

Making a Rotary Switch Behave As a Potentiometer

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Well we've all come up against it haven't we. You need to have directional control on a switch, yet still have the correct indexing on your switch (i.e. 30 degrees, 45 degrees etc). I've come across a few people lately looking to achieve this.



You could try making a Rotary act as a simple encoder, but we have come across some issues with different manufacturers product (most noticeable C&K) that cause problems with accuracy probably caused by switch bounce or the design.

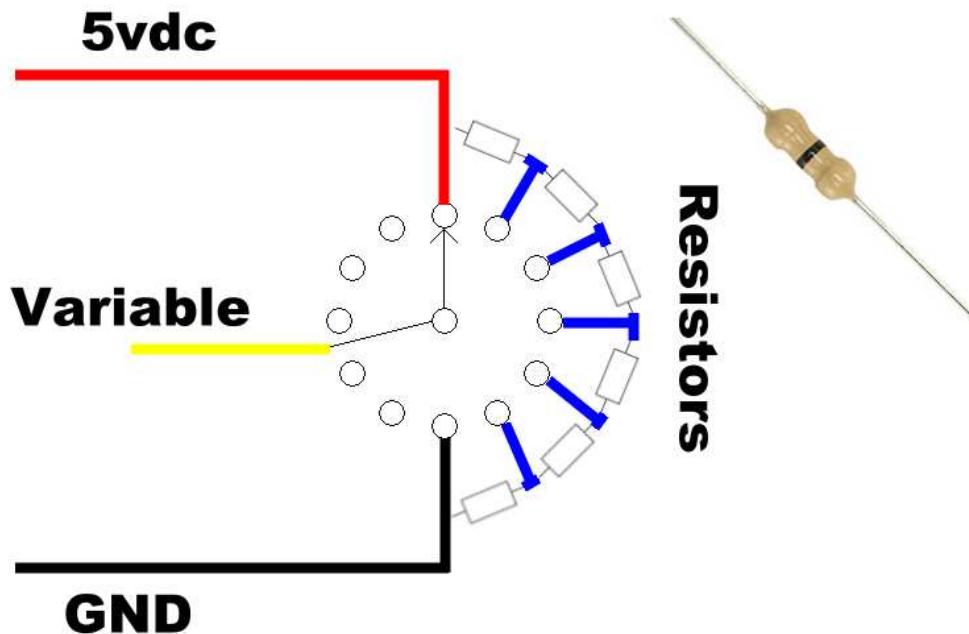
Many years ago, Mark Depono taught me how to 'ladder resistors'. That is where you chain resistors across the contacts of a switch to achieve an increasing (or decreasing) resistance at any given point on the rotation of a switch. I'd completely forgotten about this until a young colleague building a C172 project came here with a problem about his magneto switch that needs 5 positions to function correctly.



Now, let's think about a typical 100kohm potentiometer. It is a variable resistor of sorts applying a resistance of between 0 and 100kohm along it's track dependant at where on the track you take the measurement for want of a simple explanation.

Now, if you apply a resistance to a given voltage, you change it. So as the wiper moves along the track in the pot, the resistance changes and the return to the controller card also changes. That's how your controller card knows where the position of the pot is and acts.

This is how to make a Rotary Switch respond as a potentiometer and give a given value at each position, thus allowing you to send 'set' axis points into your sim or to instruct FSUIPC to do something.



Have a look at the above diagram. This is for a 7 position switch. Go on, count them :o))
 For a 3, 4 or 5 position switch, we just set the rotary for the no. of stops needed using the 'stop washer' you will receive with the switch and fit fewer resistors.

Remember that the no. of positions you need will be 1 more than the number of resistors.

7 Position, 6 resistors

6 Position, 5 resistors

5 Position, 4 resistors

4 Position, 3 resistors etc.



So how do you find out what value of resistor to use? Simply divide 100 by the no. of resistors you will use and remember the result will be Kohm. For example, a four position switch will need 3 resistors. So $100/3 = 33.3$ means a 33Kohm resistor is fine.

