-style-type: none"> <li>1. Disconnect servo from channel 1 on FS Receiver.</li> <li>2. Connect Serial Adapter to channel 1 on FS Receiver.</li> <li>3. Connect Serial Adapter to PC serial port.</li> <li>4. Launch Viewer.</li> <li>5. Turn on transmitter.</li> <li>6. Turn on FS Receiver.</li> </ol>
Record data	<ol style="list-style-type: none"> <li>1. <b>File &gt; New.</b></li> <li>2. Name and save the file.</li> <li>3. Click <b>Record</b> button.</li> <li>4. Carry out any transmitter or receiver actions you want to record.</li> <li>5. When done, click <b>Stop</b> button.</li> <li>6. To save data, <b>File &gt; Save / Close.</b></li> </ol>
Stop recording or playback	Click <b>Stop</b> button.
Pause recording or playback	

Pause recording or playback	Click <b>Pause</b> button.
Open data file	<b>File &gt; Open Data File.</b> or In Windows Explorer, double-click an FSR file. (File will begin to play immediately in Viewer.)
Play back current data file	Click <b>Play</b> button.
Move to any point in current data file	1. Click <b>Pause</b> button, then... 2. Drag player index slider. or Use right-arrow and left-arrow buttons to move through file one line at a time.
Add note to current data file	While data file is open: 1. Drag player index slider to place where you want note. 2. Click <b>Note</b> button (or press ALT-N). 3. Type note. 4. Click <b>Save</b> button (or press ALT-S).

## Keyboard shortcuts

To do this...	Press this key or combination...
Open Help Wizard	F1
Open help file (contents tab)	ALT-F1
Open help file (index tab)	ALT-F2
Open data file	CTRL-O
Save/close data file	CTRL-S
Start new data file	CTRL-N
Open or close Recorder/Player	CTRL-R

**Tip:** Each menu and command has a keyboard shortcut. For example ALT-F-X is the shortcut for the **File > Ex**

## Frequently asked questions

### General information

**Q:** Will the FS Receiver prevent my airplane from crashing?

**A:** No. The FS Receiver can only move your airplane's control surfaces and throttle to preset positions when it doesn't receive a clean signal from your transmitter. This may keep your airplane flying long enough for you to find and correct the problem.

**Q:** Can I use the FS Receiver with all types of airplanes?

**A:** Yes, with some caveats:

- For planes that return to straight and level flight when you release the transmitter sticks (e.g., trainers, many high-wing planes): assign Failsafe Mode presets for the throttle and primary control surfaces. Use Last Hold Mode for other channels.
- For aerobatic planes (which continue where pointed when you release the transmitter sticks) and helicopters: use Failsafe Mode for the throttle and Last Hold Mode for all other channels. Since an aerobatic aircraft doesn't return to straight and level flight on its own, failsafe presets for the control surfaces can't put it into a stable attitude during an extended interruption of the transmitter signal. However, you still get other benefits from using the FS Receiver: error detection, error correction, high noise tolerance, failsafe count and battery voltage readout.

**Q:** Can I use the FS Receiver with the FMA Direct Co-Pilot flight stabilization system?

**A:** Yes. In fact, this approach is recommended for aerobatic aircraft. If the transmitter signal is interrupted, Co-Pilot helps the airplane return to a stable attitude, while the FS Receiver moves the servos to failsafe or last frame hold positions. Using the FS Receiver with Co-Pilot provides full-function failsafe. If radio contact is lost, Co-Pilot will stabilize the aircraft. Set failsafe positions for low throttle and some rudder, and the aircraft should go into a flat, low-speed turn from any attitude. With some adjustments to the failsafe settings, and if the aircraft doesn't encounter an obstruction, it may actually land with little or no damage.

**Note:** If you are using a channel for on/off control of Co-Pilot, set the failsafe for that channel so that Co-Pilot is on.

### Setting up

**Q:** I can't take my computer to the flying field. How do I set up the FS Receiver without the Viewer?

**A:** You can set all FS Receiver functions without the Viewer Software. You interact with the receiver through its button and LED, and you set failsafe positions using your transmitter sticks. Details are provided in [Setting up the FS Receiver](#) and [Operating the FS Receiver](#).

**Q:** What are good failsafe preset servo positions for an airplane?

**A:** The best failsafe preset servo positions will depend on your particular aircraft and how it behaves in the air. A reasonable starting point for flight-stable airplanes is:

- Ailerons: neutral.
- Elevator: neutral.
- Rudder: moderate right turn.
- Throttle: 1/3 to 1/2.

