FACTFILE:

GCSE Technology and Design

OPTION A:
ELECTRONIC AND MICROELECTRONIC CONTROL SYSTEMS

Rewarding Learning

2.10 – Potential Dividers

Learning Outcomes

You should be able to:

- demonstrate knowledge and understanding of the use of variable resistors to adjust sensitivity in a potential/voltage divider;
- perform calculations using: $V_{out} = \frac{R2}{(R1 + R2)} \times V_{in}$;
- draw and interpret circuit diagrams containing a potential/voltage divider.

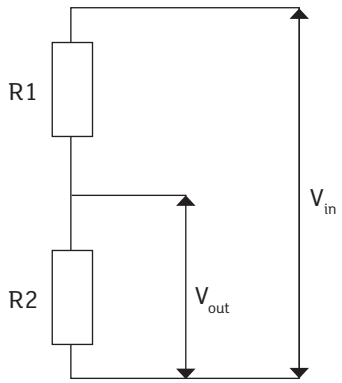
Potential Dividers

Potential dividers are sometimes called voltage dividers and are really just two components connected in series, with a voltage taken at a point between the two components.

In different publications and websites you will see both terms used.

Fixed resistors in series

Potential dividers really split or divide up the voltage within a circuit, so that parts of a circuit only receive the voltage they require. Potential dividers usually consist of two or more resistors arranged in series across a power supply. However, some other components can be used in potential dividers and we will look at that in this fact file.

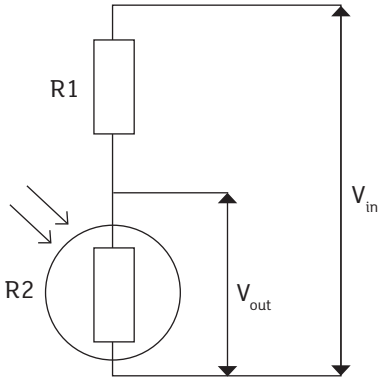


V_{out} is the output voltage in volts
R1 is the value of resistor R1 in ohms
R2 is value of resistor R2 in ohms
V_{in} is the input voltage in volts
The following calculation can be used to work out V_{out}:

$$V_{out} = \frac{R2}{(R1 + R2)} \times V_{in}$$

Potential Divider and Sensors

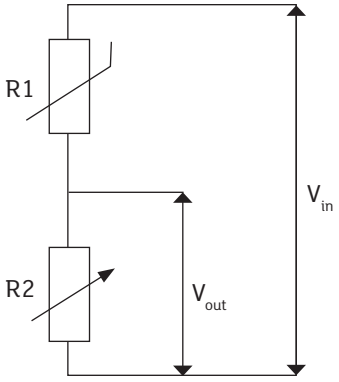
Potential dividers form an important part of sensing circuits. For example, an LDR or thermistor can be used in place of one of the resistors, with the output voltage signal being directed to the process part of a circuit.



Fixed resistor in series with an LDR

Potential Divider and Variable Resistors

Instead of using a fixed resistor, a variable resistor allows the output voltage to be adjusted; this is extremely useful in sensing circuits.

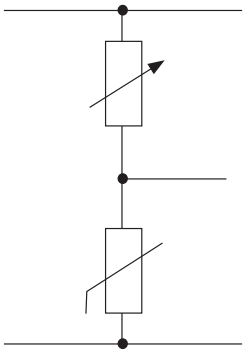


Variable resistor in series with a thermistor

Common uses of Potential Dividers

Potential dividers are important in transistor switching circuits. When a variable resistor is used on the potential divider the sensitivity of the input component can be adjusted by changing the resistance at the variable resistor.

Practical Use of a Variable Resistor in a Potential Divider



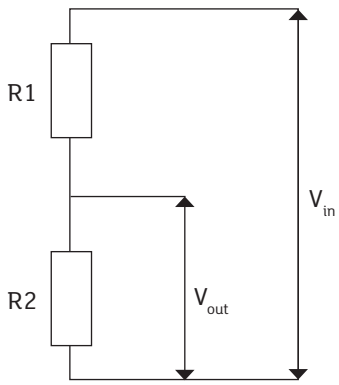
Look at the potential divider shown above; there is a variable resistor and a thermistor in series.

The variable resistor can be adjusted to increase or decrease its resistance; this in turn will affect the sensitivity of the thermistor; a variable resistor can be used in any potential divider with sensing inputs to adjust its sensitivity.

Worked example:

Question

A potential divider has one resistor R1 with a resistance of 5 ohms, a resistor R2 with a resistance 10 ohms and an input voltage of 9 volts.



What is the output voltage?

Answer

$$V_{out} = \frac{R2}{(R1 + R2)} \times V_{in}$$

$$V_{out} = \frac{10}{(10 + 5)} \times 9$$

V_{out} = 6 volts

Past Paper Questions

June 2014 – Q. 1(c)

(c) The potential divider circuit in **Fig. 3** is often used in preference to the potential divider circuit shown in **Fig. 4**.