7 Position, 6 resistors, use 18Kohm

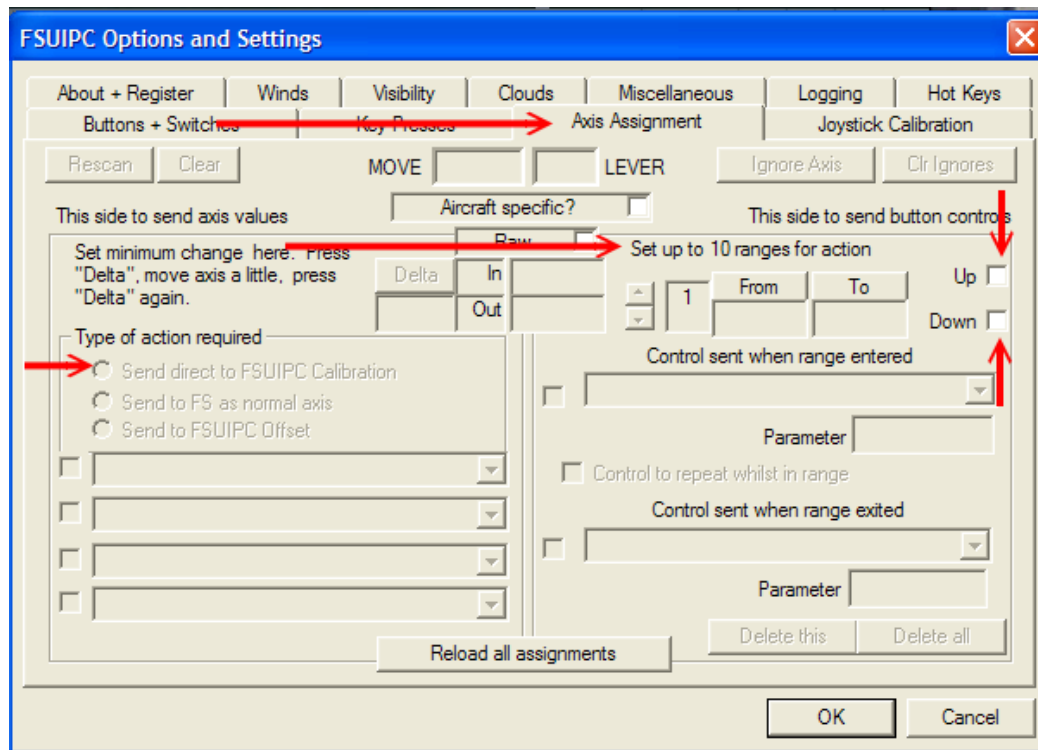
6 Position, 5 resistors, use 18Kohm or 22Kohm

5 Position, 4 resistors, use 27Kohm

4 Position, 3 resistors, use 33Kohm.

It doesn't have to be an exact science because when you calibrate the range of your rotary pot in Windows, the Calibration utility will 'allow' for any discrepancies, that's the reason we calibrate.

OK, so I hear you ask where are we going with this? Well, in FSUIPC, Pete DOWSON has allowed us to add upto 10 actions when a certain range is entered on a potentiometer's travel in both an UP and DOWN direction.



Please be advised that this technique has been designed to send Mouse Macro's into your sim, so before undertaking it, please ensure that the switch you want to action does allow Macro's to be recorded on it. Please also be aware that using this technique, will only allow you to apply this type of input to a maximum of 6 positions.

You are however free to use the 'Rotary Pot' idea for any other application you choose that requires an input from a pot i.e. Rudder Trim etc

