

# Aircraft Extras Inc.

## Flap Positioning Systems

available with or without

## Automatic Elevator Trim

FPS-Plus-nt



without Auto Elevator Trim

FPS-Plus



with Automatic Elevator Trim  
(eliminates stick back pressure)

FPS-Plus  
Reflex

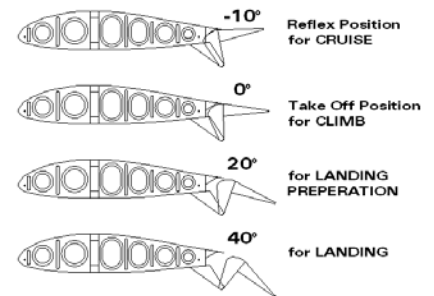


Designed for RV-10's  
and Flap Systems with Reflex

### FEATURES:

- \* FULL AUTOMATIC FLAP POSITIONING – UP TO 10 POSITIONS
- \* AUTOMATIC ELEVATOR TRIM (FPS-Plus and FPS-Plus Reflex)
- \* SENSES MOVEMENT – STOPS MOTORS IF MECH. PROBLEMS
- \* 4 MODES of OPERATION AVAILABLE, (STEP & PROPORTIONAL)
- \* COMPATIBLE WITH MOST MOTORS & INDICATORS
- \* INITIAL Set-Up is FULLY USER PROGRAMMABLE
- \* ONE BUTTON PROGRAMMING
- \* NO LIMIT SWITCHES TO INSTALL
- \* OPERATES ON +12V & +24V SYSTEMS

### REFLEX FLAP POSITION EXAMPLE



### What is the FPS-Plus?

The FPS-Plus is a full service, automatic, flap positioning system, . . . Plus! In the fully automatic step position mode, a “one button touch”, commands the flaps and elevator trim to move. One touch moves the flap from programmed flap stop, to programmed flap stop. Holding the flap button down for more than 1 second commands the flaps to go to either the full up, or the full down position. All models are user programmable up to 10 flap positions. The FPS-Plus Reflex is available for the RV-10 and aircraft that have flap systems with reflex. A “one second touch up”, returns the flaps to the take-off and climb flap position.

### The “Plus” feature and Pitch Stability

Have you ever wondered what it would be like to adjust your flaps without the nose of your aircraft pitching up or down? Perfect pitch stability is a very desirable flight characteristic that many small planes do not have. After adjusting the flaps, most pilots compensate for the pitch up or down by manually cranking in a bit of elevator trim. We have all done it. With the FPS-Plus, your aircraft can perform like the larger, more expensive aircraft with good pitch stability. Your elevator trim will be automatically adjusted for every different flap setting that you command. Using the FPS-Plus allows you to lower your flaps, and your aircraft will simply slow down without a significant change to your aircraft’s present glide path.

**“FINALLY! , . . No more manual tweaking on final approach to relieve your stick back pressure!”**

### Automatic Elevator Trim Advantages

"Aborted landings" "Touch & goes" and "Slow Flight", . . . are all made much easier without stick back pressure.

### SPECIFICATIONS:

The system will operate on +12Vdc or +24Vdc  
Dimensions: 3" x 6"x 1.25", Footprint: 3" x 6.75"  
Mounting: 2 holes, 0.156" dia, 5.375" apart.

(FPS-Plus-nt, same standard features with no Auto Trim)

Maximum amperage for each servo motor, 10A.

