Show Me ...

...How To Use a Single Pot to Operate a Flap Lever

Summary

This tutorial will show you how to use just one potentiometer to set all the flap detents on your thrust lever quadrant. The usual method for interfacing the various detents of a flap lever mechanism is the use of microswitches within each detent that you set up to perform a specific flap action when depressed. Sometimes this is not a practical exercise, especially when it comes to disassembling a real aircraft thrust lever quadrant to access the internals and set up a number of microswitches within the mechanism.

That's where the use of a single potentiometer, and the advanced potentiometer handling provided by SIM-boards, can come in handy - just 3 wires and one physical mounting within the lever operating range, and you are set to go.

You don't have to have a thrust lever quadrant to try this tutorial - try it with just a bare potentiometer if you wish. This tutorial assumes the use of the default B737 aircraft in FS2004, but you can apply the same principles detailed here for any aircraft with flaps that need to be controlled.

This tutorial assumes you have read and understood the tutorial entitled "How to Wire Up Potentiometers to an Input Module".

You will need...

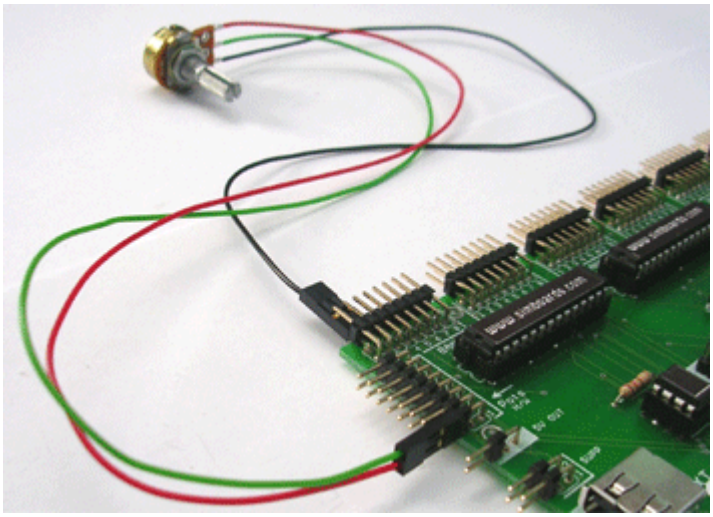
- a SIM-board USB Master Module
- a SIM-board USB Input Module (with potentiometer capability)
- 2 USB cables
- a potentiometer
- wire
- crimping tool, some crimps and crimp houses
- wire strippers
- latest version of the SIM-board Universal Control software
- a registered version of FSUIPC

This "Show Me How..." tutorial is provided in addition to the SIM-board USB Help Documentation. It is recommended you refer to both this tutorial and the Help Documentation for your modules.

Step 1: Connect your Potentiometer

(For best results, we recommend the use of 5K or 10K potentiometers where possible.)

Follow steps 1 to 6 given in the tutorial entitled "How to Wire Up Potentiometers to an Input Module" *(click to open in a new window)* to connect your potentiometer to the Input Module; install the drivers (if not done already) and load the SIM-board Universal Controller software.



Step 2: Test your potentiometer

To begin configuring the potentiometer, select the tab titled "(Pots 1-8)" to reveal the pot nodes. Then click to expand "Node 1" to reveal the pot configuration settings.

Then click on the "Calibration Settings" text to reveal the calibration settings properties. Adjust the window so you can see all the settings available.

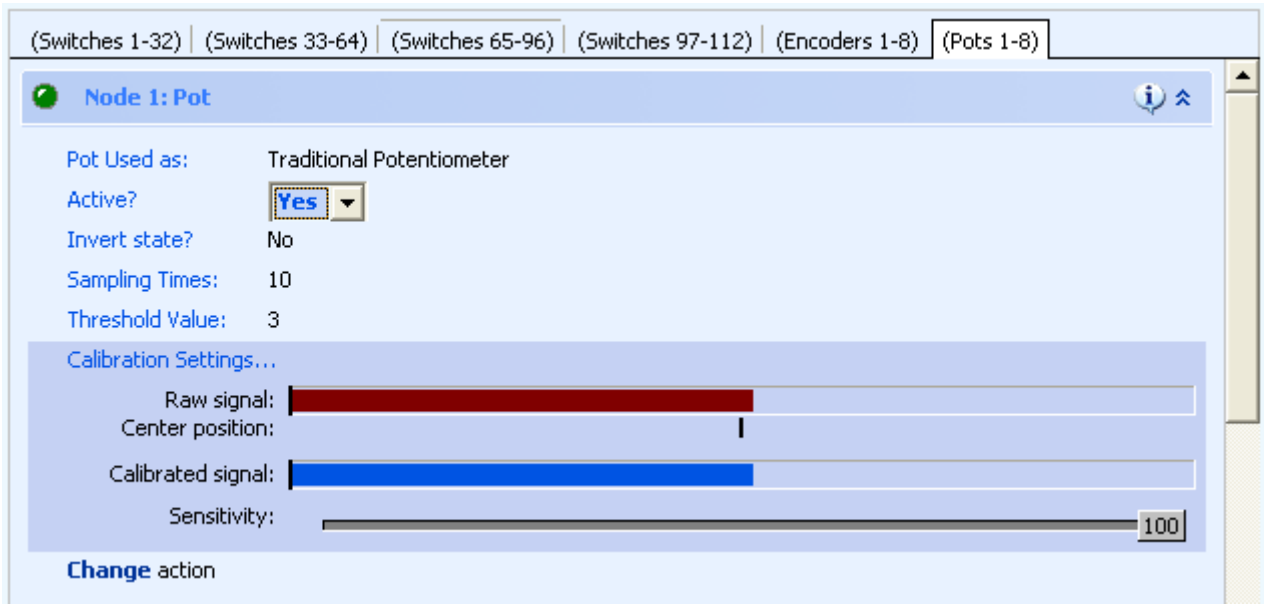
Next, change the "Active?" property to "Yes". This will activate this pot node for use. You will then see red and blue bars appear in the "Raw Signal" and "Calibrated Signal" areas. This represents the current position of the pot as detected by the SIM-board USB Input Module.

