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INSTALLATION MANUAL

FPS-Plus-nt

FPS-Plus-nt, Rev-J, 2/21/2026

THANK YOU! . . . for purchasing the FPS-Plus-nt system from Aircraft Extras, Inc. Please review **ALL** instructions thoroughly before you install and program the FPS-Plus-nt. Please adhere to ALL safety precautions.

DESCRIPTION

The FPS-Plus-nt system is an automatic flap positioning system. It can be used in the manual positioning mode, or the automatic mode. In the fully automatic mode, a "short touch" of the flap button, positions the flaps. A one second or more touch of the flaps, commands the flaps to go to either the full up or full down position.

COMPATIBLE MOTOR ASSEMBLY TYPES for the FPS-Plus-nt

The FPS-Plus-nt system was designed to operate with flap motors that are "clutch driven". In other words, when these motors are connected to the flap control surfaces, the motors cannot be over driven to damage the control surfaces or linkage components. Most aircraft actuator motor assemblies have clutches or end stops built in them so that, . . for instance, when they reach the end mechanical flap stop, the clutch slips so no damage is done to the flap or flap linkage.

NON-CLUTCH DRIVEN MOTOR ASSEMBLIES can be made to work.

If your flap motor assembly is not clutch driven, please refer to the alternate schematic published on our web and in this manual, for "non-clutch servo wiring".

INSTALLATION

ENCLOSURE INSTALLATION

The FPS-Plus-nt enclosure should be installed inside the cockpit area of the aircraft, away from excessive vibration and high temperatures. The enclosure should be secured to a metal panel by the two holes provided on the bottom flanges of the enclosure. The enclosure should then be electrically connected to the aircraft chassis common. In the case of a fiberglass aircraft, you should run a separate wire to ground the chassis of the FPS-Plus-nt. The enclosure should be mounted so that the LED can be seen for initial programming only.

PROGRAMMING BUTTON INSTALLATION

It is not necessary to install the programming button on your instrument panel like the FPS-Plus. It is not needed after initial programming. A temporary connection is necessary for initial programming of the flap stops only.

WIRING

Review the wiring diagram included, along with the "Standard Aircraft Wiring Practices Guide". Wires depicted on the schematic that have a larger thickness, (the motor current wiring to the power source) should be sized for the maximum amperage for that motor circuit. An absolute maximum motor current of 10A is allowed for the FPS-Plus-nt. All other wires are low amperage wires and can be #24AWG to #18AWG.

TO MINIMIZE ELECTRICAL and/or RF INTERFERENCE

Avoid routing wiring for the FPS-Plus-nt, in the same vicinity of your radio transmitter antenna cabling or the strobe light systems. This also includes devices such as the transponder or other types of RF transmitters, or devices that put transients on the +12V or +24V power bus.

POSITION SENSOR NOTES:

USING: Ray Allen Co. POSITION SENSORS: If you are using a *Ray Allen Co.* model POS-5, POS-7, or POS-12 position sensor, the wiper of their pot is the green wire. This should be connected to the "Flap Position In" (FPS-Plus-nt terminal 8). The orange and blue wires are the end positions of the pot. Connect the orange wire to "+5V Output" (FPS-Plus-nt terminal 4), the blue to "common" (FPS-Plus-nt terminal 3). See the schematic.

Also, see the section marked "PRE-TESTING the FPS-Plus-nt AFTER WIRING and INSTALLATION".

FPS-Plus-nt POSITION INDICATOR OUTPUTS & JUMPER SETTINGS

FPS-Plus-nt FLAP POSITION INDICATOR OUTPUTS

There are several types of position indicators on the market today. Unfortunately, they all seem use different voltages for their inputs, and have different input impedance. The FPS-Plus-nt provides two selectable output scalings to drive your position indicators. One output scaling option is (0.83V to 4.93V) for the *Ray Allen Co.* RP4 indicator. The second output scaling option is a generic (0 to 6V). This output scaling is used for any EFIS type system or the *Ray Allen Co.* RP2 Analog indicator. The proper FPS-Plus-nt output scaling can easily be changed by utilizing the jumpers on the back of the FPS-Plus-nt. Again, set for it for (0-6V) for most EFIS type system indicators. If you cannot utilize one of these two scalings for your indicators, please contact Aircraft Extras, Inc. for information on how to make these outputs work for your application.

NOTE: Just for reference, the "older FPS-Plus-nt" units were scaled for either (0 to 6V) for the *Ray Allen Co.* RP2, or for the (0.1V to 1.2V) for the *Ray Allen Co.* RP3 LED indicator. The RP3 scaling is not used as *Ray Allen Co.* obsoleted that model.

SELECTING the PROPER JUMPER POSITIONS for your TRIM & FLAP POSITION OUTPUTS

Having read the previous paragraph, you are now ready to select the correct jumper settings for your FPS-Plus-nt. These jumper positions are located on the back of the FPS-Plus-nt. Refer to the diagram included in this manual to select the correct jumper settings for your application.

PRE-TESTING the FPS-Plus-nt AFTER WIRING and INSTALLATION

Whether your flap position sensors are separate or part of your motor assemblies, you need to ensure they are connected up properly. Please pay particular attention to the direction of travel, the voltage of the signal output and how they are connected. You can test these voltages when the potentiometers are connected to the FPS-Plus-nt, and the unit is powered on. Configure your FPS-Plus-nt, for "Mode 1". You should then be able to actuate the flaps servos manually, and measure the voltages stated below.