You'll need to test these settings and adjust them as needed. Your goal is to have the plane circle and gently descend, without stalling, during a failsafe condition.

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**Q:** My airplane has flaps and/or retractable landing gear. What about failsafe presets for those?

**A:** Since flaps can slow the airplane, deploying them (with some rudder failsafe preset) may help keep the airplane close to the field. It's probably a good idea to drop the landing gear, although for some airplanes a belly landing may be less costly than bent landing gear.

---

**Q:** How do I test failsafe operation?

**A:** First, do a check on the ground:

1. Turn on your transmitter, then turn on the FS Receiver.
2. Move the transmitter sticks to make sure the aircraft controls respond correctly to your commands.
3. Turn off the transmitter and watch the airplane's control surfaces and throttle:
  - For channels with failsafe presets, the servos should move to their preset positions.
  - For channels without failsafe presets, the servos should remain where they were (last frame hold) when you turned off the transmitter.

If the radio system works properly, try forcing a failsafe condition in the air:

1. Take off and gain altitude until the airplane is at least three mistakes high.
2. Put the plane into straight and level flight at 3/4 to full throttle.
3. Turn off the transmitter for 2 to 3 seconds, THEN TURN IT BACK ON.
  - While the transmitter is off, watch how the plane responds.
  - Be prepared to correct the plane's attitude as soon as you turn the transmitter back on.

If necessary, land the airplane, change the presets, and test again on the ground and in the air. Be sure to avoid settings that would stall the airplane.

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**Q:** Do I have to set up the FS Receiver before each flight?

**A:** No, the receiver stores setup information even when power is off. However, it's a good idea to test failsafe operation on the ground (by turning off the transmitter) as part of your usual preflight checks.

## Flying

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**Q:** What can cause the FS Receiver to enter Failsafe Mode?

**A:** There are several possibilities:

- You accidentally turned off your transmitter.
- Your transmitter batteries are depleted.
- Someone else turned on a transmitter on your channel.
- There is radio interference from some unknown source.

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**Q:** When my airplane is flying, how do I know the FS Receiver is in Failsafe Mode?

**A:** Move the transmitter sticks. If the airplane doesn't respond, the receiver is in Failsafe Mode.

---

**Q:** What should I do if the FS Receiver goes into Failsafe Mode?

**A:** 1. **IMMEDIATELY WARN OTHER PILOTS AND SPECTATORS.**

2. Make sure your transmitter on/off switch is on.
3. Check your transmitter's battery status.
4. Ask other pilots if anyone turned on a transmitter on your channel. If someone did, tell them to turn off their transmitter immediately.
5. If you are unable to regain control of the aircraft, keep it in sight and continue warning everyone in

the area.

---

**Q:** What happens if the FS Receiver goes into Failsafe Mode and I can't find/fix the problem.

**A:** Ideally, your preset failsafe servo positions will put the airplane into a stable attitude that will allow it to circle and descend slowly to the ground. Because you can't control the plane, expect a hard landing. That, however, is much better than the plane drilling itself into the ground, or flying out of sight.

---

**Q:** My FS Receiver usually records a dozen or two bad frames during flights. Is that bad?

**A:** No. In fact it indicates your radio system is performing very well. Occasional glitches are common. It takes at least 50 consecutive bad frames to cause a failsafe condition. Bad frames are an indirect measure of signal quality and receiver performance.

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**Q:** What happens if the receiver battery dies during a flight?

**A:** Sorry, the FS Receiver can't help with that problem. To avoid that situation, check the receiver battery with an extended scale voltmeter before every flight.

---

**Q:** I accidentally turned off the Failsafe receiver before I "read" the bad frame count by pressing the button three times. Can I get that information later?

**A:** No. The bad frame and failsafe counts are lost when you turn off the receiver.

#### Viewer

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**Q:** I have a 4 channel transmitter, but the Viewer says it has five channels.

**A:** RC radio manufacturers sometimes use one circuit board in multiple transmitter models. In your case, they put a five channel circuit board in a four channel housing. The transmitter outputs a five channel signal, but doesn't give you a way to control the fifth channel.

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**Q:** Can I use the Viewer Software with other receivers?

**A:** No. It only works with advanced receivers from FMA Direct.

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**Q:** The Viewer suddenly shows a lot of information I've never seen before. What's that all about?

**A:** You've discovered the normally-hidden Technical Display (see below). It provides details beyond what you need to know for normal operation, but it may be useful for troubleshooting. To hide the Technical Display (or show it later), click the title ("Status") in the **Status** box.

