**F5J Program for FrSky Taranis  
QX7 and XD9 Transmitters**

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# Overview

This program for electric gliders comes with powerful configuration features, making setup of a new model quick and easy. It also provides timing and score keeping, as well as graphing of telemetry data.

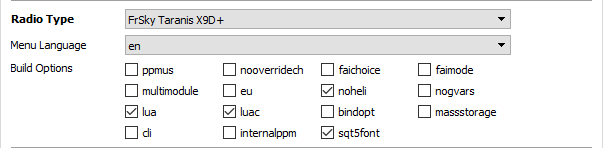
* Air brake responses for flaps and ailerons can be set arbitrarily with 5-point curves, so e.g. flaps or crow can be configured.
* Mixes for power-to-elevator, aileron differential, aileron-to-rudder, flap-to-elevator, and snap-flap.
* Camber preset for the current flight mode is set by the throttle trim. With the motor on, camber preset is reduced with increasing power.
* Full aileron response is available for any air brake position, as ailerons on both sides are “bumped” up or down, if necessary.
* Controls can easily be re-assigned to meet personal preferences. By default, the throttle stick is used for both motor and air brakes, but either can be re-assigned to e.g. a slider.
* Switches are each set up on a single logical switch line each, and can therefore easily be changed.
* Everything, including channel assignment, servo directions, centering, end points, mixes, and 5-point curves for air brakes and servo outputs for flaps and ailerons, can be configured easily in five sub-menus, where the trim buttons are used to adjust the various parameters.
* Timing and electronic score card for F5J contests. For launch height, you can use telemetry values (for practice and informal contests) or you can enter the value from an official unit like CamF5J or Altis. Scores are saved to the SD card, and can be recalled later.
* Graphing of telemetry log data. You can view receiver battery volts, RSSI signal strength and, if you have an altimeter, altitude and vertical speed.

# Installation

**Sometimes, the telemetry menus crash the first time they are opened. Just cycle power on your radio, and it should work then. Lua errors do not affect control of the plane.**

**If the problem persists, then it is probably because the “luac” option was not selected before downloading the firmware and flashing the radio, as described below.**

First of all, your transmitter must be updated to firmware version 2.2, and have the “lua” and “luac” build option checked. Open Companion, go to Settings, and check “lua” and “luac”:



Then click Download and Check for Updates. Save the firmware, and click Write Firmware to Radio.

Next, copy the files from the SD folder in the Zip file over to your radio’s SD card. Drag the entire SCRIPTS and IMAGES folders over, and merge the files into the existing folders on your radio’s SD card. If prompted, select overwrite existing files.

The following script should be saved in /SCRIPTS/FUNCTIONS:

* JFutil.lua

The following script should be saved in /SCRIPTS/MIXES:

* JF5J.lua

The following scripts should be saved in /SCRIPTS/TEMEMETRY:

* JF5Jsk.lua
* JF5JskLd.lua
* JF5Jsb.lua
* JF5JsbLd.lua
* JFgrph.lua
* JFgrphLd.lua
* J5JKcf.lua
* JFchannels.lua
* JF5Jalign.lua
* JF5Jbrkcrv.lua
* JF5Jailcmb.lua
* JF5Jadjmix.lua

The following image file should be saved in /IMAGES:

* Lua-girl.bmp

Finally, copy the radio program from the Zip file to your radio.

* Open my .OTX file for the right transmitter in Companion.
* Read models and settings from your own radio.
* Drag the “JF F5J” model from the .OTX file matching your radio model over to your own .OTX file.
* Write models and settings to the radio from your own .OTX file.

# Telemetry setup

**Before you bind the receiver, disconnect the motor! Wait until you have all of the basics configured before you test the motor.**

|  |  |
| --- | --- |
| The program uses receiver battery voltage, altitude, and flight mode (FM) internally. In order to avoid that things get messed up when you configure the sensors for your plane, I have created the calculated sensors “RBat”, “Alti”, and “FM”. |  |

**Do not delete these three sensors! If you did it anyway, please see the section “If you deleted the telemetry sensors” later in this document.**

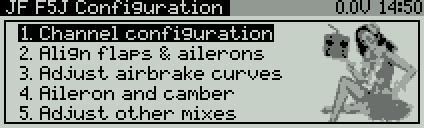
Dive into the TELEMETRY menu and select “Discover new sensors”. Then set the sources for “RBat” and “Alti” to the actual sensors.

