BAYELSA STATE POLYTECHNIC, ALEIBIRI

P.M.B 168 EKEREMOR

12/40

ELECTRICAL INSTALLATION OF BUILDINGS PRACTICAL MANUAL

COURSE CODE: EEC 129

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINERRING TECHNOLOGY

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MATRIC NUMBER: ND/COMP-ENGR/19/020

Title ***REALIZATION OF ONE WAY SWITCH CIRCUIT using PVC conduit***

Objective.

To realize a circuit consisting of a one-way switch controlling two lamps in parallel

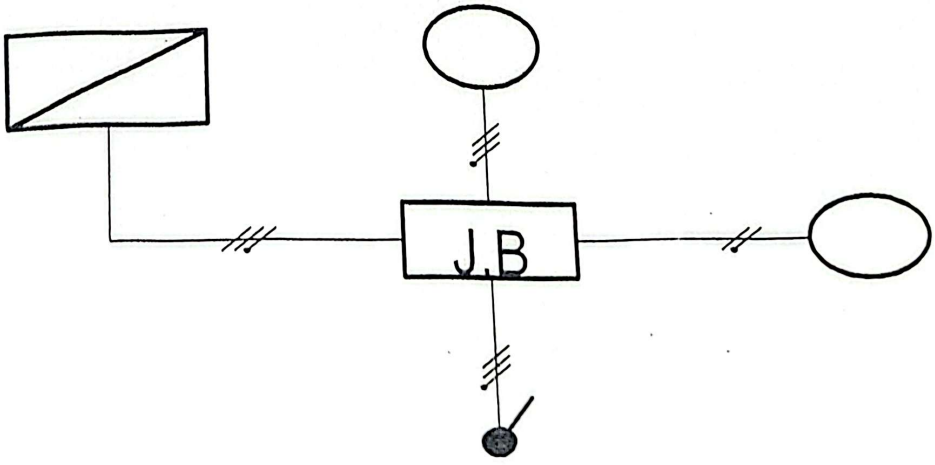
Introduction:

The most commonly used switch in domestic installation is the one way switch. It is used in domestic premises to control either a fluorescent lamp or an incandescent lamp. This practical work familiarizes the student with the connection of the one way switch circuit and further improves the student skill and ability on conduit wiring.

Equipment and tools:

- PVC conduits and their accessories).
- 2 end boxes (3/4 in.).
- 1 steel conduit box with knockouts (3/4 in.).
- 5 sockets and male bushes (3/4 in.).
- 5 spacer bar saddles (3/4 **in.**).
- A 20mm bending spring and a hacksaw.
- A bending machine.
- An electrician tool box.

Layout Diagram



General scheme

Procedure:

Step 1:

Draw the execution plan of the circuit.

Step 2:

Layout the route of the conduits and the position of the boxes on the board.

tep 3:

Cut the conduits to the lengths given by the layout diagram.

tep 4:

Prepare and bend the conduit using bending spring.

tep5:

Secure the conduit ends to the boxes, use adapters where necessary.

tep 6:

Secure the conduits on the board by the saddles.

tep7:

Draw the cables in the fittings and ensure the terminals at the boxes long enough for connections.

tep8:

trip the terminals and connect the circuit according to the layout.

Step 9:

Test the circuit for correct wiring by an ohmmeter.

Step 10:

Supply the circuit with power and ensure proper operation.

EXPERIMENT NO 2: REALIZATION OF two 2- WAY SWITCH CIRCUIT

Objective:

To connect a 2 way switch circuit

Introduction:

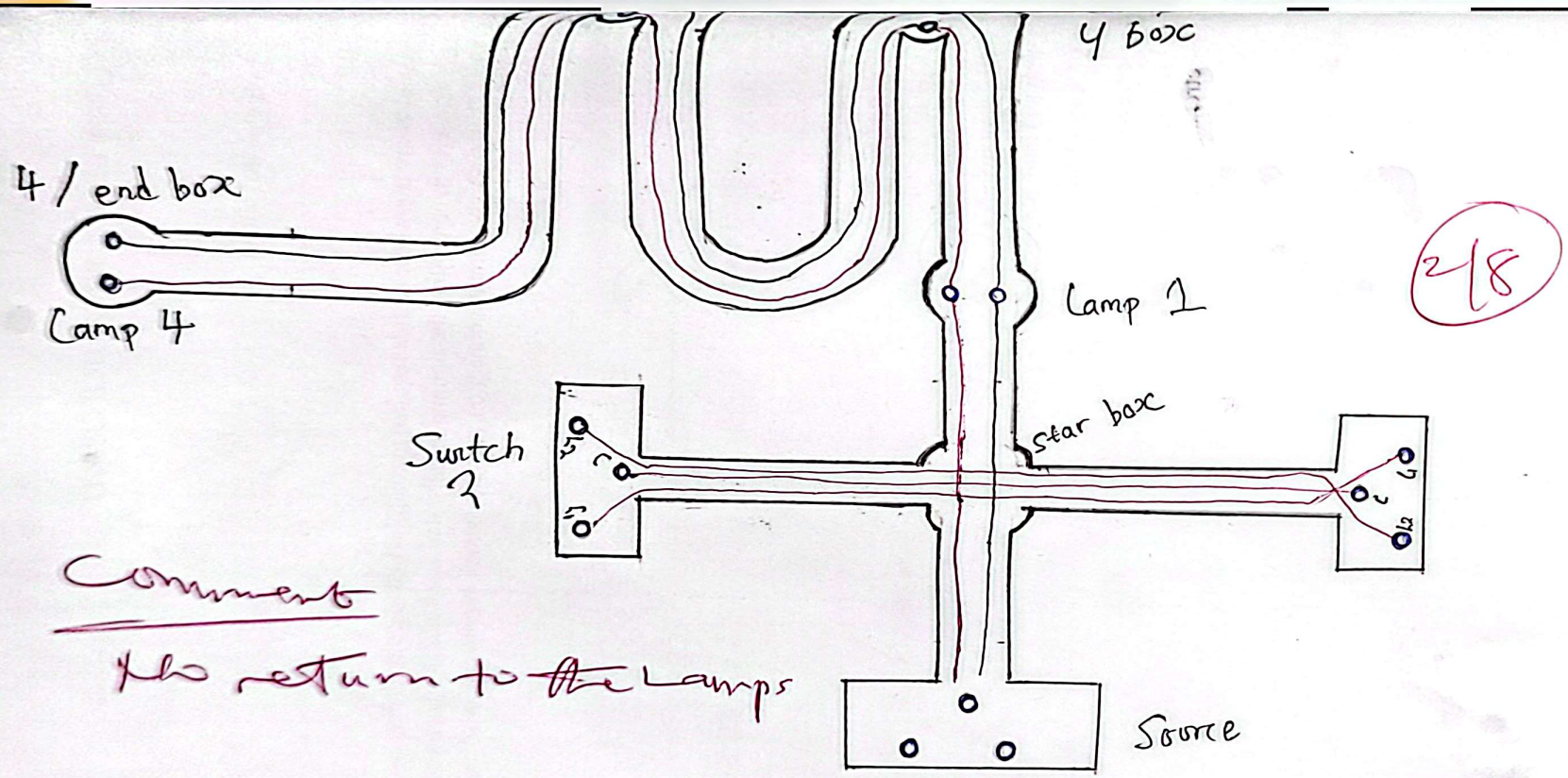
Two 2 way switches are use whenever it is required to control a Lighting circuit from two positions. This is useful in controlling the lighting of halls, stair cases and any room with two doors.Fig.1.2 shows the circuit connection and the symbol representation of the switch.

