FS8 Co-Pilot™ quick start guide

For details, see FS8 Co-Pilot™ reference manual

About the FS8 Co-Pilot™

- 8 channel high performance receiver.
- Universal: positive or negative shift.
- Interference check.
- Advanced interference rejection.
- Servo failsafe operation.
- Built-in infrared flight stabilization.
- Button/LED Module for setup, calibration and data readout.
- Basic data output via LED.
- Advanced data output via PC-based software (requires Serial Interface Module).

Parts

Included

- ☐ FS8 Co-Pilot™
- ☐ Pitch/Roll Sensor
- ☐ Button/LED Module
- ☐ Ribbon cable
- ☐ Velcro®

Optional

- ☐ Vertical ("Z") Sensor
- ☐ Low Profile Button/LED Module (for helicopters)
- ☐ Serial Interface Module (for FS Viewer Software)
- ☐ FS Flight Recorder

Items you must supply: aircraft, servos, transmitter and battery.

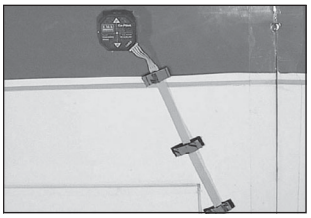
Items you may need: elevon mixer, shorter/longer ribbon cable, Advanced Servo Buffer.

Install the system

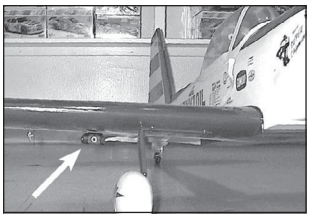
Mount the Roll/Pitch Sensor

Key points

- Sensor must be level, or nearly level, when aircraft is flying straight and level.
- Sensor must be away from muffler heat and exhaust spray.
- Sensor must have clear view of horizon on all sides.
- If Sensor is behind cockpit, rotate it 45° for clear view of horizon.
- Mount sensor securely, so it won't come loose in flight. You can substitute other secure mounting methods for those described here.



Top of wing, over spar

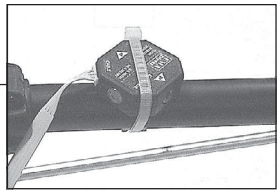


Bottom of wing (if engine is upright)

Mount on an airplane

1. Locate a mounting spot for Sensor (see above).
2. Roughen mounting surface, then clean with alcohol.
3. Mount sensor with Velcro®.
4. Remove protective stickers from four sensor windows.
5. Connect ribbon cable. Route cable to receiver area. Secure cable to airframe.

Mount on a helicopter



1. Put two pieces of double-sided tape on top and bottom of boom, behind swashplate.
2. Mount sensor with cable tie as shown. Sensor must be horizontal when heli is sitting on skids.
3. Remove protective stickers from four sensor windows.
4. Connect ribbon cable. Route cable to receiver area. Secure cable to airframe.

Mount the optional Vertical Sensor

Key points

- Sensor must point directly up and down when aircraft is in straight and level flight.
- Sensor must have a clear view of ground and sky (it's not affected by heli blades).
- Mount sensor securely, so it won't come loose in flight. You can substitute other secure mounting methods for those described here.

1. Roughen surface with sandpaper, then clean with alcohol.
2. Mount sensor using Velcro®.
3. Remove protective stickers from two sensor windows.
4. Connect ribbon cable. Route cable to receiver area. Secure cable to airframe.

Mount the Button/LED Module

Mount on an airplane

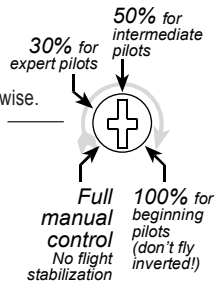
1. Drill three holes in fuselage.
2. Remove red button caps and nuts.
3. Insert buttons and LED through holes.
4. Place nameplate over buttons and LED.
5. Secure nameplate with nuts.
6. Replace button caps.