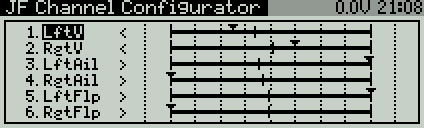
|  |  |
| --- | --- |
| Edit the “RBat” sensor, and set Source 1 to “RxBt” (or “A1” in some cases).  If you need to change the battery voltage warning threshold, then do so in logical switch line L11. |  |
| If you have an altimeter, then edit the “Alti” sensor, and set Source 1 to “Alt”.  Also set Source under Variometer to “VSpd” (find it below sensors in the TELEMETRY menu). |  |
| Enable logging for the relevant parameters (e.g. “RSSI”, and possibly “VSpd”). |  |

# Model setup

The program comes with both rudder, elevator, and left and right v-tail channels; there are not separate versions for cross- and v-tail. This is because the channel outputs can be moved around very easily with the Channel Configurator sub-menu, as described below. Just move the unused channels out of the way.

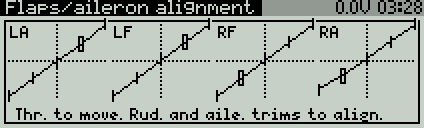
All global variables should be changed by the menus below; there is no need to change global variables directly. If you want to re-assign switches, then do so under logical switches. Please refer to “Logical switches” below, to see where to change the respective switches.

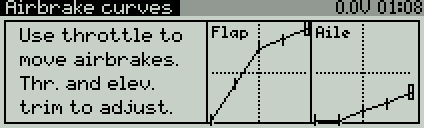
Now that the receiver is bound, telemetry has been set up, and the motor is disconnected, it is time to dive into the configuration menus. Two long presses on the PAGE button will get you to telemetry screen #4. This screen is a menu with five different sub-menus.

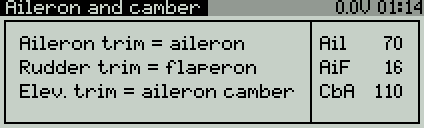
The first sub menu is the Channel Configurator. The small black triangles show the current servo positions. Use ± or Rotary to select a channel. Press ENTER to edit. Use ± or Rotary to select what to edit for the channel. Press ENTER again to edit (selection is blinking). The following items can be edited.

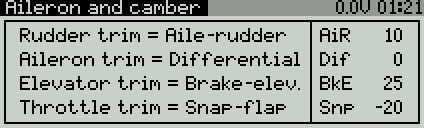
1. Channel number. This moves the channel up or down on the list.
2. Servo direction.
3. The entire servo interval. This keeps the center point in the middle between min. and max. and moves all three points up or down. If necessary, the interval is scaled to avoid exceeding ±125%.
4. Servo end points. Adjusts the range while keeping the end points symmetrical around the center.
5. Minimum point.
6. Center point.
7. Maximum point.

Press EXIT when you are done.

The second menu is for aligning the 5-point output curves for flap and aileron servos between the left and right sides. Use the throttle stick to move between the five points, and use rudder and aileron trims, respectively, to align flaps and ailerons at each point.

The third menu is for adjusting the air brake curves. Use the throttle stick to move between the five points, and use throttle and elevator trims, respectively, to set flaps and aileron positions at each point. First, you want to push the throttle stick all the way forward, and set the point where no air brake is applied. Both flaps and ailerons should be in the maximum reflex position here. This is usually where flaps and ailerons are flush with the trailing edge of the wing. Then, move the stick back and set the desired flap and aileron positions at each of the four other points.

The fourth menu is for setting aileron travels for ailerons and flaps, and camber travel for the ailerons. Aileron camber is the amount that the ailerons move when camber is applied by flight mode presets, snap-flaps, and camber on the slider, if it is enabled. Typically, you want to have about the same amount of camber movement for the ailerons as for the flaps.

The fifth and last menu is for adjusting various mixes.

If you want additional camber on a slider, then set it up under Input 7: Cmb, by changing the input source from MAX to the desired slider.

# Flying

The motor has to be armed before starting it. Arm the motor by moving switch C up from the center position. When the motor is armed, the transmitter will warn you with a siren sound and shake. The motor is then started by pulling and releasing switch F. This also starts the timers.

When the motor is running, a power-to-elevator mix is active. More power gives more down elevator. This mix can be adjusted with the elevator trim while the motor is running.

**Be careful with the power-to-elevator mix! Too much could make the model dive into the ground under full power after launching.**

You can adjust camber preset with throttle trim as for other flight modes, but the camber is reduced to zero as power is increased to maximum.

The power response is defined by Curve 9: Mot. I have set it to jump from 75% up to 100% just before the throttle stick is all the way forward. I have done this to avoid “almost full” power, as this can burn out the ESC on hard pressed systems. You can, of course, edit Curve 9 to your own liking.

