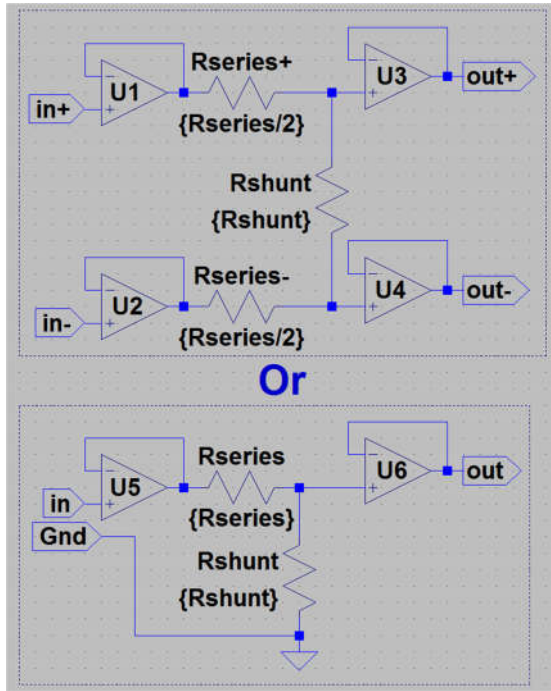


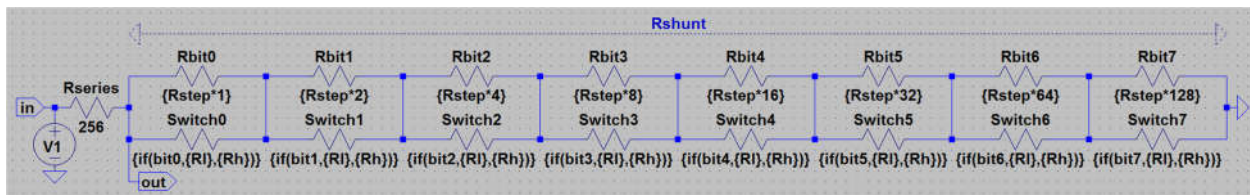
Shunt Potentiometer Calculator Excel-sheet.

This thread makes a excel sheet available that is intended to calculate the binary values needed to create a resistor ladder network emulating a logarithmic potentiometer with a fixed series element.

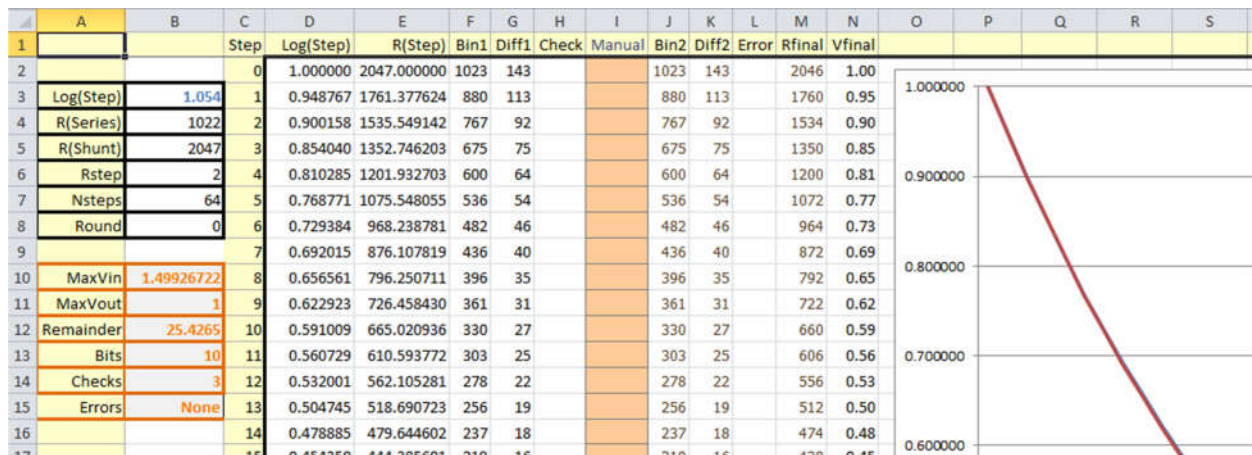


The above picture shows the configurations (among others) that can be implemented using a shunt potentiometer and a fixed-value series resistor.

By using one of these configurations you remove the potentiometer from the signal path (mostly) and, when at maximum value, only the fixed series resistor stays in the signal path. When implemented with switching elements (relays, fets, mosfets or other) these switches are all open when the shunt resistor is at maximum value and thus, the quality of the switches is not influencing the signal (mostly).



The above picture shows a ladder network that is supported by the excel sheet. The simulation file (LTspice) for this ladder network is included in the .zip-file that is made available.



Here I describe (in short you can always use the spread-sheet to experiment with) the parameters used in the spread-sheet. All parameters are in the black-bordered cells (B3...B8)

- Log(Step)[B3] Sets the slope(steeptness) of the curve. Try to find a value that gives the lowest value in Remainder[B12] to start with.
- R(Series)[B4] The fixed series resistance used in the potentiometer.
- R(Shunt)[B5] The maximum value for the shunt resistance of the ladder network.
- Rstep[B6] The step size of the ladder network. This determines the number of switches needed to implement the ladder network. The number of switches(Bits) is shown in the cell Bits[B13].
- Nsteps[B7] The number of steps(separate resistance values) used to go from the minimum to the maximum value of the calculated shunt(ladder network) resistance.
- Round[B8] The rounding factor used to calculate column Bin1[F] from column R(Step)[E]. This value is normally zero.

The calculated values are

- MaxVin[B10] The maximum input voltage for an output voltage of 1V.
- MaxVout[B11] The maximum output voltage for the calculated input voltage (always 1V).
- Remainder[B12] The value of the last cell in column R(Step)[E].
- Bits[B13] The number of bits(switches) needed to implement the ladder network.
- Checks[B14] The number of generated binary values in column Bin1[F] that need to be adjusted by user input in column Manual[I]. These are values where the difference between binary values is smaller than previous difference. E.g. the generated slope is not very smooth.
- Errors[B15] The number of uncorrected Checks[B14].

The columns are

- Step[C] The 'current' step.
- Log(Step)[D] The logarithmic steps generated using Log(Step)[B3].
- R(Step)[E] The resistor values calculated from Log(Step)[D]
- Bin1[F] The calculated binary values.
- Diff1[G] The difference between this and the previous value.

- Check[H]                Indicates If manual input is needed to correct the values in Bin1[F], the correction values should be entered in column Manual[I]
- Manual[I]              Manual corrections, values entered in this column will be shown in the Bin2[J] column and used for further calculations.
- Bin2[J]                The values from the column Manual[I] or Bin1[F] if there is no value in column Manual[I]
- Diff2[K]                The difference between this and the previous value.
- Error[L]                Indicates If manual input is needed to correct the values in Bin1[F], the correction values should be entered in column Manual[I]
- Rfinal                  The resulting shunt resistor values.
- Vfinal                  The resulting output voltages for the input voltage from MaxVin[B10].