Voltage measurements for (STAND-ALONE FLAP POSITION SENSORS, terminal #8)

For the flaps, when the potentiometer (position sensor) is connected to the FPS-Plus-nt,, it should be installed so that the "full up flap position" measures approximately 4.0Vdc to 4.95Vdc into the FPS-Plus-nt, system. The "full down flap position" should measure approximately 0.05V to 0.6Vdc. These measurements are taken from (terminals #8) "Flap Position In" to (terminal #3) "Common".

Flap Position Output for (STAND-ALONE FLAP POSITION SENSORS, terminal #11)

If you have an EFIS, RP2 or analog flap position indicator, set the jumpers for (terminal #11) for the (0 to 6V) output. Most EFIS systems should accept this scaling. See the drawings for jumper configuration.

Voltage measurements for (SERVOS with INTERNAL FLAP POSITION SENSORS, terminal #8)

NOTE: The “Stand Alone” paragraph above applies to mostly external potentiometers connected to +5V and full potentiometer travel of the pot is observed. As of (about) the year 2023, there have been several servo motors sold by Vans Aircraft, PH aviation and others that are a bit different. They have incorporated an internal position sensor in their flap servo motors. Even when these position sensors are powered by our +5V, the potentiometer output does not operate over the full travel (0 to +5V). They may typically go from (0.0 to 2.4V or something similar) These voltages could also vary depending on the servo throw length. These servos will work with the FPS-Plus-nt just fine, as long as the full up flap output voltage is higher than the full down flap position voltage.

For the flaps, when the internal servo potentiometer is connected to the FPS-Plus-nt, it should be connected so that the "full up flap position" should measure a higher voltage than the "full down flap position". These measurements are taken from (terminal #8) "Flap Position In" to (terminal #3) "Common". If these readings are reversed, you can simply reverse the connections of to the two wires on this pot that are not the wiper of this pot.

Flap Position Output for (SERVOS with INTERNAL FLAP POSITION SENSORS, terminal #11)

If you have an EFIS, RP2 or analog flap position indicator, set the jumpers for (terminal #11) for the (0 to 6V) output. Most EFIS systems should accept this scaling. See the drawings for jumper configuration.

NOTE: You may not be able to get the *Ray Allen Co.* RP4 to work properly with these types of servos unless you install a separate position sensor like the POS-12, so it will give you the (0 to +5V) output. If you have to do this, refer to the section: “STAND-ALONE FLAP POSITION SENSORS, terminal #11 above”.

PRE-TESTING the MOTOR ASSEMBLY DIRECTION

Using the FPS-Plus-nt, in "Mode 1", you can actuate the flaps motor to see if the motors respond to the proper direction. To ensure that the motor assemblies function properly with the FPS-Plus-nt, you must connect them so they move the control surfaces in the proper direction. Pay particular attention to the output wiring of the FPS-Plus-nt. When the wire that is connected to terminal 15, goes to +12V, the flap motor should move the flaps up. (The wire at terminal 16 will stay at common or ground potential)

SYSTEM OPERATION OVERVIEW

SYSTEM OPERATING MODES

During programming, there are two modes of basic operation, one mode for user programming (mode 5), and a "CHANGE MODES" mode". The "CHANGE MODES" mode is used for toggling from mode to mode during system set-up only. This system is designed to operate in one of the two operating modes while in the air (mode 1) or (mode 3). NOTE: **You should never** change from mode to mode while in the air. The user should choose one of the two operating modes below for operating his aircraft, (mode 1) or (mode 3).

When the FPS-Plus-nt is on, the LED will be blinking, denoting what mode it is in. (For example, for mode 3, the LED will blink 3 times then stop for a short time, . . then repeat that process)

MODE 1 - (Manual flap operation only)

Flap moves only when flap button is pressed. You must keep holding the button for the flap to move.

MODE 2 - ***(Not used with the FPS-Plus-nt)***

MODE 3 - **(Automatic flap mode, moves from programmed flap stop to programmed flap stop)**

Flap moves from programmed flap stop to flap stop. One press less than 1 second (Short Press) begins the movement, up or down. Hold the flap button for more than 1 second (Long Press), and the flap will go all the way to its end stop. The direction will be towards the button pressed, flap up, or flap down. If the flap is moving, to stop it, simply press the opposite command. The flap movement will stop.

MODE 4 - ***(Not used with the FPS-Plus-nt)***

MODE 5 - **(Program flap stops)**

Operation is the same as in mode 1, except that you can erase and program the intermediate flap stops.

MODE 6 - ***(Not used with the FPS-Plus-nt)***

MODE "CHANGE MODES"

In this mode, you will not be able to move any control surfaces with the FPS-Plus. The only thing this mode is used for, is to change operating modes with the programming push button. You are in this mode when the LED is blinking YELLOW. See the paragraph below on "CHANGING MODES".