Twist your potentiometer through its range of movement, and notice the slider bars changing to reflect the new position of the pot.

If the pot bars do not appear to move, or are fixed fully red and blue, then the pot wires have been connected wrongly. In this case you should swap the H, L and W pins to a different combination until the bar is representative of the current position of the pot *(see previous tutorial)*.

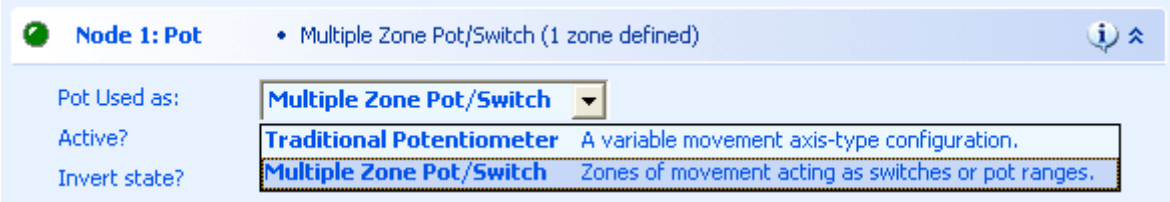
If you find that twisting your pot in a clockwise direction produces a reducing red/blue bar combination, set the "Invert state?" property of the pot node to "Yes" which will reverse the signals in software.

If this test performs correctly, you have successfully wired up your pot to the associated node.



Step 3: Set the potentiometer type

For the setting named "Pot Used As", select "Multiple Zone Pot/Switch" from the drop down list.



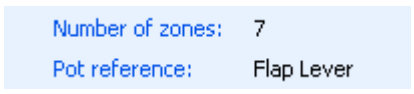
Step 4: Set up the zones for the flap detents

As you move your flap lever from detent to detent, the position of the potentiometer shaft will change. The amount of flap to deploy will depend on the position of this potentiometer at any given time.

Given that potentiometers are devices with a range of movement (as opposed to a switch which has very defined ON or OFF positions) it makes sense to be able to define "zones" of movement, within the overall movement cycle of the potentiometer, where events are to occur. When the potentiometer moves into Zone 1 for instance, the Flap Up event should be executed. Similarly, when the potentiometer is moved into Zone 2 the Flap 1 event should be performed, to begin lowering the flaps.

To make the zones, firstly click on the "Numer of zones" parameter and click the up arrow to increase the number of zones to 7. This allows for the 6 flap positions of the B737 and the fully up position, making a total of 7 zones we want to define.

You may also wish to name this potentiometer by clicking on the "Pot reference" parameter and entering a suitable name. For this example we have called this pot "Flap Lever". This naming allows easy tracking of your nodes when they are later categorized *(see separate tutorial for details on node categorization)*.