Figure 2:

Equipment and tools:

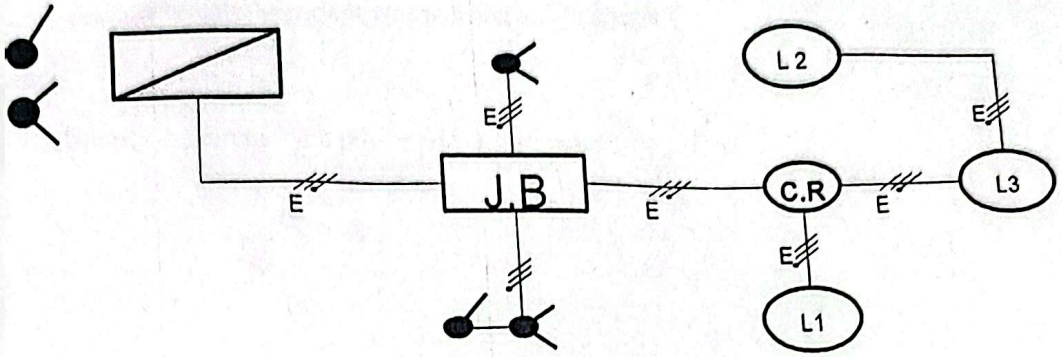
- P V C conduits and their accessories,
- Two 2 way switches.
- Lamp and lamp olders
- PVC cable 1.5mm.
- Hacksaw.
- PVC conduit bending spring.
- Electrcian tool box

Layout Diagram



Comment

No return to the Lamps



1 General scheme

Procedure:

Step 1:

Draw the execution plan of the circuit.

Step 2:

Layout the route of the conduits and the location of the boxes on the board.

Step 3:

Cut the conduit according to the sizes given on the layout diagram.

Step 4:

Make the required 90° bends as shown on the layout diagram. See Fig. (1.3 a, b), for bending springs and methods of bending.

Step 5:

Secure the conduit ends to the boxes, use adopters where necessary.

Step 6:

Secure the conduits to the board by saddles.

Step 7:

Draw the cable and ensure the terminals in the boxes are projected enough for connection to the lamp holders and the switches

Step 8:

Strip the terminals in the boxes and connect up the circuit in a layout diagram.

Step 9:

Test the circuit for correct wiring using an ohmmeter

ep 10:

Supply the circuit with power and ensure proper operation.

Title:REALIZATION OF TWO GANG SWITCH CIRCUIT

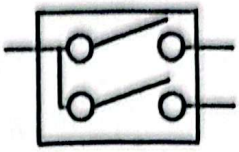
Objective:

To realize a circuit consisting of a one-way switch controlling two lamps in parallel

Introduction:

The most commonly used switch in domestic installation is the one way switch. It is used in domestic premises to control either a fluorescent lamp or an incandescent lamp. This ractical work familiarizes the student with the connection of the one way switch circuit and further improves the student skill and ability to handle heavy gauge steel conduit.

Symbol Representation

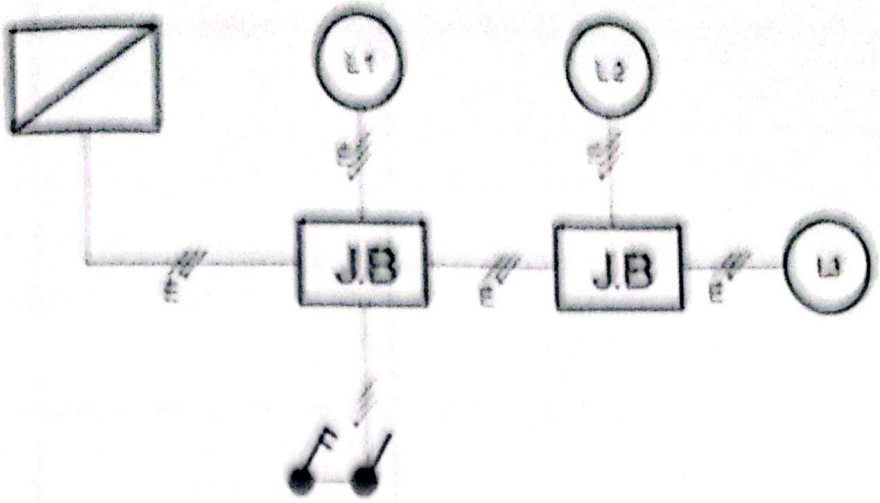


Wiring connection

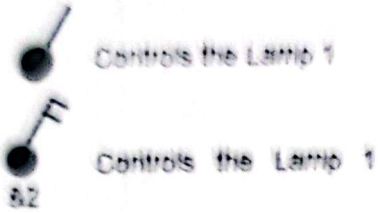
Equipment and tools:

- Heavy gauge steel conduit (3/4 in.).
- 2 end boxes (3/4 in.).
- 1 steel conduit box with knockouts (3/4 in.).
- 5 sockets and male bushes (3/4 in.).
- 5 spacer bar saddles (3/4 in.).
- A pipe vice and a hacksaw.
- Pipe reamer or half round file.
- Stock and die set. >
- Cutting oil or tallow.
- A bending machine.
- An electrician tool box.

Layout Diagram



General scheme



Procedure:

Step 1:
Draw the execution plan of the circuit.

Step 2:
Layout the route of the conduits and the position of the boxes on the board.

Step 3:
Cut the conduits to the lengths given by the layout diagram.

Step 4:
Prepare and bend the conduit using bending spring.

Step5:
Secure the conduit ends to the boxes, use adapters where necessary.

Step 6:
Secure the conduits on the board by the saddles.

Step7:

Draw the cables in the fittings and ensure the terminals at the boxes long enough for connections.

ɔ8:

ɔ the terminals and connect the circuit according to the layout.

p 9:

Test the circuit for correct wiring by an ohmmeter.

p 10:

Supply the circuit with power and ensure proper operation.

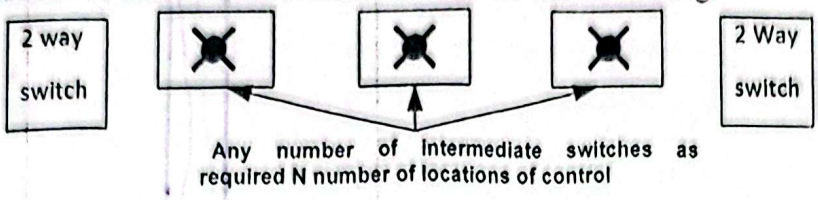
Title: ***REALIZATION OF A LIGHTING CIRCUIT WITH INTERMEDIATE SWITCH USING P.V.C CONDUIT***

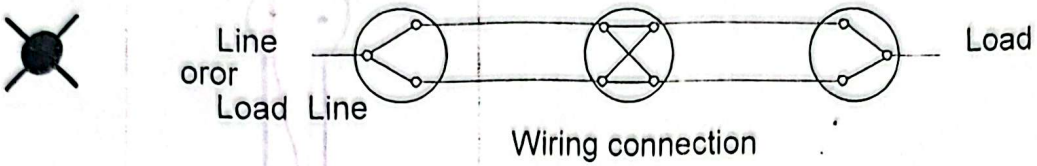
Objective:

To connect an intermediate switch correctly in a lighting circuit and to improve the student skills in handling and using P.V.C conduit.

Introduction:

A lighting circuit can be controlled from any number of locations by the use of intermediate switches together with two 2-way switches. Two controls locations will be provided by the two 2-way switches and the other locations will be provided by the number of intermediate switches used in the circuit. See Fig.



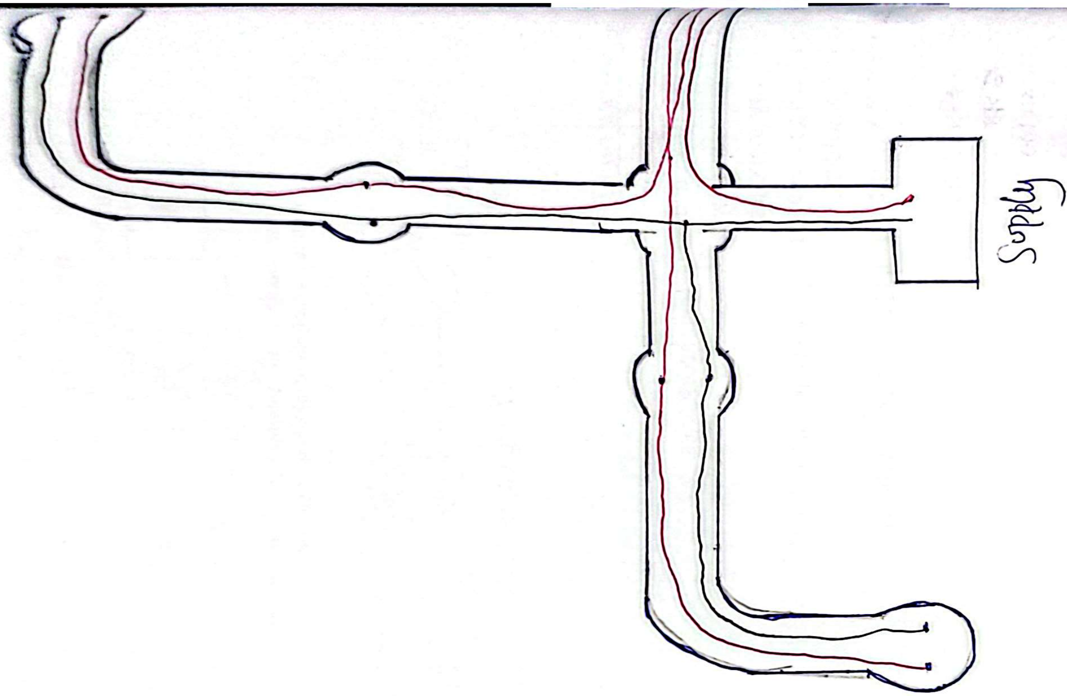


Wiring connection

Equipment and tools:

- 20 mm P.V.C conduits and their accessories.
- One intermediate switch.
- Two 2-way switches.
- Two ceiling roses and two patten lamp holders.
- Two lamp holders.
- 1.5 mm^2 P.V.C cable (red, black and green/yellow).
- Hacksaw.
- Grip vice - Fish tape.
- Bending spring
- Electrician tool box.

