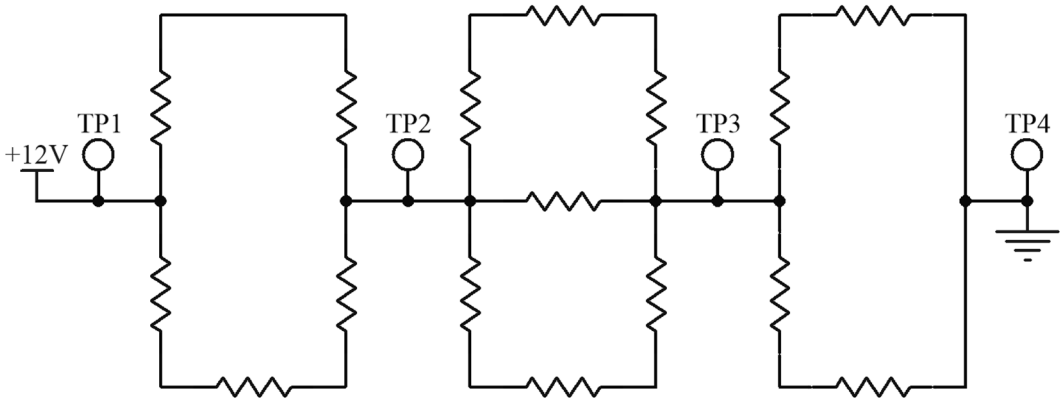
Name YUSUF ANANDA LUTION

Lab 1 – UBC Resistors

Objective: To get experience handling and soldering electronic components



17 kΩ 50 kΩ 49 kΩ SN=17500497

Procedure:

1. Write the first six digits of your Student Number (SN), in order, as three two-digit numbers in the spaces above. Skip over any leading zeroes so that all the numbers are at least 10. Consider these numbers as target resistances in kΩ. For example, if your student number were 56280761, your three target resistances would be 56 kΩ, 28 kΩ and 76 kΩ. **All resistors positions must be filled**.
2. Read and pay attention to the "Helpful Hints" for Lab 1.
3. You have available to you six different resistor values: 4.7kΩ (yellow-violet-red), 10kΩ (brown-black-orange), 22kΩ (red-red-orange), 47kΩ (yellow-violet-orange), 100kΩ (brown-black-yellow, and 220kΩ (red-red-yellow). Choose combinations of these resistors that will create resistances for each of the letters U-B-C equal to your target resistances within ±2kΩ. (Hint: you will need your series and parallel resistor formulas.) Mark your chosen resistor arrangement on the diagram. (Lucky student 56284761 could use 47kΩ resistors in every position.)
4. Insert the resistors into the circuit board, one at a time, in the chosen pattern. Where two or three resistors share the same solder pad, insert the two or three together. This will prevent the solder from the first resistor covering the hole for the next resistor.

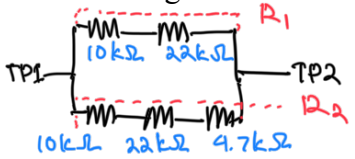
   Do not insert and solder all 16 resistors at the same time. *This "production line" method may be faster, but it defeats the objective here, which is to give you soldering practice. Instead, solder the resistors one at a time, inspect your solder joints as you make them, and seek to improve your technique for the next one.*
5. Solder short lengths of wire to the four test points: TP1, TP2, TP3 and TP4.
6. Turn on the multimeter and choose the resistance measurement setting. Measure the resistances of each letter of U-B-C and compare the results with your target values. In case of difference, check your calculations and your soldering.
7. Solder the power supply connector to the board and plug in the 12VDC wall adapter.
8. Choose the voltage measurement setting on the multimeter. Measure the voltages between test points 1-2, 2-3, 3-4 and 1-4. Confirm that these voltages correspond to the expectations from the resistances in Step 6. Use the calculated resistances and the voltage divider equation to calculate the individual voltages.
9. Comment on your results and explain important features.

Lab 1 Name YUSUF ANANDA LUTFON

Resistance	Target kΩ	Calculated kΩ	Measured kΩ	Measured V	Calculated V
"U"	17	17.09	16.90	1.80	1.75
"B"	50	50.08	99.39	5.26	5.15
"C"	99	99.53	98.69	5.186	5.09
"U+B+C"	116	116.7	119.98	12.281	12V

Resistance and Voltage Calculations:

"U":

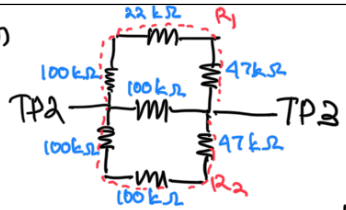


$R_{tot} = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{32\,k\Omega \cdot (36.7\,k\Omega)}{32\,k\Omega + 36.7\,k\Omega}$

$= \frac{11.744 \times 10^6}{687}\,\Omega$

$= 17.099\,k\Omega$

"B":



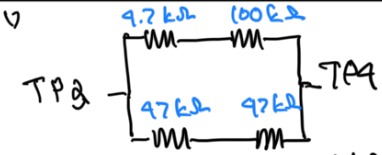
$R_{tot} = \left[\frac{1}{R_1} + \frac{1}{100\,k\Omega} + \frac{1}{R_2}\right]^{-1}$

$= \left[\frac{1}{169\,k\Omega} + \frac{1}{100\,k\Omega} + \frac{1}{247\,k\Omega}\right]^{-1}$

$= \left[\frac{6411}{3211000000}\right]^{-1}$

$= 50.085\,k\Omega$

"C":



$R_{tot} = \frac{(9.7+100)\,k\Omega \cdot (47+47)\,k\Omega}{(9.7+100+47+47)\,k\Omega}$

$= \frac{109.7 \times 99}{109.7+99}\,k\Omega = \frac{98918}{1987}\,k\Omega$

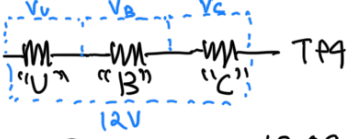
$= 49.530\,k\Omega$

$R_{UBC} = R_U + R_B + R_C$

$= (17.09 + 50.08 + 49.53)\,k\Omega$

$= 116.7\,k\Omega$

V calculation



$V_U = V_{tot} \cdot \frac{R_U}{R_{UBC}} = 12V \times \frac{17.09\,k\Omega}{116.7\,k\Omega}$

$= 1.75733\,V$

$V_B = V_{tot} \cdot \frac{R_B}{R_{UBC}} = 12 \times \frac{50.085}{116.7} = 5.150\,V$

$V_C = V_{tot} \frac{R_C}{R_{UBC}} = 12 \times \frac{49.530}{116.7} = 5.09306\,V$

Comments and Explanations

1. The appropriate resistor combination of resistors was carried out by calculating all possible combinations using the formula for total parallel and series resistances.
2. Errors between measurement and calculation results might be caused by deviations in the resistance of each resistor from its specification value.
3. As the error level is very small, it can be concluded that the resistance and voltage results of this system are in accordance with the expected values.