Sync Pulse = 7830 uS	Rec Response = 17 mS
Start Bit = 441 uS	Button ADC = 189
Frame = 18.1 mS	V Ref ADC = 407
2nd TX = 1 Searching	SV1 Low ADC = 134
Serial Errors = none	Servo Noise = 1 uS
Main Loop = -	System Resets = none
Telemetry = -	Good Frm CNT = 255
	Ch Rejected = - - - - -
<input checked="" type="radio"/> 640 ms <input type="radio"/> 1290 ms	Signal = -41 dB M
	Short Svo Errors = 0
	Long Svo Errors = 0



## Special antenna installations

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### Small aircraft

If you are installing the FS Receiver in a small aircraft, you may need a shorter antenna. You may cut off part of the antenna without detuning the receiver (a unique feature of FMA Direct receivers). However, reducing antenna length *will* reduce range.

**Proceed carefully!** Remove only a small portion of the antenna at a time, then range check the radio system on the ground after each reduction in length.

**Never cut the antenna shorter than 18" (50cm).**

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### Helicopters

Helicopters generate radio frequency noise and heavy vibration. Here are some tips for improving reception in a helicopter:

- Route the antenna as far away from the tail boom as possible. This is particularly important for helicopters with carbon fiber booms.
- Mount a plastic tube (nylon pushrod tube, for example) on the skids and route the antenna through it.

## PPM versus PCM

**PPM** stands for Pulse Position Modulation. In this approach, each servo position is encoded by a specific pulse width. Pulse width for one channel ranges from 1 to 2 milliseconds. A 6 channel transmitter will generate 6 pulses in the output signal. The receiver knows what pulse is servo 1 because of a long sync pulse that lasts 5 milliseconds. A glitch occurs when a stray pulse is introduced to the signal. Suppose a stray 0.1 millisecond pulse occurs in the channel 4 pulse. Servos 1-3 would be positioned correctly, while servo 4 would move to an incorrect position. The glitch gets worse when the receiver shifts channels 4, 5 and 6 down one position because of an extra pulse. The position of channel 5 is now given to servo 6, while servo 6 goes to the empty slot for servo 7. After a single glitch, correct servo positions are restored in the next frame. The 1/50th second wait for the next frame causes little movement of a servo. Since glitches are random, the odds are greater for glitches on the servos connected to higher channel numbers. That is why important control surfaces are on channels 1 and 2.

Standard PPM receivers have some tolerance for noise. Most of the time, only half the servos receive a big glitch. Smaller glitches will not shift the servos at all. When just one servo shakes a little, a small glitch delayed the pulse on its channel.

**PCM** stands for Pulse Code Modulation. In this method, control positions are converted to 10 bit binary numbers before transmission. Each channel requires 10 pulses to represent the numeric position. A glitch in this data stream can dramatically change the positions of all servos on channels following the glitch. However, to keep the numbers readable by the receiver, the transmitter calculates and sends a cyclic redundancy check (CRC) number. The CRC number is recalculated in the receiver and checked to see whether it matches the received channel data. If one or more bits are corrupted, the entire frame is thrown out. This is known as error detection. The PCM receiver then waits for the next clean frame before updating the servos. In a PCM radio system, moderate noise can corrupt several frames in a row.

Individual pulses are much shorter for PCM because there are so many of them. The higher number of pulses per frame slows down the frame rate. A 6 channel PCM frame will have at least 72 pulses in a frame. One delayed or changed pulse among the 72 will corrupt the entire frame. This is why PCM receivers can lose control and go into failsafe mode. To make things better, some PCM transmitters break up a 6 channel frame into two frames of 3 channels each. This way, only half the channels will be affected by a discarded frame.

When it comes to glitches, PCM receivers are better than PPM receivers because they catch all glitches. The CRC will never let a glitch through to the servos. On the down side, a PCM receiver will discard an entire 5-channel frame if it finds 1 bad bit among the 50 data bits. In comparison, if a PPM receiver encounters 1 bad pulse in 50, it still has four good 5-channel frames to work with.

The FS Receiver combines the advantages PCM (error detection and high noise tolerance) and the advantages of PPM (faster and more tolerant of glitches) to create a higher level in receiver performance. It also adds a new feature to receivers called **Digital Signal Recognition** (for details, see [How the FS Receiver works](#)).