The motor is stopped by pulling switch F again. If the motor needs to be restarted, then switch C must be moved back to the center position, and then up again to arm, and then switch F must be pulled and released.

When gliding, the three flight modes Float, Cruise, and Speed can be selected with switch B. Camber and elevator can be trimmed for each flight mode individually.

The KAPOW mode for landing moves ailerons and flaps 100% up, and the elevator goes to a fixed position that can be adjusted with the elevator trim. in “classic” KAPOW, the elevator is set to full down, to “dork” the plane into the ground. I do not want to “dork” my electric gliders, so I use a neutral elevator position to get a “belly flop” instead. KAPOW is enabled by moving switch C to the down position. The radio announces “Landing mode”. KAPOW is then activated by giving more than half air brake and full down elevator.

After motor run and KAPOW, the air brake is disabled, and the radio yells “Flaps up”. Re-enable the air brake, and make the radio shut up, by moving the throttle stick all the way forward again.

# Altimeter

If you have an altimeter sensor connected to your receiver, then the program can report your start height and the current altitude. The altimeter is reset every time you arm the motor. The start height is reported 10 sec. after motor stop, when switch A is either up or down. The variometer sound is turned on, when switch A is down. The current altitude is reported when switch H is pulled down and switch A is either up or down.

**When flying contests, you are not allowed to have altitude feedback, hence, switch A should be centered during contests.**

# Timing and score keeping

The first telemetry screen is used for timing and score keeping. Before arming the motor, use ± or Rotary to set the target time between 1 and 99 minutes.

After landing, set landing points with ± or Rotary, and press ENTER. Then set the start height and press ENTER. You can press MENU to go back and edit the previous value. Press ENTER to save, or EXIT to start a new flight without saving.

If you have an altimeter, then the altimeter start height will be pre-filled for you, otherwise, it defaults to 100 m. That way, you can practice and fly informal contests with a FrSky altimeter instead of an “official” F5J unit. If you restarted the motor, then everything will be zeroed, and you cannot edit anything.

The second telemetry screen is a score browser, where you can recall the saved scores.

# Graphing of log data

The third telemetry screen is a graph of log data. Use ± or Rotary to change the flight, press ENTER to change the parameter being plotted, and press MENU to view summary statistics.

Data for the current model on the same day is shown. If you want to look at yesterday's file, then you must either set back the date on your radio, or rename the file in the transmitter’s SD CARD menu.

Notice that individual flights are identified by time gaps and by the flight mode sensor “FM” being equal to 1 for Launch mode. If there is a problem with identifying the flights correctly, then check that the FM sensor is working correctly, and that its data is being recorded.

# If you deleted the telemetry sensors

If you accidentally deleted the three telemetry sensors that were set up in the program, then you will need to recreate them.

“Rbat” is a calculated sensor. Set “RxBt” or “A1” as the first source. It is used the following places in the program: L11, L12, SF8, and in the Top Bar under the DISPLAY menu.

“Alti” is also a calculated sensor. Set “Alt” as the first source if you have an altimeter, and check Auto Offset. It is used in SF12, SF14, SF15 (Alti+), and the Top Bar.

“FM” is a custom sensor, and it must have Id 5050. Check Logs at the bottom of the screen. Otherwise, the graphing screen will not properly identify the individual flights. The FM sensor is updated by the function script JFlib.lua.

# Logical switches

## Switch assignment

|  |  |  |
| --- | --- | --- |
| L1 | !SA- AND L48 | Switch allowing altitude announcement  (should be off during contests). |
| L2 | SA↓ AND ---- | Variometer switch. |
| L3 | SB↑ AND ---- | Switch for speed flight mode. |
| L4 | SB↓ AND ---- | Switch for float flight mode. |
| L5 | SC↑ AND ---- | Arming switch. |
| L6 | SC↓ AND !FM1 | Switch enabling KAPOW mode. |
| L7 | !SD- AND ---- | Data logging switch. |
| L8 | SF↓ AND ---- | Trigger switch (controls motor and timer). |
| L9 | SH↓ AND L01 | Switch for announcing current altitude every 15 sec. |

## Battery voltage alarm

|  |  |  |
| --- | --- | --- |
| L11 | TELE1:RBat < 5 | Low voltage alarm threshold for receiver battery. |
| L12 | TELE1:RBat > 0 | Battery voltage sensor connected (don’t alarm all the time!) |
| L13 | ( L11 AND L12 ) AND !L14 | Battery low voltage alarm. |
| L14 | Sticky(L13, ----) Duration(25s) Delay(0.1s) | Take a 25 sec. break before repeating the alarm. |

