ELECTRONICS MECHANIC

TRADE PRACTICAL

NSQF LEVEL - 4.5

VOLUME - 2

HANDBOOK FOR CRAFTS INSTRUCTOR TRAINING SCHEME

Directorate General of Training

DIRECTORATE GENERAL OF TRAINING
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
GOVERNMENT OF INDIA

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

Post Box No. 3142, CTI Campus, Guindy, Chennai - 600 032

Published by

National Instructional Media Institute
Post.Box.No. 3142,
Guindy, Chennai - 600032
Email : chennai-nimi@nic.in
Website: www.nimi.gov.in

First Edition, 2024

Rs. 430/-

Printed in India at
National Instructional Media Institute
Post. Box. No. 3142,
Guindy,
Chennai - 600032

Disclaimer

The information contained herein has been obtained from sources reliable to Directorate General of Training, New Delhi. NIMI disclaims all warranties to the accuracy, completeness or adequacy of such information. NIMI shall have no liability for errors, omissions, or inadequacies in the information contained herein, or for interpretations thereof. Every effort has been made to trace the owners of the copyright material included in the book. The publishers would be greatfull for any omissions brought to their notice for acknowledgements in future editions of the book. No entity in NIMI shall be responsible for any loss whatsoever, sustained by any person who relies on this material. The material in this publication is copyrighted. No parts of this publication may be reproduced, stored or distributed in any form or by any means either on paper or electronic media, unless authorized by NIMI.

A Comprehensive Training Program
under Crafts Instructor Training Scheme (CITS)
for Instructors

HANDBOOK ON TECHNICAL INSTRUCTOR TRAINING MODULES

अतुल कुमार तिवारी, I.A.S.
सचिव

ATUL KUMAR TIWARI, I.A.S.
Secretary

सत्यमेव जयते

भारत सरकार
कौशल विकास एवं उद्यमिता मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
AND ENTREPRENEURSHIP

Foreword

In today's rapidly evolving world, the role of skilled craftsmen and women is more crucial than ever. The Craft Instructor Training Scheme (CITS) stands at the forefront of this transformation, shaping the educators who will train the next generation of artisans and technicians. This book aims to provide an in-depth understanding of the subject, exploring its significance, methodologies, and impact on vocational training.

The Craft Instructor Training Scheme was established with the objective of enhancing the quality of instruction in industrial training institutes and other vocational training institutions. By equipping instructors with advanced skills and knowledge, the scheme ensures that they are well-prepared to impart high-quality training to their students. This, in turn, contributes to the creation of a highly skilled workforce capable of meeting the demands of modern industry.

The initial chapters provide the importance of specialized instructor training. Following this, detailed chapters delve into the curriculum covering advanced techniques, safety protocols, and instructional strategies. Each section is designed to offer both theoretical insights and practical applications, ensuring a well-rounded understanding of the subject.

The book offers recommendations for overcoming obstacles and enhancing the effectiveness of the program, with the ultimate goal of producing highly skilled instructors capable of shaping the future workforce.

This book is intended for a diverse audience, including current and aspiring instructors, vocational training administrators, policymakers, and industry stakeholders. It serves as a valuable resource for understanding the intricacies of the subject and its pivotal role in vocational education.

I extend my heartfelt gratitude to all contributors who have shared their experiences and expertise, enriching this book with their valuable insights. Special thanks to the contribution of the development team, reviewers and NIMI that have supported this endeavor, providing essential data and resources.

It is my sincere hope that this book will inspire and guide readers in their efforts to enhance vocational training, ultimately contributing to the development of a skilled and competent workforce.

ATUL KUMAR TIWARI, I.A.S.
Secretary, MSDE

त्रिशलजीत सेठी
महानिदेशक
Trishaljit Sethi, IPoS
Director General

सत्यमेव जयते

भारत सरकार
कौशल विकास एवं उद्यमशीलता मंत्रालय
प्रशिक्षण महानिदेशालय
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

FOREWORD

The Craftsmen Training Scheme (CTS) implemented by the Directorate General of Training (DGT) provides skill training to the youth and ensures a steady flow of skilled manpower for the industry. It aims to raise quantitatively and qualitatively the industrial production by systematic training, and to reduce unemployment among the youth by providing them with employable skills.

The Craft Instructor Training Scheme (CITS) is an indispensable part of the Craftsmen Training Scheme (CTS). It offers comprehensive training both in 'skills' and in 'training methodology' to the instructor trainees to make them conversant with techniques of transferring hands-on skills.

I congratulate NIMI for taking the initiative of preparation of the course content for CITS. This will help institutionalize the mechanism for imparting training to the trainers all across the ecosystem. I also extend my gratitude to the Instructors and Officials of National Skill Training Institutes (NSTIs) and the DGT for their invaluable contribution in preparation of the CITS course content.

As we navigate the complexities of a rapidly changing world and the technological disruptions, the significance of CTS and CITS has increased manifold. It not only empowers individuals with practical skills but also lays the foundation for a prosperous future. I am confident that this book will serve as a guiding light to all instructor trainees for skill development and nation-building.

Trishaljit

(Trishaljit Sethi)

PREFACE

The Craft Instructor Training Scheme is an indispensable module of the Craftsmen Training Scheme, which has been an integral part of the Indian skill development industry since its inception. This program aims to equip instructors with the necessary skills and teaching methodology to effectively transfer hands-on skills to trainees and promote a holistic learning experience. The first Craft Instructor Training Institute was established in 1948, followed by six more institutes across India in 1960. Today, these institutes, including the National Skill Training Institute (formerly Central Training Institute for Instructors), offer the CITS course, which is mandated by the Directorate General of Training (DGT).

The Craft Instructor training program is designed to develop skilled manpower for industries. The course aims to offer instructors an opportunity to improve their instructional skills, engage learners effectively, offer impactful mentoring, and make efficient use of resources, leading to a more skilled workforce in various industries. The program emphasizes collaborative and innovative approaches to teaching, resulting in high-quality course delivery. Overall, the Craft Instructor Training Scheme is a pivotal program that helps instructors grow in their careers and make a significant contribution to society. This program is essential for developing skilled manpower and promoting a robust learning environment that benefits both trainees and instructors alike.

ACKNOWLEDGEMENT

National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following experts to bring out this Instructional material **(Trade Practical)** for **CITS Electronics Mechanic (Volume - II of II) (NSQF Level - 4.5)** under the **Electronics & Hardware** Sector for **Instructors**.

MEDIA DEVELOPMENT COMMITTEE MEMBERS

Smt. K. Arulselvi	-	Assistant Director, NSTI, Chennai.
Shri. S. Janardhanam	-	Training Officer, NSTI, Chennai.
Smt. K. Hemalatha	-	Vocational Instructor, NSTI, Chennai.

COORDINATORS

Shri. G.C. Ramamurthy	-	Joint Director, CD - Section, DGT.
Shri. T.V. Rajasekar	-	Joint Director, NIMI, Chennai.
Shri. Shiv Kumar	-	Training officer, CD - Section, DGT.

NIMI records its appreciation of the Data Entry, CAD, DTP Operators for their excellent and devoted services in the process of development of this Instructional Material.

NIMI also acknowledges with thanks, the invaluable efforts rendered by all other staff who have contributed for the development of this Instructional Material.

NIMI is grateful to all others who have directly or indirectly helped in developing this IMP.

ABOUT THE TEXT BOOK

The Vocational Instructor Training Program is a comprehensive initiative designed to equip aspiring students with the necessary skills and knowledge to effectively teach in vocational education settings. This program encompasses a range of pedagogical strategies, instructional techniques, and subject-specific content tailored to the diverse vocational fields. Participants engage in coursework that covers curriculum development, assessment methods, classroom management, and the integration of industry-relevant technologies. Practical experience and hands-on training are emphasized, allowing participants to apply theoretical concepts in real-world teaching environments. Through collaborative learning experiences and mentorship opportunities, aspiring vocational instructors develop the confidence and competence to facilitate engaging and impactful learning experiences for their students. This training program aims to cultivate a new generation of educators who are not only proficient in their respective vocational fields but also adept at fostering the success and employability of their students in today's competitive workforce.

This text book covers communication, self-management, information and communication technology, entrepreneurial and green skills. It has been developed as per the learning outcome-based curriculum.

G C Rama Murthy,
Joint Director,
Curriculum Development, DGT,
MSDE, New Delhi.

MODULE 13: Cell phones

EXERCISE 118: Dismantle, Identify the parts and assemble different types of smart phones

Objectives

At the end of this exercise you shall be able to:

- dismantle the given cell phone/smart phone
- identify the different sections/parts of the cell phone/smart phone
- list the different sections/parts of the cell phone/smart phone
- reassemble the given cell phone/smart phone.

Requirements

Tools/Materials

- Precision Screwdriver Set - 1 set.
- Tweezers - 1 pair.
- Plastic Opening Tools - 1 set.
- Heat Gun - 1 set.
- Soldring Iron - 1 No.
- Desoldring Pump - 1 No.
- Replacement Parts - as reqd
- Magnifying Glass - 1 No.
- Smart Phone - 1 No.
- Digital Multimeter with probes - 1 No.
- User Manual of the given cell phone - 1 No.

Procedure

TASK 1: **Dismantling the cell phone / smart phone**

1 Switch OFF the cell phone/smart phone and locate small hole next to headphone jack. Push the tip of a needle or paperclip into hole to eject sim tray. (Fig 1)

2 Hold your device on end to locate two small screws on either side of the back cover. Remove the screws using a small star screwdriver. (Fig 2)

Fig 1

Fig 2

3 Insert a spudger between the chrome ring and front panel glass directly above one of the screw holes. Try gently to separate the display from the back panel. (Fig 3)

4 Lift the panel up from the back cover end be careful not to tear or break any ribbons connected near the other end.(Fig 4)

Fig 3

Fig 4

5 Continue to hold the display panel with one hand, and use your other hand and a spudger to disconnect the black ribbon cable labeled “1”.(Fig 5)

6 Rotate the display assembly up until it is roughly vertical. This will allow easier access for removing the remaining cables. (Fig 6)

Fig 5

Fig 6

7 Use a spudger to disconnect the black ribbon cable labeled “2”(Fig 7)

8 Use a spudger to flip up the white plastictab holding the remaining cable in place. The white tab will rotate up 90 degrees, releasing the ribbon cable(Fig 8)

Fig 7

Fig 8

9 Slide the black ribbon cable out of its connector, and remove the display assembly from the cell phone.(Fig 9)

10 Remove the screws surrounding the motherboard:

Remove the screws 2-3 mm star screws with partial thread securing the logic board to the rear panel. (Fig 10)

Fig 9

Fig 10

11 Remove the screws using 2-3 mm star screws with full threads securing the logic board and camera. (Fig 11)

12 Remove the screws using 2-3mm star screw from beneath the “Do not remove” sticker. (Fig 12)

Fig 11

Fig 12

13 Unplug ribbon which is connected to display and other parts. (Fig 13)

14 Unplug this connecting ribbon and place the mother board aside. (Fig 14)

Fig 13

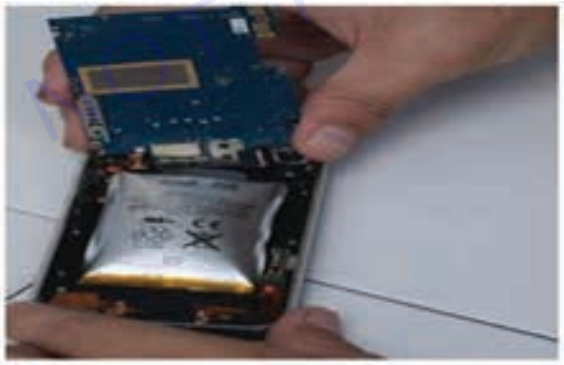


Fig 14

15 Use a spudger to gently pull the camera up and out of its housing in the rear panel. The camera cannot be removed entirely yet because its connected to the bottom of logic board.(Fig 15)

16 Use a spudger to gently up the end of the logic board closest to the dock connector. If the board won’t lift up, double check to make sure all the screws securing the logic board have been removed.(Fig 16)

17 Slide the logic board towards the back side connector and out of the cell phone.(Fig 17)

18 Use a little force, pull up and remove the attached tab on the battery. (Fig 18)

19 Replace battery and repeat steps in reverse to reassemble.(Fig 19)

20 Dismantling of the cell phone has been completed.

Fig 15

Fig 16

Fig 17

Fig 18

Fig 19

21 Get the work checked by instructor.

TASK 2: **Assembling the cell phone / smart phone**

1 Identify the parts of a cell phone given in Fig 20 and record names of each part in the Table 1.

2 Follow the step by step procedure done in TASK 1 in the reverse order to re-assemble the cell phone/smart phone.

3 Observe correct position and insert the ribbon cable/ connector,etc. carefully. [They are very delicate and will get damaged easily.]

4 Ensure that the assembling is done correctly and all the boards are fixed in their respective positions.

5 Switch on the cell phone and check the working condition.

6 Get the work cheked by the instructor.

Fig 20

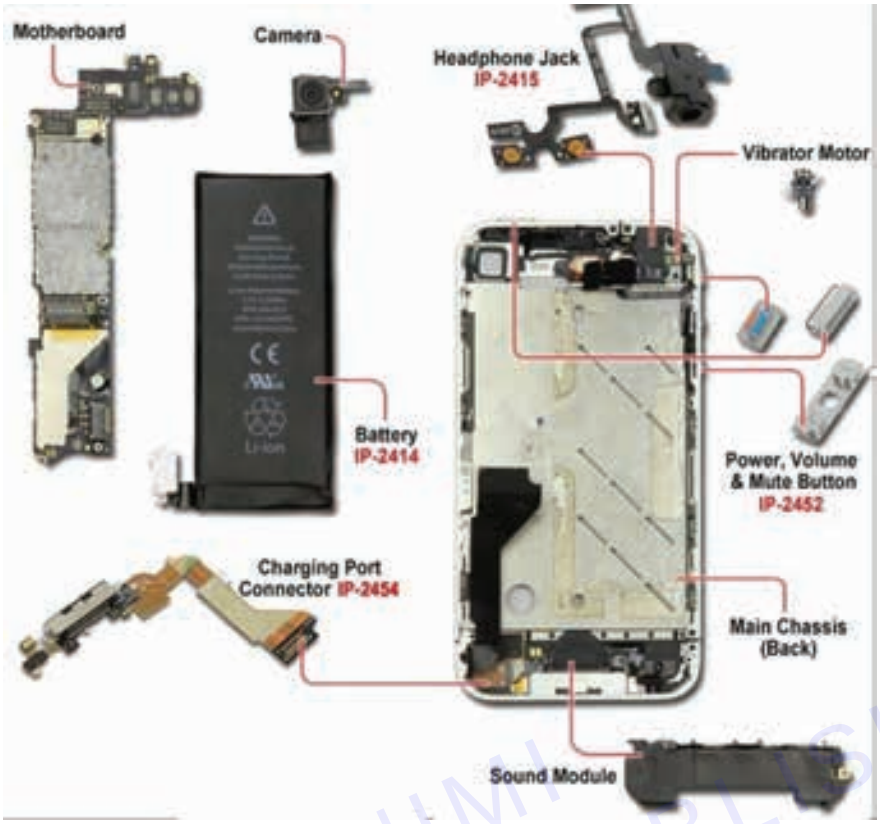


Table 1

Sl. No.	Type of phone / smartphone	Section/Part
1 2 3 4		

EXERCISE 119: Dismantle the cell phone / smart phone remove the keypad and clean it , test the continuity of the matrix/tracks

Objectives

At the end of this exercise you shall be able to:

- remove key pad of the cell phone and clean it
- replace the display and keypad of the given cell phone
- remove touch screen of the smart phone and clean it.

Requirements

Tools/Materials

- Precision Screwdriver Set - 1 Set.
- Tweezers - 1 Pair.
- Plastic Opening Tools - 1 Set.
- Heat Gun - 1 Set.
- Soldring Iron - 1 No.
- Desoldring Pump - 1 No.
- Replacement Parts - as reqd
- Magnifying Glass - 1 No.
- Smart Phone - 1 No.
- Digital Multimeter with probes - 1 No.
- User Manual of the given cell phone - 1 No.

Procedure

TASK 1: **Remove the keypad and clean it**

1 Dismantle the cell phone by referring the previous exercise.

2 Make a mixer of half rubbing alcohol and half distilled water.

3 Wipe the phones keypad with a soft cloth and remove dust.

4 Allow the cell phone to dry before reinserting the battery or putting it back in its case.

5 Check the continuity of row and column pins using DMM.

6 Place the key pad in the right position while closing the front cover for the reassembly. Do not assemble the phone of display has to be replaced.

7 Switch ON the phone and check the working condition.

— — — — —

TASK 2: **Replace the display**

1 Dismantle the cell phone by referring the previous exercise.

2 Remove the display by removing the small star head screw and lift the LCD display out of the cell phone

3 Install the new display into your cell phone and follow the procedure in reverse order.

4 Insert the battery and battery cover. Switch ON the phone and check for its working.

— — — — —

TASK 3: **Removing and cleaning the touch screen**

1 Turn the device off.

2 Cover the whole screen with some clear packaging tape.

3 Remove the back cover.

Removing the broken glass panel

1 Heat the glue holding the glass in place.

2 Use the painter's tape to take out flecks of glass.

3 Gently lift the edges of the glass off.

4 Work your way downward.

5 Remove the touch buttons carefully.

6 Remove the glass.

7 Take out the metal earpiece from the old glass.

Applying the new glass panel

1 Wipe away the remaining glue on the edges of the front of the phone.

2 Apply double-sided tape to the top and bottom of the front panel.

3 Wipe the display with a lens cleaner.

4 Remove the protective cover from your replacement glass carefully.

5 Put the touch buttons back in place.

6 Connect the metal earpiece to the new glass.

7 Apply the replacement glass onto your phone.

8 Heat the panel again.

9 Get the work checked by the instructor.

— — — — —

EXERCISE 120: Interface the cell phone/smart phone to the PC and transfer the data card

Objectives

At the end of this exercise you shall be able to:

- transfer data from phone memory to SD card
- transfer data from phone to PC.

Requirements

Tools/Materials

- Precision Screwdriver Set - 1 Set.
- Tweezers - 1 Pair.
- Plastic Opening Tools - 1 Set.
- Heat Gun - 1 Set.
- Soldring Iron - 1 No.
- Desoldring Pump - 1 No.
- Replacement Parts - as reqd
- Magnifying Glass - 1 No.
- Smart Phone - 1 No.
- Digital Multimeter with probes - 1 No.
- User Manual of the given cell phone - 1 No.

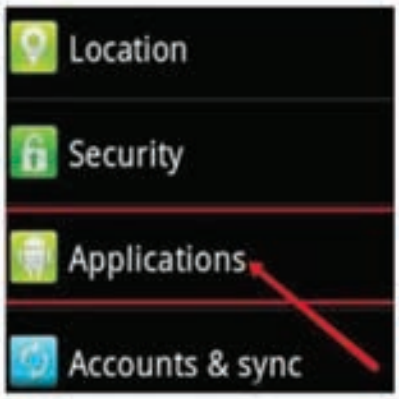
Procedure

TASK 1: **Transfer app from phone memory to SD card**

STEP 1:- Select the setting tab on screen. (Fig 1 & 2)

Fig 1

Fig 2



STEP 2:- Scroll the settings menu and select manage application tab -> Settings. (Fig 3).

NOTE:-Setting can access from tab scrolling also.

STEP 3:-Now select app needed to move from phone to SD memory card.

STEP 4:- Now select move to SD card option tab.(Fig 4)

STEP 5:- Press tab and select OK button on warning menu.

STEP 6:- Now observe tab changing move to phone.

NOTE:- Same can repeat for moving, app from memory to phone.

Fig 3

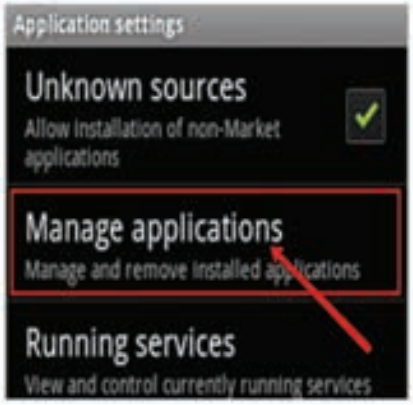


Fig 4

TASK 2: **Moving data (Files and Folder) from phone to SD memory card and vice**

STEP 1:- Go to the home screen.

STEP 2:- Then select the File manager and then tap on local.

STEP 3:- Choose the external SD folder.

STEP 4:- Tap on the folder or file to which you want to move to the SD card.

STEP 5:- Copy the folder or file to the external SD folder by clicking on paste option.

STEP 6:- Tap on the STORAGE on setting menu scroll the screen for SD card.

STEP 7:- Check the file/folder is copied into SD card.

TASK 3: **Transfer data from phone to PC using data card / USB port**

STEP 1:- Use a data cable to connect your phone to your computer's USB port. (Fig 5)

STEP 2:-Make sure your memory card is in your phone. (Fig 6)

Fig 5

Fig 6

STEP 3:-Touch the USB Connected notification on your phone's screen. (Fig 7)

STEP 4:-Turn on USB storage in some model the screen as shown in Fig 9 will appear and select the option as per require menu in the PC. (Fig 8)

STEP 5:- Click on My Computer and find removable storage. (Fig 9)

STEP 6:-Drag and drop the files you want from your phone to your computer. (Fig 10)

STEP 7:-If the files are transformed go to Notifications and select Turn Off USB Storage.

Fig 7

Fig 8

Fig 9

Fig 10

STEP 8:-Disconnect the data cable from your phone and your computer.

CONCLUSION:-

Hence, Thus the Interface the cell phone/smart phone to the PC and transfer the data card was done.

EXERCISE 121: Flash the various brands of cell phones/ smart phones

Objectives

At the end of this exercise you shall be able to:

- identity the flashing tools
- perform a flashing process
- flash the various brands of cell phones/ smart phone

Requirements

Tools/Materials

- Smart phone/ cell phone - 1 set.
- SD card - 1 pair.
- Data connection to the Cell phone - 1 set.
- USB Cable - 1 set.
- User manual - 1 No.

Procedure

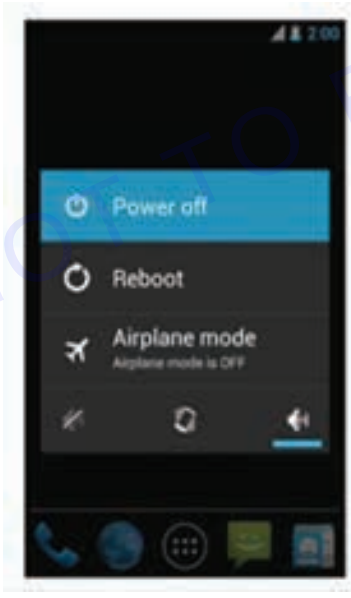
TASK 1: **Flashing the various brands of cell phone/smart phone**

STEP 1:- Download and install Android USB driver on your computer.

NOTE:- In case Android USB drivers are already installed on your computer then do the step 2.

STEP 2:- Power off the Android smart phone and remove the battery.(if it is removable)(Fig 1)

Fig 1



Precautions:-

1. Brand and model must be same you can verify/ net confirm your smart phone.
2. Never downgrade android version of your smart phone.
3. Before trying anything make a complete backup of your data in a computer.
4. The above tutorial only works with the stock firmware or custom ROM which comes with the scatter file in it.
5. Take a backup of your important data before using the smart phone flash tool because during the flashing process your personal data will be removed permanently.

STEP 3:- Download the stock ROM or custom ROM software that you want to flash on your Android smart phone and copy it on your computer.

STEP 4:- Download and copy smart phone flash tool on your computer.

STEP 5:- Now open Flash_tool.exe

STEP 6:- Click on the Download tab.

STEP 7:- In the download tab, now click on the scatter-loading button.

STEP 8:- Now, locate the scatter file (you will find the scatter file in the stock ROM folder).

STEP 9:- Now, click on the download button to begin the flashing process.

STEP 10:- Now, connect your smart phone to the computer using USB cable (without battery - if it is removable).

TASK 2: **Connect a smart phone in Wi-Fi / hotspot**

STEP 1:- Go to setting as shown in Fig 2.

STEP 2:- Click personal hotspot.

STEP 3:- Click on Wi-Fi password enter password (first time connect, you enter the password and save) as shown in Fig 3

Fig 2

Fig 3

STEP 4:- Click to connect using Wi-Fi shown in Fig 4.

Fig 4

STEP 5:- Now the internet is connected.

STEP 6:- Browse the internet, the same way as do in computer.

STEP 7:- Get the work checked by the instructor.

CONCLUSION:-

Hence, we know in this experiment that's various types of brands in our daily life or present life.

EXERCISE 122: Format the cell phone/ smart phone for virus (approach the mobile repair shop, service centre)

Objectives

At the end of this exercise you shall be able to:

- format the android phones using basic reset option
- format the android phone using recover reset option.

Requirements

Tools/ Materials

• Smart phone/ cell phone	- 1 Set.	• Precision screw driver set	- 1 Set.
• SD card	- 1 Pair.	• User manual	- 1 Set.

Procedure

TASK 1: **Formatting the android phones using basic reset option**

CAUTION:- Backup all data before resetting operation.

STEP 1:- Press menu button and select setting option. (Fig 1)

NOTE: Setting can access from tab scroll also.

STEP 2:- Scroll the menu and select the privacy option. (Fig 2)

Fig 1

Fig 2

STEP 3:- Scroll the menu and select factory reset option. (Fig 3)

STEP 4:- Press the warning message OK.

STEP 5:- Select SD card if it need format and select everything erase option.(Fig 4 and Fig 5).

STEP 6:- After few seconds, phone will reset.

STEP 7:- Check the screen. It looks like new phone memory.

Fig 3

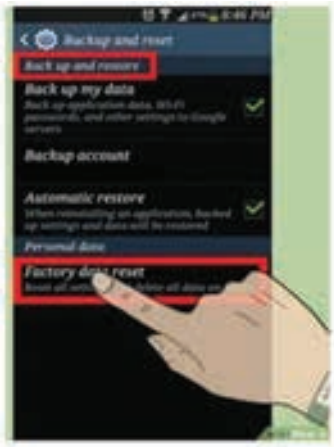
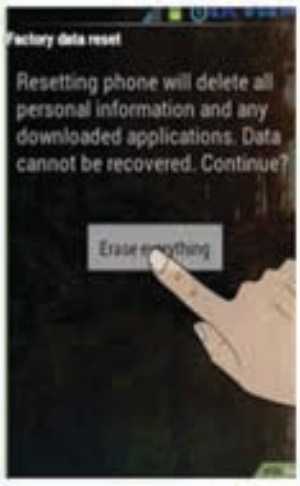


Fig 4

Fig 5



TASK 2 : **Format the android smart phone by using recovery reset option**

STEP 1:- Press the ON/OFF button for the power OFF option to appear on your device as shown in Fig 6.

NOTE:- Before you begin the reset procedure, you will need to completely power your device off.

STEP 2:- Press and hold the recovery buttons. (Fig 7).

Fig 6

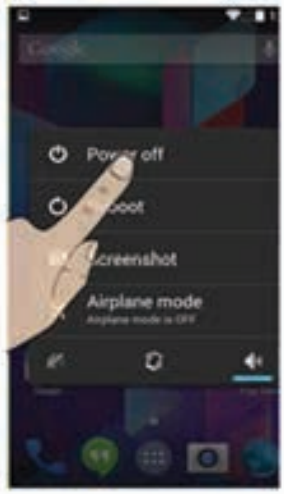


Fig 7

NOTE: Buttons will vary from device to device. So you refer to the instruction for a particular phone. If you want to press and hold the buttons for a few seconds .Some common button combinations include:

- Volume Up + Home + Power
- Volume Down + Power Home + Power
- Home + Power

STEP 3:- Select factory reset option.

NOTE: Once the recovery menu opens, you can navigate the menu with the volume buttons. You may need to open the recovery menu to find the factory reset mode. Use the power button, some models use the camera button, to select your menu options.

STEP 4:- Select to confirm the factory reset.

STEP 5:- Wait for the restore process to compete. After your phone resets, it will be set back to factory defaults and will be like new phone.

STEP 6:- Get the work checked by the instructor.

CONCLUSION:

Thus we know in this experiment that how to format the cell phone/ smart phone from virus (through mobile shop repair or service centre).

— — — — —

EXERCISE 123: Unlock The Handsets Through Codes And Software

Objectives

At the end of this exercise you shall be able to:

- to understand unlock procedures of cell phones
- to know the unlock softwares available.

Requirements

Tools/ Materials

- Available unlocking software - 1 Set.
- Desktop PC with latest configuration - 1 Pair.
- EaseUS MobiUnlock for Android - 1 Set.
- Dr. Fone - Screen Unlock - 1 Set.
- Nokia-FREE Unlock Code Calculator - 1 No.
- PassFab Android Unlocker - 1 No.
- Tenorshare 4uKey for Android - 1 No.

Procedure

1 **Device Information:** The software will typically require certain information about the device to generate the necessary unlock code or perform the unlocking process. This commonly includes the device's unique identifier, such as the IMEI (International Mobile Equipment Identity) number,

2 **Unlock Code:** Based on the device information provided, the phone unlock app will generate an unlock code or utilize a specific unlocking method to remove the network restrictions from the device

3 **Non-Supported SIM Card:** Once the unlock code is generated, the user will need to insert a non-supported SIM card into the device and enter the provided unlock code when prompted.

Theory:-

Unlock Phones Software refers to computer programs or tools designed to unlock mobile phones from specific carriers or networks, allowing them to be used with other carriers or internationally.

This software is commonly used when individuals want to switch to a different network provider or use their device while traveling abroad. Here is an overview of unlock phones software: It's important to note that the specific features and functionalities of unlock phones software can vary depending on the software provider and the device model being unlocked.

1 Unlock Codes

Unlock codes, also known as network unlock codes or IMEI unlock codes, are numeric sequences that remove network restrictions from a mobile device.

- These codes allow the phone to be used with SIM cards from different carriers or networks.
- Users can obtain unlock codes from service providers or third-party sources.
- It's essential to verify compatibility with the specific device model and carrier before using unlock codes.
- Trusted and reputable sources should be used to avoid risks associated with unauthorized tools.

2 Unlock Software

- Unlock software refers to computer programs or tools designed to unlock mobile phones.
- These tools allow users to switch to a different network provider or use their device internationally.
- Here's how phone unlock software typically works:
- Compatibility Check: Ensure the software is compatible with your device model and network provider.

- Installation: Install the software from an official app store or a trusted source.
- Gathering Device Information: Provide device details (e.g., IMEI number).
- Generating Unlock Code: The software generates an unlock code or uses specific methods to remove network restrictions.
- Entering Unlock Code: Users enter the code into the device.
- Verification and Confirmation: The software confirms that the network lock has been removed.
- Trusted software options include:
- UltFone Android Unlock: Removes screen PIN, pattern, password, fingerprint, and face lock without data loss.
- Dr.Fone - Screen Unlock (Android): Effective for unlocking Android devices.
- iSkysoft Toolbox, TFT Unlocker App, and Unlock Your Phone APK are other options

A phone unlock app, also known as an unlocking software or application, is designed to remove the network restrictions imposed by a carrier on a mobile device, allowing it to be used with SIM cards from different carriers or networks. Here is a general overview of how a phone unlocks app works:

1 **Compatibility Check:** Before using a phone unlock app, it's important to ensure that the app is compatible with the specific device model and network provider you wish to unlock. Not all apps support all devices or carriers.

2 **Installation:** Once you have confirmed compatibility, the phone unlock app needs to be installed on the device. Depending on the app, this can be done by downloading and installing it from an official app store.

3 **Gathering Device Information:** The app will typically require certain information about the device to generate the necessary unlock code or perform the unlocking process. This commonly includes the device's unique identifier, such as the IMEI (International Mobile Equipment Identity) number.

4 **Generating Unlock Code:** Based on the device information provided, the phone unlock app will generate an unlock code or utilize a specific unlocking method to remove the network restrictions from the device. The app may communicate with remote servers or use internal algorithms to calculate the code.

5 **Entering Unlock Code:** Once the unlock code is generated, the app will prompt the user to enter the code into the device. This typically involves inserting a non-supported SIM card into the device and entering the provided unlock code when prompted.

6 **Verification and Confirmation:** The phone unlock app will verify the entered unlock code and communicate with the device's firmware or software to confirm that the network lock has been removed. If the code is correct, the device will recognize the new SIM card and allow it to connect to the desired network.

7 **Completion and Confirmation:** After the unlocking process is completed, the phone unlocks app may provide a confirmation message or notification to indicate that the device is now unlocked and ready to be used with different carriers. It's important to note that the specific steps and procedures involved in unlocking a phone may vary depending on the app and the device's manufacturer and model. Some apps may require additional steps or specific instructions to complete the unlocking process

DIAGRAM:-

1 **Compatibility Check :**Ensure that the unlocking software is compatible with the specific device model and network provider you wish to unlock.

2 **Installation:** Install the phone unlock software on the device. This can be done by downloading and installing it from an official app store or sideloading it from a trusted source.

3 **Gathering Device Information:** The software will require certain information about the device to generate the necessary unlock code or perform the unlocking process. This commonly includes the device's unique identifier, such as the IMEI (International Mobile Equipment Identity) number

4 **Generating Unlock Code:** Based on the device information provided, the software will generate an unlock code or utilize a specific unlocking method to remove the network restrictions from the device.

5 **Entering Unlock Code:** Once the unlock code is generated, the software will prompt the user to enter the code into the device. This typically involves inserting a non-supported SIM card into the device and entering the provided unlock code when prompted.

6 **Verification and Confirmation:** The software will verify the entered unlock code and communicate with the device's firmware or software to confirm that the network lock has been removed.

Fig 1

Fig 2

Please note that the specific features and functionalities of unlock phones software can vary depending on the software provider and the device model being unlocked.

Result:

Thus the unlocking procedure of mobile phone is studied and unlocked the given phone successfully.

Software	Description
EaseUS MobiUnlock for Android	Supports removing various types of screen locks, such as PIN, password.
Dr. Fone - Screen Unlock	popular software for unlocking Android devices
iMyFone LockWiper	Another reliable tool for bypassing screen locks on Android devices.
NokiaFREE Unlock Code Calculator	This software is specifically designed for Nokia phones.
PassFab Android Unlocker	A comprehensive tool for unlocking Android devices.
Tenorshare 4uKey for Android	Known for its ability to bypass Android lock screens quickly.

EXERCISE 124: Perform the interfacing the cell phone/ smart phone to the PC and dismantle the cell phone and identify the power section and test its healthiness

Objectives

At the end of this exercise you shall be able to:

- to understand an importance of power section
- to understand dismantling and assembling procedures.

Requirements

Tools/ Materials

- Tool kit - 1 Set.
- Digital multi meter with probes - 1 Set.
- Mobile opener tools - 1 Set.
- Smart phone with data cable - 1 No.
- PC/Laptop - 1 No.

Procedure

TASK 1: **Flashing the various brands of cell phone/smart phone**

Step 1:- Switch ON the PC and install the “Phone companion” App in your PC. The phone companion app is built directly into window 10

NOTE: If windows 10 version is not available, download the app from internet and use it for exercise.

Step 2:- Enter your phone number for registering/adding your phone in the app. Then one time automated message will be sent from the micro-soft to your registered cell phone number. Consent is not necessary to get or use the app.

Step 3:- When the app launches, you will see the first phone companion screen, as shown in Fig 1 on the monitor.

Step 4:- click on your type of phone (like, windows/android/i Phone), and then connect your cell phone to your computer. After selection of the phone type, phone companion app will show the display as shown in Fig 2

Fig 1

Fig 2

Step 5:- Select the desired application say one note to set up in the PC sign into that one application, phone companion will identify that you are signed into your windows system with a micro-soft account and prompt you to confirm, as shown in Fig 3.

Step6:- Verify your micro soft account, you will be prompted to begin the procedure of getting the one note app for the smart phone, as shown in Fig 4.

Fig 3

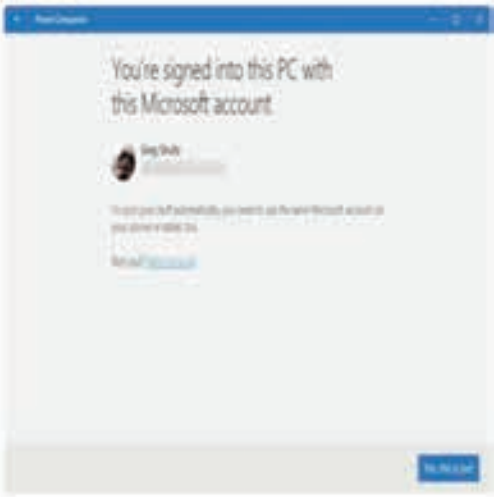


Fig 4

Step 7:- Access all the notes that you have created in windows, the one note app is synched up.

Step 8:- Get the work checked by the Instructor.

TASK 2 : To synchronise the photos and folders of the cell phone to the PC.

Step 1:- Connect the USB data cable from your computer's USB port to your cell phone. The phone companion lists you phone's available storage space and available apps as shown in the Fig.5 to synch the photos & folders.

Fig 5

Step 2:- Choose which app to install, and whether to transfer photos or files. The phone companion leaves you with three options.

NOTE:-

- Install Apps: The phone companion lists the windows apps available your phone. Install the one drive app, for example, to give you phone access to your one drive files. You can also install cortana, music, one note, skype, word, Excel, power point, and outlook - the same apps that work on your PC. By installing the apps, you can edit your one drive files with word, both on your phone and your PC.
- Import photos and videos: Choose this option to copy your photos and videos from your phone or tablet to your PC.
- Transfer other files: This option brings up file explorer, where you can view the files and folders on your tablet. Then you can transfer items from your phone or tablet to your PC or vice versa.

TASK 3: **Dismantle the cell phone and identify the power section**

STEP1:- Switch OFF the cell phone and remove the battery cover and back facial of the cell phone.

NOTE :- The screws must be kept very carefully for reassemble the cell phone

STEP 2:- Remove the battery, SIM card and memory card carefully.

STEP3:- Using suitable screwdriver, unscrew and remove all the screws and keep them in a safe box.

STEP4:- Once all the screws are open, remove the front cover or the front fascia of the mobile phone.

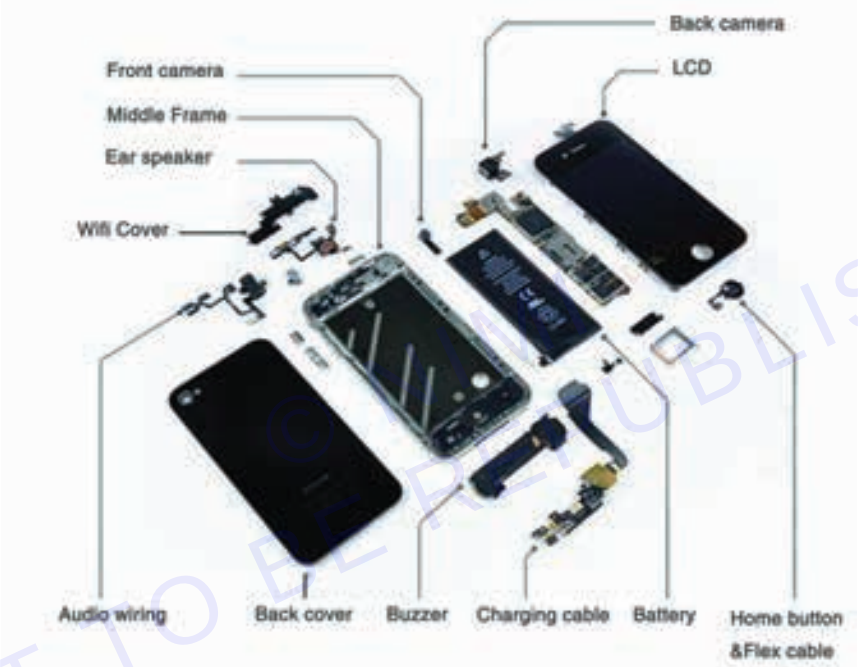
NOTE:- The phone PCB is attached with the internal fasica or skeleton of the mobile phone using screws.

STEP5:- Unscrew and open all the screws of the main assembly.

NOTE:- Safety: It is very delicate part, handle with care.

STEP6:- Remove connectors for display, camera and pull the display and the camera out as shown in Fig.6.

Fig 6



STEP 7:- Identify the power IC, and other supporting ICs

STEP 8:- Record the IC numbers/details in Table-1.

STEP 9:- Get the work checked by the instructor.

NOTE: The IC around which there are several capacitors is called power IC. In some cell phones there are 2 power ICs.

TASK 4:- **Test the healthiness of cell phone power**

STEP 1:- Keep the battery separately and set it down on flat surface such that the terminals are facing you.

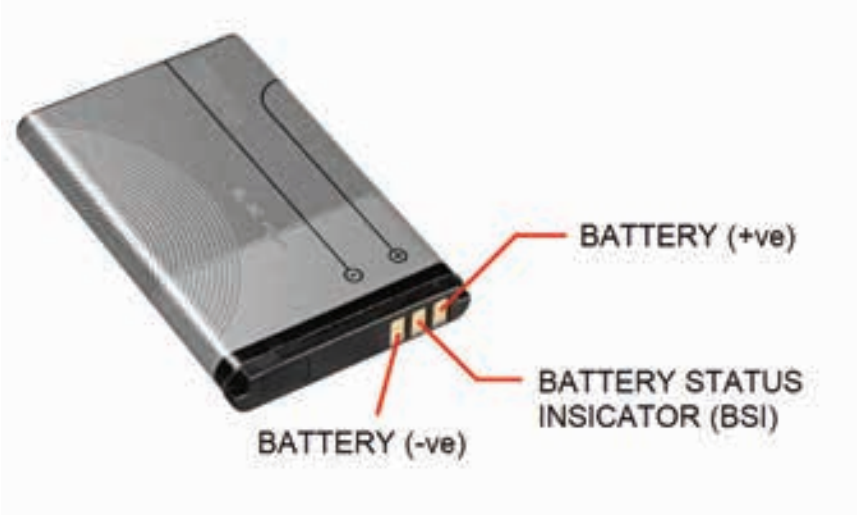
STEP 2:- Note the specification of the battery and identify the two terminals on the battery that are labeled with '+' and '-' sign as shown in Fig.7

STEP 3:- Measure and record the battery voltage, using multi- meter in Table-1.

Table 1

Sl. No.	IC NO.	Function	Remarks

Fig 7



STEP 4:- Compare with the rating of battery and observe the healthiness of the power supply of the cell phone.

STEP 5:- Get the work checked by the instructor.

STEP 6:- Carefully insert the display, camera and its connectors carefully.

STEP7:- Reassemble the cell phone, with respective screws.

STEP 8:- Insert the memory card, SIM card and battery.

STEP 9:- Switch ON the cell phone and check its working condition.

STEP10:- Get the work checked by the instructor.

Battery voltage Rating	Measured voltage of battery	Remarks

RESULT :-

Thus the procedures to interface the cell phone/smart phone to the PC have been implemented. Dismantled the given cell phone, identified power module and healthiness of the power section was verified.

EXERCISE 125: Find out the fault of basic cell phone system recetify the fault in ringer section and check the performance

Objectives

At the end of this exercise you shall be able to:

- check for any visible damage to the speaker, speaker connections, or related components
- properly functioning ringer ensures that users are promptly alerted to incoming calls and notifications, leading to increased satisfaction with the device's overall performance.

Requirements

Tools/Materials

- Multimeter - 1 No.
- Screw drivers - 1 No.
- Test signal generator - 1 No.
- Soldering iron - 1 No.
- Anti- static wrist strap - 1 No.
- Cleaning tools - 1 No.
- Voltage/ current source - 1 No.

Procedure

1 Ringer Components:

Speaker: The speaker produces sound when activated by the ringer circuit.

Ringer Circuit: This circuit includes components such as capacitors, resistors, and transistors that control the activation and modulation of the speaker.

2 Common Faults:

Speaker Damage: Physical damage to the speaker can result in no sound output or distorted sound.

Loose Connections: Loose or corroded connections between the speaker and the circuit board can cause intermittent or no sound output.

Faulty Components*: Capacitors or resistors within the ringer circuit may degrade over time or fail, leading to issues with sound quality or volume.

Software Glitches*: Software bugs or incorrect settings may prevent the ringer from activating or producing sound.

3 Testing and Performance Check:

Functional Test: Verify if the ringer produces any sound when a call or notification is received. If not, check for faults in the speaker, connections, or circuitry.

Audio Quality Test: Listen to the sound produced by the ringer to ensure it is clear and free from distortion.

Volume Test: Adjust the ringer volume settings to ensure it meets the desired level of loudness.

Consistency Test: Ensure that the ringer reliably produces sound for all incoming calls and notifications.

Software Check: Verify that the phone's software settings related to the ringer are configured correctly and reset to default settings if necessary.

4 Troubleshooting Steps:

Visual Inspection: Examine the speaker, connections, and circuitry for any visible damage or abnormalities.

Component Testing: Use a multi meter to check the continuity and resistance of components within the ringer circuit.

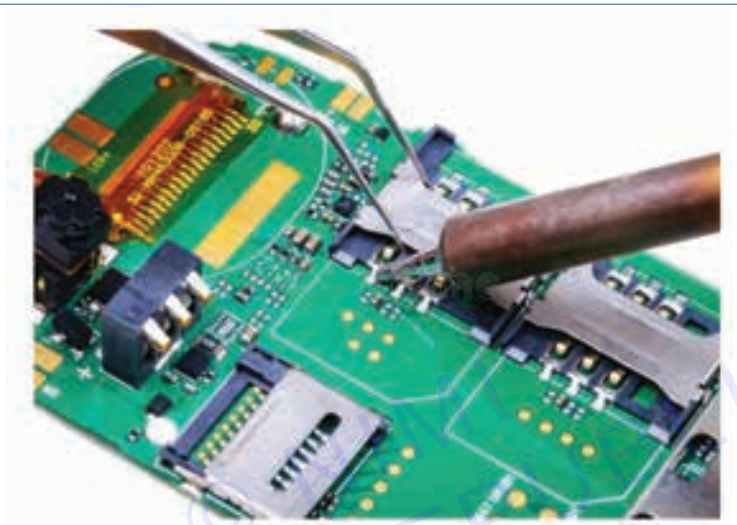
Replacement Test: If a component is suspected to be faulty, replace it with a known working one to see if it resolves the issue.

Software Debugging: Update the phone's software to the latest version or perform a factory reset to eliminate software-related issues.

Working:

Understanding Ringer Operation: The ringer section of a cell phone system characteristically consists of a speaker connected to a ringer circuit. When an incoming call or notification is received, the phone sends a signal to the ringer circuit, which activates the speaker to produce sound. The sound produced by the speaker alerts the user to the incoming call or notification.

CIRCUIT DIAGRAM:



PROCEDURE:

Determine if the phone is not ringing at all or if the sound is distorted. Check if the phone is set to silent mode or if the ringer volume is turned down. Make a test call or send a test notification to the phone to activate the ringer. Listen for any sound produced by the ringer.

RESULT:

Thus the speaker and Ringer sections have been inspected and replaced back to the original places.

EXERCISE 126: Replace various faulty parts like Mic, Speaker, Data Hanging Audio Jack etc.

Objectives

At the end of this exercise you shall be able to:

- to identify and replace the various faulty parts in a cell phone
- to understand replacing faulty speaker and mic of a cell phone
- to understand replacing data and audio jack of a cell phone
- to restore the functionality of the device and ensure smooth operation.

Requirements

Tools/Materials

- Precision screwdriver set - 1 Set.
- Tweezers - 1 Pair.
- Plastic opening tools - 1 Set.
- Heat gun - 1 Set.
- Soldring iron - 1 No.
- Desoldring pump - 1 No.
- Replacement parts - as reqd.
- Magnifying glass - 1 No.
- Smart Phone - 1 No.
- Digital Multimeter with probes - 1 No.
- User Manual of the given cell phone - 1 No.

Procedure

1 **Diagnosis:** Identify which parts are faulty by troubleshooting the device. Test the microphone, speaker, and audio jack to determine which components need replacement.

2 **Disassembly:** Power off the device and remove any external components (e.g., case, battery). Use appropriate tools to carefully open the device without damaging the casing.

3 **Component Removal:** Locate the faulty parts within the device. Use a screwdriver to remove any screws holding the components in place. Disconnect any cables or connectors attached to the faulty parts.

4 **Replacement:** Install the new microphone, speaker, or audio jack by connecting it to the device and securing it in place with screws. Ensure proper alignment and connection of cables.

5 **Reassembly:** Put the device back together by reversing the disassembly steps. Make sure all screws are tightened securely and all components are properly aligned.

6 **Testing:** Power on the device and test the replaced parts to ensure they are functioning correctly. Test the microphone, speaker, and audio jack to verify that the issues have been resolved.

7 **Final Checks:** Double-check all connections and ensure that the device is fully functional before reapplying any external components or accessories.

Working :

1 **Diagnosis:** Identify the malfunctioning components through testing and troubleshooting.

2 **Preparation:** Gather the necessary tools and replacement parts.

3 **Disassembly:** Power off the device and carefully open it using appropriate tools, such as screwdrivers and plastic opening tools, without damaging the casing.

4 **Component Removal:** Locate and remove the faulty parts by unscrewing them and disconnecting any cables or connectors attached to them.

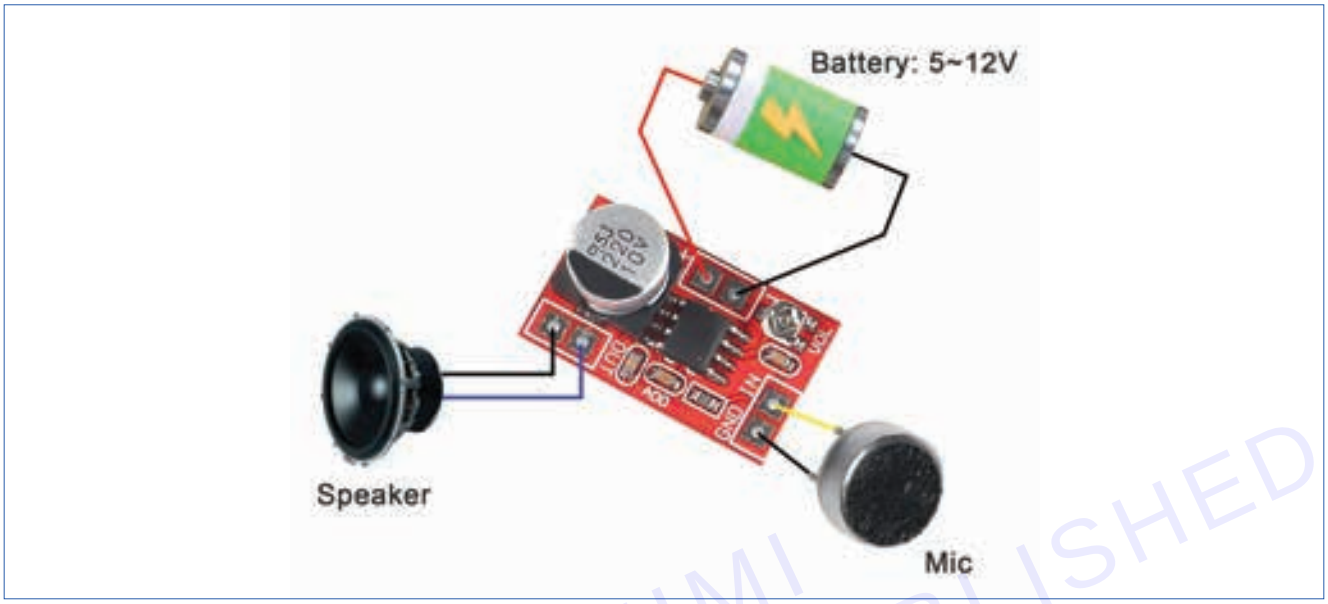
5 **Replacement:** Install the new microphone, speaker, or audio jack by connecting them properly and securing them in place with screws.

6 **Reassembly:** Put the device back together by reversing the disassembly process, ensuring all components are correctly aligned and all screws are tightened securely.

7 **Testing:** Power on the device and test the replaced parts to ensure they are functioning correctly. Test the microphone, speaker, and audio jack to verify that the issues have been resolved.

8 **Final Checks:** Double-check all connections and functionality before reapplying any external components or accessories.

CIRCUIT DIAGRAM:



PROCEDURE:

- Determine which components need replacement by troubleshooting the device's issues.
- Collect the appropriate tools such as screwdrivers, prying tools, and replacement parts.
- Ensure the device is powered off to prevent any damage or electric shock during the repair process.
- Carefully remove the outer casing of the device using the appropriate tools. Refer to the device's manual or online guides for disassembly instructions specific to your device model.
- Once inside the device, locate the faulty parts that need replacement. They are often connected to the main circuit board or other components.
- Disconnect any cables or connectors attached to the faulty parts. Be gentle to avoid damaging surrounding components.
- Install the new replacement parts in the same location as the old ones. Ensure proper alignment and connection.
- Put the device back together by reversing the disassembly steps. Make sure all screws are tightened securely, and cables are properly reconnected.
- Turn on the device and test the replaced parts to ensure they are functioning correctly. Test the mic, speaker, and audio jack to verify that the issues have been resolved.

RESULT:

Thus the faulty parte were replaced , like the microphone, speaker, and repairing the data-hanging audio jack.

MODULE 14: Smartphones app tester and SD card installation procedure

EXERCISE 127 : Perform network connections, SD Card Interactions and Bluetooth testing

Objectives

At the end of this exercise you shall be able to:

- Performing Network Connections, SD Card Interactions, and Bluetooth Testing is to demonstrate proficiency in setting up and managing network connections, interacting with SD cards, and testing Bluetooth functionality
- Testing network connections, SD card interactions, and Bluetooth functionality in software development. These areas play crucial roles in ensuring robust and reliable performance for various devices and applications.

Requirements

Tools/Materials

- Network Connections
- SD Card Interactions
- Bluetooth
- Network Testing Tool
- Monitoring Agents
- Collect Performance Data
- SD Card Reader/Writer
- Computer or Device
- Software Tools
- Bluetooth Devices
- Bluetooth Tester
- Range Testing
- Data Transfer Testing
- Security Testing
- Compatibility Testing

Procedure

Performing network connections, SD card interactions, and Bluetooth testing. These are essential aspects of ensuring the robustness and reliability of various devices. I'll break down each topic for you

Network Connections Testing:

Network Loopback Testing: This involves setting up an endpoint that allows network loopback testing across Ethernet, Wi-Fi, and Bluetooth networks. It's particularly useful for diagnosing, troubleshooting, and load testing network ports on a PC.

Purpose:

Verify that network ports are functioning correctly.

Ensure network ports remain stable under prolonged load.

Hardware Needed:

Raspberry Pi 4 Model B (4GB): A single-board computer that serves as the testing platform.

Raspberry Pi 15.3W USB-C Power Supply: Provides power to the Raspberry Pi.

Micro SD Card Reader: Required for setting up the Raspberry Pi with the necessary software.

Software Needed:

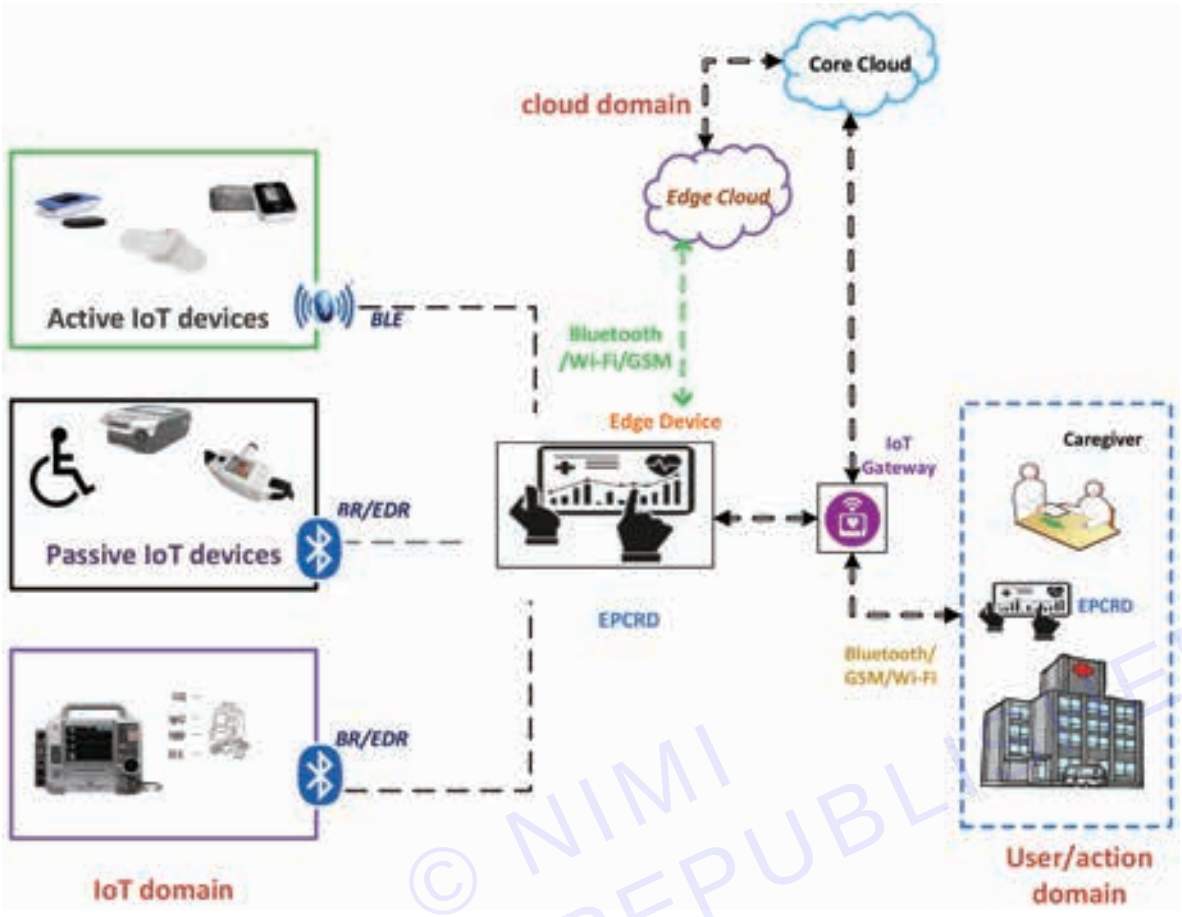
Network Loopback Tester Software: Works in conjunction with BurnInTest software to facilitate end-to-end testing of network links with bulk data over an extended period.

Testing Steps:

Prepare the Raspberry Pi device for testing.

Test Ethernet ports and Wi-Fi function

CIRCUIT DIAGRAM:



Related Formula:

Network Connections: In a fully meshed network, the number of connections (wires) required grows quadratically with the number of nodes (N).1

S_N = \frac{N(N - 1)}{2}SN=2N(N−1)

where,

S_NSN is the number of connections,

NN is the number of nodes.

SD Card Interactions: Communication with an SD card is performed by sending commands to it and receiving responses from it.

Maximum Through put is measured in bits per second (bps) and it defines the rate of data sent over a transmission channel successfully

R = \frac{D}{T}R=TD

where,

DD is the Data inventory,

RR is the Throughput rate,

TT is the Time.

Round-Trip Time (RTT) shows the total time taken by the packet to be transferred from the instant transmitter to the immediate receiver after receiving the acknowledgment3.

PROCEDURE :

Network Connections Testing1:

Does the app behave according to specification if connected to the internet through Wi-Fi?

Does the app behave according to specification if connected to the internet through 3G?

Does the app behave according to specification if connected to the internet through 2G?

Does the app behave according to specification of the app is out of network reach?

Does the app resume working when it gets back into the network reach from outside reach of the network?

Update transactions are processed correctly after re-establishing connection.

Does the app still work correctly when tethering or otherwise connected to another device?

SD Card Interactions Testing1:

Can the app be installed on the device?

Does the app behave as designed/desired if there is an incoming call?

Does the app behave as designed/desired if there is an incoming SMS?

Does the app behave as designed/desired if the charger is connected?

Does the app behave as designed/desired if the charger is disconnected?

Does the app behave as designed/desired if the device goes to sleeping mode?

Does the app behave as designed/desired if the device resumes from sleeping mode?

s if the app switches between networks (Wi-Fi,5G, 4G,3G, 2G)?

Does the app use standard network ports (Mail: 25, 143, 465, 993 or 995 HTTP: 80 or 443 SFTP: 22) to connect to remote services, as some providers block certain ports.

Bluetooth testing, you would typically check if the device can discover and pair with other Bluetooth devices, transfer data/files, and disconnect. Also, check how the device behaves when Bluetooth is turned off while connected to another device. Please refer to the specific Bluetooth testing procedure for your device or application for more detailed steps.

Tabulation:

Test Description	Checkpoints
Installation	Verify app installation on the device.
Incoming Calls	Check app behavior during incoming calls
Incoming SMS	Observe app behavior when an SMS arrives
Charger Connection	Validate app behavior when the charger is connected
Charger Disconnection	Confirm app behavior when the charger is disconnected
Sleep Mode	Test app behavior during device sleep mode
Lock Screen	Check app behavior after resuming from the lock screen
Device Tilt	Observe app behavior when the device is tilted
Local Messages	Confirm app behavior with local messages (e.g., calendar reminders, to-do tasks)
Push Messages	Test app behavior with push messages (e.g., Twitter mentions, WhatsApp messages).
GPS Sensor	Verify correct interaction with the GPS sensor (on/off, data retrieval)
Button Functionality	Ensure all device buttons/keys function as intended

RESULT:

Thus the tools and procedures help ensure the reliability and stability of network connections, SD card functionality, and Bluetooth communication.

EXERCISE 128: Execute Testing Mobile Apps on different Platforms

Objectives

At the end of this exercise you shall be able to:

- to test apps required for mobile phone on android emulators and simulators
- to undergo a Lambda test for a comprehensive cross browser compatability.

Requirements

Tools/Materials

- Head spin
- Test IO
- Test board
- Selendroid
- Bug hunter
- Requires computing power 1
- Rapidly changing graphics or fluid animations 2
- Update interface without new download,run A/B tests 3
- Familiarity 4
- Distribution 5

Procedure

Device and OS Fragmentation: Understand the diversity of devices and operating systems in the market. This includes different screen sizes, resolutions, hardware capabilities, and versions of Android, IOS, or other operating systems.

Compatibility Testing:

Ensure the app is compatible with different versions of the operating system (OS) and various devices. Test the app on a range of devices with different screen sizes, resolutions, and hardware specifications.

Functional Testing:

Verify that all features and functionalities of the app work as intended across different platforms. This includes testing user interactions, navigation, input validation, data processing, and integrations with external services.

Performance Testing:

Assess the app's performance metrics, such as load times, response times, CPU usage, memory usage, and battery consumption, across different platforms. Identify and address any performance bottlenecks or resource-intensive operations.

Security Testing:

Conduct security testing to identify and mitigate potential vulnerabilities and threats on different platforms. This includes testing for data encryption, secure authentication, secure network communication, and protection against common security risks such as injection attacks and data leaks.

Working:

1 **Identify Platforms:** Determine which platforms (IOS, Android, etc.) you want to test the app on.

2 **Set up Test Environment:** Install necessary tools like emulators, simulators, or physical devices for each platform you're testing on.

3 **Test Planning:** Create test cases and scenarios covering various aspects of the app such as functionality, usability, performance, and security.

4 **Execute Tests:** Run the tests on each platform, ensuring to check for platform-specific issues or inconsistencies.

5 **Bug Reporting:** Document any bugs or issues found during testing, including detailed steps to reproduce and screenshots if needed.

Example Commands

Identify, Platforms, Set Up Test, Environment, Test Planning,

Execute Tests, Bug Reporting, Regression testing, Repeat

CIRCUIT DIAGREAM:

PROCEDURE:

User Acceptance Testing (UAT): engage real users or stakeholders to authenticate the app's usability, functionality, and overall fulfillment on different platform. collect feedback and address any reported issues or concerns. Once testing is complete and all issues are resolved, prepare the app for deployment to the respective app stores (App Store for iOS, Google Play Store for Android) or enterprise distribution channels.

Continuously monitor user feedback, app performance, and platform updates post-deployment. Address any reported issues promptly and release updates as necessary to maintain compatibility and improve user experience.

EXERCISE 129: Best Practices in Mobile App & Setting Testing

Objectives

At the end of this exercise you shall be able to:

- to perform the test like development lifecycle, unit testing, integration testing, and UI testing
- to identify and fix bugs early in the process, preventing them from escalating into more significant issues in future.

