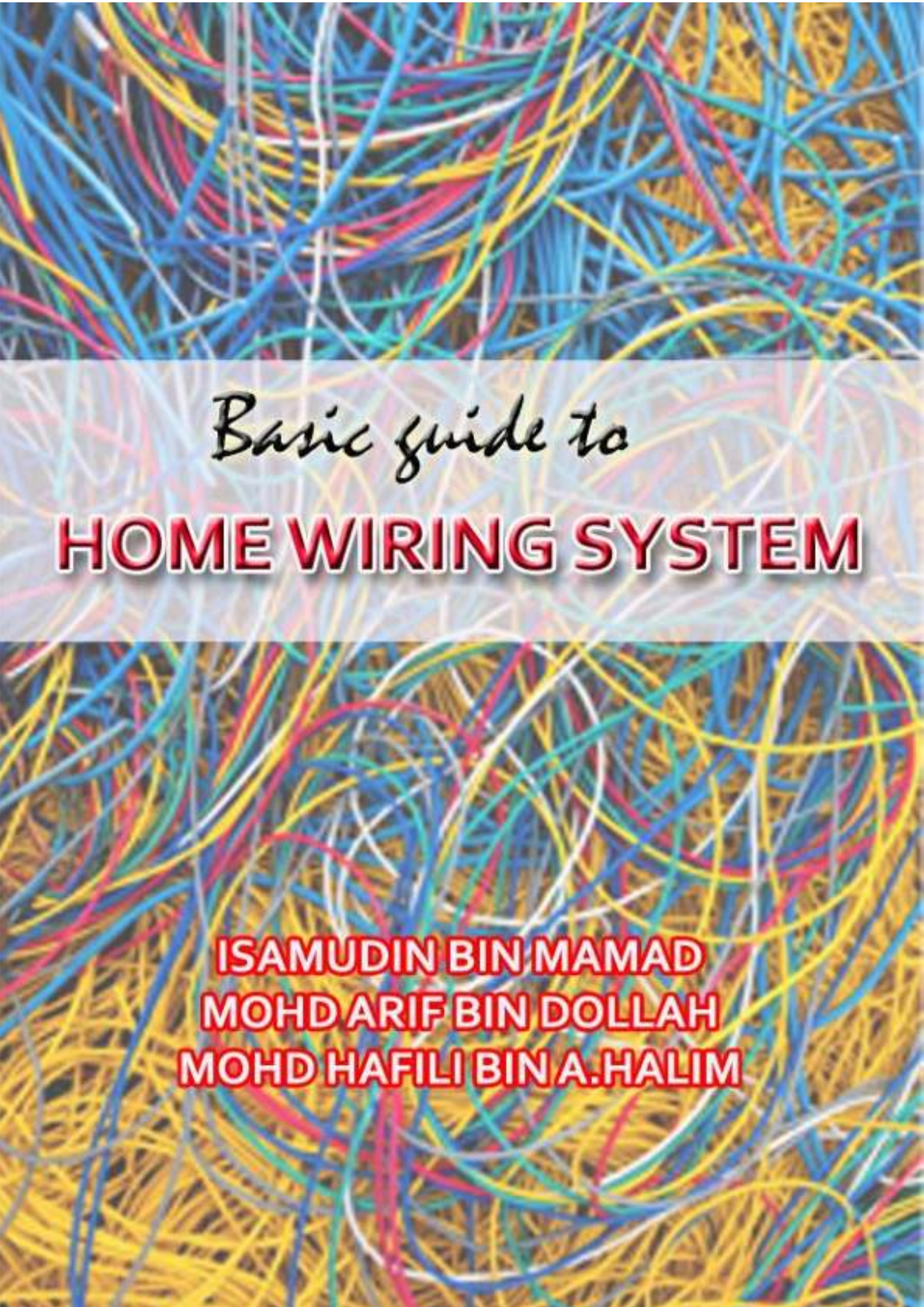
Basic guide to
HOME WIRING SYSTEM
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BASIC GUIDE TO HOME WIRING SYSTEM

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PREFACE

In the name of Allah, the Most Beneficent and the Most Merciful. All praises and thanks to God the Almighty for His showers of blessings that this e-book is successfully published.

We would like to express our deepest appreciation and extremely grateful to our families for their love, prayer, caring, sacrifice and continuous support throughout our researching and writing works to complete this e-book. Our sincere thank also go to our friends and colleagues at Department of Electrical Engineering, Politeknik Sultan Mizan Zainal Abidin for their support and guidance.

This **Basic Guide to Home Wiring System** e-book provides the simple and basic guide on how to do the electrical wiring system at the house. The explanation in each topic is brief but enough to give the reader the exposure to electrical wiring installation. The wiring installation procedures of lighting and power circuit are explained in step by step, aiding with the pictures and explanations at each step of work to help the reader to refer it during the wiring work.

We hope that the reader will get much beneficial knowledges and skills from this e-book and have the chance to do-it-yourself their basic wiring system at home. Other than that, we also hope this e-book will be the good deed in the sight of Allah SWT as per say by the prophet Muhammad SAW (p.b.u.h):

"When a man dies, his good deeds come to an end except three: ongoing charity, beneficial knowledge, and righteous offspring who will pray for him." (Muslim)

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1.0 INTRODUCTION

Home electrical wiring is a process of connecting cables and wires from the electrical pole to the to the main circuit and consumer circuit in order to supply the electrical energy to the home appliances such as lights, fans, socket outlets and air conditioners. This wiring system starting from the live and neutral cable from the electrical pole, normally rating single phase 240 volts alternating current (AC) to the service panel. The service panel consists of service fuse (cut-out), neutral link and Kilowatt Hour Meter. The service fuse acts as the overcurrent protection and limiting the current usage, while the Kilowatt Hour Meter 's function is to measure the electrical energy used by the consumer for the electrical bills. This service panel is under responsibility of the electrical energy provider, Tenaga Nasional Berhad (TNB). The Kilowatt Hour Meter then been connected to the main circuit at the distribution board (DB).

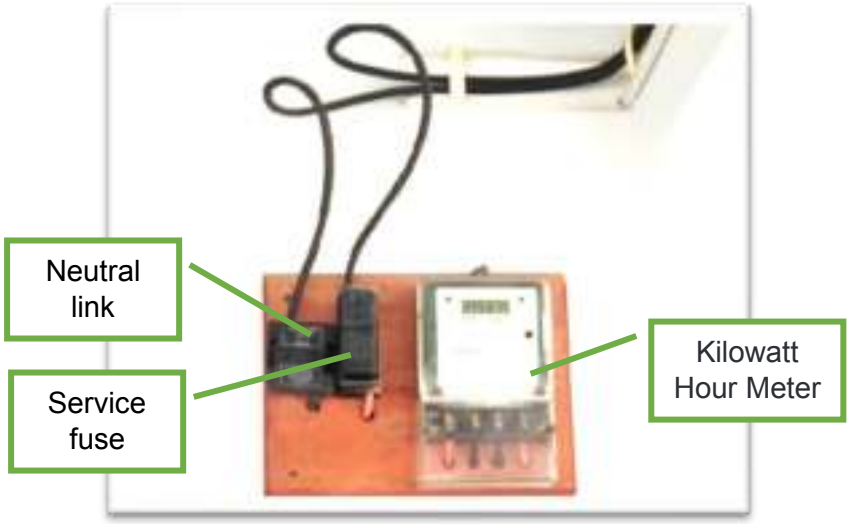


Figure 1: Service panel consists of service fuse, neutral link and Kilowatt Hour Meter

2.0 MAIN CIRCUIT

A main circuit is installed in the distribution board (DB). The function of the main circuit is to distribute the electrical energy to the home appliances according to the consumer's needs. The main circuit consists of main switch (MS), residual current circuit breaker (RCCB) and the miniature circuit breaker (MCB).