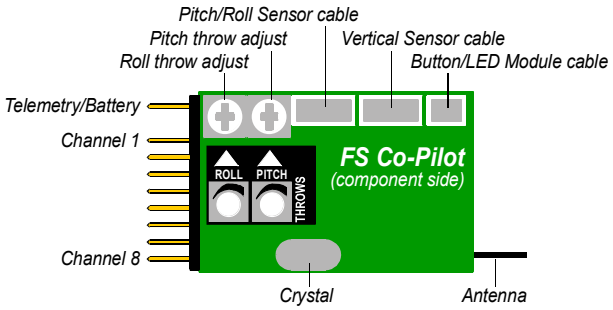
Mount optional Low Profile Button/LED Module on a helicopter

Attach module using two cable ties through holes in PC board.

Connect the components

1, Install crystal.
2. Set Throw controls on receiver:
   - If transmitter will control flight stabilization: set fully clockwise.
   - If transmitter will not control flight stabilization: as shown.
3. Connect servos, switch harness, ribbon cable(s) from sensor(s) and cable from Button/LED Module to receiver.
4. Wrap receiver in foam and secure in aircraft.
5. Route antenna.
6. Check for normal radio system operation.





This quick start guide provides brief instructions for experienced modelers. Please also read the FS8 Co-Pilot™ Reference Manual, which contains extensive information about

- Sensor mounting and system installation.
- Setting up the system.
- Infrared calibration: why it's important and what it means.
- Flying techniques for airplanes and helicopters.

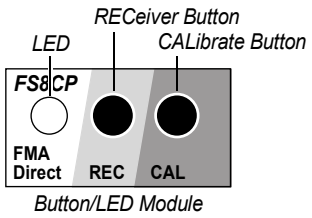
Plus technical information, troubleshooting, FAQs and much more useful stuff.

U.S. Patent 6,181,989. Foreign and other patents pending.
Manual for Version 1.11 firmware. 6/15/2004

Set up the system

Key points

- **There are no shortcuts to setting up. Follow all instructions in sections A, B and C.**
- Generally, you only need to set up once. Repeat setup if you move FS8 Co-Pilot™ to another aircraft or change the aircraft's configuration.



Button/LED Module

A. Set up failsafe operation

Key points

- FS8 Co-Pilot™ ships with all channels set for Last Good Frame Hold.
- Suggested initial failsafe positions (test and adjust as needed):

Airplane		Helicopter	
Goal	Gently descending circle	Goal	Gradual descent
Ailerons	Neutral	Roll	Neutral
Elevator	Neutral or slight up	Pitch	0 to 1°
Rudder	Moderate right turn	Collective	Hover
Throttle	1/4 to 1/3	Throttle	Idle
Flight stabilization	On	Flight stabilization	On

To do this...	Do this...
Enter Receiver Setup Mode	Turn on transmitter, press and hold RECeiver Button, turn on FS Co-Pilot™, then release button. In Receiver Setup Mode: ■ LED twinkles. ■ Servos set for Last Frame Mode move slowly back and forth. ■ Servos set for Failsafe Mode move to failsafe positions.
Do in any order, or skip. Channel not changed remains in previous state: Last Good Frame Hold or failsafe position.	
Set failsafe position for one channel	*While in Receiver Setup Mode:* 1. On transmitter, move stick/control for that channel to desired failsafe position (watch control surface or throttle). 2. LED blinks the selected channel(s). 3. Press RECeiver Button 1 time to save failsafe position. 4. Return transmitter stick/control to neutral *within one second* (or when setting throttle, leave stick where it is). If stick or control has programmed mixing, this procedure sets failsafe positions for all channels in that mix.
Set failsafe positions for multiple channels	*While in Receiver Setup Mode:* 1. On transmitter, move sticks/controls to desired failsafe positions. 2. LED blinks the selected channel(s). 3. Press RECeiver Button 1 time. 4. Return transmitter sticks/controls to neutral *within one second* (leave throttle stick where it is).
Erase failsafe position for one channel	*While in Receiver Setup Mode:* 1. On transmitter, move stick/control for channel you want to erase. 2. Return stick/control to neutral (or idle for throttle). 3. **Do not press button.** 4. When LED turns on, the channel operates in Last Frame Hold Mode. 5. LED blinks channel number just erased.
Erase all failsafes for all channels	*While in Receiver Setup Mode:* Press and hold RECeiver button for 10 seconds (until channel 2 ticks once). *All channels now operate in Last Good Frame Hold Mode.*
Determine a channel's mode	*While in Receiver Setup Mode:* Watch servos, control surfaces and throttle: ■ Servos set for Last Good Frame Hold Mode move slowly back and forth. ■ Servos set for Failsafe Mode move to their preset failsafe positions (and don't move back and forth).
Leave Receiver Setup Mode	1. Turn off FS8 Co-Pilot™ (saves settings). 2. Turn off transmitter.