Layout Diagram



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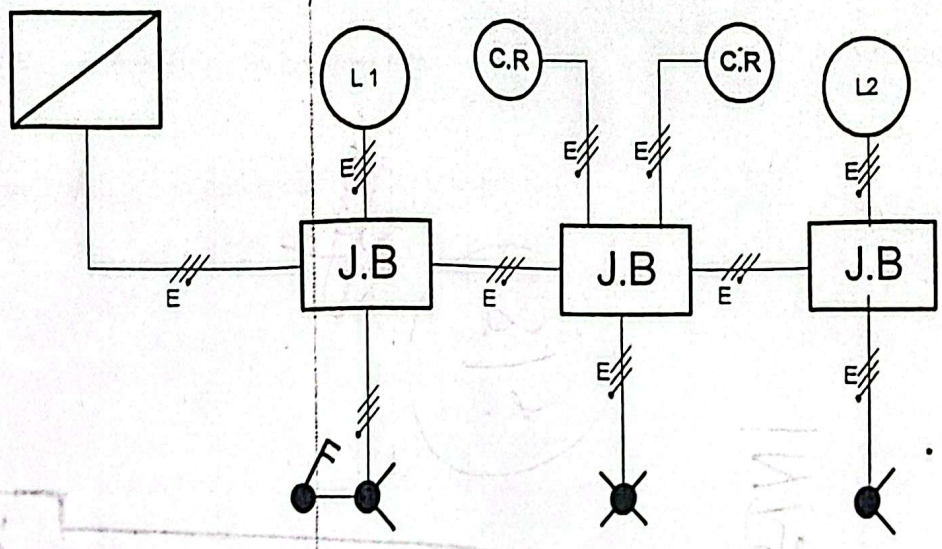
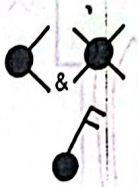
Cable crossing not allowed



General scheme



Controls the Lamp 1 & 2

Controls the C.Rs

Procedure:

Step 1:

Draw the execution plan of the circuit.

Step 2:

Layout the route of the conduits and the position of the boxes on the board.

Step 3:

Cut the conduits to the lengths given by the layout diagram.

Step 4:

Prepare and bend the conduit using bending spring.

Step5:

Secure the conduit ends to the boxes, use adapters where necessary.

Step 6:

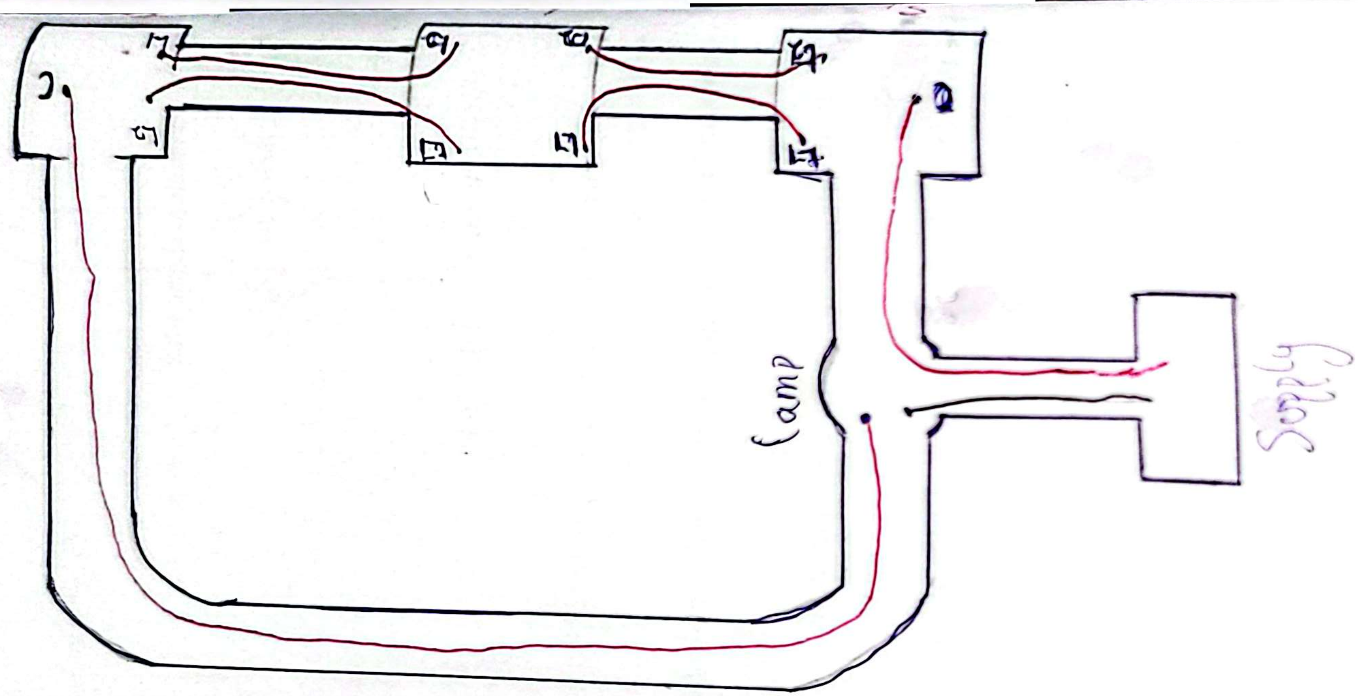
Secure the conduits on the board by the saddles.

Step7:

Draw the cables in the fittings and ensure the terminals at the boxes long enough for connections.

Step8:

Strip the terminals and connect the circuit according to the layout.