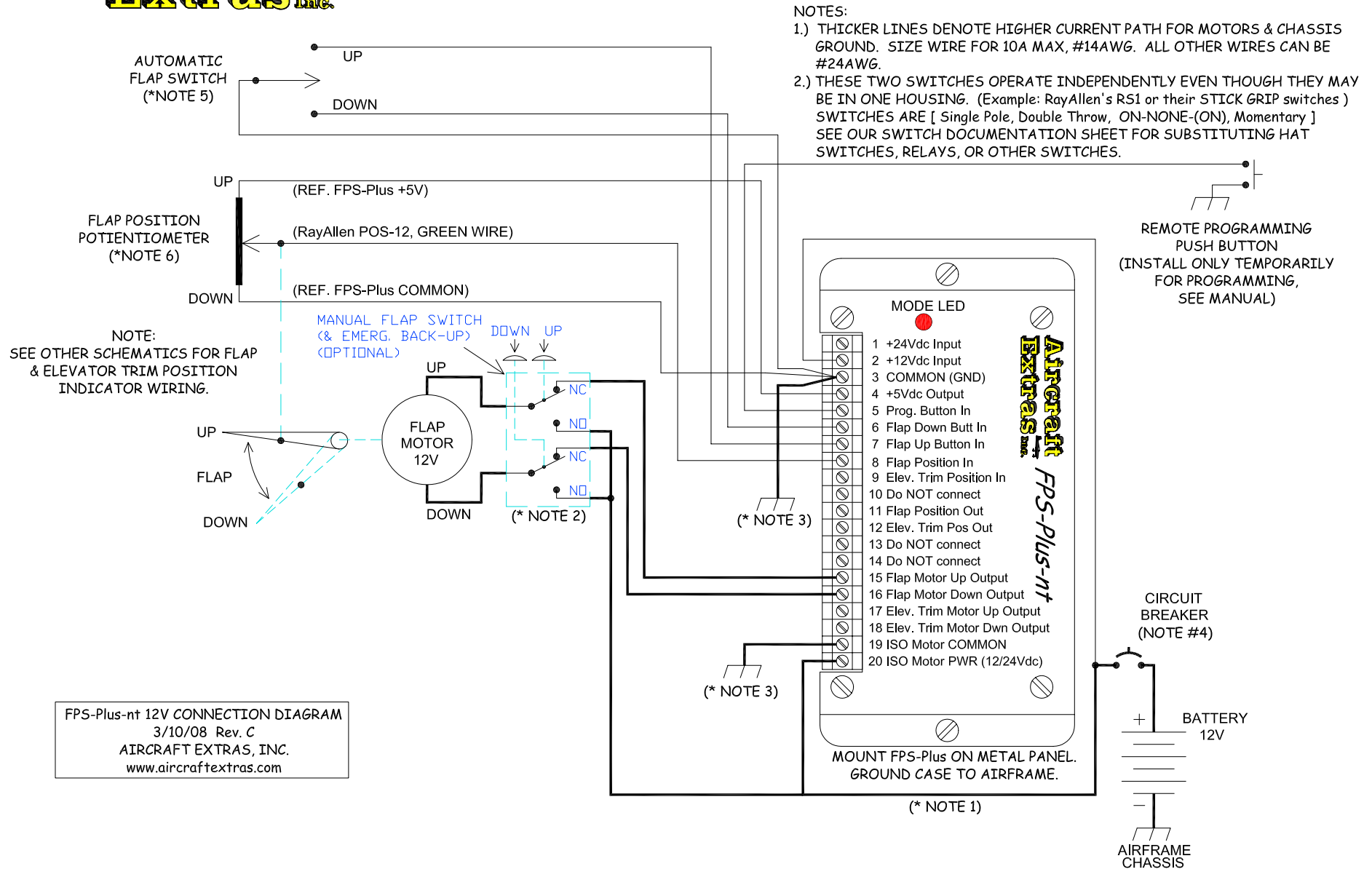
Weight: < 8oz.

Will operate with existing sensors, motors & indicators for retrofits  
(FPS-Plus Reflex, for RV-10's or other aircraft with Flap Reflex)

Aircraft Extras, Inc. • 4908 Mc Kenna Ct. • Columbus, • OH • 43221 • USA Phone (614) 876-6345