Figure 2: The main circuit consists of main switch (MS), residual current circuit breaker (RCCB) and the miniature circuit breaker (MCB).

2.1 Components in main circuit

- Main switch (MS)

The function of main switch is to connect and disconnect the electrical supply to the home appliances. The ratings for the main switch are 40A and 63A, depends on the fuse inside the main switch. The main switch also acts as the overcurrent protection device as the metal strip or wire element inside the fuse will melt and break the connection if high current passing through it.

- Residual current circuit breaker (RCCB)

A residual current device (RCD), or residual current circuit breaker (RCCB) is a safety device that quickly breaks an electrical circuit when there is a leakage current to the ground, in order to protect the human and the equipment. This leakage could happen when there is a misconnection between live cable or neutral cable with the ground cable. When this situation happens, the residual current circuit breaker will automatically trip off and isolate the electrical supply from connecting to the home appliances or user. The ratings for the residual current circuit breakers are 40A and 63A

- Miniature circuit breaker (MCB)

A miniature circuit breaker is an automatically operated electrical switch used to distribute the electrical energy separately to the different types of end consumer circuits such as lighting circuit and power circuit. There are many ratings of miniature circuit breaker such as 6A, 13A,

20A until 63A and their usage base on the types of circuit such as lighting circuit, power circuit and air conditioning circuit. The miniature circuit breaker also acts as protection device as it will trip off when there is overcurrent or short circuit that causing that particular end circuit will be break off.

2.2 Installation of the main circuit

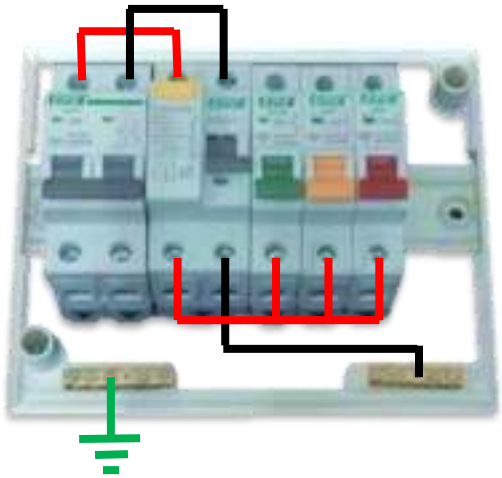


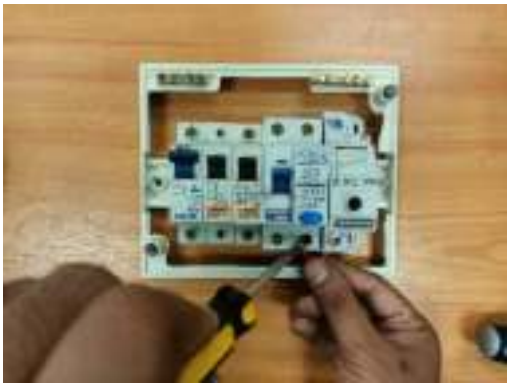
Figure 3: The connection diagram of the main circuit.

The connection of the main circuit is starting from the main switch (MS) that is connected to the residual current circuit breaker (RCCB) using live (red) and neutral (black) cables. Next, the live cables from the RCCB will be connected to the all the miniature circuit breaker (MCB). The neutral cable from the RCCB will be connected to the neutral terminal at the right side of the distribution board. The left side will be the ground terminal that will connected using ground cable (green) to the earthing system in the ground outside the house. The steps to install the connection of the main circuit are as following:

- Firstly, remove the distribution board cover by unscrew the screw of the board.

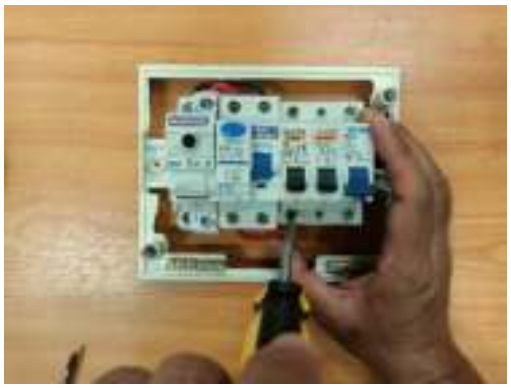
- Attach the main switch, residual current circuit breaker and the miniature circuit breakers at the horizontal bar at the distribution board. These is done by fitting the clip beneath the components to the bar. The numbers of miniature circuit breakers used are depend on the consumer's need.


- Connect the red cable as the live cable from the upper side of the main switch to the residual current circuit breaker. The size of the cable is 16mm^2.

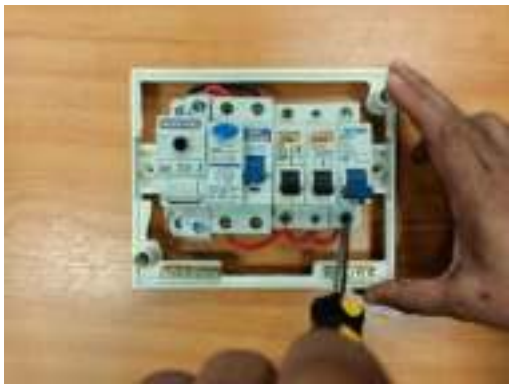



- Next to the live cable, connect the black cable as the neutral cable from the main switch to the residual current circuit breaker. The size of the cable is 16mm^2

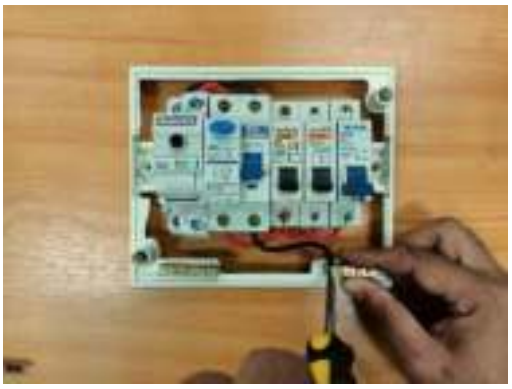

- From the lower side of residual current circuit breaker, connect it with the live cable to the miniature circuit breaker.

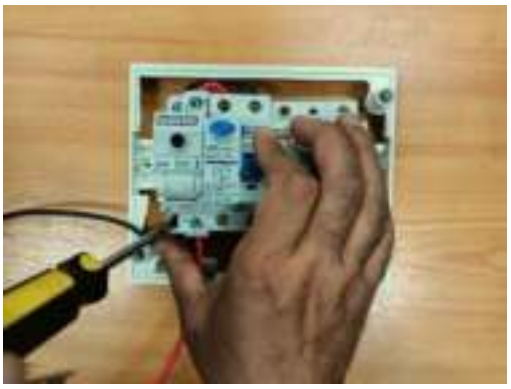
- Connect all the miniature circuit breaker together with the live cables.