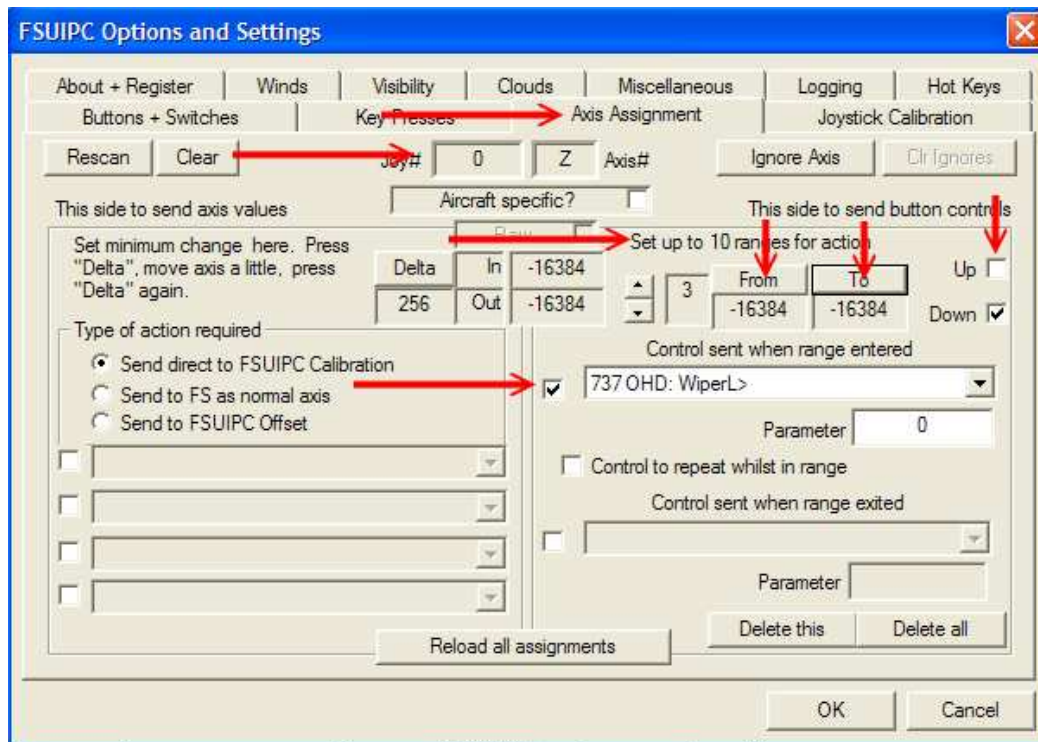


Right, well we now need an example, so let's look at the Left Wiper Switch here. It's a 4 position switch that is bi-directional. That is it means we need to be able to command a clockwise and anti-clockwise turn on the software switch.

Ok, once you have made your switch up. Connect it to your controller card and if all goes to plan, the controller will see it as an axis. Use an axis that does not ask you for a centre point.



It is now essential that you calibrate the axis in your Game Controllers page so that your PC knows what to expect from the 'Rotary Pot'. Once calibrated, open your sim and please check in your FS Assignments Menu that FS (or FSX or whatever) has not automatically assigned something to this Axis. If so, delete that assignment because everything we will do with this switch will be in FSUIPC. By the way, you will need a registered version of FSUIPC to do this. Please register your version because that keeps Pete Dowson working on the program and supporting it. THANKS.



Open your FSUIPC Axis Assignment page. Identify your axis (in our case Card 0, Axis Z). Make sure your switch is in it's off position. This will give you a value in the FSUIPC 'In' box of around 16383 or -16384 dependant on which way you have connected your pot to the 5v and GND connections of the card. Make a note of this number because it is our starting point and will have a bearing on how we deal with the UP & DOWN boxes.

Let me just explain..... In my example, when the switch is in it's Off position, I am reading a value in the In box of 16383. So that means as I rotate the switch, the value will decrease at each position. Therefore I will use the Down box for my first directional movements and the Up box for my return actions because as I move the switch one way the values are coming down from 16383 and from the other extreme of the switch my values are increasing from -16384 thru to 16383. You may have to deal with the Up/Down Boxes the other way round.

My switch gives me these values:

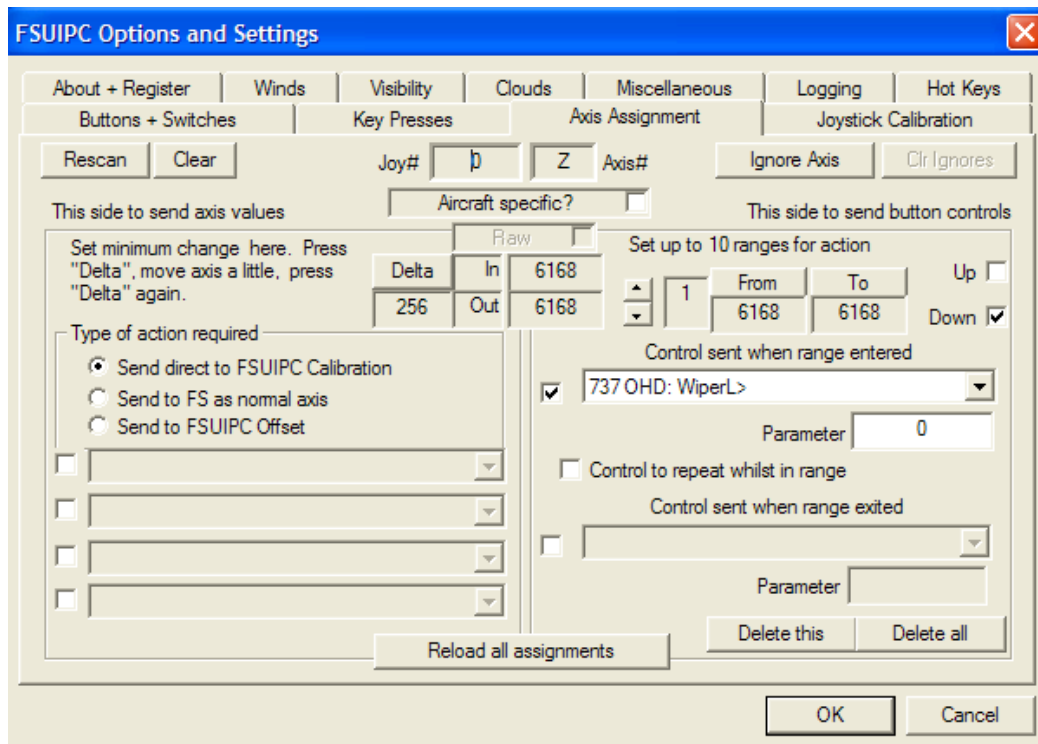
Off = 16383. Pos.1 = 6168. Pos.2 = -6046 Pos.3 = -16383

This is the 'tricky' bit :o)) I am rotating my switch clockwise from off thru 3 positions to reach the 4th position (your switch may have to be rotated the other way, so just be aware of that). Place the switch in the Off position (Park in my example).



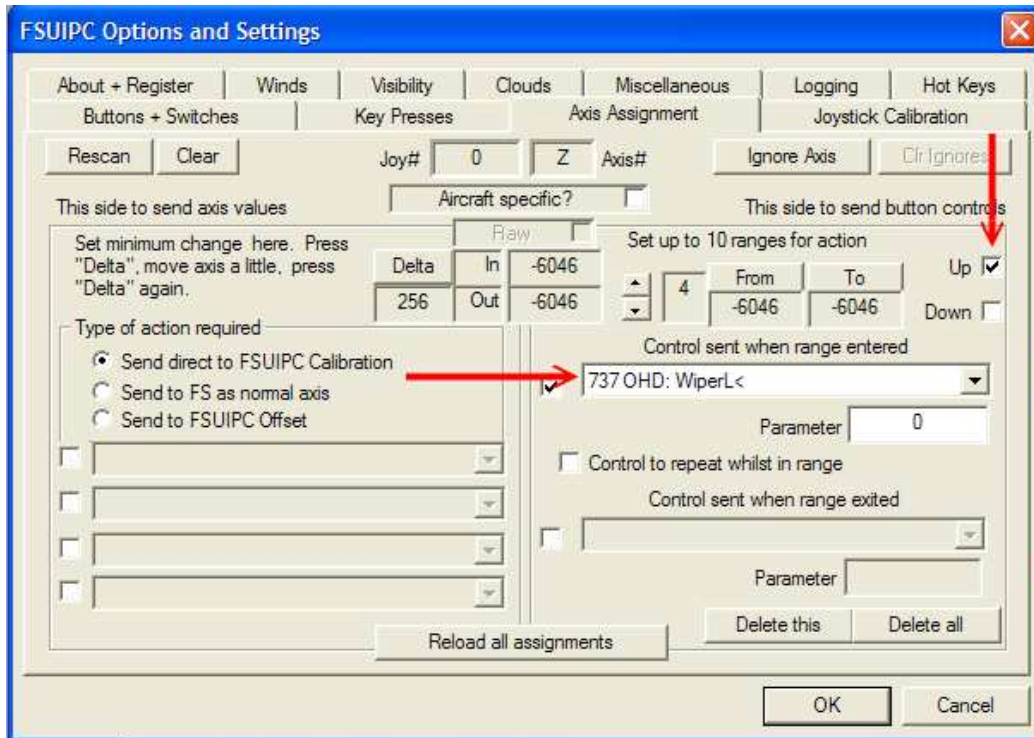
That means there are three positions to get to on the way up Int, Low & High. Place the switch in the first position (Int in my example). The value in the In Box in FSUIPC will change as in the image below. Click the From & To buttons so the value at your first position is set in both boxes. Now in the dropdown menu, select the action you want to happen when the