INTERMEDIATE SUPPLY SYSTEM

:p 9:
Test the circuit for correct wiring by an ohmmeter.

ep 10:
Supply the circuit with power and ensure proper operation.

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1. [illegible]
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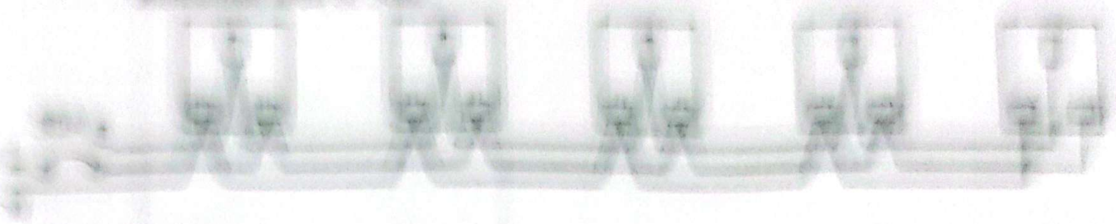
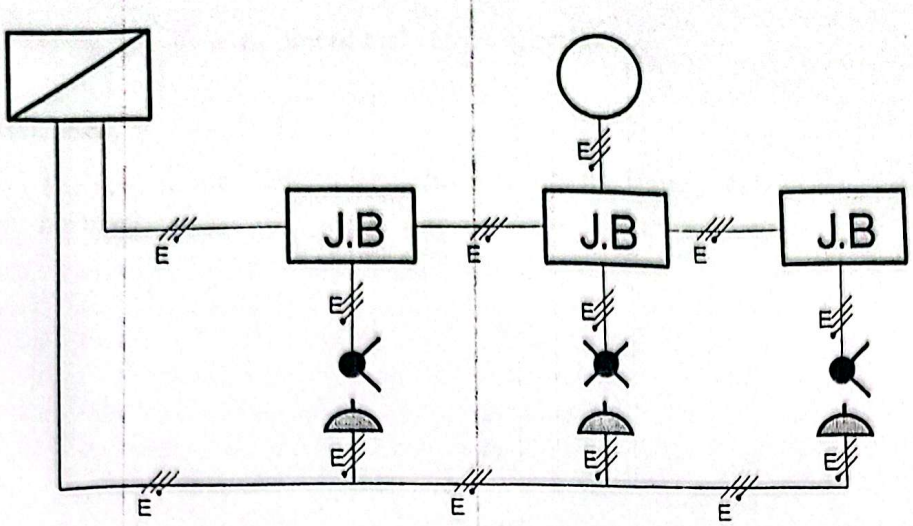


Equipment and tools:

- P.V.C conduits (20 mm) with fish accessories
- P.V.C trunking (25×16 mm)
- 3 socket outlets (13A)
- Two-way switches
- Intermediate switch
- 1.5 mm² P.V.C cables: Red, black, green/yellow
- 2.5 mm² P.V.C cables: Red, black, green/yellow
- 4 flush boxes (P.V.C) and one end box
- 3 surface boxes (P.V.C)
- Hacksaw and grip vice
- Smooth file
- Bending spring
- Tab tape
- Electrician tool box

Layout Diagram:



General scheme

Procedure:

Step 1:
Draw the execution plan of the circuit.

Step 2:
Mark the routes of the conduits and trunking/ as well as the locations of all boxes on the board.

Step 3:
Cut and prepare the trunkings/ then fix them on the board according to the layout diagram.

Step 4:
Fix all boxes on the board/ according to the positions and dimensions given to you.

Step 5:
Cut/ prepare and bend the conduits then secure them to the **boxes** and board.

Step 6:
Install the 2.5 mm^2 cables in the trunking and draw the 1.5 mm^2 cables in the conduits as shown by the layout diagram.

Step 7:
Strip the terminals and connect up the circuits.

Step 8:
Test the circuit for correct wiring/ using an ohmmeter

Step 9:

Supply the **circuit with power** and ensure operation.

Safety note:

The student must not connect the circuit to the supply without the permission of his teacher.

***Title:* REALIZATION OF A RINGCIRCUIT USING P.V.C TRUNKING**

Objective:

To connect a ring main circuit correctly and to consolidate the student skill in connecting the one way switch.

Introduction:

Every residential installation contains at least one ring main circuit. The ring circuit

uses 13A socket outlets/ wired with 2.5mm^2 cable and protected by a 30A circuit breaker. The circuit can serve a maximum area of 100m^2 and the maximum number of sockets it can contain is 10 with 2 **spur.**

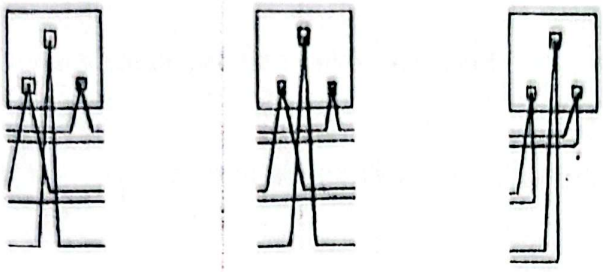


Fig. (1.7) 3 socket outlets connected to form a ring circuit

Fig. (1.7) indicates the way by which sockets are connected to form a ring circuit.

Equipments and tools:

- P.V.C conduits size 20 mm with their accessories
- P.V.C trunking (25 x16 mm)
- 3 pieces of 13 A socket outlets
- 1 one way switches
- 3 lamp holders
- 2 end boxes (P.V.C) + 1 angle box + 1 through box

tep 1:

raw the execution plan of the circuit.

tep 2:

Mark the routes of the conduits and trunking/ then locate the positions of all boxes.

tep 3:

Fix all boxes on the **board as indicated by the layout diagram**

tep 4:

Cut the trunking to the correct length then fix them on the board.

tep 5:

Cut/ bend and prepare the conduits, then secure them to the board, with space bar saddles.

tep 6:

nstall the cables **in the**trunking and draw them **in** the conduits using fish tape.

tep 7:

Strip/ the terminal/ in the boxes/ and connect up the circuit as shown by the layout liagram.

tep 8:

Test the circuit by an ohmmeter for correct wiring.

tep 9:

upply the circuit with power to ensure proper operation.

afety **Note:**

Never supply the circuit with power without the teachers permission.