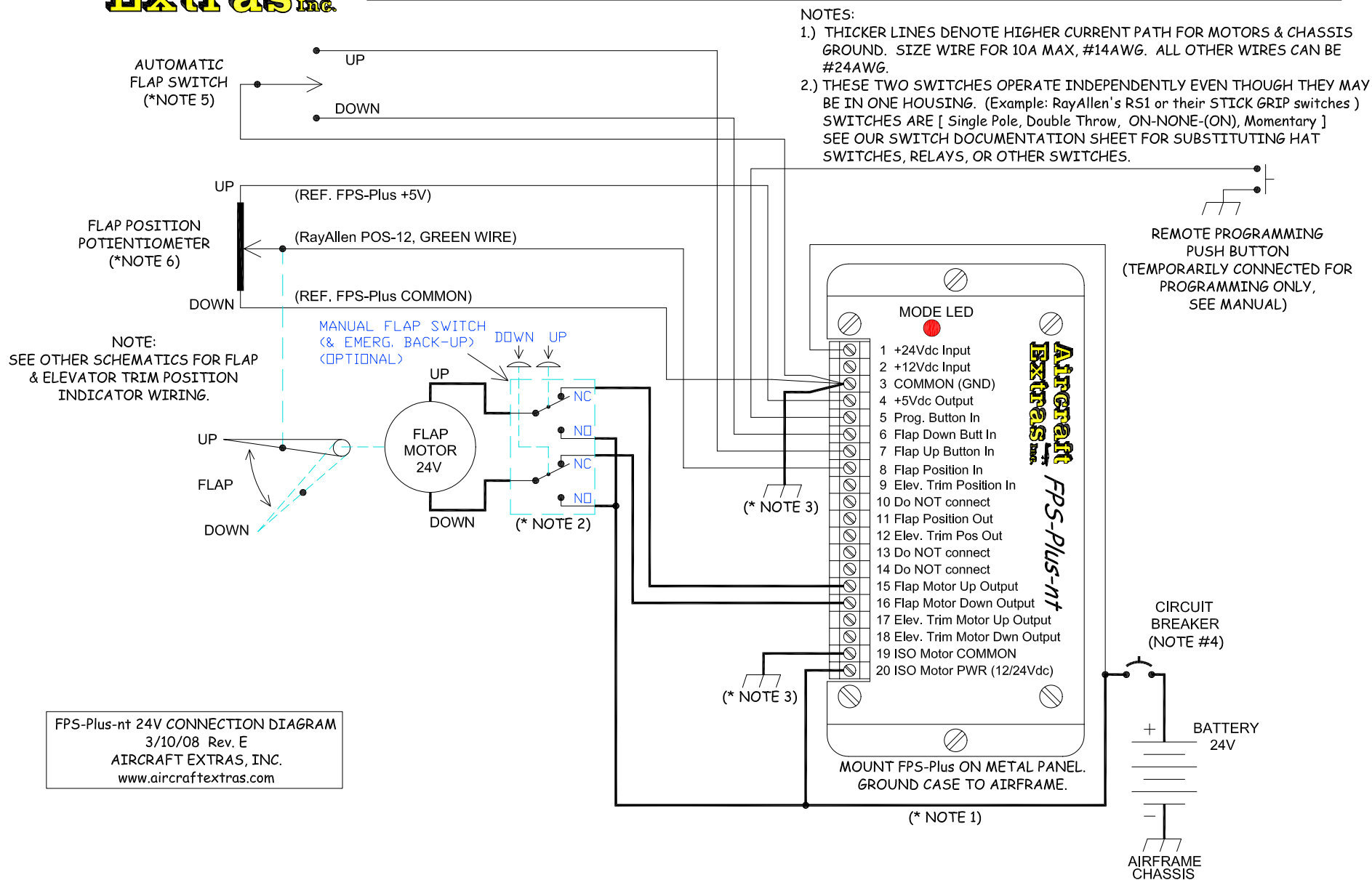
Visit [www.aircraftextras.com](http://www.aircraftextras.com) for all details and see **MORE** great products!

## SCHEMATIC (FPS-Plus-nt for +12V Systems)



- NOTES:**
- 3.) SEPERATE LARGER WIRE TO CHASSIS. (#18AWG to #10AWG)
  - 4.) WE RECOMMEND A PUSH-ON/PULL-OFF BREAKER. SIZE CIRCUIT BREAKER FOR MAX. MOTOR CURRENTS UP TO 10A.
  - 5.) ANY SWITCH [ Single Pole, Double Throw, (ON)-OFF-(ON), Momentary ] WE DO NOT RECOMMEND MOUNTING THIS SW ON STICKS SINCE ACCIDENTALLY BUMPING THIS SWITCH ACTIVATES A SIGNIFICANT FLAP MOVEMENT.
  - 6.) POTENTIOMETER CAN BE 5K, 10K, or 20K Ohms. (Ex. model: RayAllen's POS-12)
  - 7.) FOR SWITCHES, (ON) MEANS "ON MOMENTARY" OR SPRING LOADED. ALL SWITCHES SHOWN DE-ENERGIZED.

## SCHEMATIC (FPS-Plus-nt for +24V Systems)



FPS-Plus-nt 24V CONNECTION DIAGRAM  
3/10/08 Rev. E  
AIRCRAFT EXTRAS, INC.  
www.aircraftextras.com