Requirements

Tools/Materials

- Appium
- Kolabiton
- Testgrid
- Calabash
- Testing bot
- Mobot
- Headspin

Procedure

Define Clear Requirement:

Begin with clearly defining the requirements for the mobile app or setting. Understand the user needs, functionality, and performance expectations.

Plan Test Strategy: Develop a comprehensive test strategy that covers different aspects such as functional testing, usability testing, performance testing, security testing, etc.

Test on Real Devices: Test the app or setting on a variety of real devices with different screen sizes, resolutions, operating systems, and network conditions to ensure compatibility and responsiveness.

Automate Testing: Use automation tools and frameworks to automate repetitive tests such as regression testing, UI testing, and compatibility testing. This helps in saving time and ensuring consistent results.

Focus on User Experience (UX): Pay attention to the user interface, navigation, and overall user experience. Conduct usability testing to identify any issues and improve user satisfaction.

Security Testing: Ensure that the app or setting is secure by performing security testing to identify vulnerabilities such as data leaks, unauthorized access, and insecure communication protocols.

Performance Testing: Evaluate the performance of the app or setting under different load conditions to identify bottlenecks, memory leaks, and other performance issues. This includes testing for responsiveness, speed, and resource usage.

Do proper expectation setting:

- It might be tempting to overpromise in your advertisements and app store descriptions. But try to be honest.
- After the app download, you have the opportunity to start a relationship with your new user, and you don't want to start with disappointment.

APP TESING:

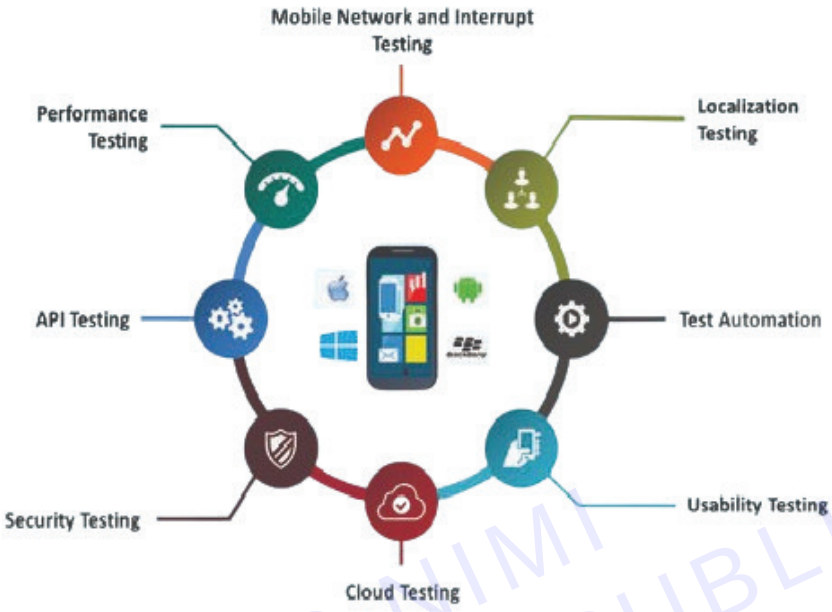
ADVANTAGE OF TESING:

The benefit of mobile app and setting testing include ensure compatibility across various devices, identifying and fixing bugs or glitches, optimizing performance, user experience and Enhancing security trial to protect user data. Ultimately testing helps in delivering a reliable and seamless experience to users.

DISADVANTAGE OF TESTING:

Some of cons in the mobile testing includes increased time and cost associated with thorough testing. There are potential delays in the release of product as per the schedule. Furthermore, testing may not always catch all issues, leading to post-release bugs or user complaints.

CIRCUIT DIAGRAM:



PROCEDURE:

- Clearly outline what aspects of the mobile app you want to test, such as functionality, usability, performance, security, and compatibility across different devices and operating systems.
- Create Test Cases: Develop detailed test cases covering various scenarios, including positive, negative, and edge cases. Each test case should have clear steps to reproduce, expected outcomes, and actual results.
- Document all issues encountered during testing, including steps to reproduce and severity level. Use a bug tracking system to prioritize and track the resolution of issues.
- Iterate and Improve Incorporate feedback from testing to iteratively improve the app's quality and user experience. Regularly review and update test cases to adapt to changes in requirements or features.

RESULT:

Continuously test the app after each update or code change to identify and fix any regressions or unintended side effects

MODULE 15: Smartphone hardware, Software and Installation procedure

EXERCISE 130: Demonstrate Popular Application used in Android Mobile System

Objectives

At the end of this exercise you shall be able to:

- valuable app is one that users use regularly and that improves their quality of life in some way
- smooth navigation and intuitive functionalities increase user satisfaction and encourage long-term retention
- think Up aims to provide users with daily positive affirmations. These affirmations help users find the motivation and encouragement they need to succeed.

Requirements

Tools/Materials

- Desktop/ Laptop - 1 No.
- Pointer - 1 No.
- Android Studio
- Java/Kotlin
- Android SDK
- XML
- SQLite Database
- Open-Source Tools

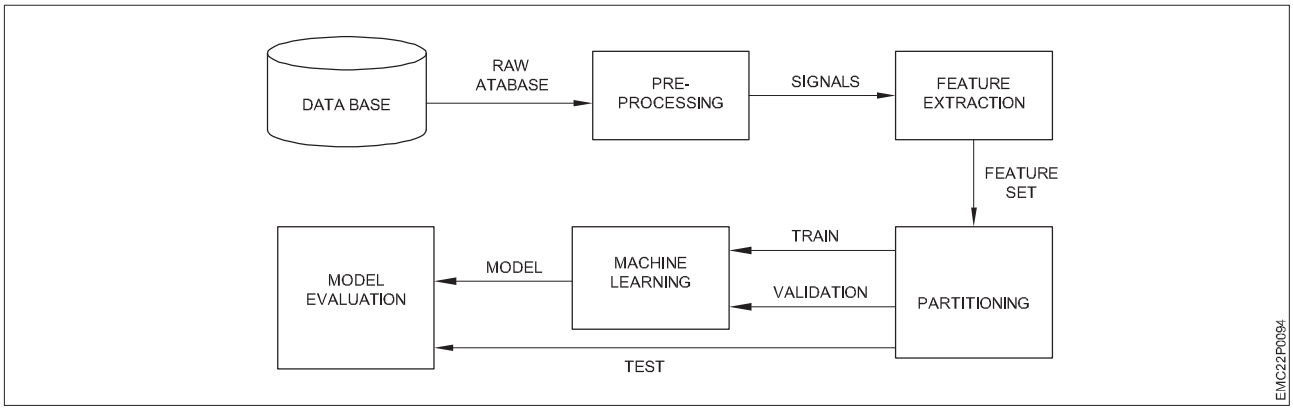
Procedure

Android is the most popular mobile operating system in the world, with over two billion active users1. There are three main types of Android applications: -

They are designed to make the most of all the features and tools of the phones, such ascontacts, cameras, sensors, etc. Examples include Whatsapp, Spotify, and PokemonNative Apps: These are built for specific operating systems, such as Android and iOS. GO2.

- **Web Apps:** These are built to run on browsers and are mainly integrations of HTML, CSS, and JavaScript. They require an active internet connection to work. Examples include Gmail, Canva, and Google Docs2.
- **Hybrid Apps:** Also known as Cross-Platform Applications, these run on multiple platforms like Android and iOS2.
- Here are some of the best Android apps for 20243:
- **1Weather:** An excellent weather app for pluviophiles and casuals alike3.
- **Google Drive:** A cloud storage solution available on Android where all new users get 15GB for free permanently upon signing up3.
- **Google Maps and Waze:** Navigation apps that provide real-time GPS navigation, traffic, and transit info3.
- **Microsoft Swiftkey:** A keyboard app that learns from you to offer better auto-corrections and predictions3.
- **Nova Launcher:** A powerful and customizable home screen replacement3.
- **Pocket Casts:** A podcast app with a beautiful UI and a wealth of features3.
- **Poweramp:** A powerful music player for Android3.
- **Solid Explorer:** A file management app with cloud support3.
- **Tasker and IFTTT:** Apps that automate tasks on your Android device3.
- **Textra:** A highly customizable text messaging app3.
- **TickTick:** A simple and effective to-do list and task management app3.
- **YouTube and YouTube Music:** Video sharing and music streaming services3.
- **Zedge:** An app for downloading ringtones, notification tones, and wallpapers3.

Circuit Diagram:



Related Formula:

Conceptual formula that encapsulates the key elements of such a demonstration:

Effective Demonstration=Selection+Preparation+Presentation+Demonstration+Engagement+Evaluation

Where:

- **Selection:** Choosing a range of popular and diverse applications.
- **Preparation:** Understanding the features and use cases of each application.
- **Presentation:** Developing a script or outline that covers the introduction and main features of each app.
- **Demonstration:** Showing the actual use of the app through a live device or emulator.
- **Engagement:** Encouraging audience interaction and feedback.
- **Evaluation:** Assessing the audience's understanding and satisfaction to refine future demonstrations.

Procedure:

1 **Identify Popular Applications:** Research and select the most commonly used Android applications. You can find this information through app store rankings, tech blogs, or user surveys.

2 **Prepare Your Android Device:** Ensure that your Android device is updated to the latest operating system and has enough storage space to install the applications.

3 **Download and Install Applications:** Visit the Google Play Store and download the applications you wish to demonstrate.

4 **Familiarize Yourself with the Apps:** Before demonstrating, spend some time using the applications. Understand their key features, usability, and any unique aspects they offer.

5 **Create a Demonstration Plan:** Outline the key points you want to cover for each application. This might include the app's purpose, its main features, and why it's popular among users.

6 **Set Up Screen Recording:** If you're demonstrating the apps remotely or want to create a tutorial, use a screen recording tool to capture your interactions with the applications.

7 **Demonstrate the Applications:** Start by introducing the application, then walk through its features, showcasing how to use them effectively. Highlight any tips or tricks that might benefit users.

8 **Encourage Interaction:** If you're presenting live, allow time for questions and encourage the audience to interact with the applications on their own devices.

9 **Provide Additional Resources:** Offer links to tutorials, guides, or forums where users can learn more about the applications and get support if needed.

Tabulation:

Type of Application	Examples	Primary Function
Social media	Instagram	Communication and sharing
Productivity	Google Docs, Evernote	Task management and document creation
Entertainment	Netflix, Spotify	Streaming media content
Utility	Google Maps, Weather apps	Providing tools and information
Gaming	Candy Crush, PUBG	Interactive entertainment
News & Magazines	The New York Times, Flipboard	Delivering news and articles
Lifestyle	Tinder, Fitbit	Personal lifestyle enhancement
Education	Duolingo, Khan Academy	Learning and educational content

Calculation: -

```
package com.example.simplecalculator;
import androidx.appcompat.app.AppCompatActivity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.TextView;
public class MainActivity extends AppCompatActivity {
```

```
    EditText number1, number2;
    Button addButton, subtractButton, multiplyButton, divideButton;
    TextView result;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        // Your code here...
    }
}
```

Result:

Thus, we become more aware of the variety of apps available and their functionalities. And we also gain a better understanding of how to use the applications and their features.

EXERCISE 131: Demonstrate process of making Ringtone, singtones, editing video clip, basic photo editing using apps

Objectives

At the end of this exercise you shall be able to

- to demonstrate process of making rington & singtone using apps
- to demonstrate process of making editing video clip.& basic photo editing using apps.

Requirements

Tools/Materials

• Smart Phone (android,los)	- as reqd.	• Desktop PC	- 1 No.
• Monitor	- 1 No.	• Photo Editing App	- 1 No.
• Headphone	- 1 No.	• Audio Editing App	- 1 No.
• Mic	- 1 No.	• Video Editing App	- 1 No.

Theory

Ringtone: The sound made by a cell phone to signal an incoming call.

Video editing: Video editing is the process of manipulating video by rearranging different shots and scenes in order to create a whole new output. It can be as simple as stitching together different scenes and shots with simple video transitions, and can become as complicated as adding different audio and tying together different elements.

Photo editing: Photo editing is the act of image enhancement and manipulation. This process is usually done with a digital photo editing software. Photo editing can involve basic tweaks like when you crop and resize images or adjust saturation.

Procedure

TASK 1: **Process of making Ringtone& Singtone using app**

Step 1: Launch the Music App.

- Open the Music app on your Android & Mac.

Step 2: Select Your Song and Determine Timing.

- Find the song you want to turn into a ringtone in your music library. Play the song and make a note of the specific time you want the ringtone to start and end.

Step 3: Access Song Information.

- Right-click on the song, and from the pop-up menu, choose “Get Info.”

Step 4: Configure Start and Stop Times.

- In the song’s information window, go to the “Options” tab. Check the “Start” box and enter the starting time from step 2. Then, check the “Stop” box and enter the end time. Click “OK.”

Step 5: Create an AAC Version.

- Select the modified song, go to the “File” menu, and choose “Convert” > “Create AAC version.”

Step 6: Locate the File in Finder.

- A new version of your song will appear under the original. Right-click on it and select “Show in Finder.” If the file extension is .m4a, change it to .m4r. If it’s .mp3, convert it to .m4a using QuickTime Player and change the extension to .m4r.

Now, your custom ringtone is ready for your iPhone and android.

Some of the name and images related to the Ringtone& Singtone

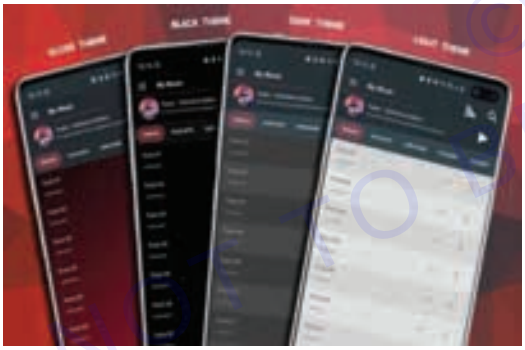
i Inshot Mp3 Cutter and ringtone Maker

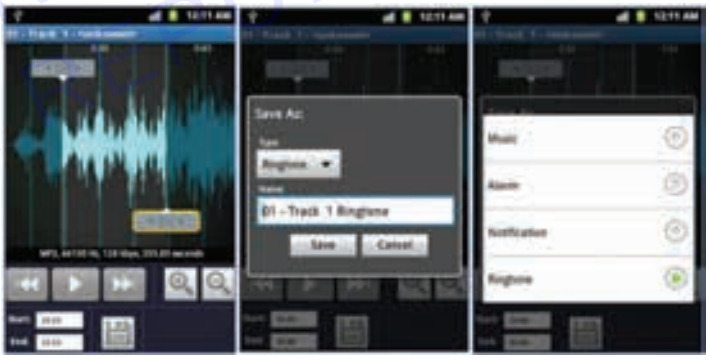
ii Pi music Player

iii Ringtone maker

iv Zedge

v Z Ringtone





TASK 2: **Process of making Editing Video Clip using app**

STEP 1: Organise your footage.

- Keeping your video clips and audio files in order will allow you to quickly find the pieces you need when you need them.
- Create folders for your project on your device and make subfolders for your raw clips depending on their type, or where they belong in your edit.

STEP 2: Making a plan.

- If you want to include voiceover or narration, write a script by outlining the points you want to make, then writing them out to sound natural. Read it out, make adjustments, and repeat until it sounds right.

STEP 3: Choose clips that show important action.

- Trim clips to include only the parts you need. Ask yourself: What does my story need? “You don’t have to keep everything.

STEP 4: Use establishing shots.

- Viewers like to feel situated. While close-up and medium shots show action up close, they often leave out the characters environment.
- An establishing shot shows a scene's wider context, allowing your viewers to understand where everything fits, helping immerse them in the setting.

STEP 5: Use match cuts.

- A match cut is when you cut from one clip to another by matching the visual interests of the frame.
- You can use similar framing, similar shapes, or similar motions to cut two clips together.

STEP 6: Use the right transitions — or none at all.

- If you're transitioning from one clip to the next within the same scene, you probably don't need to apply transitions.
- To cut from one clip to the next, just stick them together. If your video includes more than one scene, you might want to add graphic transitions between them.
- These transitions not only join scenes but can help shape the pace of your video. Stick to cross fades or dissolves.

STEP 7: Choose a colour scheme.

- If you need to, use colour correction tools to give your footage a natural look. Many editing tools also let you colour grade your footage, i.e. manipulate the colour and contrast of your images for creative rather than corrective purposes.

STEP 8: Don't neglect sound.

- A high-quality video includes high-quality audio.
- People will watch something with poor video quality if the audio quality is good, but they won't watch something with good video quality if the audio quality and sound effects are poor.

STEP 9: Add music.

- Your soundtrack enhances the feeling of immersion more than any other aspect of your video: design it carefully.
- Don't let music overpower your soundtrack, and make sure the songs you use are royalty-free or that you cleared the copyright if you plan to publish your video publically.

STEP 10: Export to the right format.

- Before you start editing, make sure you're starting in the right project format. Including choosing the right aspect ratio. Once you're happy with your edit, export your video.
- Different editing platforms offer different exporting settings, including video format, and other presets, like bitrate, which determines the quality level.
- The video format determines how your video file stores audio and video data as well as how that data is used for playback. Popular video formats include .webm, .mp4, .flv, .wmv, and .mov, most of which are supported by the main online platforms, like YouTube and Social media.

Process of making Basic Photo Editing using app

STEP 1: Straightening images.

- Sometimes when you are taking photos, they can turn out not completely straight. This is the case when taking landscape photos as the horizon should be straight, so that your picture looks harmonious.

STEP 2: Removing unwanted elements from a photo.

- Sometimes there are small details in the picture that could distract the viewer and draw their attention away from the subject. It is recommended to remove these unwanted elements.

STEP 3 : Editing the exposure.

- A rule of thumb says that if in doubt, you should underexpose your photo slightly as valuable image details are lost in overexposed photos.
  - EXPOSURE
  - BRIGHTNESS
  - HIGHLIGHTS
  - DEPTHS OR SHADOWS
- In addition to correcting exposure, you can also reduce image noise in photos. This occurs when you have worked with a high ISO value or a long exposure time.

STEP 4: Changing the contrast.

- Contrast describes the ratio of black and white tones in the picture .
- A low contrast blurs the contours, while a high contrast strongly emphasises the contours and makes the image look exaggerated.

STEP 5: Adjusting the white balance.

- White balance (or temperature) controls the colour temperature of the image. When it comes to white balance its more about personal preference or what your picture should represent.
- A warm white balance makes your picture look inviting and summery.
- A cool white balance, on the other hand creates a more distant and wintery image.

STEP 6: Making colour corrections.

- You should edit the colours of your photo after you have made any exposure corrections and adjusted the white balance as they can change the colours in your photo.
  - **Saturation**: These changes all the colours in the image equally. A high saturation brings more colour into your image, while a low saturation reduces the radiance of the colours
  - **Dynamics**: this only changes the colours in the picture that are not yet as saturated. This option allows you to change the colour effect in a more targeted and subtle way.
  - **Adjustment of individual colour channels**: You can edit individual colours. You can make a red t-shirt in a picture shine or de-saturate it a little using the red colour channel.

STEP 7: Changing the size of your image:-

- By using the cropping tool, you can crop your photos.
- This way you can find the right size and emphasise your subject or find a composition that suits you.
- Cropping photos will give them a more interesting effect and a clearer message

STEP8: Sharpening your images:-

- Photos taken in RAW format sometimes appear slightly blurred. You can counteract this with the sharpen tool.
- Quite often small changes are enough to make your picture look more natural and clearer.

Results: Thus, the editing of photos , videos and making ringtone has been completed successfully.

EXERCISE 132: Demonstrate downloading procedure

Objectives

At the end of this exercise you shall be able to

- to demonstrate download any file or image from internet.

Requirements

Tools/Materials

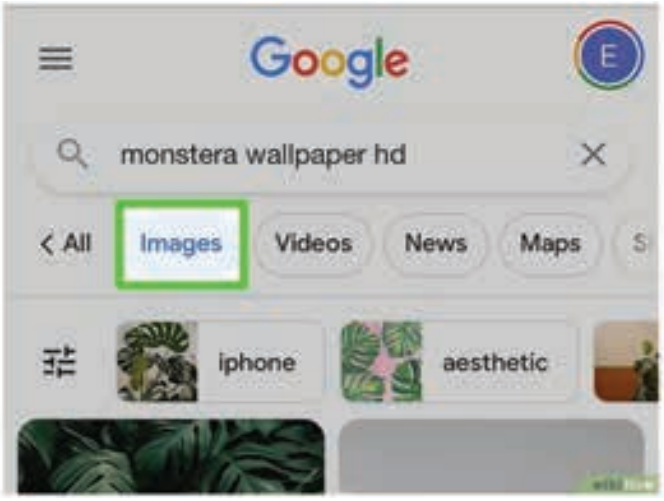
- Smart Phone (Any android ISO phone) - 1 No.

Procedure

iPhone & iPad

1 Open a web browser.

- You can also use Google Chrome, Firefox, or a different web browser on your iPhone



2 Navigate to a file you wish to download.

Go to the website that contains the file you want to download. If you're not sure where it is, you can search for it. To do so, tap the bar at the top of the screen, then type in the name of an item you wish to view and tap Go.

If you want to download a photo, search for the photo, and then tap the IMAGES tab to filter your search results by image.

3 Download a non-photo file.

If you're downloading a photo, skip to the next step. If you want to download a file that is not an image (i.e., a PDF or a document), tap file's Download button or link. It may be an icon that resembles a tray with an arrow pointing down, or it may be a button or link that has the filename. Non-image files you download from the internet will be found using the Files app on your iPhone or iPad.

4 Tap a photo you wish to save.

If you want to download a photo, tap it so a larger version expands

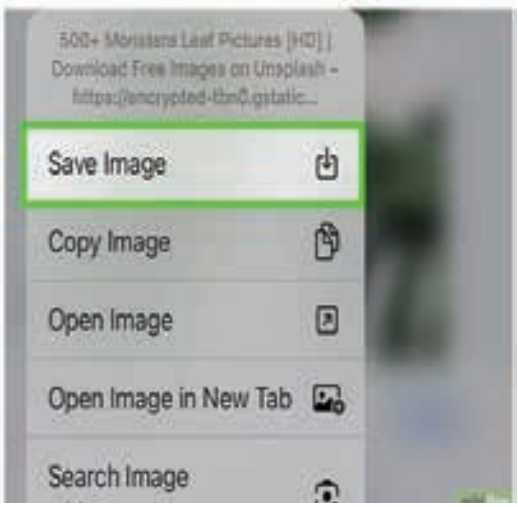
5 Tap and hold the photo.

After a moment, a menu will pop up at the bottom of the screen

6 Tap Save Image.

It's at the top of the pop-up menu. This will download the photo onto your iPhone.

You'll be able to find the photo in your iPhone's Photos app.



Result: We did photo download from internet.

Demonstrate to registration procedure via banking app

Objectives: At the end of this exercise you shall be able to

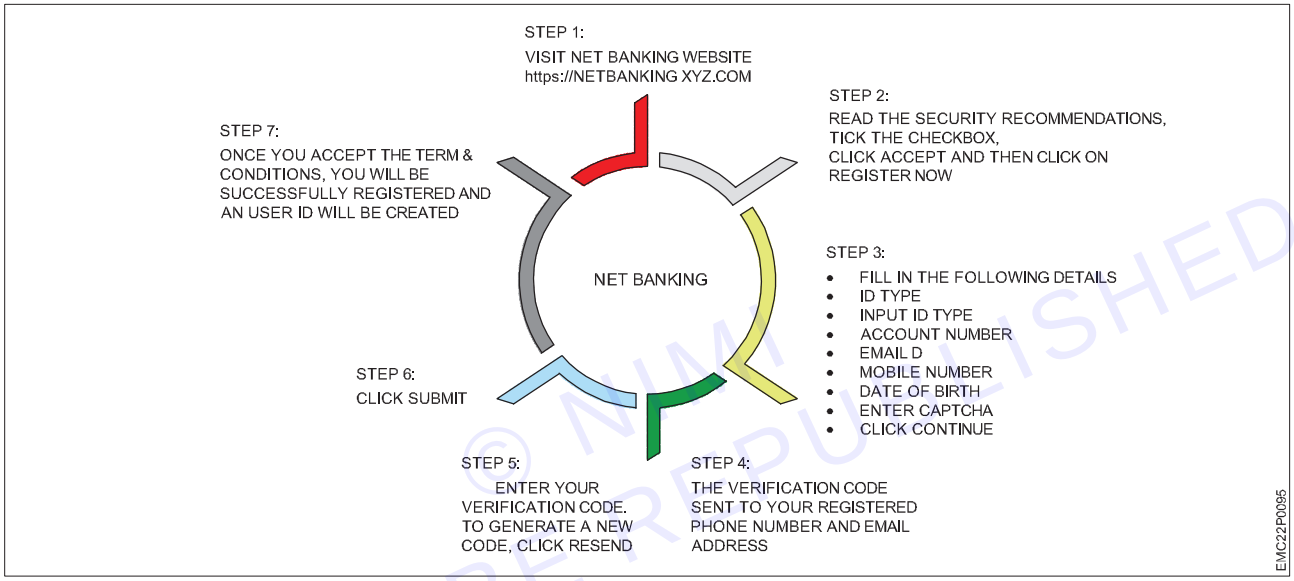
- to demonstrate the registration procedure with bank.

Requirements

Tools/Materials

- Smart Phone - 1 No.
- Bank account - 1 No.
- ATM card - 1 No.

Example: Net banking with axis bank



Procedure

1 Visit the Axis Bank Website

Go to the Axis Bank Internet Banking page or any enternet banking application.

2 Click on “Register Here”:

On the login page, click on the “Register here” link to begin the registration process.

3 Keep Your Details Handy:

You’ll need the following information:

Customer ID: This is mentioned in your welcome letter and printed on your cheque book.

KYC Details: Ensure that your registered mobile number and email address are active.

Debit Card: Details related to your Axis Bank debit card.

4 Choose Your Registration Option:

If you have a savings or current account with Axis Bank, you’ll be presented with one or more of the following options:

Debit Card: Use your debit card details.

OTP: Receive a one-time password (OTP) on your registered mobile number.

Email Link: Follow the link sent to your registered email address.

KYC: Complete the KYC process.

5 Set Your Password:

Fill in the required details to set your password and complete the registration.

6 Login Options:

After successful registration, you can log in using:

Customer ID/Login ID & Password

Debit Card Number, ATM PIN, and OTP

Customer ID &mPIN

Registered Mobile Number, mPIN& OTP

7 Security Measures:

Set three security questions and answers during your first login.

If you forget your password, use the “Reset Here” link on the login page.

Be cautious with incorrect login attempts to avoid locking your internet banking access.

Result: Today we did registration to internet banking in mobile.

Sharing internet via hotspot

Objectives: At the end of this exercise you shall be able to

- understand internet sharing
- hotspot setup procedures.

Requirements

Tools/Materials

- Smart Phone (Any android phone) - 1 No.
- Computer - 1 No.

Procedure

1 Enable Hotspot on Your Device

- On your phone or computer, navigate to the settings menu.
- Look for the “Hotspot” or “Tethering” option.
- Enable the hotspot feature.

2 Configure Hotspot Settings

- Set a network name (SSID) for your hotspot.
- Choose a password to secure your hotspot.
- Select the type of connection (Wi-Fi, Bluetooth, or USB).

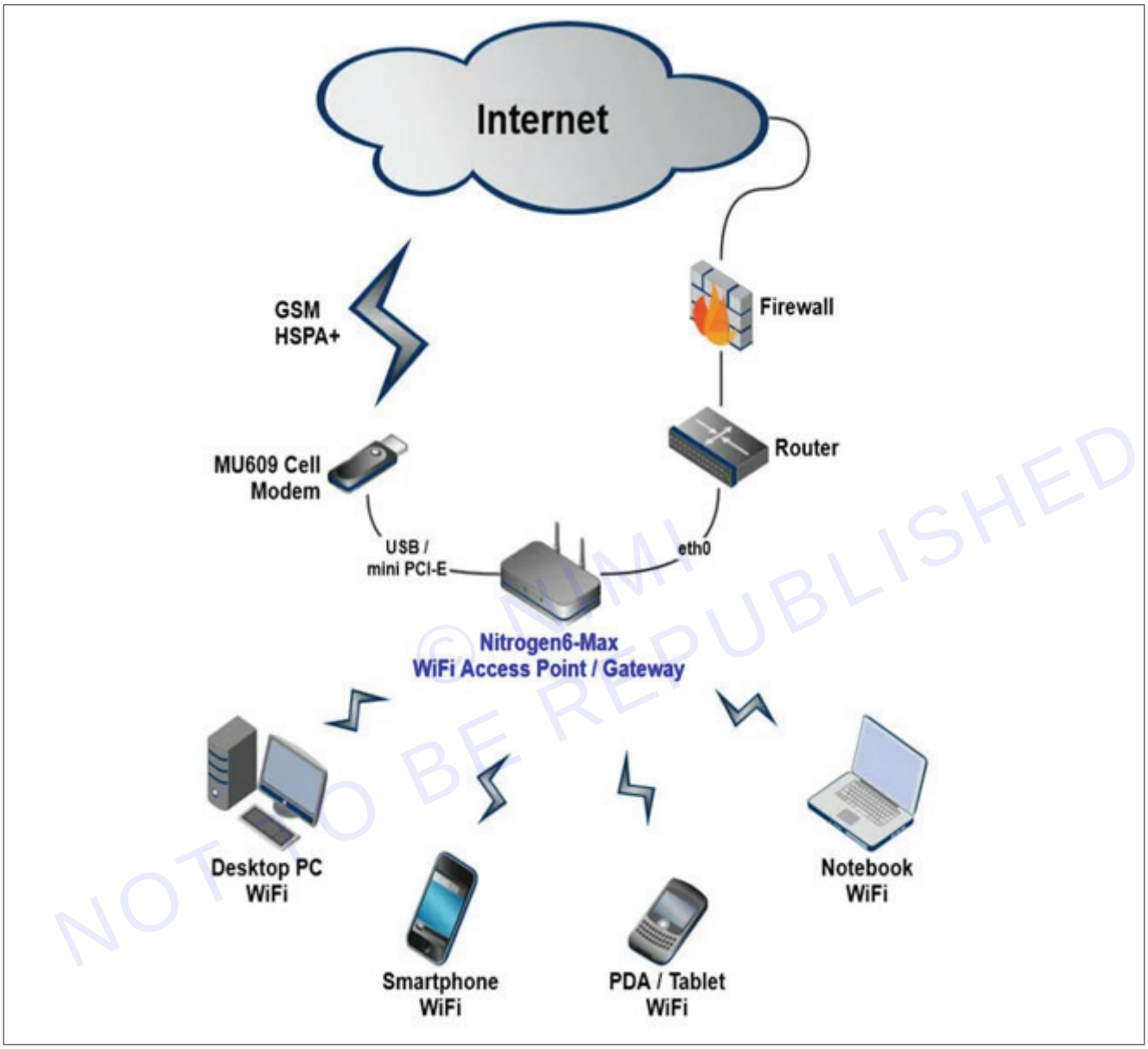
3 Connect Devices to Your Hotspot:

- On other devices (such as laptops, tablets, or other phones), search for available Wi-Fi networks.
- Locate your hotspot network (the one you named in step 2).
- Enter the password when prompted.

4 Enjoy Internet Sharing:

- Once connected, the other devices will have access to the internet through your hotspot.

Procedure image



Result: We see procedure of Sharing internet by hotspot.

Demonstrate file sharing procedure of Bluetooth

Objectives: At the end of this exercise you shall be able to

- the bluetooth file transfer window, select send files.

Requirements

Tools/Materials

- Smart phone
- PC

Procedure

1 Open Bluetooth Settings:

Go to Bluetooth & other devices settings on your Android device.

Scroll down to Related Settings and select Send or receive files via Bluetooth.

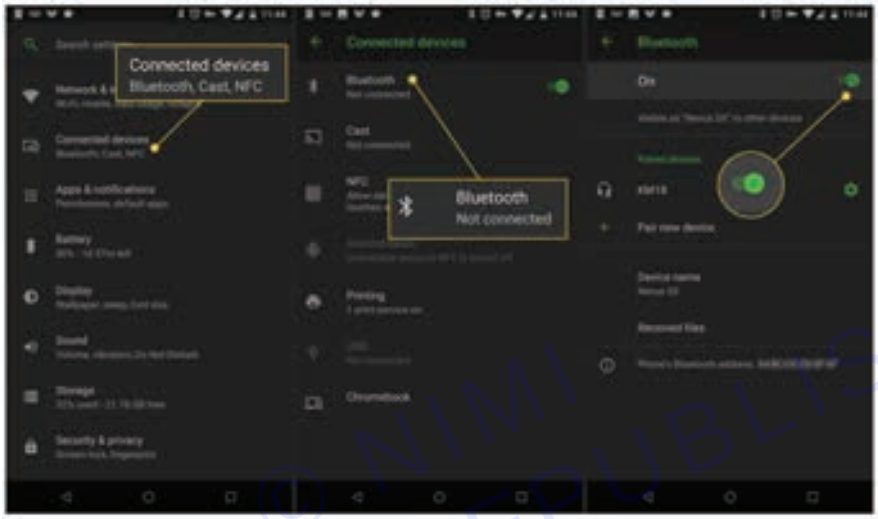
2 Choose Device and File:

In the Bluetooth File Transfer window, select Send files.

Choose the phone you want to share files with and click Next.

Browse for the file(s) you want to share, then click Open.

Click Next to send the file(s), and finally, click Finish



Result: As we shared file Bluetooth & other devices settings on your Android device

Demonstration of Data cable, OTG, Card reader

Objectives: At the end of this exercise you shall be able to

- demonstration of data cable
- types of data cable
- OTG
- card reader.

Requirements

Tools/Materials

- Data cable - 1 No.
- OTG - 1 No.
- Card reader - 1 No.

Procedure

TASK 1: **Data cable**

A data cable is a physical connector that facilitates the transfer of data between electronic devices. These cables serve as the veins of modern technology, allowing devices to communicate with each other and with the internet. Here are some key points about data cables.

TASK 2: **Types of data cables**

Data cables can be categorized into three main types:

Twisted Pair Cabling: Used for various applications, including Ethernet connections.

Coaxial Cabling: Commonly used for cable television and broadband internet.

Fiber Optic Cabling: Known for maintaining high-speed data signals over long distances.

Efficient and Reliable Data Transfer:

Data cables are designed to transmit either electrical or optical signals, depending on the technology and medium involved.

Properly designing and constructing these communication cables is vital to preserve signal integrity, reducing interference or loss during data transmission

— — — — —

TASK 3: **OTG**

OTG, is a specification that lets some Android smartphones and tablets act as a USB host so that you can plug other USB peripherals, such as keyboards or flash drives, into them. Here's more information about USB OTG, how to know if your device supports it, and how to use this handy functionality.

— — — — —

TASK 4: **Card reader**

A card reader is a handy device that allows you to read and transfer data between memory cards (such as SD cards, microSD cards, and CompactFlash cards) and your computer or other devices. Here are some key points about card readers:

1 **Functionality**: Card readers serve as an intermediary between your memory card and your computer. They allow you to access files, photos, videos, and other data stored on the card.

2 **Types of Memory Cards Supported**: Card readers are compatible with various types of memory cards, including SD (Secure Digital), microSD, CF (CompactFlash), and Memory Stick. Make sure to choose a card reader that supports the specific type of memory card you use.

3 **Connection Types**

USB Card Readers: These are the most common type. They connect to your computer via a USB port.

Built-in Card Readers: Some laptops and desktops come with built-in card readers, allowing you to insert memory cards directly into the device.

4 **Speed and Compatibility**

Look for card readers that support high-speed data transfer (USB 3.0 or higher) for faster file transfers.

Ensure compatibility with your operating system (Windows, macOS, Linux) before purchasing.

5 **Variety of Models**

There are compact single-slot card readers as well as multi-slot readers that can handle multiple card types.

Some card readers also include additional features like USB hubs or OTG (On-The-Go) functionality.

EXERCISE 133: Demonstrate assembling and disassembling of Smartphone using different tools

Objectives

At the end of this exercise you shall be able to

- to demonstrate dismantle the given Smartphone
- to demonstrate assembling the given Smartphone
- to Identify the different parts of smartphone.

Requirements

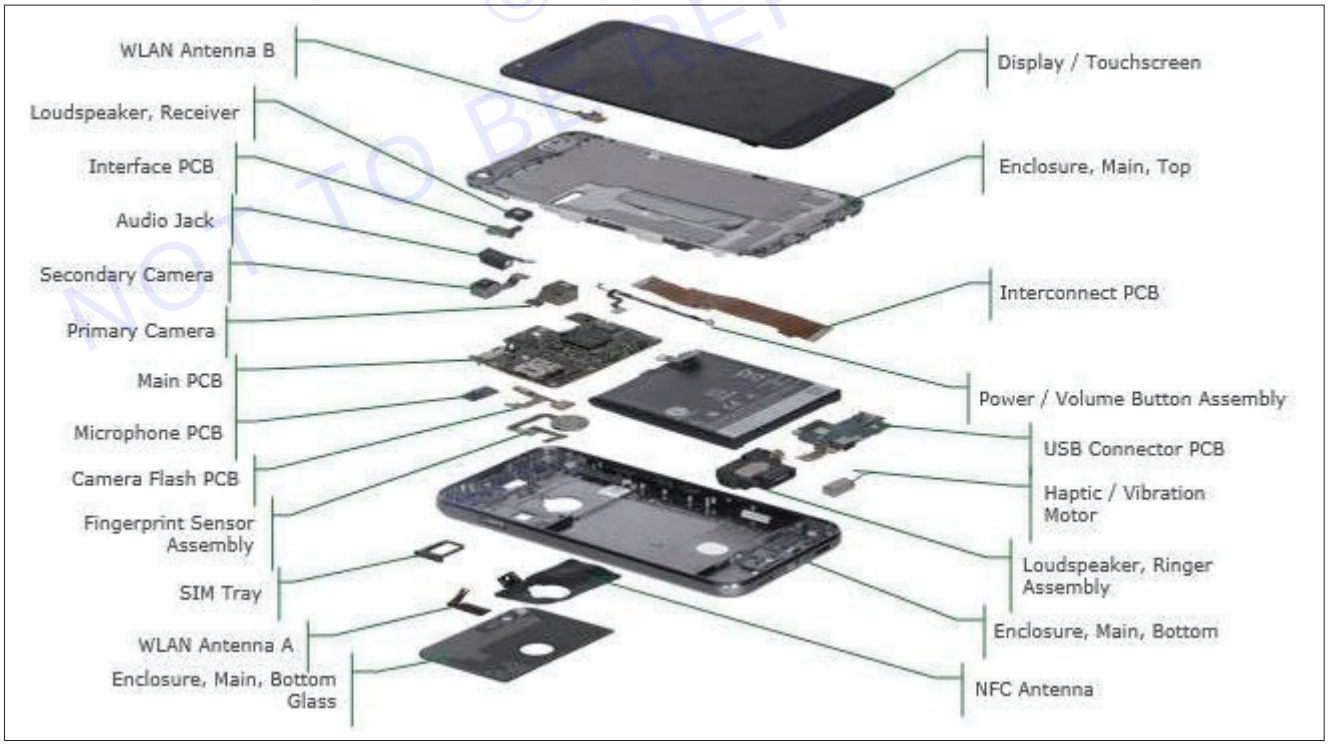
Tools/ Materials

- smartphone - 1 No.
- Precision screw driver set - 1 Set.
- Trainees tool kit - 1 Set.
- Digital multimeter with probes - 1 No.
- User manual - as reqd.
- Glasses,frames,touch sensing - 1 No.
- CNC machines - 1 No.
- Electronic component - 1 Set.

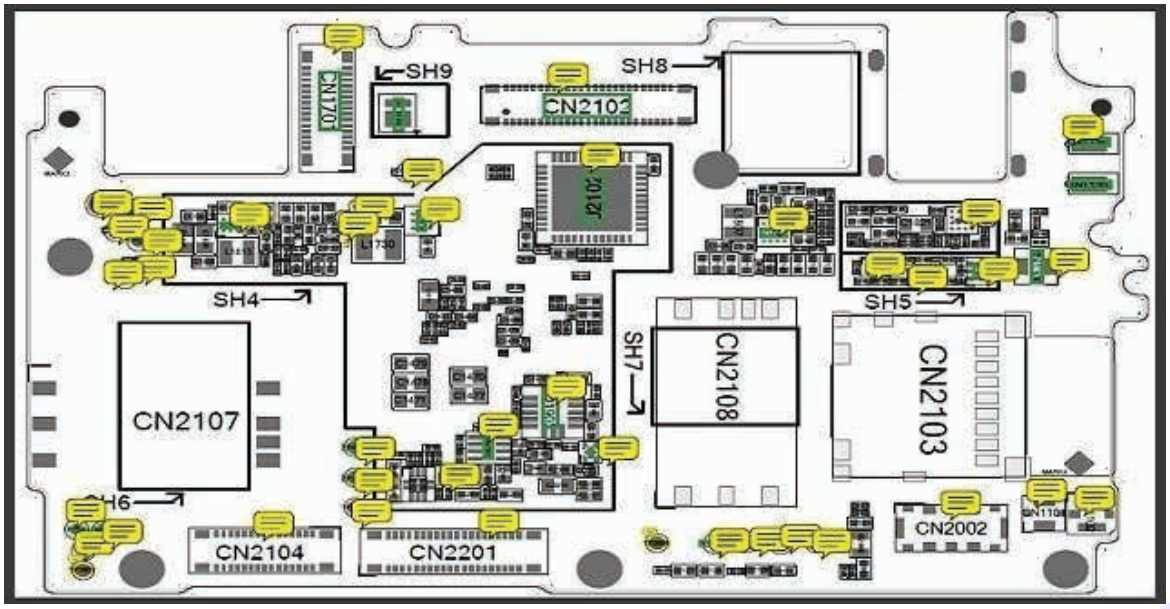
Procedure

Theory

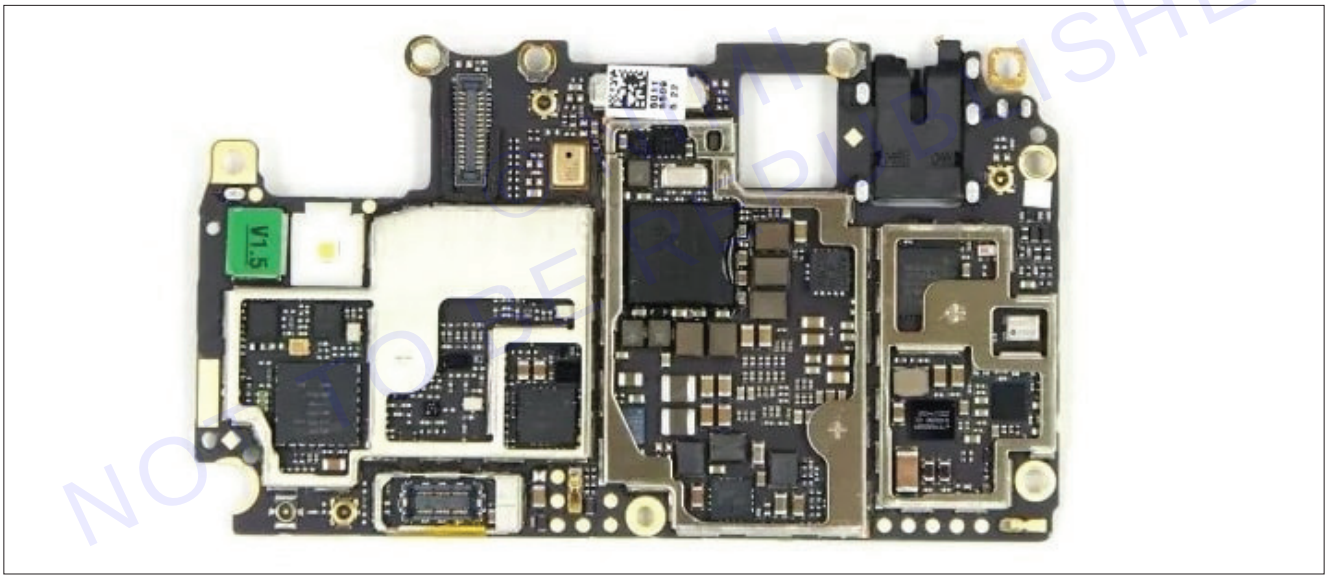
Parts of Smart Phone



Layout Diagram



Motherboard of Smart Phone



Procedure

1 identfy the part of a smartphone given in record names of each part.

2 Follow the step by step procedure done in TABLE 1 in the reverse

3 Order to re-assemble the smartphone.

4 Observe correct position and insert the ribbon cable connector etc.

5 Ensure that the assembling is done correctly and all the boards are fixed in their respective positions.

6 Switch on the smartphone and check working condition.

Results: Thus the assembling and disassembling of smartphone using different tools and assembling back the smartphones were completed successfully

EXERCISE 134: Demonstrate different types of ICs

Objectives

At the end of this exercise you shall be able to

- to demonstrate Introduction of Integrated Circuit (ICs)
- to demonstrate different type of ICs.

Motivations

- an IC can function as an amplifier, oscillator, timer,counter, logic gate, computer memory, etc.

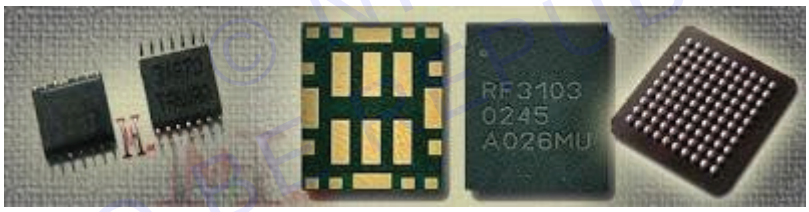
Requirements

Tools/Materials

• IC Chip Remover	- 4 Pieces.	• CRO	- 1 No.
• Pin set	- 1 No.	• Bread board	- 1 No.
• Tool kit	- 1 Set.	• Connecting wires and probes	- 1 No.
• Resister	- 1 No.		

Procedure

Integrated Circuits



Integrated circuits is nothing but the entire circuit of an electronic circuit is designed and fabricated in semiconductor material with VLSI(very large Scale Integration) technology as a single module. It is compact in size and consuming less power. Especially there are three main type IC s in mobile phone.

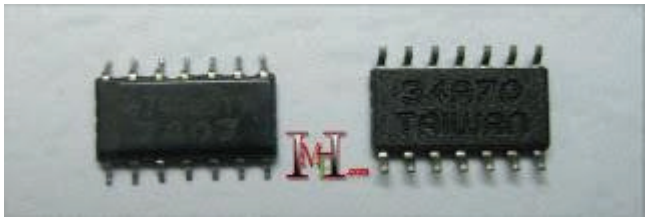
a PinIC

b PathIC

c MBGA(MicroBallGridArray)/BalltypeIC

Pin IC

The chip is packaged in a plastic holder with pins which will fit the holes on strip board and breadboards.

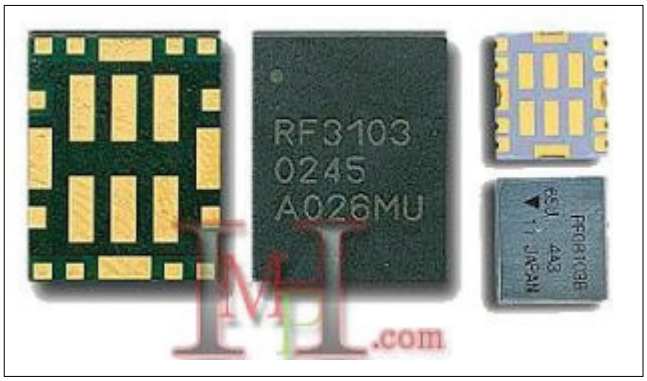


You can mount and unmount or replace these IC s using SMD rework station. However when you replace like this IC you must mount all pin to the PCB and do not short circuit. Specially Latest mobile phones have not like this IC s. But when you training to mount and unmount these Ic s then you will be able to replace chinease phone display , Switches ... etc.

Path IC

When you check your mobile phone PCB ,you will be unable to find these ICs quickly. But when you un mount these ICs you can easily identify that following images will be help full for understanding about its external appearance.

Majority ,Power Amp and Antenna Switch are come as this type of IC.

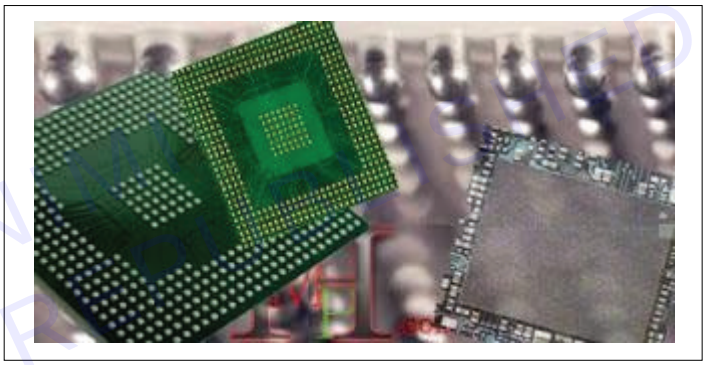


MBGA(Micro Ball Grid Array)

The BGA is descended from the pin grid array (PGA), which is a package with one face covered (or partly covered) with pins in a grid pattern. These pins conduct electrical signals from the integrated circuit to the printed circuit board (PCB) onwhich it is placed. In a BGA, the pins are replaced by balls of solder stuck to the bottom of the package.

List of major mobile phone intergrated circuit with their functions and faults

Check following list of ICs and try to understand about that faults.



- Power Amp
- Antenna Switch
- RF Processor(hagarIC)
- Power IC
- CPU
- Charging IC
- Flash IC(ROM orEEPROM)
- Oscillator(VCO)
- Sim IC
- Key Pad IC
- LCD Light control IC

Power Amp

This is a very important IC for Transmitting signal(Tx) in your phone. This IC is work as a Tx amplifier and it get high voltage directly from the battery. When it is damage we can see following faults.

i Signal Drop

ii No Network or Access

iii Battery low quickly

iv Can't make a call (Tx not work properly)

v Power on failure

vi Phone will heat

Antenna Switch

Antenna switch is help to filtering frequency Bands as 900Mhz, 1800Mhz and connect Rx, Tx (Receiver and Transmitter). Therefore when damage this IC we can see faults as following

i Signal Drop

ii No Network found

iii Some Frequency band are not worked properly

RF Processor

RF (Radio Frequency) Processor is a main IC in your phone PCB. This IC is used for processing Rx and Tx signal (for Modulating and Demodulating). Sometimes it makes a low frequency clock signal is used to start CPU functions. Therefore when damage this IC we can see faults as following.

Power on failure

i Signal drop

ii No network

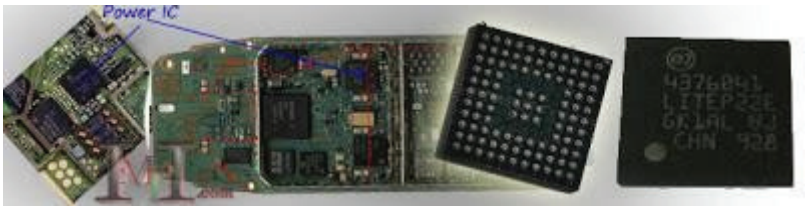
iii Caller drop

iv Rx or Tx or both are not work properly

v Battery empty quickly and phone will heat

Power IC

Power IC distribute current to all the components and IC in PCB. we can see some times some applications are not working because of Power IC is damage.(when power ic not distribute current for circuits that circuits are not worked).



i Power on failure

ii Battery empty quickly

iii Phone will heat

iv Insert Sim

v No Charging

vi Some applications are not worked properly

vii Auto Restart

CPU (Central Processing Unit)/Processor/Microprocessor

Central Process Unit is the brain in your mobile phone and controller all commands which we have given. Specially this IC check flash IC before booting mobile phone after that it will give command to Power IC. When it damages we can see following faults.

i Power on failure

ii Auto Restart/Reboot

iii Command not accepted

iv Key Pad not working or responding

v Battery empty

vi Phone will be heat

vii Phone will stuck

Charging IC

This IC is not a common IC among latest phone. However it is used for controlling charging. when it is damage we can see charging faults like these No charging , Not Charging , Auto charging or Charger not support(Bad contact charger). Nowadays Power IC (UEM) working as a charging control IC.

Flash IC (ROM or EEPROM)

This IC holds flash or booting information (program). When this IC damage we can see software problems in your phone as followings.

i Power on failure

ii Booting faults.(only booting screen)

iii Phone will stuck

iv Battery empty quickly

v Some applications are not worked(camera,Mp3,VideoBluetooth...etc)

vi Phone work as a unconditional

VCO(Voltage Control Oscillator)

VCO is the RF signal generator. It makes clock frequency which is used to run digital components. When this IC is damaged digital components fail to work and the result is power on failure.

i Power on failure

ii Signal faults

SIM IC

This IC is used for controlling SIM card data. when it is damage you can see following faults. This is a crystal IC because of that when fallen down your phone like this IC will be damage easily. Therefore we can say following faults are common faults in nowadays.

i Insert Sim

ii Unable to power on with sim card

iii Sim not accepted.

Key Pad IC

This IC is used for Controlling Key pad circuit. We can see this IC as crystal and normal type. because of that when fallen down your phone like this IC will be damage easily. Therefore we can say following faults are common faults in nowadays.

i Key pad not work as a order

ii Key pad stuck

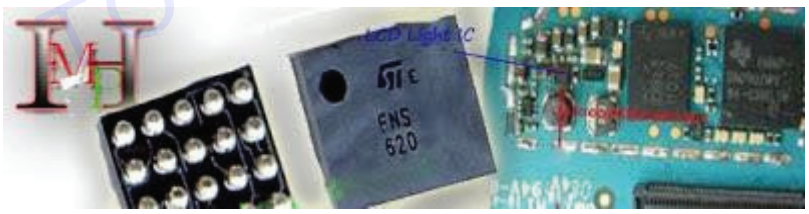
iii When power on one key is dialing continuously

iv When press a key phone will shut down or restart

v Keypad work as a unconditional

LCD Light control IC

This IC is used for controlling keypad and LCD lights. We can see this IC as crystal and normal type. when this is damaged we can see following faults.



i Key pad lights not work

ii LCD lights not work

iii White Display

iv Display not work

When you see like above damages don't try to do remove that ICs. Because there have a method for solving any faults in mobile phone. Therefore firstly try to understand about mobile phone ICs and about its works and also damages.

Hot Air Blower: It is also called SMD (Surface Mount Device) rework system and SMD repair system. It has control to regulate or manage temperature and flow or hot air. Always buy a good quality ESD-Safe hot air blower.

Figure Hot air blower.

The hot Air blower used to de-solder and solder the Ics of Mobile phone.

The hot air is blown at Ics to be removed.

Clean the surface gently and remove unwanted particles.

Solder the new component with proper soldering procedure

EXERCISE 135: Demonstrate process of password cracking

Objectives

At the end of this exercise you shall be able to

- to demonstrate process of password cracking.

Requirements

Tools/Materials

- Cain and Abel
- Ophcrack
- John the Ripper
- Slurpie

Procedure

What is password cracking?

Password cracking is the process of using an application program to identify an unknown or forgotten password to a computer or network resource. It can also be used to help a threat actor obtain unauthorized access to resources.

With the information malicious actors gain using password cracking, they can undertake a range of criminal activities. Those include stealing banking credentials or using the information for identity theft and fraud.

A password cracker recovers passwords using various techniques. The process can involve comparing a list of words to guess passwords or the use of an algorithm to repeatedly guess the password.

How do you create a strong password?

Password crackers can decipher passwords in a matter of days or hours, depending on how weak or strong the password is. To make a password stronger and more difficult to uncover, a plaintext password should adhere to the following rules:

Be at least 12 characters long. The shorter a password is, the easier and faster it will be cracked.

Take advantage of password creation tools and managers. Some smartphones will automatically create long, hard-to-guess passwords. For example, Apple iPhones will create strong website passwords for users. An iPhone stores the passwords in its password manager, iCloud Keychain and automatically fills the password into the correct field so the user doesn't have to remember the complicated password.

What does a password cracking attack look like?

1 The general process a password cracker follows involves these four steps:

2 Steal a password via some nefarious means. That password has likely been encrypted before being stored using a hash Hashes are mathematical functions that change arbitrary-length inputs into an encrypted fixed-length output.

3 Choose a cracking methodology, such as a brute-force or dictionary attack, and select a cracking tool.

4 Prepare the password hashes for the cracking program. This is done by providing an input to the hash function to create a hash that can be authenticated.

5 Run the cracking tool.

6 A password cracker may also be able to identify encrypted passwords. After retrieving the password from the computer's memory, the program may be able to decrypt it. Or, by using the same algorithm as the system program, the password cracker creates an encrypted version of the password that matches the original.

What are password cracking techniques?

1 **Brute force.** This attack runs through combinations of characters of a predetermined length until it finds the combination that matches the password.

2 **Dictionary search**. Here, a password cracker searches each word in the dictionary for the correct password. Password dictionaries exist for a variety of topics and combinations of topics, including politics, movies and music groups.

3 **Phishing.** These attacks are used to gain access to user passwords without the use of a password cracking tool. Instead, a user is fooled into clicking on an email attachment. From here, the attachment could install malware or prompt the user to use their email to sign into a false version of a website, revealing their password.

4 **Malware.** Similar to phishing, using malware is another method of gaining unauthored access to passwords without the use of a password cracking tool. Malware such as key loggers, which track keystrokes, or screen scrapers, which take screenshots, are used instead.

5 **Rainbow attack.** This approach involves using different words from the original password in order to generate other possible passwords. Malicious actors can keep a list called a rainbow table with them. This list contains leaked and previously cracked passwords, which will make the overall password cracking method more effective.

6 **Guessing.** An attacker may be able to guess a password without the use of tools. If the threat actor has enough information about the victim or the victim is using a common enough password, they may be able to come up with the correct characters.

What are password cracking tools?

Password crackers can be used maliciously or legitimately to recover lost passwords. Among the password cracking tools available are the following three:

Cain and Abel. This password recovery software can recover passwords for Microsoft Windows user accounts and Microsoft Access passwords. Cain and Abel uses a graphical user interface, making it more user-friendly than comparable tools. The software uses dictionary lists and brute-force attack methods.

Ophcrack. This password cracker uses rainbow tables and brute-force attacks to crack passwords. It runs on Windows, macOS and Linux.

UNIX password cracking

- Generally harder than NT to crack.
- 3-step process used by cracking programs
- create file of possible passwords (dictionary file)
- Encrypt file of possible passwords
- Compare results with encrypted form of passwords
- Obvious why it is harder to guess if you dont use simple words. Dictionary created must include combinations of words with various connectors
- There are different dictionaries for different environments/countries.

UNIX Password Encryption

- UNIX uses an encryption algorithm called crypt to encrypt passwords.
- Crypt is a hash algorithm that performs a one-way transformation.
- There is thus no way to decrypt a password that has been encrypted with crypt
- Each encrypted password is 11 characters and is combined with a 2-character salt.

UNIX Password Crackers

- CRACK
- John the Ripper
- XIT
- Slurpie

Password Cracking Lab

- Two password files, one for NT, one for Unix.

- Linux shadow file
- NT Sam file
- Need to locate, choose, and download password crackers
- Need to install programs and let them run
- You will probably NOT be able to get all of the passwords cracked.
- You may assume a the file came from a U.S. system when choosing a dictionary

Protecting against Cracking

- Have a good password policy
- Change them on regular basis (how regular?)
- Lock account after 3 failed attempts
- Password should contain 1 alpha, 1 number, and one special character.
- Dont allow users to reuse previous passwords.
- Password should not be word found in a dictionary. -Consider using pass-phrase.
- Consider use of one-time passwords (most common form is smart-card).

Result: Hence, Demonstration of password cracking is completed.

EXERCISE 136: Install various operating system (OS) in mobile phones

Objectives

At the end of this exercise you shall be able to

- to demonstarate Install various operating system (OS) in mobile phones.

Requirements

Tools/Materials

- Mobile phone
- Computer
- Data Cable
- Software's

Procedure

Palm OS 2.0	1997	Mail and Expense are added
Palm OS 3.0	1998	HotSync Support, Web Clipping Support, native 8-bit color support
Pocket PC 2000	2000	
Pocket PC 2002	2001	MSN Messenger, Media Player 8 Enhanced UI
Palm OS 4.0	2001	External File Systems, 16-bit color screens
Palm OS 5.0	2002	PACE Emulator, Bluetooth Emulator
Windows Mobile 2003	2003	Bluetooth Integration, Pocket Internet Explorer, Windows Media Player 9.0
Windows Mobile 2003 SE	2004	SE Potrait and Landscape switching for Pocket PCs and WPA
Palm OS Cobalt	2004	Telecommunication, Wi-Fi and Bluetooth Connectivity
Windows Mobile 5	2005	Windows Media Player 10 Mobile, Global Positioning System (GPS) Management Interface, Introduction to Office Mobile
Blackberry OS 4.1	2005	OS UI, Web Clips on Home Screen, Multitouch Gestures, Mobile Safari, Visual Voicemail, Maps, iTunes Sync, iTunes Wi-Fi Music Store, Multitouch Keyboard
iPhone OS 1.0	2007	Core iOS UI, Web Clips on Home Screen, Multitouch Gestures, Mobile Safari, Visual Voicemail, Maps, iTunes Sync, iTunes Wi-Fi Music Store, Multitouch Keyboard
Windows Mobile 6	2007	NET Compact Framework v2 SP2 Microsoft SQL Server 2005 Compact Edition Windows Live
Blackberry OS 4.2	2007 folders	Voice Notes Option,Email and SMS in separate
iPhone OS 2.0	2008 contacts	Third Party Application support, Sync Google
Blackberry OS 4.5	2008	HTML emails, faster performance and improved multi-tasking, Microsoft Office Documents ToGO
Windows Mobile 6.1	2008	Threaded SMS full page, zooming in Internet Explorer and Domain Enroll
Android 1.0 Alpha	2008	Google Apps like Gmail, Maps, Calendar and Youtube
Symbian OS	2008	Desktop Interactive Widgets, FaceBook IM chat

Android 1.1 Base	2009	Support for saving attachments from MMS, Marque in layouts, API changes
Blackberry OS 5	2009	Wireless Sync, Blackberry Enterprise Server 5, almost revamped web browser
Windows 6.5	2009	Internet Explorer Mobile 6 and Multi touch support
Samsung Bada 1.0	2009	Internet Explorer Mobile 6 and Multi touch support
iPhone OS 3.0	2009	Push Notifications, cut, copy and paste, Turn-by- Turn Navigation, Voice memos
HP Web OS	2009	Synergy app, multi-touch gestures and multi- tasking
Android 1.5 (Cup cake)	2009	Bluetooth A2DP and AVRCP support, Uploading videos to YouTube and pictures to Picasa
Android 1.6 (Donut)	2009	WVGA screen resolution support Google free turn- by turn navigation
Android 2.0/2.1 (Éclair)	2009	HTML5 support, Microsoft Exchange Server, Bluetooth 2.1
iPhone iOS 4.0	2010	Multitasking, Folders
Blackberry OS 6	2010	New media interface, stronger social media integration, Multiple Contact Lists, track pad support for swipe gestures
Windows Phone 7	2010	Tiled UI, Loud-based services support, Multitasking
Android 2.2 (Froyo)	2010	USB tethering and Wi-Fi hotspot functionality, Adobe Flash 10.1support
Android 2.3 (GingerBread)	2010	Multi-touch software keyboard, Support for extra large screen sizes and resolutions
Symbian^2 OS	2010	Royalty-free version
Symbian^3 OS	2010	Native Webkit browser, 2D and 3D graphics architecture, UI improvements and support for external displays through HDMI
Android 3.0 (HoneyComb)	2011	Optimized tablet support, with a new UI, 3D desktop, Video chat with Gtalk support
iOS 5	2011	Siri, Notification center, PC-Free, iTunes Wi-Fi Sync, iMessage, iCloud
Android 4.0 (Sandwich)	2012	It combined many of the options of the tablet-only Honeycomb version with the smartphone-oriented Gingerbread.
Android 4.1 (jelly Bean)	2012	Some of the new additions in these software updates included new notification features that displayed more content or action buttons, along with full support for the Android version of Google's Chrome web browser, which was included in Android 4.2.
iOS 6	2012	iCloud tabs, Siri enhancements, mail enhancements, FaceTime over Cellular, Facebook integration, Passbook, Homegrown Maps and Tun-by-Turn navigation
Windows Phone 8	2012	Replaced Windows CE-based architecture
iOS 7	2013	Visual overhaul, control center, AirDrop, iTunes Radios, FaceTime Audio, Refreshed Core Apps
Android 4.4 KitKat	2013	It was optimized to run on smartphones that had as little as 512 MB of RAM.
Windows Phone 8.1 Start Screen.	2014	Notification center, support for Internet Explorer 11 web browser, tab syncing among Windows 8.1 devices, separate volume controls and the option to skin and add a third column of live tiles to the
iOS 8	2014	Continuity, QuickType, Widgets, iCloud Drive, Extensibility, Healthkit, Homekit, Family Sharing

Android 5.0 Lollipop	2014	It was the first version of the OS that used Google's new Material Design language. It made liberal use of lighting and shadow effects, among other things, to simulate a paper-like look for the Android user interface.
Windows 10 mobile	2015	Mobile OS for smartphones and tablets running on ARM architecture. Its primary focus is unification with Windows 10, its PC counterpart.
iOS 9	2015	Night Shift, Lower Power Mode, Public Beta Program
Android 6.0 Marshmallow	2015	It included features such as a new vertically scrolling app drawer, along with Google Now on Tap, native support for fingerprint biometric unlocking, USB Type-C support, the introduction of Android Pay (now Google Pay), and much more.
Android 7.0 Nougat	2016	Nougat's many new features included better multi- tasking functions for the growing number of smartphones with bigger displays, such as split- screen mode, along with quick switching between Apps. Google made a number of big changes behind the scenes too. It switched to a new JIT compiler to speed up apps, supported the Vulkan API for faster 3D rendering, and enabled OEMs to support its now-defunct Daydream VR platform
iOS 10	2016	iMessage Apps, Delete built-in Apps
Android 8.0 Oreo	2017	As far as features go, Android Oreo packed in lots of visual changes to the Settings menu, along with native support for picture-in-picture mode, notification channels, new autofill APIs for better management of passwords and fill data, and much more. Android Oreo first came installed on Googles' own Pixel 2 phones.
iOS 11	2017	Augmented Reality, Major Enhancements on iPad, AirPlay 2
Android 9.0 Pie	2018	Android 9.0 Pie also included some new features designed to help extend your smartphone's battery life. That was achieved with the use of on-device machine learning which predicts which apps you will use now, and which apps you won't use until later. Pie also has Shush, a feature that automatically puts your phone in Do Not Disturb mode when you flip your phone screen down on a flat surface.
iOS 12	2018	Grouped Notifications, ARKit 2, Siri Improvements, Screen Time, Memoji
Android 10	2019	Android Q is officially known just as Android 10. The features included support for the rush of then- upcoming foldable phones. Android 10 also introduced a system-wide dark mode, along with new gesture-navigation controls, a more efficient sharing menu, smart reply features for all messaging apps, and more control over app-based permissions.
iOS 13	2019	System-wide Dark Mode, New Improved Siri Voice, Overhauled Stock Apps like Reminders and Notes, New Privacy and Security Options, New Potrait Lighting Option, Sign In with Apple User Account System
Android 11	2020	That includes a new Conversations notification category where all of your chats from various apps are collected in one place. You also have the option to save every notification that has appeared on your phone in the past 24 hours. A brand new feature lets you record your phone's screen, complete with audio, without needing a third-party app. There's also a new section of Android 11 dedicated to controlling smart home devices.