B. Set up flight stabilization

Key points

- Move transmitter sticks only when instructed. Move only one stick at a time.
- If ambient temperature is >75°, substitute hot tap water in plastic soda bottle for hand.

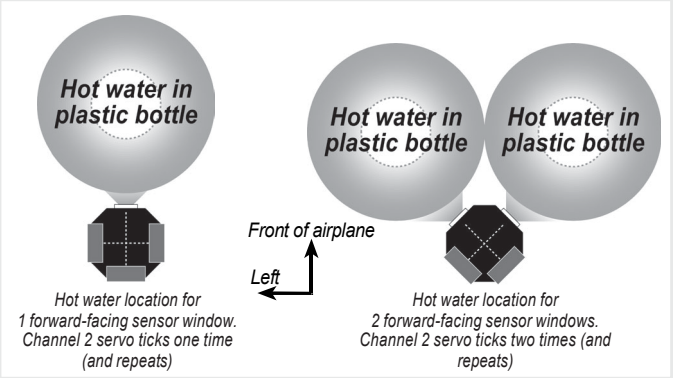
Do this (in order)...

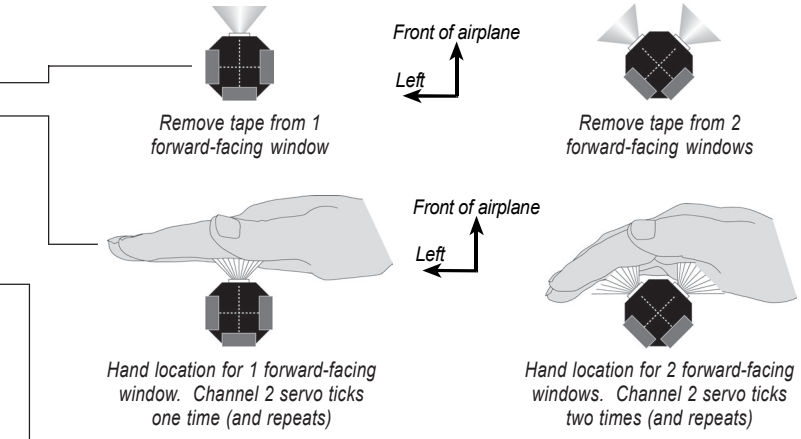
1. Disconnect cable from Vertical ("Z") Sensor (if sensor is installed).
2. Put black tape on all four Pitch/Roll sensor windows. Wait one minute.
3. Turn on transmitter.
4. Press and hold CALibrate Button, turn on FS8 Co-Pilot™, then release button. This puts receiver in Flight Stabilization Setup Mode:
   - ■ Channel 2 servo ticks three times.
   - ■ LED twinkles.
   - ■ LED blinks 1 time = Setup Mode 1.
5. Press and hold CALibrate button for 10 seconds to clear previous settings.
6. Assign pitch channel:
   a. Remove tape from forward-facing window(s).
   b. Place hand or heat source in front of forward facing window(s) on Pitch/Roll Sensor.
   c. Slowly move elevator (pitch) stick for up elevator and back to neutral.
7. Replace tape on uncovered sensor windows. Wait one minute.
8. Assign roll channel:
   a. Press CALibrate Button 1 time. LED blinks 2 times = Setup Mode 2.
   b. Remove tape from right-facing window(s).
   c. Place hand or heat in front of right-facing window(s) on Pitch/Roll Sensor.
   d. Slowly move aileron (roll) stick for left roll and back to neutral.
9. Remove tape from all sensor windows.
10. Assign remote on/off channel:
    a. Press CALibrate Button 1 time. LED blinks 3 times = Setup Mode 3.
    b. Move remote on/off knob, slider or switch.
11. Verify pitch/roll flight stabilization.