## Motor control

|  |  |  |
| --- | --- | --- |
| L16 | !L08 AND !L20 | Trigger switch not pulled and motor off; allow arming. |
| L17 | ( Edge(!L05, [0:0]) ) AND L16 | Arm the motor. |
| L18 | Sticky(L17, L21) | Motor armed. |
| L19 | ( Edge(L08, [0:0]) ) AND L18 | Start the motor. |
| L20 | Sticky(L19, L24) | Motor on (and Motor flight mode).  Referenced by the LF5Jsk lua script. |
| L21 | !L05 OR L20 | Arming switch off or motor running – disarm motor. |
| L22 | !L05 OR L08 | Arming switch off or trigger switch pulled. |
| L23 | Timer2 > 29 | Motor timer expired. |
| L24 | L22 OR L23 | Stop the motor. |
| L25 | L08 AND !L18 | Trigger pulled and not armed.  Referenced by the LF5Jsk lua script. |
| L26 | ( LUA1a > 0 ) AND L17 | LUA1a = Tmr is on, and motor is armed: reset the altimeter. |

## KAPOW

|  |  |  |
| --- | --- | --- |
| L28 | ( I5:Brk < 0 ) AND L06 | Airbrake on and KAPOW enabled. |
| L29 | ( Ele > 90 ) AND L28 | … and elevator down: KAPOW flight mode. |

## Disable air brake

|  |  |  |
| --- | --- | --- |
| L31 | L20 OR L29 | Motor running or KAPOW: disable airbrake. |
| L32 | ( I5:Brk > 90 ) AND !L31 | Stick up: re-enable airbrake. |
| L33 | Sticky(L31, L32) | Air brake disabled. |
| L34 | ( L33 AND !L31 ) AND !L32 Delay(3s) | “Flaps up” warning. |

## Altitude announcement

|  |  |  |
| --- | --- | --- |
| L36 | Edge(L20, [0:0]) | Motor is stopped, and altitude announcement is allowed. |
| L37 | Sticky(L36, ----) Duration(10s) | Wait 10 sec. after motor stopped. |
| L38 | Edge(L37, [0:0]) | End of 10 sec. window. |
| L39 | L38 AND L01 | Announce launch altitude. |

## Data logging

|  |  |  |
| --- | --- | --- |
| L41 | Sticky(L19, L38) | From motor started until 10 sec. after motor stopped. |
| L42 | ( L07 AND L48 ) AND L41 | Fast data logging. |
| L43 | ( L07 AND L48 ) AND !L41 | Slow data logging. |

## Flight timer

|  |  |  |
| --- | --- | --- |
| L45 | ( LUA1a = 1 ) AND L19 | LUA1a = Tmr is on, and motor is started: start the flight timer. |
| L46 | ( LUA1a = 0 ) AND L08 | LUA1a = Tmr is off, and the trigger switch is pulled. |
| L47 | L46 AND !L41 | AND 10 sec. after the motor was stopped: stop the flight timer. |
| L48 | Sticky(L45, L47) | Flight timer running. |

## Adjustment modes

|  |  |  |
| --- | --- | --- |
| L50 | LUA1b = 1 | LUA1a = Adj = 1: align flaps and aileron output curves. |
| L51 | LUA1b = 2 | LUA1a = Adj = 2: adjust airbrake curves. |
| L52 | LUA1b = 3 | LUA1a = Adj = 3: adjust flaperon, aileron, and aileron camber. |
| L53 | LUA1b = 4 | LUA1a = Adj = 4: adjust aileron-rudder, differential, brake-elevator, and snap-flap mixes. |
| L54 | L50 OR L51 | Disable aileron and camber for these two adjustment functions. |