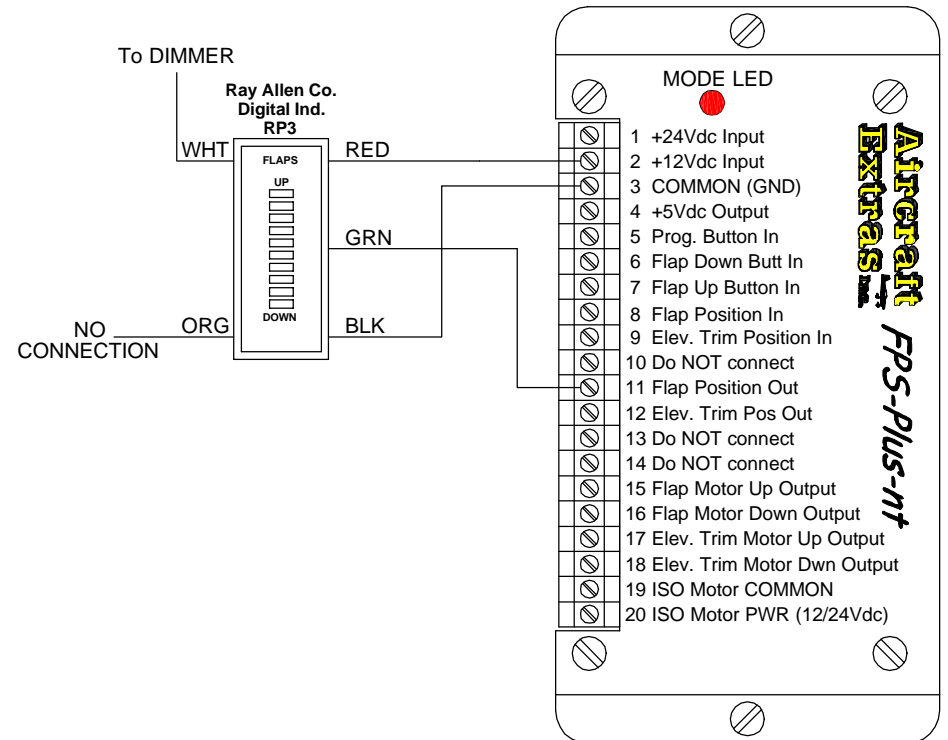
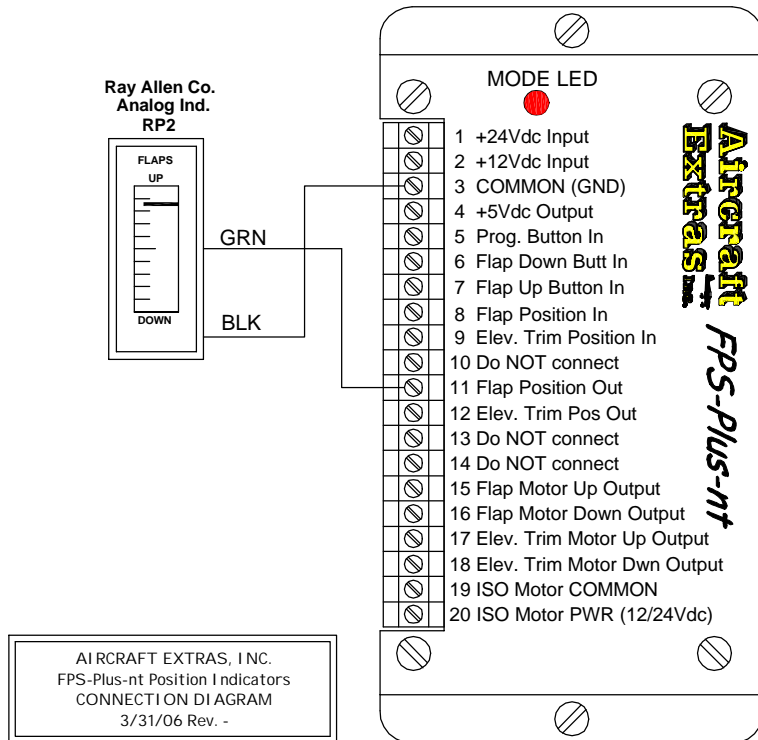
- NOTES:
- 1.) THICKER LINES DENOTE HIGHER CURRENT PATH FOR MOTORS & CHASSIS GROUND. SIZE WIRE FOR 10A MAX, #14AWG. ALL OTHER WIRES CAN BE #24AWG.
  - 2.) THESE TWO SWITCHES OPERATE INDEPENDENTLY EVEN THOUGH THEY MAY BE IN ONE HOUSING. (Example: RayAllen's RS1 or their STICK GRIP switches) SWITCHES ARE [ Single Pole, Double Throw, ON-NONE-(ON), Momentary ] SEE OUR SWITCH DOCUMENTATION SHEET FOR SUBSTITUTING HAT SWITCHES, RELAYS, OR OTHER SWITCHES.

- NOTES:
- 3.) SEPERATE LARGER WIRE TO CHASSIS. (#18AWG to #10AWG)
  - 4.) WE RECOMMEND A PUSH-ON/PULL-OFF BREAKER. SIZE CIRCUIT BREAKER FOR MAX. MOTOR CURRENTS UP TO 10A.
  - 5.) ANY SWITCH [ Single Pole, Double Throw, (ON)-OFF-(ON), Momentary ] WE DO NOT RECOMMEND MOUNTING THIS SW ON STICKS SINCE ACCIDENTALLY BUMPING THIS SWITCH ACTIVATES A SIGNIFICANT FLAP MOVEMENT.
  - 6.) POTENTIOMETERS CAN BE 5K, 10K, or 20K Ohms. (Ex. model: RayAllen's POS-12) (FOR ELEV. TRIM, YOU CAN USE THE INTERNAL POT THAT IS A PART OF RayAllen's SERVOS IF DESIRED.)
  - 7.) FOR SWITCHES, (ON) MEANS "ON MOMENTARY" OR SPRING LOADED. ALL SWITCHES SHOWN DE-ENERGIZED.