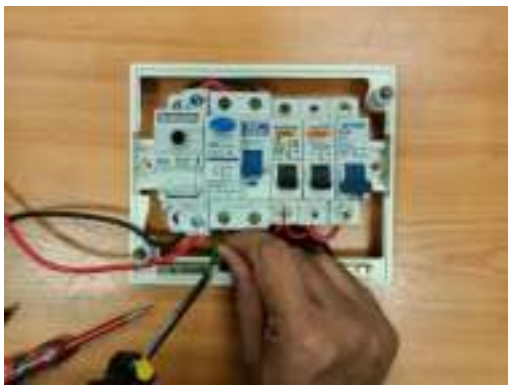
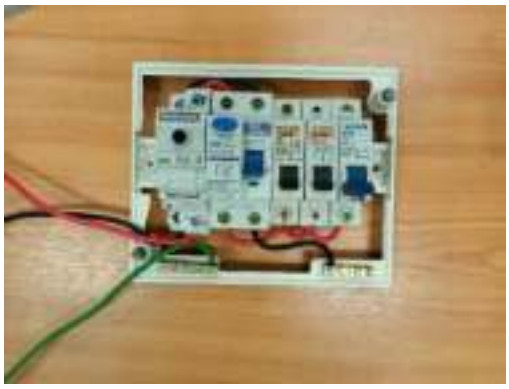
- At the lower side of the residual current circuit breaker, a neutral cable then been connected to the right terminal. This will be the neutral terminal.

- Then, the live and neutral cables will be connected to the lower side of the main switch. These cables will be the incoming electrical energy connected from the Kilowatt Hour Meter at the service panel.

- Connect the green cable to the left terminal and this will be the ground terminal. The green cable act as the ground cable and is connected to the earthing system outside the house. This safety element will automatically redirect the electrical energy to the ground if there is a current leakage or the short circuit.

- Lastly, attach the distribution board cover and screw it.


3.0 LIGHTING CIRCUIT

Lighting circuit is the consumer circuit that is used to connect the lamp and the fan. It is connected from the 6A miniature circuit breaker at the distribution board to the lamp and fan using 1.5 mm^2 PVC cable.

The lamp and the fan in the lighting circuit is connected in a simple close loop connection of live and neutral cables. The ground cable also added to the connection as the safety precaution. The lamp and the fan can be controlled from: 1) 1 point using one-way switch, 2) 2 points using two-way switch and 3) multiple points using two-way switch and intermediate switch.

3.1 Lighting controlled from one point using one-way switch

This type of lighting circuit is used to control the lamp or the fan from one point or one location. Most of the lamp and fan used this type of connection, such as at the living room, bedroom and kitchen. The circuit will connect the miniature circuit breaker 6A to the one-way switch and lamp holder. Other accessories needed are terminal box, round PVC block, casing and 1.5 mm2 PVC cables.

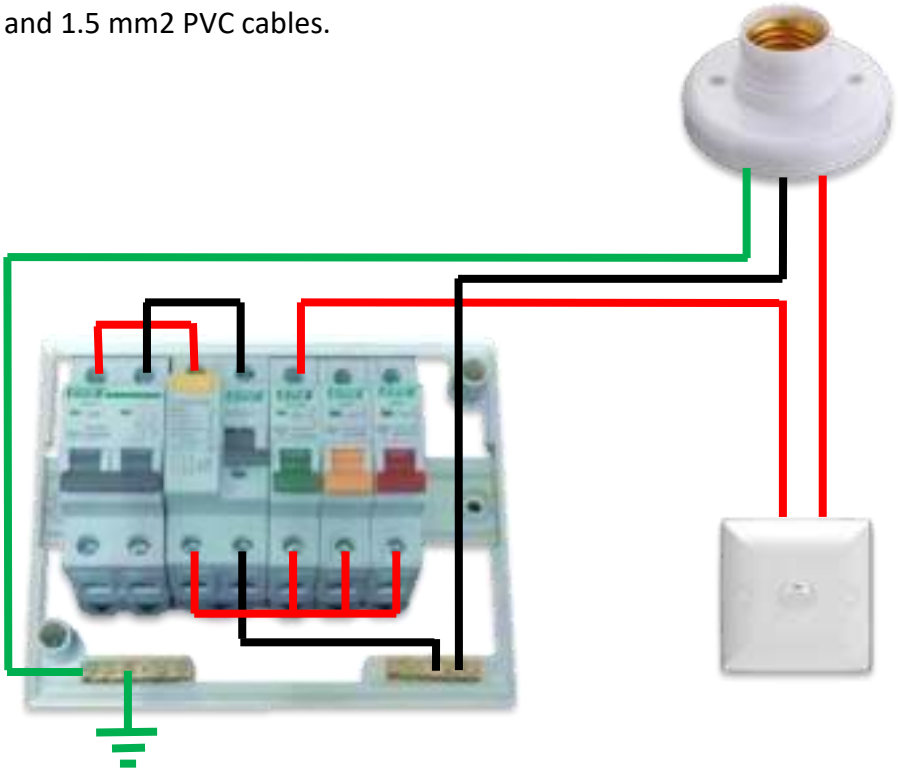


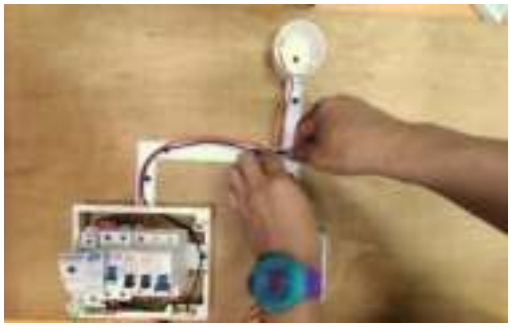
Figure 4: The connection diagram of the light controlled from one point

The connection of the lighting circuit controlled from one point using one-way switch is starting from the miniature circuit breaker (MCB) that is connected to the one-way switch using live (red) cable. Next, the live cable from the one-way-switch will be connected to the lamp holder together with the neutral (black) and ground (green) cables from the distribution board. The steps to install the connection of the circuit are as following:

- Firstly, fit the live cable (red cable) at the 6A miniature circuit breaker in the distribution board (DB). Then insert the live cable from the DB through the casing to the terminal box. This terminal box will be the base for the one-way switch.

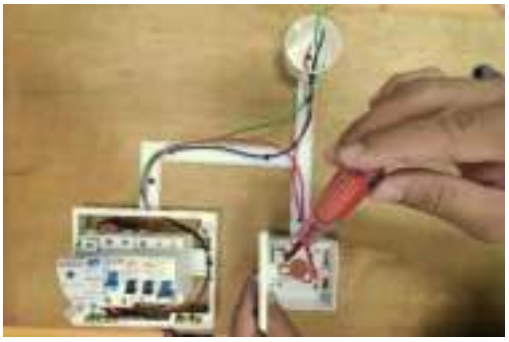

- Next, insert the live cable from the terminal box to the round PVC block. This round PVC block will be the base for lamp holder


- Fit the neutral cable (black cable) at the neutral terminal. Then insert the neutral cable from the distribution box to the round PVC block.



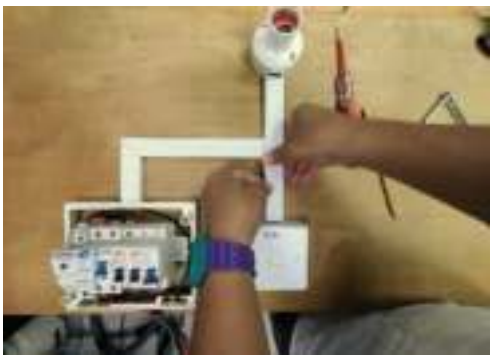

- Fit the ground cable (green cable) at the ground terminal. Then insert the ground cable from the distribution box to the round PVC block.


- Fit the live cables at the terminal box to the one-way switch. The live cable from distribution box is screw to the terminal L1 and the live cable from round PVC is screw to the terminal L2

- Fit all the live, neutral and ground cables at the round PVC block to the lamp holder.


- Screw the lamp holder and the switch. Then install the casing cover and the distribution board cover.

- Turn on the switch at main switch, residual current circuit and miniature circuit breaker. Finally, turn on the one-way switch to light up the lamp


3.2 Lighting controlled from two points using two-way switch

This type of lighting circuit is used to control the lamp or the fan from two point or two locations. Normally, this type of connection used at the porch or stair, where the switch can be turn on and off from downstair or upstairs. The circuit will connect the miniature circuit breaker 6A to the two-way switches and lamp holder. Other accessories needed are terminal boxes, round PVC block, casing and 1.5 mm2 PVC cables.