# Mixers

|  |  |  |
| --- | --- | --- |
| CH1:Rudd | I1:Rudd Weight(+100%)   += I3:Aile Weight(+GV3:AiR) NoTrim [AileRudd] | Rudder. |
| CH2:Elev | I2:Elev Weight(+100%) Flight modes(Cruise, Motor, Speed, Float, FM5, FM6, FM7, FM8)   += CH23:EleMix Weight(+100%) | Elevator. Stick input is disabled in KAPOW mode. |
| CH3:LftAil | I3:Aile Weight(+GV1:Ail) Switch(!L54) Diff(-GV4:Dif)   += CH31:FlpAil Weight(-100%) | Left aileron. |
| CH4:RgtAil | I3:Aile Weight(+GV1:Ail) Switch(!L54) Diff(GV4:Dif)   += CH31:FlpAil Weight(+100%) | Right aileron. |
| CH5:LftFlp | I3:Aile Weight(+GV2:AiF) Switch(!L54) Diff(-GV4:Dif)   += CH32:Flap Weight(-100%) | Left flap. |
| CH6:RgtFlp | I3:Aile Weight(+GV2:AiF) Switch(!L54) Diff(GV4:Dif)   += CH32:Flap Weight(+100%) | Right flap. |
| CH7:Motor | I4:Moto Weight(+100%) | Motor. Input is set to -100% for non-motor flight modes. |
| CH9:LftV | I1:Rudd Weight(+50%)   += I2:Elev Weight(-50%) Flight modes(Cruise, Motor, Speed, Float, FM5, FM6, FM7, FM8)   += I3:Aile Weight(+GV3:AiR) NoTrim [AileRudd]   += CH23:EleMix Weight(-50%) | Left V-tail is 50% rudder - 50% elevator. |
| CH10:RgtV | I1:Rudd Weight(+50%)   += I2:Elev Weight(+50%) Flight modes(Cruise, Motor, Speed, Float, FM5, FM6, FM7, FM8)   += I3:Aile Weight(+GV3:AiR) NoTrim [AileRudd]   += CH23:EleMix Weight(+50%) | Right V-tail tail is 50% rudder + 50% elevator. |
| CH22:Brake | I5:Brk Weight(+100%) Curve(CV11:DB)   := MAX Weight(+100%) Switch(L33) [BrakeOff]   := I8:Adj Weight(+100%) Switch(L51) [Adjust] | Air brake input, disabled by L33 and overridden by L51 for the airbrake curve adjustment |
| CH23:EleMix | I4:Moto Weight(+GV6:BkE) Offset(GV6:BkE) Delay(u1:d0) Slow(u0:d1) [MotEle]    += CH22:Brake Weight(-GV6:BkE) Offset(GV6:BkE) Curve(CV5:BrF) [BrkEle]   += MAX Weight(+GV6:BkE) Offset(-GV6:BkE) Curve(CV5:BrF) [BEOffs]   := MAX Weight(+GV6:BkE) Flight mode(KAPOW) [KAPOW] | Elevator mix consists of motor compensation, air brake compensation, and fixed position for KAPOW. |
| CH24:CbrPS | I6:CbPS Weight(+100%)   \*= I4:Moto Weight(-50%) Offset(50%) [MotCbrPS] | Flight mode camber preset is reduced as motor power is increased. |
| CH25:SnpFlp | CH24:CbrPS Weight(+100%) Offset(-GV7:Snp)  [Cbr-Snp]   \*= I2:Elev Weight(+100%) NoTrim Curve(CV7:Snp) | Snap flap. Maximum deflection is independent of camber preset. |
| CH26:Camber | I7:Cmb Weight(+10%) Offset(-10%) Curve(CV11:DB) [Slider]   += CH24:CbrPS Weight(+100%)   += CH25:SnpFlp Weight(+100%) Diff(-100%) | Total camber, including slider input (if enabled), preset, and snap-flap. |
| CH27:FlpAil | CH22:Brake Weight(+100%) Curve(CV6:BrA)   += CH26:Camber Weight(+GV5:CbA) Switch(!L51)   := MAX Weight(+100%) Flight mode(KAPOW) | Air brake and camber input to the ailerons, or KAPOW all up. |
| CH28:AbsAil | I3:Aile Weight(+GV1:Ail) NoTrim Curve(CV10:Abs) | Absolute aileron deflection. |
| CH29:UpExc | CH27:FlpAil Weight(+100%) Offset(-100%)   += CH28:AbsAil Weight(+100%) Diff(GV4:Dif) [AilUp] | Amount that total aileron up travel exceeds 100%. |
| CH30:DnExc | CH27:FlpAil Weight(+100%) Offset(100%)   += CH28:AbsAil Weight(-100%) Diff(GV4:Dif) [AilDown] | Amount that total aileron down travel exceeds -100%. |
| CH31:FlpAil | CH27:FlpAil Weight(+100%)   += CH29:UpExc Weight(-100%) Switch(!L51)  Diff(-100%) [BmpDn]   += CH30:DnExc Weight(-100%) Switch(!L51) Diff(100%) [BmpUp]   := I8:Adj Weight(+100%) Switch(L50) [Align] | Air brake, camber, and KAPOW input to ailerons, bumped up or down to allow for aileron deflection. Override for alignment mode. |
| CH32:Flap | CH22:Brake Weight(+100%) Curve(CV5:BrF)   += CH26:Camber Weight(+100%) Switch(!L51)   := MAX Weight(+100%) Flight mode(KAPOW)   := I8:Adj Weight(+100%) Switch(L50) [Align] | Airbrake, camber, and KAPOW input to the flaps. Override for alignment mode. |