Some of the popular mobile operating systems are:

- Android
- iOS
- Symbian
- Windows Mobile
- Linux Android OS

Android is an operating system for mobile devices that is developed by Google. Android operating systems are based on the Linux kernel and the GNU software. Android has a large community of developers writing applications that has helped to extend the functionality of the devices. The developers write managed code in Java, controlling the device via Google-developed Java libraries. Android is a mobile operating system that has an open-source framework and is based on Linux which helps us to develop advanced and user-friendly applications. It follows a Monolithic kernel approach.

iOS

iOS is an operating machine based on the UNIX environment constructed for Apple's iPhone, iPod touch and iPad of different cell devices. The iOS architecture is layered. It follows a hybrid kernel approach. It contains an intermediate layer between the applications and the hardware so they do not communicate directly. The lower layers in iOS provide the basic services and the higher layers provide the user interface and sophisticated graphics. iOS is also used to manage the hardware of a gadget and for supplying applied sciences required to enhance each and every application and internet applications also. iOS used to be first introduced and launched as the operating system gadget of the iPhone introduce on the twenty-ninth of June, in the year 2007. The iOS has also consisted of apps like phone, messaging, core services of CF network, security services as keychain and certificate and trust services and core os.

Symbian

Symbian operating system is the most popular operating system used in most Smartphones and mobile phones today. The heritage of Symbian OS begins with some of the first handheld devices. This operating system began its existence in 1988 as SIBO (an acronym for '16-bit organizer'). SIBO ran on computers developed by Psion Computers, which developed operating system to run on small footprint devices. It was designed with specific criteria that can be characterized by event-driven communications, using client-server relationships and stack-based configurations. Symbian OS model follows layered approach and contains UI frame work layer, Application services layer,

Windows Mobile

Windows Mobile is an operating system used in various mobile phones and Smart phones. It encompasses the entire software stack from the kernel to the application interface. This operating system is compatible with the Microsoft Office suite of programs. The current version is called "Windows Mobile 6.5". It is based on the Windows CE 5.2 kernel. Additionally, third-party software development is available for Windows Mobile, and the software can be purchased via the Windows Marketplace for Mobile. Originally appearing as the Pocket PC 2000 operating system, most Windows Mobile devices come with a stylus pen, which is used to enter commands by tapping it on the screen.

Linux

Linux is unique among the other operating systems. This is because its development is driven by a community of developers rather than by a single company such as Symbian operating system in Nokia phones and blackberry OS in blackberry phones. According to ARCchart, the Linux operating system supports more processors than other operating system, though the most popular phone models still use the Symbian operating system. However, Linux is an open source operating system, where in, the developers constantly change and update it even at the kernel level platforms.

Smartphones based on the open source Linux operating system have emerged in the market. There are many advantages to using an open-source operating system like Linux. No cost and the opportunity to tap into the Linux open source community are appealing. This has made Linux grow, not only for the server and PC market space, but also in the embedded device area including handheld computers. For example, Motorola that is a notable supporter of Linux has released the A760 Smartphone based on this operating system.

EXERCISE 137: Perform reboot procedure

Objectives

At the end of this exercise you shall be able to:

- to perform reboot procedure in pc (in different types of windows)
- to perform reboot procedure in mobile phones or tablets.

Requirements

Tools/Materials

- Personal computer - 1 No.
- Mobile phone - 1 No.
- Tablet - 1 No.

Theory

Rebooting a computer system means to restart a computer via the power button. Generally, we need to reboot a system when we install any new software on our system. Rebooting is the process which may happen either intentionally or unintentionally. The running processes get stopped and restart again to execute normally. We can see that sometimes the computer suddenly stops to respond, hangs or displays a blue screen, and when we try to use a mouse or keyboard to shut down, it doesn't work. It becomes a critical condition that can be tackled by rebooting the system. Thus, a computer user needs to know the method of rebooting a computer system. Most users, who are new to the computer or don't have enough computer knowledge, they just turn off the power button when they detect any hanging problem with the computer. However, it is not the right way to tackle the situation because it can harm the data stored in the computer or, in some cases, it may crash the Operating System. Turning off the power button should be the last option when none of the methods works and the computer is still frozen. Otherwise, one should avoid experimenting with such things.

Here, we will discuss each step one by one to learn how we can easily reboot a computer system.

Procedure

METHOD 1: Reboot a Windows 11, 10, or 8 Computer

The "normal" way to reboot a computer running Windows 11/10/8 is through the Start menu:

1 Open the Start menu.

2 Select the power icon at the bottom (Windows 11/10) or top (Windows 8) of the screen.

3 Select Restart.

METHOD 2: Using the Power User Menu

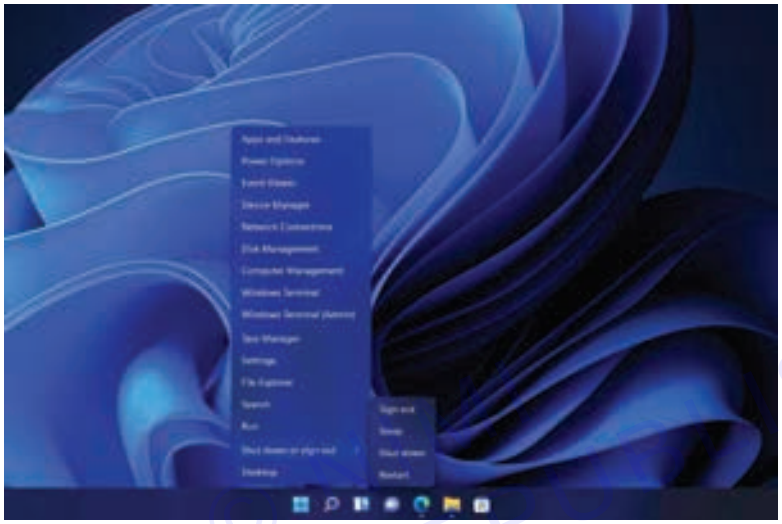
This second method is a little faster and doesn't require the full Start menu:

1 Open the Power User Menu by pressing the **Win** (Windows) key and **X**.

2 Go to **Shut down or sign out**.

3 Select **Restart**.

TIP: The Windows 8 Start screen functions differently from the Start menus in other versions of Windows. Install a Windows 8 Start menu replacement to return the Start screen to a legacy-looking menu and have easier



METHOD 3: Reboot a Windows 7, Vista, or XP Computer

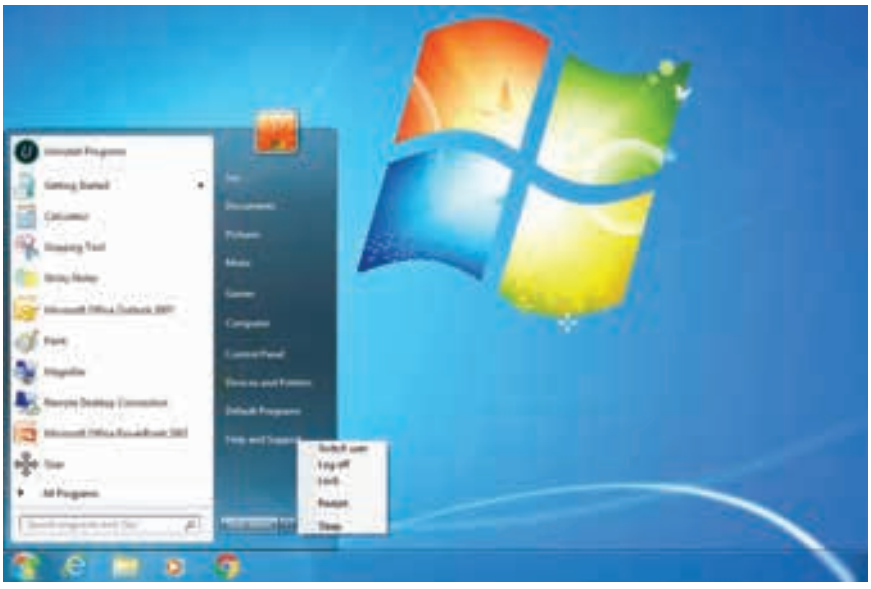
The quickest way to reboot Windows 7, Windows Vista, or Windows XP is through the Start menu:

1 Open the Start menu from the taskbar.

2 In Windows 7 and Vista, select the small arrow next to the right of the Shut down button.

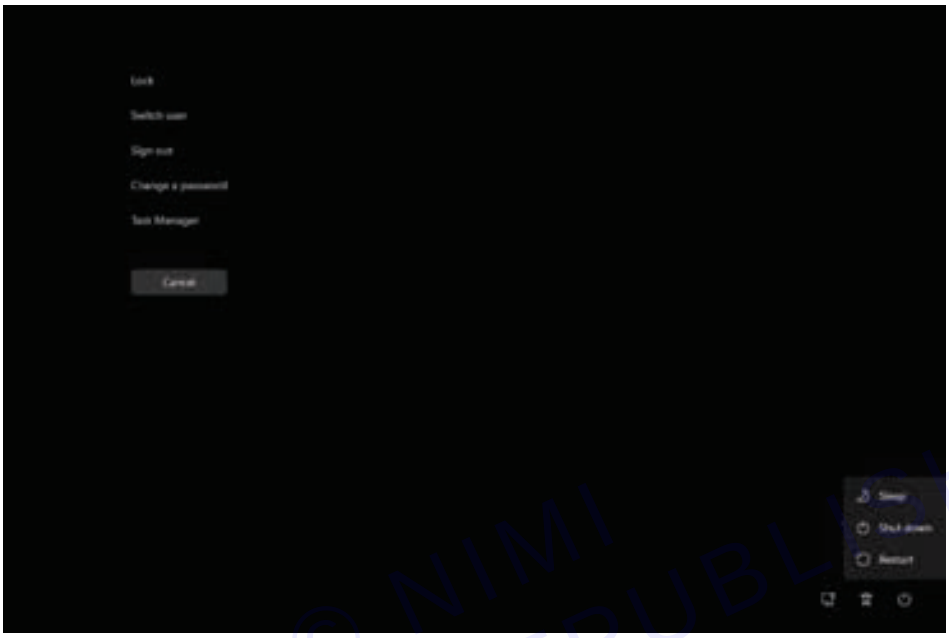
3 In Windows XP, select Shut Down or Turn Off Computer

4 Choose Restart.



METHOD 4: Restart a Computer With Ctrl+Alt+Del

- Use the Ctrl+Alt+Del keyboard shortcut to open the shutdown dialog box in all versions of Windows. This approach is an optional method that works just as well as using the Start menu or the Start screen.
- Related: The Best Windows Keyboard Shortcuts in 2024
- The screens look different depending on which version of Windows you're using, but each of them gives the option to restart the computer.



METHOD 5: Restart a Computer With Alt+F4

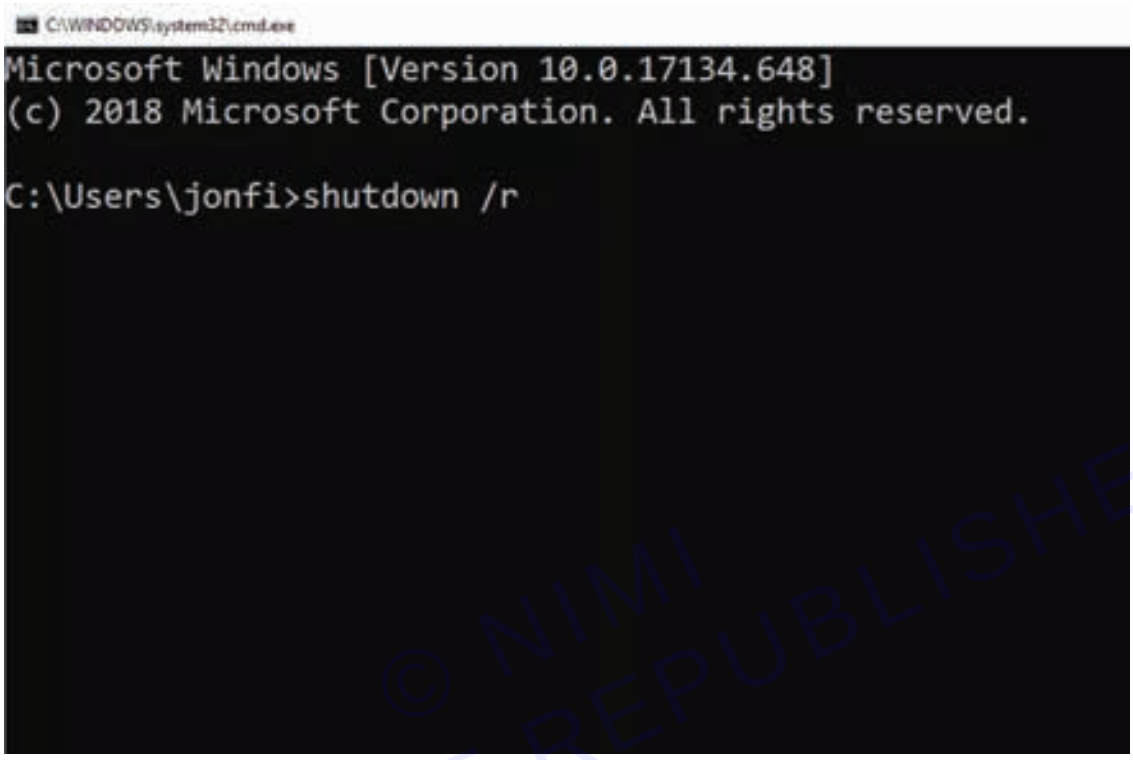
- This is another keyboard shortcut, but you have to be careful with it!
- Close all open windows so that you're on the Desktop. Select a blank area on the Desktop, and type Alt+F4. On the menu that pops up, choose Restart, and then OK

Note : It's important to focus on the Desktop before entering these

METHOD 6: **Restart Windows From Command Prompt**

The /r parameter specifies that it should restart the computer instead of just shut it down (which is what happens when /s is used).

Tip: The same restart command



- **Reboot an Android Smartphone or Tablet**

  Sometimes, you must reboot (or restart) a wonky Android device to solve problems like freezing/crashing apps and slow performance. The specifics might differ, but these reboot instructions generally apply regardless of the phone manufacturer or Android version.

- **Press the power button**

  Press-and-hold the power button for a few seconds. It's usually on the right side of the device.

  A menu will appear with the Power off option. The latest Android version might offer other options, including Restart, which is a better option.

  Some devices work a little differently. For example, the latest Pixel phones show the power off menu when you press the Power + Volume Up keys at the same time.

- **Do a Hard Reboot**
  - Even when the Android operating system can't display the power down menu, you can perform a hard reboot, also known as a hard restart. Not every Android device is programmed to do a hard reboot the same way.
  - Many devices reboot when you hold down the power button. However, it may take 10 to 20 seconds before it's triggered.
  - If that doesn't work, try holding down both the Power and Volume Up buttons for up to 20 seconds. After that, the screen will go black, signaling that the device has powered down

NOTE: Factory resetting an Android device is very different from rebooting one. Learn more about reboot vs reset to see which option is best for you.

- **Remove the Battery**

  If you have a removable battery in your device (not all do), remove it to shut everything down. Then, reattach it and power on your phone or tablet. It's a great backup if you've exhausted all other options

WARNING: Don't touch the battery or any components on the device with your fingers. Instead, use a piece of plastic, such as a guitar pick, to pop the battery out. Some devices include a battery lock or switch that you must press to pop it out.

- **Try Closing Apps Instead**

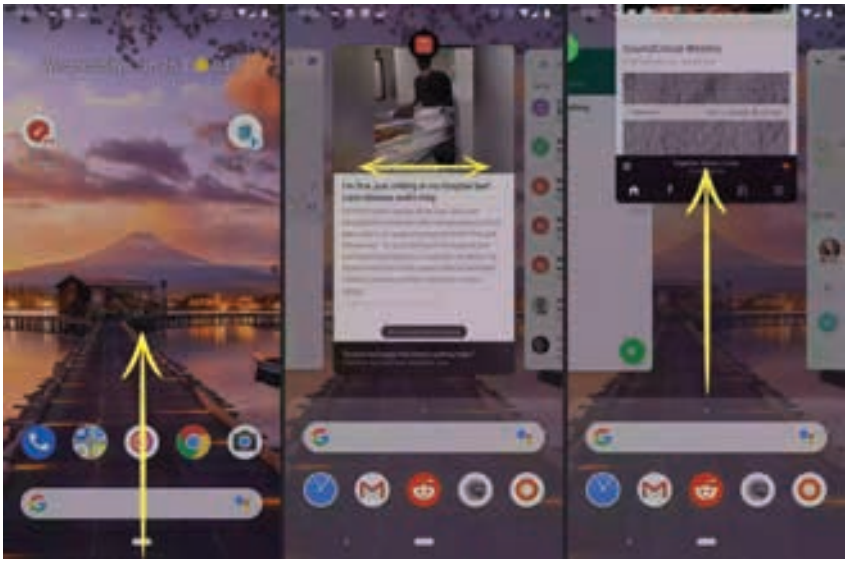
  You don't always need to reboot to solve problems. If your device is running slowly, closing a few apps might speed it up. When you leave an app, Android keeps it available so that you can quickly switch back to it. In the meantime, it continues to consume memory.

  Swipe up, or tap the square at the bottom right of your device, to show recently used apps. Then, swipe up on an app to close it. On

  some devices, you can swipe all the way to the left while viewing the open apps to find a Clear all button which quickly closes down all the apps

- **Close Recently Used Apps**

  Some Android devices have a Recently Used Apps button in the lower-left corner of the device. To close apps in this view, tap the X on each app or tap Close All.



EXERCISE 138: Demonstrate the setting different parameters for DC power supply blower machine

Objectives

At the end of this exercise you shall be able to

- to demonstrate different parameters for blower machine
- to demonstrate DC power supply of blower machine.

Requirements

Tools/Materials

• Portable fans	- 1 No.	• Turbines	- 1 No.
• Leaf blowers	- 1 No.	• Air movers	- 1 No.

Theory

- A blower is a machine that creates pressure to move air at required pace. Blowers, to put it another way, are machines that blow air or gas to perform certain functions.
- These devices are well-suited to complex operations and have proved indispensable in a number of instances.
- We hear about blowers around us, and many of us may have seen them functioning as well.
- Blowers are installation equipment that transfers air at high or low pressure in the emitting environment and turns the fan with the force applied by the engine

Procedure

1 **Power Input**: This is where the blower machine is connected to a power source.

2 **On/Off Switch**: Allows the user to turn the blower machine on or off.

3 **Speed Control**: If the blower machine has variable speed settings, this control adjusts the speed of the blower motor.

4 **Blower Assembly**: This includes the blower motor and fan assembly responsible for generating airflow.

5 **Air Outlets**: Where the airflow generated by the blower machine is expelled.

PARAMETERS

DC blower machines, like other fans and blowers, have several key parameters that are crucial for their operation and selection. Here are some of the important parameters

1 **Airflow (Q):** This is the volume of air that the blower can move per unit time. It's usually measured in Cubic Feet per Minute (CFM) or Cubic Meters per Minute (CMM).

2 **Air Pressure:** This is the pressure that the blower can generate to overcome the resistance in the system. It's typically measured in inches of water gauge (in-wg) or Pascals (Pa).

3 **Power (P):** This is the electrical power consumed by the blower. It's usually measured in Watts (W).

4 **Fan Speed:** This is the rotational speed of the blower's impeller. It's usually measured in revolutions per minute (RPM).

5 **Operating Temperature:** This is the range of ambient temperatures within which the blower can operate without overheating or failing.

6 **Noise Level:** This is the amount of noise that the blower generates during operation. It's usually measured in decibels (dB).

7 **Efficiency:** This is the ratio of the useful power output (air power) to the electrical power input.

DC Power supply for Blower machine

The DC power supply for a DC blower machine is a crucial component that provides the necessary Direct Current (DC) for the blower to operate. Here are some key parameters to consider when selecting a DC power supply for a DC blower machine:

DC Blower with DC Power supply

1 **Output Voltage:** This should match the voltage requirements of the DC blower. For instance, if the blower operates at 12V, the power supply should also provide an output voltage of 12V1.

2 **Current:** The power supply should be able to provide enough current to meet the blower's demand. The current rating of the power supply is usually given in Amps (A).

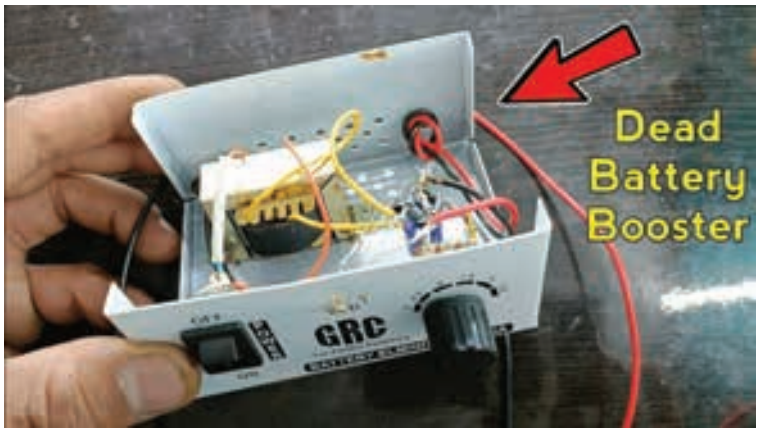
3 **Power**: The power (in Watts) is the product of the voltage (in Volts) and the current (in Amps). The power supply should have a power rating that is sufficient to operate the blower.

4 **Protection Features:** Look for features like over-voltage, over-current, and short-circuit protection. These features can help protect both the power supply and the blower from potential damage.

5 **Adjustability**: Some power supplies allow you to adjust the output voltage and current, which can be useful for fine-tuning the blower's performance.

NOTE:Remember, it's important to refer to the blower's specifications or consult with the manufacturer to ensure the power supply is suitable for your specific DC blower machine.

Booster for battery charger



Result: Thus, After this demonstrate we know tha parameters and dc power supply for dc blower machine.

Demonstrate of charging booster for dc blower machine

Objectives: At the end of this exercise you shall be able to

- to demonstrste chargeing booster of dc blower machine

Requirements

Tools/Materials

- DC blower - 1 No.
- DC power supply (12V) - 1 No.
- Charging booster - 1 No.

Procedure

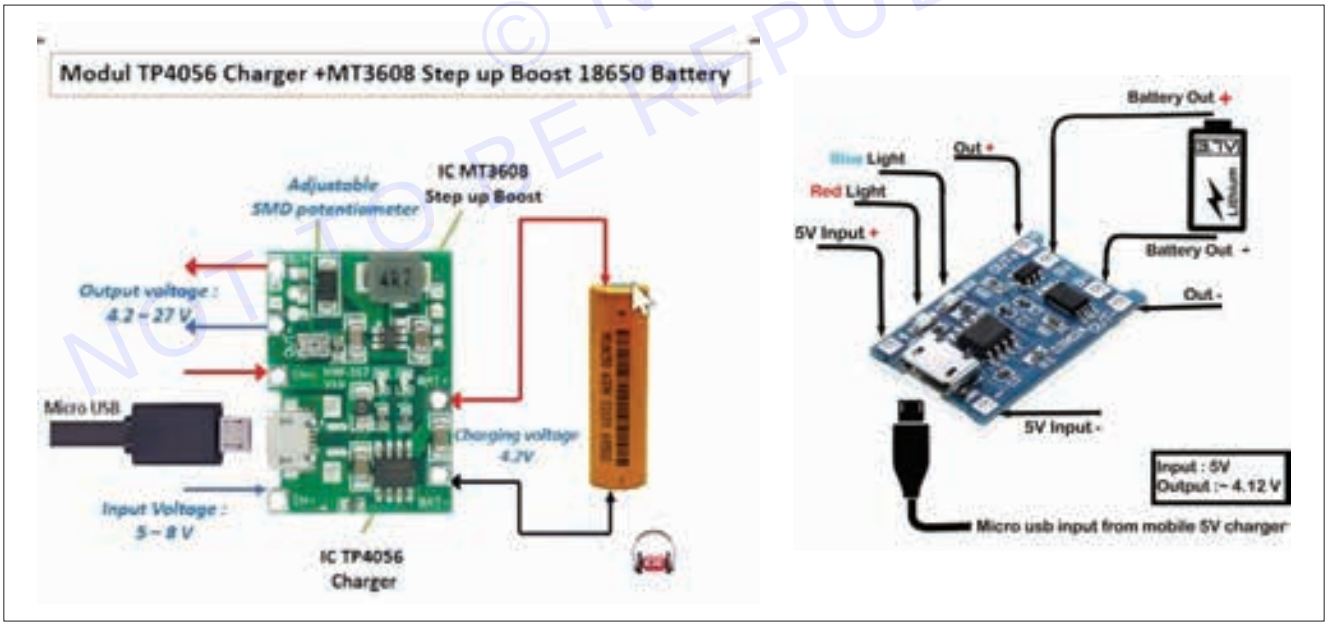
DC Charging booster

A DC Charging Booster, also known as a boost converter or step-up converter, is a DC-to-DC converter that increases voltage while decreasing current from its input (supply) to its output (load).

Examples

1 **Icstore TP4056 / TP 4056 / TPA4056 DC Charging Boost:** This module is designed for charging rechargeable batteries using the constant-current/constant-voltage (CC/CV) charging method. It has overcharge, over discharge, and overcurrent protection. The charge current can be adjusted externally with the Rprog resistor R32.

2 **CentIoT - TP4056 DC-DC Step Up Boost Module:** This module can manage battery charging and discharging, and also has a built-in boost converter to boost the voltage to match load conditions. It has an input voltage of 4.5-8V DC and an output voltage of 4.3-27V DC, which is continuously adjustable



PROCEDURE

1 Understand the Device Requirements: Identify the input and output voltage requirements of your device. This is crucial for selecting the appropriate DC charging booster1.

2 Select the Appropriate DC Charging Booster: Choose a DC charging booster that matches your device's requirements. For instance, the Boost Charger™200 delivers 200 kW of high-power charging at a lower cost and with lesser grid impact2.

3 Connect the DC Charging Booster: Connect the input terminals of the booster to your power source and the output terminals to your device. Ensure that the connections are secure to prevent any power loss.

4 Operate the Device: Once everything is connected, you can operate your device. The DC charging booster will convert the input voltage to the required output voltage.

5 Monitor the Device: Regularly check the device and the DC charging booster to ensure they are working properly. If you notice any issues, disconnect the power source and inspect the connections.

NOTE: Remember, the exact procedure may vary depending on the specific model of the DC charging booster and the device you are using. Always refer to the manufacturer's instructions for best results

Tabulation:

Calculation:

Result: Thus, we know to use dc charging booster.

EXERCISE 139: Demonstrate SMD rework station and BGA IC Reballing and Installing

Objectives

At the end of this exercise you shall be able to

- to demonstrate SMD rework station
- to demonstrate BGA IC Reballing and Installing.

Requirements

Tools/Materials

• Soldering Kit	- 1 Set.	• Hand tools	- 1 Set.
• Wire cutter	- 1 No.	• Soldering kit	- 1 Set.
• End nippers	- 1 No.	• Wire	- as reqd.
• Spare wire leads	- 1 No.	• Cleaning supplies	
• Small drill (either a dremel or a hand drill)	- 1 No.	• Pump or solder Wick	

Procedure

Theory

An SMD Rework Station is a tool used for performing intricate reworks and repairs of broken or off - kilter electronic components. It makes surface-mount soldering more manageable and faster. Here are some key features and accessories:

Key Features:

Hot Air Generation: The station can generate hot air temperatures needed to melt metal for reworks1.

Air Flow Grade: A dial on the main hardware adjusts the rate of hot air flowing from the hand tool1.

Temperature Control: Allows operators to adjust the temperature from the lowest to the highest range1.

Hot Air Wand: A handheld tool used to apply heat to metal solder1.

Wand Holder: A place to keep the wand when it's not in use1.

Essential Accessories:

Nozzle Tips: Compatible with the station's brand model1.

Solder: Used for repairing metal1.

Tip Cleaner: For constant tip maintenance1.

Flux: A liquid solution used for cleaning oxides and impurities from metal surfaces1.

SMD Tweezers: Help operators pick up small components without touching them1.

ESD Table Mat & Wrist Strap: Protect components from harmful static discharge1.

These stations are available from various manufacturers and suppliers, with prices varying based on features and brand3.

Model of SMD work station

Related Formula

Procedure

- Closed loop temperature Control, large power in starting, rapid temperature rise, accuracy and constant temperature, little effect caused by amount of air flow;
- Prevent static electric and leakage electric to damage the PCB.
- Unnecessary to touch the PCB, to avoid moving element and heating impaction.
- Extensively adjust air and temperature and select different nozzle, so it can fit most of SMD.
- Uses inlet heating element, the type of heating element and nozzle is same as the international.
- Delay in air flow shutdown when turn the power is turned off.

Usefulness

- Fits most of SMD, Example for SOIC, CHIP, QFP, PLCC, BGA etc.
- Compact hose

Operating Instructions

Before Operation

- Select the Pick-up Wire that matches the size of the IC.

  The Pick-up has an S wire (14mm) attached to it, but an L wire (30mm) may be necessary,

- Depending on the size of the IC, Choose the appropriate wire for the IC.
- Select the Nozzle that matches the size of the IC.
- Attach the nozzle when both the Pipe and the Nozzle are cool.
  - Loosen the screw on the nozzle
  - Attach the Nozzle as shown in the drawing.
  - Fasten the screw properly.

The display and temperature setting

The digital display

1 shows the actual temperature of the nozzle of the hot air gun.

2 shows the setting temperature. Pressing the “UP” or “DOWN” button can switch the digital display to the set point display. The set-point can be changed for ±1°C by tapping the “UP” or “DOWN” button. Pressing the button will change the set-point quickly. The digital display will return automatically to the actual value and the iron will reach to the setting temperature quickly.

3 °C°F/ display: Switching the temperature display from to by pressing the “ / ”button °C°F°C°F and then the electronic system will display the actual temperature and setting temperature in 1 2 °F and vice versa.

4 When the actual temperature of the nozzle is less than the set-point, “HEAT ON” will display and make the nozzle heat up.

5 When the difference is more than ±10°C between the actual temperature and the set-point of the nozzle, “WAIT” will display. It means that the temperature electronic control system is not in the stable situation, Wait a moment to let the “WAIT” disappear.

6 When “ERROR” display, there may be a trouble on the system, or the soldering iron is not connected to the control system correctly. 2-3 QFP Desoldering

- Plug the power cord into the power supply. After connection, the automatic blowing function may start sending air through the pipe, but the If the width of the IC does not match the size of the FP Pick-up, adjust the width of the wire by bendng the wire.
- Melt the solder hold the iron so that the Nozzle is located directly over, but not touching the IC, and allow the hot air to melt the solder. Be careful not to touch the leads of the IC with the nozzle.
- Remove the IC. Once the solder has melted, remove the IC by lifting the FP Pick-up.
- Turn the Power Switch off. After the Power Switch is turned off, an automatic blowing function begins sending cool air through the pipe in order to cool both heating element and the handle. In case you don’t use the unit for a long time, disconnect the plug.
- Remove any remaining solder. After removing the IC, remove remaining solder with a wick or desoldering tool.

NOTE: in case of SOP, PLCC desolder it by using tweezers, etc.

Tabulation:

Specification	
Rated power	320w
Input voltage	AC 110-130V,60Hz
Air Pump	Diaphragm pump
Capacity	24L/min (max)
Hot Air Temperature	150-5000 C
Sensor	Type K thermocouple

EXERCISE 140: Demonstrate De-solder and remove the BGA IC from the PCB and clean the solder from the bottom of the IC

Objectives

At the end of this exercise you shall be able to

- to demonstrate de-soldering BGA IC from PCB
- to demonstrate clean the solder from the bottom of the IC.

Requirements

Tools/Materials

- Trainees tools kit - 1 Set.
- Soldering iron,25W - 1 No.
- De-soldering pump (plunger type) - 1 No.
- Heat sink plier - 1 No.
- Cleaning supplies - 1 No.
- De-soldering wick - as reqd.
- Cleaning solution (IPA)
- Flux - as reqd.
- Cleaning brush - 1 No.
- Assembled PCB board for De-soldering work - as reqd.

Procedure

Theory

Here are the steps to de-solder a Ball Grid Array (BGA) IC from a PCB and clean the solder from the bottom of the IC:

Apply Liquid Flux: Apply liquid flux on the sides of the BGA package1.

Preheat the Package: Preheat the package from both the top and bottom. Heat can be given from the bottom using a preheater, while heat from the top can be given using a Hot Air Rework System1.

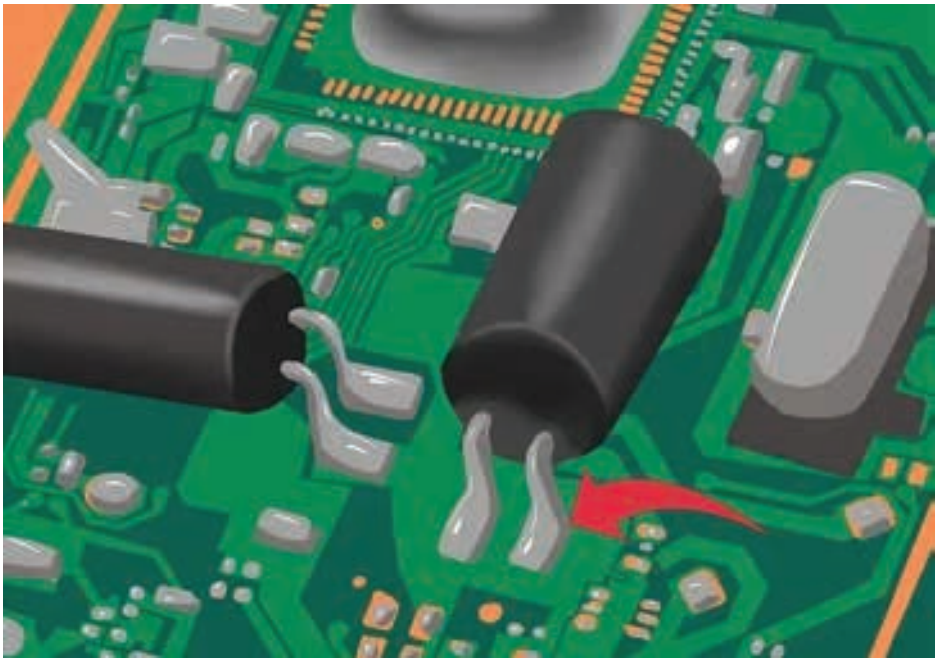
De-soldering: The most common practice to de-solder BGA is hot air1.

Cleaning the Pad: Once the BGA Package is removed, clean the pad and remove any excess solder from the board1.

Removing Excess Solder: Use a solder sucker or de-soldering braid to remove any excess solder from bridged joints2. Carefully reheat the joint and suck up excess material.

Please note that BGA soldering and de-soldering is different and more difficult than SMD soldering and desoldering1. It's important to ensure the correct process of soldering and inspection.

PCB board



TASK 1: **De-soldering components from PCB using de-soldering pump**

1 Clean the PCB using brush; locate the component to be de-soldered from the PCB

2 Mark the component lead soldered pad/track on the solder of PCB.

3 Prepare the soldering iron for de-soldering work; touch the hot soldering iron top on the marked solder joint

4 Press the plunger, lock and hold the de-soldering pump in left hand; keep the nozzle on the de-soldering point, hold the de-soldering pump firmly and release the button to suck the molten solder

5 Empty the de-soldering pump into

6 Repeat steps 3 to 5 on the other marked point also to de-solder the molten solder on the joint.

7 Visually inspect for leads of the component are free from the pad and pull the component from top side of PCB using crocodile clip.

the trash so that pump is ready for next de-soldering ping.

De-soldering components using de-soldering wick

1 Follow the steps 1 to step 3 of task 1.

2 Unwind few inches of solder wick from the coil as shown in

3 Dip the end of wick into the flux and make for a clean removal

4 Place the braid over the marked soldered joint as shown in Fig 6 for de-soldering the component.

5 Place a hot soldering iron tip over the braid at the desired pin and allow the molten solder is absorbed by the de-solder wick.

6 Remove the soldering iron and the braid quickly from the PCB; discard the used portion of the wick.

7 Observe the pad/track on the PCB and ensure the component lead is desoldered from that point.

8 Repeat the above steps for other terminals of component to be desoldered/removed.

9 Clean the PCB using IPA solution with brush. 10 Get the work checked by the Instructor.

Results: Thus, After this demonstrate we know that De-solder and remove the BGA IC from the PCB and clean the solder from the bottom of the IC.

EXERCISE 141: Practice use of different soldering iron (10W and 25W) and de – soldering wire or wick

Objectives

At the end of this exercise you shall be able to:

- Used for joining two ends of a metal to make a electrical or mechanical bond
- A soldering iron is a hand tool used in soldering. It supplies heat to melt solder so that it can flow into the joint between Soldering is a process two work pieces.

Requirements

Tools/Materials

• Soldering Iron	- 1 No.	• Soldering gun	- 1 No.
• Soldering wick	- 1 No.	• Soldering station	
• Solder	- 1 No.	• Soldering pencil	- 1 No.
• Magnifying glass	- 1 No.	• Solder flux	- 1 No.
• Wire Cutters	- 1 No.	• Butane soldering Iron	- 1 No.

Procedure

Theory: Soldering is the process of joining two ends of a metal to make a electrical or mechanical bond between them.It typically uses a low melting point metal alloy (solder) which is melted and applied to the metal parts to be joined and these bonds to the metal parts and forms a connection when the solder solidifies. The 10 watt power rating is suitable for smaller and more delicate soldering tasks, making it a great tool for hobbyists and DIY enthusiasts.

Features: Nickel-plated for durability and prevention of oxidation. 10 watt power rating for precise and delicate soldering tasks

Soldering is a skill anyone working or experimenting in electronics needs to know. Proper soldering takes practice, patience, and persistence. Solder is a metallic “glue” that holds the parts together and forms a connection that allows electrical current to flow.

Soldering is a process in which two or more metal items are joined together by melting and then flowing a filler metal into the joint—the filler metal having a relatively low melting point.

Soldering is used to form a permanent connection between electronic components.

The metal to be soldered is heated with a soldering iron and then solder is melted into the connection.

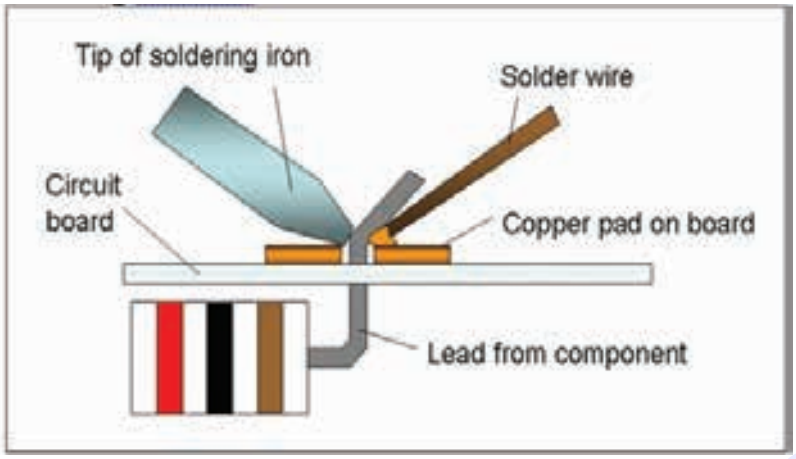
Soldering Basics

Materials Needed for Soldering

A Soldering Iron

- A soldering iron is used to heat the connections to be soldered.
- For electronic circuits, you should use a 25- to 40-watt (W) soldering iron.
- Higher wattage soldering irons are not necessarily hotter; they are just able to heat larger components.
- A 40-W soldering iron makes joints faster than a 25-W soldering iron does.

Soldering Process



1 Solder needs a clean surface on which to adhere

- Buff the copper foil of a PC board with steel wool before soldering.
- Remove any oil, paint, wax, etc. with a solvent, steel wool, or fine sandpaper.

2 To solder, heat the connection with the tip of the soldering iron for a few seconds, then apply the solder.

- Heat the connection, not the solder.
- Hold the soldering iron like a pen, near the base of the handle.
- Both parts that are being soldered have to be hot to form a good connection.

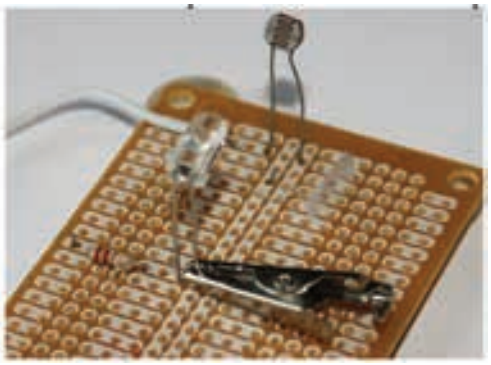
3 Keep the soldering tip on the connection as the solder is applied.

- Solder will flow into and around well-heated connections.
- Use just enough solder to form a strong connection.4. Remove the tip from the connection as soon as the solder has flowed where you want it to be. Remove the solder, then the iron.

5 Don't move the connection while the solder is cooling.

6 Don't overheat the connection, as this might damage the electrical component you are soldering.

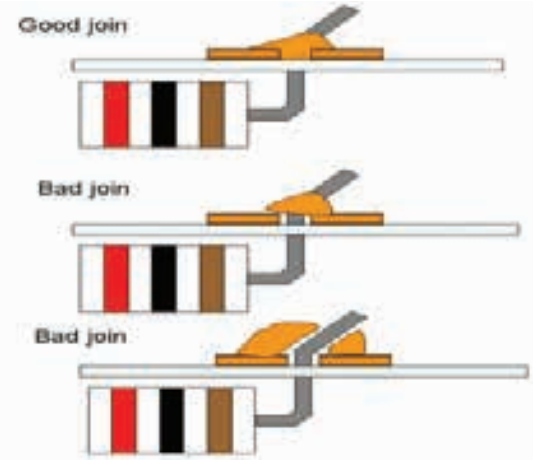
- Transistors and some other components can be damaged by heat when soldering. A crocodile clip can be used as a heat sink to protect these components.



7 Soldering a connection should take just a few seconds.

8 Inspect the joint closely. It should look shiny.

- If you are soldering a wire (called the lead) onto a PC board (on the track), it should have a volcano shape.
- If the connection looks bad, reheat it and try again.



Desoldering Basics

Materials Needed for Desoldering

a Solder Sucker/ Desoldering Pump

The most commonly used and convenient equipment needed for desoldering is the desoldering pump. A good manual solder sucker like this one works pretty well for selectively removing through holes parts from a PCB. Cheaper and smaller units do not work as well. They're marketed as compact but they don't works as well due to the limited stroke length and smaller cylinders.

Desoldering Process

One of the nicest ways to desolder a component involves using a desoldering pump. A desoldering pump is essentially a small, high pressure vacuum. After heating up the solder, you can use the desoldering pump to suck the solder up and out of the way. Here are the basic steps for using a hand-powered desoldering pump. 1. Heat up the solder you want to remove with a soldering iron (some desoldering pumps also come with attached irons).

2 Press down on the plunger (If your pump has a bulb, just squeeze the bulb).

3 Once the solder is molten, place the tip of the desoldering pump against the solder that you want to remove.

soldering iron use:- A soldering iron is a hand tool used in soldering. A quality soldering iron is one of the most important tools you'll need in almost every soldering projects. It supplies heat to melt Solder which acts as a sort of metallic glue that joins elements together. Soldering irons have many applications. It is very helpful for repairing small holes in metal items, use by jewellers, metal workers, roofers and electronics technicians.

Different Uses of Soldering Iron

Soldering Tools for Circuit Boards

Used in plumbing such as closing small gaps between two metal pipes

Craft projects

Can be used to solder mosaics and stained glass

For engine and car repair services

FORMULA:-

Examples of these four-element compositions are 18/64/14/4 tin-silver-copper-zinc (melting range 217–220 °C) and 18/64/16/2 tin-silver-copper-manganese (Sn-Ag-Cu-Mn; melting range of 211–215 °C)

Types of solder

Lead-Based Solder. Lead solder, made of lead and tin, is used for most electronic manufacturing applications to form a strong bond between the joints of other metals, such as copper and aluminium.

Lead-Free Solder. Lead-free solder generally has a higher melting point than conventional solder.

EXERCISE 142: Replace Various ICs on mobile handsets

Objectives

At the end of this exercise you shall be able to:

- to perform precise soldering and desoldering on mobile PCBs
- to perform replacements of ICs without damaging nearby components during the process.
- for technicians and DIY enthusiasts, IC replacement offers a chance to learn and hone soldering skills
- It's a practical application of electronics knowledge.

Requirements

Tools/ Materials

- Soldering Iron - 1 No.
- Magnifying Glass or Microscope - 1 No.
- Flux and Solder - 1 No.
- PCB Holder or Third Hand Tool - 1 No.

Equipments

- Soldering and anti-static measures - 1 No.
- Solder Wire - as reqd.
- Fine-Tip Tweezers - 1 No.
- Multimeter - 1 No.
- Chip Extractor,Hot Air Rework Station - 1 No.

Procedure

Theory

Integrated circuits (ICs) are miniature electronic components that combine multiple electronic functions onto a single chip. They serve as the "brains" of our devices, handling tasks such as processing, power management, audio, and communication.

Types of Replaceable ICs in Mobile Phones

Power IC (PMIC): Responsible for managing power distribution, charging, and voltage regulation.

Audio IC: Handles audio input/output, including speakers, microphones, and headphone jacks.

Touch Digitizer IC: Enables touch functionality on the screen.

Other ICs specific to certain phone models.

Identifying Damaged ICs

Your phone may exhibit different symptoms based on the damaged IC:

Power IC: Phone won't turn on.

Touch Digitizer IC: Touchscreen won't work.

Audio IC: No audio output.

Inspect the phone's PCB (printed circuit board) for visible burn marks on the ICs.

Use a multimeter to detect short circuits and identify damaged ICs.

Can You Replace ICs Yourself?

Replacing ICs requires specialized soldering and desoldering equipment.

It's not recommended to attempt this without proper tools and expertise.

Opening your phone might void its warranty.

Where to Get ICs Replaced

Official Repair Service

iPhones: Send them to an Apple-authorized service center or visit an Apple store.

Android phones: Send them to the manufacturer's official repair service or an authorized agent.

Third-Party Repair Shops:

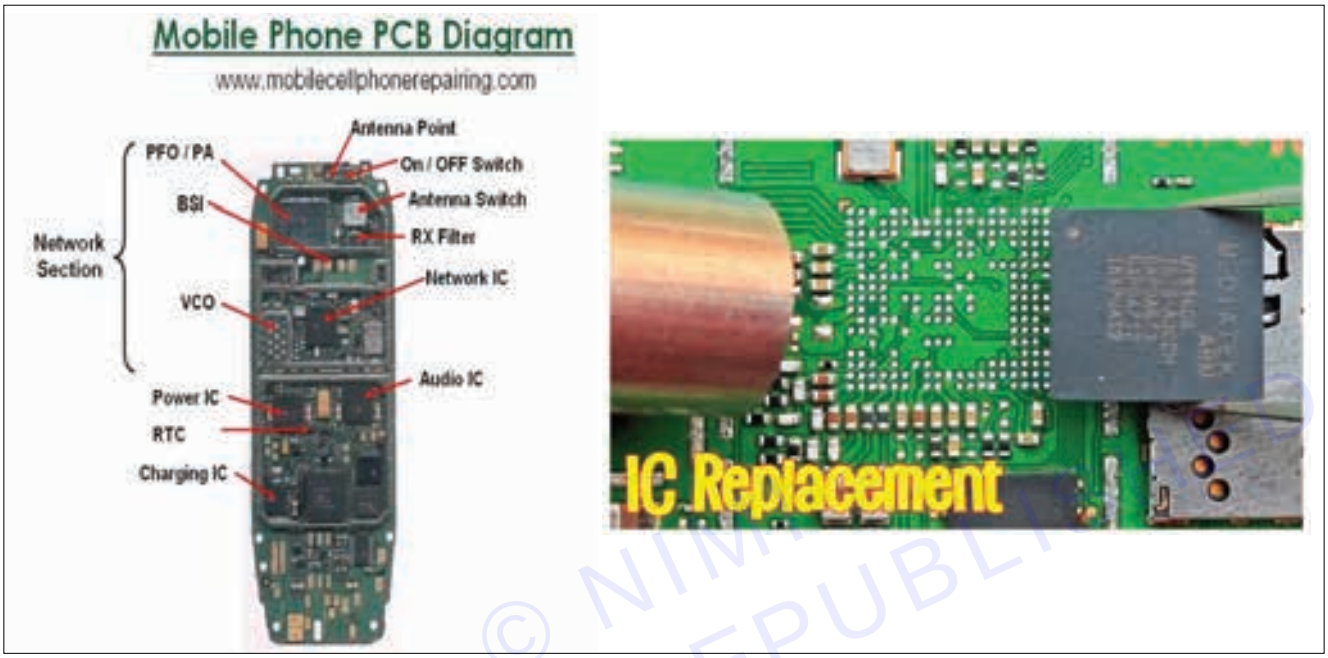
Some offer board-level repairs, including IC replacements.

Cost of IC Replacement:

If your phone is under warranty, IC replacement is usually covered.

Otherwise, the cost varies based on the specific IC.

Layout



PROCEDURE:- Replacing various ICs on mobile handsets is a delicate process that requires specialized equipment and expertise. Here's a general procedure:

1. **Identify the Damaged IC:** Your phone will show different symptoms depending on the damaged IC. For instance, the phone won't turn on if it's the power IC, the touchscreen won't work if it's the touch digitizer IC, and you won't hear audio if it's the audio IC1. You can also identify damaged ICs by inspecting the phone's PCB; damaged ICs often have easily noticeable burn marks.
2. **Acquire the Replacement IC:** It's possible to replace a damaged power IC, audio IC, touch digitizer IC, and several other ICs on many phone models, but the replacement IC must be available.
3. **Desolder the Damaged IC:** This requires special desoldering equipment. The damaged IC is carefully heated and removed from the circuit board.
4. **Solder the New IC:** The new IC is then soldered onto the circuit board using special soldering equipment.
5. **Test the Device:** After the new IC is installed, the device should be tested to ensure the replacement was successful.

Please note that this process should be performed by a qualified technician to avoid damaging the device further. Opening your phone might also void its warranty. If you're not comfortable doing this yourself, consider sending your phone to the official

RESULT

The results of replacing various ICs on mobile handsets can vary depending on the specific IC being replaced and the phone model. However, it is generally possible to replace damaged ICs like the power management IC (PMIC), audio IC, and touch digitizer IC, among others, with the right tools and expertise

Here are some key points regarding the replacement of ICs on mobile handsets:

- **DIY Considerations:** Replacing phone ICs requires special soldering and desoldering equipment and it's not recommended to attempt it without proper skills and tools

EXERCISE 143: Demonstrate damages from ingress of the water and practice to resolve. Analyze the hanging issues and practice to resolve it

Objectives

At the end of this exercise you shall be able to:

- fixing phone hanging issues and phone drops that have fallen in water
- just as a person gets cold and fever when he gets wet in the rain.

Requirements

Tools/Materials

- Screw driver - 1 No.
- Multimeter/Testing meter - 1 No.
- Credit card/Plastic gadgets - 1 No.
- 2 Small containers - 1 No.

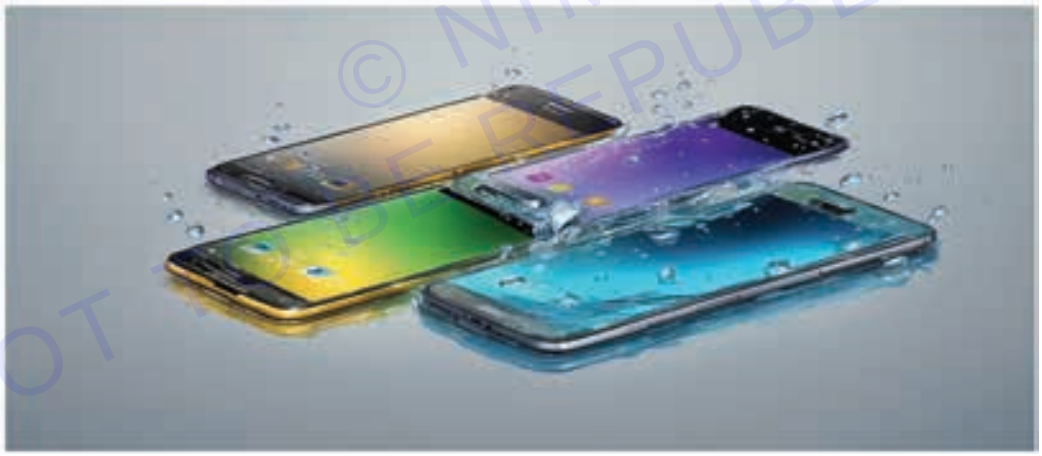
Equipments

- Display - 1 No.
- Battery
- Speaker - 1 No.

Procedure

THEORY:-1 Dropping in water and Impact

Dropping a phone in water is one of the most common causes of phone damage.



How to get water out of your phone

Here's what to do if you drop your phone in water or get it wet:

1 Remove it from the liquid immediately. The longer it stays there, the more liquid will seep into various inlets.

2 Turn the phone off and leave it off.

3 Remove the protective case.

4 If possible, open the back and remove the battery, SIM card, and microSD card (if you have one). Not sure how to remove the SIM card? Check out our guide for iPhone and Android.

5 Use a cloth or paper towel to dab your phone dry. Do not rub the phone, as doing so could accidentally push liquid into the phone's more sensitive parts. If the phone was completely submerged, you might try (very) gently vacuuming around the phone's creases and openings to suck more water out.

6 Resist the urge to bake your phone in the sun. Keep it in a cool, dry place.

7 You've probably heard the suggestion to put your phone in rice if it gets wet, but we do not recommend this method. Instead, try silica gel packets, like the ones that often come with new products such as a pair of shoes, as they've proven to be much more effective. Fill a plastic zip-top bag with silica gel packets and bury the phone in the bag. Leave your phone in the bag for 24–48 hours.

8 After you've allowed your phone to fully dry, switch it on. If it doesn't turn on right away, charge it fully and try again.

If your phone turns back on, great! Still, keep an eye on it over the next week or so, as sometimes certain features won't work the way they used to.

If possible open the mobile phone separate their parts and leave it for 2 days and turn it ON.

2 Solve Hanging Problem in Smartphone:-

One of the common problems we face with Smartphone nowadays is none other than "Hanging". Almost every Smartphone.The common reason of Smartphone hang is when you use too much of RAM.

Check your RAM:-

Most and hangs, if there is not enough space on RAM. So avoid, downloading heavy applications without checking the Smartphone lags

RAM. If your phone is running on low RAM memory, try to close all the background application and uninstall unused apps and apps that are not essential.

Task Manager: - Close the unwanted apps running on background using Task Manager on Android device.

Avoid Live Wallpaper: - Don't keep animated or Live wallpaper, as it would directly affect RAM's performance. Try to keep your device display with simple or no wallpaper.

Internal memory: - Too much use of phone memory is the main reason to get phone hanged. To solve the hanging problem in your Android phone move all your data's including songs, videos and other info in SD card.

Multitasking :- While surfing internet don't run multiple tabs or perform multiple tasks because it slows down processor and consumes lot of RAM

Avoid running multiple apps: - If you are using a low-end Smartphone, try not to run multiple apps at the same time.

Anti-virus: - Install reliable Anti-Virus software on your mobile. Sometimes, malware or virus can slow down your Smartphone.

Cache: - Generally, the apps which we are using daily create cache resulting in hangs and lags. However, it should be cleared on regular basis.

Software update: - If you face hanging problem quite often, then it can be a problem of phone software bug. To avoid this software bug, the Smartphone requires the updating of its firmware software, which can be checked under section "About Phone".

Delete unwanted data's : - Free up internal as well as external memory as much as you can by deleting/moving unnecessary files

PROCEDURE: - If the phone falls into water, the screen may get scratched and the screen may break and the phone`s body may also get damaged. Many registers and capacitors in the phone`s motherboard may get damaged, such as the phone`s camera, speaker, battery, RF component.

After checking all these problems, the phone repairing specialist carefully repairs the phone after making sure that the problem is fixed and the hardware problems of the phone get fixed.

To fix the phone hanging problem, first of all we should check the RAM of our phone. Live wallpaper should be checked to see how much space is left in it. You should not download un necessary apps in the phone. You should keep updating the phone`s software. The advantage data of the phone should be deleting. All these tasks should be done. By doing this the hanging problem of the phone will be solved.

RESULT: - Hardware problems and software problems that occurred after the phone fell in water have been rectified through careful testing.

EXERCISE 144: Perform replacement of touch sensor and finger print sensor in smartphones

Objectives

At the end of this exercise you shall be able to:

- To perform Replacement of touch sensor and finger print sensor in a Smartphone.

Requirements

Tools/Materials

- Screw driver 0.8 or 1.2mm - 1 No.
- Opening tools 200mm - 1 No.
- Tweezers 150mm - 1 No.
- Heat gun or hair dryer 250mm - 1 No.

Equipments

- Replacement sensors - 1 No.
- Anti- strips wrist strap - 1 No.
- Adhesive strips or adhesive remover - 1 No.

Procedure

Theory

Sensor

- sensors are the devices that detect changes or events in their environment and convert them into measurable signals or outputs.

They come in various types and are used across industries for different purposes, such as monitoring temperature, pressure, motion, proximity, light, sound and more.

Sensors play a crucial role in enabling automation, control systems, data collection, and decision-making processes.

They provide input to electronic systems or microcontrollers based on the detected changes in the environment.

Examples of sensors include temperature sensors, pressure sensors, proximity sensors, motion sensors, light sensors, and many others.

Touch sensors

There are 3 types of Touch screen sensors, they are resistive, capacitive, and surface acoustic wave sensors.

Touch sensors detect physical contact or touch on a surface and convert it into an electrical signal.

They are commonly used in touchscreens for smartphones, tablets, laptops, and other electronic devices.

Types of touch sensors:-

- Capacitive touch sensors
- Resistive touch sensors
- Surface acoustic wave touch sensors
- Infrared touch sensors
- Optical touch sensors
- Projected capacitive touch sensors

Finger print sensors

Fingerprint sensors are biometric security devices that capture and analyze fingerprint patterns for identification or authentication purposes.

Phones use one of three different technologies to read your fingerprint: optical, capacitive or ultrasonic. An optical fingerprint reader is the oldest of the three. It uses a specialized miniature camera to take a picture of your finger, often backlit with little LEDs or the phone's screen.

unluckily, these sensors are easy to fool – even a good photo can trick them, so it may be combined with a capacitive sensor, the second technology, to check there is really a finger there.

A capacitive fingerprint sensor uses a grid of tiny capacitors that store electricity, which is discharged only at the points where your fingerprint ridges touch. An array of thousands of capacitors can then be used to map the pattern of your fingerprint. Sometimes these sensors also support swipes or force sensing.

The third and most advanced form of fingerprint sensing uses ultrasonic. Much like the ultrasonic scanners used for medical purposes, an ultrasonic sound pulse is transmitted to your finger and the reflected pulse is measured. Bats, whales and dolphins use ultrasonic to understand the shape of their surroundings; the sensors on a Smartphone use it to understand the 3D shape of the ridges in your fingerprint. It can even work through the phone screen.

Types of finger print sensors

- Capacitive fingerprint sensors.
- Optical fingerprint sensors.
- Ultrasonic fingerprint sensors.
- Thermal fingerprint sensors.
- RFID fingerprint sensors.

PROCEDURE

1 Preparation

Power off the Smartphone and disconnect it from any power source.Gather the necessary tools and replacement sensors.

2 Accessing the Components

Remove any protective case or cover from the smartphone.Use appropriate opening tools to carefully open the smartphone's casing without damaging it. Be cautious around the edges and connectors.

3 Locating the Sensors

Identify the touch sensor, usually located beneath the touchscreen display.Locate the fingerprint sensor, typically found near the home button or on the rear of the smartphone.

4 Disconnecting the Sensors

Use tweezers or a small screwdriver to disconnect any connectors or ribbon cables attached to the sensors.Be gentle to avoid damaging the connectors or cables.

5 Removing the Old Sensors

Unscrew any screws securing the sensors in place, if applicable.Carefully lift out the touch sensor and fingerprint sensor from their respective locations.

6 Installing the New Sensors

Align the new touch sensor and fingerprint sensor in their designated positions.Secure them in place using screws, if provided.Reconnect any connectors or ribbon cables to the new sensors.

7 Testing

Power on the smartphone and test the functionality of the replaced sensors.Ensure that the touchscreen responds accurately to touch inputs and that the fingerprint sensor can successfully recognize fingerprints.

8 Reassembly

Once testing is complete and everything is functioning properly, carefully reassemble the smartphone.Make sure all components are securely in place and any screws are tightened appropriately.

9 Final Checks

Power off the smartphone again and perform a final inspection to ensure everything is correctly installed and aligned.Clean the touchscreen and fingerprint sensor area, if necessary, before reattaching any protective case or cover.

RESULTS

The results of replacing touch sensors and fingerprint sensors in smartphones include restored functionality, improved performance, enhanced security, extended lifespan, and increased user satisfaction.

EXERCISE 145: Replace camera of faulty smartphones

Objectives

At the end of this exercise you shall be able to:

- taking good quality photos with a smartphones.
- in this way,by changing the lenses of the eyes, the person starts seeing properly.