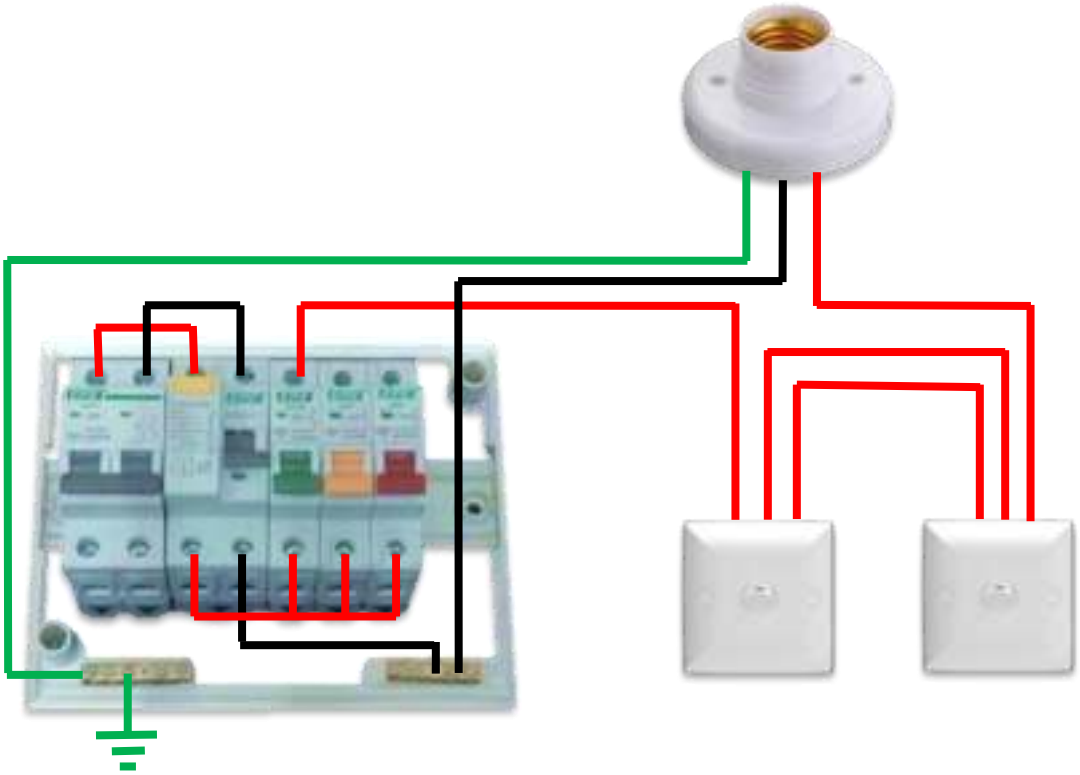
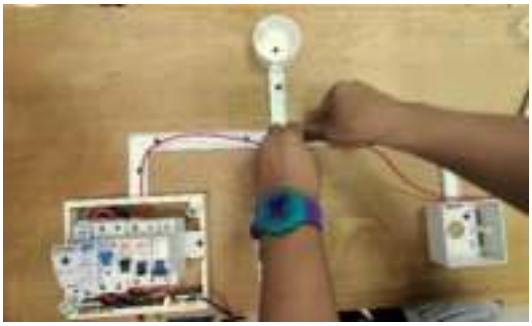


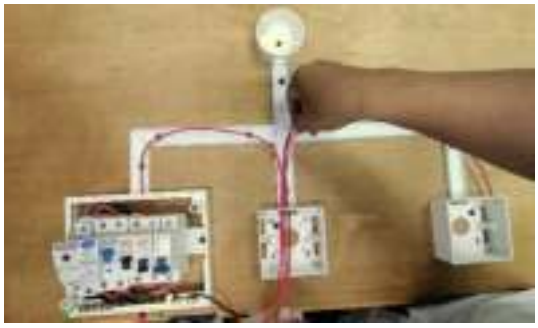
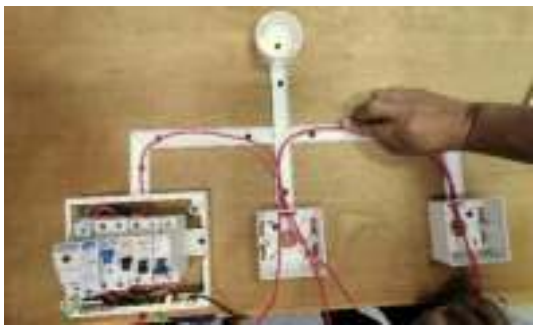
Figure 5: The connection diagram of the light controlled from two points

The connection of the lighting circuit controlled from two points using two-way switch is starting from the miniature circuit breaker (MCB) that is connected to two two-way switches using live (red) cable. Next, the live cable from the two-way-switches will be connected to the lamp holder together with the neutral (black) and ground (green) cables from the distribution board. The steps to install the connection of the circuit are as following:

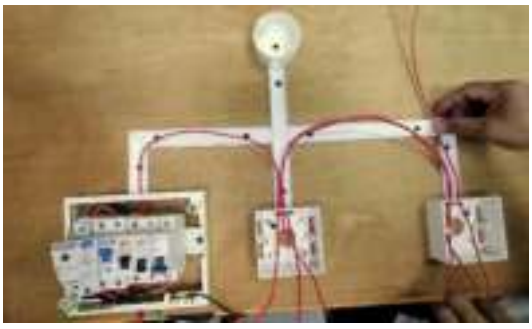
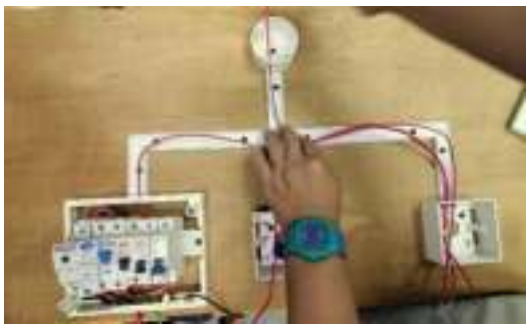
- Firstly, fit the live cable (red cable) at the 6A miniature circuit breaker in the distribution board (DB). Then insert the live cable from the DB through the casing to the terminal box. This terminal box will be the base for the first two-way switch.



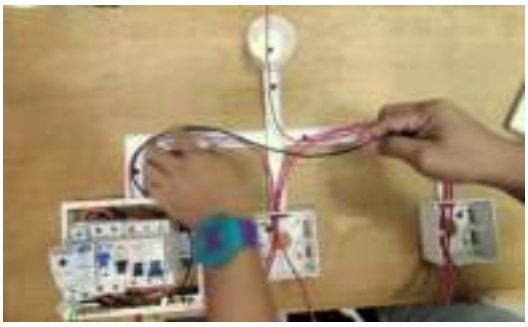
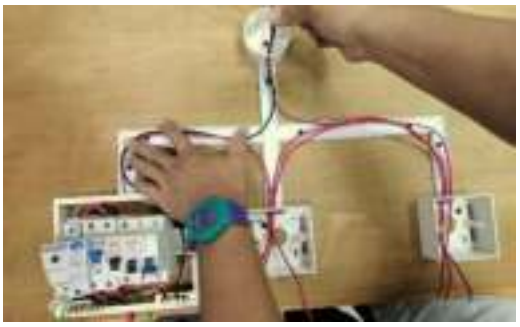
- Next, insert another 2 live cables from the first terminal box to the second terminal box. The second terminal box will be the base for the second two-way switch.