(MODE OPERATION BEFORE PROGRAMMING)

NOTE: Before you program the FPS-Plus-nt, the normal operating modes (1 or 3) will function as follows:

Mode 1 - Full operation as described above

Mode 3 - Full operation as described above (except - the only positions that will be recognized, are flap full up, and full down)

MOTOR ZERO SPEED SENSING

If the FPS-Plus-nt commands a motor to move, and it senses that the motor is at or near zero speed, the FPS-Plus-nt will stop the output command to move that particular motor within about 1 second. This is a built-in safety feature for your aircraft.

PROGRAMMING

There is one mode that you must program, mode 5. In mode 5 you can program your flap positions or "flap stops". Reading further will detail how this is accomplished.

CHANGING MODES

The first thing that you need to do, is learn how to change operating modes of the FPS-Plus-nt**. <u>This should be done only when the aircraft is on the ground, and parked.</u>** A program push button (normally open switch) should be temporarily installed between terminals 5 and 3. See the connection diagram. After the unit has been successfully programmed, this button should be removed.

To change modes of operation, simply make sure there is no power to the FPS-Plus-nt unit. Depress the program button. Keep the program button depressed, and then, turn on power to the FPS-Plus-nt. Keep the button pressed until the LED on the unit starts blinking RED, rapidly. Now, release the button. Notice that the RED LED, will blink YELLOW, indicating that the FPS-Plus-nt is in the "Mode Change" mode. The number of yellow blinks will indicate your present mode number. (For example, for mode 3, the LED will blink 3 times then stop for a short time, . . then repeat that process) Now, to change the mode, simply press and release the program button once, to advance to the next mode. Notice that the number of LED blinks changes every time that you press the program button. Do this until the LED counts, match the mode that you desire. After you have reached your desired mode, turn the unit off. When you power back up, (without depressing the program button) you will be in the mode you just selected. The unit will respond by blinking your mode number in RED, not YELLOW. Keep in mind, if the LED blinks YELLOW, the only thing you can do is change modes. You have to power down, and then back up again to be in your desired mode.

FLAP POSITION PROGRAMMING (Mode 5)

<u>Programming of the flaps should be done only when the aircraft is on the ground, and parked.</u> Temporarily install a programming push button (normally open, a push button switch) between terminals 5 and 3.

In order to program the intermediate flap stops, you will need to put the unit in mode 5. Follow the previous instructions given in "Changing Modes" to change to mode 5. Make sure the LED color is "RED", and blinking 5 times before proceeding.

Starting up in Mode 5

NOTE: This is the flap programming mode. Powering up the FPS-Plus-nt in mode 5, erases <u>ALL</u> previously programmed flap stops. Another way to ensure that they were all erased, is to depress and hold the program button in for 5 seconds or more after power up. The LED will turn GREEN temporarily, then blink RED very rapidly, letting you know that all previously programmed flap stops have been erased. Now, release the program button. You may begin programming your flap stops.

Programming the flap stops

Just as a reminder;

1. **All intermediate flap stops have to be programmed. (It can be done in any order)**
2. **<u>DO NOT</u> program the full up and full down flap stop positions!** The FPS-Plus-nt will sense these automatically.

Using the flap up button, position the flap so it is in its "full up" position. Remove your hand from the flap button. Now, pressing the flap down button, move the flap down to the first intermediate flap position you choose. Now, momentarily press the program button (approx. 0.5 to 1 seconds). You will note that the LED will turn GREEN while the program button is depressed, indicating that you have stored the first flap position. Press the "flap down" button again until you reach your next desired flap stop.

Repeat this process for as many flap stops as desired, until you reach your last intermediate flap stop (8 maximum). DO NOT program the full down flap position. After all intermediate flap stops have been programmed, turn the unit off. Change to mode 3. Test the flaps to see that you have programmed them properly by momentarily pressing the flap button up or down. If the flap stops are not where you desire, repeat the flap programming steps. NOTE: If your flaps do not go all the way up, or down, you may have installed the position potentiometer incorrectly.

FLIGHT TESTING

JUST TO KEEP YOU ALL SAFE!

We feel that it is the responsibility of Aircraft Extras, Inc. to protect all pilots. We have to assume that there will be all skill levels of aircraft builders and pilots using our systems. This being the case, we have to make the following recommendations to keep all of you safe during your flight testing. After all, you are using this system to automatically alter your aircraft's flight configuration.

1.) Before flight, you should have permanently installed the FPS-Plus-nt system and programmed all flap stops utilizing mode 5.

2.) Do not flight test the FPS-Plus-nt for the first time, unless you are at least 4000 AGL in altitude and you are familiar with the aircraft, flight characteristics, and all emergency procedures.

3.) Make sure you know how to override the automatic adjustments of the flap made by the FPS-Plus-nt in case of emergency. Make sure you know how to turn the FPS-Plus-nt off, and to take over manual control of the flaps.

5.) Before you fly, be sure that you test the FPS-Plus-nt (mode 3) on the ground while;
keying up each of the transmitting devices aboard the aircraft,
operating the strobe systems of the aircraft,
operating the transponder. (unit transmitting),
operating any other electrical apparatus that may interfere with the operation of the FPS-Plus-nt,
. . . . and no abnormal behavior of the flap system is noted.

6.) Ensure that all installed switches are working properly, including your manual control switches.

7.) For initial flight testing, DO NOT actuate the flaps in the air unless you are below a speed that will accept full flap travel.

If all pre-testing was satisfactory, and there was no abnormal operation, you may proceed.