Requirements

Tools/Materials

- Screw driver 150mm - 1 No.
- Creditcard/ guitar pick - 1 No.
- 2 Small containers - 1 No.
- Cotton cloth - 1 No.

Equipments

- A new camera - 1 No.
- Good light source - 1 No.
- Even and clean surface - 1 No.

Procedure

Theory:- First of all this phone should be switched off.

After that the back cover is removed.

The Pages Present in the mobile phone are opened

After that the battery removed the phone.After that, fist carefully remove the inner cover covering the phone's camera. with the help of a plastic gadget or creditcard. He has to carefully take.

After removing the old camera from the phone, carefully install the new camera in its place. And the inner cover has to be installed, after that all the screws have to be tightened properly. After that the back cover of the smartphone has to be installed.

PROCEDURE :-

1 All the tools and items needed. The phone whose camera needs to be changed should be kept in one place.

2 The back cover, screws and old camera of the phone have to be removed from the phone.

3 After installing the new camera, put the screws and back cover in place.

4 After this process the phone is now ready to take good quality photos.

RESULT:-

Just as when a person changes the lens of his eyes, he able to see everything clearly, similarly by changing the old camera of the phone and installing a new camera, the phone becomes capable of taking good quality pho-tos and videos.

MODULE 16: CCTV: Closed cricuit television

EXERCISE 146: Demonstration Of Different CCTV Components

Objectives

At the end of this exercise you shall be able to:

- study different part of CCTV components.

Requirements

Tools/Materials

- Cable stripper (0.75mm-2.5mm) - 1 No.
- Crimping tool - 1 No.
- Combination pliers - 1 No.
- Camera - as reqd.
- Monitor (18.5 Inch) - 1 No.
- Cables - as reqd.
- Routers - 1 No.
- VDR (Digital Video Recorders) - 1 No.
- NVR (Networks Video Recorders) - 1 No.
- Data Storage (1 TB) - 1 No.

Procedure

CCTV is a state-of-the-art technology surveillance system, an eye on complete organisation. This can be most gainfully utilized to achieve optimum security level. The idea of CCTV is to ensure safety & security by surveillance. It creates a safe and secure environment by ensuring the following:

a Detecting offenders and preventing crimes, theft, sabotage, burglary within the facility.

b Providing evidence for any investigation and offender's prosecution.

c Preventing and responding effectively to any crises and harassment of any kind

d Enhancing confidence and commitment to the security of premises.

A CCTV camera system makes use of video cameras, also called surveillance cameras to keep track of the interior and exterior of a property, transmit the signal to a monitor or set of monitors, and give real-time 24/7 viewing access.

With all these benefits, a surveillance system has become a must in a society where there is an increase in the crime rate. So, when you decide which security system is best for your unique necessities, these are the 5 essential components you should give importance to:

Basic principle of CCTV:

CCTV systems work based on capturing a sequence of images and displaying them as Real-time videos. The two types of CCTV systems are wired and wireless systems. Wireless systems work on the concept of connecting to a signal hub connection and giving you 24/7 viewing.

1 Camera:

If you're building a CCTV Camera System, you have two camera options: Internet Protocol (IP) or analog. IP is usually the preferred choice due to its compatibility with most devices. Many different types of cameras can be installed, for example -dome cameras, bullet cameras, covert cameras.

Depending on how many angles you want to cover, how many cameras you will need in that specific area, how much resolution or detailing you require when you choose your preferred cameras.

Type of cctv camera:

Dome CCTV Cameras

PTZ Pan Tilt & Zoom Cameras

Bullet CCTV Cameras

Day/Night CCTV Cameras

C-Mount CCTV Cameras

Infrared/night vision CCTV

2 Monitoring Station:

A monitor arguably facilitates the most important function of a security camera: viewing recorded images and footage. Deciding how many monitors you'll need is dependent upon what, and which area you are monitoring. You wouldn't need more than three to five screens if you aren't operating in a large-scale facility. Although if your requirements change, you can easily add or remove monitors anytime to match the compatibility of your camera.

3 Cables &Routers:

Depending on the type of surveillance system, and cameras you choose, you will need supporting technologies like cables, and routers to be integrated into your system for a seamless connection. For example, wireless systems require a router, while wired versions do not.

Therefore, choose the cables, and wires after selecting your cameras, and monitors according to your unique needs.

4 Video Recorders

The video recorder is the device where video recorded on the camera gets processed for storage & viewing. There are two types of video recorders: DVR (Digital Video Recorders) and NVR (Network Video Recorders). You can learn more about them.

5 Data Storage

Your CCTV security system is only as good as the hard disk backing it. The storage device for a security camera system should be able to record, store and re-play videos non-stop from multiple feeds. Regular hard drives that are used in PCs and Laptops are ill equipped to handle CCTV storage needs. Hence, it is critical to choose a robust storage system for safe data storage.

Procedure:

1 First, we take DVR and cameras all equipment's.

2 Install all camera at location. And give DC supply and we connect BNC connector to DVR by using the cable coaxial cable.

3 A monitor connect to HDMI portal and a laptop as per requirement.

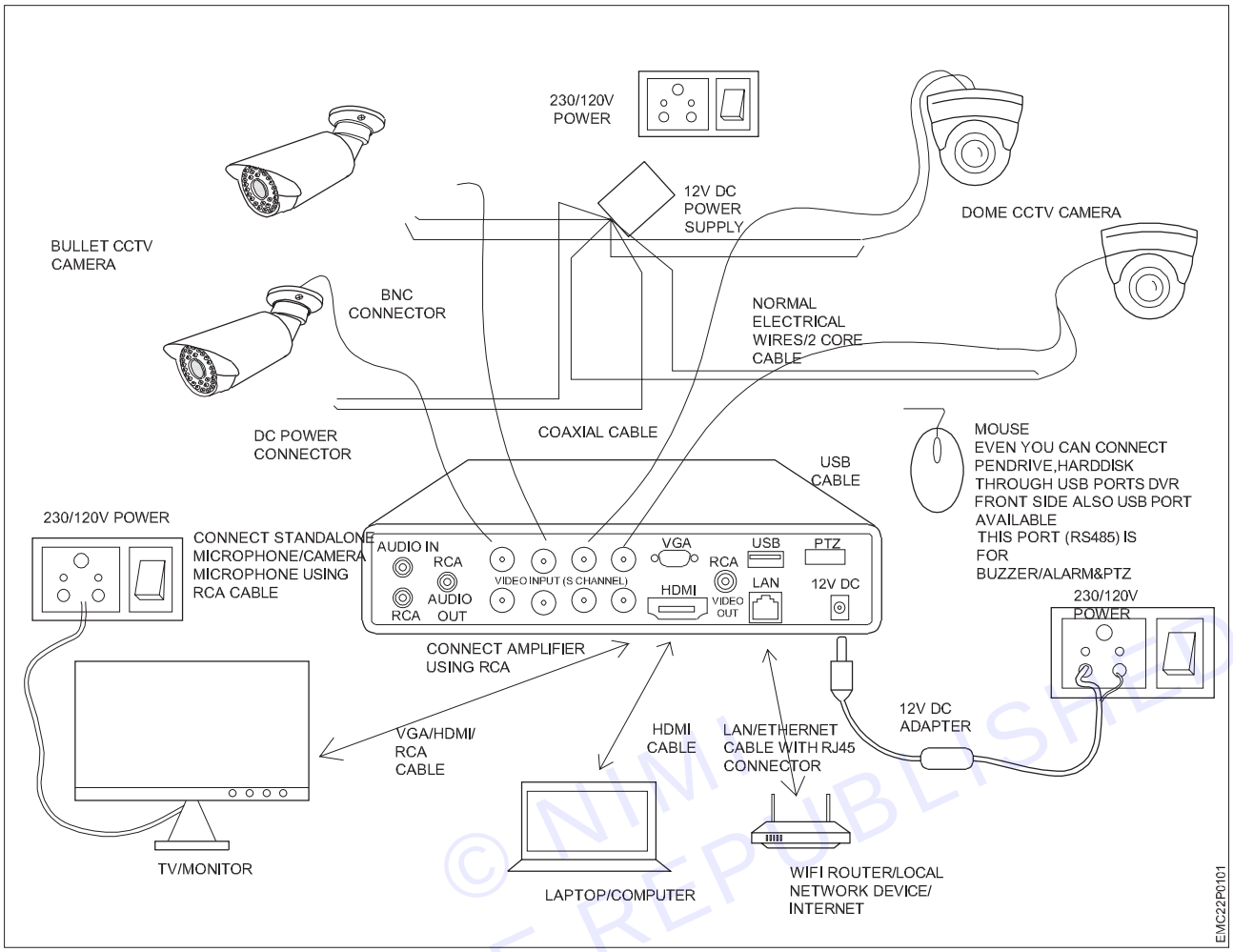
4 We connect the one wifi router to LAN portal.

5 And a mouse connect to USB portal to control all screen and for other work.

6 And last, we give the 12 v DC supply by 12 V DC adopter.

RESULT:

Thus the different parts of CCTV system has been demonstrated successfully.



EXERCISE 147: Draw Trace or Follow the CCTV Setup of any Commercial Installation

Objectives

At the end of this exercise you shall be able to:

- study and demonstrate the CCTV setup in a building.

Requirements

Tools/Materials

- Cable stripper (0.75mm-2.5mm) - 1 No.
- Crimping tool - 1 No.
- Combination pliers - 1 No.
- Camera - as reqd.
- Monitor (18.5 Inch) - 1 No.
- Cables - as reqd.
- Routers - 1 No.
- VDR (Digital Video Recorders) - 1 No.
- NVR (Networks Video Recorders) - 1 No.
- Data Storage (1 TB) - 1 No.

Procedure

The front door, back door, and first-floor windows are the most common entryways for criminals. CCTV camera installation service providers should cover main entrances, such as front and back doors, gates, and the paths leading up to them.

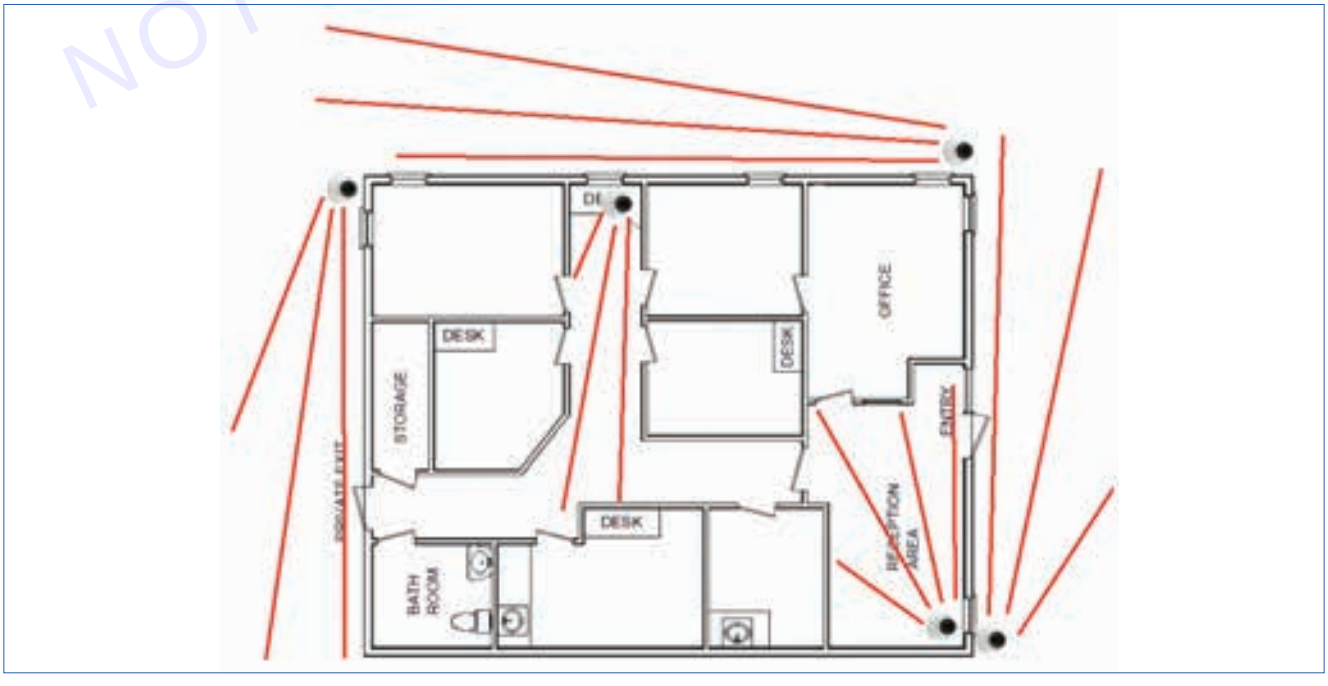
They should also monitor first-floor windows, where trouble is most likely. After that, cameras can be placed at the corners of your building to capture the entire perimeter. Parking lots and garages are also risky areas, which should be monitored day and night.

Pay attention to the field of view and avoid blind spots when installing business security camera systems. You should also pay attention to lighting; placing cameras in well-lit areas ensures a brighter, clearer image. You may also consider cameras that use infrared to detect body heat and function similarly to night vision.

Commercial grade security cameras should be high so people can't tamper with them — around 9 feet off the ground is usually enough. Another thing to consider is whether you want your cameras to be visible to intruders.

Commercial Installation:

CCTV cameras serve as a powerful resource when any crime is committed in or around the business premises.



Practical Guidelines for Commercial CCTV Installations

When installing CCTV systems in commercial properties, it's essential to adhere to specific guidelines set by UK data protection law. Here's a summary of the key points businesses need to follow:

1 Signage: Clearly display signs to inform people that CCTV is in operation and explain the reason for its use. This helps in maintaining transparency with the public.

2 Access to Footage: If someone is recorded on your CCTV, you must be able to provide them with their images within one calendar month upon request. This is part of the individual's right to access personal data.

3 Cooperation with Authorities: Be prepared to share CCTV footage with authorities, like the police, if they legally request it. This can be crucial for law enforcement and public safety.

4 Retention of Footage: Store CCTV images only for as long as necessary for your business needs. Avoid keeping footage for longer than required, as this can breach data protection principles.

5 Data Protection Fee: Pay the required data protection fee. This fee is a legal obligation for businesses operating CCTV.

6 No Charging for Image Provision: Generally, you can't charge a fee for providing someone with their images from your CCTV.

Additionally, the Information Commissioner's Office (ICO) provides comprehensive guidance on using CCTV cameras and storing images. The ICO has a useful checklist to assess your CCTV system, ensuring it complies with legal requirements.

Key Compliance Areas in Commercial CCTV Use

While understanding the legal underpinnings of the DPA and GDPR is crucial, equally important is the practical implementation of these regulations in the day-to-day operation of CCTV systems in commercial settings. This section will cover the operational compliance areas that businesses must consider.

Procedure:

Here are six basic steps for installing a CCTV system:

1 **Plan :** Planning is vital for your CCTV installations. Decide where you want to place the cameras, how large an area do you want to cover, and consider what type of camera you want to use.

2 **Run the cables to the camera sites :** Use structured cabling that runs throughout the walls and connects your security cameras to the server or NVR.

3 **Connect the cables to the DVR :** A DVR is a device that stores the video footage from your camera.

4 **Mount and install the cameras :** Place the camera's power wire into a socket. Ensure that the camera is above 10ft so that it cannot be easily knocked down.

5 **Switch on the power :**

6 **Set-up the DVR :** Connect the DVR to a power socket and then turn on the DVR.

Here are some additional tips for installing CCTV cameras:

Result: Thus we followed the CCTV installation in a building successfully.

EXERCISE 148 : Demonstrate the strategic locations for the installations of cameras

Objectives

At the end of this exercise you shall be able to:

- to Demonstrate installations of cameras.

Requirements

Tools/Materials

- Combinations Plier 250mm] - 1 No.
- Screw Driver Set 150mm - 1 No.
- Wire Stripper - 1 No.
- Camera - as reqd.
- DVR - 1-2 Nos.
- Camera cable - as reqd.
- Camera pin and socket - 10-15 pics.

Procedure

Note: Cameras are being used in various places in various locations.

Cameras: CCTV (closed circuit televisions) is a TV system in which signals are not publicly distributed but are monitored, primarily for surveillance and security purposes.

CCTV uses cases:

Older CCTV systems used small, low-resolution black and white monitors with no interactive capabilities. Modern CCTV displays can be color, high-resolution displays and can include the ability to zoom in on an image or track something (or someone) among their features.

CCTV is commonly used for a variety of purposes, including:

- Maintaining perimeter security in medium- to high-secure areas and installations.
- Observing behaviour of incarcerated inmates and potentially dangerous patients in medical facilities.
- Traffic monitoring.
- Overseeing locations that would be hazardous to a human, for example, highly radioactive or toxic industrial environments.
- Building and grounds security.
- Obtaining a visual record of activities in situations where it is necessary to maintain proper security or access controls (for example, in a diamond cutting or sorting operation; in banks, casinos, or airports).

Procedure:

There are the following points for installations of cameras in different places :-

Front door

This is the most obvious route for criminals to gain access into your home, and the biggest proportion of break-ins occur via this entrance. To prevent any items being launched at the delicate CCTV cameras, consider mounting the equipment at the second floor level or fitting a wire cage around it.

Back and side doors

Any entrance into your property is viewed as a potential channel for a criminal to gain access into your private space. Have some cameras trained on all doors, as these are your most vulnerable spots. Take the same protective precautions as described in the previous point, to prevent any tampering.

Patio and French doors are especially defenceless against break-ins, so support their stability with thick glass and a well-placed CCTV camera.

Off-street windows

Windows that are not facing onto a busy street or road may be attractive to crooks as there are no prying eyes from the public. In addition to cameras, as an extra safety enforcement, never neglect your windows and keep them closed and locked whenever you go out.

Garage

Some people may not think to monitor their garage, but this is often a common access route for burglars. Therefore, whether your garage contains valuable equipment or not, it's important to keep it safeguarded.

A camera facing the driveway or garage area is great for picking up signs of suspicious activity. Alternatively, you may wish to place the camera inside the garage, pointing it at an angle where the light from the opening door can light up the dark interior.

Backyard

Whether it's a shed bursting with pricey gardening machinery, or a garden full of play equipment for the kids, often our gardens house many expensive items that make them inviting to crooks. To keep this area safe and secure, have a few smartly placed cameras dotted around, along with some security lights.

All these elements can act as great deterrents to lawbreakers, making them think twice about accessing your garden.

Indoors

It is a common misconception that CCTV cameras are exclusively suited to the outdoors. Installing a camera on the inside of your house, lens trained on the doors or windows, can record a criminal entering your home, offering a full view of their face for easier identification.

The only disadvantage with indoor placement of cameras is that they are not as visually deterring and a criminal has to first enter your home to notice them.

For more advice on the best locations for home security cameras, simply ask a security specialist who will be able to offer some insight.

Some of the related images:




Results:

Thus the fixing and positions of CCTV cameras were demonstrated successfully.

EXERCISE 149: Operate and learn the procedure for switching cameras to have different views

Objectives

At the end of this exercise you shall be able to:

- to understand the Procedure for switching cameras to have different views.

Requirements

Tools/Materials

- Combinations Plier 250mm] - 1 No.
- Screw Driver Set 150mm - 1 No.
- Wire Stripper 100 mm - 1 No.
- Camera - as reqd.
- DVR - 1-4 Nos.
- Camera gimble - as reqd.
- Camera hanger - as reqd.

Procedure

1 FISHEYE VIEW:

- This is the standard 360° fisheye view, ideal for total situational awareness.
- Using this view, you'll get 100% coverage in real-time and on playback with no blind spots. And since you have total 360° situational awareness, there's no chance of your camera being pointed in the "wrong" direction.

2 PANORAMIC+

- Panoramic+ solves issues such as stitching, alignment, light balance, and blind spots.
- These images are a true edge-to-edge dewarped view of the original fisheye image taken from the centre of the scene.
- This view uses the centre of the fisheye sensor to generate a true 180° image.

3 CORRIDOR+

- This view is a split two-way hallway view from a ceiling-mounted camera. It allows you to watch both directions of a 360° image at the same time so that individuals and objects can move seamlessly from one view to the other.
- Corridor+ enables you to see two perfect halves from the entire hallway image side-by-side, which allows you to monitor both directions of the scene at the same time.

4 T-CORRIDOR+

- From a ceiling-mounted camera, T Corridor+ allows you to see in all three directions.
- At the same time with no blind spots even when individuals and objects move from one view to the other.

5 V-CAM

- A V-Cam or Virtual Camera is a user-defined dewarped view of a specific chosen area of the fisheye image.
- It enables you to focus on one particular area without losing the overall view being recorded with the 360° view.
- Up to four separate V-Cams can be created, or up to three alongside the fisheye stream.
- This view is particularly useful at building entrances and exits, POS areas, and reception desk areas.

PROCEDURE:

There are two different types of switching cameras in different views:-

- Manual switching
- Automated switching

Manual switching:

Manual switching refers to the process of changing cameras views or perspectives manually by human operators.

Process of switching cameras manually:-

1 **Access Camera setting:** Open the camera app or software interface on your device.

2 **Locate switch camera option:** Look for an icon or button within the camera interface that allows you to switch between cameras. This could be labeled ”switch cameras,” “Front/ Rear,” or represented by icons indicating the different cameras.

3 **Tap or Click on the Switch Button:** Once you’ve located the switch camera option, tap or click on it to toggle between the available cameras.

4 **Preview:** After switching cameras, you’ll see a preview of the new camera’s feed on your screen. Use this preview to ensure the framing and composition are as desired.

5 **Adjust Settings (Optional):** Depending on your preferences and the capabilities of your camera, you may need to adjust settings such as resolution, exposure, or focus after switching cameras. These settings are often accessible through the camera app’s interface.

6 **Capture Content:** Once you’re satisfied with the preview and settings, you can proceed to capture photos or record videos using the newly selected camera.

7 **Review and Repeat (if necessary):** After capturing content, review it to ensure it meets your requirements. If needed, you can repeat the process of switching cameras and capturing until you achieve the desired results.

Automated switching:

Automated camera switching is a process where camera views are changed automatically based on predefined criteria or triggers, without the need for manual interventions.

Process of switching cameras automatically:

1 Condition Monitoring: The system continuously monitors various parameters such as lighting conditions, subject movement, distance, or user preferences.

2 Criteria Evaluation: Based on the monitored conditions, the system evaluates predefined criteria to determine whether a switch in cameras is warranted. Criteria could include low-light conditions favoring a camera with better low-light performance or detecting a close-up subject suitable for the macro lens.

3 Decision Making: Using algorithms, the system makes decisions on whether to switch cameras or not. These algorithms consider the current conditions and the predefined criteria to make informed choices.

4 Instantaneous Switching: Upon determining the need to switch cameras, the system initiates the switch seamlessly without user intervention. The transition should be smooth to avoid disrupting the user experience.

5 Dynamic Adaptation: The system continuously adapts its decision-making process based on real-time feedback and user interactions. This adaptive approach ensures that the camera switching remains effective in various scenarios.

6 Optimization and Learning: Over time, the system may learn from user behavior and preferences, refining its algorithms to optimize camera switching decisions.

7 User Override (Optional): Some systems may offer users the option to override automated camera switching manually. This allows users to select a specific camera regardless of the automated decision, providing more control over the capturing process.

Results:

The conclusions of the topic of camera switching to different views can vary depending on the specific context and applications.

EXERCISE 150: Demonstration of connectors and sockets used on DVRs

Objectives

At the end of this exercise you shall be able to:

- to demonstrate different types of connectors are uses in DVRs
- to demonstrate different types of sockets are used in DVRs.

Requirements

Tools/Materials

- DVR/ NVR - 1 No.
- Different connectors

Procedure

DESCRIPTION:-

BNC CONNECTORS:

BNC1 - Straight BNC solder less connector

BNC2 - BNC male twist for RG59/U

BNC3 - male BNC to female RCA connector

BNC4 - Crimp type BNC male for RG59 co-ax cable

BNC4B - BNC boot to cover crimping BNC

BNC4F - BNC Crimp Female

BNC5 - BNC barrel connector(F/F)

BNC6 - Male RCA to female BNC connector

BNC7 - T-Piece BNC (M toF/F)connector

BNC8 - Female RCA to female BNC connector

BNC9 - Panel-mount BNC connector(F/F)

BNC10 - RCA connector solder type

RCA1 - RCA connector (m)-solder type. Not BNC for video

BNC179 - BNC male crimp for RG179

DC CONNECTORS:

Used where a connection is required from a DC power supply to a camera or any other electronic equipment that utilizes this type of DC power connection

DCJACK - Solder on DC Jack

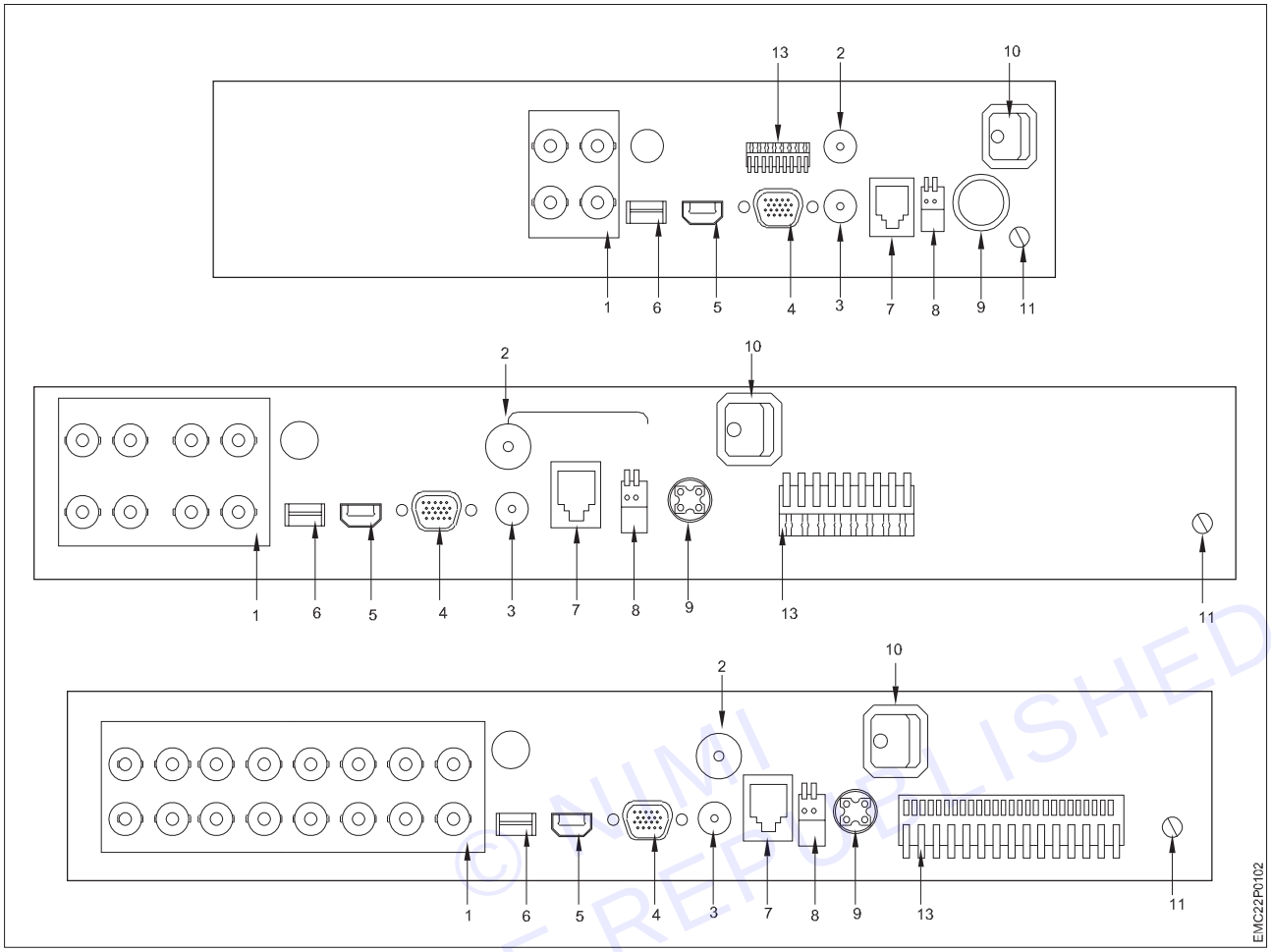
DCJACKM - Male DC Jack

DCJPLUGM - Male DC Jack plug

DCJLEAD - DC Jack with a 10cm extension lead for easy connection

DCJLEAD4 - 4 DC jack lead

REAR PANELS



S.No	Item	Description
1	Video In	BNC interface for TVI and analog video input
2	Video Out	BNC connector for spot output/video output
3	Audio In	RCA connector
4	USB Port	USB port for additional devices.
5	HDMI	HDMI video output connector
6	VGA	DB-15 connector for VGA output. Display local video output and menu.
7	Audio Out	RCA connector
8	Network Interface	Connector for network
9	RS-485 Interface	Connector for RS-485 devices. T+ and T- pins connect to R+ and R- pins of PTZ receiver respectively.
		D+, D- pin connects to Ta, Tb pin of controller. For cascading devices, the first DVR's D+, D- pin should be connected with the D+, D- pin of the next DVR.
		Connector for alarm input
		Connector for alarm output
10	Power Supply	12 VDC power supply
11	Power Switch	Switch for turning the device on/off

12	Gnd	Ground
13	Line In	BNC connector for audio input
14	eSATA	Connects external SATA HDD, CD/DVD-RW
15	RS-232 Interface	Connector for RS-232 devices

Great for connecting a BNC plug onto CAT5 or alarm cables

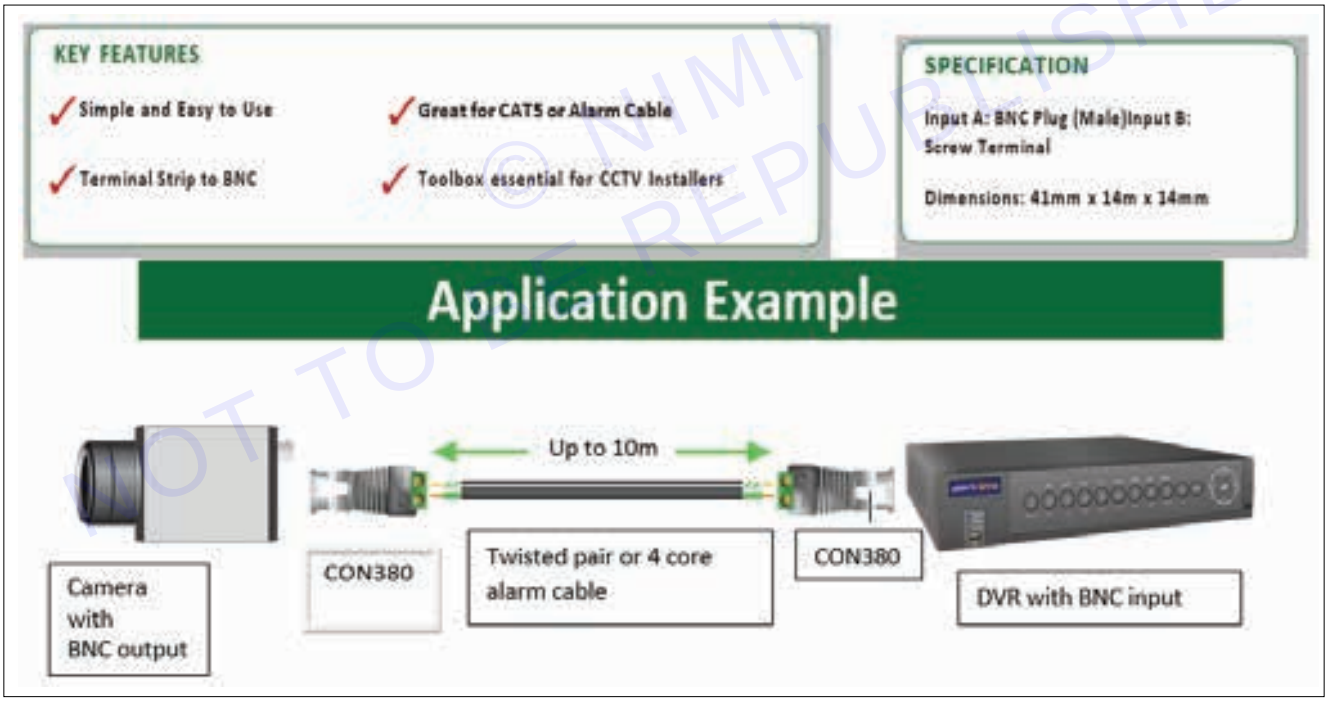
It has a terminal strip connection, which makes the wiring simple! With a BNC plug at one end and a

T-Strip at the other makes it great for sending video over a CAT5 or alarm cable.

This product makes life simpler using this to connect a BNC plug to a multi-core cable.

The Zulug connector eliminates the need to solder or crimp connectors, making it one of the fastest ways to make bare power cores into a DC power connection.

Zulug is a range of easy fit DC connector, ideal for CCTV cameras



1

Connect the DVR power supply (marked For DVR use only). Do Not connected it to mains power at this stage.

connect the mouse to the mouse USB port.

if you are require remote access to Your DVR(e.g. from your phone or tablet),connect the network cable to the LAN port.

2a

If you wish to use a TV to display the images from the DVR, please use the supplied coaxial cable and connect one end to the Video Out port on the DVR, and the other end to the yellow composite AV port on your TV, as per the illustrations below.

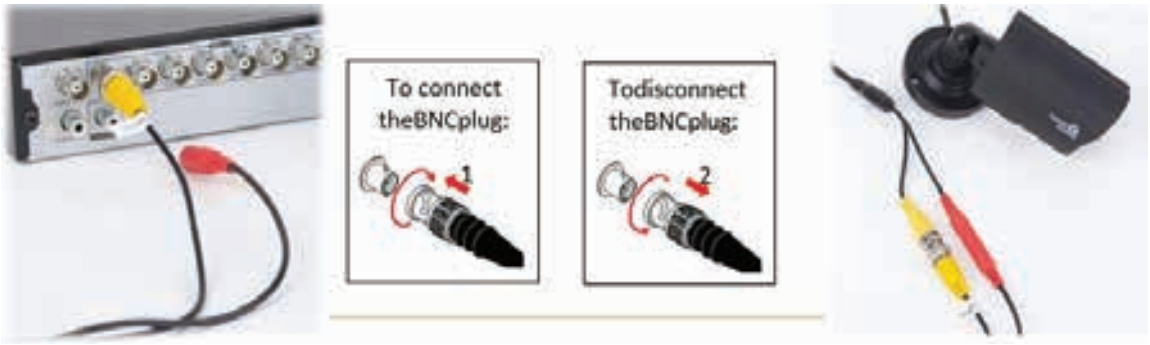
OR

2b

If you wish to use a monitor, please use a VGA cable* and connect it to the VGA port on the DVR and to the VGA port on your monitor:

*Usually supplied with your monitor

3



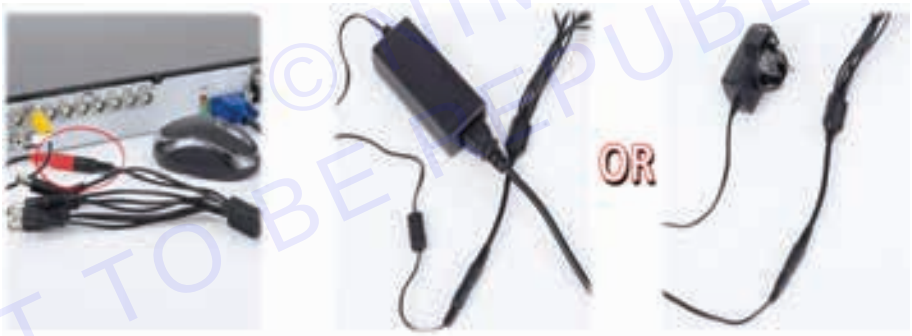
Connect the CCTV cables video lead to the DVR in each video input port as required. Ensure you use the connector marked “For DVR side only”.

Connect the CCTV cable video and power lead to the camera leads.(marked for camera use only).

4

The cameras are powered via the18m CCTV cables supplied.The cable carries both the power to the camera, and the video feed from the camera to the DVR. This setup allows you to powerup to 8 cameras from a single power socket.

Connect the CCTV Cable(s) power lead(s) to the splitter cable, then connect the splitter cable to the camera power supply.



5

The system is now fully connected and the power supplies can be connected to the mains.This example uses a VGA connection:

Note : the port layout pictured above may differ from your DVR depending on model

EXERCISE 151: Test the healthiness cables and connectors

Objectives

At the end of this exercise you shall be able to

- to test of healthiness of cables and assemble them
- to test of healthiness connectors and assemble.

Requirements

Tools/Materials

• Multimeteter	- 1 No.	• BNC connectors	- as reqd.
• Cable tester	- 1 No.	• Coaxial cable stripper	- 1 No.
• Video balun	- 1 No.	• Coaxial cable cutter	- 1 No.
• Power supply	- 1 No.	• Coaxial cable crimpers	- 1 No.

Procedure

Theory

Before testing the CCTV cable, it is essential to know the different types of tests you can perform. Some of the common tests include:

Continuity test: It determines the connection from end-to-end along the length of the cable.

Cable length test: It measures the distance between the two ends of the CCTV cable.

Signal test: It checks the signal quality between the CCTV camera and the recording device.

Voltage test: It checks if the CCTV cameras are receiving the right voltage to function correctly.

Continuity Test

To perform continuity testing, follow the steps below:

Place one end of the CCTV cable in the multimeter probe's positive port and the other end in the negative port.

Turn on the multimeter and set it to continuity test mode.

If the multimeter beeps, it means the CCTV cable is okay, and if it doesn't beep, it indicates that there is an issue with the continuity of the cable.

Cable Length Test

Use a cable tester to measure the CCTV cable length accurately.

Ensure that the length of the cable is less than the recommended limit.

If the cable length is excessive, there may be issues with the signal transmission.

Signal Test

To perform the signal test, ensure you have a video balun, power supply, BNC connectors and crimpers, as well as the CCTV cameras and the recording device. Follow the steps below:

Attach BNC connectors to both ends of the CCTV cable and crimp them using crimpers.

Attach video balun to one end of the CCTV cable and connect it to the CCTV camera.

Connect the other end of the CCTV cable to the recording device through the video balun and power supply.

Turn on the CCTV camera and verify if the recording device is receiving the footage.

If the recording device is receiving the footage, the signal test is successful.

Voltage Test:

To perform the voltage test, use a multimeter to measure the voltage provided to the CCTV cameras. Follow the steps below:

Connect one end of the CCTV cable to the recording device and the other end to the CCTV camera.

Use the multimeter to measure the voltage provided to the CCTV camera.

If the voltage is within the recommended range, the voltage test is successful.

Test Coaxial Cable

Coaxial cables, one of the most commonly used materials in networking, are responsible for accurate data transfer. We can find them in almost every network, including cable, internet, and satellite. Once installed, the coaxial cables will start to play videos and music for us in great quality.

Method 1: How to Test A Coaxial Cable With Easy Steps

In many professionals' eyes, using a multimeter is the first method that pops up when talking about coaxial cable tests.

But it's a little bit complex to tell and understand the differences in resistance for beginners and homeowners. We need a more straightforward method to know a broken or good coaxial cable.

Test Coaxial Cables with Cable Tester

a leading manufacturer of network testers released a multifunction cable tester for all network cables like RJ45, RJ11, and coaxial cables.

Steps to test coaxial cables(s)

Step 1: Connect the coaxial cable

Launch NF-858C and press the OK button to choose the first mode: CONT (cable continuity test).

Take out the coaxial cable and connect it to the Emitter and a remote of NF-858C.

Set the Type to BNC by pressing OK again.

Press the Down button on the Emitter device to navigate the Start option. Press OK. The coaxial tester will start to check the cable continuity.

In seconds, the wire map of the coaxial cable is shown.

Step 2: Read the wire map

There are two parts inside a cable to transmit data, the center core and the metallic shield.

When the cable is working well, you will see this map: 1 and 2 wire found by M (Emitter) and R (Remote) are matched accordingly

If any of them are broken, one of the pairs will not be matched.

When both pairs are not connected, the insulator between them is damaged. This leads to a short circuit inside the cable. Data is forced to stop at the short point.

To test multiple cables, unplug the current cable and insert a new one. Run the CONT test.

Additional: Trace the coaxial cable with NF-858C

When you can't find the other end of a coaxial cable, NF-858C helps locate it.

Connect one end of the coaxial cable to the Emitter's BNC connecter. Use the Right/Down button to select the Scan mode. Press OK to confirm.

The Emitter will start to send digital signals to the cable.

Take out the Receiver device. Tap the probe to other coaxial cables in the room or another room.

The Receiver has a tone generator. When it detects the signals, it beeps.

This tracing and beeping will work even if the other end of the coaxial cable is attached to a wall outlet.

Test coax cable with a multimeter

The best way to check for continuity when testing coaxial cables is by using a digital multimeter. Testing for continuity on coaxial cables can be done in the following steps:

Test your coaxial cable for proper connection by disconnecting it from all attachments. This includes disconnecting the cord from the TV, camera, or other cables near where the cord is plugged in.

When you attach the tip of your coaxial cable to an external source, touch one probe of the multimeter to where it meets a metallic part. Touch the other probe of the multimeter to where it meets the center wire or core. You're looking for a readout close to zero ohms/

Get a reading greater than zero? Then, your coax cable needs to be fixed - or replaced. This reading is telling you that something has interrupted the signal from ever making it there in time..

You could measure how much resistance the circuit has with an ohmmeter.

Connect the ohmmeter to the cable. If it's working, there should be a low-to-moderate resistance reading of 75-100ohms.

If the reading is outside of this range, it may be time to replace your cables.

EXERCISE 152: Connect CCTV cameras to dvr, record and replay

Objectives

At the end of this exercise you shall be able to

- evaluate the equipment/ basic requirements for CCTV set up
- analyze operational requirements
- segregate the tools needed for CCTV installation.

Requirements

Tools/Materials

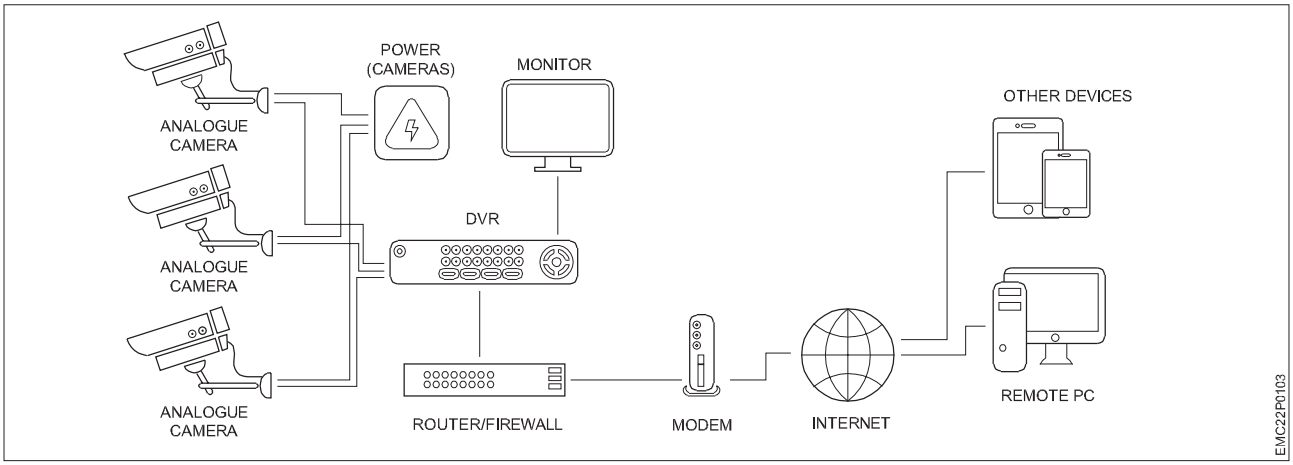
- Precision screwdriver set - 1 Set.
- Tweezers - 1 Pair.
- Plastic opening tools - 1 Set.
- Heat gun - 1 Set.
- Soldring iron - 1 No.
- Desoldring pump - 1 No.
- Replacement parts - as reqd.
- Magnifying glass - 1 No.
- Smart Phone - 1 No.
- Digital Multimeter with probes - 1 No.
- User Manual of the given cell phone - 1 No.
- CCTV camera
- DVR (Digital Video Recorder)
- Coaxial Cable or Ethernet Cable
- Power supply
- Monitor
- Storage Device
- Tools for Installation
- Software

Procedure

Working:

CCTV cameras are used extensively since these are highly effective in preventing crime. These cameras are like perfect spies that are able to capture and show more than what meets one"s eyes. Often the nitty-gritty of a crime site is revealed by investigators due to these CCTV cameras that provide all important clues to get hold of the culprits. However, a CCTV setup is actually required to prevent crime. The very presence of a CCTV camera and it being noticed by a stranger convey a Message to the person.

Interconnections of all the components

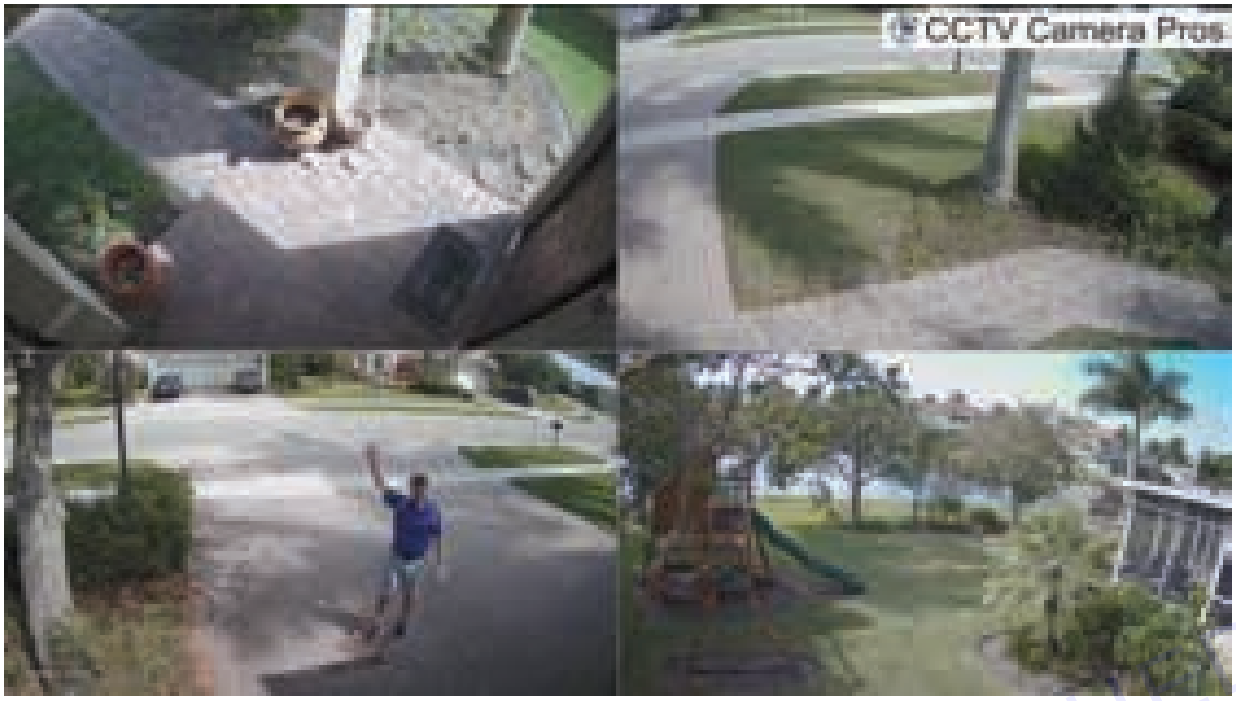


Tools and Signal Monitoring equipments

CCTV Tool Monitor: It is a small monitor which has the required video inputs and used for checking the field anytime needed.	
Tool Bag: All the tools mentioned must be neatly arranged in a tool bag, otherwise the required tool may not be found at the time of need.	

Use of CCTV to View Footage on Computer

- Double click the surveillance icon on the desktop and click OK on the option to Login.
- The user name and password should be entered and after a few seconds the programme will start to display.
- The programme screen should be maximized by clicking on the square symbol which is usually on the right hand top most corner of the screen.
- Once the device option is shown, below it a list will be displayed. From this, the name of the CCTV should be double clicked.
- The step will display a list of all the cameras that are allotted to the device list.
- The Playback button will be clicked on the lower left hand of the screen and a series of fields with further drop down boxes will appear in the device panel which will be on the screen"s right hand side.



- The next field should be selected (it is the channel) by the down arrow being clicked which will be next to the channel box. The camera needed for viewing a particular place will be selected from the list of cameras which will be displayed.
- The desired date can be selected or entered in the date box.
- The time period should be selected next either by entering manually or by scrolling up and down within the options given.
- The user can then select the required video from the list of videos that were recorded within the given time period.

Result: Thus the installation of CCTV system has been completed successfully.

EXERCISE 153: Dismantle DVR and Demonstrate major functional blocks and test for the healthiness

Objectives

At the end of this exercise you shall be able to

- on-board software, such as video analytics
- image protection /authentication techniques
- ports for additional recording capabilities
- internal hard drive for video storage
- ability to easily search for and locate event
- ability to record one or more camera Inputs while performing video analytics.
- removable hard drive for archiving purposes
- ability to transfer data to expendable storage systems called redundant Array of Independent Disks (RAID) to Free up recording space. DVR installation.

Requirements

Tools/ Materials

- DVR/ NVR
- Screw driver set
- Wire stripper

Procedure

1 Analog CCTV

A CCTV system may send Digital or analog video to the recording system. A DVR receiving analog video takes two fields of the analog signal and builds one image, which is then digitized and compressed. If the video going to the DVR is digital, it is normally compressed to save storage space. Various data compression methods can be used that offer verifying degrees of performance, quality, and capabilities such as:-

2 Digital CCTV / IP system

Some basic Component of different CCTV system are belo:-

- **Security Camera:** Security Cameras captures the video of the source. It is an essential of any CCTV system. Every camera has three basic elements:

a faulty DVR unit

1 Prepare Your Tools and Equipment. ...

2 Power Off and Unplug. ...

3 Open the DVR Case. ...

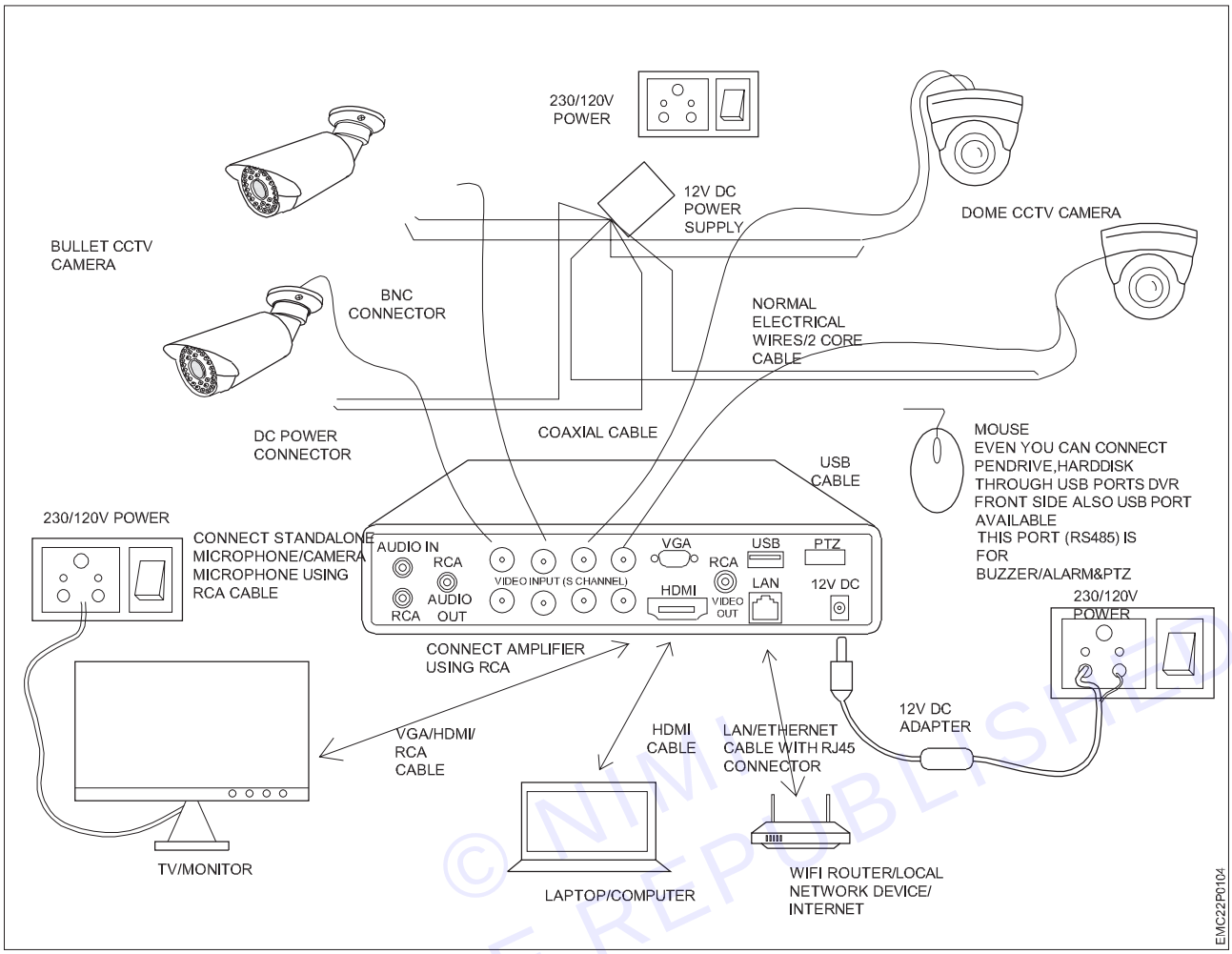
4 Locate the Hard Drive. ..

5 Disconnect the Cables. ..

6 Remove the Faulty Hard Drive. ...

7 Install the New Hard Drive. ...

8 Reconnect Cables.



How do I replace or upgrade a faulty hard drive in my CCTV DVR

If you're facing issues with a faulty hard drive in your CCTV DVR unit and want to replace or upgrade it, here's a step-by-step guide to help you through the process:

1 **Prepare Your Tools and Equipment**

Gather the necessary tools, such as a screwdriver and an ESD (Electrostatic Discharge) wrist strap to prevent any static damage. Make sure you have the new hard drive that you want to replace or upgrade to.

2 **Power Off and Unplug**

Turn off the DVR unit and unplug it from the power source. This ensures your safety and prevents any electrical accidents while working on the device.

3 **Open the DVR Case**

Use the appropriate screwdriver to open the case of the DVR unit. Different DVR models have varying methods of accessing the internal components, so refer to the user manual or manufacturer's instructions for guidance. If you are facing difficulty at the time of opening the DVR case then it is highly recommended to consult a professional CCTV repair and service provider near you

4 **Locate the Hard Drive**

Identify the faulty hard drive that you want to replace or upgrade. It's usually situated inside the DVR case and connected to the motherboard via cables.

CCTV Camera fixing

5 **Disconnect the Cables**

Gently disconnect the power and data cables from the faulty hard drive. Ensure you remember the connections for reassembly.

6 **Remove the Faulty Hard Drive**

Carefully remove the faulty hard drive from its slot. Sometimes, it might be held in place by screws or brackets that need to be removed.

7 **Install the New Hard Drive**

Place the new hard drive in the same slot and secure it using screws or brackets, if necessary. Make sure it's properly seated.

8 **Reconnect Cables**

Attach the power and data cables to the new hard drive, ensuring they are securely connected. Double-check the connections to avoid any loose connections.

9 **Close the DVR Case**

Put the DVR case back together and secure it with screws. Make sure everything is properly aligned before tightening the screws.

10 **Power On and Test**

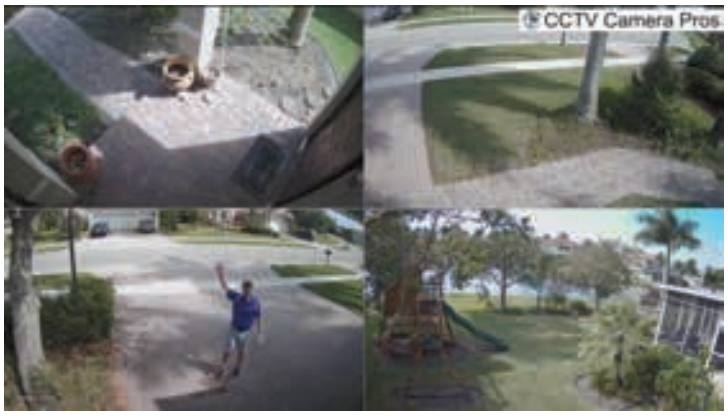
Plug the DVR unit back into the power source and turn it on. Check if the new hard drive is detected and functioning properly. You might need to format or initialize the new hard drive through the DVR's settings.

11 **Configure Settings (If Necessary)**

Depending on the DVR model and settings, you might need to configure the new hard drive's settings, such as storage allocation and recording preferences.

12 **Monitor Performance**

Regularly monitor the performance of the new hard drive to ensure it's working optimally and recording video footage as expected.



EXERCISE 154: Take the students to any nearby commercial CCTV installation to carry out the above

Objectives

At the end of this exercise you shall be able to

- evaluate the equipment/ basic requirements for CCTV set up
- analyze operational requirements
- segregate the tools needed for CCTV installation
- demonstration of parts of CCTV
- installation Procedures of CCTV
- recording and playback footage.

Requirements

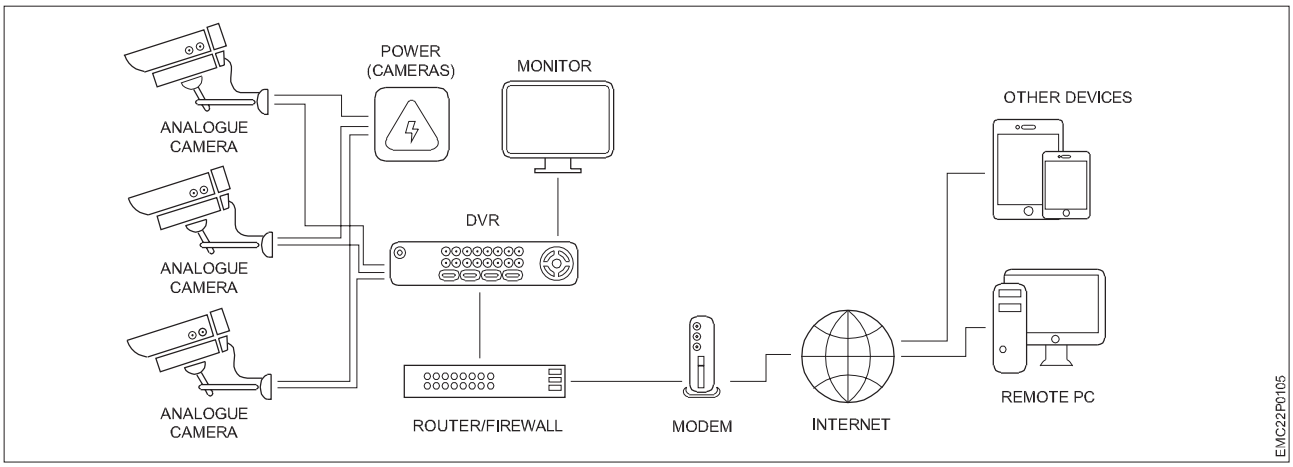
Tools/Materials

- Precision screwdriver set - 1 Set.
- Tweezers - 1 Pair.
- Plastic opening tools - 1 Set.
- Heat gun - 1 Set.
- Soldring iron - 1 No.
- Desoldring pump - 1 No.
- Replacement parts - as reqd.
- Magnifying glass - 1 No.
- Smart Phone - 1 No.
- Digital Multimeter with probes - 1 No.
- User Manual of the given cell phone - 1 No.
- CCTV camera
- DVR (Digital Video Recorder)
- Coaxial Cable or Ethernet Cable
- Power supply
- Monitor
- Storage Device
- Tools for Installation
- Software

Procedure

Working:

CCTV cameras are used extensively since these are highly effective in preventing crime. These cameras are like perfect spies that are able to capture and show more than what meets one"s eyes. Often the nitty-gritty of a crime site is revealed by investigators due to these CCTV cameras that provide all important clues to get hold of the culprits. However, a CCTV setup is actually required to prevent crime. The very presence of a CCTV camera and it being noticed by a stranger convey a Message to the person.



Tools and Signal Monitoring equipments:

CCTV Tool Monitor: It is a small monitor which has the required video inputs and used for checking the field anytime needed.	
Tool Bag: All the tools mentioned must be neatly arranged in a tool bag, otherwise the required tool may not be found at the time of need.	

Use of CCTV to View Footage on Computer

- Double click the surveillance icon on the desktop and click OK on the option to Login.
- The user name and password should be entered and after a few seconds the programme will start to display.
- The programme screen should be maximized by clicking on the square symbol which is usually on the right hand top most corner of the screen.
- Once the device option is shown, below it a list will be displayed. From this, the name of the CCTV should be double clicked.
- The step will display a list of all the cameras that are allotted to the device list.
- The Playback button will be clicked on the lower left hand of the screen and a series of fields with further drop down boxes will appear in the device panel which will be on the screen"s right hand side.

- The next field should be selected (it is the channel) by the down arrow being clicked which will be next to the channel box. The camera needed for viewing a particular place will be selected from the list of cameras which will be displayed.
- The desired date can be selected or entered in the date box.
- The time period should be selected next either by entering manually or by scrolling up and down within the options given.
- The user can then select the required video from the list of videos that were recorded within the given time period.

Result: Thus the parts , installation , recording and playback of video footage have been demonstrated at nearby commercial CCTV system successfully.

MODULE 17: Home theater

EXERCISE 155 : Demonstration of different parts of home theatre

Objectives

At the end of this exercise you shall be able to

- evaluate the equipment/ basic requirements for home theater setup
- analyze operational requirements
- segregate the tools needed for home theater installation
- demonstration of parts of home theater
- installation Procedures of home theater
- recording and playback in home theater.

Requirements

Tools/Materials

• Display	- Television & projector
• Sound system	- Receiver, speakers, subwoofer & soundbar
• Media devices	- Blu-ray/DVD players, streaming devices, gaming consoles, media servers
• Lighting & ambiance	- Dimmable lights, curtains or blinds & LED strips
• Seating and comfort	- Home theater seating, acoustic treatment & room layout

Procedure

Theory

Display: The display is the visual centerpiece of your home theater. You have two main options.

Television (TV): Convenient, easy to install, and available in various sizes. LED LCD TVs are popular for their clear images and affordability.

Projector: Offers a cinematic experience but requires proper installation. Projectors can outperform TVs **when** done right.

Receiver

- The heart of your home theater system. It processes audio and video signals from various sources (like Blu-ray players, gaming consoles, etc.).
- Receivers decode surround sound formats (like Dolby Atmos) and distribute audio to speakers.
- Look for features like HDMI inputs, power output, and compatibility with your devices.

Speakers

- Essential for immersive sound. A typical setup includes:
  - Front Speakers: Left, center, and right speakers for dialogue and music.
  - Surround Speakers: Placed around the room for ambient effects.
  - Subwoofer: Adds deep bass for impact.
- Consider speaker placement, size, and quality for optimal sound experience.

Media Devices

- These include Blu-ray players, streaming devices (like Apple TV or Roku), and gaming consoles.
- Connect these to your receiver for audio and video playback.

Lighting

- Proper lighting enhances the theater experience. Dimmable lights or smart lighting control can set the mood.
- Consider blackout curtains to prevent glare on the screen.

Room Acoustics

- Proper room design and acoustics matter. Use rugs, curtains, and acoustic panels to minimize sound reflections.
- Position speakers correctly for balanced sound.

Remember, a well-designed home theater system combines these components to create an immersive entertainment experience. Whether you're watching movies, gaming, or enjoying music, each part plays a crucial role in delivering the magic of the big screen to your home!

CIRCUIT DIAGRAM

1 Mono Wiring Diagram

- The simplest setup involves a single amplifier connected to a set of speakers. The amplifier powers the speakers and also has inputs for devices like CD players, TVs, and DVD players.

2 Two-Channel Stereo Wiring Diagram

- For stereo sound, you'll need two amplifiers and two sets of speakers. Each amplifier powers one set of speakers. Inputs are available for various audio devices.