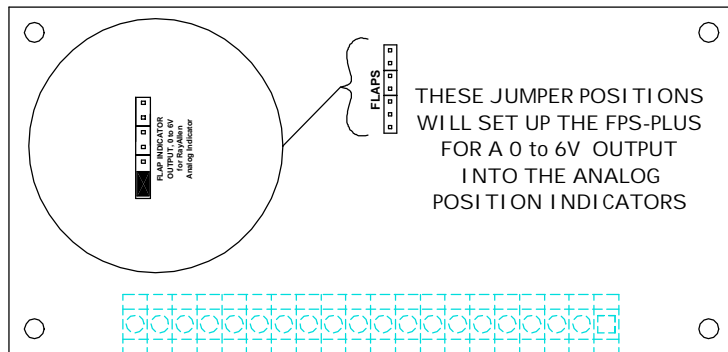
# SCHEMATIC (FPS-Plus-nt Position Indicator Connection)

## for Analog Indicators

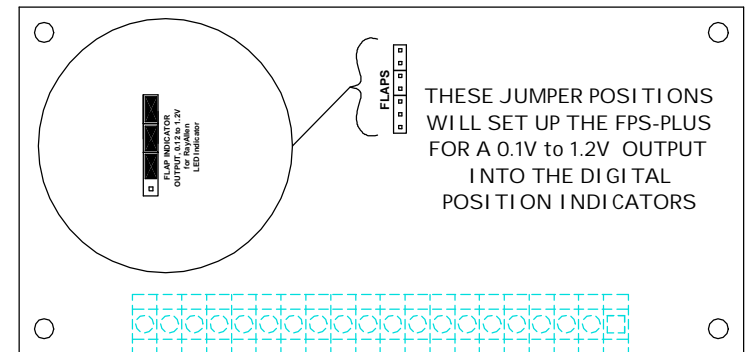
## for Digital Indicators



### JUMPER CONNECTIONS (FPS-Plus-nt bottom side)



### JUMPER CONNECTIONS (FPS-Plus-nt, bottom side)



#### NOTES:

- 1.) IT MIGHT BE HELPFUL TO WIRE THE FPS-Plus-nt TO THE +12V or +24V DIAGRAMS BEFORE WIRING THE FLAP POSITION INDICATOR.
- 2.) OTHER OUTPUT SCALINGS ARE POSSIBLE TO INTERFACE WITH DIFFERENT POSITION INDICATORS. PLEASE CONSULT FACTORY.

# Additional Information for Planning the Installation of FPS-Plus, FPS-Plus-nt or FPS-Plus Reflex

Builders ask, . . . “What do you need to complete the installation?”

## You will need:

- 1.) an Automatic Flap Switch
- 2.) a Flap Position Sensor
- 3.) an ON/OFF Switch or a Push/Pull Circuit Breaker
- 4.) a Manual Flap Switch (optional, see explanation below)
- 5.) a Programming Switch (FPS-Plus & FPS-Plus Reflex) (temporarily installed for FPS-Plus-nt)



Some of you have a good electrical background. Some do not. The explanation below is a little “wordy”, but it will clear up a lot of application questions that are occasionally asked by all of you great builders. Please also refer to our “Switching Options Diagram” for more details if you are unfamiliar with switch and relay terminology.

## We do not include: Switches, Circuit Breakers, Position Sensors, or Position Indicators

We do not include Switches, Circuit Breakers, Position Sensors, or Position Indicators with any of our FPS-Plus models. The reason for this is simple. Most people want to use their own components, and have already purchased them. This being the case, for those of you that haven’t made the purchase yet, here is a quick summary of what you need to complete this system and how to choose your parts.

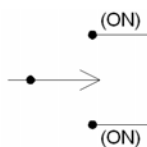
## 1.) You need an Automatic Flap Switch

### Switch Location

First, a bit of CAUTION. We do not recommend that you use the stick grip switch to drive the FPS-Plus's automatic flap input. The reason for this is simple. The Stick Grip switches may be easy to bump during flight. If you bump your stick grip switch, it will cause the FPS to automatically move the flaps to the next flap position. This may not be what you really want to do at a high cruise speed, landing, or take off. For safety, we recommend that the "automatic flap switch" for the FPS-Plus only be installed on your instrument panel, and in a place where it cannot be accidentally bumped.

### Switch Type

This automatic flap switch should be a Single Pole, Double Throw, (ON)-OFF-(ON), momentary, 3 position switch. Refer to SW2 of our “Switching Options Diagram” for more details.