Before you take flight, put the FPS-Plus-nt in mode 3. Make sure that the LED is flashing 3 times and is RED. Test the operation of the flaps. If all is OK, you may take-off normally and climb to 4000 AGL or some safe altitude. Test the flaps for all different flight configurations. Once you are satisfied with the operation you may land. This concludes the flight testing.

MISCELANEOUS

EMERGENCY PROCEDURES

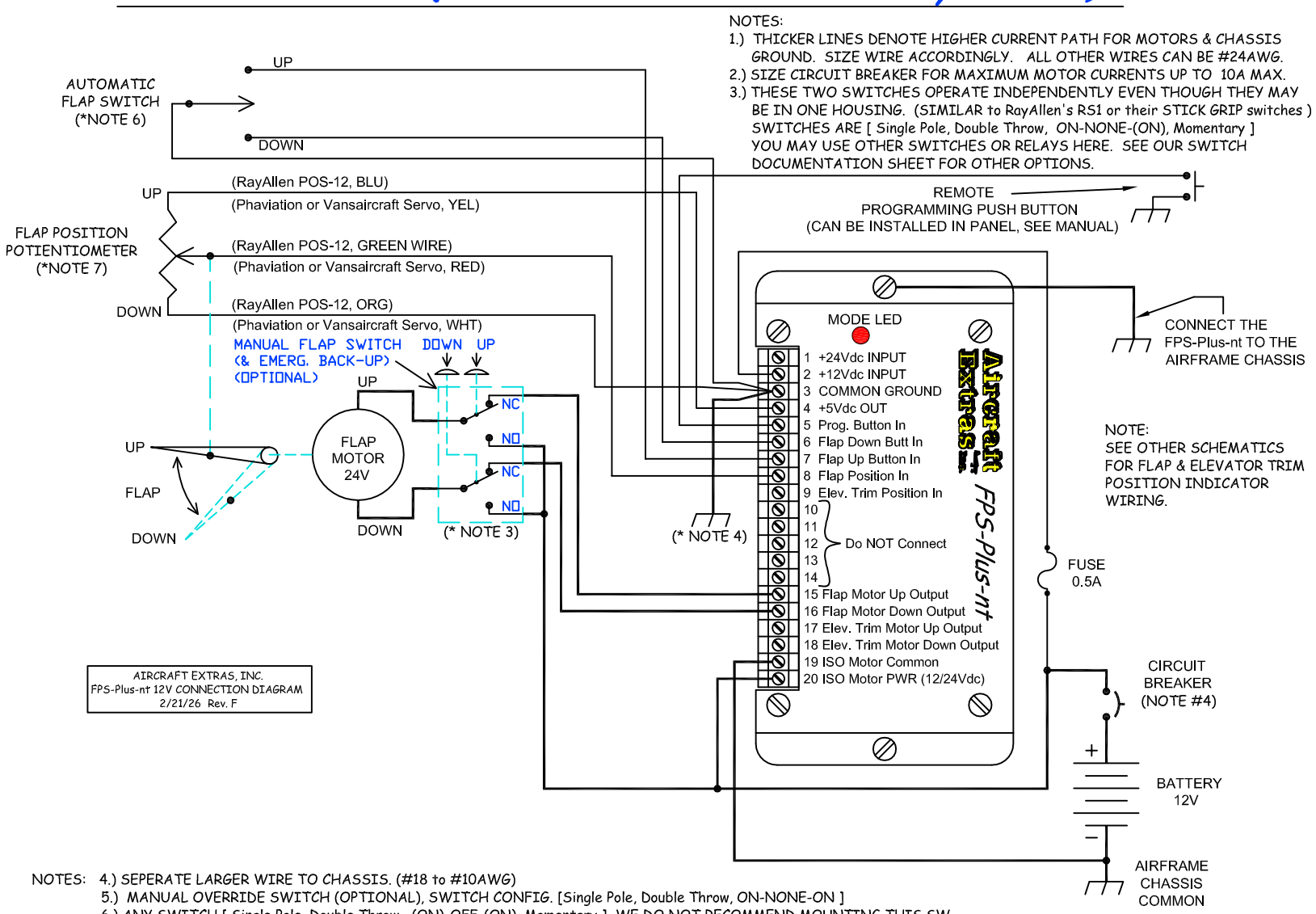
Be prepared! Make sure that you review what needs to be done in case of a failure of the FPS-Plus-nt in flight. Put the procedures that you create, in the aircraft manual. Create and display in the aircraft, any applicable pla cards, warnings, labels, or cautions if applicable. After all, you are using this system to automatically alter your aircraft's flight configuration.

SOFTWARE

The FPS-Plus-nt is micro-controller based. If there are any safety issues or up-dates, we will attempt to contact you and advise you how to get the latest up-dates. Please keep us informed as to your latest address, or please visit our web site regularly to review any up-dates on this product. (web: www.aircraftextras.com) (e-mail: sales@aircraftextras.com) Phone: (614) 876-6345. Other features may become available for this product as well.

GOOD LUCK, have FUN, and please FLY with SAFETY!