## Sending a data file for analysis

The Viewer Software shows every detail of the FS Receiver's operation. If you suspect something is not functioning properly, you can send a sample Viewer data file to FMA for analysis. Follow these steps to send a sample data file:

1. Click **File > New** and change the directory to **C:\**. This will make the data file easy to find when you send it.
2. Use the default name **Datalog1**. Click **Save** to create the data file.
3. Turn on the transmitter, then turn on the FS Receiver.
4. Make sure the FS Receiver is communicating with the PC by moving the transmitter sticks. If you don't see activity in the Viewer window, fix the problem before continuing. Be sure the receiver is powered up and is connected to the PC's serial port with the adapter cable.
5. In the Viewer window, click the red **Record** button.
6. If there is a setup problem, try to show it in the Viewer while recording the data log. If there is a range check problem, then do a range check while recording the data log. (You don't need to be outside to perform a range check.)
7. When you have recorded the problem, click the **Stop** button.
8. Try to explain the problem in an e-mail message, or better yet, insert notes into the data file. To insert notes, play back the data file and pause where you want to insert the note. Then click the **Note** button, type the note and click **Save**.
9. When you are done, click **File > Save / Close**, or just exit the Viewer.
10. Launch your e-mail program and create a new message addressed to **support@fmadirect.com**. In the message, include any information that would be helpful in diagnosing the problem.
11. Add the data file **C:\Datalog1.FSR** to the message as an attachment. (To insert an attachment in an Outlook message, for example, use the **Insert > File...** command.)
12. Send the message.

FMA Direct technical specialists will examine your data log and respond as soon as possible.

## FS Receiver quick start

**CAUTION:** These instructions leave out a lot of details that help you understand and use the receiver. Click the links for more information.

**What it does:** When the FS Receiver stops getting a signal from the transmitter, it moves the servos to preset positions. Where the servos move depends on how you set up each channel in **Setup Mode**. (See [How the FS Receiver works.](#))

**Modes** (see [About FS Receiver modes](#)):

- The FS Receiver has two operating modes: **Setup Mode** (where you tell it what to do) and **Normal Flight Mode** (for flying).
- When the receiver doesn't get a good, clean signal from the transmitter, it puts each channel into **Failsafe Mode** (servos go to positions you set) or **Last Frame Hold Mode** (servos stay where they were during last good signal). You tell the receiver which type you want in Setup Mode.

**Installing.** Install the receiver pretty much like any other. (See [Parts of the FS Receiver](#) and [Installing the FS Receiver.](#))

1. Plug in crystal, servos and battery/switch harness. Servo channel 1 is farthest from crystal. Black or brown wires on servo/battery connectors go toward outside. **Failure to observe correct servo/battery polarity voids warranty. Damage may result to both receiver and servos.**
2. **Different:** External Switch/LED Module (installation optional, but recommended) lets you interact with receiver from outside aircraft. Mount module in holes in fuselage, then plug it into receiver on pins between button and crystal (white wire toward servo connectors).
3. Wrap receiver in foam rubber and secure in aircraft. **Failure to protect receiver voids warranty.**
4. Route antenna. Do not coil antenna, as this substantially reduces range. You may cut antenna to as short as 18" without de-tuning the receiver. However, range will be reduced. Be sure to range test and cut off a little bit at a time until antenna reaches desired length.

**Setting up** (see [Setting up the FS Receiver](#))

1. Enter Setup Mode: Turn on transmitter, *press and hold receiver button while turning on receiver*. LED "twinkles" in Setup Mode. Servos set for Last Frame Mode move slowly, servos set for Failsafe Mode move to failsafe positions (and don't move after that).
2. Set a channel for Failsafe Mode: Move transmitter stick to desired failsafe position, press receiver button, return stick to neutral (or idle) before LED turns on. Repeat for other channels. Channels in a mix are set at the same time. If not set for Failsafe Mode, channel is automatically in Last Frame Hold Mode.
3. Leave Setup Mode: Turn receiver off. Receiver retains settings even when power is off.

### Checking failsafe operation on ground

1. Turn on transmitter, turn on receiver.
2. Turn off transmitter. Receiver moves servos to failsafe/last frame positions.
3. Turn on transmitter. Receiver LED blinks, indicating a failsafe occurred.

**Checking range at the field** (see [Checking radio system range](#) for initial testing and troubleshooting)

(Because the FS Receiver corrects for occasional glitches, you can't check range by watching for jittering control surfaces.)

1. Turn on transmitter, turn on receiver.
2. Collapse transmitter antenna, walk 50 paces away from model.
3. *Different:* Keep transmitter on, return to model and look at LED:
  - If LED is on steady, there were no failsafes. Radio system passed range check.
  - If LED is blinking, failsafes (loss of good signal) occurred. Find and fix problem before flying.