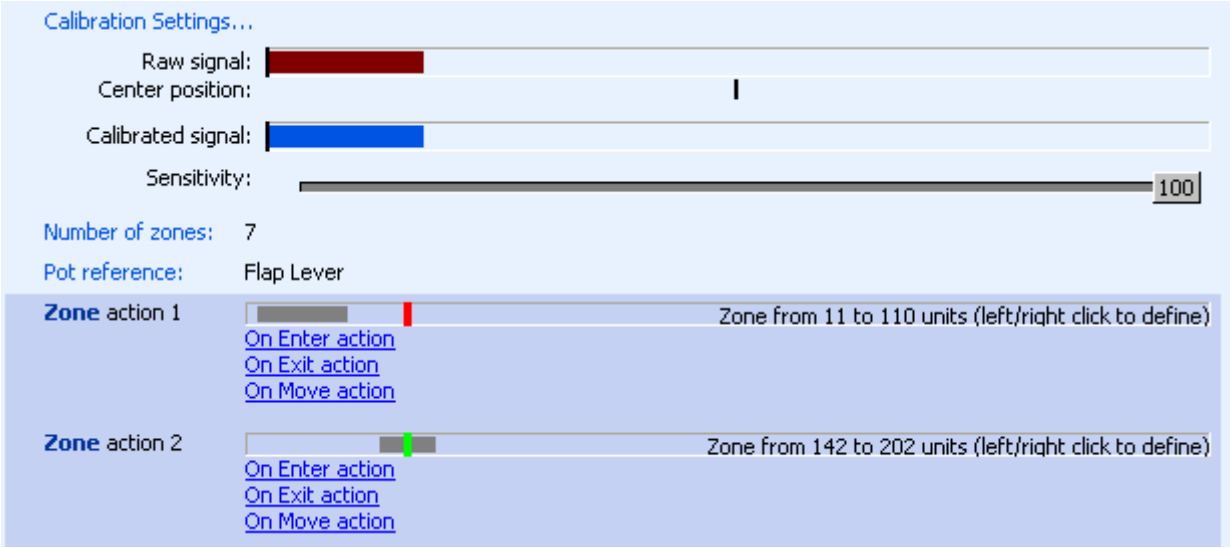
Step 5: Define the zones of movement

You will notice there are now 7 "Zone action" blocks shown, named "Zone action 1" to "Zone action 7". These zone blocks hold the configuration for each zone: where the zone starts and ends, what events to perform when the potentiometer position enters the zone from outside the zone, and what events to perform when it leaves the zone.

The grey bar defines the zone itself. By default each zone is defined as being the whole potentiometer range. To change it, click on the bar with the left mouse button to define the start position (lower end) of the zone, and click with the right mouse button to define the end position (upper end) of the zone.

The example shows Zone 1 defined between 11 units and 110 units of potentiometer travel (full range is 0 to 1023). Zone 2 is defined as 142 to 202 units.

Notice the small red and green vertical bar within each zone. This represents the current position of the potentiometer. If you move the potentiometer shaft now, you will see this position change within each zone. A green bar means the potentiometer is within the defined zone; a red bar means it is outside of the zone. Use these position bars to accurately define the range of movement you want to have for each zone.



Step 6: Define the zones of movement (continued)

Repeat these steps to define a zone of movement for each of the 7 zones. (Be sure that zones do not overlap with each other, otherwise the higher numbered zone will have priority when it comes to performing the assigned actions).

The image shows a typical setup.

Step 7: Set the software actions to be performed

Now that the zones are defined, we must tell the SIM-board Universal Controller what actions to perform when the potentiometer moves into (or out of) these zones.

You will notice that each zone can have actions associated with it for when the potentiometer moves into the zone (On Enter); when the potentiometer moves out of the zone (On Exit); and can even perform actions when the potentiometer is moved within the defined zone (just like a normal, scaled potentiometer action) through the On Move action parameter.

For this flap lever example, we are only interested in performing an action to set the flaps to a given position when the potentiometer enters each zone. Therefore, we only need to assign an action to the On Enter events of each zone.

To set an action, click on the "On Enter action" parameter for each zone and choose the appropriate flap lever action from the "FS : Flaps" subsection. The image below shows the correct setup.

(The other events of On Exit and On Move allow for advanced effects such as generation of flap lever EICAS/ECAM caution messages when the flap lever is out of detent - provided your third-party software supports such an eventuality, you could program this into your flap lever potentiometer and generate very realistic caution messages utilizing both the On Enter and On Exit events!)

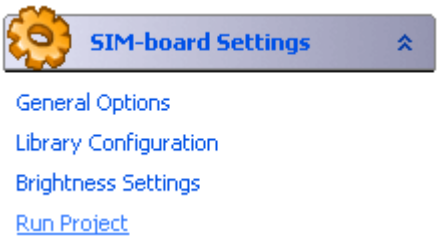
Step 8: Load Flight Simulator

Load Flight Simulator on your PC, or if you are using WideFS over a network, ensure you have Flight Simulator and the appropriate applications of WideFS running and connected properly.

Once loaded, select the default B737 aircraft model as the active aircraft. If the thrust lever quadrant is not shown, press Shift-4 to bring it up. Note the position of the flap lever within Flight Simulator.

Step 9: Run your test project

From the left hand side of the SIM-board Universal Controller window, select the "Run Project" option. Your simple project will begin to run, meaning that it is now active. If there is a problem with the project, or an error occurs, the details will be shown in the message area at the bottom of the window.



To test your project, minimize the SIM-board Universal Controller window and twist your pot. As you do so you should see the flap lever move between its detents, as you have defined. If you bring up the SIM-board Universal Controller window again and move your pot, you will be able to see the mapping between pot position, active zone and FS flap lever position.

Once you have checked the operation, collapse the "Node 1 : Pot" by clicking on it. This will speed things up as the program no longer has to graphically draw the position of the bars.

Congratulations! You have now made your entire flap lever interface using just a single potentiometer!

To stop your project, click on "Stop Project".

previous
(How To Common LED Connections)

next
(How To Use a Single Pot to Operate a Speedbrake Lever)

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