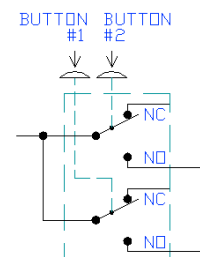


**The (ON) stands for “on momentary”, a spring loaded switch.**

You can purchase this switch type most anywhere. The current and voltage rating of the switch does not matter since it switches both low voltages and low currents.

## Compatible Panel Switches

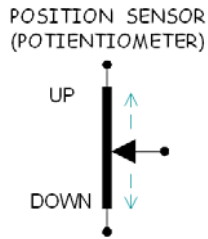
The RayAllen Company’s RS2 and ROS-4 switches are compatible with this switching methodology, however the RS2 switch provides two independent switches inside its housing. You can wire them together to obtain this switching operation. Refer to RayAllen's documentation for details. Other vendors for switches are ([www.rayallencompany.com](http://www.rayallencompany.com), [www.digikey.com](http://www.digikey.com), [www.mouser.com](http://www.mouser.com), or [www.newark.com](http://www.newark.com))



## Compatible Stick Grips

Both the RayAllen Company and Infinity Aerospace Inc. stick grips are compatible with this switch methodology. Again, the RayAllen stick grip switch is compatible with this switching methodology, however they provide two separate switches inside their stick that you can wire together to obtain this switching operation. Refer to RayAllen's documentation for details.

## 2.) You need a Position Sensor



We recommend the RayAllen Company's ([www.rayallencompany.com](http://www.rayallencompany.com)) POS-12. It is a 5K Ohm potentiometer. You may however use any linear pot that has a resistance of 5K, 10K, or 20K Ohms. You can also use the RayAllen POS-5 and POS7, but the total wiper movement of these pots is shorter than the POS12. The POS-12 may have a bit more resolution and some additional advantages. Using the POS-12 may help eliminate a bit of mechanical slop in the connection to your flap mechanism and improve the accuracy of the position signal a bit. I guess our general rule would be, the greater potentiometer wiper travel of the pot, the better!

## 3.) You need an FPS-Plus “ON/OFF Switch” or a “Push/Pull circuit Breaker”

CIRCUIT BREAKER  
(PUSH ON/PULL OFF)



During normal operation, there is really no need to use the on/off switch or circuit breaker to turn the FPS-Plus on and off. We leave ours on 100% of the time, . . . BUT . . . if you want to be able to turn the FPS-Plus off, you'll want to install this switch or breaker.

SWITCH  
ON/OFF



Your switch can be any switch or breaker that is capable of carrying your maximum flap motor current. The switch is a simple Single Pole, Single Throw, ON-OFF switch that you can purchase most anywhere.

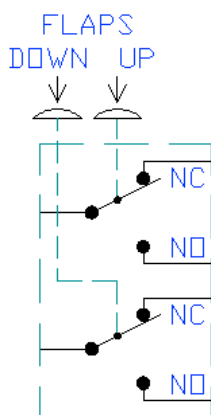
### Compatible ON/OFF Switches:

You can use any switch described above that is rated for your maximum motor currents. Here are some switches we recommend if you do not have any idea where to start. Mountain Switch #103-R13-112A-02-EV round flat switch (up to 16A), Mountain # R13-25A2-01 toggle switch (up to 10A), all from [www.mouser.com](http://www.mouser.com).

## 4.) You may need a Manual Flap Switch (this is OPTIONAL)

The Manual Flap Switch is optional. If you desire to operate your flaps manually, or simply have a back-up if the FPS-Plus system fails, you definitely want to install this switch. We recommend it.

### Method #1 (two separate switches mounted in one housing, mounted on the panel or in the stick grip)



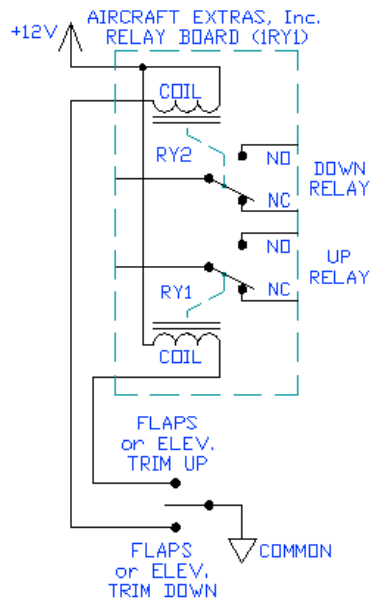
The manual flap switch should operate as two independent switches (up/down). Refer to the FPS-Plus or FPS-Plus-nt schematic diagram. The schematic depicts the two switches in one enclosure. Both switches should be a Single Pole, Double Throw, ON-NONE (ON), momentary, 2 position switch. They should be capable of switching your full flap motor currents. Wire them to the schematic.