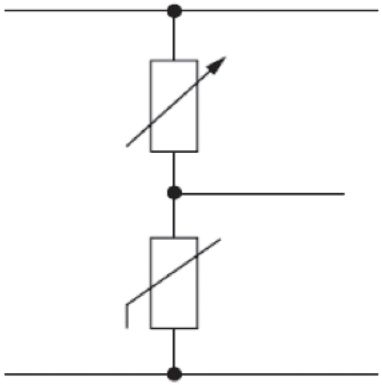


Fig. 3

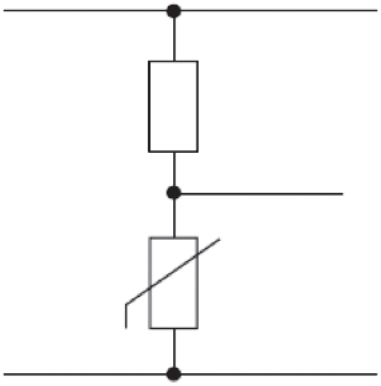


Fig. 4

State the difference between the two potential divider circuits shown and explain why the potential divider circuit shown in **Fig. 3** would be used in preference to the potential divider circuit shown in **Fig. 4**.

Difference _____ [1]

Explanation _____

_____ [2]

June 2013 – Q. 1(b)

(b) **Fig. 1** shows a Voltage Divider circuit diagram.

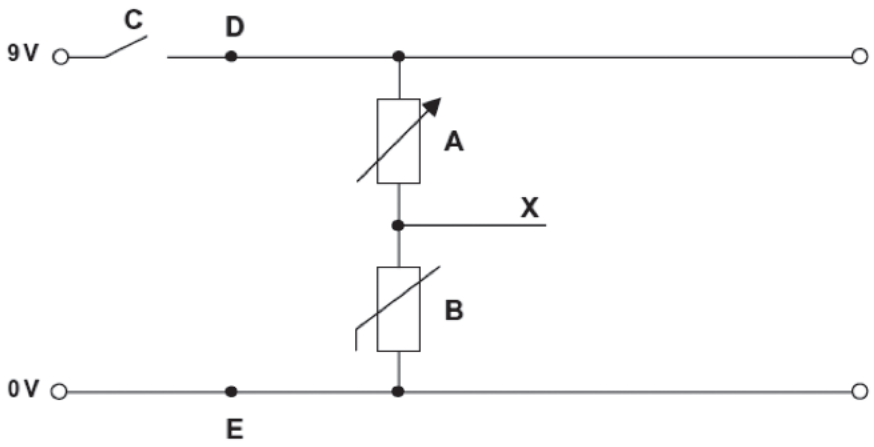


Fig. 1

(i) State another name for this circuit.

_____ [1]

(ii) Name the components shown by their electronic symbols **A** and **B** in **Fig. 1**.

A _____ [1]

B _____ [1]

(iii) What type of switch is shown at **C** in **Fig. 1**?

_____ [1]

(iv) With reference to the labelled components **A**, **B** and **C** in **Fig. 1** explain how an output at point **X** is achieved.

_____

_____

_____

_____ [4]

June 2015 – 1(c)

(c) Fig. 2 shows a potential divider circuit.

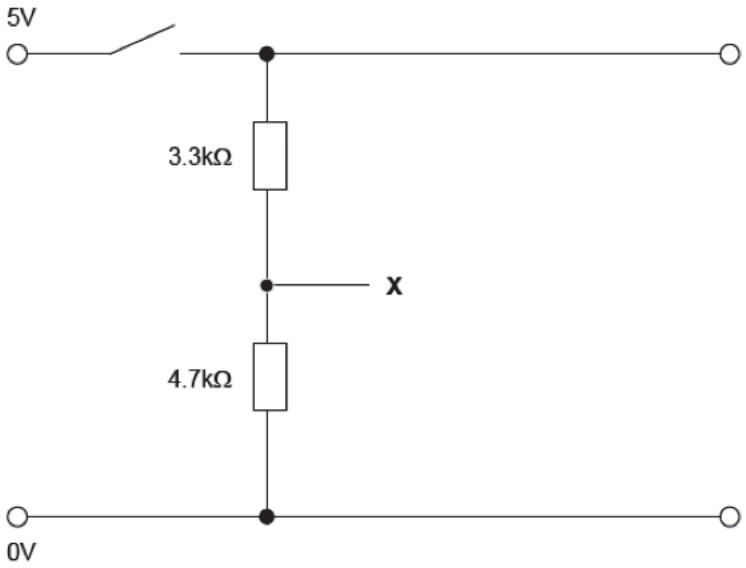


Fig. 2

(i) Calculate the output voltage at point **X**.