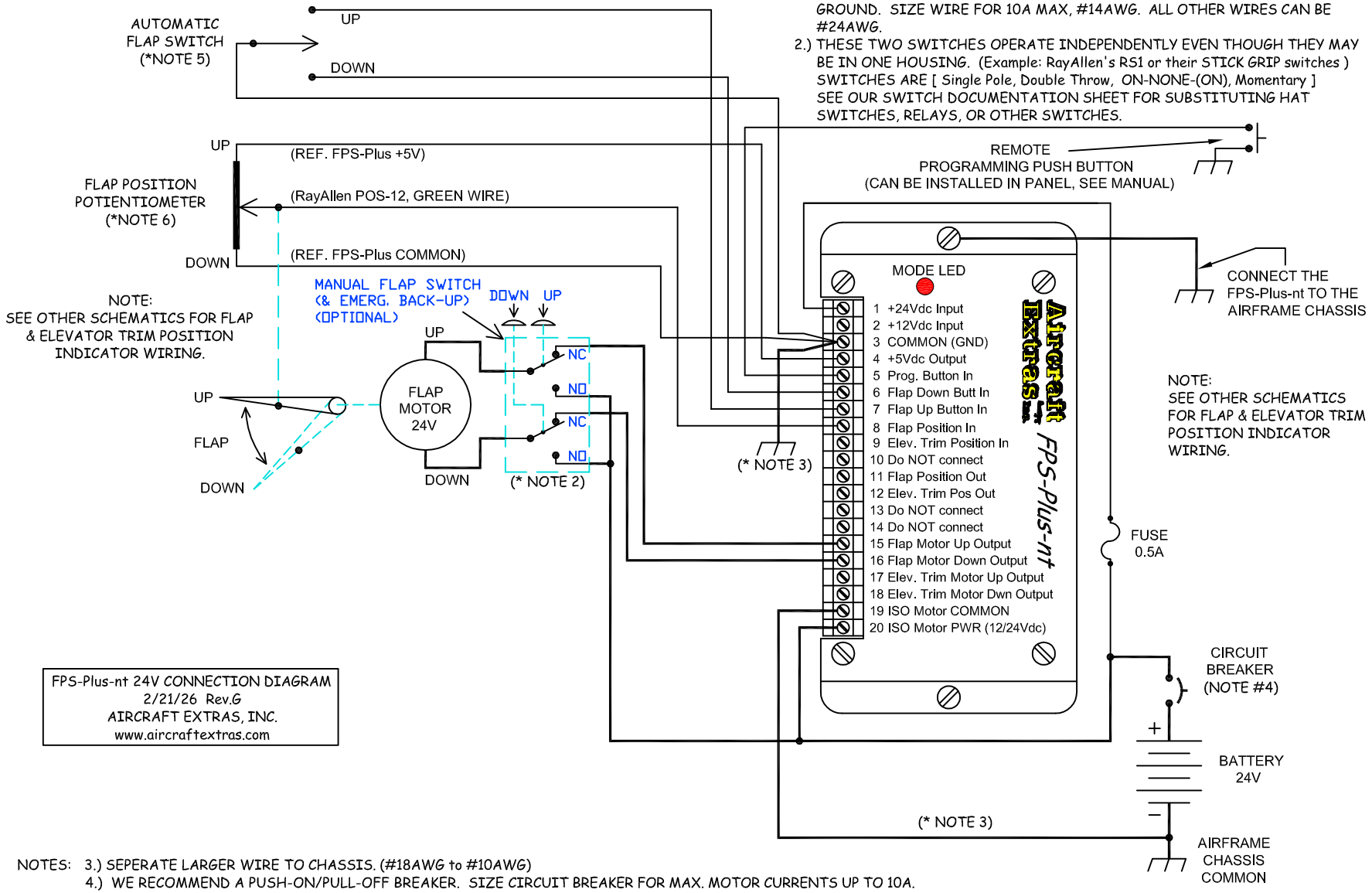
SCHEMATIC (FPS-Plus-nt for +12V Systems)



NOTES: 4.) SEPERATE LARGER WIRE TO CHASSIS. (#18 to #10AWG)
5.) MANUAL OVERRIDE SWITCH (OPTIONAL), SWITCH CONFIG. [Single Pole, Double Throw, ON-NONE-ON]
6.) 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 SIGNIFICENT FLAP MOVEMENT.
7.) POTIENTIOMETERS CAN BE 5K, 10K, or 20K Ohms. (Similar to RayAllen's POS-12) (FOR ELEV. TRIM, YOU CAN USE THE 5K Ohm POT THAT IS MOUNTED INSIDE RayAllen's SERVOS IF DESIRED.)
8.) ALL SWITCHES SHOWN DE-ENERGIZED.

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

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.