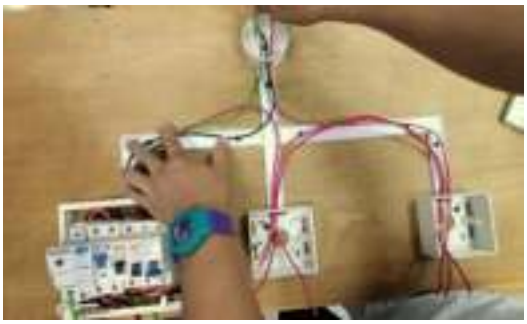
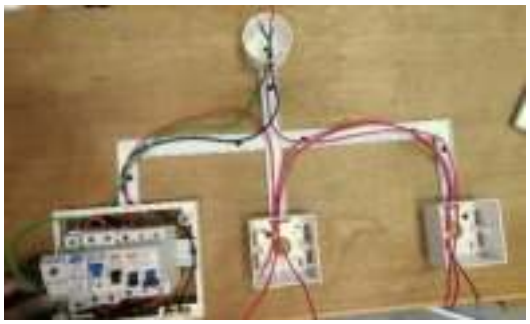
- Insert one live cable from the second terminal box through the casing to the round PVC block. This round PVC block will be the base for lamp holder

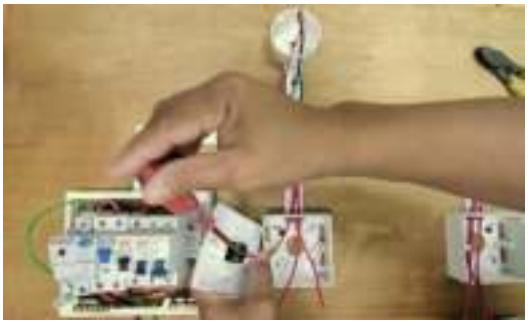
- Fit the neutral cable (black cable) at the neutral terminal. Then insert the neutral cable from the distribution box to the round PVC block.

- Fit the ground cable (green cable) at the ground terminal. Then insert the ground cable from the distribution box to the round PVC block.

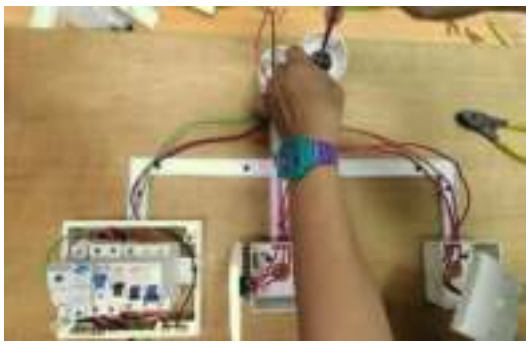
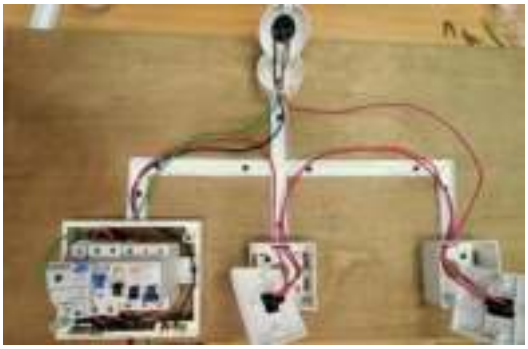



- Fit the live cables at the first terminal box to the first two-way switch. The live cable from distribution box is screw to the terminal common (C) and the two live cables from second two-way switch are screw to the terminal L1 and L2

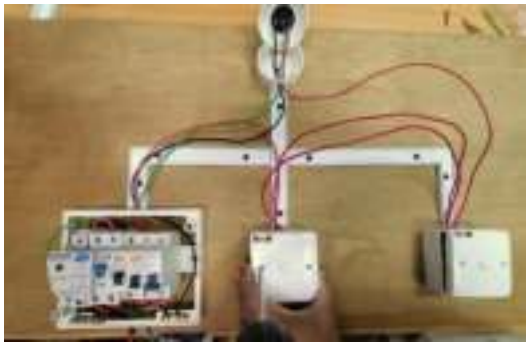



- Fit the live cables at the second terminal box to the second two-way switch. The live cable from the round PVC block is screw to the terminal common (C) and the two live cables from first two-way switch are screw to the terminal L1 and L2


- Fit all the live, neutral and ground cables at the round PVC block to the lamp holder.

- Screw the lamp holder and the switches. Then install the casing cover and the distribution board cover.




- Turn on the switch at main switch, residual current circuit and miniature circuit breaker. Finally, turn on the two-way switches to light up the lamp


3.3 Lighting controlled from multiple points using two-way switches and intermediate switch

This type of lighting circuit is used to control the lamp or the fan from multiple points or locations. For example, a long corridor or walkway used three switches which are the first switch located at the entering point of corridor, the second switch at the middle and the third switch located at the end of corridor. The circuit will connect the miniature circuit breaker 6A to the two-way and intermediate switches and to lamp holder. Other accessories needed are terminal boxes, round PVC block, casing and 1.5 mm2 PVC cables.

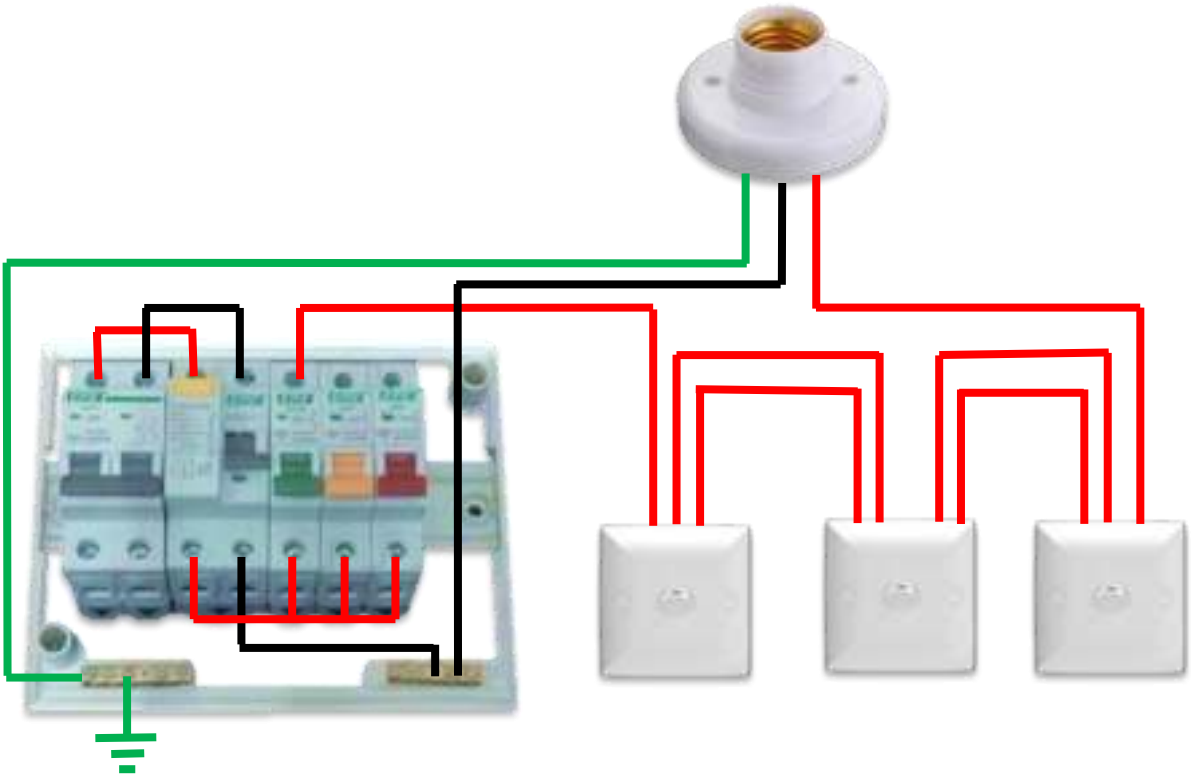
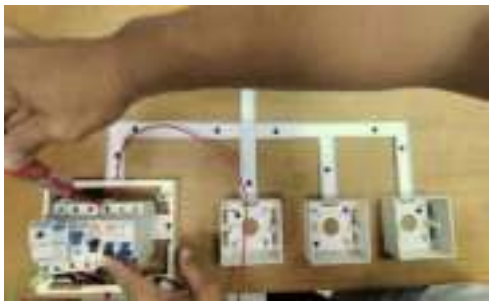