    a. Turn off FS8 Co-Pilot™ (saves flight stabilization settings).
    c. Turn on FS8 Co-Pilot™ without holding any buttons (puts receiver in Normal Flight Mode).
    d. Assure remote on/off is on and set to maximum throw.
    e. Place hand or heat source in front of forward-facing window(s) on Pitch/Roll Sensor. Correct response:
       - ■ Conventional airplane: elevator moves up.
       - ■ Flying wing: both elevons move up.
       - ■ Helicopter: swashplate tilts back, and does not tilt left or right.
    f. Place hand or heat source in front of right-facing window(s) on Pitch/Roll Sensor. Correct response:
       - ■ Conventional airplane: left aileron moves up, right aileron moves down.
       - ■ Flying wing: left elevon moves up, right elevon moves down.
       - ■ Helicopter: swashplate tilts left, and does not tilt forward or back.
12. Verify Vertical ("Z") Sensor operation (if Sensor is installed).
    a. Turn off FS8 Co-Pilot™.
    b. Reconnect cable to Vertical Sensor (if sensor is installed).
    c. Turn on FS8 Co-Pilot™.
    d. Place hand or heat above Vertical Sensor to simulate inverted flight. Pitch stabilization should be reduced. Roll stabilization is not affected.

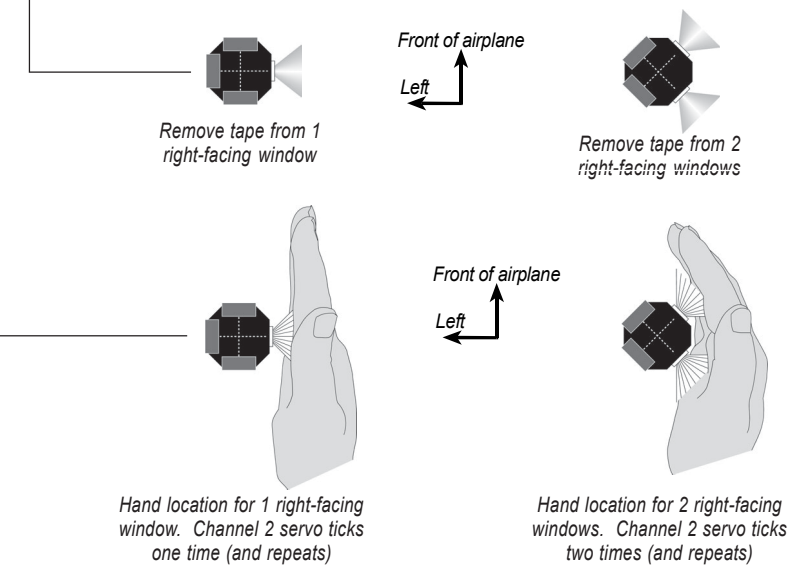
Alternate heat source

If ambient temperature is above 75°F (24°C), substitute hot tap water for your hand. Fill one or two *plastic* soda bottles with **hot tap water** (at least 120°F or 49°C). Cap the bottle(s).

- **Do not use shiny metal cans.**
- **Do not heat the water on a stove, as it becomes too hot to work with safely.** Tap water is hot enough.