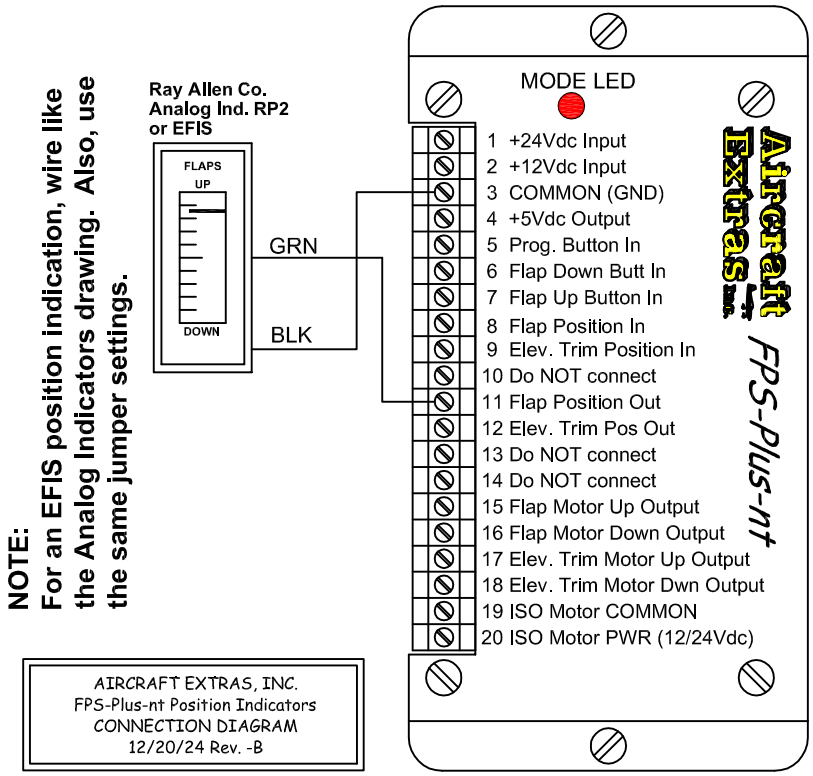


FPS-Plus-nt 24V CONNECTION DIAGRAM
2/21/26 Rev.G
AIRCRAFT EXTRAS, INC.
www.aircraftextras.com

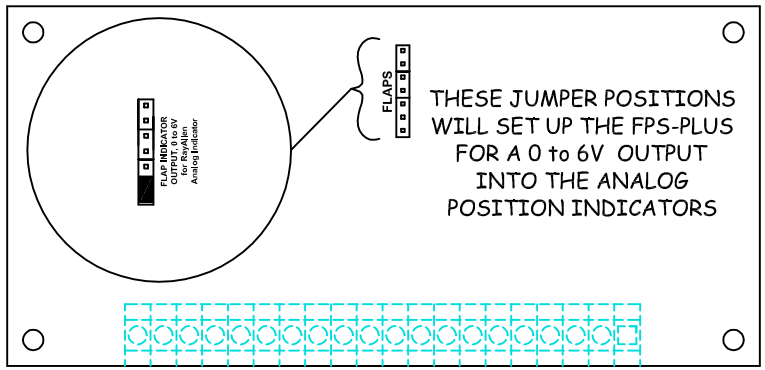
NOTES: 3.) SEPERATE LARGER WIRE TO CHASSIS. (#18AWG to #10AWG)
4.) WE RECOMMEND A PUSH-ON/PULL-OFF BREAKER. SIZE CIRCUIT BREAKER FOR MAX. MOTOR CURRENTS UP TO 10A.
5.) ANY SWITCH [Single Pole, Double Throw, (ON)-OFF-(ON), Momentary] WE DO NOT RECOMMEND MOUNTING THIS SW ON STICKS SINCE ACCIDENTALLY BUMPING THIS SWITCH ACTIVATES A SIGNIFICENT FLAP MOVEMENT.
6.) POTIENTIOMETERS 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)

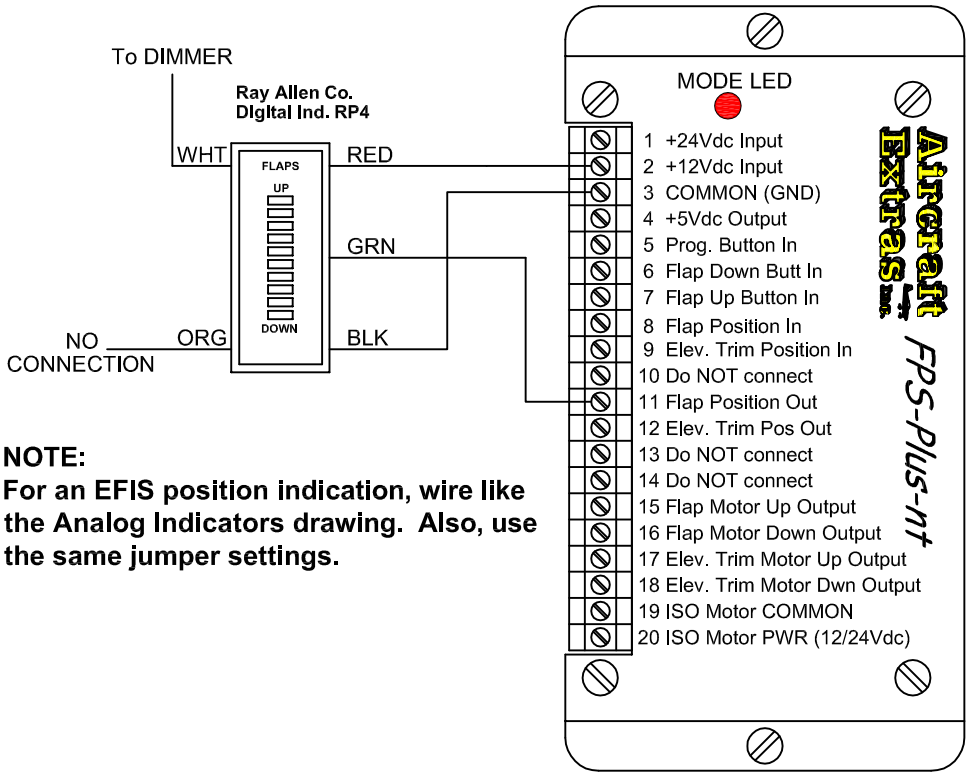
for Analog or EFIS Indicators



JUMPER CONNECTIONS (FPS-Plus-nt bottom side)