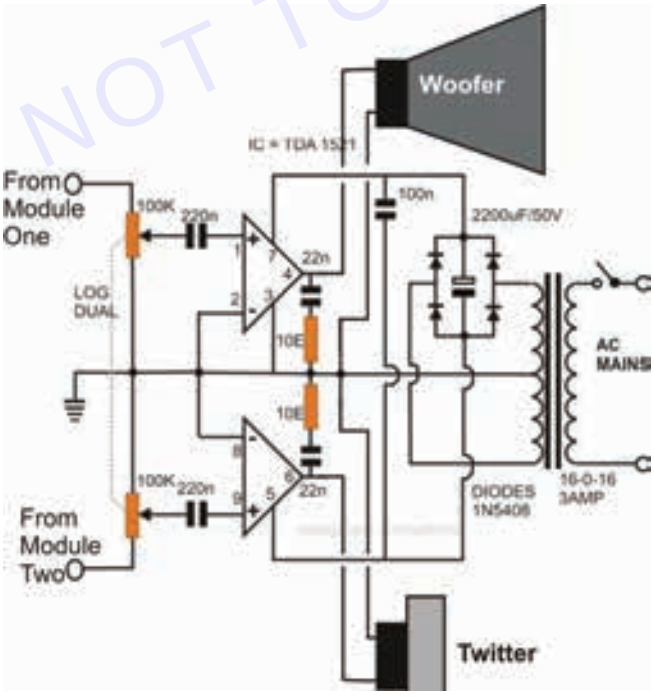
3 **Five-Channel Surround Sound Wiring Diagram**

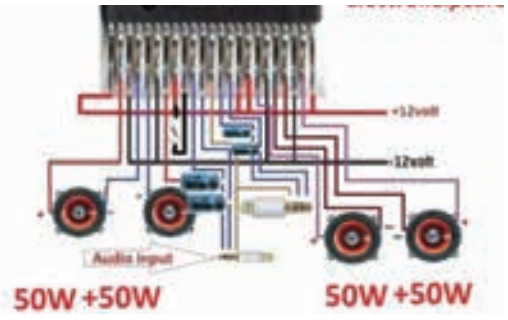
- A more complex setup for surround sound includes five amplifiers and five speaker sets. These amplifiers power different speakers (front, center, and rear) for an immersive experience.

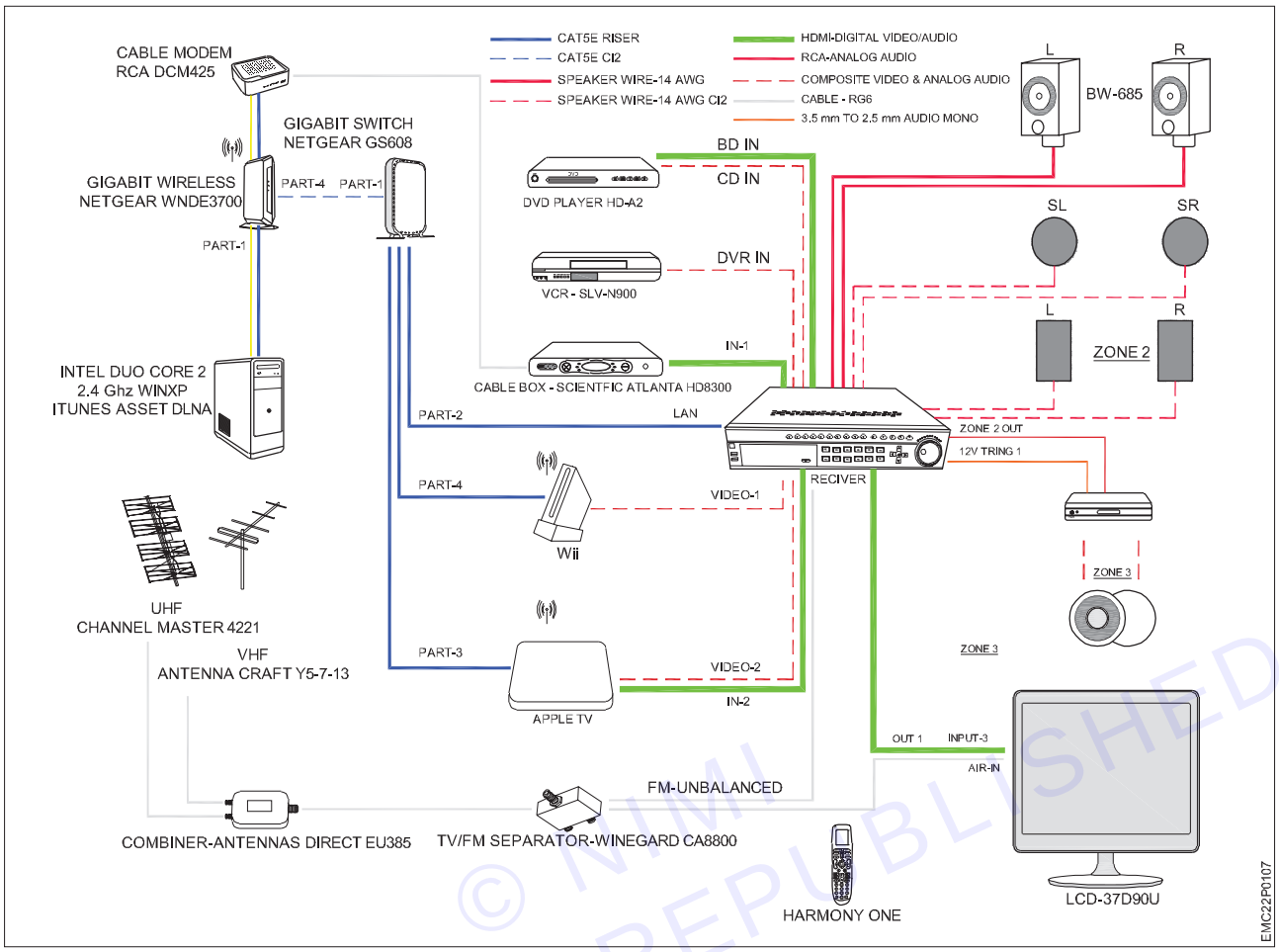
4 **Seven-Channel Surround Sound Wiring Diagram**

- The most intricate configuration involves seven amplifiers and seven speaker sets. This setup caters to additional channels (such as height or rear surround) for a cinematic feel.

Remember, these diagrams illustrate how components connect, ensuring optimal sound quality. Whether you're a novice or an enthusiast, understanding these circuits will help you set up your home theater system effectively.







PROCEDURE

1 Identify Components

- First, identify the key components of your home theater system. These typically include:
  - **TV or Projector:** The display device.
  - **A/V Receiver:** The central hub that connects all audio and video sources.
  - **Speakers:** Front, center, surround, and subwoofer speakers.
  - **Media Players:** DVD/Blu-ray players, streaming devices, gaming consoles, etc.

2 Layout the Components

- Arrange the components on paper or a digital tool to represent their physical placement in your room.
- Use symbols to represent each component (e.g., rectangles for speakers, circles for connectors).

3 Connect the Components

- Draw lines to represent the connections between components.
- Indicate the type of connection (e.g., HDMI, optical, speaker wires).
- Label each connection (e.g., “HDMI from Blu-ray to TV,” “Speaker wires from receiver to front speakers”).

4 Include Inputs and Outputs

- Show the inputs and outputs on each component (e.g., HDMI input/output, speaker terminals).
- Label them appropriately (e.g., “HDMI In,” “Front Left Speaker”).

5 Color Coding (Optional)

- Use different colors for different types of connections (e.g., red for audio, blue for video).
- This makes the diagram easier to follow.

6 Add Power Supply

- Include the power supply connections (e.g., power cords from the wall outlet to each component).

7 Label the Diagram:

- Add a legend or key explaining the symbols and colors used.
- Label each component with its name (e.g., “TV,” “Receiver,” “Front Left Speaker”)

Tabulation:

Component	Description
Display	This could be a television or a projector. The display is where the video content is shown. The quality of the display can greatly affect the viewing experience.
Receiver	The receiver is the control hub of your home theater system. It usually controls the sound and is the connection between your speakers and viewing device.
Speakers	Speakers are essential for delivering high-quality audio. The number and type of speakers can vary depending on the specific home theater setup.
Media Devices	These are the devices that play the media content. This could be a DVD player, a game console, a streaming device, etc.
Lighting	Lighting can enhance the viewing experience by creating the right ambiance.

Result: Each of these components plays a crucial role in the overall home theatre experience. The main purpose of a home theatre is to improve your viewing experience compared to standard technology, and ultimately to emulate a cinema experience as much as possible.

EXERCISE 156: Testing of speakers,woofers & tweeters

Objectives

At the end of this exercise you shall be able to

- testing speakers, woofers, and tweeters is to ensure that they are functioning properly and delivering the best sound quality.

Requirements

Tools/ Materials

- Microphone and Computer
- Software
- Calibrated Microphone
- Laptop (Recommended)
- Avoid Reflections

Procedure

Frequency Response

Importance: No other single measurement correlates more strongly with listener preference than frequency response**.**

Observation: It refers to the range of frequencies a speaker can produce, from low bass tones to high treble notes.

Impulse Response

Importance: Impulse response characterizes a speaker's transient behavior.

Details: It represents how a speaker responds to sudden changes in input signal.

Application: Used to assess transient accuracy and time-domain performance.

Cumulative Spectral Decay (Waterfall Plot)

Importance: Reveals resonances and decay behavior.

Details: A 3D waterfall plot shows off-axis response at various angles.

Application: Helps determine listening window, early reflections, and power respons.

Polar Response

Importance: Represents a speaker's off-axis response.

Details: Examined using a 3D plot, which provides insights into directivity and dispersion.

Application: Useful for optimizing speaker placement and minimizing room interactions.

Step Response

Importance: Evaluates a speaker's transient behavior.

Details: Measures how quickly a speaker responds to a step input.

Application: Helps assess time alignment and phase coherence.

Impedance

Importance: Impedance affects amplifier compatibility.

Details: Impedance curve shows variations across frequency.

Application: Helps design suitable crossover networks.

Efficiency/Sensitivity

Importance: Relates to how efficiently a speaker converts electrical power into sound.

Details: Sensitivity is measured in decibels (dB) per watt at a specific distance.

Application: Influences amplifier choice and overall system efficiency.

Distortion

Importance: Distortion affects sound quality.

Details: Includes harmonic distortion, intermodulation distortion, and transient distortion.

Application: Minimizing distortion leads to cleaner sound reproduction.

Importance: Dynamics refer to a speaker's ability to handle varying loudness levels.

Details: Assess transient response and compression effects.

Application: Crucial for accurate reproduction of music's dynamic range.

Remember, while these measurements provide valuable engineering data, subjective listening tests remain essential for evaluating musicality and overall speaker quality. The combination of objective measurements and human perception ensures a well-designed loudspeaker

Circuit diagram

EC60268

IEC60268 is categorized into several parts, however, part a, b and c are the most relatable in evaluating speaker performance

Part a: The standard on analogue and digital amplifiers specifies the characteristics of amplifiers in a sound system for professional or household applications**.**

Part b: The standard for evaluating microphones using measurement of impedance, sensitivity, polar patterns, dynamics, etc.

Part c: The standard on loudspeakers, excluding loudspeakers with built-in amplifiers. The purpose of this standard is to define the characteristics of loudspeakers using the measurement parameters that have been previously mentioned, such as frequency response and impulse response.

EN50332

EN50332 is divided into two parts

Part 1: When the standardized sound track is played, the speaker's output sound pressure should be less than 100dBA. This evaluation needs to be done by a "Head and Torso Simulator (HATS)".

Part 2: If the speaker uses a battery as its power supply, its highest output voltage should be under 150 mV.

What to Listen to When Evaluating Speaker Performance?

Tonal uniformity

The evenness of sound and tone across the frequency spectrum, from bass to treble.

Bass extension

The sounds produced in the audio range at the 20-to-40-Hz octave.

Spatial character

The spaciousness and depth of sounds produced by a speaker in a practical environment.

Dynamic linearity

Minimal audible distortions when producing sounds across the full frequency spectrum.

PROCEDURE

Understanding the Basics:

To test a speaker, you'll need an audio source (such as an amplifier or receiver) that plays music or sounds through the speaker.

Use a sound meter to measure volume levels in decibels (dB).

Position the speaker correctly and avoid obstacles that may affect performance.

Understand specifications like RMS power rating and sensitivity.

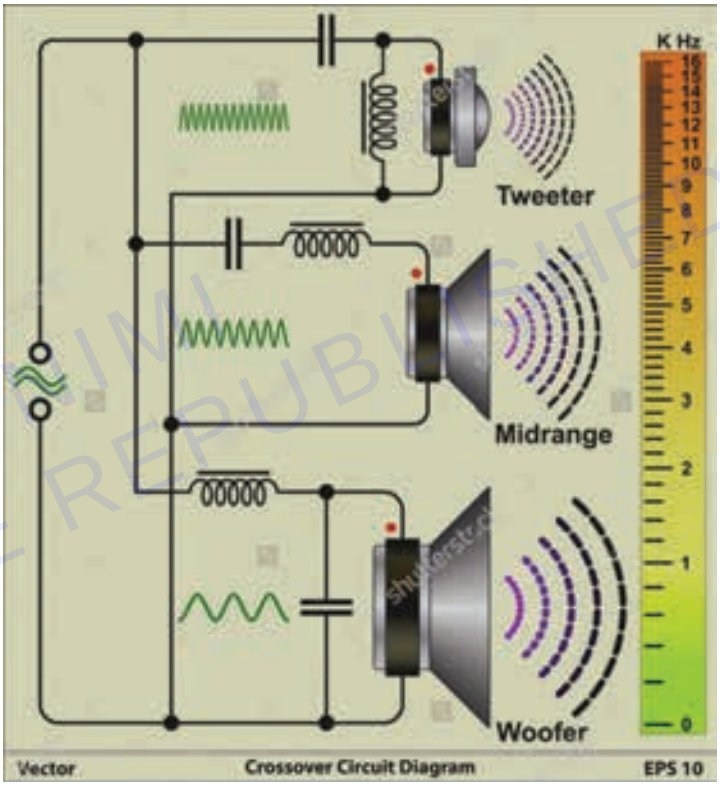
Testing Process:

Ensure the power rating on your amplifier matches that of the speaker.

Place the speaker in an open area and connect it to your amplifier.

Play a test tone at low volume and gradually increase it until you reach a comfortable listening level.

Listen for any distortion, uneven frequency response, or low output levels.



Test both left and right channels to ensure stereo sound.

Common Issues and Solutions:

If you can't hear sound, check:

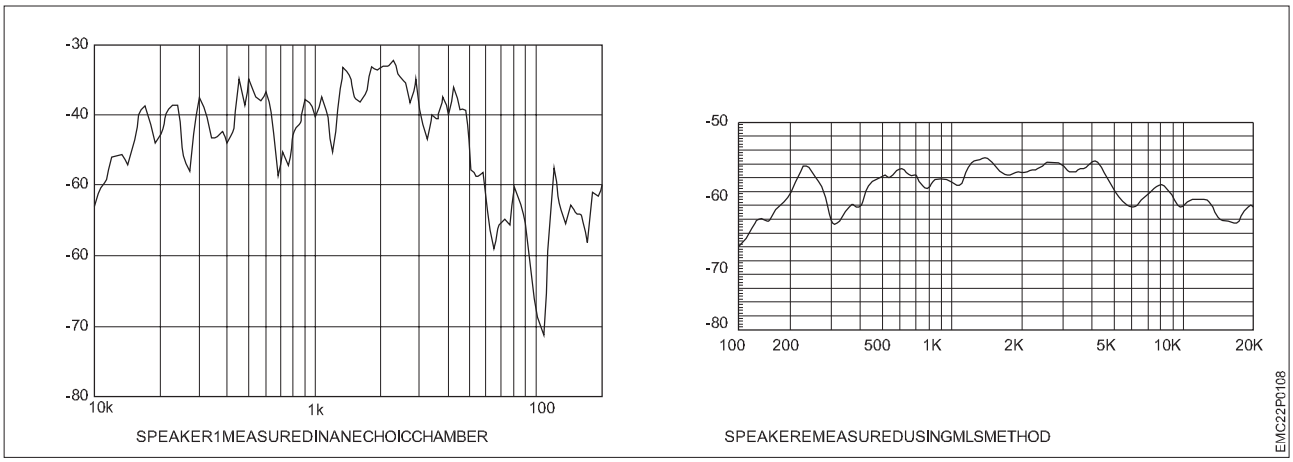
Speaker power and connection.

Volume settings on your computer or device.

Correct playback device in your operating system.

If you hear only one channel, ensure the speakers are connected to each other.

Remember to protect your ears and prevent damage while testing. Regular speaker testing helps maintain optimal sound quality and longevity.



Result: Thus the Testing can help identify issues such as distortion, low output level, or uneven frequency response

EXERCISE 157: Set up of home theatre using specific devices

Objectives

At the end of this exercise you shall be able to

- the aim of setting up a home theatre using specific devices is to create a high-quality, immersive audio-visual experience in the comfort of your own home.

Requirements

Tools/Materials

- Home theater video equipment
- Home theater audio equipment
- Audio video processing equipment
- Audio optimization tools and work
- Video optimization tools and work
- Media sources or streaming devices
- Power surge protector
- Seating for the audience
- Cables for connectivity
- Universal remote control

Procedure

Setting up a home theater system can be an exciting project, and it doesn't have to be daunting. Let's break down the process step by step, focusing on the essential components and connections

Choose Your Components:

Home Theater Receiver (AV Receiver): This central hub handles audio and video signals. It connects to your speakers, TV, and other devices.

TV or Video Projector with Screen: Decide whether you want a large TV or a projector setup.

Antenna or Cable/Satellite Box: For live TV.

Disc Player: Choose one compatible with your media preferences (Ultra HD, Blu-ray, DVD, or CD).

Media Streamer: To access streaming services like Netflix or Hulu.

Loudspeakers: Consider a 5.1 or 7.1 speaker setup.

Subwoofer: Enhance low-frequency sounds.

Connection Cables and Speaker Wire: HDMI, RCA, optical cables, and speaker wire.

Wire Stripper: If working with raw speaker wire.

Sound Meter: For precise audio calibration.

Determine Your Space

Find an ideal location for your home theater system. Consider room size, layout, and acoustics.

Plan the connection path for audio and video signals to flow seamlessly from source components to speakers and the display.

Connect Your Components

TV/Projector to Receiver: Use HDMI or other appropriate cables.

Disc Player to Receiver: Connect via HDMI or other compatible cables.

Media Streamer to Receiver: Again, use HDMI or other suitable cables.

Speakers to Receiver: Follow the speaker layout (5.1 or 7.1) and use speaker wire.

Subwoofer to Receiver: Connect using an audio cable.

Antenna/Cable Box to TV/Projector: Use coaxial or HDMI cables.

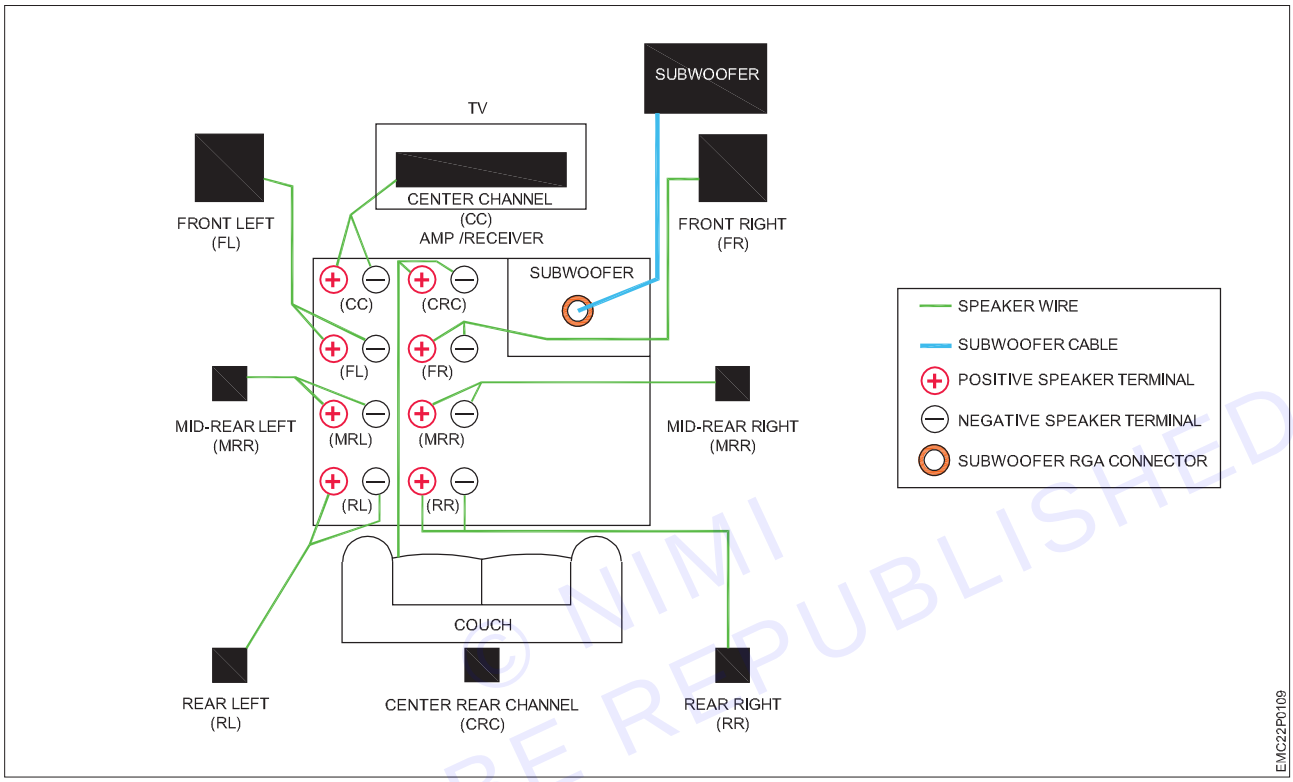
Power Outlet Strips: Plug in all components.

Calibrate Audio and Video

Use a sound meter to achieve optimal speaker levels and balance.

Adjust TV/projector settings for picture quality.

Layout of Home theater



PROCEDURE

Choose Your Components

Home Theater Receiver (AV Receiver): This central hub handles audio and video signals. Connect it to your speakers, TV, and other devices.

TV or Video Projector with Screen: Decide whether you want a large TV or a projector setup.

Antenna or Cable/Satellite Box: For live TV.

Disc Player: Choose one compatible with your media preferences (Ultra HD, Blu-ray, DVD, or CD).

Media Streamer: To access streaming services like Netflix or Hulu.

Loudspeakers: Consider a 5.1 or 7.1 speaker setup.

Subwoofer: Enhance low-frequency sounds.

Connection Cables and Speaker Wire: HDMI, RCA, optical cables, and speaker wire.

Wire Stripper: If working with raw speaker wire.

Sound Meter: For precise audio calibration.

Determine Your Space

Find an ideal location for your home theater system. Consider room size, layout, and acoustics.

Plan the connection path for audio and video signals to flow seamlessly from source components to speakers and the display.

Connect Your Components

TV/Projector to Receiver: Use HDMI or other appropriate cables.

Disc Player to Receiver: Connect via HDMI or other compatible cables.

Media Streamer to Receiver: Again, use HDMI or other suitable cables.

Speakers to Receiver: Follow the speaker layout (5.1 or 7.1) and use speaker wire.

Subwoofer to Receiver: Connect using an audio cable.

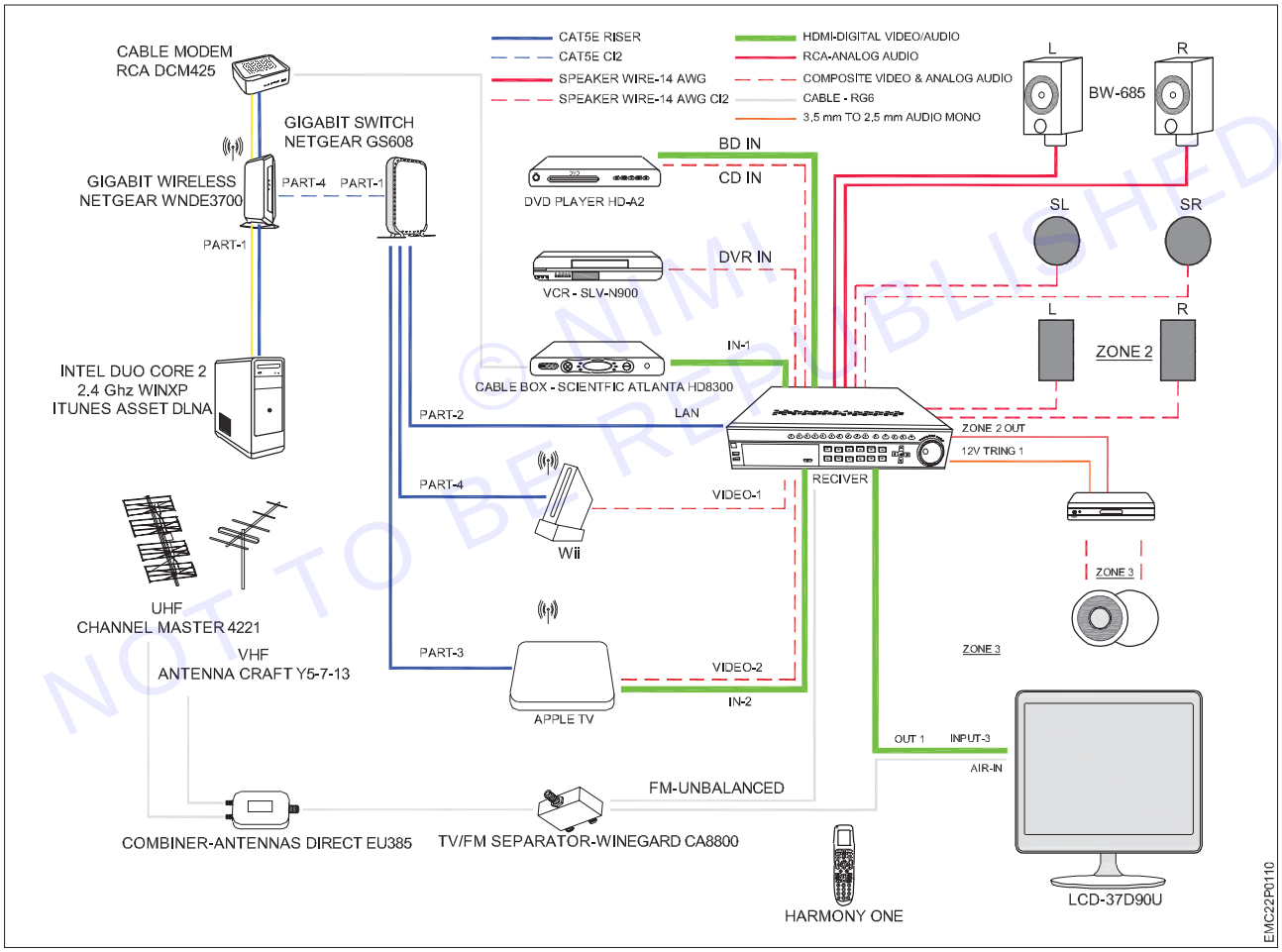
Antenna/Cable Box to TV/Projector: Use coaxial or HDMI cables.

Power Outlet Strips: Plug in all components.

Calibrate Audio and Video

Use a sound meter to achieve optimal speaker levels and balance.

Adjust TV/projector settings for picture quality.



Result: Setting up a home theater system can indeed seem daunting, but with patience and the right guidance, you can achieve an impressive cinematic experience right in your living room.

EXERCISE 158: Demonstration of diffrent parts of AV receiver

Objectives

At the end of this exercise you shall be able to

- to demonstrate various Input and output of AV receiver
- to demonstrate various parts of AV receiver.

Requirements

Tools/Materials

• Combination plier (250mm)	- 1 No.
• Screw driver set (150mm)	- 1 No.
• Wire stripper	- 1 No.
• AV receiver	- as reqd.
• Connecting wire	- as reqd.

Procedure

HDMI

HDMI is the most important connection on modern home theater receivers. (Receivers may also be referred to as AV receivers or surround sound receivers.) It is where you connect HD and 4K source devices, including Blu-ray and Ultra HD Blu-ray Disc players, cable and satellite boxes, media streamers, and game consoles.

Home theater receivers usually have four or more HDMI inputs and a least one output that connects to a TV or video projector. However, some home theater receivers may have two or three HDMI outputs, similar to the example shown above.

Digital Audio Connections

Home theater receivers include two types of digital audio-only connections: optical and coaxial. Use these to connect audio from most DVD players, Blu-ray Disc players, and HD and 4K Ultra HD TVs. Some CD players also provide one or both of these output options.

These connections access two-channel stereo and standard Dolby Digital and DTS surround sound signals. These connections cannot pass enhanced surround formats, such as Dolby Digital Plus, TrueHD, Atmos, and DTS-HD Master Audio or DTS:X. Those are only accessible from an HDMI connection.

Analog Audio Input Connections

Most audio is available digitally. Still, many devices either use analog exclusively (such as vinyl record turntables, audio cassette decks, and VCRs) or provide it as an alternate audio connection option (using RCA style jacks and cables) on devices such as TVs, cable and satellite boxes, and DVD and Blu-ray Disc players.

AM/FM Radio Antenna Connections

Another audio source included in home theater receivers is radio reception. Most home theater receivers provide connections for AM and FM antennas. However, some home theater receivers only provide FM antenna connections as these receivers may not include an AM tuner.

Speaker Connections

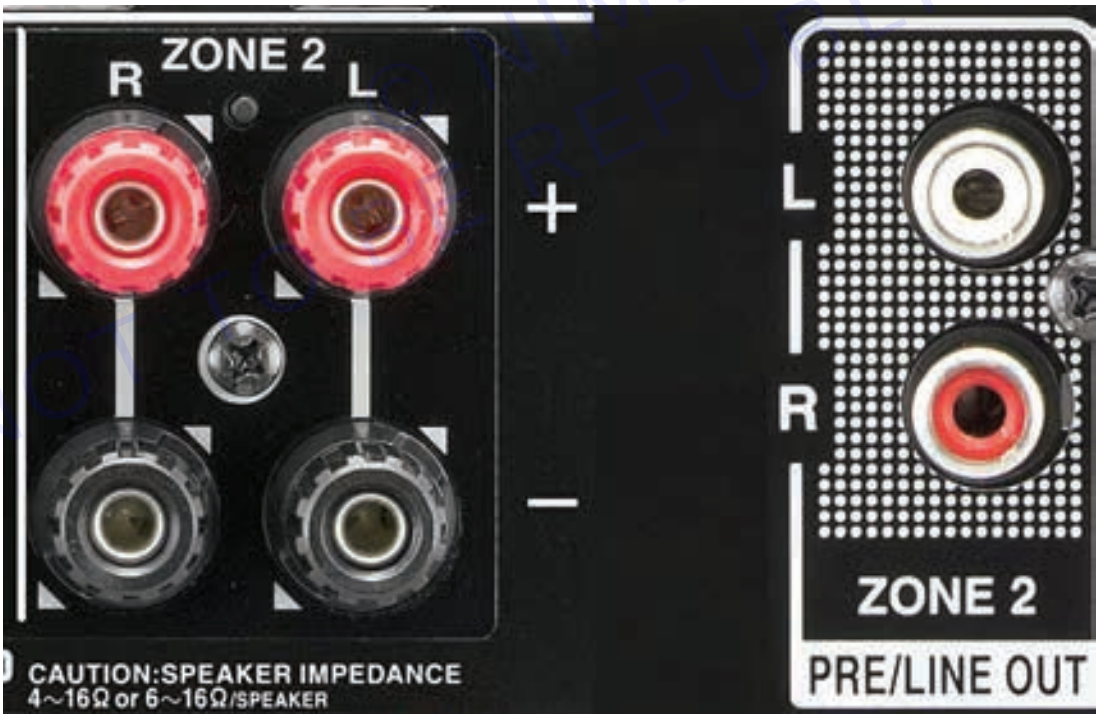
You can't hear the sound from a home theater receiver unless you connect some speakers.

When connecting speakers, match the speaker terminals with the speaker placement. This means connecting the center speaker to the center channel speaker terminals, the left front to the main left, the right front to the main right, the surround left to the surround left, and the surround right to the surround right.

Some speaker terminals may provide more than one channel option (not at the same time, though). For example, if you want to accommodate a different type of speaker setup—such as for Dolby Atmos, DTS:X, Auro 3D Audio, or a powered 2nd Zone—refer to the added illustrations in the user manual to find out which terminals to use and how to assign each correctly.

In addition to connecting the correct speaker channel, make sure the polarity (+ -) is correct. Red is positive (+), and black is negative (-). If the polarity is reversed, the speakers will be out-of-phase, resulting in inaccurate surround sound and poor low-frequency reproduction.

Zone 2 Speaker Connections and Analog Audio Outputs



On home theater receivers that offer it, the Zone 2 feature allows a second source signal to be sent to speakers or a separate audio system in another room through a wired or cable connection.

Zone 2 functionality allows you to watch a Blu-ray Disc or DVD movie with surround sound in the main room while someone else listens to a CD player, AM/FM radio, or a two-channel source in another room at the same time. The source components are connected to the receiver and are accessed and controlled separately with the receiver's remote.

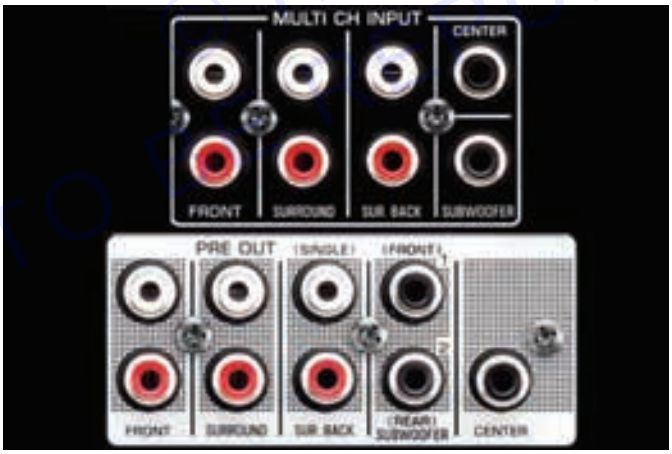
Subwoofer Preamp Outputs

Another type of speaker that needs to be connected to a home theater receiver is a subwoofer. The subwoofer doesn't connect to the terminals provided for the other speakers. Instead, the subwoofer connects to an RCA-type connection that is labeled as Subwoofer, Subwoofer Preamp, or LFE (Low-Frequency Effects) output.

This type of connection is used because subwoofers have built-in amplifiers, so the receiver doesn't power the subwoofer. It only supplies the audio signal. RCA-style audio cables are used for this connection.

Home theater receivers provide at least one subwoofer output. Still, many provide two, as shown in the above example. This provides added setup flexibility.

Multichannel Analog Audio Inputs and Outputs



Higher-end home theater receivers offer an additional analog audio connection option, referred to as a multichannel analog audio connection.

A separate connection for each channel of audio is provided. This means that just as there are left-channel and right-channel analog audio connections for stereo, for surround sound, it is possible to include separate analog audio connections for the center, left surround, right surround, and, in some cases, left surround back and right surround back. The connections use RCA jacks and cables.

Multichannel Analog Outputs

The most common multichannel analog connection options, which are found mostly in mid- and high-end home theater receivers, are multichannel analog audio outputs.

These outputs connect a home theater receiver to external amplifiers. However, when multichannel analog preamp outputs are used, these outputs disable the home theater receiver's internal amplifiers that are designated for the corresponding channels. You can't combine the power output of an internal amplifier with an external amplifier for the same channel.

Multichannel Analog Inputs

Some home theater receivers provide multichannel analog audio inputs, but these are rare in newer models.

If a home theater receiver has this option, it provides the flexibility to connect some DVD and Blu-ray Disc players or another source component that may offer this as an output connection option.

Analog Video Inputs

There are three types of analog video input.

Component Video

This analog video connection option separates luminance (Y) and color (Pb, Pr or Cb, Cr) into three channels. It requires three cables (colored red, green, and blue) to transfer video from a source device to a receiver or a TV.

Component video cables can transfer both standard and high-definition (up to 1080p) video signals. However, most sources restrict signals from passing through component video cables to standard definition due to copy-protection issues.

Composite Video

Composite video uses a single RCA connection (usually yellow, as illustrated in the photo example) to send the color, B/W, and luminance portions of an analog video signal from a source device to a TV or home theater receiver. Composite video signals are standard definition resolution analog signals.

S-Video

S-Video is another type of video connection you might find if you have or purchase an older used home theater receiver.

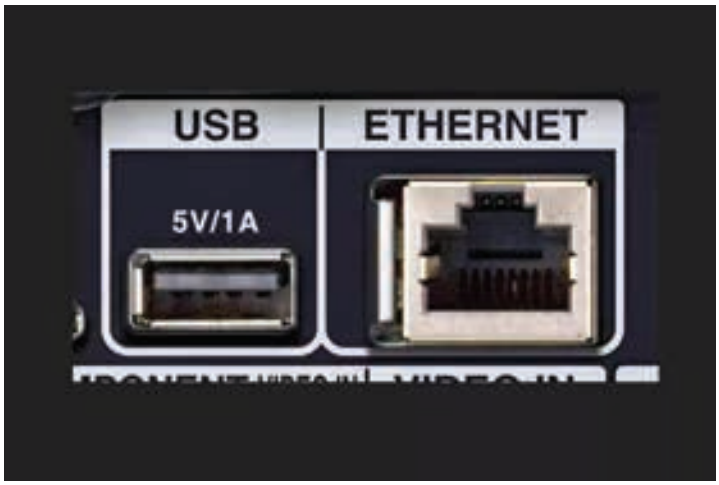
The S-Video cable sends the B/W and color parts of the video signal through separate pins within a single cable connector. This provides better color consistency and edge quality than the composite video option. It has been superseded by both component and HDMI video connections.

USB and Ethernet

A USB port is provided on many home theater receivers. This allows you to play music stored on flash drives or other compatible USB devices and, in some cases, power a smartphone or another compatible USB device.

A growing number of home theater receivers also provide network and internet connectivity. This can be provided by connecting an Ethernet cable to the receiver using a provided Ethernet/LAN port.

However, a growing number of home theater receivers provide both Ethernet and Wi-Fi connectivity, which provides added flexibility as to where you place the receiver in relation to a broadband router.



RS232, IR Sensor Cable, and 12V Trigger

On high-end home theater receivers, you may find this trio of connections:

RS232

Provides a physical connection to a PC or custom home theater controller.

IR Sensor Cable Input

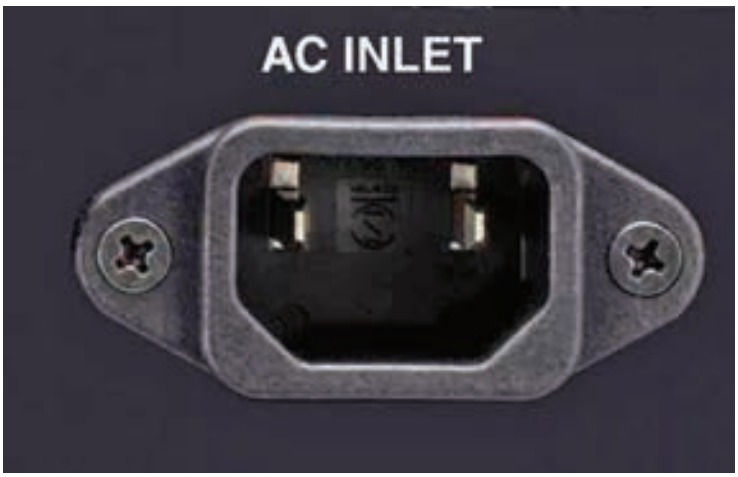
If this is an input, you can connect an IR blaster cable so that the home theater receiver doesn't have to be in a direct line of sight for your remote control.

If this is an output, it allows the home theater receiver to blast an IR signal to control another receiver.

12V Trigger

This connector allows the receiver to turn other compatible devices on or off or to start some functions, such as lowering or raising a video projection screen.

Power Cord Inlet



You'll need to power your home theater receiver. For convenience, most receivers provide a power cord that plugs directly into an AC inlet or socket.

Front Panel Inputs and Headphone Jack

In addition to the connections on the rear panel, many home theater receivers have connections on the front panel. On some home theater receivers, these may be hidden by a flip-down door.

The connections may include one or more of the following:

HDMI Input

This comes in handy when connecting temporary devices, such as digital cameras and smartphones. It is more convenient than having to reach an HDMI input on the back of the receiver.

3.5 mm or RCA Analog Audio Inputs

As shown in the photo.

Mic Jack

Most home theater receivers include an automatic speaker setup feature that uses self-generated test tones. The mic jack is where you connect the mic to receive the tones that the receiver can then analyze and adjust the speaker levels in relation to the room size and acoustic properties.

Headphone Jack

This is usually a 1/4-inch type. You can use an adapter if your headphones use 1/8-inch connectors. When headphones are plugged in, usually, the speakers are disabled.

USB Port

Although not shown in the photo example, some home theater receivers may provide a USB port on the front panel for playing music stored on flash drives or for connecting with an iPod or iPhone.

Composite Video Input

Not shown in the image. Some receivers include a composite video input on the front panel.

Wireless Connections

Sony

In addition to the physical connections, most home theater receivers include some level of wireless connectivity, which may include one or more of the following:

- Bluetooth.
- AirPlay.
- Wireless multi-room audio (DTS Play-Fi, Denon Heos, Yamaha MusicCast, and others).
- Compatibility with Alexa or Google Assistant.

EXERCISE 159: Demonstrate the faults in AV receiver & rectify

Objectives

At the end of this exercise you shall be able to

- to demonstrate various fault in AV receiver &rectify
- to demonstrate various indicators of AV receiver &rectify.

Requirements

Tools/Materials

• Combination plier (250mm)	- 1 No.
• Screw driver set (150mm)	- 1 No.
• Wire stripper	- 1 No.
• AV receiver	- 1 No.
• Connecting wire	- as reqd.

Procedure

AV receiver issues and their potential solutions

Check the Power Source: Ensure that the receiver is plugged into a working power outlet. Try a different outlet if needed and ensure the power cable is securely connected.

1 **Remote Control Issues**

Check Batteries: If the remote isn't working, replace the batteries and ensure they're inserted correctly.

Reset Remote Control: Some remotes may need to be reset. Consult the receiver's manual for instructions on how to reset the remote control.

2 **Bluetooth or Network Connectivity Issues**

Update Firmware: Ensure that the receiver's firmware is up-to-date. Some issues can be resolved through firmware updates.

Reconnect Bluetooth Devices: If using Bluetooth, disconnect and reconnect your devices. Ensure the receiver is set to the correct Bluetooth input.

Audio/Video Sync Issues

Adjust Audio Delay: Some AV receivers allow you to adjust audio delay to sync with video. Explore the receiver's settings for audio delay or lip sync adjustments.

3 **Overheating**

Check Ventilation: Ensure proper ventilation around the receiver. Clear any obstructions near the vents and consider using a fan to improve airflow.

Reduce Volume or Power Output: High volumes or excessive power output can lead to overheating. Reduce the volume or consider using an external cooling solution.

4 **Speaker Protection Mode**

Check for Short Circuits: If the receiver goes into protection mode, inspect speaker wires for short circuits or loose strands. Disconnect speakers one by one to identify the problematic speaker or wire.

Remember to consult your specific AV receiver's manual for detailed troubleshooting steps. If the **issue** persists, professional assistance may be necessary.

Image of fault

Procedure

- Identify the parts
- Differentiate different modules
- Brief each module on its working and uses.

Result: AS we find the Demonstrate the fault in AV receiver &rectify

MODULE 18: Domestic appliances

EXERCISE 160: Check controls on touch key pad of microwave oven

Objectives

At the end of this exercise you shall be able to

- If your microwave keypad is not working you'll need to test the membrane switch, and control board. Learn how to troubleshoot with our microwave repair guide.

Requirements

Tools/ Materials

- Vom (multitester)
- Instructional/operational manual
- Screw driver
- Pliers
- Microwave oven - 1 No.

Procedure

Theory:A device called a magnetron inside the oven produces microwaves. The microwaves reflect off the metal interior of the oven and cause the water molecules in food to vibrate. This vibration results in friction between molecules, which produces heat that cooks the

Principle: High powered microwaves are generated and are allowed to fall on the food stuff. These waves heat the molecules in the food particles evenly and cook the food.

Construction: In consists of a microwave generator called a magnetron, which is used to take electricity from the power outlet and converts into high powered micro waves, as in figIn consists of a microwave generator called a magnetron, which is used to take electricity from the power outlet and converts into high powered micro waves, as in fig Fig 3.8.1 Microwave oven The food compartment is made up of reflective metal walls, just like a mirror, to have effective focusing of microwaves onto the food particles. A rotating spinning arrangement, so called turn table is used to rotate the food stuff so as to cook the food evenly. A channel of common wave guide is used to transfer the microwaves from the magnetron to the food compartment. The total setup is completely surrounded by strong metal boxes for safety. A timer display is also provided in the modern microwave ovens to choose various options in cooking variety of food items like Gril

Touch key pad controls of Microwave oven

Working

Food to be cooked is placed on the turn table and the electricity is switched ON.

The magnetron converts the electrical energy into high powered radio waves, so called microwaves. The magnetron blasts these microwaves into the food compartment through a channel called a common wave guide. Microwave bounces back and forth between the reflective metal walls and reaches the food.

This Micro wave penetrates inside the food and makes the molecules in the food to vibrate. The vibrations will cause heat then faster the molecules vibrate, the food becomes hotter. Thus in this way micro wave pass their energy onto the molecules in the food and cook the food by heating it. The food is evenly cooked by rotating the spinning or turn table slowly ,so that the micro waves are passed in each and every part of the food.

Advantages

It is portable,small in size.

Easy and faster to cook, with high efficiency.

Micro wave can penetrate more than two centimetres into the food.

Cost of micro wave oven is less.

Disadvantages

Microwaves are dangerous and so there should not be any leakage.

Every time the lock of the door should be checked properly

We should not use cell phone in microwave oven cooking areas.

Uneven heating (or) cooking of food is not good for health.

Tips on Safe Microwave Oven Operation

Follow the manufacturer's instruction manual for recommended operating procedures and safety precautions for your oven model.

Use microwave safe cookware specially manufactured for use in the microwave oven.

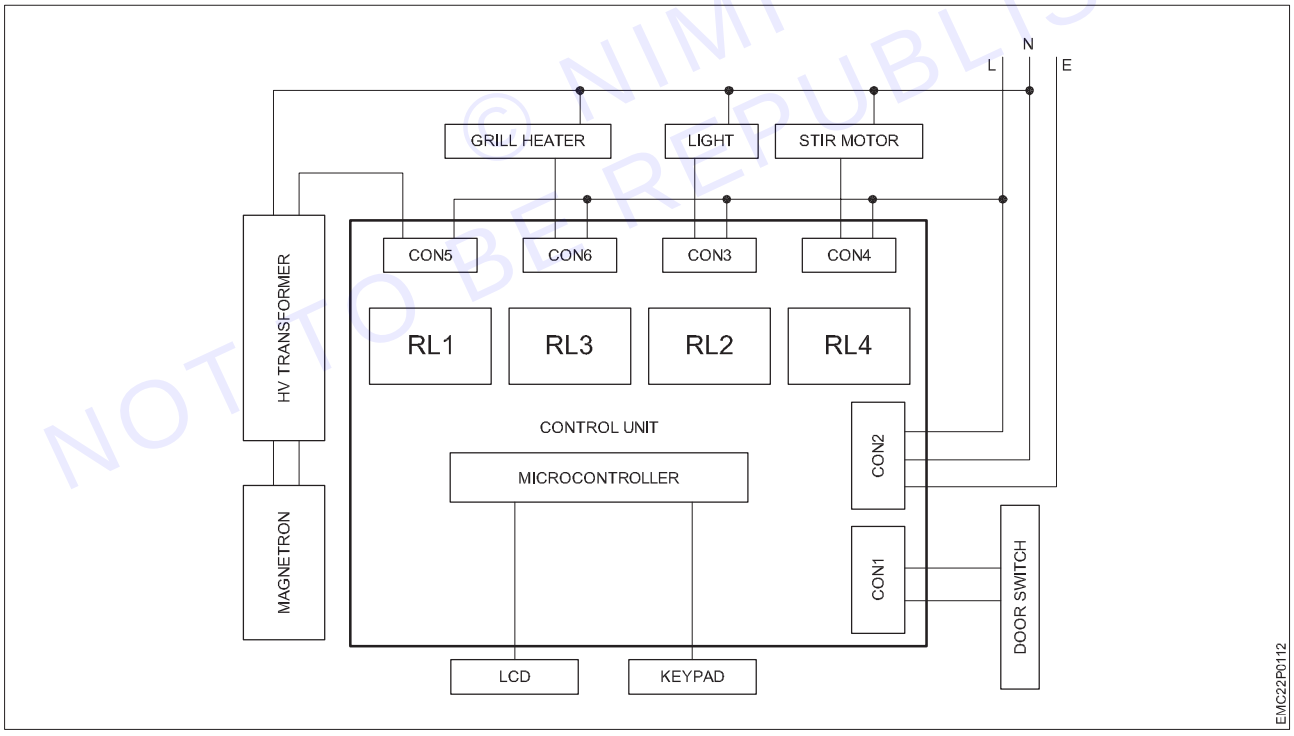
Don't operate a microwave oven if the door does not close firmly or is bent, warped, or otherwise damaged.

Stop using a microwave oven if it continues to operate with the door open.

As an added safety precaution, don't stand directly against an oven (and don't allow children to do this) for long periods of time while it is operating.

Do not heat water or liquids in the microwave oven longer than recommended in the manufacturer's instructions.

Some ovens should not be operated when empty. Refer to the instruction manual for your oven.



Microwave Ovens and Health

Microwave radiation can heat body tissue the same way it heats food. Exposure to high levels of microwaves can cause a painful burn. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because there is relatively little blood flow in them to carry away excess heat. Additionally, the lens of the eye is particularly sensitive to intense heat, and exposure to high levels of microwaves can cause cataracts. But these types of injuries – burns and cataracts – can only be caused by exposure to large amounts of microwave radiation.

Consumers should take common sense precautions regarding handling of hot foods and beverages. For more safety recommendations see the section of this page titled: Tips on Safe Microwave Oven Operation.

EXERCISE 161: Monitor and check dismantling of various parts, wiring, tracing of varius controls of microwave oven

Objectives

At the end of this exercise you shall be able to

- to understand and Identify parts of Microwave oven
- to dismantle all the parts as per the manual
- to Trace the various controls in the Microwave oven.

Requirements

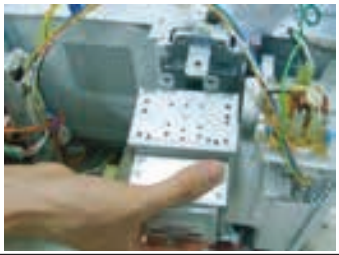
Tools/Materials

- Precision screwdriver set - 1 Set.
- Tweezers - 1 Pair.
- Plastic opening tools - 1 Set.
- Heat gun - 1 No.
- soldring iron - 1 No.
- desoldring pump - 1 No.
- Replacement parts - as reqd.
- Magnifying glass - 1 No.
- Digital Multimeter with probes - 1 No.
- User Manual of the given Microwave oven - 1 No.
- Microwave oven of any Brand (1000 W) - 1 No.

Procedure

Remove the magnetron including the shield case, permanent magnet, choke coils and capacitors (all of which are contained in one assembly)

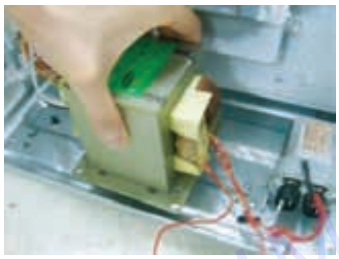
Parts	Explanation Photo	Explanation
Magnetron, Motor Assembly and Lamp		1 Disconnect all lead wires from the magnetron and lamp.
		2 Remove a screw securing air cover.
		3 Remove the air cover.

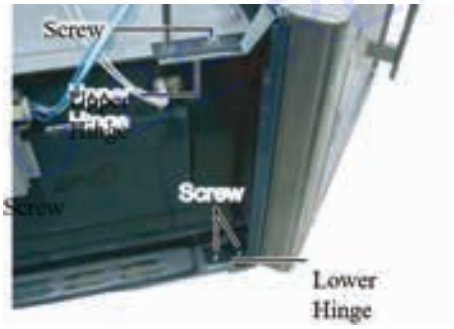
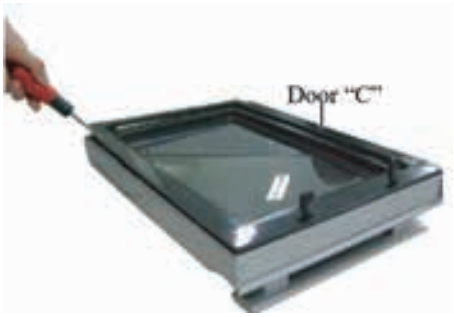
Parts	Explanation Photo	Explanation
Magnetron, Motor Assembly and Lamp		4 Remove screws securing the magnetron to the waveguide.
		5 Take out the magnetron very carefully.
		6 Remove two screws from the back panel. 7 Takeout the fan motor.
		8 Remove the oven lamp from hole of air cover.

NOTE 1: When removing the magnetron,make sure that its antenna does not hit any adjacent parts or it may be damaged.

NOTE 2: When replacing the magnetron,be sure to remount the magnetron gasket in the correct position and make sure the gasket is in good condition

Parts	Explanation Photo	Explanation
High Voltage Transformer		1 Discharge the high voltage capacitor

High Voltage Transformer		2 Disconnect all the leads.
		3 Remove the air cover.
		4 Replace the High Voltage Transformer 5 After replace, reconnect the Leads correctly and firmly.

Parts	Disassembly Photo	Explanation
Removal of Door Assembly		Remove hex bolts securing the upper hinge and lower hinge. Then remove the door assembly
Removal of Door "C"		Insert flat screwdriver into the gap between Door "A" and Door "C". Be careful when handing Door "C" because it is fragile. Then remove the door assembly.

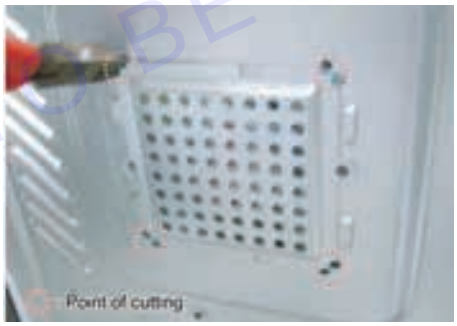
Removal of Door "E"		Following the procedure as shown in the figure, insert and bend a thin metal plate between Door"E"and Door "A" until you hear the 'tick' sound. • Insertion depth of the thin metal plate should be 0.5mm or less.
Removal of Key Door & Spring		Remove pin hinge from Door"E" Detach spring from Door"E" and key door.

Replacement of Fuse

1 Disconnect the oven from the power source.

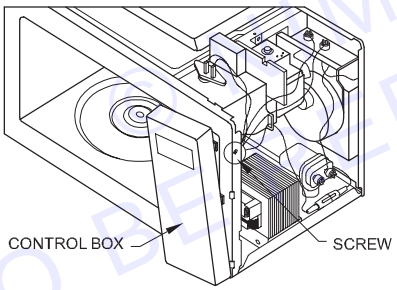
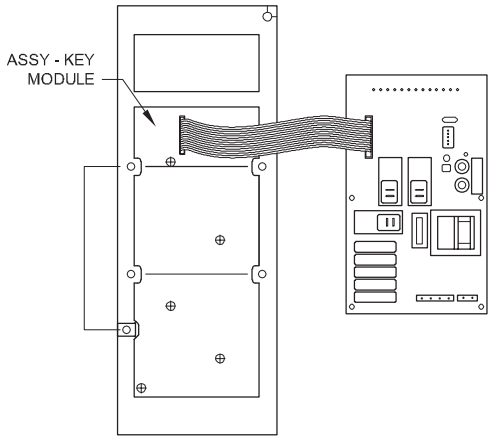
2 When12A fuse blows out by the operation of interlock monitor switch failure, replace the primary interlock switch, door sensing switch, monitors witch and power relay.

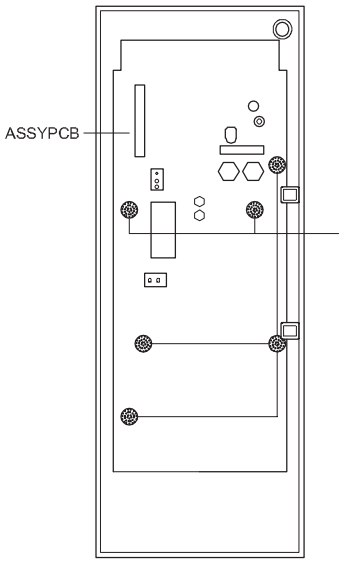
Replacement of Drive Motor

Parts	Explanation Photo	Explanation
Drive Motor		1 Take out the glass tray, guide roller from oven cavity, disconnect power. 2 Remove turn table motor cover from case bottom. **CAUTION**: Remove sharp edge After cover removal
		3 Disconnect leads from motor. 4 Remove the screws securing motor to bottom of over cavity.

Parts	Explanation Photo	Explanation
Drive Motor		6 Lift out the motor. 5 When replacing the motor, be sure to remount it in the correct position. **NOTE:The shaft of motor should Fit tip coupler.**
	COVER FIXING SCREW : MATCHINESCREW(6006-001170)	6 When reassemble a drive motor cover. Give a turn in a 180° and fix with a screw. **NOTE:Bring the spare screw from service center**

Replacement of Control Circuit Board

Parts	Explanation Photo	Explanation
Removal of Control Box Assembly		1 Be sure to ground any static electric charge in your body and never touch the control circuit. 2 Disconnect the connectors from the control circuit board. 3 Remove screws securing the control box assembly. 4 Remove the screw securing the ground tail of the keyboard.
Remove P.C.B Assembly		1 Remove screws securing the control circuit board. 2 Lift up the control circuit board from the Ass'y control box.

Result: Thus the dismantle of given microwave unit was done and replaced faulty parts successfully.

EXERCISE 162: Detect the faults in the given Microwave oven & rectify

Objectives

At the end of this exercise you shall be able to

- to analyze various faults in the microwave oven
- to understand and Identify parts of Microwave oven
- to dismantle faulty parts and replace as per the manual.

Requirements

Tools/Materials

- Precision screwdriver set - 1 Set.
- Tweezers - 1 Pair.
- Plastic opening tools - 1 Set.
- Heat gun - 1 No.
- soldring iron - 1 No.
- desoldring pump - 1 No.
- Replacement parts - as reqd.
- Magnifying glass - 1 No.
- Digital Multimeter with probes - 1 No.
- User Manual of the given Microwave oven - 1 No.
- Microwave oven of any Brand (1000 w) - 1 No.

Procedure

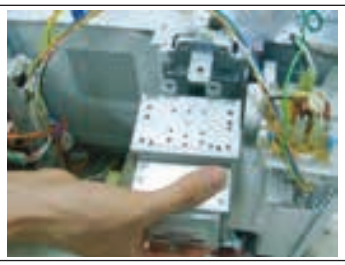
Faults Identified

Oven is not heating up

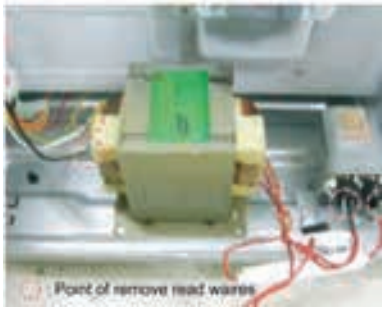
1 Due to Faulty Magnetron- Motor Assembly

Remove the magnetron including the shield case, permanent magnet, choke coils and capacitors (all of which are contained in one assembly)

Parts	Explanation Photo	Explanation
Magnetron, Motor Assembly and Lamp		1 Disconnect all lead wires from the magnetron and lamp.
		2 Remove a screw securing air cover.
		3 Remove the air cover.

Parts	Explanation Photo	Explanation
Magnetron, Motor Assembly and Lamp		4 Remove screws securing the magnetron to the waveguide.
		5 Take out the magnetron very carefully.
		6 Remove two screws from the back panel. 7 Takeout the fan motor. 8 Remove the oven lamp from hole of air cover.

2 Oven is not working due to failure in the high voltage transformer- verified with help of multimeter

Parts	Explanation Photo	Explanation
High Voltage Transformer		1 Discharge the high voltage capacitor
		2 Disconnect all the leads.

High Voltage Transformer		3 Remove the air cover.
		4 Replace the High Voltage Transformer 5 After replace, reconnect the Leads correctly and firmly. 6 Replaced High voltage transformer carefully.

3 Oven is not getting proper power in the circuit

Replacement of Fuse

1 Disconnect the oven from the power source.

2 When12A fuse blows out by the operation of interlock monitor switch failure, replace the primary interlock switch, door sensing switch, monitors witch and power relay.

4 Drive motor is not running properly.

1 remove the dust if any and Replacement of Drive Motor

Parts	Explanation Photo	Explanation
Drive Motor		1 Take out the glass tray, guide roller from oven cavity, disconnect power. 2 Remove turn table motor cover from case bottom. **CAUTION**: Remove sharp edge After cover removal
		3 Disconnect leads from motor. 4 Remove the screws securing motor to bottom of over cavity.

Replacement of Drive Motor

Parts	Explanation Photo	Explanation
Drive Motor		6 Lift out the motor. 5 When replacing the motor, be sure to remount it in the correct position. **NOTE:The shaft of motor should Fit tip coupler.**
	COVER FIXING SCREW : MATCHINESCREW(6006-001170)	6 When reassemble a drive motor cover. Give a turn in a 180° and fix with a screw. **NOTE:Bring the spare screw from service center**

Result : Thus the faulty parts of given microwave oven was identified and replaced successfully

EXERCISE 163: Disassembling and studying various parts of a washing machine such sensors, wiring, tracing various controls and electronic circuits

Objectives

At the end of this exercise you shall be able to

- to Identify parts of Washing Machine
- to identify faulty parts in a given washing machine
- to trace the wiring circuits leads to various parts in a washing Machine.

Requirements

Tools/ Materials

- Screw driver (300 mm) - 1 No.
- Tester (150 mm) - 1 No.
- Combination plier (250 mm) - 1 No.
- Wire cutter (200 mm) - 1 No.
- Multimeter - 1 No.
- Flat File (300 mm) - 1 No.
- Nut Driver 8,10,11mm (350 mm) - 1 No each.
- Nose plier (200 mm) - 1 No.
- Spanner 10-11/12-13 mm (150 mm) - 1 No.

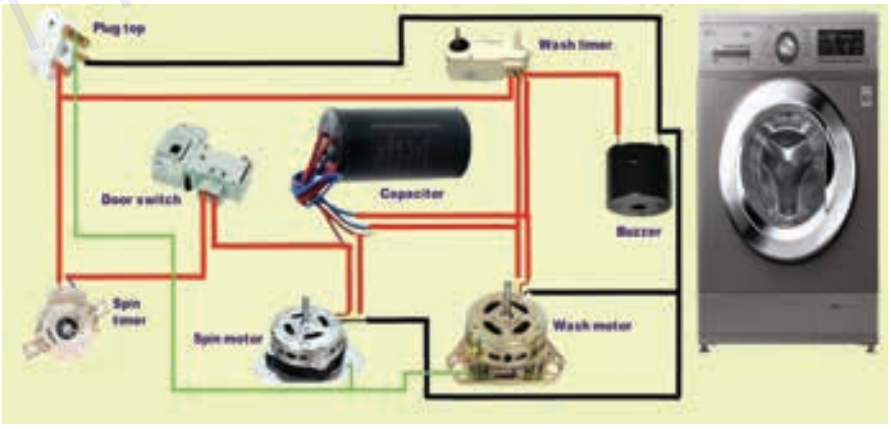
Procedure

Theory

All the tips for dismantling the washing machine should be kept near the machine in an organized manner. And with the help of your senior, you

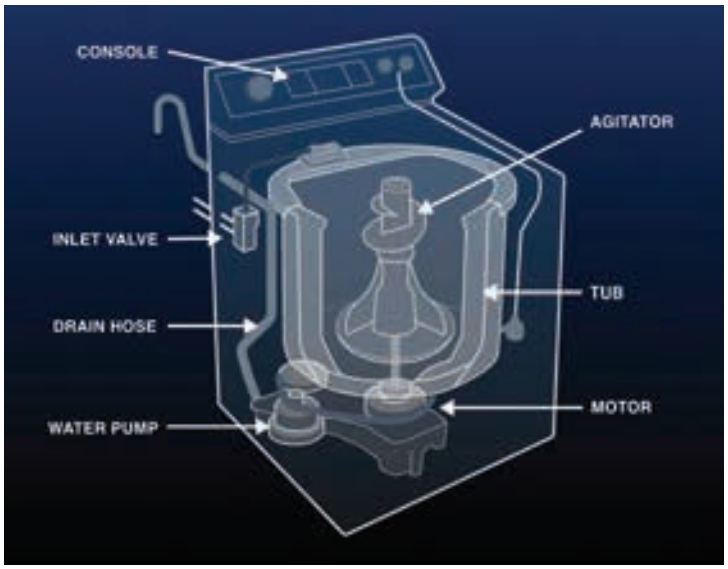
Should open each chapter and find out its name and its work process.