### Compatible Stick Grips & Panel Switches:

The RayAllen RS2 and ROS-4 panel switches and their stick grip switches are all compatible with this switching methodology. They all provide two separate switches inside that you can wire together to get this type of switching operation. You won't have to purchase any other components if your motor currents are lower than the maximum allowable switch currents for their products. NOTE: (We have been using the RayAllen stick switches successfully directly driving our flap motor for our RV-6A for more than 6 years now. Our flap motor is rated at 2A, purchased from Vans Aircraft.)

If your motor currents are higher than your switches will take (in most cases 2A or less), you will need to purchase our relay board (Model: 1RY1) and use a Single Pole, Double Throw, (ON)-OFF-(ON), momentary, 3 position switch to drive it. Refer to our “Switching Options Diagram” and our model 1RY1 schematics for more details.

**Method #2 (using one “single pole, double throw” switch) (commonly called a HAT switch)**



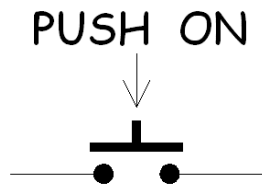
If you do not have two independent switches (up/down) on your stick grip or instrument panel, you may use a single switch and one of our relay boards (Model: 1RY1) to do the job. Our relay board will convert the single switch operation to the double switch operation mentioned in Method #1. The switch driving our relay board should be a Single Pole, Double Throw, (ON)-OFF-(ON), momentary, 3 position switch (can be HAT switch). Refer to our “Switching Options Diagram” and “1RY1 board Diagrams” for more details. You can purchase this type of switch most anywhere. The current or voltage rating of the switch does not matter since it switched low currents.

**Compatible Stick Grips & Panel Switches:**

The Infinity Aerospace stick grip has a Single Pole, Double Throw, (ON)-OFF-(ON), momentary, 3 position switch in it. This is compatible with this switching method.

If you need this type of switch for your instrument panel, you can purchase it almost anywhere. This type of switch is very common. Some other examples of panel switches are, Alcoswitch #A105P3YZQ, or C&K #7205J61ZQE22, all from [www.mouser.com](http://www.mouser.com). We’re sure you can find many other varieties.

**5.) You may need a programming switch (FPS-Plus & FPS-Plus Reflex) (temporarily installed for FPS-Plus-nt)**



For the FPS-Plus-nt, you only need to temporarily install this switch for programming. For the FPS-Plus and FPS-Plus Reflex, you will want to install this switch on the instrument panel. This allows you to easily store a new elevator trim position in flight. See the manual for more details. This switch should be a simple pushbutton that is a spring loaded, momentary ON switch. OFF/(ON) You may choose any switch that will do the job. We can recommend any switch similar to model #107-1258BU or #107-1258B from Mouser ([www.mouser.com](http://www.mouser.com))

**Switching Options and our Relay Boards**



There are many switching schemes utilized in aircraft systems. If you do not see a switching methodology that fits your aircraft while installing our FPS-Plus models, please be sure to check out Aircraft Extras, Inc.’s relay boards (Model: 1RY1). There you will find many switching options that can be adapted to the FPS-Plus and other control systems for your aircraft. You will find several schematic diagrams detailing several switching methods used for aircraft systems.

**Protection Against Accidental Flap Deployment at High Airspeeds (an OPTIONAL add-on product that we sell)**



Since the introduction of automatic flap controllers for the experimental aircraft market, some pilots have accidentally bumped their flap down switch during high speed flight. This initiates a flap down movement when you need it least, above the white arc! Granted your flap controller may only move the flaps down one notch of flaps, but if you do not want this to happen, we have a solution.

Aircraft Extras has developed a device that you can use with almost any flap controller that eliminates this problem. When our relay board is used with our airspeed switch, you can protect you flaps from being actuated in the downward direction when your airspeed is too high. We provide the end user with easy connection diagrams for several different systems. Refer to our Model ASRY1.

## **Automatic Elevator Trim Motor Speed Adjust at different airspeeds (an OPTIONAL add-on product that we sell)**



Since the introduction of electric elevator trim adjustment, several of you have complained that the adjustment speed of the elevator trim motor at high airspeeds is too fast. This makes it difficult to adjust the elevator trim and find a good stable trim position at higher airspeeds. It is highly desirable to have a fast elevator trim motor speed at lower airspeeds, and a lower trim motor speed at higher airspeeds. Aircraft Extras has a solution for this problem.

When our relay board is used with our airspeed switch, it eliminates this problem. Using it, you will have two elevator trim motor speeds, fast for slower airspeeds, and slower for high airspeeds. Refer to our Model ASRY1.

### **In Summary**

We hope this wasn't too much information to scare off the non-electrical builders! We want to make it easy. The FPS-Plus, FPS-Plus-nt, and FPS-Plus Reflex systems are really simple when you first decide what stick grips, panel switches, and sensors you want to use. If we can help you further or direct you toward other reference material, please let us know. This is really a GREAT and reliable flap positioning system!