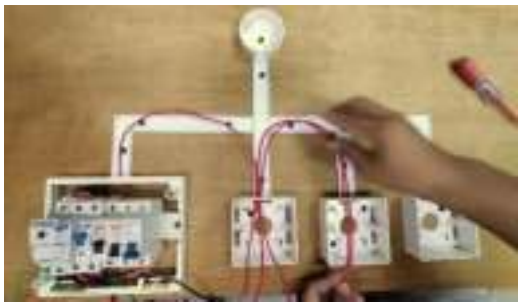
Figure 6: The connection diagram of the light controlled from three points

The connection of the lighting circuit controlled from three points using two-way switch and intermediate switch is starting from the miniature circuit breaker (MCB) that is connected to two two-way switches and intermediate switch using live (red) cable. Next, the live cable from the switches will be connected to the lamp holder together with the neutral (black) and ground (green) cables from the distribution board. The steps to install the connection of the circuit are as following:

- Firstly, fit the live cable (red cable) at the 6A miniature circuit breaker in the distribution board (DB). Then insert the live cable from the DB through the casing to the terminal box. This terminal box will be the base for the first two-way switch.

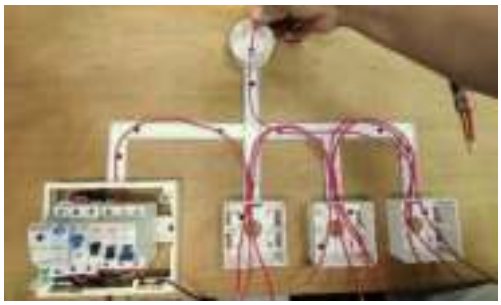



- Insert 2 live cables from the first terminal box to the second terminal box. The second terminal box will be the base for the intermediate switch.

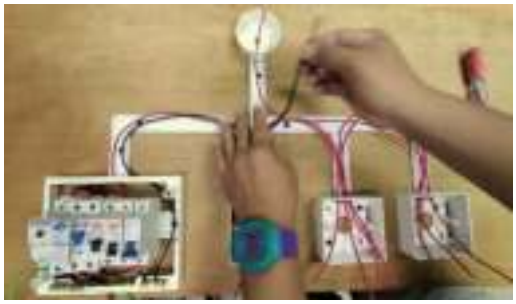
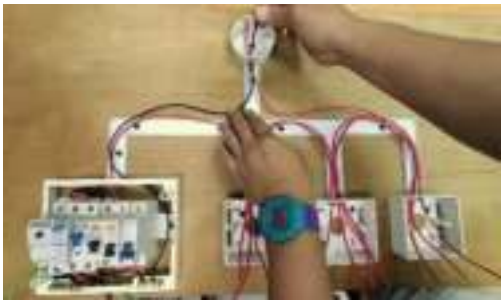



- Next, insert another 2 live cables from the second terminal box to the third terminal box. The third terminal box will be the base for the second two-way switch.

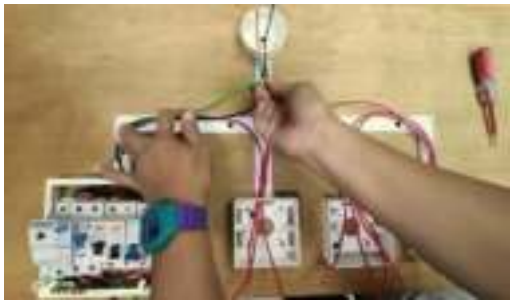
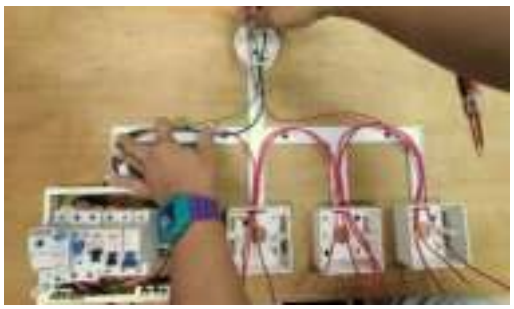

- Insert one live cable from the second terminal box through the casing to the round PVC block. This round PVC block will be the base for lamp holder

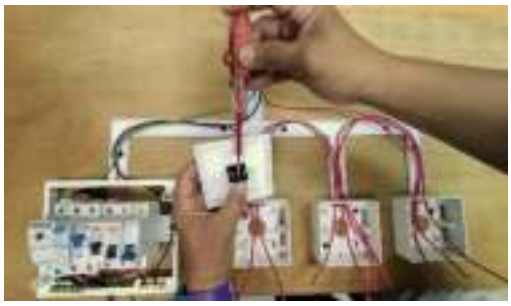
- Fit the neutral cable (black cable) at the neutral terminal. Then insert the neutral cable from the distribution box to the round PVC block.

- Fit the ground cable (green cable) at the ground terminal. Then insert the ground cable from the distribution box to the round PVC block.

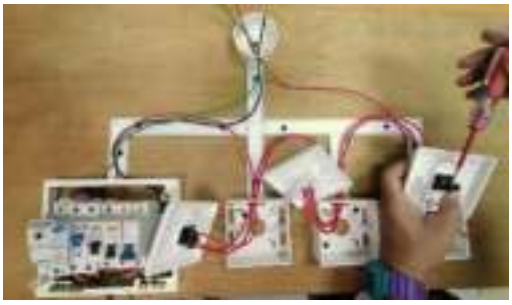



- Fit the live cables at the first terminal box to the first two-way switch. The live cable from distribution box is screw to the terminal common (C) and the two live cables from second two-way switch are screw to the terminal L1 and L2




- Fit the live cables at the second terminal box to the intermediate switch. The live cables from the first two-way switch are screw to the terminal L1 and L3 and the two live cables from second two-way switch are screw to the terminal L2 and L4


- Fit the live cables at the third terminal box to the second two-way switch. The live cable from the round PVC block is screw to the terminal common (C) and the two live cables from the intermediate switch are screw to the terminal L1 and L2




- Fit all the live, neutral and ground cables at the round PVC block to the lamp holder.


- Screw the lamp holder and the switch. Then install the casing cover and the distribution board cover.


- Turn on the switch at main switch, residual current circuit and miniature circuit breaker. Finally, turn on the switches to light up the lamp


The above procedure is used to install the lighting circuit that is controlled from three points. It used two two-way switches and intermediate switch. If there is a need to control the lamp from more points or location, just add more intermediate switches in the middle of those two two-way switches. So, the lamp can be control from multiple points.

4.0 POWER CIRCUIT

Power circuit is the consumer circuit that is used to connect the socket outlet in order to supply the electrical energy to the home appliances via plug top. It is connected from the miniature circuit breaker rating 20A, 30A or 32A at the distribution board to the 13A rating socket outlet using 2.5 mm^2 PVC cable. The socket outlets in the power circuit are connected in two types of connection which are: 1) Radial connection and 2) Ring connection.