**Using** (see [Operating the FS Receiver](#) and [FS Receiver button summary](#))

- To check for other transmitters on your frequency: Turn on receiver (leave your transmitter off) and watch LED: 1 blink = frequency clear, or continuous blinking = interference.
- To check battery voltage: While moving transmitter sticks (to load system), press receiver button 1 time, then count LED blinks (long blink = 1 volt, short blink = 0.1 volt).
- Fly like you normally do. If receiver loses signal, servos go to failsafe presets or stay at last good position.
- *Optional:* After flight, keep transmitter and receiver on. Review flight history:
  - If LED is blinking, number of blinks = number of failsafes during flight.
  - Press receiver button 3 times, count LED blinks to determine number of bad frames during flight (each long blink = 10 frames, each short blink = 1 frame). Less than 30 bad frames indicates a very clean signal during flight.

## Viewer Software quick start

**What it does:** The Viewer Software provides real-time information about the receiver, its failsafe settings, battery voltage, transmitter type, signal strength and failsafe history. It can also be used to record and play files containing this data. Although the Viewer is not required to set up and use the FS Receiver, it can be helpful for troubleshooting. If installed on a laptop computer, the Viewer can be used at your flying field.

**Installing** (see [Installing the Viewer Software and Interface Module](#)):

1. Put FMA Direct Viewer Software CD in your computer's CD drive.
2. If Microsoft .NET Framework software is not already installed on your computer, launch *dotnetfx.exe* on CD. Follow on-screen instructions.
3. Launch *setup.exe* on CD. Follow on-screen instructions.
4. Connect Interface Module to channel 1 of FS Receiver, in place of servo.
5. Connect Interface Module to serial cable, then connect serial cable to computer's serial port.

**Using** (see [Using the Viewer Software](#)):

1. Turn on transmitter, turn on receiver.
2. Launch Viewer.

For an interpretation of Viewer data: **Help > Help Wizard** (see [Using the Help Wizard](#)).

To record or play data files, open Recorder: **View > Data Recorder** (see [Recording and playing a data file](#)).

## Software updates

Viewer Software updates are available in the Support section of the FMA Direct Web site.

**Note:** You don't need to uninstall the previous version. The installer will overwrite the version currently installed on your computer.

1. Click here: [Support](#).  
or  
Use your Web browser to open [www.fmadirect.com/site/fma.htm?body=Support](http://www.fmadirect.com/site/fma.htm?body=Support) .
2. Scroll down the Support page to find the Software Updates section.
3. Click the link for the latest Viewer Software version.
4. In the **File Download** window, click the **Open** button.
5. Follow the on-screen instructions.

## Technical support and contact information

### **FMA Direct**

5716A Industry Lane  
Frederick, MD 21704 USA

Web: [www.fmadirect.com](http://www.fmadirect.com)

Product manuals and software updates are provided in the [Support](#) section of the FMA Direct Web site.

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### **For technical support:**

Telephone: (301) 668-7614  
E-mail: [support@fmadirect.com](mailto:support@fmadirect.com)

See also

[Software updates](#)

[Frequently asked questions](#)

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### **For sales information:**

Telephone: (800)-343-2934  
E-mail: [sales@fmadirect.com](mailto:sales@fmadirect.com)  
Fax: (301) 668-7619



## Warranty

FMA, Inc. warrants this product to be free of manufacturing defects for the term of one year from the date of purchase. Should any defects covered by this warranty occur, the product shall be repaired or replaced with a unit of equal performance by FMA, Inc. or an authorized FMA service station.

**Limits and exclusions.** This warranty may be enforced only by the original purchaser, who uses this product in its original condition as purchased, in strict accordance with the product's instructions. Units returned for warranty service to an FMA service center will be accepted for service when shipped postpaid, with a copy of the original sales receipt or warranty registration form, to the service station designated by FMA, Inc.

This warranty does not apply to:

- Consequential or incidental losses resulting from the use of this product.
- Damage resulting from accident, crashes, misuse, abuse, neglect, electrical surges, reversed polarity on connectors, lightning or other acts of God.
- Damage from failure to follow instructions supplied with the product.
- Damage occurring during shipment of the product either to the customer or from the customer for service (claims must be presented to the carrier).
- Damage resulting from repair, adjustment, or any alteration of the product by anyone other than an authorized FMA technician.
- Installation or removal charges, or damage caused by improper installation or removal.

Call (301) 668-7614 for more information about service and warranty repairs.

## Viewer Software version

*To determine the version of your Viewer Software: **Help > About**.*

This Viewer is written in Microsoft Visual Basic.NET. Source code is available for language translation.

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6/6/2003