Parts of washing Machine



Basic washing machine parts diagram

You can use this washing machine parts diagram to get an idea of where basic parts are located inside a washing machine. Exact locations may vary from top to front load machines, as well as model to model. If you're having an issue with a particular washer part, read the Maytag guide to washer troubleshooting or consult your owner's manual.



Washing machine tub

Most washing machines have an inner and outer tub. The inner tub is called a wash basket in top load washers and a drum in front load washers. The outer tub remains stationary and holds the wash basket or drum, catching the wash water so it can be drained out. The wash basket or drum is the part of the washer that holds the clothes and rotates to wash them. They can be plastic, porcelain or stainless steel.

Washer agitator or impeller

In top load models, wash action inside the tub is aided by an agitator or impeller. An agitator is a central post that twists back and forth, rubbing against clothes to help break apart soils. An impeller is a cone or disc that rotates to rub clothes against each other to help get them clean. In front load models, lifters or fins keep clothes tumbling in the drum.

Washing machine motor

The washer motor usually sits at the bottom of the washer in top load models and the back in front load models. The most common type of motors used in washers are direct drive or belt drive. The direct drive motor is attached directly to the wash basket, while the belt drive motor sits independently and uses a belt to turn the wash basket.

Washing machine drain pump

The water drain pump is in the bottom of the washer, usually towards the back in top load models and the front in front load models. The drain pump controls the removal of water from the tub throughout the cycle, draining the tub after the main wash, after the first rinse and during the final spin.

Washing machine water inlet valve

The water inlet valve is in the back of the washer, toward the top. It has one port for hot water and one for cold. Some front load models only have one port for cold water and an internal heater to warm the water up to temperature. The inlet valve opens and closes when it receives electrical signals from the washer, letting water enter the tub at the right times during a cycle.

Water pump. This circulates the water through the machine, rotating in two directions. It's used for circulating the water through the wash cycle and also for draining the water during the spin cycle.

- **Printed circuit board (PCB).**This is where you'll find mainly the electronics that operate the machine from electrical components to circuits. These can be programmed and help operate the machine, acting as the artificial intelligence for the washing machine, sometimes even deciding on the time needed for rinsing or washing.
- **Timer.** This helps set the wash time for your clothes, which can be set manually or automatically.
- **Heating element.** This heats the water up in the washing machine to the desired temperature.

Result: Thus the Various parts of washing machine, Sensors, wiring, tracing, circuit diagram, washing motor, spin motor, gear box, belt, controller, drain pump, wash timer, complete information has been obtained so that the faults occurring in the washing machine in future can be efficiently rectified.

EXERCISE 164: Identify the faults in the given washing machine and rectify

Objectives

At the end of this exercise you shall be able to

- to identify the faults of the washing machine and fix those faults.

Requirements

Tools/Materials

- Screw driver (300 mm) - 1 No.
- Tester (150 mm) - 1 No.
- Combination plier (250 mm) - 1 No.
- Wire cutter (200 mm) - 1 No.
- Multimeter - 1 No.
- Flat File (300 mm) - 1 No.
- Nut Driver 8,10,11mm (350 mm) - 1 No each.
- Nose plier (200 mm) - 1 No.
- Spanner 10-11/12-13 mm (150 mm) - 1 No.

Procedure

Common problems in washing machines and rectify the same

Machine Won't Start

This could be due to various issues, including a malfunctioning door latch, a faulty timer or control knob, or a problem with the wiring. Try the following to solve the problem:

- Make sure the door is latching and closed tightly.
- Check the control knob or timer to ensure it is set to the correct cycle and position.
- Check the power supply and ensure the machine is properly plugged in.

Machine Stopped Spinning

This common washing machine problem could be caused by a malfunctioning belt, a problem with the motor, or an imbalance in the load. Try the following to solve this issue:

- Check the belt for any visible damage or wear and replace it if necessary.
- Check the motor for any visible damage or wear and replace it if necessary.
- Adjust the load in the machine to ensure it is evenly distributed.

Machine Makes Loud Noise

This problem could be caused by various issues, including a malfunctioning motor, a problem with the pump, or an imbalance in the load. Try the following to solve this issue:

- Check the motor for any visible damage or wear and replace it if necessary.
- Check the pump for any visible damage or wear and replace it if necessary.
- Adjust the load in the machine to ensure it is evenly distributed.

Water Leaking

This is a common washing machine problem caused by a problem with the hoses, a malfunctioning pump, or a problem with the door seal. Try the following to solve this issue:

- Check the hoses for any visible signs of damage or wear and replace them if necessary.
- Check the pump for any visible damage or wear and replace it if necessary.
- Check the door seal for any visible damage or wear and replace it if necessary.

Drainage Problem

This common washing machine problem could be caused by a clogged drain hose or pump or a problem with the drain valve. Try the following to solve this issue:

- Check the drain hose for any visible clogs and remove them if necessary.
- Check the pump for any visible clogs and remove them if necessary.
- Check the drain valve for any visible damage or wear and replace it if necessary.

Water Filling Issues

This issue could be caused by a problem with the water inlet valve, a clogged water supply hose, or a malfunctioning water level switch. Try the following to solve this issue:

- Check the water inlet valve for any visible signs of damage or wear, and replace it if necessary.
- Check the water supply hose and remove any visible clogs if necessary.
- Check the water level switch for any visible damage or wear and replace it if necessary.

Machine Stopped Agitating

This issue could be caused by a problem with the drive belt, a malfunctioning motor, or a problem with the transmission. Try the following to solve this issue:

- Check the drive belt for any visible damage or wear and replace it if necessary.
- Check the motor for any visible damage or wear and replace it if necessary.
- Check the transmission for any visible damage or wear and replace it if necessary.

Water Rinsing Issue

This common washing machine problem could be caused by a problem with the water inlet valve, a clogged water supply hose, or a malfunctioning water level switch. Try the following to solve this issue:

- Make sure the water pressure is sufficient.
- Check the water inlet hose for any kinks or blockages.
- Check the detergent dispenser for any blockages.

Bad Odor from Washer

A buildup of bacteria and filth may cause washing machines to start to smell. This typically occurs when cold washes are the only ones employed. Consider the following to resolve this issue: Utilise the hot water cycle; this ought to operate. If not, try running it using the following safe mixture of ingredients:

- 1/4 cup baking soda
- 14 cups of water
- 2 cups white vinegar

Before beginning a cycle on the high heat setting, add the baking soda and water to the detergent drawer and the white vinegar to the washing machine's drum.

If the smell persists, check the filter in your washing machine. The drain trap filter may have a sizable buildup of clothing-related debris.

Clothes Being Ruined by The Washer

There may be several causes for a washing machine ruining garments; this is a common issue. Here are some possible causes and solutions:

1 **Overloading The Machine**

Overloading the washing machine can cause clothes to become tangled and torn. To fix this issue, make sure you are not exceeding the manufacturer's recommended load size for your machine.

2 **Using The Wrong Type of Detergent**

Using too much detergent, or using a detergent that is unsuitable for your machine, can cause clothes to become damaged. To fix this issue, follow the manufacturer's recommendations for detergent use and ensure you use a detergent suitable for your machine.

3 **Using The Wrong Wash Cycle**

Using the wrong wash cycle can cause clothes to become damaged. For example, using a high-spin cycle for delicate clothes can cause them to become stretched or torn. To fix this issue, make sure you are using the correct wash cycle for the type of clothes you are washing.

4 **Washing Clothes with Sharp Objects**

If you have left sharp objects, such as safety pins or keys, in your pockets, they can cause holes or tears in your clothes during the wash cycle. Check your pockets for sharp objects before washing your clothes to fix this issue.

5 **Washing Clothes with Zippers or Buttons**

If you have zippers or buttons that are not fully closed, they can become caught on other clothes and cause damage. Close all zippers and buttons before washing your clothes to fix this issue.

6 **Washing Clothes with Stains**

If you have stains on your clothes, they can become set in during the wash cycle. To fix this issue, pretreat stains before washing your clothes.

7 **Using The Wrong Water Temperature**

Using water that is too hot or too cold can cause clothes to become damaged. To fix this issue, make sure you are using the correct water temperature for the type of clothes you are washing.

Conclusion

Everybody makes errors, but some have more severe repercussions than others. When compared to a mistake that may spoil your clothing or break a costly laundry device, forgetting to pick up the milk at the store is inconvenient. This article is our guide to diagnosing common washing machine problems and solutions to get your washer back in working order.

Result: Thus the common problems which are occurring frequently were identified and rectified as per manual guidance.

EXERCISE 165: Check dismantling of various parts, wiring tracing of various controls electronic circuits in various types of vacum cleaners

Objectives

At the end of this exercise you shall be able to

- diagnosis and troubleshooting to identify and rectify any issues or malfunctions within the vacuum cleaners electrical system controls, or wiring.

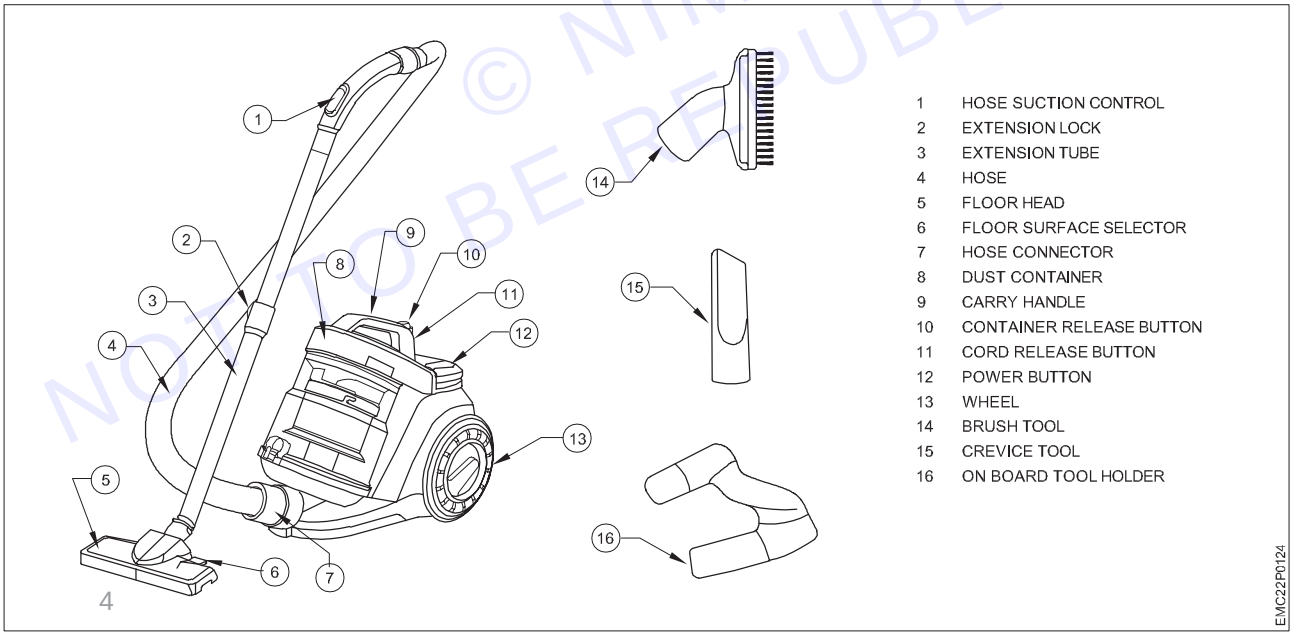
Requirements

Tools/Materials

• Screw driver (150 mm)	- 1 No.	• Wire Cutters	- 1 No.
• Multimeter	- 1 No.	• Safety Gloves and Goggles	- 1 No.

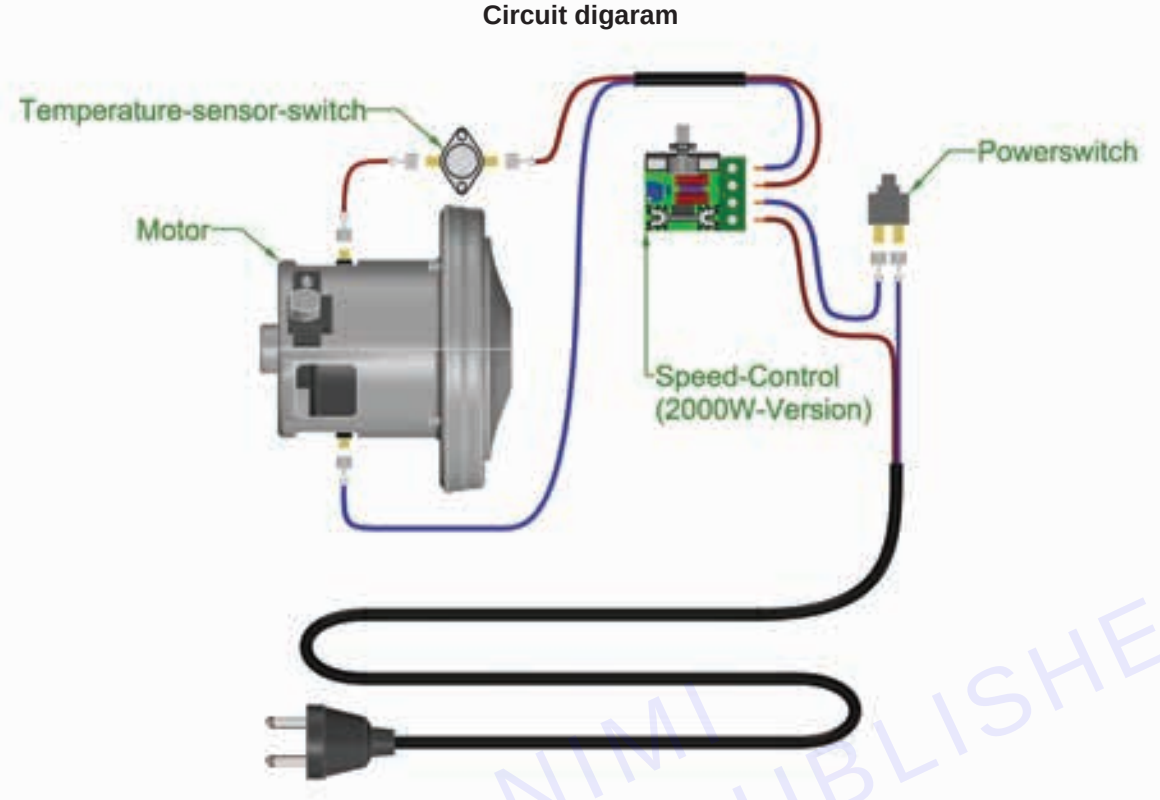
Procedure

Different Parts of Vaccum Cleaner



Detaching components to avoid damage wiring tracing involves

Circuit digaram



Tapes of vacuum cleaners

1 **Upright Vacuum Cleaners**

Design: Upright vacuum cleaners have a simple ergonomic design with a tilt-and-push mechanism.

Function: The motorized brush pulls dirt from carpeted surfaces efficiently.

Ideal for: Carpeted areas.

Sensor: Contains a sensor to detect and remove particles from carpet fibers.

2 **Robotic Vacuum Cleaners:**

Function: These autonomous cleaners are powered by sensors.

Operation: Turn them on, and they navigate around the house, cleaning as needed.

Surfaces: Suitable for wood, tile, carpeted surfaces, and even corners.

3 **Stick Vacuum Cleaners**

Features: Lightweight, thin, and easy to store.

Design: Resemble brooms.

Motor: Integrated into the stick for suction.

Useful for: Navigating tight areas, cleaning hardwood floors, and small carpeted spaces.

4 **Canister Vacuum Cleaners**

Dust Collection: Have a motor-powered dust-gathering receptacle.

Versatility: Clean various surfaces, including carpets, hard floors, wooden floors, tiles, vehicles, stairwells, walls, ceilings, corners, and upholstery.

5 **Handheld Vacuum Cleaners**

Compact: Lightweight and fit comfortably in one hand.

Usage: Suitable for both home and on-the-go cleaning.

Variety: Corded or cordless options available.

Purpose: Clean confined spaces like car interiors, tables, stairs, and corners.

PROCEDURE

Unplug and Turn Off: Ensure your vacuum cleaner is unplugged and turned off.

1 **Disassemble Relevant Parts**: Disassemble the relevant parts according to your user manual. Keep any screws or small parts in a safe place for reassembly later.

2 **Remove the Old Part:** Once you've identified the worn-out part, remove it from its position.

Tracing Wiring of Controls

A wiring diagram of a vacuum cleaner displays the motor, motor control, switch, and power supply wiring as well as the wiring of other components, such as switches, sensors, fans, and control units. Each individual component is typically drawn in black or white which will be used as a reference when connecting the parts. The respective colors of the components correspond to the colors of the connectors.

Electronic Circuits in Vacuum Cleaners

A circuit diagram for a vacuum cleaner contains three major components: the motor, the power supply, and the switch. The motor is responsible for powering the suction of the vacuum cleaner, and is connected to the power supply and switch via wiring. The power supply provides power to the motor, and the switch controls when the motor is on or off.

Result: Dismantling and identifying various parts, wiring, and tracing of various controls and electronic circuits in vacuum cleaners is a complex process that requires a solid understanding of electronic terminology and symbols, as well as the construction and operation of common electronic components.

EXERCISE 166: Identity the fauits in various types of vacuum cleaners & rectify

Objectives

At the end of this exercise you shall be able to

- to identify common faults in various types of vacuum cleaners and provide rectification steps.

Requirements

Tools/ Materials

- Screw driver (150 mm) - 1 No.
- Multimeter - 1 No.
- Needle-Nose Pliers - 1 No.
- Brush or Soft Bristle - 1 No.
- Replacement Parts - 1 No.

Procedure

1 **Broken Vacuum Cleaner Belt**: This is a common issue. Signs of a perishing belt include finding little flecks of rubber in the machine or spotting a trail of debris on the floor in the path of the vacuum. Replacing the belt is straightforward: unplug the machine, lay it on its back, unscrew the housing that covers the brush, remove the broken belt, and hook on a replacement.

2 **Rotating Brush Doesn't Spin**: This could be due to tangled hair, pet hair, and carpet fiber strands. Remove these with a pair of scissors. Once you're satisfied that there aren't any foreign objects on the brush, re-attach the belt and clip the brush back into place.

3 **Loss of Suction**: This could be caused by an obstruction in the hose. Disconnect the hose from the vacuum head and body and give it a good shake to see if anything falls out or rattles.

4 **Clogged Filter**: Check, empty and/or replace the filter if needed.

5 **Jammed Cleaning Head:** Look and feel for any objects or clumps of dirt and remove.

PROCEDURE

1 **Fault Detection:** This is the process of discovering the presence of a fault in the vacuum cleaner before it manifests itself in the form of a breakdown. There are two main approaches to fault detection.

2 **Model-based fault detection**: Carried out through mathematical modeling of signals and processes.

3 **Knowledge-based fault detection**: A method that leverages historical data on equipment performance.

4 **Fault Diagnosis**: After detecting a fault, the next step is to diagnose it. This involves isolating the fault and identifying its cause.

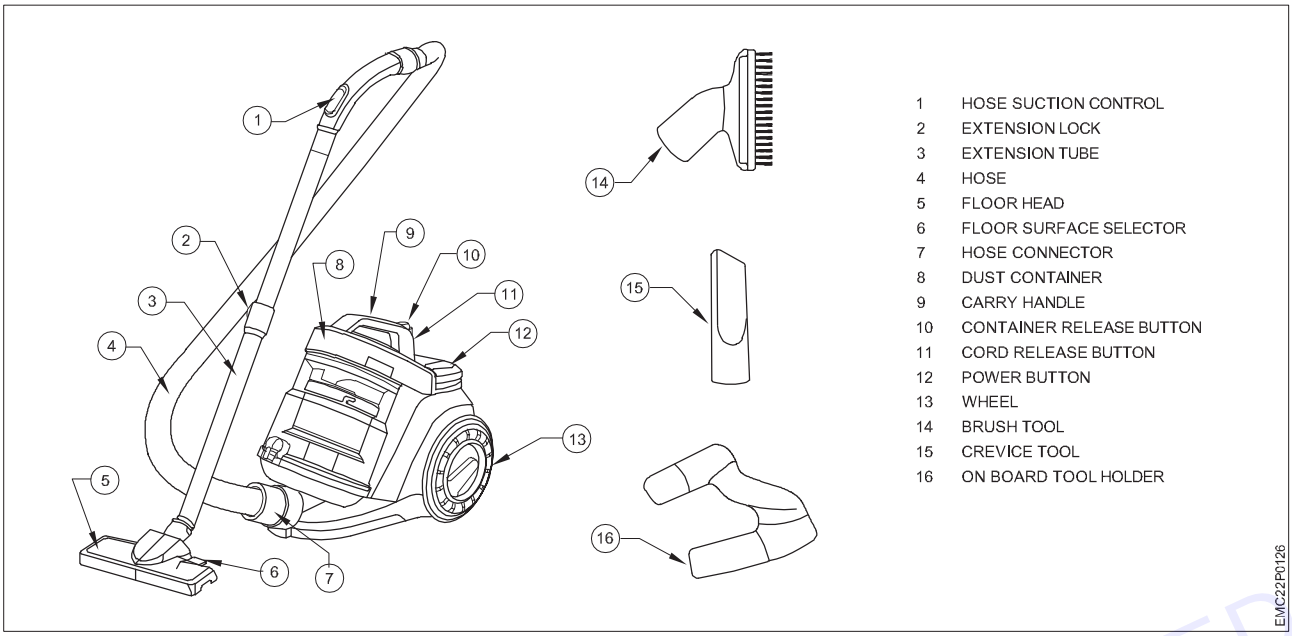
5 **Fault Rectification**: Once the fault has been diagnosed, the next step is to rectify it. This involves repairing or replacing the faulty component. In some cases, sophisticated algorithms can even initiate failure containment actions to auto-correct the failure itself and restore the vacuum cleaner to its healthy condition.

6 **Evaluation**: After the fault has been rectified, it's important to evaluate the vacuum cleaners performance to ensure that the issue has been fully resolved.

7 Remember, all procedures must be undertaken in accordance with the quality management system Standard Operating Procedures (SOPs), organizational policies, and prevailing legislation. It's also important to report any equipment faults to the relevant authorities for further investigation.

8 Please note that the exact procedure may vary depending on the specific model and type of vacuum cleaner. Always refer to the manufacturer's instructions or consult a professional if you're unsure.

Different Parts of Vaccum Cleaner



Problem	Possible cause	Solution
My vacuum cleaner has no suction	Bags and filters too full or blocked	Unplug equipment, check, or replace filters/ bags and clean out.
	Hoses and attachments are blocked	Unplug equipment, check the hoses/ attachments, and clean out.
My vacuums smells	Damp bag, offensive contents, bags not emptied regularly	Empty contents of reusable bag and clean bag. Replace disposable bag. Air out the bag by placing in the sun. Schedule a set day to clean reusable bags.
	Overheating motor (burning smell)	Let the machine cool down. Check filters for blockages and clean filters. If it persists, contact your Supervisor.
My machine will not turn on or randomly stops working and has no power	RCD Tripped	Test the RCD and if it fails, isolate the machine, and call your Supervisor.
	Batteries have run out of charge	Check battery, recharge battery.
	Power failure	Check power point, connections and mains power.
	Overheating of the motor	Unplug the equipment and let it cool down. Check bags, filters and fittings are clear.
	Damaged Vacuum power cord and extension leads	Turn the equipment off at the socket. Check the cord for damage. If so, immediately place an out of service tag and call your Supervisor.

My vacuum has changed pitch or is making a different noise	Dirty filters, full dust bag or blockage in fittings causing the machine to work harder	Clean filters, empty dust bag, check and remove any blockage from fittings.
	Motor has a jam or worn bearings	Submit for repair. Contact your Supervisor.
My vacuum is blowing dust out the exhaust vent	Bag and filter are full	Check and clean filters for blockages, empty/ replace bag or filter.
	Missing Bag or Bag not fitted correctly into machine. Missing filter	Replace and/or fit bag correctly. Replace filter correctly.
	Hole in the Bag	Replace bag if disposable. Contact your supervisor to replace a cloth bag.

Result: Dismantling and identifying various parts, wiring, and tracing of various controls and electronic circuits in vacuum cleaners is a complex process that requires a solid understanding of electronic terminology and symbols, as well as the construction and operation of common electronic components.

EXERCISE 167: Monitor and check dismantling of various parts, wiring tracting of various controls electronic circuits in various types of mixer/ grinders

Objectives

At the end of this exercise you shall be able to

- to Identify various parts of Mixer/Grinder and demonstrate
- to trace the electrical / Electronic circuit in a Mixer/Grinder.

Requirements

Tools/ Materials

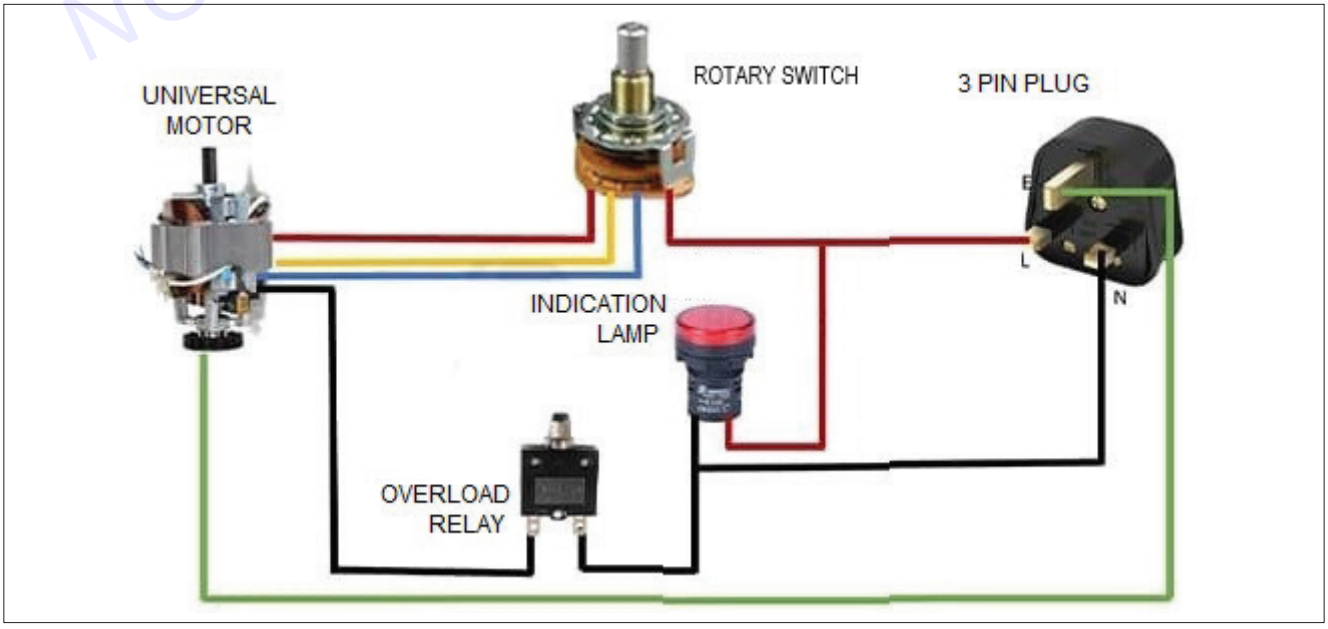
- Screw driver (300 mm) - 1 No.
- Tester (150 mm) - 1 No.
- Combination plier (250 mm) - 1 No.
- Wire cutter (200 mm) - 1 No.
- Multimeter - 1 No.
- Flat File (300 mm) - 1 No.
- Nut Driver 8,10,11mm (350 mm) - 1 No each.
- Nose plier (200 mm) - 1 No.
- Spanner 10-11/12-13 mm (150 mm) - 1 No.
- universel motor
- rotary switch
- indicating light
- over load relay
- 3 pin top plug

Procedure

Theory

Monitoring and checking the dismantling of various parts, along with tracing wiring in mixer/grinders involves understanding the electronic circuits and their components. This includes capacitors, resistors, diodes, transistors, and integrated circuits. The theory behind it encompasses studying circuit diagrams, identifying components, understanding their functions, and ensuring proper connections during dismantling and reassembly. Additionally, knowledge of safety protocols, such as handling electricity and following manufacturer guidelines, is crucial to prevent damage and ensure user safety.

Wiring diagram



PARTS and Working

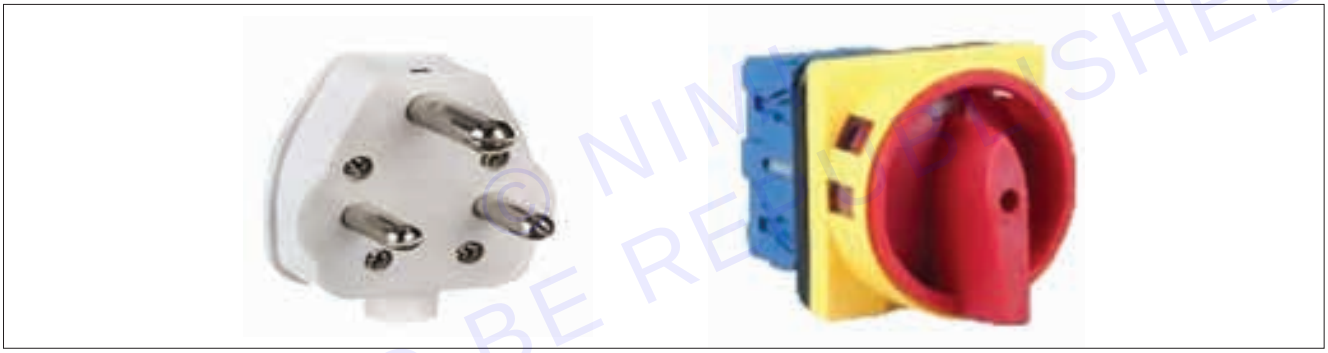
Universal Motor

A universal motor is a type of electric motor that can be powered by either AC or DC power and uses an electromagnet as its stator to generate a magnetic field. It is a commutated series wound motor, with the stator field coils connected in series with the rotor windings through a commutator. The universal motor is structurally very similar to a DC series motor but slightly modified to operate with AC power.

Selector Switch

A Mechanical Switch That can be rotated Left, right, or center to open or close the electrical contacts is known as a Selector switch. The Main Function of This Selector Switch is to Control Devices and also to Switch Between a Minimum of 2 or Above Electrical Circuits.

Pin plug point



The Three-pin plug tops are used on appliances, extension leads, Light fittings, etc. The Packaging Comes with Wiring Instructions For the Electrician. A transparent cover makes it visually easy to Keep an Eye on the Wiring Connections. Three-Pin Plugs are Designed so That Mains Electricity can be Supplied to Electrical Appliances Safely. A 3-Pin Plug Consists of 3-pins. Each Pin Must be Correctly Connected to the Three Wires in the Electrical Cable. Each Wire Has its Own Specified Color so that it can be easily identified.

Overload Relay

Overload Protection is Protection against a Running Over current That Would Cause Overheating of The Protected Equipment. Hence, An Overload is Also a Type of Over current. Overload Protection Typically Operates on an Inverse Time curve where the Tripping Time becomes less as the Current Increases. This Overload Protector is an Essential Component for Many Sockets. The Top-Quality Overload Protector can Effectively Protect Electrical Products from Power Surges.

Result: Thus the parts of the Mixer/ Grinder has been identified and demonstrated successfully.

EXERCISE 168: Defect in various types of mixier/ grinders & rectifly

Objectives

At the end of this exercise you shall be able to

- to Identify parts of mixer /grinder
- to identify faulty parts in a given mixer /grinder.

Requirements

Tools/ Materials

- Screw driver (300 mm) - 1 No.
- Tester (150 mm) - 1 No.
- Combination plier (250 mm) - 1 No.
- Wire cutter (200 mm) - 1 No.
- Multimeter - 1 No.
- Flat File (300 mm) - 1 No.
- Nut Driver 8,10,11mm (350 mm) - 1 No each.
- Nose plier (200 mm) - 1 No.
- Spanner 10-11/12-13 mm (150 mm) - 1 No.
- armature
- mixer grinder motor
- mixer grinder body set
- rotary switch
- mixer grinder shaft
- mixer grinder blade
- grinder blades

Procedure

Mixer /Grinder

A mixer grinder is often brought to ease out the things in the kitchen. The mixer grinder offers multiple operations in the everyday kitchen routine, such as grinding, mixing liquids, and many more. However, even a minor issue in the juicer mixer grinder will restrain us from completely using it. The following common problems lead occur in the Mixer Grinder

1 **Leaking**

Leaking is one of the most common problems occurring in a mixer grinder. This could happen due to 3 reasons. The blade assembly is loosely fitted, a problem in the rubber gasket, or cracks in the jar. For the first case, you will have to fit the blade assembly tightly into the jar. If there is a problem with the rubber gasket, then you will have to change it. And lastly, if there are cracks in the jar, you will have to replace it with a new one.

2 **Blunt Blades**

When used for a long time, it is natural for the blades to lose their sharpness. To sharpen them, you will have some rock salt into the jar and spin the unit for a few minutes. Alternatively, you can also use rods or sharpening stones instead of rock salt. Ensure that the lid is closed tightly before starting the mixer grinder. The rock salt will sharpen the blades of the mixer and will make it as good as new.

3 Tripping

The reset button present under the mixer grinder will trip if you continuously use the appliance for long hours or grind hot items. It is highly recommended that you don't use your mixer grinder for too long and wait till the food is cooled down before grinding it. If the tripping happens due to excessive heat, you need to reset the red switch located on the undersurface of the mixer grinder. Unplug the mixer grinder, remove the jar, and look under the appliance to find the switch. This should prevent your mixer grinder from tripping.

4 Broken Coupler

Couplers connect the base of the blender to the jar. They will break or wear after using them for a few. If you frequently blend frozen fruits and vegetables at high speeds, it will damage the coupler. You can not repair a broken blender. The only option is to replace it. You need to be very cautious while replacing the blender as the blades are very sharp. It is not such a bad idea to seek the help of a professional.

5 Stuck Buttons

The buttons in your mixer grinder will get stuck if you spill food or liquid on them. They enter the space between the buttons and make them defective. To solve this, you need to wipe the buttons with a clean wet cloth. Some models come with an option where you can remove the face of the buttons. This makes it very easy and convenient for cleaning purposes.

6 Slow Moving Blades

When food particles get clogged between the blades, they cause the blades to move slowly. This can be very frustrating because it takes up a lot of time for grinding. If that is the case, you have to remove the blade assembly and clean it. Soak the blades in warm water and scrub the sides and edges of the blades. Now, assemble and fit them into the mixer grinder. The blades should rotate faster.

7 Jar Getting Stuck

If the bearings in the jar are damaged, the jar will get stuck on the unit. Corrosion in blades occurs when there is a leakage in the blades. The food or liquid that is ground will enter into the bearings and cause corrosion. To rectify this, you need to remove the jar and pour a few drops of oil around the motor coupler. After allowing it for a few minutes, you have to twist the motor coupler using pliers. Now, fix the jar in the mixer grinder and run it for two minutes. Then, fill the jar till it reaches half and allow it to run for a minute. Wipe the jar with a clean dry cloth. After doing this, you should be able to fix and unfix the jar seamlessly.

8 Overload Problem

The mixer grinder will shut off automatically if there is an overload. The overloading of a mixer grinder happens due to three reasons,

9 Low Capacity Motor

When the motors are not powerful and you run them for a long time, the motor will get heated and the unit will overload. Run the unit for short durations with frequent gaps to prevent this.

10 Air Circulation

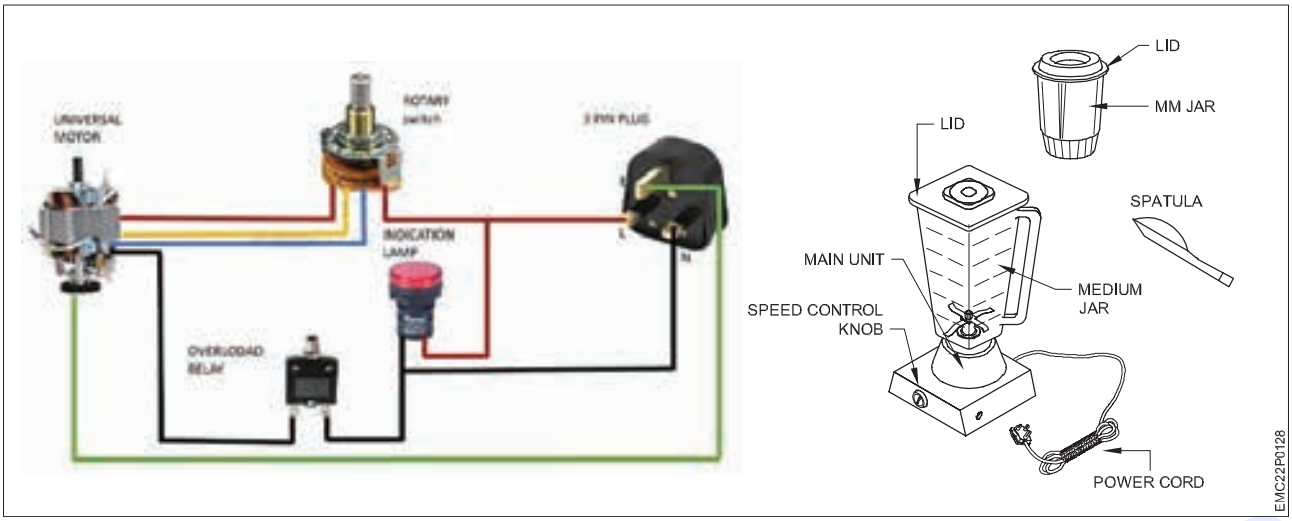
Air circulation will cool the mixer grinder and prevent it from overheating. Some models will have extensions at specific points or at the edges on its lower surface. This will facilitate air circulation. Alternatively, you can place the unit on a stand with holes.

11 Thick Materials

When you put too much food into the jar or when the food is very thick, the motor will get heated and overload. To prevent this, put small quantities of food into the jar. If the food is very thick, add a small quantity of water to soften them.

12 Faulty Wiring

If there is a fault in the wiring, the mixer grinder will turn off automatically. The main reason for this problem is the poor build quality or long usage of the mixer grinder.



PROCEDURE

- **Visual Inspection:** Examine the mixer/grinder for any visible defects, such as cracks, loose parts, or signs of wear.
- **Functional Test:** Plug in the mixer/grinder and test its functionality. Check if it turns on, spins smoothly, and operates at different speeds (if applicable).
- **Check Power Supply:** Ensure that the power outlet is functioning correctly. Test the power cord and plug for any damage or loose connections.
- **Inspect Blades and Accessories:** Remove the grinder's lid or mixer's attachment and inspect the blades and other accessories for damage or wear. Replace any worn-out or damaged parts.
- **Motor Inspection**: Listen for any unusual noises coming from the motor while it's running. Check for overheating or burning smells, which could indicate motor issues.
- **Electrical Components**: If the mixer/grinder has electrical controls, switches, or a speed regulator, inspect them for any damage or loose connections. Test them using a multimeter if necessary.
- **Bearings and Bushings:** Check the bearings and bushings for wear and tear. If there's excessive play or grinding noises, they may need to be replaced.
- **Lubrication**: Apply lubricant to moving parts such as bearings, gears, and shafts to ensure smooth operation. Avoid over-lubricating, as it can attract dust and debris.
- **Cleaning:** Thoroughly clean the interior and exterior of the mixer/grinder, removing any accumulated debris or food residue.

Result: Ensuring that the mixer grinder operates correctly and safely after defect rectification helps maintain compliance with regulatory standards and industry regulations.

EXERCISE 169: Dismantle and identifications of various parts, wiring, tracing of various controls, electronic circuit in steam iron

Objectives

At the end of this exercise you shall be able to

- to dismantle the various parts of steam iron
- to Identify and demonstrate various parts in steam iron
- to Trace the Wiring layout of steam iron box.

Requirements

Tools/Materials

- Screw driver (300 mm) - 1 No.
- Tester (150 mm) - 1 No.
- Combination plier (250 mm) - 1 No.
- Wire cutter (200 mm) - 1 No.
- Multimeter - 1 No.
- Flat File (300 mm) - 1 No.
- Nut Driver 8,10,11mm (350 mm) - 1 No each.
- Nose plier (200 mm) - 1 No.
- Spanner 10-11/12-13 mm (150 mm) - 1 No.
- Stream Iron Box - 1 Nos.

Procedure

Theory

Steam iron: A steam iron is an electrical appliance that uses heat to convert water into steam. This steam is emitted onto fabric to smooth out wrinkles. It has adjustable settings for different fabrics.

Types of steam iron

Power Source: Corded vs. Cordless Iron

Temperature Control: Automatic vs. Non-Automatic Iron

Type of Heat: Basic Clothes vs. Steam Iron

Sole Plate Material: Ceramic, Stainless, vs. Titanium

Portability: Foldable vs. Mini Iron

Parts of steam iron

A steam iron consists of several key parts

Sole Plate: The flat and roughly triangular base of the iron. It's typically made of aluminum coated with a non-stick material.

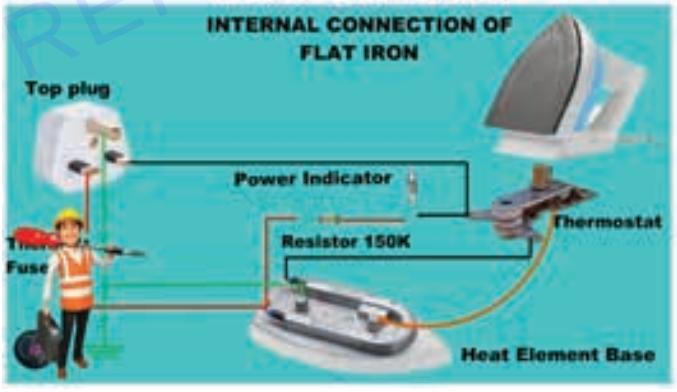
Thermostat: Built into the iron, it allows a user to control the sole plate temperature. It's essentially a spring with power contacts on the end mounted on a metal post.

Water Reservoir: This is where the water to create the steam is stored.

Handle: Typically made from injection-molded plastic that won't melt, the handle also holds the controls for the thermostat and steam release.

Power Cord: This provides the electricity needed to heat the water to steam and to heat the sole plate to the desired temperature.

Wiring Layout of Steam Iron Box



Result : Thus the parts of steam iron box were identified and Demonstrated , The wiring diagram was traced successfully.

PROCEDURE

STEP1: Clothes Iron Teardown.

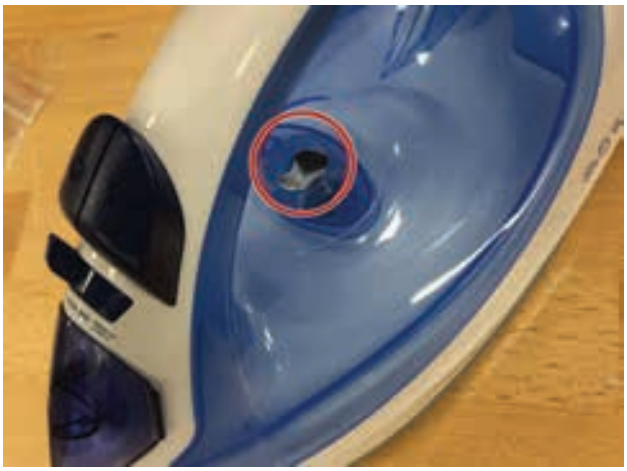
This is the steam iron prior to disassembly.

Model no. - Philips Easy Speed 2100W Steam Iron

STEP 2: Temperature dial removal.

Remove the temperature dial from the clothes iron by prying it off with a chisel.

Be careful when doing this as the dial may snap due to force.



STEP 3: Spray Button Removal.

Pull out the spray and steam button from the iron. This should be able to do through a bit of force.

Tip: if it is not coming out easily, a little wiggle would help in pulling out the buttons.

Try not to twist the buttons around too much as it may snap from excessive force.

STEP 4: Back Portion Removal.

Remove the back plastic piece of the clothes iron through carefully prying it off with a chisel.

Warning: As this piece is quite fragile, it can snap easily during this step.

The second image displays what the back cover looks like when removed.

STEP 5: Removing Upper Casing.

Using a small pin, carefully pry out the rubber plug used to keep the crew underneath from rusting.

Then using a screw driver, remove the screw underneath the plug. You should then be able to remove the upper portion of the clothes iron.

STEP 6: Mid Casing Removal.

After removing the screw in the prior step, gentle pull the upper portion of the clothes iron apart.

The casing should now be released from the sole plate.

The second photo displays what it should look like when this step has been executed.

STEP 7: Tearing Down Iron Sole Plate.

Remove the screw with a screw driver, which keeps together the sole plate and the housing cover for it.

There should be 2 screws on either ends of the bottom plate.

The second picture shows what the sole plate will look like when this step has been executed.

STEP 8: Contact Strip Removal.

Next remove the 2 screws which attaches the contact strips of the sole plate.

The location of the 2 screws are highlighted in image 2.

STEP 9: Upper Casing Removal.

Carefully pry the upper casing off to reveal the circuit board.

The casing may be difficult to remove, use a flat tool like a chisel or flathead screwdriver to act as a lever, gently lifting the casing off.

STEP 10: Circuit Board Removal.

Remove circuit board from housing.

Note - Circuit board cannot be removed along with the wiring of the clothes iron, due to it being a hazard.

Note - The circuit board has a clear plastic casing which can easily be unclipped from the board.

STEP 11: Settings Switch Removal.

Pull out the settings switch for the clothes iron, this is very easy as it is not held in place by any fasteners.

STEP 12: Spray Nozzle Lid Removal.

Carefully clip off the blue casing which covers the spray nozzle,

This is quite difficult as the hinges are small, ideal to use a thin flat object to pry it out.

EXERCISE 170.1: Detect the faults in steam iron & rectify

Objectives

At the end of this exercise you shall be able to

- Identifications of faults in steam iron & solve it.

Requirements

Tools/ Materials

- Screw driver - 1 Nos.
- Multimeter - 2 Nos.
- Circuit tester - 1 Nos.
- Manual guide - 1 Nos.

Procedure

Theory

Steam iron: A steam iron is an electrical appliance that uses heat to convert water into steam. This steam is emitted onto fabric to smooth out wrinkles. It has adjustable settings for different fabrics.

Types of faults

- **Mineral Build-Up:** This is one of the most common problems with steam irons. The water you put in it can be hard and contain minerals that can deposit in the iron's vents and lines. If these prevent the steam from the iron from venting, the result could be dripping.
- **Spotting**: If your steam iron is overfilled, it will emit a stream of water from the ports that allow you to use the appliance. Water stains on clothing from dripping or falling water can be unsightly.
- **Iron Not Turning On or Heating:** This is another common steam iron issue. To determine the source of this problem, first, ensure that the power cord is properly connected and turned on. If you haven't used your steam iron in a few minutes, it may have shut down automatically.
- **Dirty Sole plate:** Many people have also had the experience of steam iron sticking to the fabric. In this case, the problem is likely to be with the sole plate.
- **Lack of Steam:** If the iron fails to produce steam, it could indicate a blockage in the steam vents or a malfunction in the heating element or steam pump (for steam generator irons).
- **Leaking Water:** Water leakage can occur if there is a crack in the water tank, loose connections, or a faulty valve.

PROCEDURE

There are the following steps for rectifying steam iron

STEP 1

Check Power Supply: Ensure the iron is properly plugged in and that the power outlet is functioning correctly .If the iron doesn't turn on at all, try using a different outlet or checking the power cord for any damage.

STEP 2

Inspect Water Supply: Make sure the water tank is filled with clean water and that there are no leaks from the tank or steam vents. If the iron is not producing steam or is leaking water, it could be due to a blockage in the steam channels or a malfunctioning steam generator. Clean the steam vents with a needle or pipe cleaner, and de-scale the iron if necessary using a descaling solution.

STEP 3

Test Heating Element: If the iron is not heating up or is overheating, the heating element or thermostat may be faulty. Use a multi meter to check the continuity of the heating element and thermostat. If either component is defective, it will need to be replaced.

STEP 4

Inspect Sole-plate: Check the sole-plate for any signs of damage or mineral deposits. Clean the sole-plate with a damp cloth and vinegar to remove any sticky residue or scale build-up.

STEP 5

Check Steam Control Mechanism: Test the steam control button or dial to ensure it's functioning correctly. If the steam output is inconsistent or the control mechanism is not responsive, it may need to be repaired or replaced.

STEP 6

Inspect Auto Shut-Off Feature: If the iron has an auto shut-off feature, test it to make sure it's working properly. If the iron doesn't shut off after the set period of inactivity, the auto shut-off mechanism may need to be adjusted or replaced.

STEP 7

Test Electrical Components: Inspect the power cord, wiring, and connections for any signs of damage or wear. Use a multi-meter to check for continuity and ensure there are no loose connections.

STEP 8

Physical Inspection: Check the iron for any physical damage such as dents, cracks, or misalignment of internal components. If the iron has been dropped or subjected to impact, it may need to be repaired or replaced.

STEP 9

Refer to Manual or Contact Manufacturer:- If you're unable to diagnose or rectify the fault yourself, consult the manufacturer's manual for troubleshooting tips or contact customer support for assistance. If the iron is still under warranty, it may be eligible for repair or replacement.

Some of the related images


Conclusions

In this experiment we have know that how to find the faults and how to solve it.

EXERCISE 170.2: Dismantle and identifications of various faulty parts and replace the parts

Objectives

At the end of this exercise you shall be able to

- to dismantle the various parts of steam iron
- to Identify faulty parts and demonstrate in steam iron
- to Trace the Wiring layout correct the wrong connections of steam iron box.

Requirements

Tools/Materials

- Screw driver (300 mm) - 1 No.
- Tester (150 mm) - 1 No.
- Combination plier (250 mm) - 1 No.
- Wire cutter (200 mm) - 1 No.
- Multimeter - 1 No.
- Flat File (300 mm) - 1 No.
- Nut Driver 8,10,11mm (350 mm) - 1 No each.
- Nose plier (200 mm) - 1 No.
- Spanner 10-11/12-13 mm (150 mm) - 1 No.
- Stream Iron Box - 1 Nos.

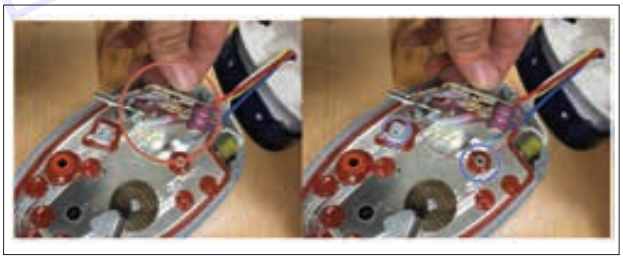
Procedure

Theory

Steam iron: A steam iron is an electrical appliance that uses heat to convert water into steam. This steam is emitted onto fabric to smooth out wrinkles. It has adjustable settings for different fabrics.

Temperature Control: Automatic vs. Non-Automatic Iron

Type of Heat: Basic Clothes vs. Steam Iron



PROCEDURE

STEP1: Clothes Iron Teardown.

This is the steam iron prior to disassembly.

Model no. - Philips Easy Speed 2100W Steam Iron

STEP 2: Temperature dial removal.

Remove the temperature dial from the clothes iron by prying it off with a chisel.

Be careful when doing this as the dial may snap due to force.

STEP 3: Spray Button Removal.

Pull out the spray and steam button from the iron. This should be able to do through a bit of force.

Tip: if it is not coming out easily, a little wiggle would help in pulling out the buttons.

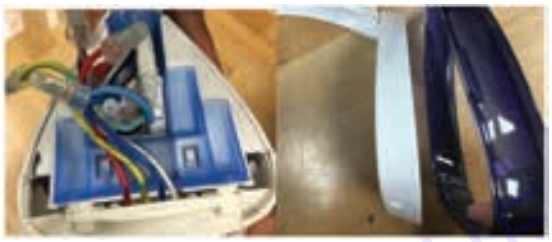
Try not to twist the buttons around too much as it may snap from excessive force.

STEP 4: Back Portion Removal.

Remove the back plastic piece of the clothes iron through carefully prying it off with a chisel.

Warning: As this piece is quite fragile, it can snap easily during this step.

The second image displays what the back cover looks like when removed.



STEP 5: Removing Upper Casing.

Using a small pin, carefully pry out the rubber plug used to keep the crew underneath from rusting.

Then using a screw driver, remove the screw underneath the plug. You should then be able to remove the upper portion of the clothes iron.

STEP 6: Mid Casing Removal.

After removing the screw in the prior step, gentle pull the upper portion of the clothes iron apart.

The casing should now be released from the sole plate.

The second photo displays what it should look like when this step has been executed.

STEP 7: Tearing Down Iron Sole Plate.

Remove the screw with a screw driver, which keeps together the sole plate and the housing cover for it.

There should be 2 screws on either ends of the bottom plate.

The second picture shows what the sole plate will look like when this step has been executed.

STEP 8: Contact Strip Removal.

Next remove the 2 screws which attaches the contact strips of the sole plate.

The location of the 2 screws are highlighted in image 2.

STEP 9: Upper Casing Removal.

Carefully pry the upper casing off to reveal the circuit board.

The casing may be difficult to remove, use a flat tool like a chisel or flathead screwdriver to act as a lever, gently lifting the casing off.

STEP 10: Circuit Board Removal.

Remove circuit board from housing.

Note: Circuit board cannot be removed along with the wiring of the clothes iron, due to it being a hazard.

Note: The circuit board has a clear plastic casing which can easily be unclipped from the board.

STEP 11: Settings Switch Removal.

Pull out the settings switch for the clothes iron, this is very easy as it is not held in place by any fasteners.

STEP 12: Spray Nozzle Lid Removal.

Carefully clip off the blue casing which covers the spray nozzle,

This is quite difficult as the hinges are small, ideal to use a thin flat object to pry it out.

Result : Thus the Faulty parts of steam iron was identified and replaced with new parts.

EXERCISE 171: Test Various Components Of Electric Rice Cooker, Controls And Trace The Circuit And Rectify The Simulated Faults

Objectives

At the end of this exercise you shall be able to:

- to identify all part the Electric rice cooker
- to identify faulty parts of the electric rice cooker
- to trace the faulty parts and replace it.

Requirements

Tools/ Equipments/ Instruments

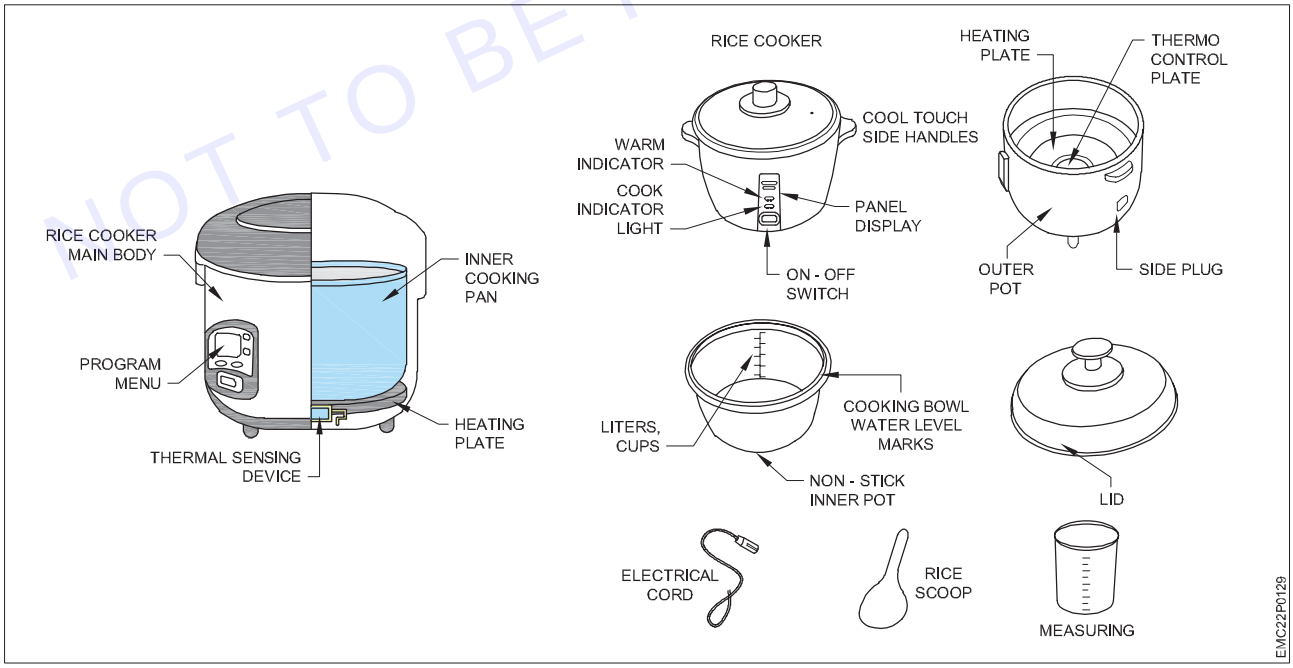
- Multimeter - 1 No.
- Screwdriver Set - 1 No.
- Thermostat Limiter Sensor - 1 No.
- Fuses - 1 No.
- Wire Stripper/Cutter - 1 No.
- Soldering Iron and Solder Wire - 1 No.
- Circuit Diagram of the Rice Cooker - 1 No.
- Insulation Tape - 1 No.

Procedure

Theory

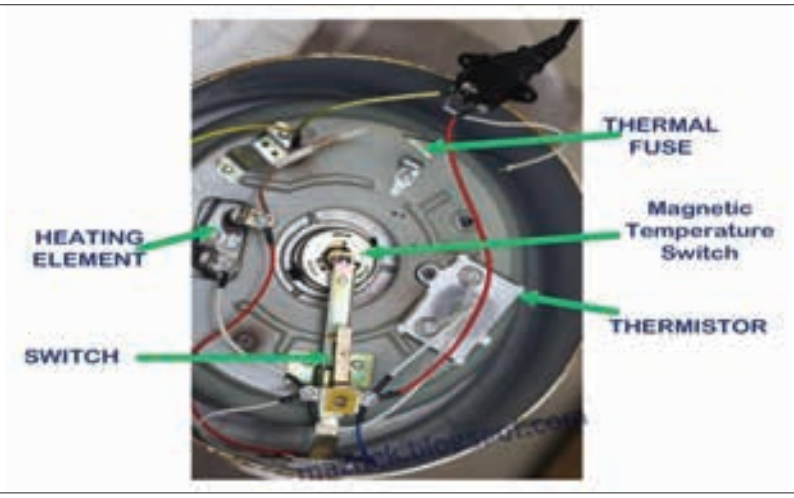
Understanding Components

A rice cooker typically consists of a heating element, temperature sensor, and control circuit. The heating element provides the heat required for cooking, the temperature sensor monitors the temperature inside the cooker, and the control circuit regulates the power supply to the heating element based on the temperature sensor's readings.



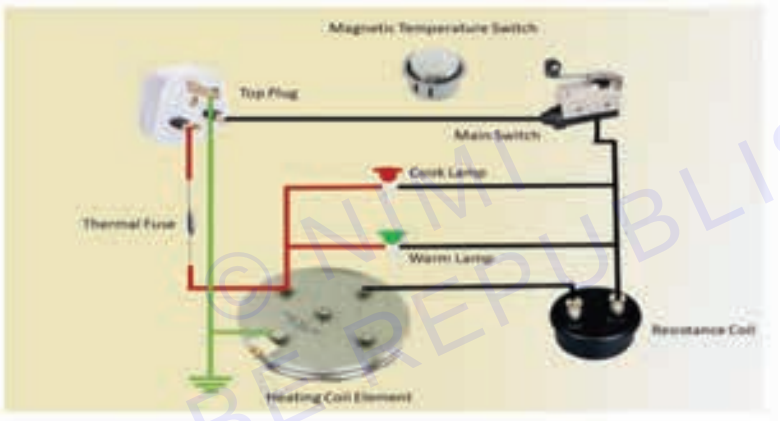
Testing Components

Each component can be tested individually. For instance, the heating element can be tested for resistance using a multimeter. If the resistance is within the specified range, the element is functioning correctly. The temperature sensor (usually a thermistor) can also be tested using a multimeter by checking its resistance at different temperatures.



Tracing the Circuit

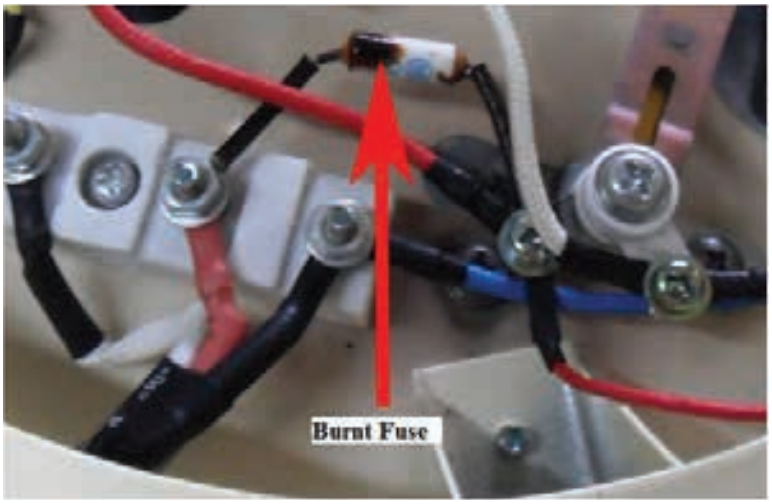
The circuitry of a rice cooker can be traced using a circuit diagram. This involves identifying the connections between the power source, control circuit, heating element, and temperature sensor.



Rectifying Simulated Faults

Once the faulty component or connection is identified, it can be replaced or repaired. For example, a faulty heating element can be replaced with a new one, or a loose connection can be soldered.

Remember, safety is paramount when dealing with electrical appliances. Always ensure the appliance is unplugged before starting any testing or repair work. If you're unsure about any part of the process, it's best to consult with a professional.



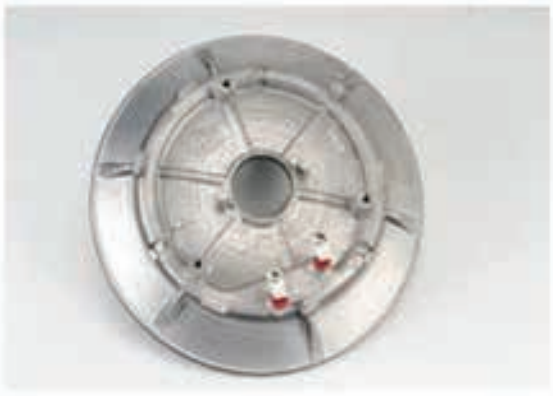
PROCEDURE

Check the Power Source: Ensure that the rice cooker is properly plugged into a functioning power outlet.

1 **Inspect the Power Cord:** Look for visible damage such as fraying, twisting, or breaks. You can use a multimeter to check for current flow. If there's no current, the power cord is faulty and needs to be replaced.

2 **Test the Switch:** Use a multimeter to check if the switch is working correctly. If the switch is faulty, it will need to be replaced.

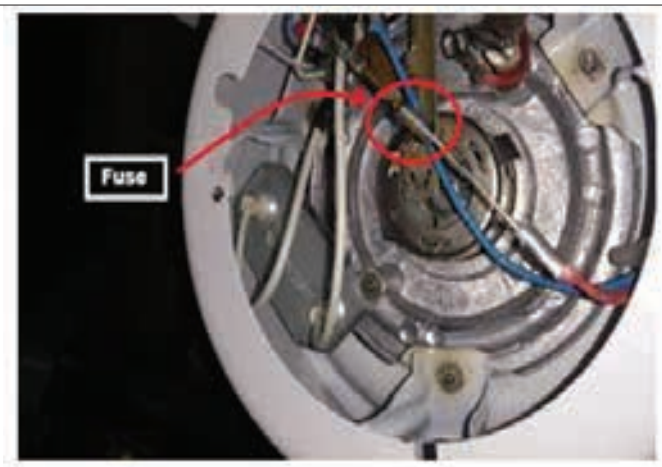
3 **Examine the Heating Element :** Unplug the appliance and let it cool. Remove the outer covering and locate the heating element at the base of the rice cooker. If it doesn't heat up, it may be damaged and need replacement.