4.1 Radial Connection

This type of power circuit is simple and easy to install. Most of socket outlets in the house use this type of connection because it is also low cost. However, this type of connection also has its disadvantages, which is if there is a wire break off at any socket outlet, other socket outlets that share the same connection will also be malfunction. This circuit will connect the miniature circuit breaker 20A to the first and second socket outlets in one route connection. Other accessories needed are terminal boxes, casing and 2.5 mm^2 PVC cables.

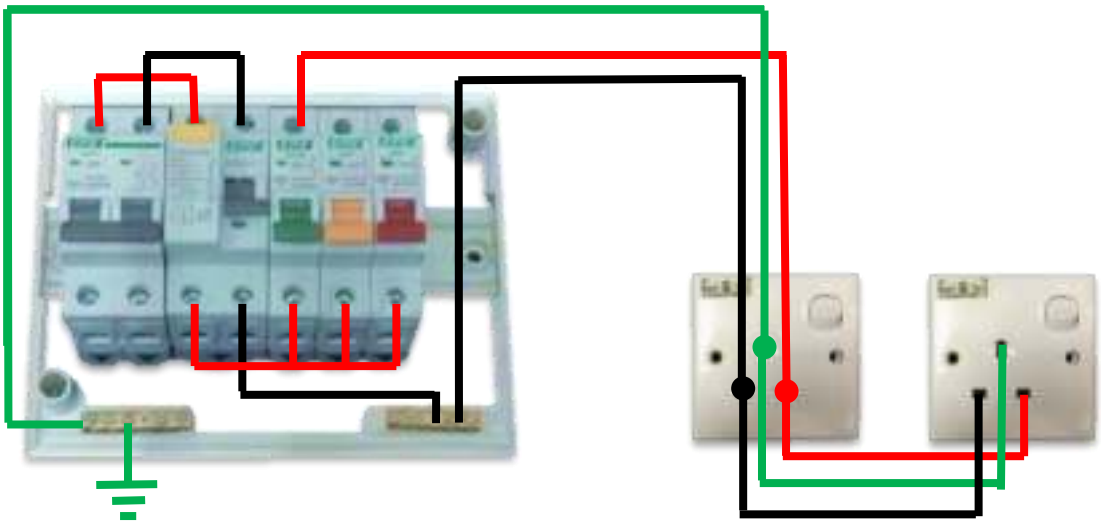
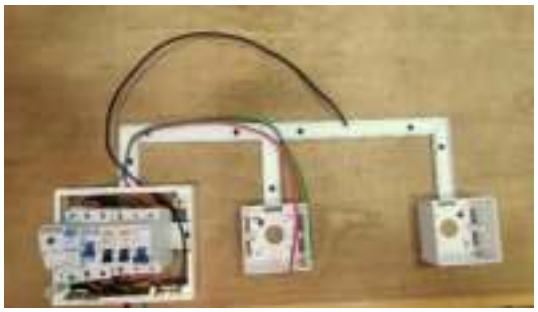
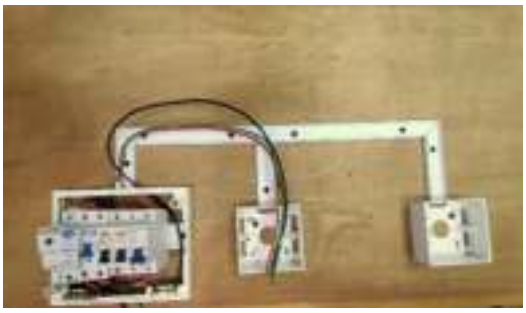


Figure 7: The connection diagram of the power circuit using radial connection

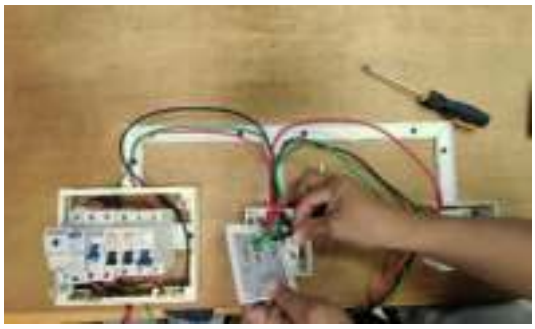
The connection of the power circuit using radial connection is starting from the miniature circuit breaker (MCB) that is connected to socket outlets using live (red) cable, together with neutral (black) cable and ground (green) cable from the distribution board in one route connection. The steps to install the connection of the circuit are as following:

- Firstly, fit the live cable (red cable) at the 20A miniature circuit breaker and fit the neutral cable (black cable) and ground cable (green cable) at each terminal in the distribution board (DB). Then insert all these three cables from the DB through the casing to the terminal box. This terminal box will be the base for the first socket outlet.

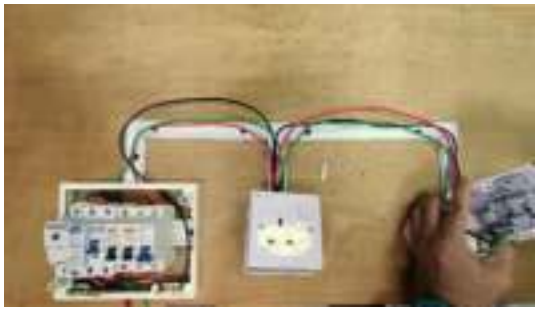
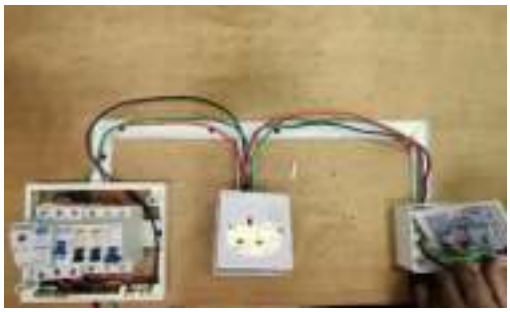



- Insert another live, neutral and ground cables from the first terminal box to the second terminal box. The second terminal box will be the base for the second socket outlet.


- Twist together two live cables at the first terminal box and fit it to the live terminal at the first socket outlet. Repeat the same step with the neutral and ground cables

- Fit the live, neutral and ground cables according to each terminal at the second socket outlet

- Screw the socket outlets. Then install the casing cover and the distribution board cover.


- Turn on the switch at main switch, residual current circuit and miniature circuit breaker. Finally, use the socket tester to test the functionality of the socket outlets.


4.2 Ring Connection

This type of power circuit is a little complex to install and require more cost because it used more cables compared to radial circuit. This type of connection is rarely used at home. However, this type of connection also has its advantage, which is if there is a wire break off at any socket outlet, other socket outlets that share the same connection will still function because there is another route of connection that supply the electrical energy. This circuit will connect the miniature circuit breaker 30A or 32A to the first and second socket outlets in two routes connection. Other accessories needed are terminal boxes, casing and 2.5 mm^2 PVC cables.