C. Set up Auto Trim

Key points

- Auto Trim maintains trim settings when you switch FS8 Co-Pilot™ on and off.
- **Best for beginners: Auto Trim should be on.** Take off with FS8 Co-Pilot™ on, and trim in the air with FS8 Co-Pilot™ on. With Auto Trim on, aircraft stays in trim when FS8 Co-Pilot™ is turned off in the air.
- **Best for experts: Auto Trim should be off.** Take off with FS8 Co-Pilot™ off, and trim in the air with FS8 Co-Pilot™ off (since Auto Trim is off, it has no effect on trim). After turning on FS8 Co-Pilot™ for emergency recovery, don't trim, or you must retrim when FS8 Co-Pilot™ is off.

1. Turn on transmitter, then turn on FS8 Co-Pilot™.
2. Determine whether Auto Trim is on or off: with flight stablization off, place hand or heat source in front of right or left-facing Pitch/Roll Sensor window(s).
   - If pitch and roll surfaces move slightly, Auto Trim is on.
   - If pitch and roll surfaces don't move, Auto Trim is off.
3. To change Auto Trim from current setting: Press RECeiver Button 6 times.

Button summary

RECeiver Button in Receiver Setup Mode

Do this...	And this happens...
Press and hold RECeiver Button, turn on FS8 Co-Pilot™	FS8 Co-Pilot™ enters Receiver Setup Mode (LED twinkles). Do not turn off transmitter during Receiver Setup Mode.
Move transmitter stick to servo failsafe position for channel, press RECeiver Button, return stick to neutral (or low throttle) in 1 second	FS8 Co-Pilot™ sets servo to failsafe position for channel. For mixed channels, this sets failsafe positions for all channels in mix.
Press and hold RECeiver Button for 10 seconds	FS8 Co-Pilot™ sets all channels to Last Good Frame Hold (this removes Failsafe Mode servo presets from all channels).

CALibrate Button in Flight Stabilization Setup Mode

Do this...	And this happens...
Press and hold CALibrate Button, turn on FS8 Co-Pilot™	FS8 Co-Pilot™ enters Flight Stabilization Setup Mode (LED twinkles). Do not turn off transmitter during Flight Stabilization Setup Mode.
Press CALibrate Button	Move to next Setup Mode, in this order: 1. Setup Mode 1 (pitch). 2. Setup Mode 2 (roll). 3. Setup Mode 3 (remote on/off).
Press and hold CALibrate Button for 10 seconds	FS8 Co-Pilot™ sets all flight stabilization channels to neutral (factory defaults). Puts FS8 Co-Pilot™ into Flight Stabilization Mode 1 (pitch).

RECeiver Button 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).
Press button 6 times	Turn Auto Trim on/off.
Press button 11 times	Change between 100% and 140% maximum servo throw.

Field checklist

Besides your regular preflight checks, for FS8 Co-Pilot™...

Infrared field calibration

Key points

- Calibrate before first flight of the day, and any time weather changes significantly.
- Calibrate outside, near where you will be flying.
- Calibrate over type of terrain aircraft will fly over.

1. In Normal Flight Mode, measure temperature difference over typical terrain:
   - If optional Vertical Sensor is installed: set aircraft level on ground.
   - If optional Vertical Sensor is not installed: point aircraft straight down at the ground.

   Press CALibrate Button for 2 seconds (servos tick once). Release CALibrate Button, then count servo ticks. 3 to 10 ticks is good, don't use flight stabilization if only 1 tick.
2. Set level orientation: place model level on ground, walk 10 feet away, move any transmitter stick.

Repeat when weather changes.