TITLE: **REALIZATION OF POLARITY TEST**

Objective: To connect a simple circuit and to perform the polarity test on it.

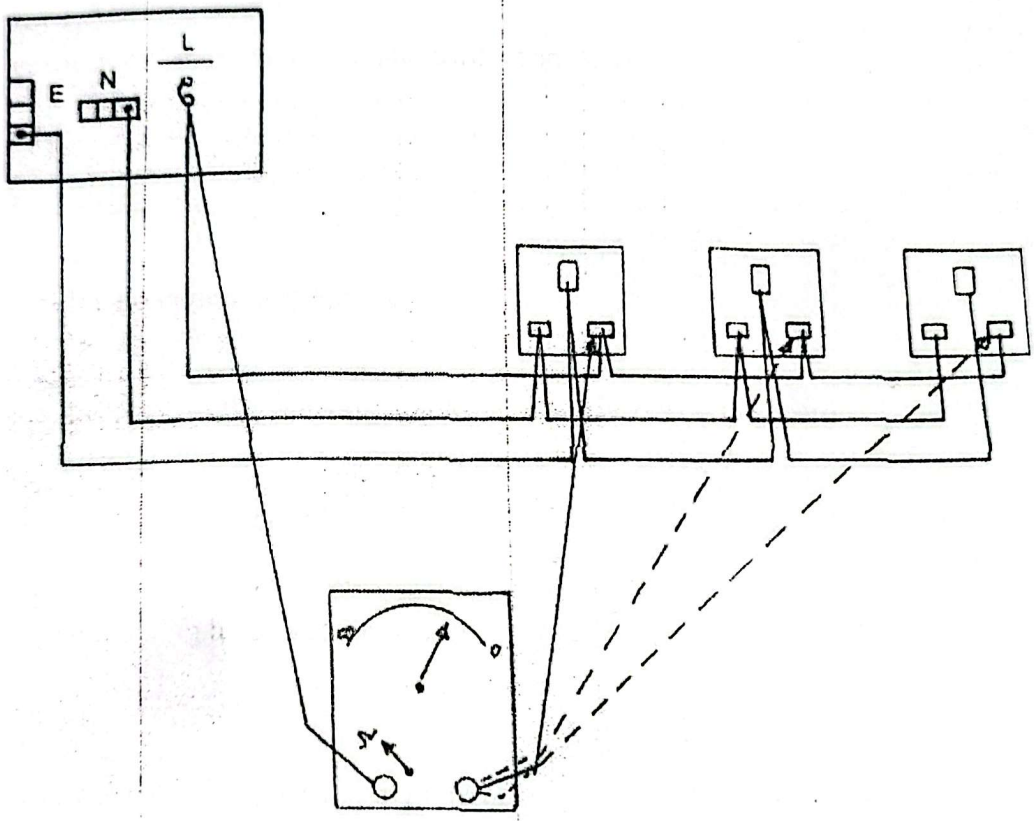
Introduction:

This test is carried out to ensure that all protective devices and single pole controls, (e.g one-way switches) are connected in the phase conductor only. In addition the test confirms that socket outlets "\L' terminals are connected to the phase conductor/ "N" terminals are connected to the neutral conductor and the "E" terminals are connected to the earth continuity conductor (E.C.C) It also confirms that the centre contact of Edison-type screw (E.S) lamp holders are connected to the phase side of the supply.

Tests are carried **out with all switches dosed,** lamps and equipment removed.

The test instrument can be a continuity tester, or a low- reading ohmmeter if no main supply is available. If the circuit is "live" a test lamp with approved and fused leads and test probes can be used.

Circuit **diagram**



Equipment and Material:

- 20 mm P.V.C conduits and their accessories.
- 2.5mm^2 P.V.C cable.
- 13A socket outlets.
- Multimeter(polarity tester). - Electrician tool box.

Procedure:

Step 1:

Connect up the circuit on the board.

Step 2:

Connect one lead of the tester to the line terminal in the D.B/ and the other one to the " L" terminal of each socket.

Note:

If a reading is obtained on the ohmmeter then the polarity of the phase conductor is correct.

Step 3:

Repeat step (2) for the neutral and earth conductors.

Procedure:

Step 1:

Draw the execution diagram.

Step 2:

Mark the route of the trunking and locations of boxes on the board.

Step 3:

Fix all boxes on the board.

Step 4:

Cut the trunking to the required length and fix them.

Step 5:

Install the cables in the trunking and boxes.

Step 6:

Strip the terminals in the boxes and connect **up the circuit**

tep 7:
est the circuit for correct wiring by an ohmmeter.

tep 8:
upply the circuit with power and ensure proper operation.

Objective:
To connect up a lighting circuit and to perform the earthing test on it.

Introduction:

This test is required to find the resistance of the continuity conductors (ECC) in order to verify that these conductors are correctly connected and electrically sound. This is important from safety point of view. It shows that when an earth leakage fault occurs, the resistance to the fault current flowing through these conductors (ECC) is low enough to result in melting the fuse or opening the circuit breaker protecting the circuit. The readings obtained for the resistances of the (ECC) should not exceed 1 ohm. Fig.(1.10) shows how this test is carried out in socket circuits.

Note that the resistance or impedance of the complete earth-fault path is not taken into account by this test/ and the test for this impedance is outside the scope of this book.