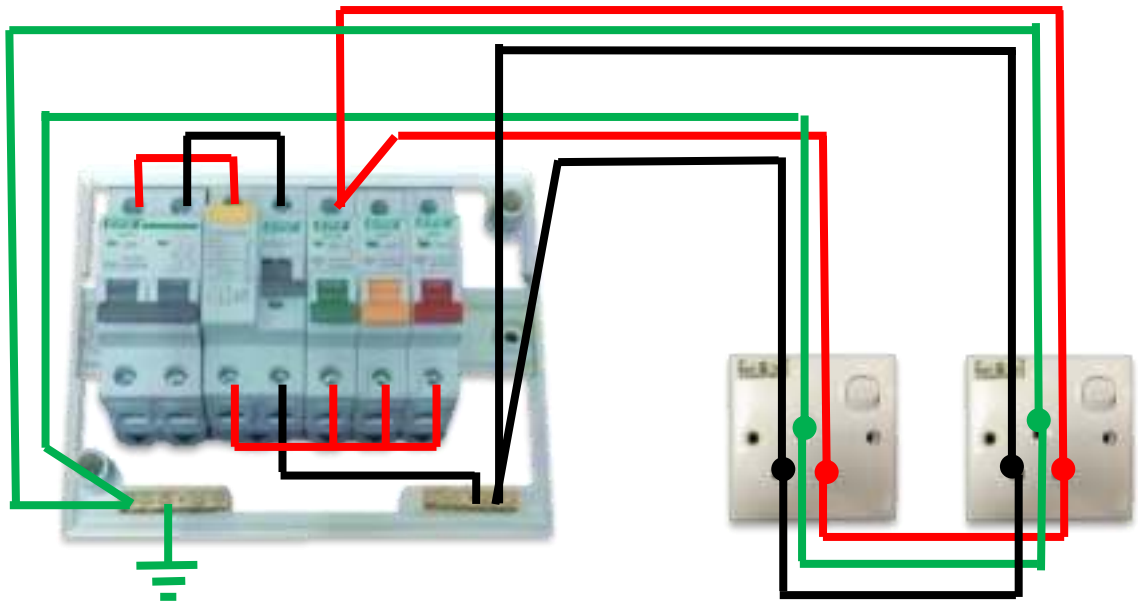
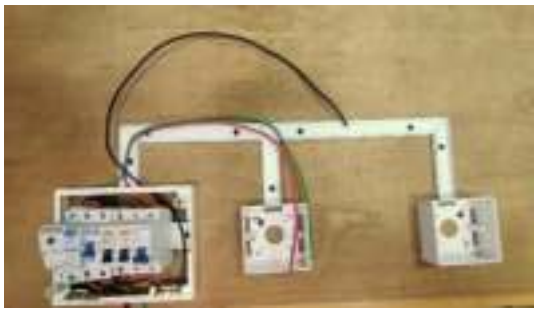
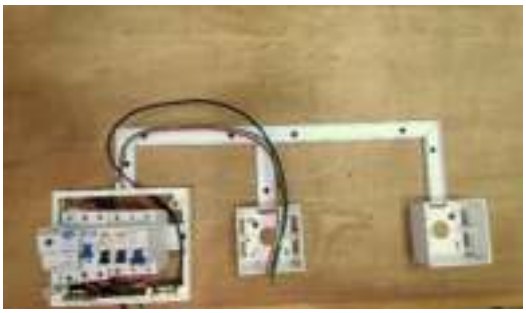


Figure 8: The connection diagram of the power circuit using ring connection

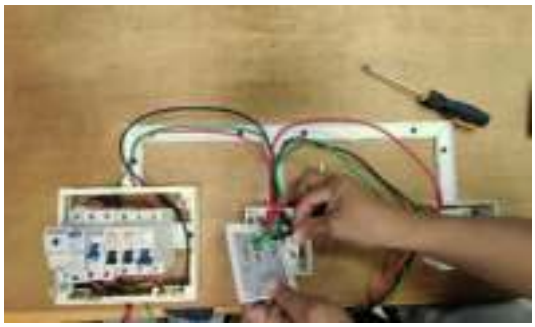
The connection of the power circuit using radial connection is starting from the miniature circuit breaker (MCB) that is connected to socket outlets using live (red) cable, together with neutral (black) cable and ground (green) cable from the distribution board in two routes connection. The steps to install the connection of the circuit are as following:

- Firstly, fit the live cable (red cable) at the 32A miniature circuit breaker and fit the neutral cable (black cable) and ground cable (green cable) at each terminal in the distribution board (DB). Then insert all these three cables from the DB through the casing to the terminal box. This terminal box will be the base for the first socket outlet.

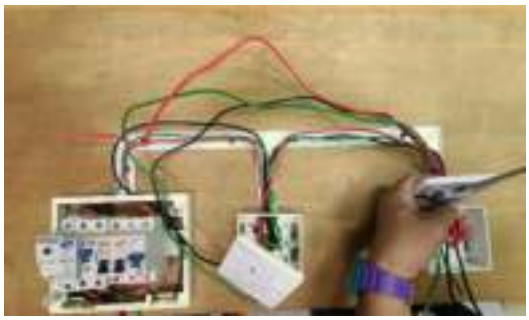
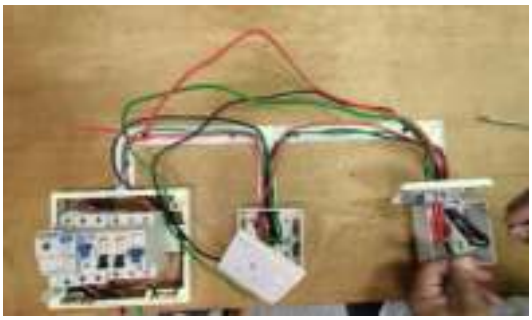



- Insert another live, neutral and ground cables from the first terminal box to the second terminal box. The second terminal box will be the base for the second socket outlet.

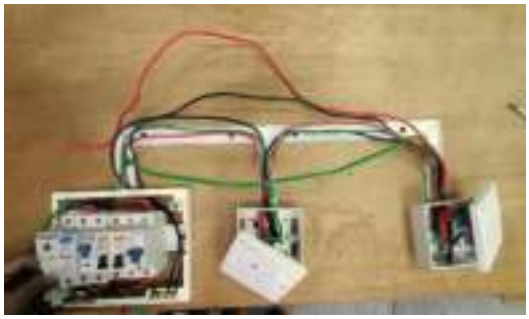
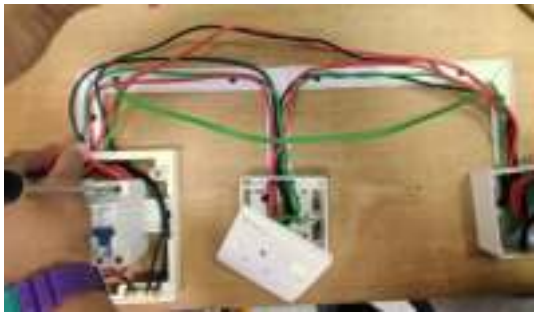

- Twist together two live cables at the first terminal box and fit it to the live terminal at the first socket outlet. Repeat the same step with the neutral and ground cables

- Insert another live, neutral and ground cables from distribution board to second socket outlet. Twist together two live cables at the second terminal box and fit it to the live terminal at the second socket outlet. Repeat the same step with the neutral and ground cables

- Fit the live cable (red cable) at the same 32A miniature circuit breaker and fit the neutral cable (black cable) and ground cable (green cable) at each terminal in the distribution board (DB).

- Screw the socket outlets. Then install the casing cover and the distribution board cover.


- Turn on the switch at main switch, residual current circuit and miniature circuit breaker. Finally, use the socket tester to test the functionality of the socket outlets.

5.0 CLOSING

At this point, you should already know the basic knowledge and procedures on how to install the lighting and power wiring system at your home. The most efficient method in learning any technical skill is by practicing it. So, this could be the starting point for you to start any small wiring project at your home such as adding new lamp circuit or new socket outlet. Knowing this basic knowledge also give the ideas on how the wiring connection works and how to figure out its faulty. This could be very beneficial if there is any malfunction in your home wiring connection. Other than that, improve yourself by gaining more knowledge and skills in electrical wiring so that you will become a better wireman in the future. Goodluck.

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