FS8 Co-Pilot™ preflight check

1. Check for interference: with transmitter off, turn on FS8 Co-Pilot™. LED on, then off (and stays off) = no interference.
2. Turn on transmitter. Receiver LED will blink, then remain on.
3. Check receiver battery voltage: move transmitter sticks, press RECeiver Button 1 time, count blinks.
4. Check radio system range: collapse transmitter antenna, walk 150 feet away from model, return to model. Receiver LED continuously on = no failsafes.*
5. Check pitch compensation: with flight stabilization on, point aircraft nose down; surfaces should respond this way:
   - Conventional airplane: elevator moves up.
   - Flying wing: both elevons move up.
   - Helicopter: swashplate tilts back, and does not tilt left or right.
6. Check roll compensation: with flight stabilization on, roll aircraft to right; surfaces should respond this way:
   - Conventional airplane: left aileron moves up, right aileron moves down.
   - Flying wing: left elevon moves up, right elevon moves down.
   - Helicopter (boom parallel to ground): swashplate tilts left, and does not tilt forward or back.
7. Check pitch and roll neutral positions: place aircraft level on ground; pitch and roll surfaces should be centered (or helicopter swashplate level) when flight stabilization is on.
8. Set dual or tri rates to high.
9. Assure all sensor windows are clean.
10. Check failsafe operation: turn off transmitter; servos with failsafe settings should move to those positions.
11. Test all transmitter controls, including stabilization on/off.
12. If using a buddy box, activate it for 2 seconds *before each flight*.

Flying with FS8 Co-Pilot™

- To recover from an error: Center the sticks. FS8 Co-Pilot levels the aircraft.
- If optional Vertical Sensor is installed, aircraft will try to roll out from inverted.
- If optional Vertical Sensor is *not* installed, aircraft might loop out from inverted. **CAUTION:** If aircraft is too low, it will crash! Recommended: turn off flight stablization when flying inverted or knife edge.
- Flight stabilization will attempt to keep aircraft level. You'll need to apply more stick motion to overcome this.
- If aircraft shakes or oscillates, reduce Throw.
- Taildragger: Apply full up elevator when taxiing and at start of takeoff (when tailwheel is on ground, flight stablization attempts to level aircraft by applying down elevator).

Normal Flight Mode

To do this...	Do this...
Check for interference	1. Turn on FS Co-Pilot™ (leave transmitter off). 2. LED is on for 2 seconds to confirm power. After that: ■ LED off = no interference. ■ Continuous blinks = interference is present.
Enter Normal Flight Mode	1. Turn on transmitter. 2. Turn on FS Co-Pilot™.
Check receiver input voltage	*While in Normal Flight Mode:* 1. While moving all transmitter sticks (to load radio system), press RECeiver Button 1 time. 2. Count LED blinks: ■ Each long blink = 1 volt. ■ Each short blink = 0.1 volt. (Example: 4 long blinks + 9 short blinks = 4.9 volts.)
Check radio system range*	*While in Normal Flight Mode:* 1. Collapse transmitter antenna. 2. Walk 50 paces (about 150 feet or 45m) away from model. 3. KEEP TRANSMITTER ON and return to model. 4. Watch FS Co-Pilot™ LED: ■ Continuously on: no failsafes. ■ Blinking: failsafes occurred.
Check failsafe count after flight or range check	1. Keep transmitter on, keep receiver on! 2. LED continuously on = perfect signal. or Count LED blinks: each blink = 1 failsafe (maximum report is 9 failsafes).
Check bad frame count after flight or range check	1. Keep transmitter on, keep receiver on! 2. Press RECeiver Button 3 times. 3. Count LED blinks: ■ Each long blink = 10 bad frames. ■ Each short blink = 1 bad frame. (Example: 2 long blinks + 4 short blinks = 24 bad frames; maximum report is 99 bad frames)
Change between 1X and 2X LED flash rate	(1X = 1 flash per second, 2X = 2 flashes per second.) Press RECeiver Button 5 times.
Turn Auto Trim on/off	Press RECeiver Button 6 times.
Change between 140% and 100% max servo throw	Press RECeiver Button 11 times.
Clear failsafe count and bad frame count	Turn off receiver. (Failsafe *positions* are retained.)

*This is a quick range check. If you suspect problems, use the advanced range check procedure on page 21 of the FS8 Co-Pilot™ Reference Manual.