PLEASE fly safe, and have fun!

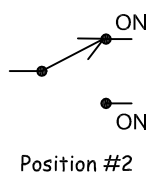
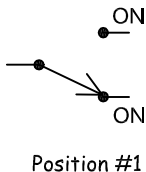
(FPSInstallationInfoA.doc, 3/22/08)  
www.aircraftextras.com



# Switching Options & Background knowledge

## SW1

Single Pole, Double Throw  
ON-NONE-ON  
2 Positions



## SW2

Single Pole, Double Throw  
(ON)-OFF-(ON)  
3 Positions  
(Switch is a momentary on switch)

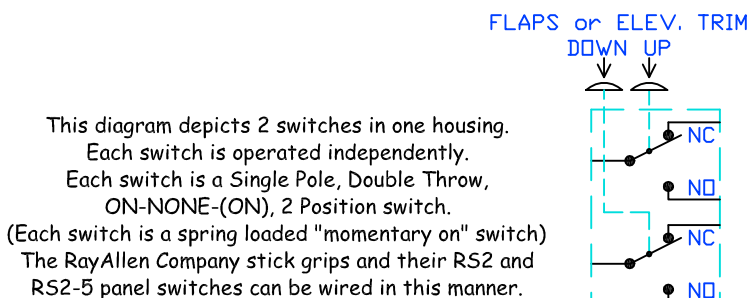
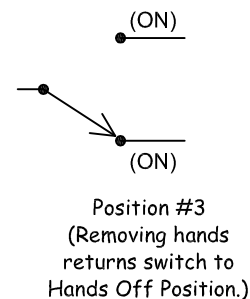
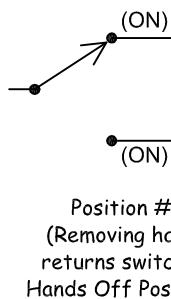
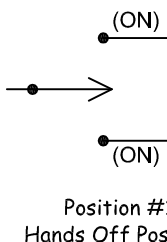


Figure 1

**NOTE:**

IF YOU DO NOT HAVE 2 INDEPENDENT SWITCHES THAT YOU CAN WIRE LIKE FIGURE #1, YOU CAN OBTAIN THIS SAME SWITCHING ACTION BY USING A STANDARD SWITCH (SW2 as pictured above) WITH OUR RELAY BOARD (1RY1). SEE THE DIAGRAM ABOVE. THE RELAY BOARD ARCING PROTECTION CIRCUITRY WAS OMITTED FROM THIS DIAGRAM FOR SIMPLICITY. IF YOU DESIRE TO ADD A SWITCH FOR THE CO-PILOT OR TO ANOTHER PANEL LOCATION, YOU MAY ACHIEVE THIS BY SIMPLY PARALLELING SEVERAL SWITCHES FOR SW2.

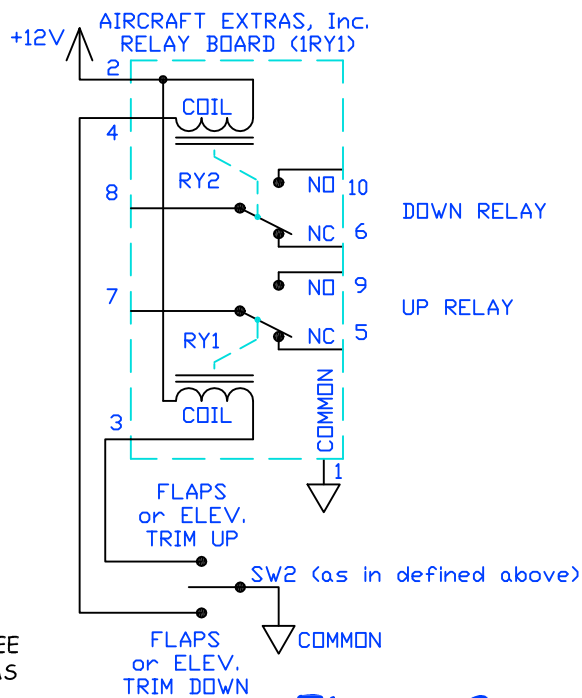


Figure 2

**GENERAL NOTES:**

- 1.) FOR SWITCHES, (ON) MEANS "ON MOMENTARY" OR SPRING LOADED.
- 2.) FOR RELAYS, NO = NORMALLY OPEN, NC = NORMALLY CLOSED WHEN DE-ENERGIZED.
- 3.) ALL RELAYS AND SWITCHES ARE SHOWN IN THE DE-ENERGIZED STATE.



SWITCHING OPTIONS DIAGRAM  
Rev. - B, 6/20/10  
AIRCRAFT EXTRAS, INC.