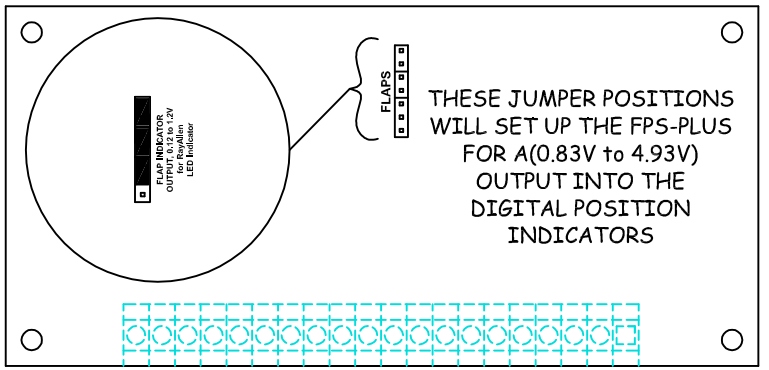


for Digital Indicators



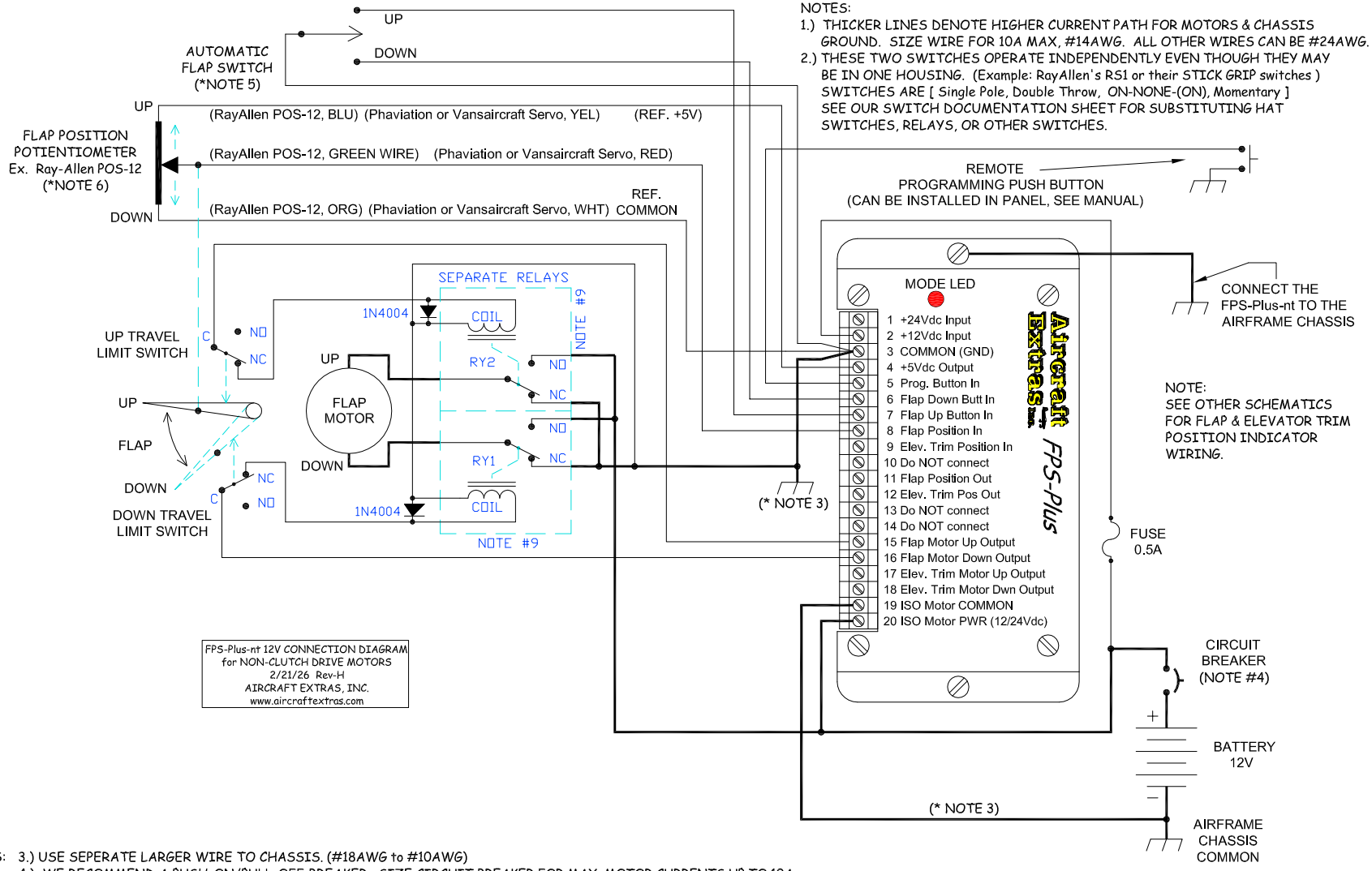
NOTE:
For an EFIS position indication, wire like the Analog Indicators drawing. Also, use the same jumper settings.