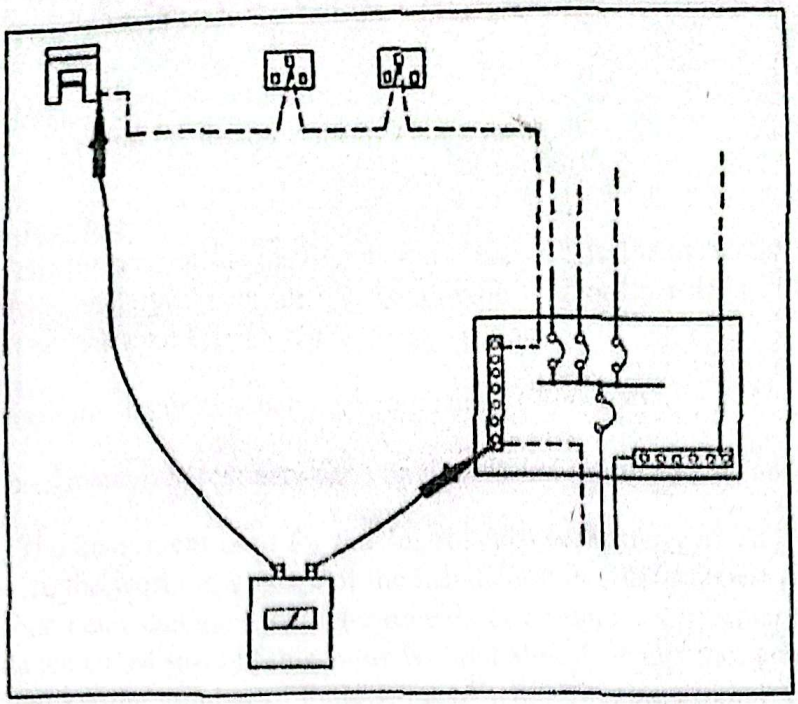


Fig. (1.10)

REALIZATION OF INSULATION RESISTANCE TEST

Objective:

To perform insulation tests on a simple circuit.

Introduction:

The purpose of the insulation-resistance (IR) test is to ensure that the quality of the insulating materials used in the installation is good/ particularly the insulation of the circuit conductors. Fig. (1.12).

a - Insulation test between conductors (L and N)

b - Insulation test between conductors and earth ("L/ N" and E)

The instrument used for making this test is the megger. The testing voltage should be twice the working voltage of the installation in order to stress the insulation to check if it has been damaged or deteriorated. The minimum acceptable value of insulation resistance is 1M -n-/ but this value will not always remain the same. It depends on many factors like/ the number of outlets (i.e switches, lighting fittings/ socket outlets/ etc), the moisture and dirt being present on the wiring/ fittings and accessories.

Before carrying this test/ it is essential to disconnect any neons and capacitors from the circuit because they will upset the readings/ obtained. In addition any device which contain semi-conductor components must also be disconnected as they can be damaged by the test voltage.

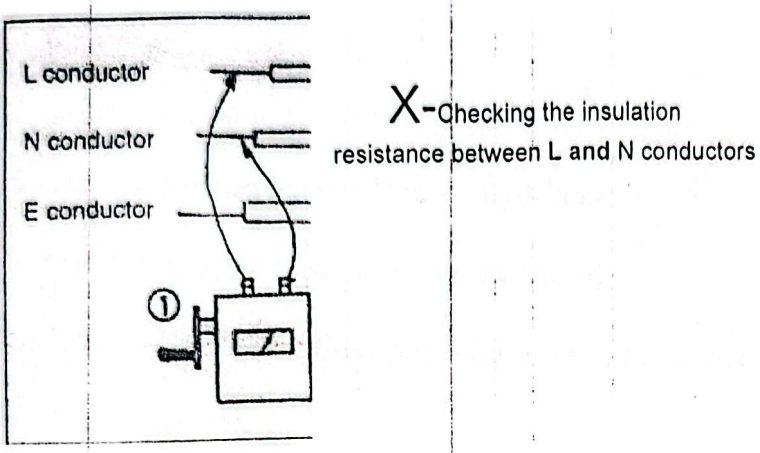


Fig. (1.12)

Circuit Digram

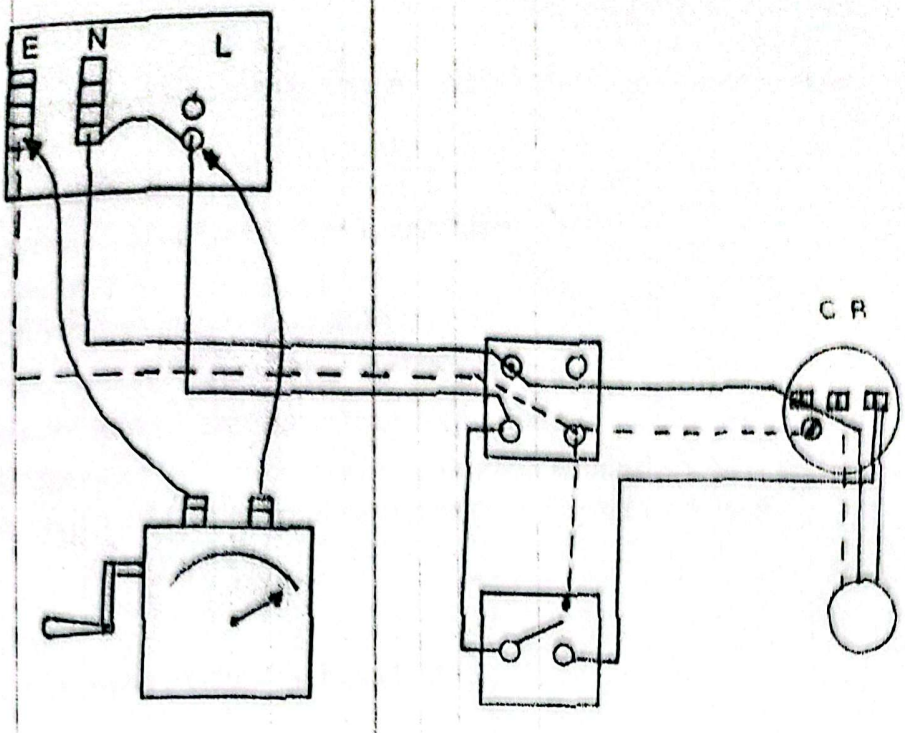


Fig. (1.13)

Equipment and tools:

- P.V.C conduits with accessories.
- One-way switch.
- Ceiling rose.
- A lamp and a patten lamp holder. - 2 flash boxes.
- 1.5mm^2 P.V.C cable (red, black/ yellow/green).
- Insulation resistor tester (Megger). - Hacksaw and grip **vice.**
- Electrician tool box.

