

An electrical wiring diagram for the one-way lighting circuit

[Engineering](#)



**ASSIGN
BUSTER**

The paper "An Electrical Wiring Diagram for the One-Way Lighting Circuit" is an excellent example of an assignment on engineering and construction.

- Draw a line diagram for a one-way lighting circuit
- Draw an electrical wiring diagram for the one-way lighting circuit

Note: Earth wires have been omitted from diagrams for clarity, but must be connected at all earth terminals.

- Explain how this circuit functions

The number of ways (1-way or 2-way) depicts the number of switches controlling a light. A one-way light circuit is a circuit where a single switch operates a lamp. In live wire, the voltage changes all the time but in neutral the voltage stays the same. Switch contains a live wire and a switched live wire. As soon as the switch is lit on, the connection is made between live and switched live wire. This, in turn, makes the circuit complete and the current start flowing through the circuit. The bulb glows. A fuse is placed in the active line of a circuit, to provide protection by fusing of wire in case of a short circuit.

- What rating of fuse would you use and why?

Fuses work at a particular flow of current. So they are rated as per the amperage. The rating of fuses depends on two parameters:

- Voltage of circuit
- Current rating (Normal Operation)

Every electrical appliance is marked with its power (wattage) and voltage.

Thus we can calculate the amperage of the fuse to be used in a circuit by the

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formula: $(\text{Watts} / \text{Volts}) = \text{Amps}$ After calculation, chooses a fuse which is the nearest size above the required amperage. In general, we use a 5amp fuse for lighting circuits and a 15amp fuse power sockets.

- Draw a line diagram for a two-way lighting circuit
- Draw an electrical wiring diagram for the two-way lighting circuit

Note: Earth wires have been omitted from diagrams for clarity, but must be connected at all earth terminals.

- Explain how this circuit functions

A two-way light circuit is a circuit where two switches can independently operate a lamp. Sometimes it is necessary to control the lamp from more than one position e. g. staircase where lamps need to be operated both from downstairs and upstairs. In such situations, we use two-way circuits. The basic functioning remains the same. There is a common terminal between the switches and apart from it, there are two other connections also. This common connection helps in the independent functioning of the switches. 8. What rating of fuse would you use and why? Fuses work at a particular flow of current. So they are rated as per the amperage. The rating of fuses depends on two parameters:

- Voltage of circuit
- Current rating (Normal Operation)

Every electrical appliance is marked with its power (wattage) and voltage. Thus we can calculate the amperage of the fuse to be used in a circuit by the formula: $(\text{Watts} / \text{Volts}) = \text{Amps}$ After calculation, chooses a fuse which is the

nearest size above the required amperage. In general, we use a 5amp fuse for lighting circuits and a 15amp fuse power sockets.

- Explain in each case what size of cable you would use, with calculations
- The size of the cable is expressed in terms of cable diameter and its rating is given in terms of the amperage (the amount of current used by the appliance). The size of the cable to be used in the circuit will depend upon the appliances which are used like, lamps, fans, kettles, etc. When we look at any electrical appliance, we find the information regarding the voltage, wattage, and frequency. For the purpose of calculation for the size of the cable, we need the figures for voltage and wattage. Sometimes wattage is given in a range. In that case, always take the higher value for the calculations. Now we have to apply the formula: $(\text{Watts} / \text{Volts}) = \text{Amps}$ Dividing the wattage by the voltage (generally 230v for domestic circuits), we will get the amperage. Now we need to know the length of the one way length of the cable to be fitted. According to Ohm's law, there will be some voltage drop along the cable. We need to factor that also in our calculation. As a thumb rule, a voltage drop of 5% is considered for a single-phase circuit. If it is a short (under 20 m) it won't really matter much. Now the final formula for wire size is: $\text{Wire size (diameter)} = \sqrt{((\text{conductor resistivity}) \times \text{Amperage} \times \text{One way cable length}) / \text{Voltage drop}}$ Note: Conductor resistivity is 11. 2 for copper and 17. 4 for Aluminium In general, the cable used for lighting circuits is of diameter 1 mm, 11 amps and 3 cores.

9. Explain what a ring and radial circuits are

There are two main configurations for power outlet circuits. One is a ring circuit and the other is a radial circuit. In the radial configuration, the outlets make a chain, running continuously from the supply point to the final outlet in the system at the farthest point. The figure below shows a radial circuit. On the contrary, the in-ring configuration, the final outlet is connected back to the supply. In this configuration, every outlet has two complete paths to the starting supply. It can be said that a ring circuit is like a radial circuit with the final outlet connected back to the supply. The figure below shows a ring circuit.

10. Draw a line diagram for a mains power circuit
12. Draw a wiring diagram for the mains power circuit
13. Explain how this circuit functions.

In general, as it is also evident from the diagram given above that, a domestic power supply has two circuits. The first circuit supplies electricity at 230 volts and 5 amperes for lighting purposes. The second one supplies electricity at 230 volts and 13 amperes for sockets. The latter is also called the powerpoint circuit. The live wire from the outside supply carries the current at high voltage (230V). It enters the main switch box after passing from the electrical meter. Each circuit that is lighting and the socket is further protected by their own fuse. Current, at a lower voltage returns to the outside power supply through the neutral wire. If live current short circuits due to a fault in any electrical appliance, it is taken safely away through the Earth wire. Given below is the function of an important component of any mains supply:

1. Live: Carries supply at maximum voltage
 2. Neutral: Returns current at the lower voltage
 3. Fuse: Breaks the circuit in case of fault by melting
 4. Earth: Returns excess current to earth in case of short circuit
14. What rating of fuse would you use and why?

In general, the following rating of fuse is used in the domestic mains supply

1. 5 Amps for lighting connections
2. 13 amps for socket connections

Every individual circuit in any domestic supply has to be provided with the correct rating of the fuse. The fuse protects the circuit from possible current surge which can be dangerous and fatal. The current surge heats up the circuit and can melt it. It can also cause an electrical fire. The fuse will provide protection against this. The fuse gets heated by any current surge and ultimately will melt so that the circuit is broken. This stops a dangerous current surge propagating to the rest of the circuit.

15. Draw a radial circuit for a shower unit

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16. Draw the electrical diagram for the shower unit

The above diagram shows a radial electrical circuit for the shower.

17. Calculate the size of a protection device to be used?

In order to calculate the size of a protection device let us have a look at the total power requirement of the shower system. There are two radial circuits. One is for lighting having a lamp of say 100-watt power. Another circuit is for

the electric water heater. Since very little time is there to heat water, we need to have a powerful heater say 10 KW. Now voltage is the same in both the circuits say 230 Volts. Now applying the formula: $(\text{Watts} / \text{Volts}) =$

Amps Calculations:

1. For Lighting circuit: $100 / 230 = 43$ Amps

Thus the rating of protection should be near this value.

1. For Electric Water circuit: $10,000 / 230 = 50$ Amps

Here the rating of protection should be quite high.

18.

What size of the cable would you use in both cases explaining why?

In the case of the shower unit, since there is a radial circuit arrangement, we can use different sizes of cable for both lighting and heater circuits.

1. For Lighting circuit: We can have a flexible dual-core 0.5 mm diameter cable which can carry up to 3 amperes of current. This will take care of even a moderate surge of current in the circuit.

1. For the Water heater circuit: For this current rating is quite high. We can use 3 cores 10 mm diameter cable which can carry up to 56 amperes of current. This will also take care of a moderate surge of current in the circuit.