4 **Check the Temperature Sensor :** This sensor monitors the temperature inside the rice cooker and sends this information to the control circuit. If it's faulty, it will need to be replaced.

5 **Inspect the Control Circuit :** This circuit controls the power supply to the heating element based on the information it receives from the temperature sensor. If it's not functioning correctly, it will need to be repaired or replaced.

6 **Look for a Blown Thermal Fuse :** The fuse is a protective device that ensures user and appliance safety. If it's blown, it will need to be replaced.



7 **Trace the Circuit :** Follow the path of electricity from the power source, through the switch and heating element, to the control circuit. This will help you identify any breaks in the circuit that could be causing problems.

8 **Rectify Simulated Faults :** Once you've identified the faulty components, replace or repair them as necessary. Always ensure the appliance is unplugged before attempting any repairs.

Remember, if you're not comfortable performing these tests and repairs yourself, it's best to consult with a professional appliance repair technician.

Tabulation

Sl.No	Procedure
1	**Check the Power Source:** Ensure that the rice cooker is properly plugged into a functioning power outlet.
2	**Inspect the Power Cord:** Look for visible damage such as fraying, twisting, or breaks. Use a multimeter to check for current flow. If there's no current, the power cord is faulty and needs to be replaced.
3	**Test the Switch:** Use a multimeter to check if the switch is working correctly. If the switch is faulty, it will need to be replaced.
4	**Examine the Heating Element:** Unplug the appliance and let it cool. Remove the outer covering and locate the heating element at the base of the rice cooker. If it doesn't heat up, it may be damaged and need replacement.
5	**Check the Temperature Sensor:** This sensor monitors the temperature inside the rice cooker and sends this information to the control circuit. If it's faulty, it will need to be replaced.
6	**Inspect the Control Circuit:** This circuit controls the power supply to the heating element based on the information it receives from the temperature sensor. If it's not functioning correctly, it will need to be repaired or replaced.
7	**Look for a Blown Thermal Fuse:** The fuse is a protective device that ensures user and appliance safety. If it's blown, it will need to be replaced.
8	**Trace the Circuit:** Follow the path of electricity from the power source, through the switch and heating element, to the control circuit. This will help you identify any breaks in the circuit that could be causing problems
9	**Rectify Simulated Faults:** Once you've identified the faulty components, replace or repair them as necessary. Always ensure the appliance is unplugged before attempting any repairs.

RESULT : Thus, the all faulty components of electric rice cooker replace successfully.

EXERCISE 172: Monitor various components of Water purifier Mantling and dismantling of water purifier

Objectives

At the end of this exercise you shall be able to:

- to demonstration of Water purifier
- to component list of Water purifier
- dismantle all parts of Water purifier.

Requirements

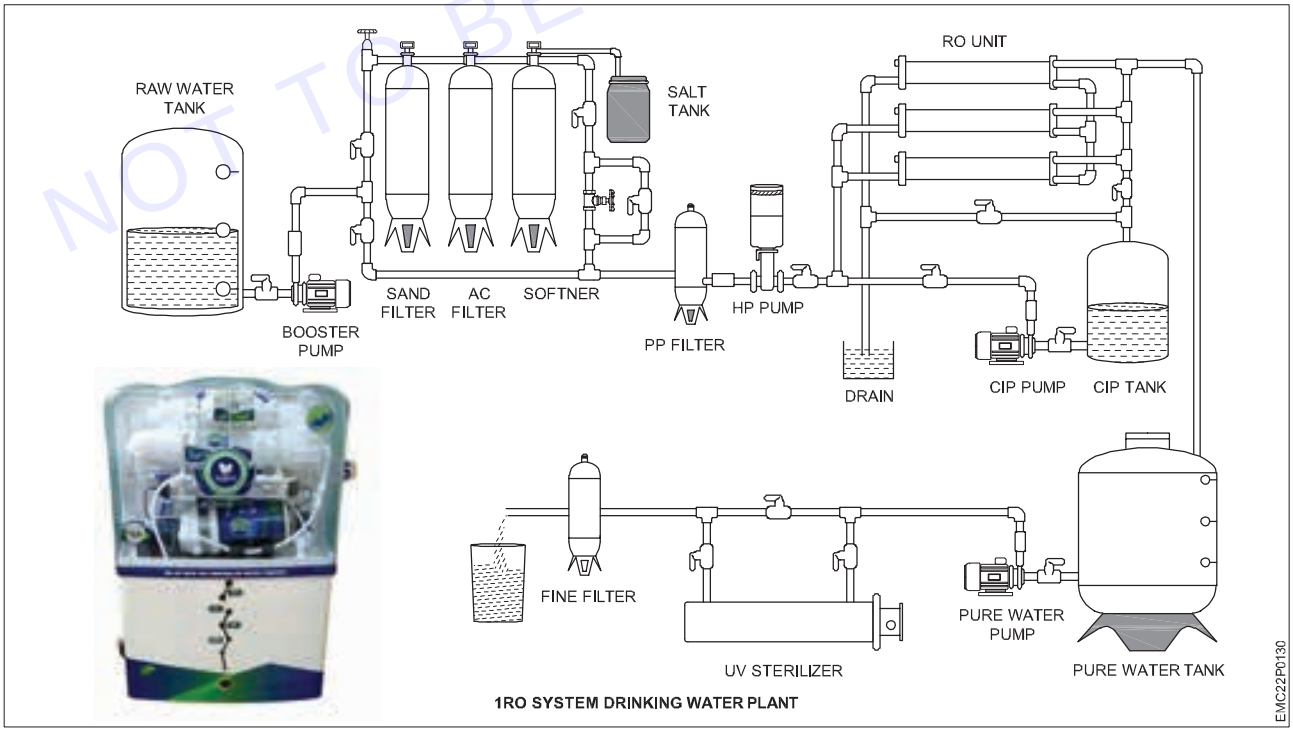
Tools/ Equipments/ Instruments

- Water purifier - 1 No.
- Screw driver - 1 No.
- Combination pliers - 1 No.
- Multimeter 500 V - 1 No.
- Test lamp 40W/240V - 1 No.

Procedure

Theory:

Water purifiers are devices designed to remove impurities from water, making it safe for consumption. There are various types, including reverse osmosis, UV, activated carbon, and gravity-based purifiers, each employing different mechanisms to purify water. When choosing a water purifier, consider factors such as the quality of water in your area, the types of contaminants present, and your specific needs and preferences.



1RO SYSTEM DRINKING WATER PLANT

Components

Common components found in water purifiers include:

1 **Filter Cartridges:** These are cartridges containing filtering media such as activated carbon, ceramic, or other materials that physically trap or chemically remove contaminants from the water.

2 **Sediment Filter:** This filter removes larger particles and sediments such as dirt, sand, and rust from the water.

3 **Activated Carbon Filter:** Activated carbon filters use porous carbon to absorb impurities like chlorine, volatile organic compounds (VOCs), and certain chemicals.

4 Reverse Osmosis Membrane: In RO purifiers, this semi-permeable membrane removes a wide range of contaminants, including dissolved salts, heavy metals, and microorganisms, by forcing water through it at high pressure.

5 UV Lamp: UV purifiers use ultraviolet light to disinfect water by killing bacteria, viruses, and other microorganisms.

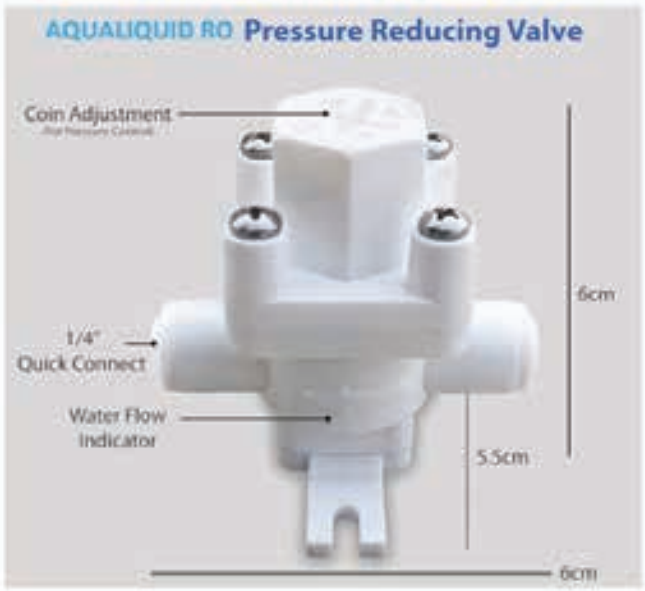
6 Storage Tank: Some water purifiers come with a storage tank to store purified water for on-demand use.

7 Faucet/Tap: This is the outlet through which purified water is dispensed for consumption or other uses.

8 Pre-filter: This filter traps large particles and sediments to protect the main filter components from damage or clogging.

9 Post-filter: After the water has been purified, a post-filter may be used to further improve taste or remove any residual impurities.

10 Pressure Regulator: In RO systems, a pressure regulator helps maintain optimal pressure for efficient filtration.



These are some of the key components commonly found in water purifiers, though the specific components and their arrangement may vary depending on the type and model of the purifier.

Dismantling procedure;

Here's a general step-by-step guide for dismantling a typical water purifier:

1 **Turn off the Water Supply:** Before starting, turn off the water supply to the purifier to prevent leaks or spills.

2 **Disconnect Power:** If your purifier has any electrical components, such as UV lamps or pumps, unplug the unit from the power source.

3 **Empty the Storage Tank:** If your purifier has a storage tank, drain any remaining water from it by dispensing water through the faucet/tap until it's empty.

4 **Remove External Parts:** Take off any external parts like covers or panels that may be covering the internal components. These are usually held in place with screws or clips.

5 **Remove Filters:** Depending on the design of your purifier, carefully remove the filter cartridges or filter housings. Twist or unscrew them according to the manufacturer's instructions.

6 **Disconnect Tubing:** If there are any tubes or hoses connected to the purifier, disconnect them carefully. Note their positions or take pictures if needed for reassembly.

7 **Detach Electronic Components:** If your purifier has electronic components like UV lamps or sensors, carefully detach them according to the manufacturer's instructions.

8 **Clean Components:** Once everything is disassembled, clean each component thoroughly according to the manufacturer's recommendations. Use mild soap or a cleaning solution and rinse with clean water.

9 **Inspect for Damage:** While cleaning, inspect each component for any signs of damage or wear. Replace any damaged parts as needed.

10 **Reassemble:** Once everything is clean and inspected, reassemble the purifier in the reverse order of disassembly. Make sure all connections are tight and secure.

11 **Turn on Water Supply and Power:** Once reassembled, turn on the water supply and plug the purifier back into the power source. Check for any leaks or issues.

12 **Flush the System:** Before using the purified water, flush the system according to the manufacturer's instructions to remove any air or residual cleaning solution.

It's essential to follow the specific instructions provided by the manufacturer of your water purifier, as the dismantling process may vary depending on the model and design of the unit. If you're unsure or uncomfortable with dismantling the purifier yourself, consider contacting a professional technician for assistance.

Result: Thus, we can remove the all faulty part and replace successfully

EXERCISE 173: Water Purifier Clean And Replace The Worn Out Consumable Parts Following The Troubleshooting Manual

Objectives

At the end of this exercise you shall be able to:

- to demonstration of Water purifier
- to component list of Water purifier
- dismantle all parts of Water purifier.

Requirements

Tools/Equipments/Instruments

- Water purifier - 1 No.
- Screw driver - 1 No.
- Combination pliers - 1 No.

Procedure

Theory

Water purifiers are home appliances that provide clean, safe water for drinking, cooking, and bathing. To ensure optimal function and to prevent the growth of bacteria and other hazardous elements, water purifiers must be cleaned on a regular basis.

Water purifiers, manufactured by Faber India, ensure that the water we drink is free of chemicals and impurities. However, these purifiers may collect dirt, minerals, and other contaminants over time, reducing their efficiency.

Clean the exterior of a water purifier?

The exterior of a water purifier can be cleaned with a mild detergent and water. Here are the steps involved:

1 Gather your basic objects

- A mild detergent
- A soft cloth
- Clean, cold water

1 Turn off the water supply to the water purifier.

2 Unplug the water purifier from the electrical outlet.

3 Wipe down the exterior of the water purifier with a soft cloth dampened cleaning Tips for the Outside of a Water Purifier

1 To clean the exterior of a water purifier, avoid using strong chemicals or abrasive cleansers. These might damage the surface of the water purifier and make cleaning harder.

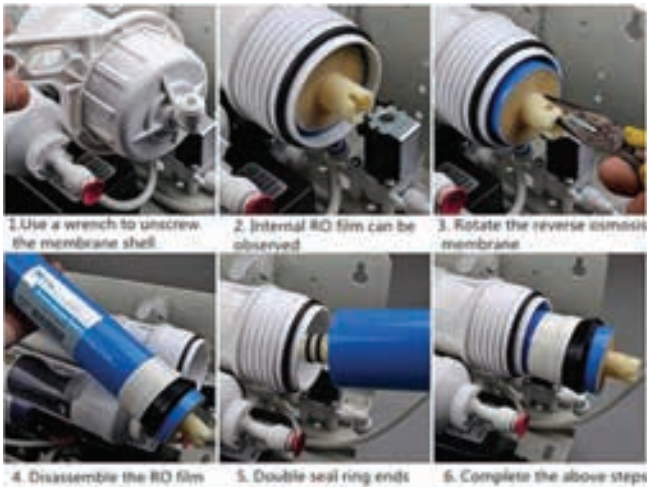
2 After cleaning, rinse the water purifier with clean water. This will aid in the removal of any soap residue that may taint the water.

3 Clean the outside of the water purifier on a regular basis to avoid debris, dust, and grime from accumulating.

Clean the water tank of water purifier

Cleaning the water storage of your water purifier is an important step in keeping your drinking water pure. The storage tank can gather sand, bacteria, and smells over time, reducing the quality of the water it dispenses. Follow 5 steps to clean the water tank properly.

1 Disassembling: Empty and remove the purifier by removing the water tank per the manufacturer's instructions. Remove any residual water from the container.



2 **Cleaning Solution:** To make a cleaning solution, use a mild dish soap and water. Avoid applying powerful chemicals that could damage or contaminate the water source.

3 **Scrub and Rinse:** Scrub the interior of the reservoir with the cleaning solution using a soft brush or sponge. Give special attention to corners and gaps where dirt can collect. To remove soap residue, carefully rinse with clean water.

4 **Airing Out:** After rinsing, allow the tank of air to completely dry. This prevents germs and microbes from growing in a moist environment.

5 **Restore and test:** Once the reservoir has been dried, rebuild it according to the manufacturer's instructions. Make sure that all components are securely attached. Connect the purifier and test its operation to ensure there are no leaks or problems.

Clean the Filters of Water Purifier

The filters of a water purifier should be cleaned regularly to remove dirt, dust, and bacteria to ensure the on-going supply of clean and safe drinking water.

1 **Turn Off and Disassemble:** Turn off the purifier's water supply. Carefully remove the filters from their places, following the manufacturer's instructions.

2 **Rinse Pre-Filter:** Pre-filters should be carefully rinsed under running water to get rid of dirt and waste. This prevents blockage and keeps the water running.

3 **Prepare Cleaning Solution:** Make a cleaning solution with water of white vinegar or citric acid. These natural compounds help in the removal of mineral accumulation and the disinfection of the filters.

4 **Soak and Rinse:** Soak and rinse the filters in the cleaning solution for some time, making sure they are completely submerged. After soaking, rinse the filters completely with clean water to remove any residue from the cleaning solution.

5 **Air Dry:** Allow the filters to air dry completely in a well-ventilated place. This step is important for preventing the growth of germs or bacteria.

6 **Reassemble and test:** Once the filters have dried, replace them in their original places according to the manufacturer's instructions. Turn on the purifier and check its operation to ensure there are no leaks or problems.

Clean filters result in better water flow, better taste, and a longer purifier lifespan. By following these above steps, you can now ensure the water purifier continues to offer pure water through its regular maintenance.

Final Check on Reassembled components

After cleaning **Faber best water purifier**, you need to do final tests to ensure correct performance and the ongoing delivery of clean drinking water. Here's how to carry out these important checks:

1 **Inspect for Leaks:** After turning on the water purifier, carefully inspect all connections and joints for any signs of leaks. Address any leaks as soon as possible to avoid water waste and damage.

2 **Water Quality Test:** Fill a glass with purifier water and carry out a simple visual and taste test. The water should be clear and have no unpleasant odours or tastes. If you detect any irregularities, double-check your cleaning procedure or contact customer service.

3 **Maintenance Indicators:** If your Faber water purifier contains maintenance indicators, make sure you reset them per the manufacturer's recommendations. This step allows you to correctly follow the next maintenance cycle.

4 **Flow Rate Inspection:** Check the flow rate of the purified water. It should be consistent and steady. An unexpected drop in flow could suggest a system blockage or poorly reassembled components.

5 **Check for unusual noises:** During operations, listen for any strange noises, such as shaking or buzzing. Unusual noises could suggest loose parts or possible issues with the purifier.

Conclusion:

Choosing the best water purifier for your home is an important step toward protecting the health of your family. Buying the water purifier is an investment in your health, and Faber's reputation adds to its credibility.

We have studied the importance of proper maintenance for the best water purifier for home. Cleaning and caring for your water purifier on a regular basis ensures that you always have access to pure, safe, and pleasant water. By following the cleaning instructions, you can maximize the benefits of a water purifier.

A well-maintained water purifier also helps with the appliance's life. Regular cleaning prevents mineral deposits, bacteria, and germs from growing, which can reduce the purifier's performance over time. By maintaining the filters and internal components clean, you may extend the life of the purifier and avoid costly repairs

EXERCISE 174: Simulate And Rectify The Faults.Repeat The Above Exercise For Uv Type Water Purifier

Objectives

At the end of this exercise you shall be able to:

- to demonstration of Water purifier
- to component list of Water purifier
- dismantle all parts of Water purifier.

Requirements

Tools/ Equipments/ Instruments

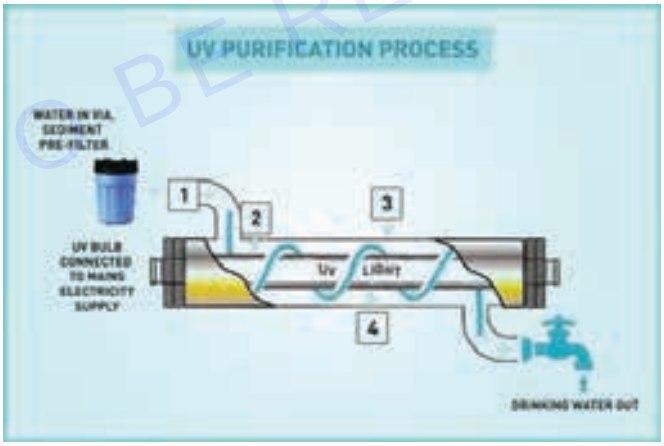
- Water purifier - 1 No.
- Screw driver - 1 No.
- Combination pliers - 1 No.
- Multimeter 500 V - 1 No.
- Test lamp 40W/240V - 1 No.

Procedure

UV Water Purifiers

A UV water purifier utilizes ultraviolet rays to neutralize microorganisms such as bacteria, germs, and viruses, rendering them harmless to our health. Here's how it works:

1 **UV Emission:** Inside the purifier, there's a UV lamp that emits ultraviolet rays at a wavelength of 254 nm. These rays are potent enough to scramble the DNA of living organisms, making them ineffective.



2 **Pathogen Elimination:** The UV dosage emitted by the lamp is measured in mJ/cm². The higher the dosage, the more effective the UV water purifier becomes. It can eliminate up to 99.99% of harmful microorganisms, including:

- Algae
- Cholera
- Cryptosporidium
- Dysentery Bacilli
- E. Coli
- Fungi
- Giardia

- Hepatitis B
- Mycobacterium Tuberculosis
- Salmonella
- Streptococcus

3 **Pre-Filters:** Most UV water purifiers come equipped with one or more pre-filters to remove larger contaminants like dirt and debris.

4 **Chamber and Quartz Sleeve:** The purifier contains a chamber with a transparent glass quartz sleeve that houses the UV lamp. The UV rays pass through this sleeve, disinfecting the water around it.

5 **Mercury Vapor:** The UV lamp also features mercury vapor, which fuels the lamp via vaporization.

6 **Sealed Enclosure:** The entire assembly is sealed with O rings to prevent water from seeping into the UV enclosure.

Advantages of UV Water Purifiers

1 **Effective Pathogen Elimination:** UV rays kill most harmful pathogens, ensuring safer drinking water.

2 **Chemical-Free:** Unlike some other purification methods, UV purification doesn't require chemicals.

3 **Low Energy Consumption:** UV purifiers consume minimal electricity.

4 **No Altered Taste or Odor:** UV treatment doesn't affect the taste or smell of water.

Disadvantages of UV Water Purifiers

1 **Inability to Remove Non-Living Contaminants:** UV purifiers don't remove non-living impurities like heavy metals, chemicals, or dissolved solids.

2 **Dependent on Water Clarity:** Water must be clear for effective UV treatment.

3 **No Storage:** UV-treated water should be consumed immediately; it doesn't remain disinfected over time.

Maintenance Cost

The maintenance cost for UV water purifiers primarily includes replacing the UV lamp periodically. Regular cleaning of the quartz sleeve and pre-filters is also essential.

Result: Thus, the remove all useless thing from the water successfully.

EXERCISE 175 : Monitor and check dismantling of various parts, wiring and connections of immersion heater

Objectives

At the end of this exercise you shall be able to

- to monitor and check of various parts of immersion heater
- to dismantling of various parts of immersion heater
- to wiring and connection of immersion heater.

Requirements

Tools/ Materials

- Cable stripper (0.75mm-2.5mm) - 1 No.
- Crimping tool - 1 No.
- Combination pliers - 1 No.
- Sheath material
- Power density
- Wattage
- Enclosure
- Temperature range
- Heating element

Procedure

Theory

Immersion Heater

An immersion heater is a fast, economical, and efficient method for heating liquids in tanks, vats, or equipment. Known as bayonet heaters, they have heating elements that can be directly inserted into a container of water, oil, or other material in order to heat the entire contents.

By using the direct heat transfer of an immersion heater, liquids quickly reach the desired temperature. Made of bundles of tubing, immersion heaters can be mounted on the side of a container or submerged in the contents. Their heating coils transfer heat to the contents, which spreads throughout the container.

Immersion heaters are a cost effective and ecologically sound method for heating material and provide a clean source of energy without leaving residual discharge or pollutants. In nuclear reactors, immersion heaters are used to keep heated water at a constant temperature for creating steam.

Parts of Heater

Rating plate:- The rating plate in an immersion heater typically provides important information about the heater's specifications and electrical requirements.

Such as-Manufacturer Information,model number,serial number,electrical rating,frequency,temperature rating etc.

1 **Thermostat**: Immersion heaters often include a thermostat to regulate the temperature of the water. When the water reaches a certain temperature, the thermostat cuts off power to the heating element to prevent overheating.

TYPICAL CONTROL THERMOSTAT

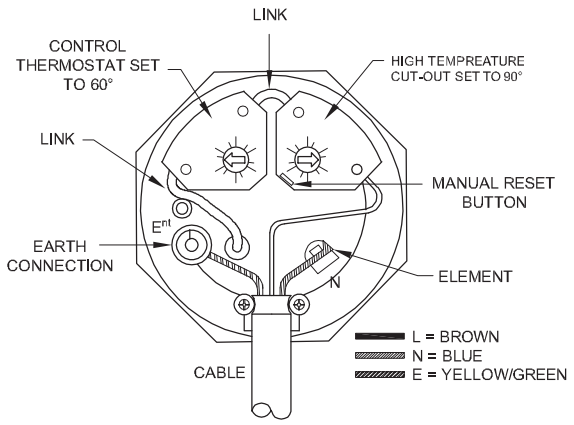
TYPICAL SAFETY / MANUAL RESET THERMOSTAT

2 **Safety features:** Many immersion heaters are equipped with safety features such as a thermal cut-out switch. This switch turns off the heater if it detects that the water level is too low or if the heater gets too hot.

3 **Heating element:** This is the part that actually generates the heat. It's usually made of a conductive material like copper, stainless steel, or an alloy. Electricity passes through the heating element, causing it to heat up.

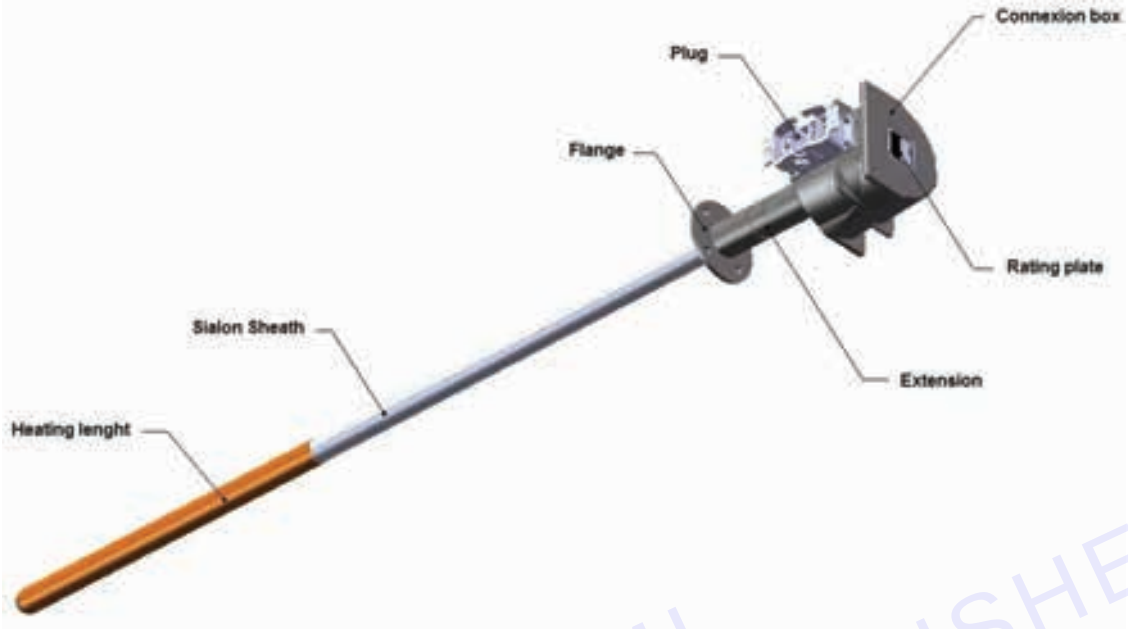
4 **Immersion tube:** This is the part of the heater that is immersed in the water to heat it. It usually consists of a metal tube that encases the heating element.

5 **Terminal box:** This is where the electrical connections are made. It houses the wiring and terminals that connect the immersion heater to the power supply.



6 **Insulation**: Insulation materials are used to minimize heat loss from the immersion heater to the surroundings, increasing its efficiency.

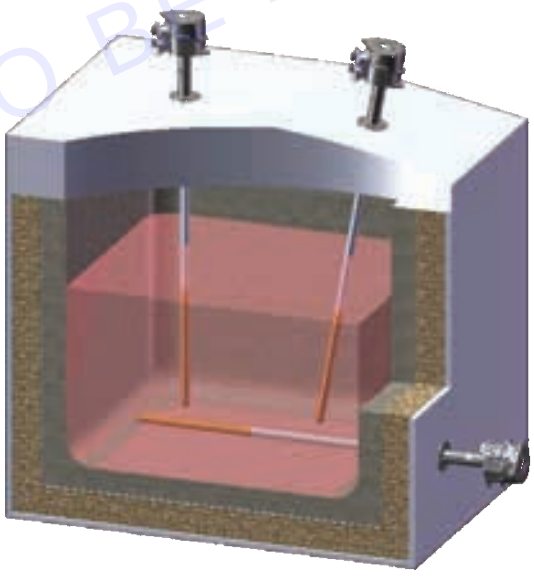
Diagram



Immersion heater installation design

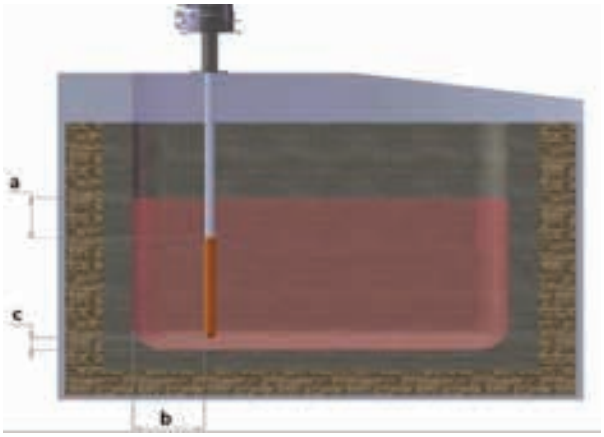
Installation

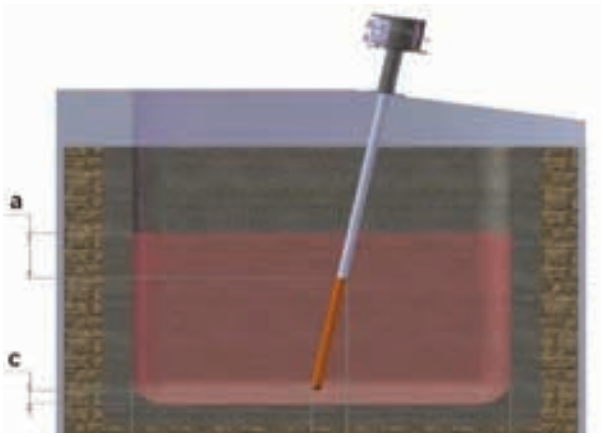
Immersion heater's installation design rules must be taken into account. Immersion heaters can be implemented vertically, tilted or horizontally.

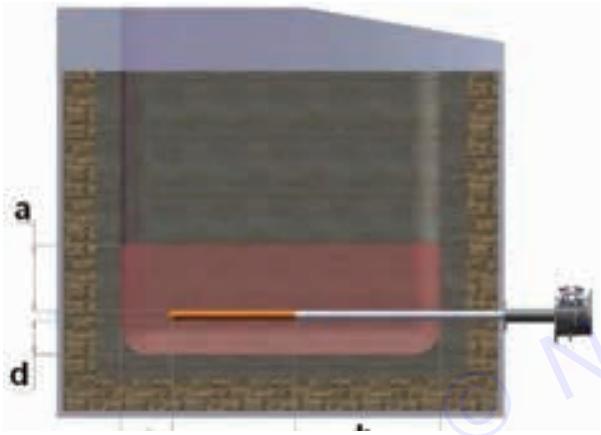


It is mandatory that the heating length stays totally immersed in the liquid metal while working.

The safety distances between the immersion heaters and the furnace walls (or any solid object submerged in the furnace, for example a rotor) to be respected are set out in the diagrams and tables below:







a: distance between the top of the heating length and the bath level.

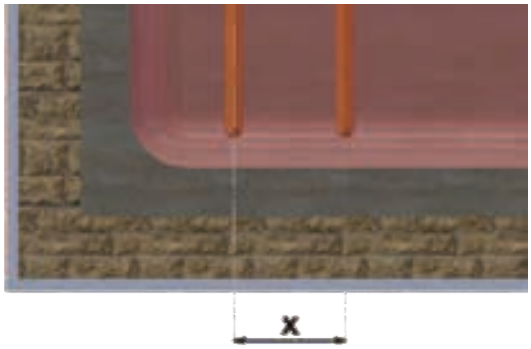
b: distance between the sheath or the heating length and the furnace wall.

c: distance between the end of the sheath and the bottom of the tank or the walls.

d: distance between the sheath or the heating length and the furnace wall.

Immersion heater position	Minimum distance to be respected			
	a (mm)	b (mm)	c (mm)	d (mm)
Vertical Fig 1	50	100	50	-
Tilted Fig 2	50	100	50	100
Horizontal Fig 3	100	100	50	100

Distance between two immersion heaters



Centre-to-centre distance X minimum = 100 + immersion heater diameter.

Mounting

Immersion heaters must be fixed through to the lid of the furnace or its walls.

The immersion heater installation must allow compliance with the following temperatures during operation:

Connections

We offer two types of connector:

- Quick plug, “Harting” type or equivalent
- Connection by terminal/cable lugs and cable gland fitting

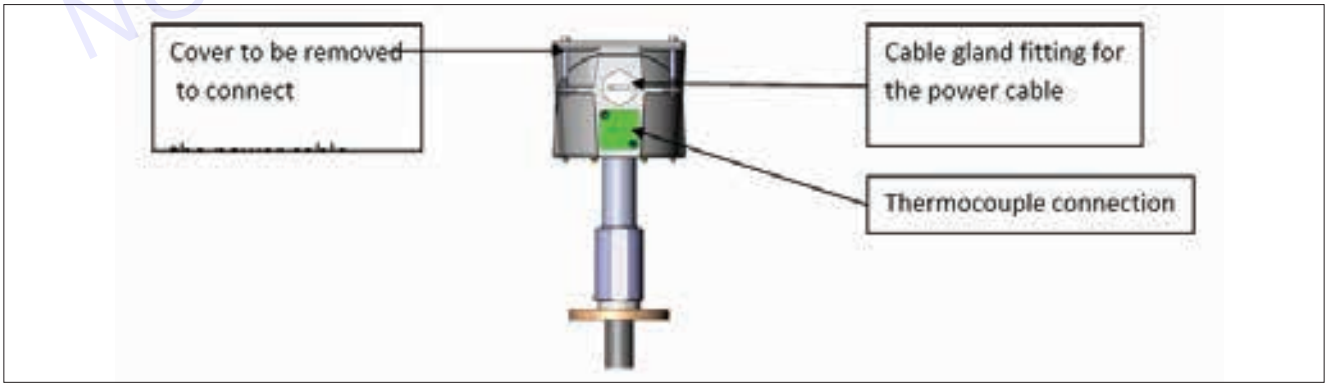
Connection with quick plug

The male socket delivered fitted to the immersion heater is pre-wired and no intervention is required.

Direct connection to terminal block via cable gland fitting

Removing the head:

The head has to be removed to be able to connect to the immersion heaters through the cable gland fitting. The plastic plug delivered fitted to the head should be replaced by a gland fitting PG21 (immersion heaters ø28 and 32) or PG36 (immersion heater ø55).

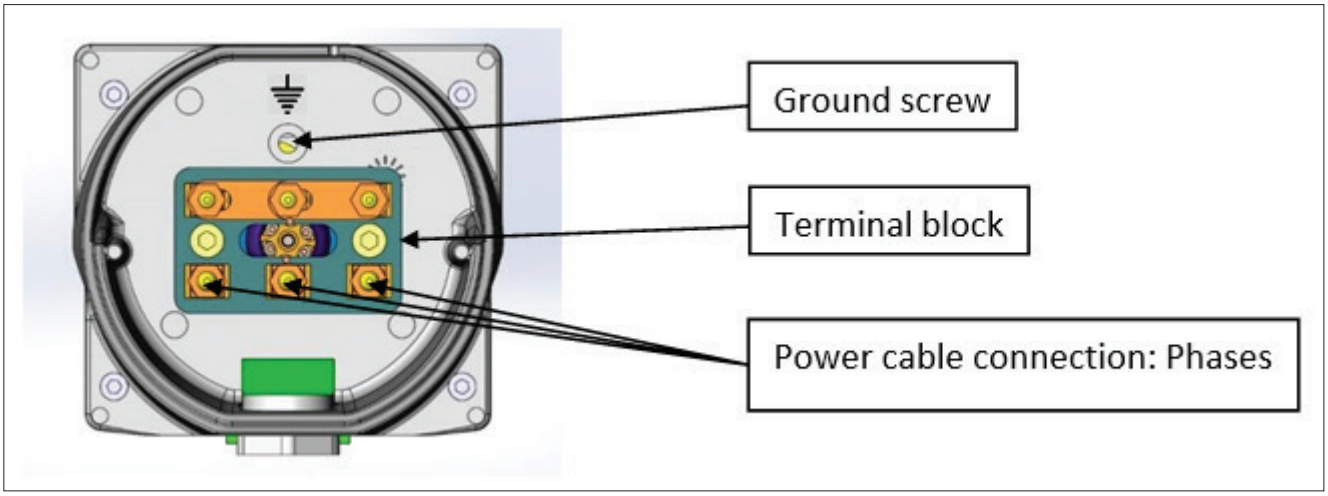


Connecting the power cable (not supplied by ATHERM):

The power cable is dimensioned based on the amperage required for the immersion heater to operate.

Thread the power cable through the cable gland fitting.

Remove the first nut from terminals U1, V1 and W1 and connect the power cable lugs. Retighten the nuts to a max. torque of 3 Nm.



Remove the ground screw and connect the ground cable. Retighten the screw to a max. torque of 3 Nm.

Thermocouple connection

The thermocouple must be connected to the immersion heater using a thermocouple cable type K.

Connect the thermocouple cable type K to the female socket on the immersion heater.

The thermocouple cable must be connected to the control cabinet and should cut off the power to the immersion heater if the sets points are exceeded

Result: Thus, monitor and check of various parts, dismantling, installation and wiring has been completed successfully.

EXERCISE 176: Demonstrate Replacing of coil and fixing insulation failure problems. Remove scale formation from heating element

Objectives

At the end of this exercise you shall be able to

- to service & repair geyser
- to demonstrate replacing heating element of geyser
- to locate the faults in geyser and solve them.

Requirements

Tools/ Materials

- Cable stripper (0.75mm-2.5mm) - 1 No.
- Crimping tool - 1 No.
- Combination pliers - 1 No.
- Phase tester - 1 No.
- Geyser (2400 w) - 1 No.
- Geyser heating element (2400w) - 1 No.
- Geyser thermostat - 1 No.
- 3 core flexible cord (16A/3pin) - 1 No.
- Test lamp (100w) - 1 No.

Procedure

Theory:

An electric geyser is a type of water heater that uses electricity to heat water. It typically consists of a tank (or cylinder) to store water and one or more electric heating elements that warm the water when activated.

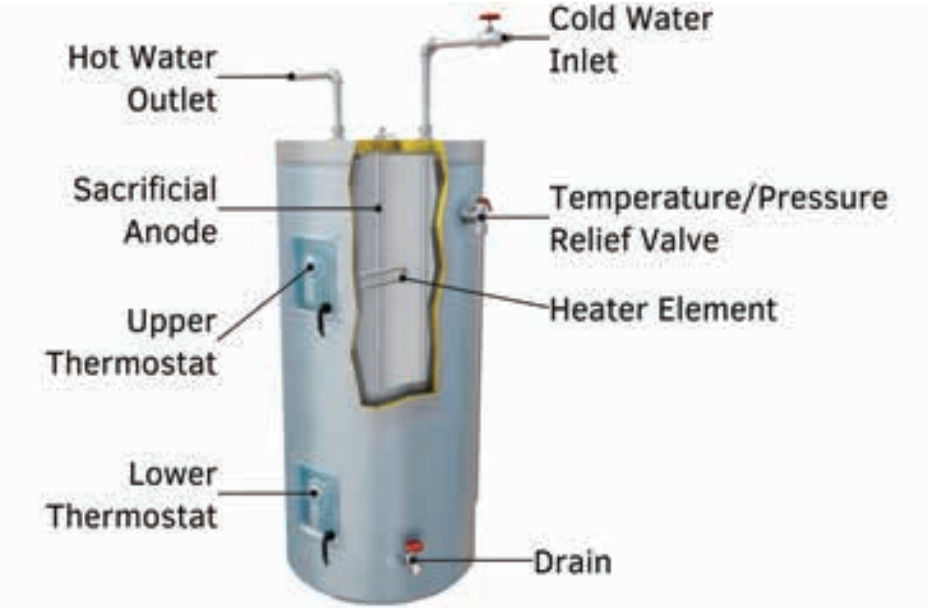
Here's how it generally works

1 **Cold Water Inlet**: Cold water enters the geyser through a pipe connected to the main water supply.

2 **Thermostat and Heating Element**: Inside the geyser tank, there are one or more heating elements controlled by a thermostat. When the temperature of the water drops below the set level, the thermostat activates the heating element(s) to warm the water.

3 **Hot Water Outlet:** Once the water reaches the desired temperature, it's ready for use. Hot water is drawn from the top of the tank through a separate outlet pipe.

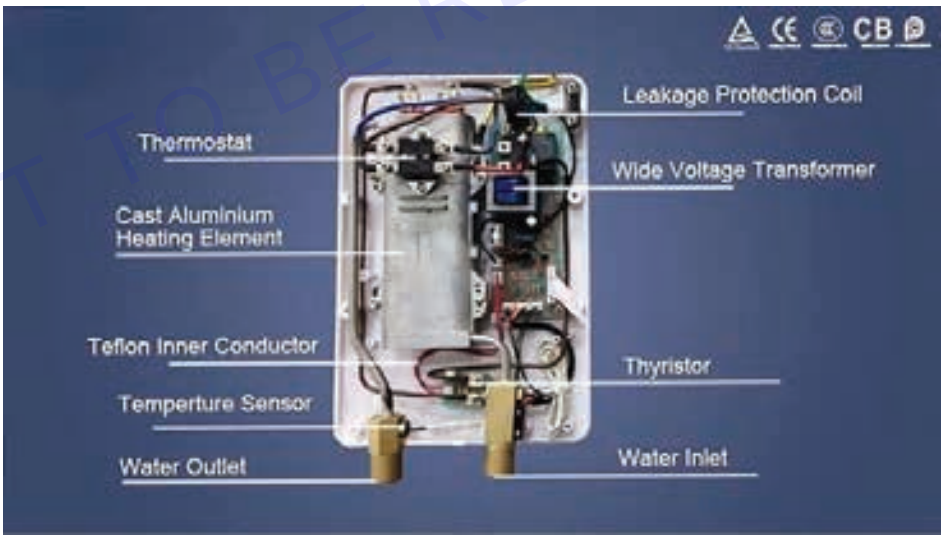
4 **Insulation:** Geyser tanks are usually insulated to help retain heat and prevent energy loss.



How Does an Immersion Heater Work?

A steady flow of electricity goes through the heating element, which, in response, heats the water right inside your tank. Also, an internal or external thermostat regulates the temperature of your water, keeping it ready for use for your peace of mind.

So, whenever you turn on a tap, a cold, high-pressure stream of fresh water enters the tank and pushes the heated water out. Once the temperature is high enough, the water rises to the top of your cylinder, right next to the heating element.



Procedure

1 open the inspection Cover for electrical Terminals, Connection & Thermostat installation in the geyser after removing power plug.

2 Conduct visual Examination of the Power cord Termination and also terminate at appliance.

3 Check for Proper tightness and good electrical Contact at termination. Replace the Plug pin if found damaged.

4 Conduct insulation resistance on the Cord between the leads, insulation & Earth.

5 Measure the Insulation Resistance between the element and the earth / body..

6 Connect the Geyser to the Supply & Switch “ON” the appliance, keeping the inspection/ bottom Cover Of the electrical connection are open

7 Observe the heating Process is Cut Off by the actuation of the thermostat.

8 Switch “OFF” the Supply & Remove the plug.

9 Measure the I.R Value between terminals and body.

10 Check the thermostat for Continuity between its terminals at different settings. Replace the detective thermostat with good one.

11 Thermostat Cut -off Calibration, Adjust the thermostat for a higher Setting Switch Supply and observe the Cut-Off, if the thermostat is found to be good.

Defective heating element

Check the element for its continuity and Measure insulation value between the terminal and the body and replace the heating element with an identical good one. Switch Off the power. Supply and Observe.

Water is too hot

a Thermostat setting is too high.

b Defective element.

c Check the Setting of the thermostat & adjust it to a lower value. Switch” ON “the geyser unit for the thermostat to cut off the Supply the inlet for about 20 minutes. Open the water at Outlet & measure hot water temperature.

Water Not hot enough

i Thermostat setting too low-

ii In correct heater element.

iii Excessive lime in element.

iv Check thermostat setting; adjust it to a higher Value

v Check the wattage of heating element.

Solution

Unfortunately, fixing the immersion heater’s central component is a challenging task, and even the bravest of DIY experts will have a tough time with it. Overall, the process includes removing the old heating element, cleaning the heater’s opening and fitting the new component.

However, it’s easier said than done as the task requires some prior experience in plumbing and a bit of knowledge about electrical fixtures. So, for your safety, please contact a professional technician to change the element and ensure that everything works fine.

Remove scales from a heating rod

Put the heating tube in a pot or kettle, fill it with water, add a little baking soda, and boil it. After a few minutes, the scale will automatically fall off. Cleaning the heating tube with clean water multiple times will completely clean it.

Reduce scale formation

Various chemical anti-sealants, such as chelates, phosphates or phosphonates (organophosphates), polycarbonates, and components of polymers, have been developed to inhibit or reduce the formation of inorganic scales.

Result: Thus, service & repair geyser, demonstrate replacing heating element of geyser, locate the faults in geyser and solve faults has been completed successfully.

EXERCISE 177: Check the faults in induction cooktop and rectify

Objectives

At the end of this exercise you shall be able to

- to check the faults in Induction cooktop
- to rectify the faults in induction cooktop.

Requirements

Tools/Materials

- Screw driver - 1 No.
- tester - 1 No.
- Combination pliers - 1 No.
- wire cutter - 1 No.
- Main control board - 1 No.
- Filter board - 1 No.
- Elements coil - 1 No.
- Terminals box - 1 No.
- Cooktop glass assembly - 1 No.

Procedure

Theory

Induction Cooktop faults

1 The induction stove not detecting pan

If you are new to using induction cooktops, I am sure you have gone through this. It is because you are unaware of the fact that you cannot place any pan or pot. It needs to be “induction safe”. In case you are buying a new one, ask for an induction ready one. Manufacturers do state whether it is compatible with an induction stove or not. If you plan to use your old utensil, you can always check for this in the user manual. Another way of checking? Place a magnet in the base. If it sticks, then your pan will be able to handle an induction cooker.

2 The induction stove sensor is not working

This is not a major complication and is easily solvable. The appliance is equipped with an infrared sensor. It shuts off automatically when no cookware is detected for a few seconds. If your sensor is turned off, it could be because the cookware is not in the centre of the cooking zone. Due to this, it does not get detected. Place it back right. Still not working? Please turn off the power for a few seconds and then switch it on. This can help your appliance reset.

3 The induction cooktop constantly beeping

Is your induction cooktop constantly beeping? It's a sign you cannot ignore. The reason could be too much load on the control panel, wrong cookware or simply because of some technical issue. Check the vessel you are using, turn off the appliance for a while. If nothing works, get it checked by an expert. Is the appliance too old? If it is, a replacement might be an even better option.

4 The induction cooktop is not heating up

If your induction cooktop is not heating up, the food ingredients will not get heated either. Hence, it needs immediate action. It could be due to various reasons. Maybe you are not using the right pan. Maybe there is a fault in the circuit board. It would help if you also looked into the main circuit unit. Another reason could be that the appliance does not have enough power.

5 Induction cooktop turning off

Oh yes, this can be so infuriating. You are in the middle of your cooking. You haven't turned off the appliance, but it shuts automatically. What exactly is the reason? Perhaps you have exceeded the cooking time limit, or the sensor cannot identify the pan (you know the reason for that). The cooktop can also overheat. It is best to

turn off the appliance and take a break. The heat sensor may have detected something fishy going on in the internals. A quick restart might fix the issue, but if it doesn't, it would be best if you get the cooktop checked.

6 The induction cooktop is not responding to touch

In case your induction cooktop does not respond to touch, it could be due to three reasons. Number one, your touch has switched it to lock mode by mistake. Unlock it. Number two, your appliance is not getting enough power. Check your power source to solve the issue. Number three, there is a fault in the circuit board of your appliance. This circuit board is placed right below the touch. In this case, you cannot fix it by yourself. It would be best if you consult a skilled professional.

7 Food is getting burned, or food is getting cooked unevenly

Wondering why is your food getting burned on the induction cooktop? It could be because your cookware is pretty light in weight and is getting heated up too quickly. So, the issue is not with the cooktop but with the cookware. Change it. In the case of uneven cooking, the fault is most likely in the vessel. The lightweight ones usually do not heat up evenly. You also need to ensure that the vessel covers the cooking zone perfectly. So, indulge in the right size vessel. Note that your cookware must also have a ferromagnetic bottom.

8 Food not getting cooked on an induction cooktop

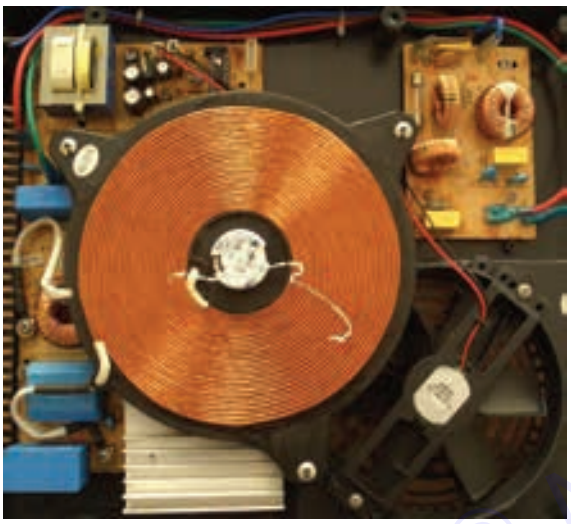
Yes, this is one of the most common induction cooktop problems. I have come across people with this issue. They have given enough time for the food to get cooked. But there is no reaction. What's the reason? The cooking setting is likely not right. There is a reason why the cooktop is equipped with different cook settings.

Stick to basics. Don't experiment unless you know what you're doing. Also, make sure the temperature is adequate to deliver enough heat for the food to get cooked.

9 The induction cooktop is not turning on

You have switched on the induction cooktop, but it did not turn on. You tried again and again and again. Of course, you would get worked up about it. Wondering what is wrong? Why is the induction cooktop not grasping the instruction? Relax; your cooktop is can still work. Either the circuit board is defective, or the wiring is faulty. I would recommend you not to fix it yourself. It could get worse. Call a technician. They can fix the issue quickly.

10 Induction cooktop displays error code



A reader of mine subjected this to BOSCH induction cooktop problems. Well, no. You could face this problem no matter which cooktop you are using. It means your appliance cannot read the temperature settings and the cookware. The only way out is to replace the sensor.

Those were the ten most common induction problems & solutions. Let's be honest. An induction cooktop is so extravagant. Why not take all the measures to avoid as many problems as possible?

Result: thus, check and identify the faults in induction cooktop and rectified the faults successfully.

EXERCISE 178: Demonstrate dismantling of various parts, wiring and tracking of various controls, electracial and electronic circuit of electrical induction

Objectives

At the end of this exercise you shall be able to

- to dismantling of various parts of induction cook top
- to demonstrate wiring and tracking various controls in electrical induction cooktop
- to demonstrate electrical and electronic circuit in electrical cooktop.

Requirements

Tools/ Materials

- Screw driver (150 mm) - 1 No.
- tester - 1 No.
- Combination pliers (150 mm) - 1 No.
- wire cutter - 1 No.
- Main control board (240v/50hz) - 1 No.
- Filter board - 1 No.
- Elements coil (1500w) - 1 No.
- Terminals box - 1 No.
- Cooktop glass assembly - 1 No.
- Electrical induction (1500 w) - 1 No.

Procedure

Dismantling an electrical induction cooktop

Dismantling an electrical induction cooktop involves understanding its various parts and their functions. Here are the key components of an induction cooktop and their roles:

When dismantling, it's important to carefully remove each part in order to avoid damaging them. Always ensure the cooktop is disconnected from the power supply before starting the process. After dismantling, you can inspect each part for any signs of wear or damage.

- **Safety first**
  - Unplug the cooktop, Before starting any disassembly, ensure that the cooktop is unplugged from the power source to prevent electric shock.
  - Allow cooling, Let the cooktop cool down if it has been recently used.

(i) Unplug from power supply

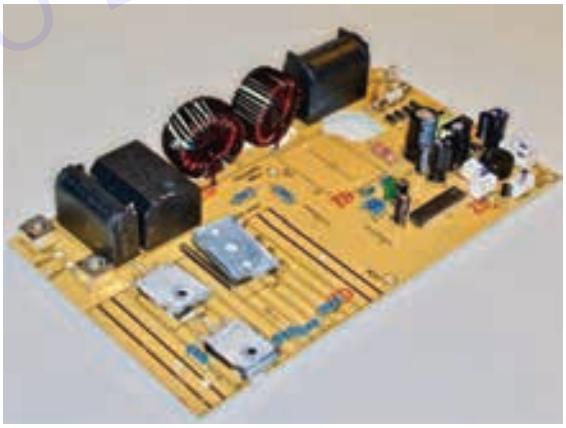
(ii) waiting for cooling

- **Remove the Cooktop Glass Top**
  - Most induction cooktops have a glass top. To remove it:
  - Remove Control Knobs: Take off the control knobs (if applicable).
  - Unscrew and Lift: Unscrew any screws holding the glass top in place. Carefully lift the glass top off the cooktop.

- **Access Internal Components**
- Once the glass top is removed, you'll have access to the internal components. These may include:
  - **Induction Coils**: These generate the magnetic field for cooking.
  - **Electronics Board:** Contains control circuits and sensors.
  - **Fan and Ventilation System:** Responsible for cooling.
  - **Wiring and Connectors**: Ensure you disconnect these carefully.

(i) Induction coil

(iii) dc fan for ventilation



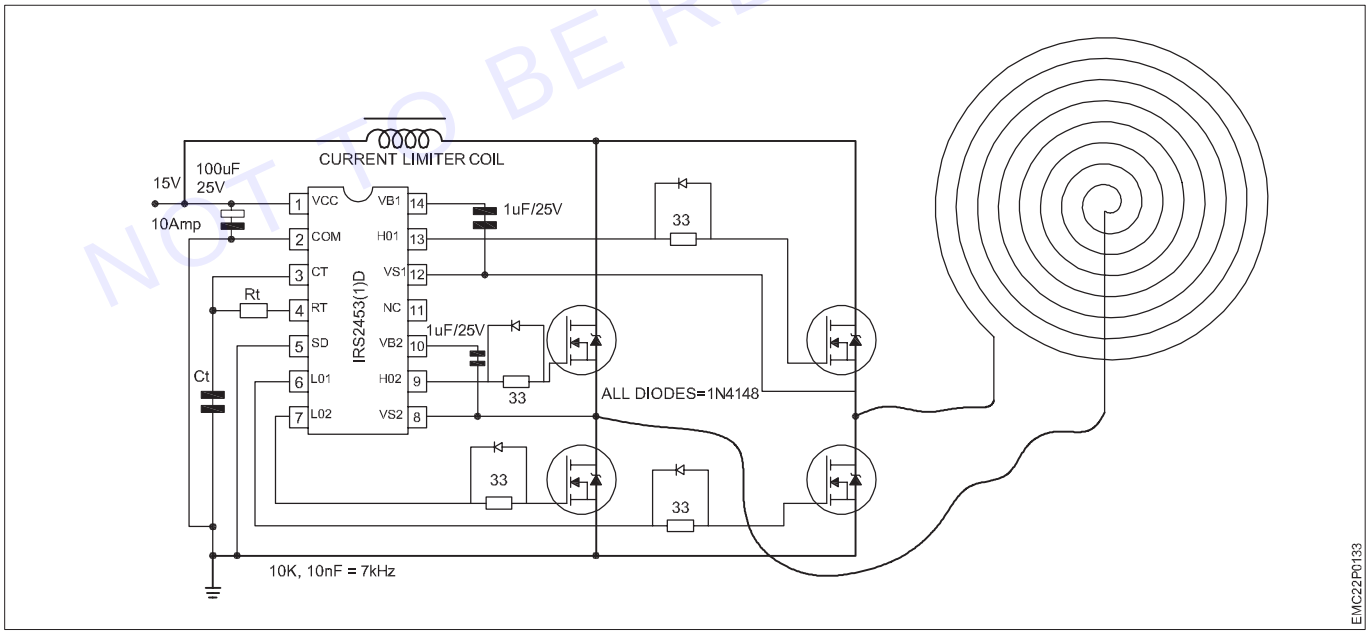
(ii) Electronic board

- **Specific Component Removal**
- Depending on your purpose (repair, cleaning, or replacement), focus on specific components:
  - **Coils**: If you need to replace coils, disconnect them from the board.
  - **Electronics Board:** Unscrew and detach the board.
  - **Fan and Ventilation System:** Remove any screws or clips securing the fan assembly.
  - **Wiring and Connectors:** Disconnect wires and connectors as needed.

- **Reassembly**
  - When reassembling, follow the reverse order.
  - Ensure proper alignment of components.
  - Tighten screws securely but avoid overtightening.
- **Cleaning and Maintenance**
  - While disassembled, clean the glass top and other components.
  - Use a soft cloth and mild detergent for the glass.
  - Avoid using ammonia-based cleaners on the glass, as they can damage the surface.

- **Controls of induction and wiring**
- **Power On**: Start by switching on the induction hob unit. Usually, there's a power button or switch. Make sure the cookware you intend to use is nearby.
- **Place Cookware**: Put your induction-compatible pan or cookware on the specific cooking ring you want to use. Remember that no heat is generated unless there's cookware on the cooking ring.
- **Control Panel Types**
  - Touch Sensor Controls: Most induction cooktops have touch-sensitive controls. These allow you to adjust settings by tapping the relevant buttons on the display panel.
  - Rotating Knob Controls: Some models feature a rotating knob control. You turn the knob to adjust the heat level.
  - Press Button Controls: Another type has press buttons for adjusting settings.

- **Select the Ring**: If you have a multiple-burner cooktop, select the sensor corresponding to the ring you wish to use.
- **Adjust Heat**: Use the + and - buttons to adjust the heat level. These buttons allow you to fine-tune the temperature precisely.
- **Cooking:** Once you've set the desired heat level, start cooking! The induction cooktop will maintain the selected temperature.
- **Power Off:** When you're done cooking, hold down the power button to turn off the induction cooktop.
- Wiring layout electrical and electronic



Result: Thus the dismantling of various parts, wiring and tracking of various controls in induction cooktop has completed successfully

EXERCISE 179 : Demonstrate replacing the induction tube (coil) in induction cooktop

Objectives

At the end of this exercise you shall be able to

- to demonstrate induction tube (coil) in Induction cook top
- to demonstrate replacing the Induction tube (coil) in Induction cook top.

Requirements

Tools/ Materials

- Screw driver - 1 No.
- tester - 1 No.
- Combination pliers - 1 No.
- wire cutter - 1 No.
- Main control board - 1 No.
- Filter board - 1 No.
- Elements coil - 1 No.
- Terminals box - 1 No.
- Cooktop glass assembly - 1 No.

Procedure

Theory

The induction coil determines how effectively and efficiently a workpiece is heated. Induction coils are water-cooled copper conductors made of tubing that is formed into the shape of the coil for the induction heating process. Induction heating coils do not themselves get hot as water flows through them.

Procedure

Wear protective gloves to avoid burns or electric shocks.

Access the Coil

Remove the cook top: Depending on your cook top model, you may need to lift the glass surface or remove screws to access the coil underneath.

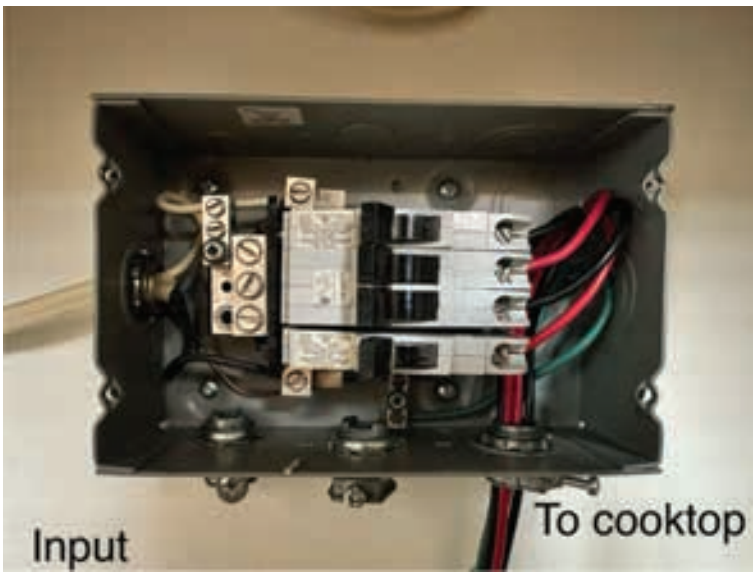
Locate the coil: The coil is usually a circular or rectangular component made of copper wire.

Disconnect the Old Coil

Disconnect the wires: Carefully detach the wires connected to the old coil. Take note of their positions for reassembly.

Remove any mounting clips or brackets: These hold the coil in place.

Install the New Coil



Place the new coil: Position the replacement coil in the same spot where the old one was.

Secure it: Use mounting clips or brackets to hold the coil securely.

Reconnect the wires: Attach the wires to the corresponding terminals on the new coil.

Plug in the cooktop: Reconnect the power supply.

Turn on the cooktop: Check if the new coil heats up properly.

Calibration (if needed): Some cooktops require calibration after replacing components. Refer to your user manual for specific instructions.

Remember that this is a general guide, and the exact steps may vary based on your cooktop model. If you're unsure or need specific instructions, consult the manufacturer's manual or consider seeking professional assistance.

Result: Thus the replacing of the induction tube (coil) in Induction cook top was successfully demonstrated.

MODULE 19: PLC & Electronic pnuematic

EXERCISE 180: Demonstrate various indicators on PLC modules and interpret

Objectives

At the end of this exercise you shall be able to

- to demonstrate various indicators on PLC modules and interpret
- identify various indicators on PLC.

Requirements

Tools/ Materials

- PLC Module
- Power Supply
- I/O modules(devices)
- Wiring Materials and connectors
- Sensors and Actuators
- LED Indicators
- Programming device

Procedure

Theory

- **Indicators and Alarms**

  The indicators/alarms include devices that can represent a predetermined state in a basic PLC control system.

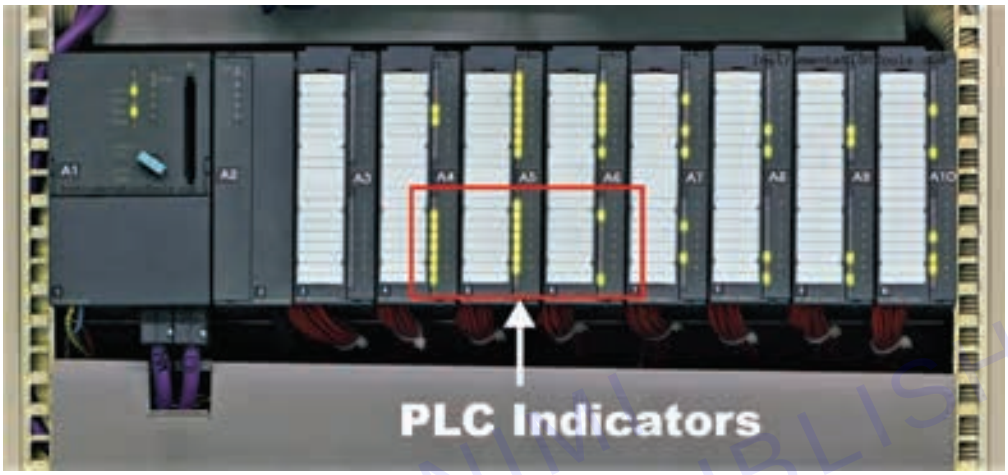
  Indicators such as pilot lights—usually a green one, may represent that the PLC system is running properly. A red pilot light usually represents a PLC system that does not have ongoing operation.

1 Power LED (Green)

- **Indication**: This LED indicates whether the module is receiving power.
- **Interpretation**: If the Power LED is lit, it signifies that the module is powered on. If it's not lit, it suggests there might be a power supply issue, such as a disconnected power source or a faulty power supply unit.
- **Representation**: A green LED labeled "PWR" or "POWER".
- **Significance**: Indicates whether the module is receiving power from the power supply unit.
- **Interpretation**: Lit when power is supplied; off if there's a power supply issue.

2 Status LED (Green)

- **Indication**: The Status LED reflects the operational status of the module.
- **Interpretation**: A steady green light typically means the module is functioning properly. However, if it's blinking or off, it could indicate various states such as a programming error, communication issue, or module fault.
- **Representation**: A green LED labeled "STATUS" or "ST".
- **Significance**: Reflects the operational status of the PLC module.
- **Interpretation**: Steady green indicates normal operation; blinking or off may indicate various system states or faults.