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.

SCHEMATIC (FPS-Plus-nt for +12V Systems)
(for NON-CLUTCH DRIVEN FLAP MOTORS)

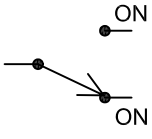


NOTES: 3.) USE SEPERATE LARGER WIRE TO CHASSIS. (#18AWG to #10AWG)
4.) WE RECOMMEND A PUSH-ON/PULL-OFF BREAKER. SIZE CIRCUIT BREAKER FOR MAX. MOTOR CURRENTS UP TO 10A.
5.) ANY SWITCH [Single Pole, Double Throw, (ON)-OFF-(ON), Momentary] WE DO NOT RECOMMEND MOUNTING THIS SW ON STICKS SINCE ACCIDENTALLY BUMPING THIS SWITCH ACTIVATES A SIGNIFICENT FLAP MOVEMENT.
6.) POTIENTIOMETERS 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.
8.) YOU MAY ADD A MANUAL SWITCH FOR FLAPS IF DESIRED. INSERT OUR RELAY BOARD INBETWEEN THE FPS-PLUS PINS 15 & 16 AND THE LIMIT SWITCHES. FOR MORE DETAIL, SEE OUR RELAY DIAGRAM.
9.) YOU CANNOT USE AIRCRAFT EXTRAS, INC RELAY BOARD 1RY1 BECAUSE THE PROTECTION DIODES ON OUR BOARD ARE REVERSED FROM WHAT YOU NEED FOR THIS CONNECTION. WE CAN MAKE YOU ONE THAT WILL WORK IF YOU ASK, OR YOU CAN JUST USE DISCRETE RELAYS FROM ANOTHER SOURCE.

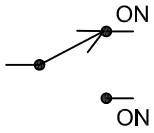
Switching Options & Background knowledge

SW1

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



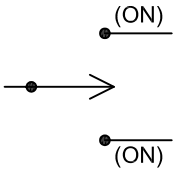
Position #1



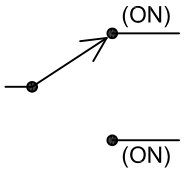
Position #2

SW2

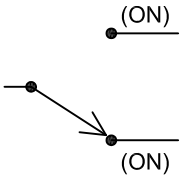
Single Pole, Double Throw
(ON)-OFF-(ON)
3 Positions
(Switch is a momentary on switch)



Position #1
Hands Off Position



Position #2
(Removing hands returns switch to Hands Off Position.)



Position #3
(Removing hands returns switch to Hands Off Position.)

This diagram depicts 2 switches in one housing.
Each switch is operated independently.
Each switch is a Single Pole, Double Throw,
ON-NONE-(ON), 2 Position switch.
(Each switch is a spring loaded "momentary on" switch)
The RayAllen Company stick grips and their RS2 and RS2-5 panel switches can be wired in this manner.

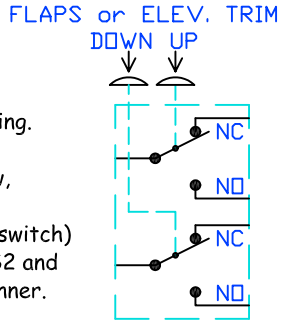


Figure 1

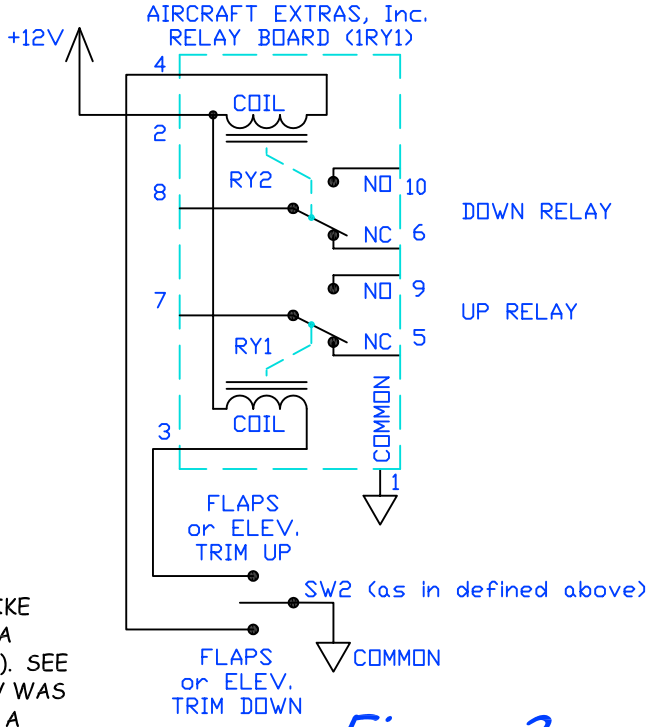


Figure 2

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.

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.

Aircraft Extras Inc.

SWITCHING OPTIONS DIAGRAM
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