Axis value enters this range. I have used the WiperL> macro, but you can choose whatever you want. Notice the Up/Down counter to the left of the From To boxes. It contains the digit 1. We have now set that, so increase the number to 2. Turn the switch to the second position (Low in my example) and record the values in the From and To Boxes.



Again select the action you want to happen in the dropdown menu. Increase the step counter to 3 and move the switch to the next position. Record the value in the In and Out boxes and select from the dropdown menu what action you want to happen. OK, for this example, we have now reached the last position we need on the switch. You may have another position you need, so just repeat the steps above.

Now it's time to turn the switch the other way.....

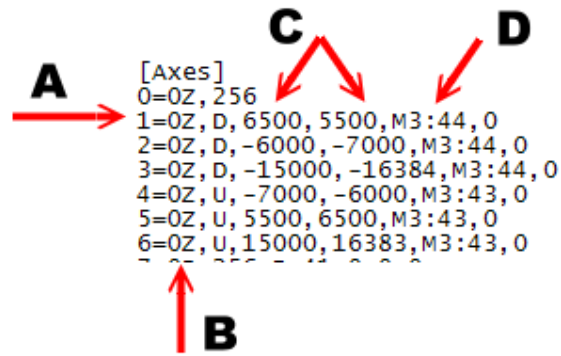


Increase the Step Counter and turn the switch to the first position back towards the Off (or Park in this example) and record the values in the To and From boxes. Select the action you want from the dropdown menu. Notice that now as we are going in a different direction, I have changed the tick box from Down to Up. That's because the values are changing in an increasing direction. I have also changed the Macro I am applying. Repeat this for the next two positions of the switch remembering to increase the step counter, select your action from the dropdown menu and select the correct Up or Down box.

Well I hope I explained that properly.

Ok, now we have to do a bit of 'editing' of the FSUIPC.ini file. Why? Well what we did was record a single value in the From/To boxes. But because FSUIPC will only act when it sees the pot in the range, it is highly likely that your switch will not be accurate with a single digit value. What we need to do is tell FSUIPC to act when the switch return value enters a range. We will edit the lines in the FSUIPC.ini file to give each position of the switch a buffer that we know our switch will enter when at each position.

Here's a screenshot of the lines in the .ini file from the computer I used to test this technique. You will find these lines under the heading Axes in the .ini file.



A is the Step No. B is the Axis ident, remember in our example it was card 0 axis Z. You will also see that the ident is followed by a U or a D, meaning it is an Up or Down reading. C is the range I have edited to make sure that the value from my hardware switch will definitely enter at each position. And finally D is the action I have selected from the dropdown menu.

Save the .ini file and return to your sim and the FSUIPC Axis assignment page. Press the Reload all settings button and when you check your Axis, you will see that the values in the From/To boxes are as you edited them in the FSUIPC.ini file. You may have to play around with your 'buffer' ranges to polish up the performance, but I found this very good 1000 range as my buffer.

Well I hope that has given you something to chew on and that it just may help out somebody else because if I know four people wanting to do this, how many more are there out there that I don't know about :o))

Thanks for your interest and as always comments, corrections and criticism always welcome.

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ADDENDUM

Just in case you don't want to make the switch up yourself, Leo BODNAR is making them up For Sale. A 12 way Rotary Switch fitted onto a PCB which has 'Built In' resistance and connects to your controller via 3 standard 2.54mm pitch header pins. You can find them here at the bottom of the page: <http://www.leobodnar.com/products/SLI-PRO/>

