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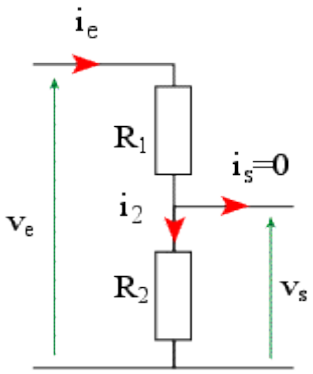
Department of Material Sciences
2 YL Physics (S3), 2024 - 2025

PW N° 3 : Voltage divider

Assembly :



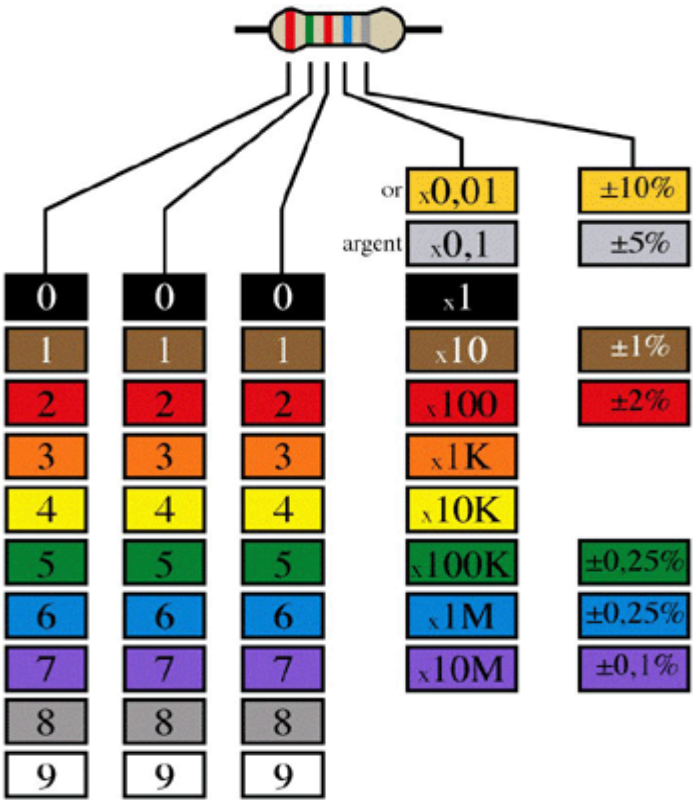
v_e : Input voltage
v_s : Output voltage

Objectives

Discover and experimentally verify the relationship between vs and ve of the divider bridge.

Hardware

1 Connection Plate, 1 Adjustable Continuous Power Supply, Wires, 2 Multimeters
- R : 220 Ω, 330 Ω, 1 kΩ, 1 kΩ, 4,7 kΩ, 10 kΩ.



1. Experimental study of vs as a function of ve.

1.1. Measures

R_1 = 1 kΩ
Carry out the assembly and place the multimeters to display the v_e and v_s voltages.

Have the assembly checked

For v_e varying 2 to 10 V, in 2 V steps, read v_s.

Make this statement to R_2 = 330 Ω ; 1 kΩ, 4,7 kΩ puis 10 kΩ.

Create the table in Excel and draw the four curves on the same graph.

Measure the precise values of the resistors with the ohmmeter. Note them in the report.

1.2. Operation

What is the model of the bonding equation vs and v_e ?

Model the four curves and display the equations on the graph.

How does the equation vary between v_s and ve when R_2 increases **?**

1.3. Conclusion of the experimental study

What is the type of relationship between v_s and v_e ?

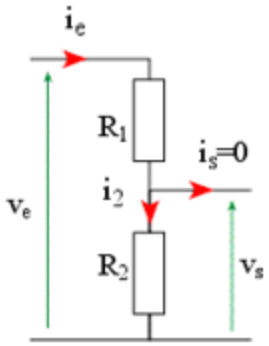
Does this relationship depend on the value of the resistances ?

The relationship $v_s = \frac{R_1}{R_2} v_e$ does it satisfy experimental observation ?

Justify your answer.

2. Theoretical study of the assembly

1. Express the law of knots between i_e, i_2 and i_s.
2. Deduce the relationship between i_e and i_2.
3. Express v_s in terms of i_2 and R_2.
4. Deduce v_s as a function of i_e and R_2.
5. Express v_e in terms of R_1, ie, R2 and i_2.
6. Derive v_e as a function of R_1, i_e and R_2.
7. Derive the ratio v_s/v_e as a function of R_1 and R_2.
8. Deduce v_s as a function of R_1, R_2 and v_e.



3. Conclusion

Include in a frame (a table with a single cell) the assembly, the formula and the condition for the formula to be valid.

4. Special case: $R_1 = R_2$

What is v_s with respect to v_e if R_1 is equal to R_2 ?