Procedure:

Connect the circuit as shown in Fig. (1.13).

Test 1:

Insulation - resistance test between conductors and earth.

Before testing.

-a) Disconnect mains supply by opening main switch and removing main fuses.

Make sure that all lamps are in their lampholders.

b) Place all switches in the ON position.
c) See that all circuit breakers are in the ON position.
d) Connect one lead of the tester to the joined L and N.
e) Connect the other lead of the tester to main earth terminal.
f) Operate the tester/ obtain a reading and record it in your work book.

Test 2:

Insulation test between conductors/ Fig. (1.13).

Before testing.

a) Disconnect main supply.
b) Place all switches in the ON position.
c) Remove all lamps from their holders.
e) See that all circuit breakers are in ON position.
f) Connect one lead of the tester to the terminal and the other lead to the neutral terminal.
g) Operate the tester and record the reading in your workbook

Objective:

To perform the continuity test.

Introduction:

This test is made to ensure that the conductors are continuous throughout their length and are good conductors in that, their resistance is zero or nearly zero. The instrument used to carry out this test is the continuity tester or a low-reading ohmmeter. In ring main circuits the test is made to ensure that the conductors (Line/ neutral earth) are electrically continuous and to make sure that there is no breaks or disconnection in these conductors. An actual break could exist in the ring circuit without detection because one conductor will remain connected to the supply and could thus be overloaded.

Equipment and tools:

- P.V.C conduits with accessories. - 3 13A socket outlets
- 3 flash boxes.
- 2.5mm^2 P.V.C cables (Red/black. green/yellow).
- Hacksaw - Grip vice
- Smooth file
- Electrician tool box.

Circuit Diagram

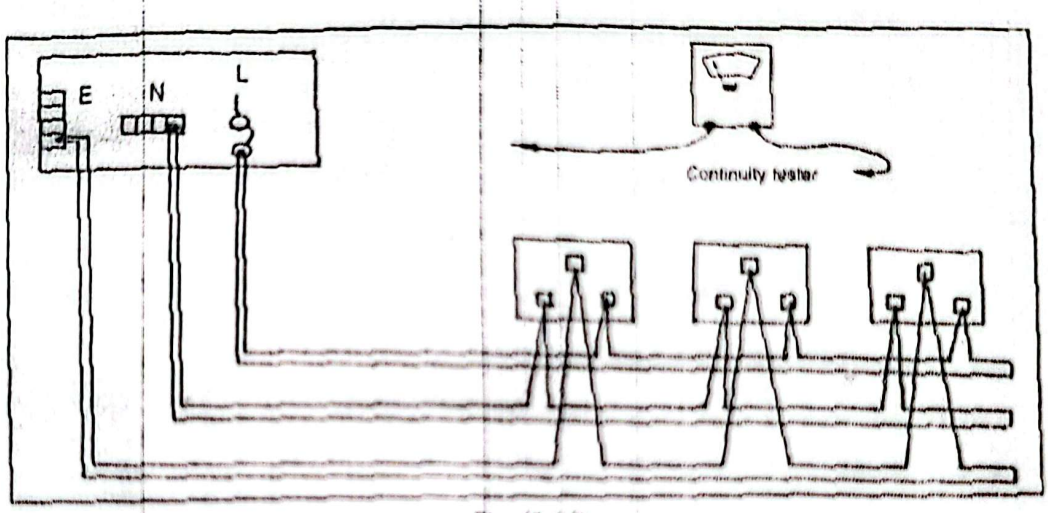


Fig (1.14)

Procedure:

Step 1:
Connect the ring main circuit as shown in Fig. (1.14).

Step 2:
Disconnect the ends of the line conductor in the distribution board Fig. (1.15).

Step 3:
Connect the tester between **the** two ends of the line conductor as shown in the figure.

Step 4:
Read the value and record it in your work book.

Step 5:
Repeat steps (2), (3) and (4) for the neutral and earth conductors.

Step 6:
Join the ends of L conductors again and connect one lead of the instrument to the join/ Fig. (1.16).

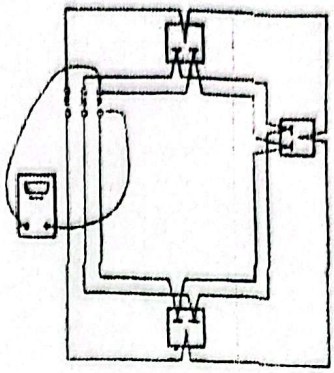


Fig. (1.15)

Step 7:
Connect the other lead to the 'L' terminal of each socket outlet.

Step 8:
Read the ohmmeter and complete table ()/ in your workbook.

Step 9:
Repeat steps (6)/ (7) and (8) for the nature and earth conductors.

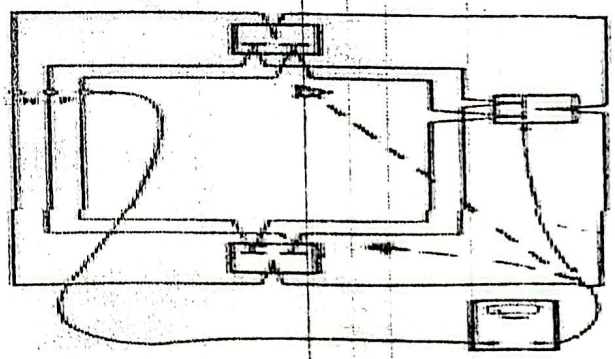


Fig. (1.16)