3 Communication LED (Yellow)

- **Indication**: This LED shows the status of communication between the PLC module and other devices.
- **Interpretation**: A solid or blinking yellow light usually indicates communication activity. If the LED is off, it could suggest communication failure, incorrect settings, or faulty cables.
- **Representation**: A yellow LED labeled "COM" or "COMM".
- **Significance**: Indicates the status of communication with other devices or the PLC system.
- **Interpretation**: Solid or blinking yellow suggests communication activity; off if communication failure occurs.

4 Input LEDs (Green)

- **Indication**: Each input channel may have its own LED to indicate the status of the input signal.

- **Interpretation**: A lit LED indicates that the corresponding input signal is active. If an input LED remains off when it should be active, it could signify a wiring issue, sensor malfunction, or programming error.
- **Representation**: Multiple red LEDs labeled “I1”, “I2”, etc., corresponding to input channels.
- **Significance**: Shows the status of input signals received by the PLC.
- **Interpretation**: Lit when an input signal is active; off when the signal is inactive.

5 Output LEDs (Green)

- **Indication**: Similar to input LEDs, output LEDs indicate the status of output channels.
- **Interpretation**: A lit LED suggests that the associated output is energized. If an output LED remains off when it should be active, it might indicate a fault in the control logic, output device, or wiring.
- **Representation**: Multiple red LEDs labeled “O1”, “O2”, etc., corresponding to output channels.
- **Significance**: Indicates whether the outputs are energized.
- **Interpretation**: Lit when the output is active; off when the output is inactive.

6 Fault LED (Red)

- **Indication**: This LED illuminates when there’s a fault within the module or PLC system.
- **Interpretation**: A steady red light indicates a fault condition. It’s essential to consult the PLC documentation or diagnostic tools to identify the specific fault and take appropriate corrective actions.
- **Representation**: A red LED labeled “FAULT” or “ERR”.
- **Significance**: Illuminates when a fault condition occurs within the module or the PLC system.
- **Interpretation**: Steady red light indicates a fault; consult documentation for specific fault details.

7 Run LED (Green)

- **Indication**: The Run LED indicates whether the PLC program is running.
- **Interpretation**: A steady green light signifies that the PLC program is executing properly. If the Run LED is off, it suggests issues such as a halted program, mode configuration problems, or hardware faults.
- **Representation**: A green LED labeled “RUN”.
- **Significance**: Indicates whether the PLC program is running.
- **Interpretation**: Lit when the program is executing; off if the program is stopped or paused.

They are usually placed in the control system to tell the operator, for example, “Hey, you have a DC voltage output at the solenoid valve right now”

or “Hey, something is wrong because your temperature level inside the system is too low or too high”.

This makes it REALLY easy to identify which are working, and at the same time, you also identify which should SUPPOSEDLY work or not.

As an example, let's say you want to power a motor when a START button is pressed, and make it stop immediately when the STOP button is pressed.

You know that the motor shaft creates a lot of friction at the output side, and so you set a temperature threshold using a temperature limit switch placed at the object in contact with the output shaft.

Your PLC programming would look like this:

Notice that I put 3 indicator lights. The START light will only power when the START button is pressed, as it should be. The STOP light will only be turned on when the motor is not running, so by default, this should immediately be turned ON if we just supply power to the PLC.

The third pilot light that I put is a special case for the PLC control system—the pilot light was placed such that the temperature limit switch will turn it on.

Because of the third pilot light, the operator will know whether the PLC control system was turned OFF by another operator, or it was the high temperature that turned the motor OFF.

Of course, there are limitless applications of these pilot lights in PLC automation or PLC control systems because they are just plain handy.

However, you would not want everything in your system to be indicated by pilot lights, as they occupy an output terminal at the PLC output side. The most important elements of the design must be considered first, namely, the input and output devices.

Result: thus,demonstration various indicators on PLC modulesand interpret has been completed successfully.

EXERCISE 181 : Wire in various digital input and output device to respective modules of PLC (Programmable Logic Devices)

Objectives

At the end of this exercise you shall be able to

- to demonstrate various wiring I/O device in PLC
- to identify suitable circuits
- to demonstrate the connection of I/O device to respective modules.

Requirements

Tools/Materials

- PLC Module
- Power Supply
- I/O modules(devices)
- Wiring Materials and connectors
- Sensors and Actuators
- LED Indicators
- Programming device

Procedure

Theory

In this article, we are studying the basic concepts of PLC and DCS control systems Wiring Diagrams for Digital Input (DI), Digital Output (DO), Analog Input (AI), and Analog Output (AO) signals.

Note that these diagrams are without a Barrier or isolator, fuses, or surge protector to keep them very simple and understandable.

Wiring Diagrams of PLC and DCS

The basic types of wiring connections available for DI, DQ, AI, and AQ Signals:

Digital Input (DI) Signals

Digital Outputs(DQ) Signals

Analog Input(AI)

Analog Output (AQ) Signals

Digital Input Signals to PLC / DCS

Input type with respect to the system Terminal type/connection, Shield is not shown for simplicity.

The two-wire connection is used to connect field instruments like limit switches, proximity switches, motor run feedback, Pump start permissive, etc.

An additional power supply (24 VDC, 110 VDC, 230 VAC, etc) in the marshaling cabinet (at the control room side) to power the field instrument.

This configuration is generally used for hooters, beacons, high-power solenoid valves, etc.

Interfacing with Other Control Systems (DCS/PLC/ESD)

This configuration is widely used in industries for interfacing with third-party control systems.

DO with Line Monitoring

The line monitoring for digital output cards is also possible but up to relay coil and/or up to field shall be confirmed by the system vendor.

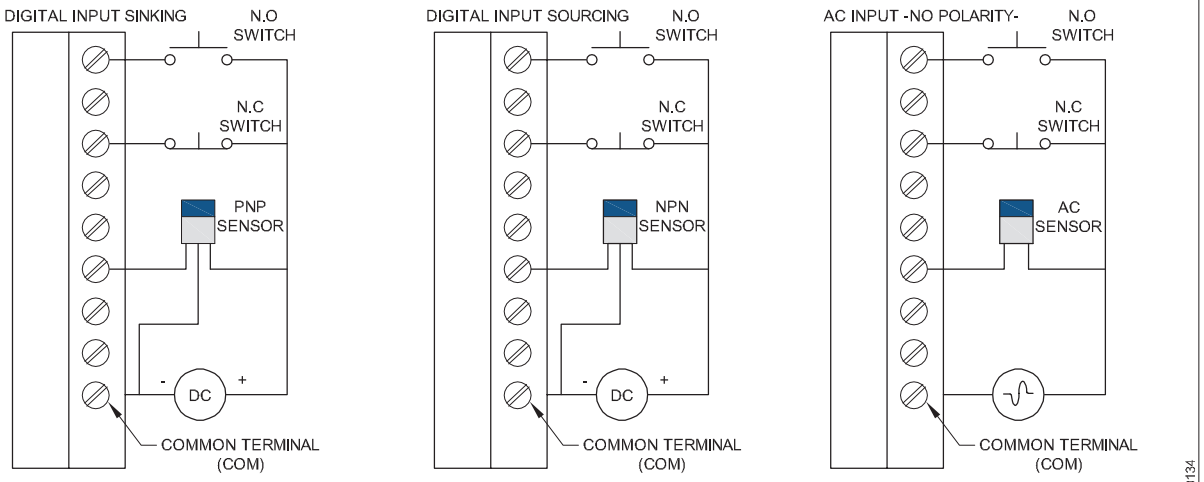
Analog Input Signals to PLC / DCS

Two-wire Connection with AI Card

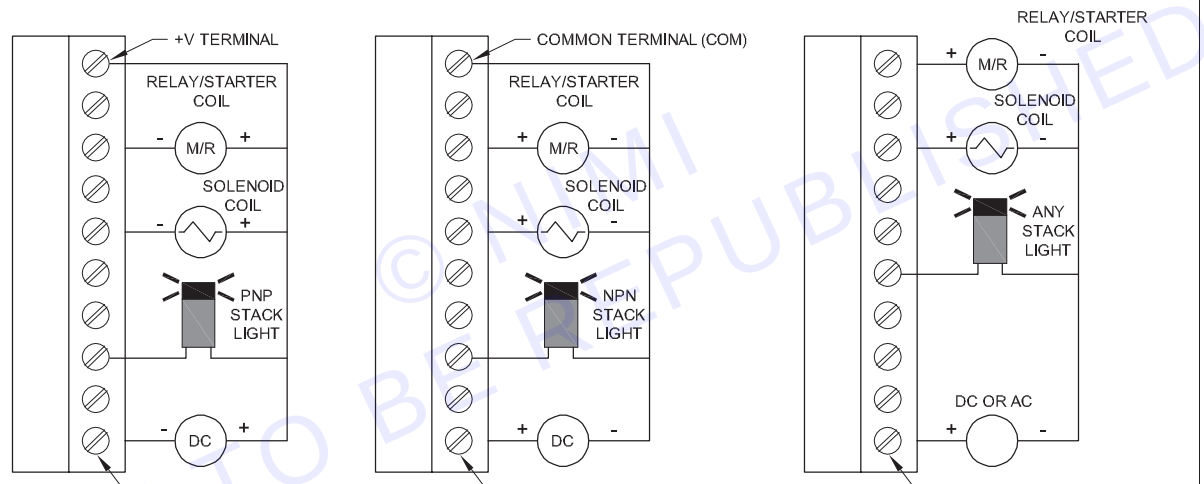
This configuration is used to connect two-wire transmitters like PT, TT, FT, LT, etc.

We may use barriers also after the AI card for safety precautions. These are not shown in the diagrams.

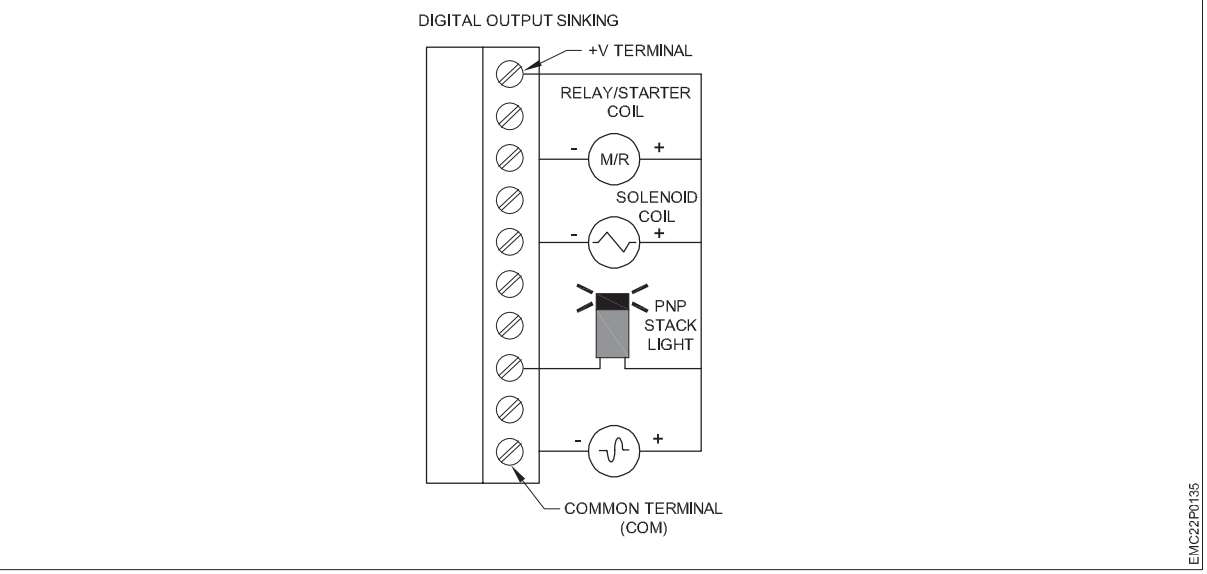
Result : Thus the Different I/O Modules of PLC have been identified successfully.



DC/AC INPUT MODULES



DC/AC INPUT MODULES



EXERCISE 182: Wire analog input and output devices to the respective modules

Objectives

At the end of this exercise you shall be able to

- to demonstrate wire analog input and output devices to the respective modules.

Requirements

Tools/Materials

- Combination Plier (250mm) - 1 No.
- Screw Driver set (150mm) - 1 No.
- Wire Stripper - 1 No.
- Potentiometers - 1 No.
- Sensors - 1 No.
- temperature sensors - 1 No.
- light sensors - 1 No.
- Analog Voltage Output Modules - 1 No.
- Digital-to-Analog Converters - 1 No.

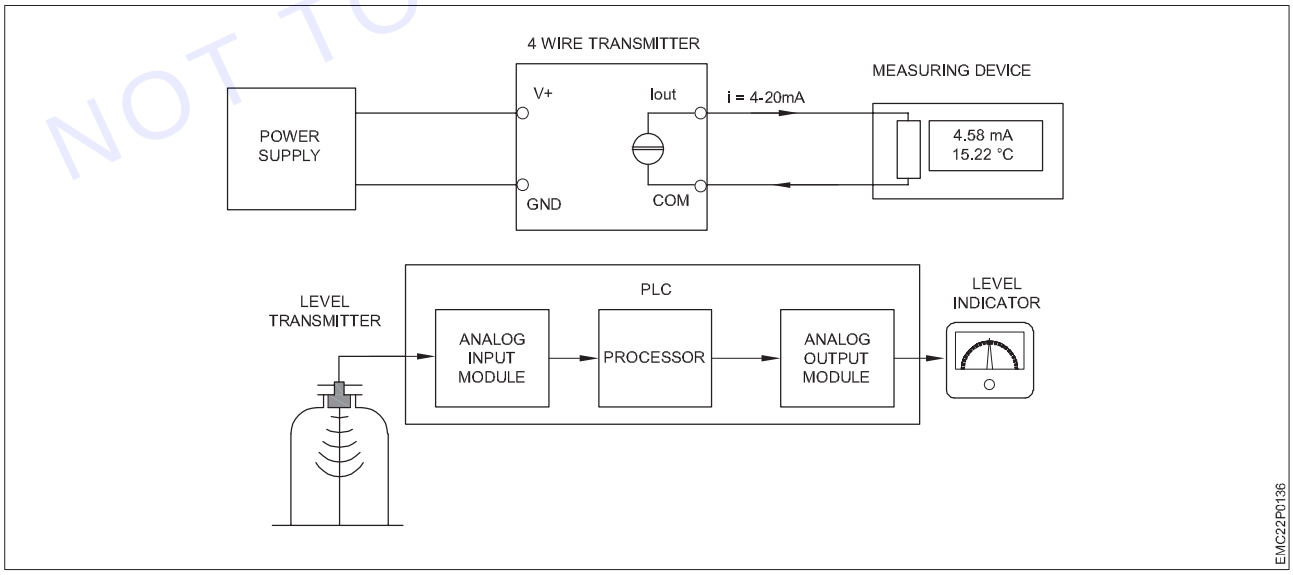
Procedure

To wire analog input and output devices to their respective modules, you'll need to follow the specific wiring instructions provided by the manufacturer of your modules and devices. However, I can provide you with a general guideline on how to wire analog devices to modules commonly used in electronic circuits.

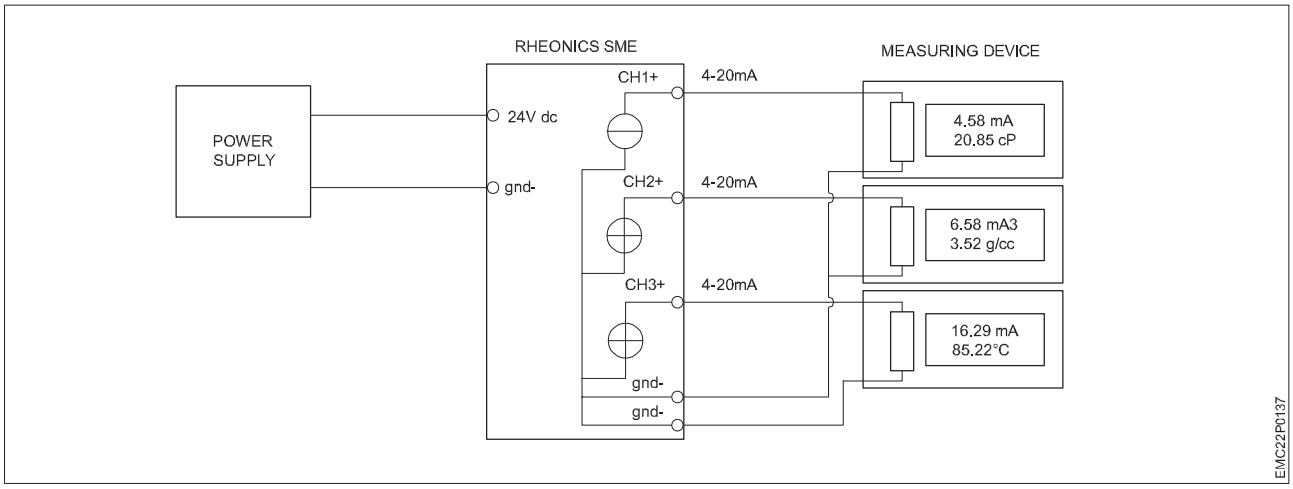
Analog Input Devices

1 **Potentiometers:** Potentiometers are variable resistors commonly used as analog input devices. They have three terminals - two outer terminals and one wiper terminal. Wire one outer terminal to the ground (GND) of your module and the other outer terminal to the power supply voltage (Vcc) of your module. Then connect the wiper terminal to the analog input (usually labeled A0, A1, etc.) of your module.

2 **Sensors (e.g., temperature sensors, light sensors):** Most analog sensors have three terminals - power supply, ground, and signal output. Connect the power supply terminal to the Vcc of your module, the ground terminal to the ground (GND) of your module, and the signal output terminal to the analog input of your module.



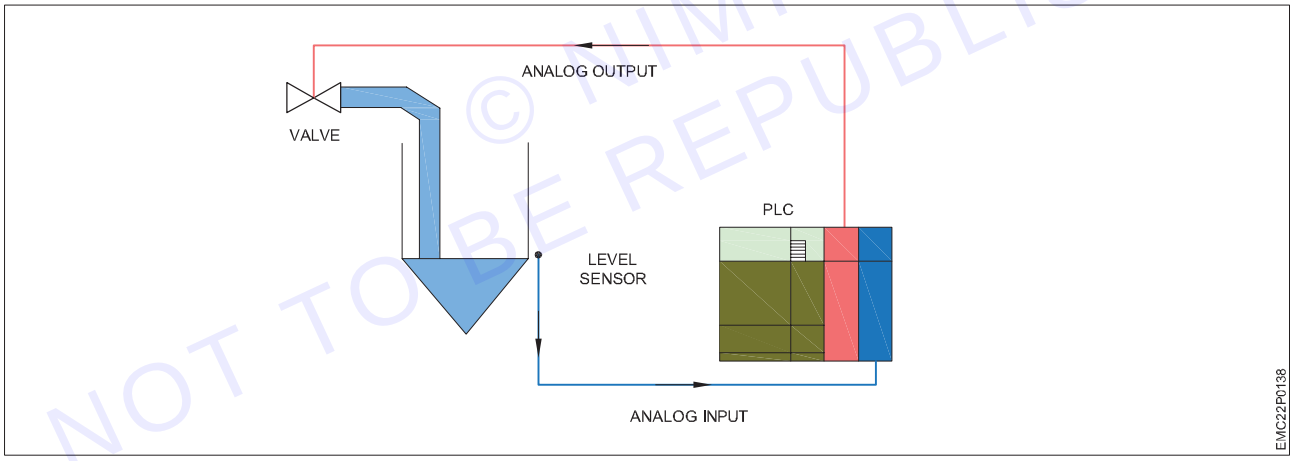
Discrete devices are inputs and outputs that have only two states: on and off. In comparison, analog devices represent physical quantities that can have an infinite number of values. Typical analog inputs and outputs vary from 0 to 20 milliamps, 4 to 20 milliamps, or 0 to 10 volts.



Analog Output Devices

1 Analog Voltage Output Modules: Some modules are designed to output analog voltage signals. They typically have an analog output pin (AO), ground (GND), and possibly a Vcc pin. Wire the analog output pin to the input of the device you want to control with the analog signal. Connect the GND pin to the ground of your circuit.

2 Digital-to-Analog Converters (DACs): DACs are used to convert digital signals into analog voltages. Follow the datasheet of your DAC module to determine the wiring specifics. Typically, you'll connect the digital input pins to your microcontroller or digital output module and the analog output pins to the device you want to control.



Note: Double-check the voltage and current requirements of your devices and modules to avoid damaging them.

Result: Thus the Wiring from PLC to the respective I/O modules have been performed successfully.

EXERCISE 183: Connect and configure plc hardware and software

Objectives

At the end of this exercise you shall be able to

- to demonstrate connection of PLC
- identify various connection software and hardware.

Requirements

Tools/Materials

- Mounting
- Power Supply
- I/O wiring
- Wiring Materials and connectors
- Communication Ports
- Grounding
- Install Software
- PLC Programming
- PLC Configuration
- Download Program
- Backup

Procedure

Theory

Note: Most newer PLCs having its own configuration methods.Advised to follow respective user manual. (Most of the procedures are same), Considered Siemens PLC as an example.

Setting up your S7-1200 PLC using STEP 7 Basic

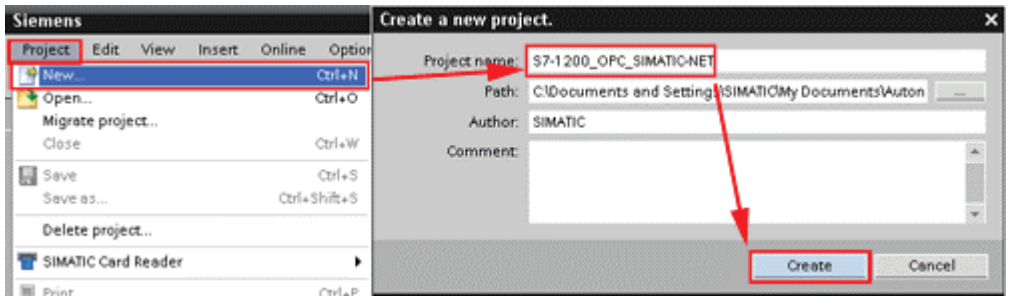
Configure your S7-1200 PLC and provide data to be monitored via an Open Platform Communications (OPC) connection.

Hardware configuration

For the hardware configuration, use the project view of STEP 7 Basic V10.5.

Create the project

Select the menu command “Project > New”. The dialog box “Create a new project” opens. Enter the name “S7-1200_OPC_SIMATIC-NET” in the “Project name” input field. Click the “Create” button.

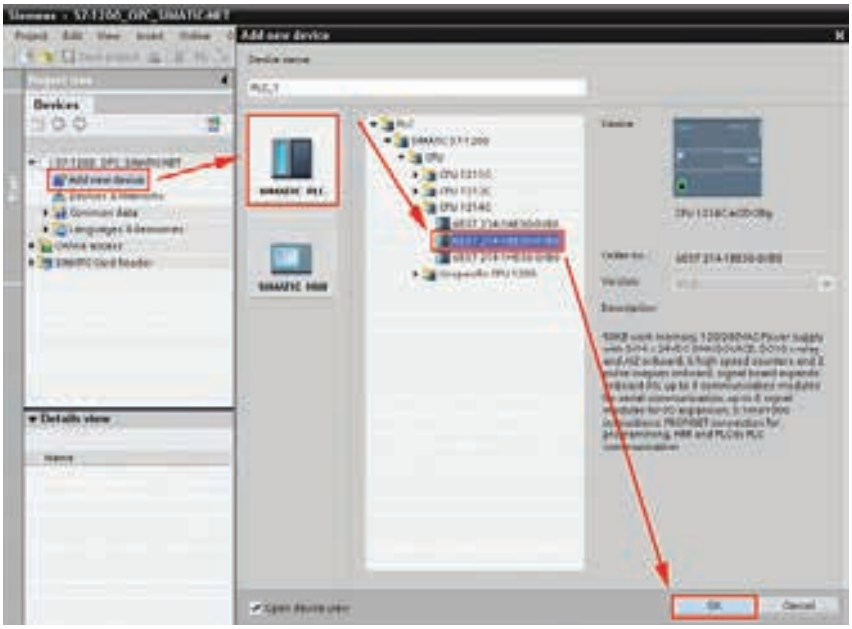


Add a new PLC to the project

Double-click the project tree command “Add new device”. The “Add new device “ dialog box opens. In the work area, click the “SIMATIC PLC” button, and select your PLC by clicking its MLFB. Click the “OK” button.

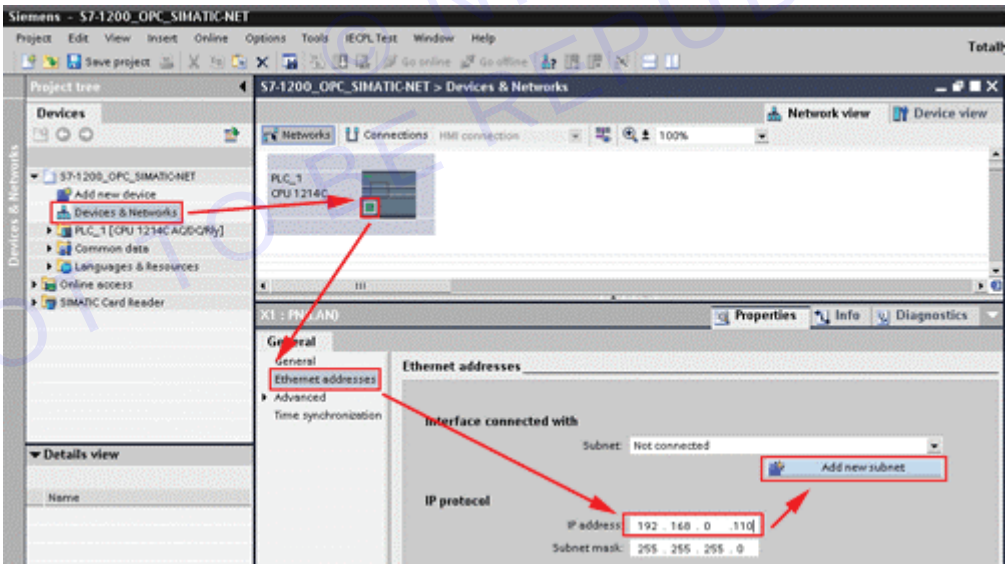
Change the IP address of the Ethernet port

Double-click the project tree command “Devices & Networks”. In the “Devices & Networks” work area, click the “Ethernet port” of your S7-1200 PLC.



In the navigation area of the “Properties” tab, select the “Ethernet addresses” instruction. Define the IP address “192.168.0.110” for the Ethernet port in the “IP address” input field.

Click the “Add new subnet” button. In the “Devices & Networks” work area, you will find the subnet PN/IE_1 connected to your S7-1200 PLC.



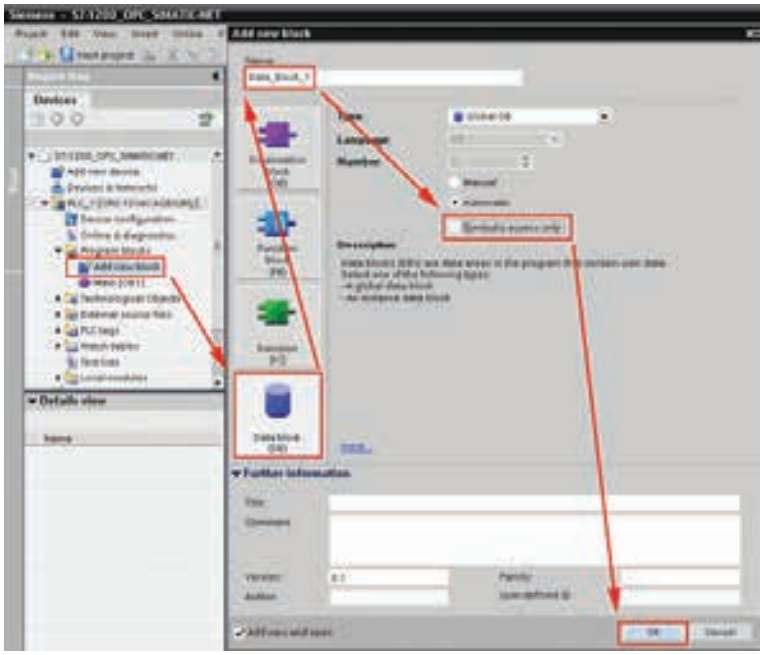
Software configuration

To see value changes, you will now create a small program in which two hardware inputs and a hardware output of your PLC are connected to a software flip-flop.

Add a global data block

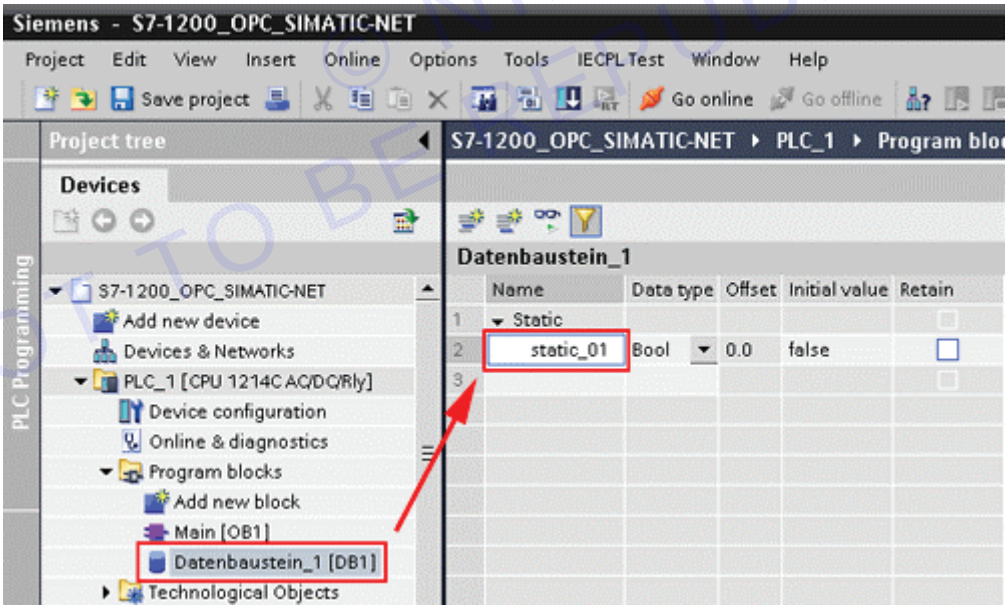
In the “Project tree”, click the expand button of your PLC folder (for example, PLC_1 [CPU 12…]). Open the “Program blocks” sub-folder by clicking its expand button, and double-click the “Add new block” instruction.

In the “Add new block” dialog box, select the “Data block (DB)” button, enter the name “Data_block_1” in the “Name” input field, and uncheck the “Symbolic access only” check box. Click the “OK” button. The “Data_block_1” work area opens.



Create static data in a global data block

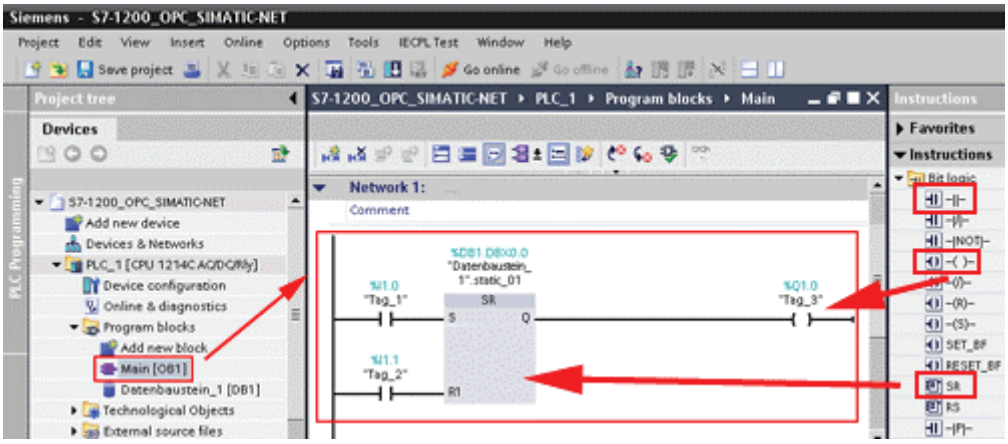
Create a “Bool” data type tag named “static_01” in the “Data_block_1” work area.



Create a program in Main [OB1]

In the “Program blocks” folder of your PLC, double-click the “Main [OB1]” instruction. Copy the program shown in the next picture.

You will find the bit logic operations in the “Bit logic” folder in the “Instructions” pane on the “Instructions” task card. Drag’n’Drop the “Normally open contacts”, “the Output coil”, and the “Set/Reset flip-flop” into “Network 1” of your “Main [OB1]” work area, according to the picture shown below. Make sure that the input fields are configured in the same way as shown in the picture and in the table.



Contacts

Table 2-1

SR FlipFlop input S: normally open contact	I1.0
SR FlipFlop input R: normally open contact	I1.1
SR tag	DB1.DBX0.0
SR FlipFlop output Q: output coil	Q1.0

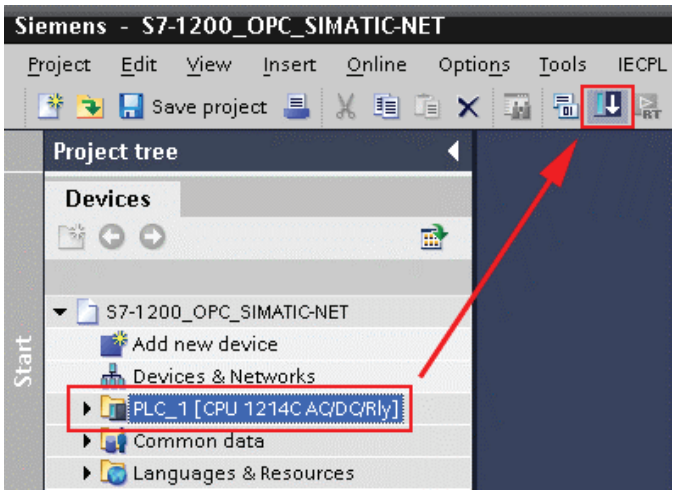
Note: The "%" in front of the addresses is added by STEP 7 Basic V10.5 automatically.

Finalize the S7-1200 PLC work

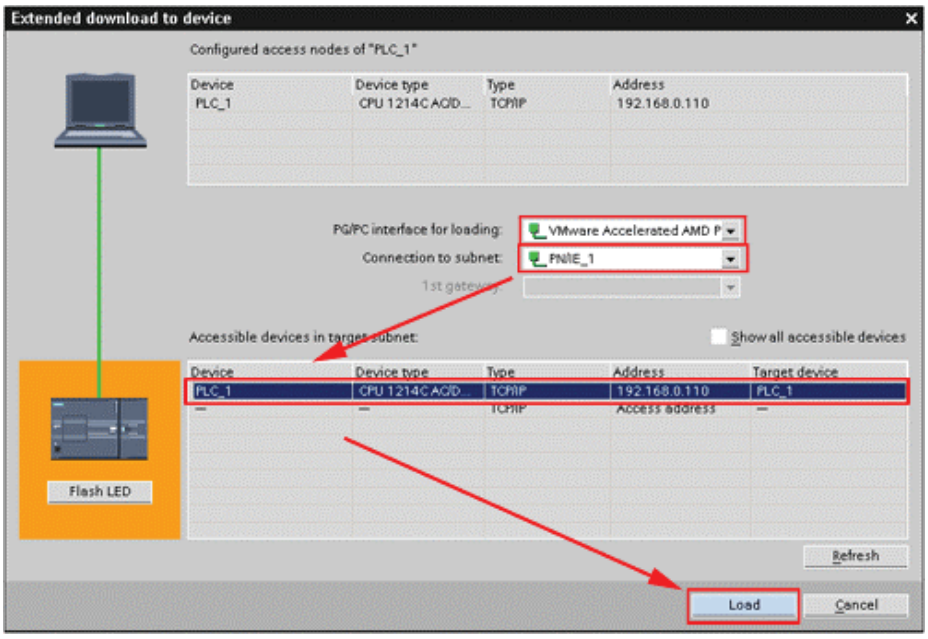
Highlight the "PLC_1 [CPU12…]" folder in your project tree in order to compile, download, and run your S7-1200 PLC.

Compile and download the program

Press the "Download to device" button in the Toolbar.

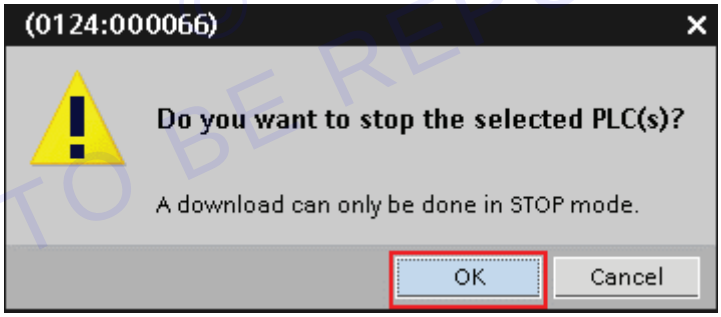


The “Extended download to device” dialog box opens. Ensure that the selected PG/PC interface and subnet are correct. Select “PLC_1”. Click the “Load” button.

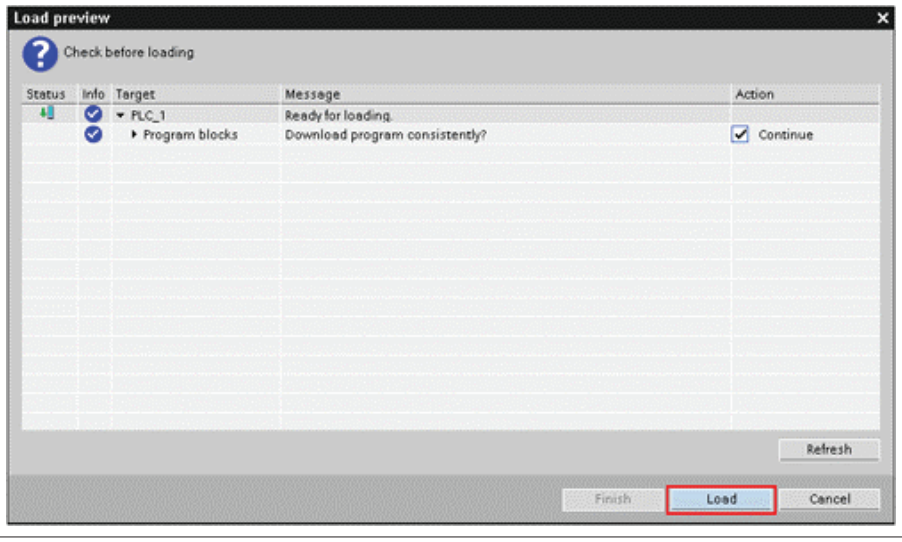


If you have downloaded your project before, the “load preview” dialog box may open instead of the “Extended download to device” dialog box.

Another dialog box may open, asking to stop the S7-1200 PLC for downloading. Acknowledge by clicking the “OK” button

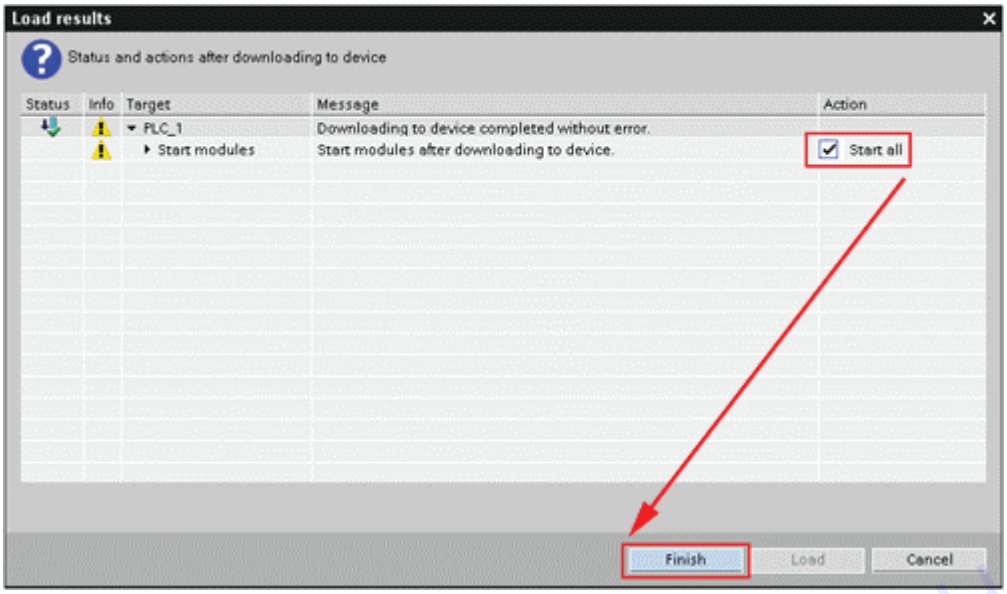


The load preview dialog box opens. Click the “Load” button



Switch the S7-1200 PLC to run

The load result dialog box opens. Check the “Start all” check box, and press the “Finish” button. Your S7-1200 PLC status LED changes from stop to run.



Result: Thus the steps involved in configuring Siemens S7-1200 PLC has been successfully demonstrated.

EXERCISE 184: Develop and RUN simple program to read sensor status and to control various output

Objectives

At the end of this exercise you shall be able to

- to Develop and RUN simple Bottle filling program in PLC
- read Sensor data status and Control value status.

Requirements

Tools/ Materials

- Power Supply - 1 No.
- Wiring Materials and connectors - 1 No.
- Communication Ports and cables - 1 No.
- PC/LAPTOP Latest configuration - 1 No.
- PLC for Programming - 1 No.

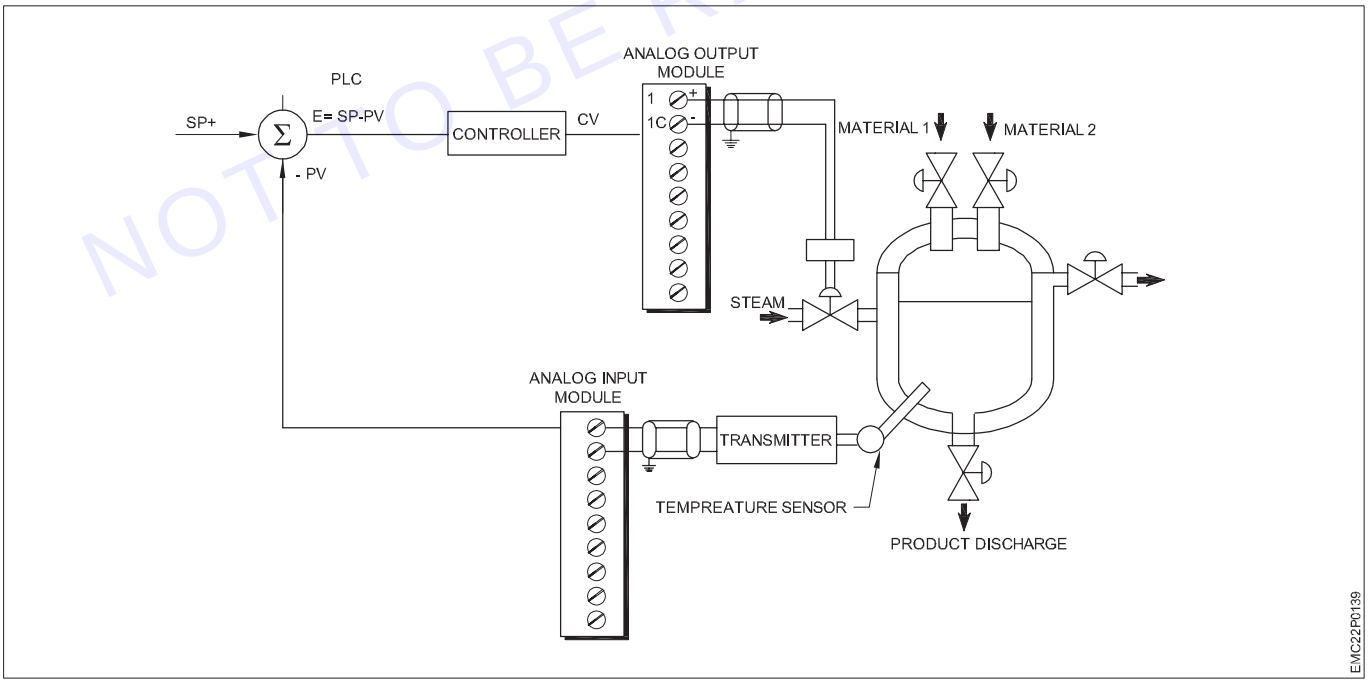
Procedure

Theory

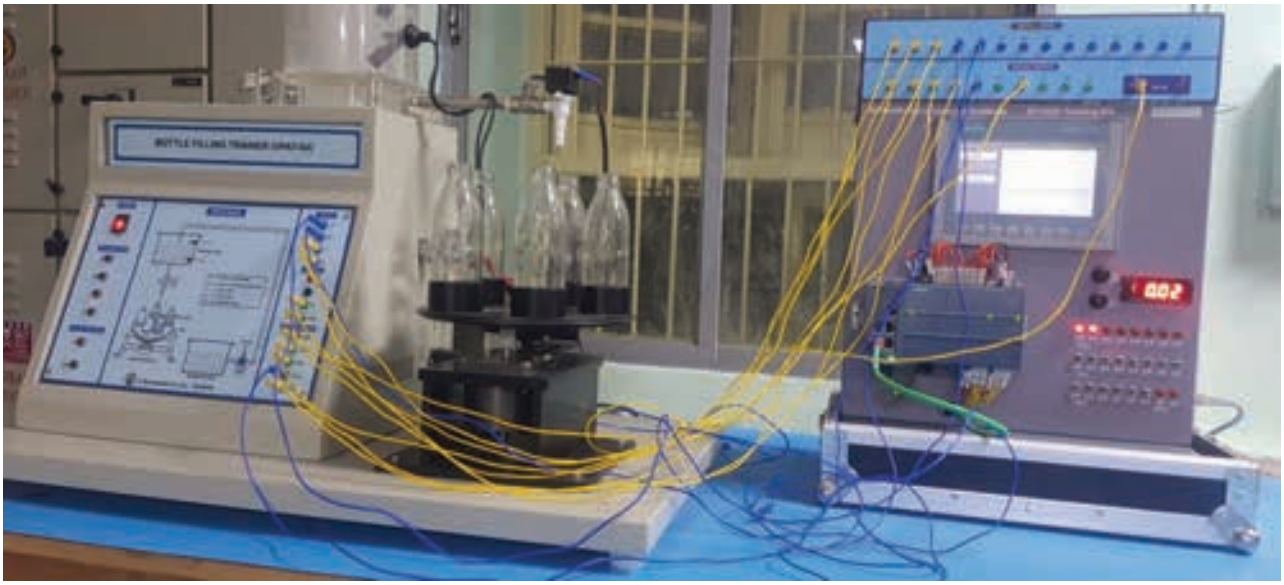
Note: Most newer PLCs having its own configuration methods.Advised to follow respective user manual. (Most of the procedures are same), Considered Siemens PLC as an example.

Setting up your S7-1200 PLC using STEP 7 Basic

Configure your S7-1200 PLC and provide data to be monitored via an Open Platform Communications (OPC) connection.



Hardware wiring

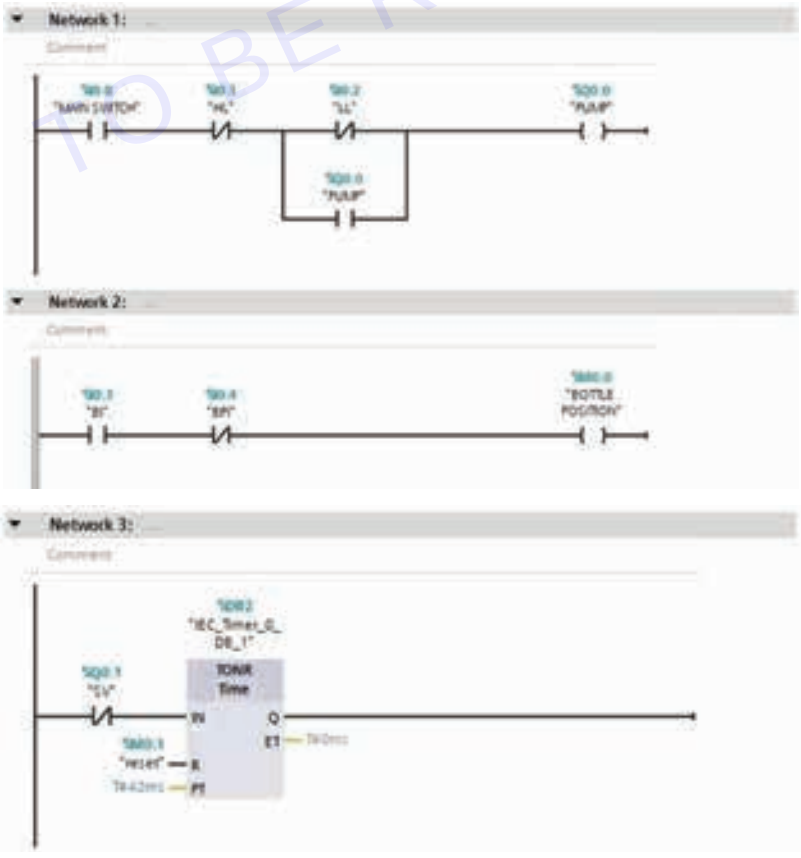


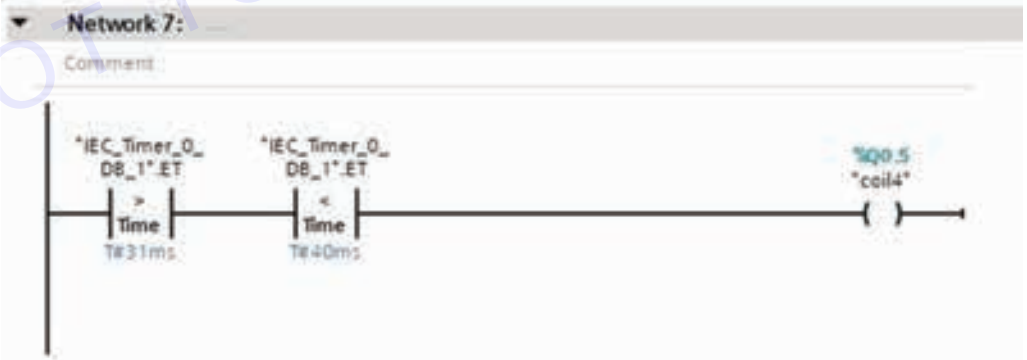
Create a program in Main [OB1]

In the “Program blocks” folder of your PLC, double-click the “Main [OB1]” instruction. Copy the program shown in the next picture.

You will find the bit logic operations in the “Bit logic” folder in the “Instructions” pane on the “Instructions” task card. Drag’n’Drop the “Normally open contacts”, “the Output coil”, and the “Set/Reset flip-flop” into “Network 1” of your “Main [OB1]” work area, according to the picture shown below. Make sure that the input fields are configured in the same way as shown in the picture and in the table.

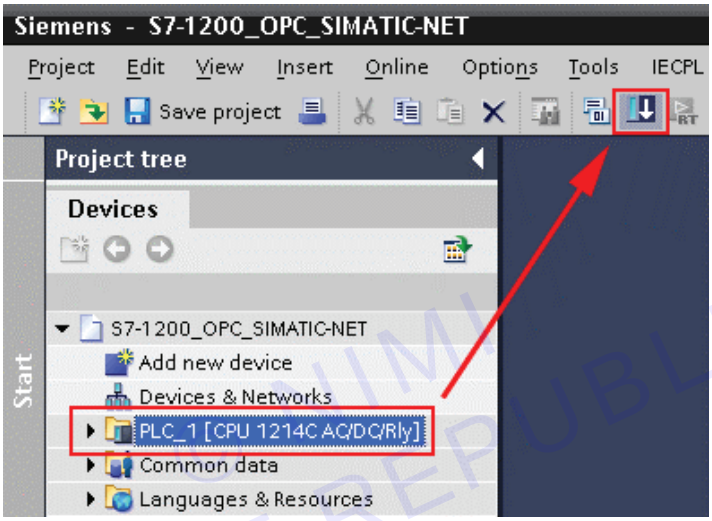
Bottlefiller



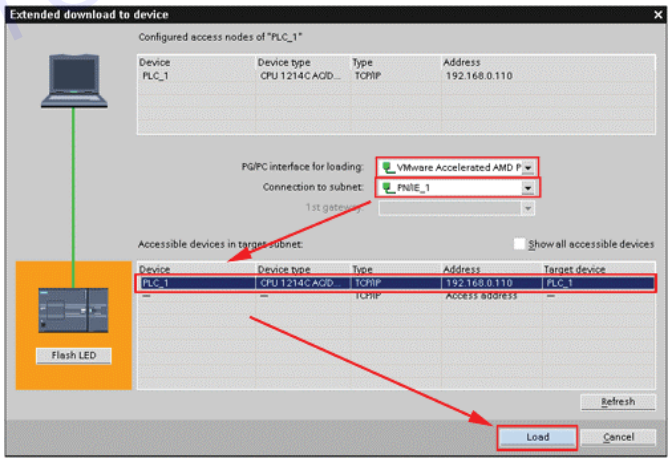


Compile and download the program

Press the “Download to device” button in the Toolbar.



The “Extended download to device” dialog box opens. Ensure that the selected PG/PC interface and subnet are correct. Select “PLC_1”. Click the “Load” button.



If you have downloaded your project before, the “load preview” dialog box may open instead of the “Extended download to device” dialog box.

Result: Thus the steps involved in programming S7-1200 PLC for reading of simple sensor data and controlling control valve has been successfully demonstrated.

EXERCISE 185: Force input and output devices using the software

Objectives

At the end of this exercise you shall be able to

- to create simple ladder logic using software
- force I/O divices from the software.

Requirements

Tools/Materials

- Power Supply - 1 No.
- Wiring Materials and connectors - 1 No.
- Communication Ports and cables - 1 No.
- PC/LAPTOP Latest configuration - 1 No.
- PLC for Programming - 1 No.

Procedure

Theory

Note: Most newer PLCs having its own configuration methods.Advised to follow respective user manual.(Most of the procedures are same), Considered Siemens PLC as an example.

Setting up your S7-1200 PLC using STEP 7 Basic

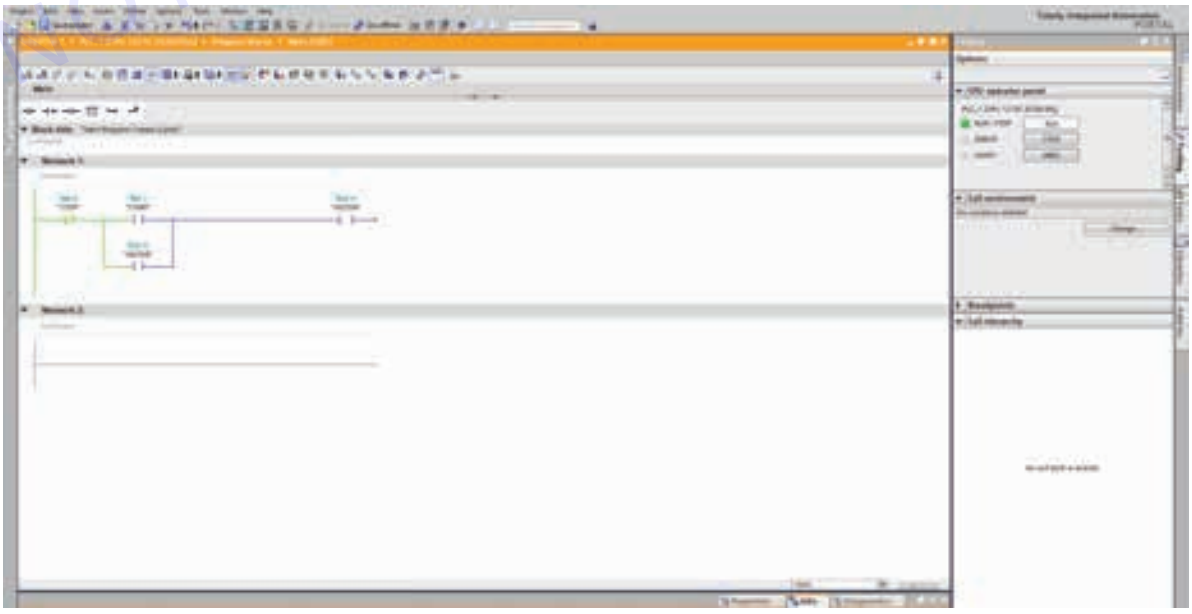
Configure your S7-1200 PLC and provide data to be monitored via an Open Platform Communications (OPC) connection.

Create a program in Main [OB1]

In the “Program blocks” folder of your PLC, double-click the “Main [OB1]” instruction. Copy the program shown in the next picture.

You will find the bit logic operations in the “Bit logic” folder in the “Instructions” pane on the “Instructions” task card. Drag’n’Drop the “Normally open contacts”, “the Output coil”, and the “Set/Reset flip-flop” into “Network 1” of your “Main [OB1]” work area, according to the picture shown below. Make sure that the input fields are configured in the same way as shown in the Fig 1.

Fig 1

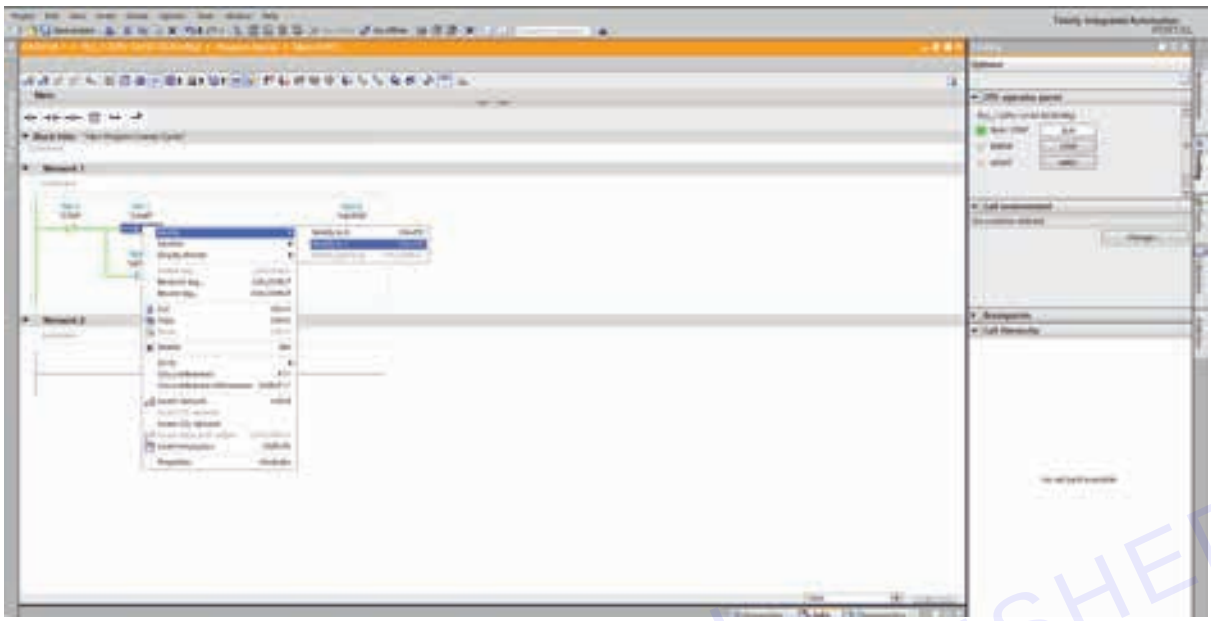


1 Right click on the specified IO device to force it to the other state.

2 Choose option as modify .

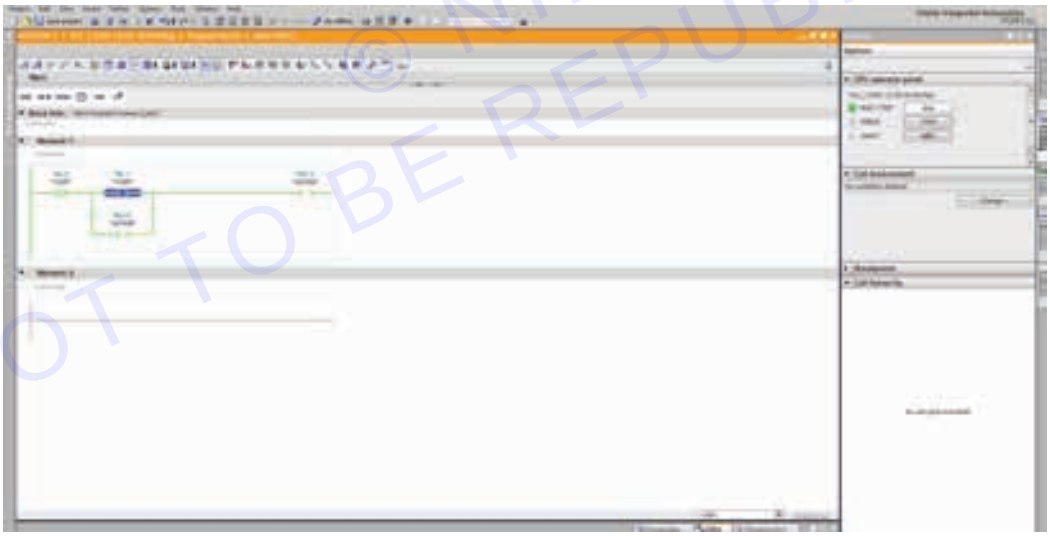
3 Choose modify to 1 from 0 or modify to o from 1 as shown in the Fig 2.

Fig 2



4 The output device is activated from the software as shown in the Fig 3

Fig 3



5 Similarly the another input divice is forced to change its state from the software as shown in the Fig 4 and Fig 5.

Fig 4

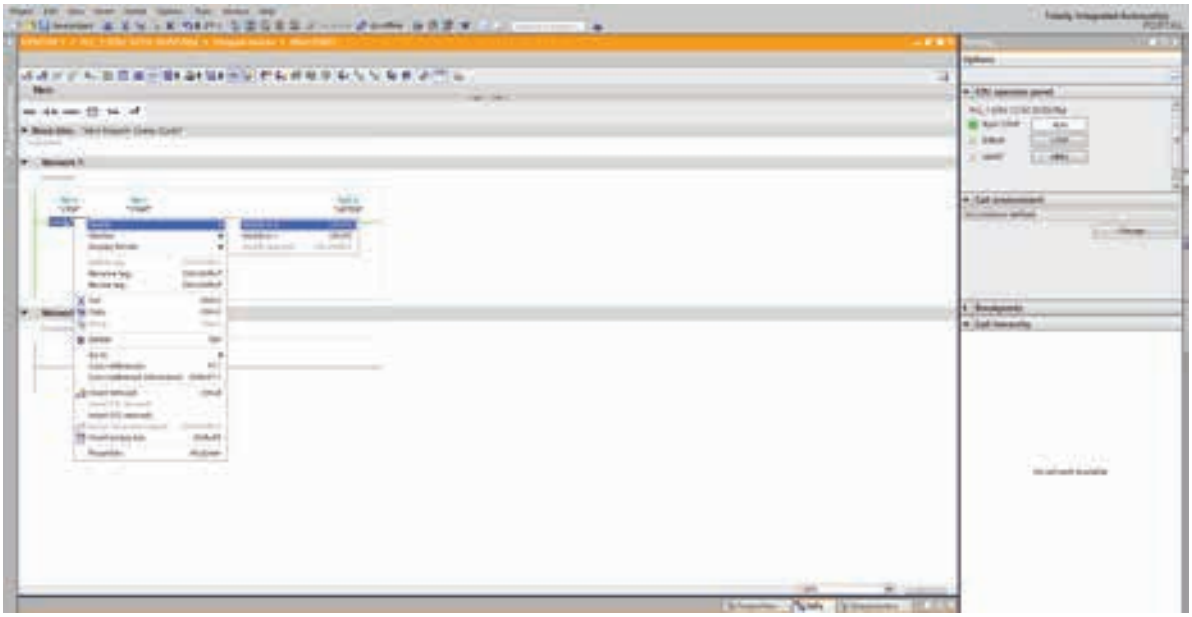
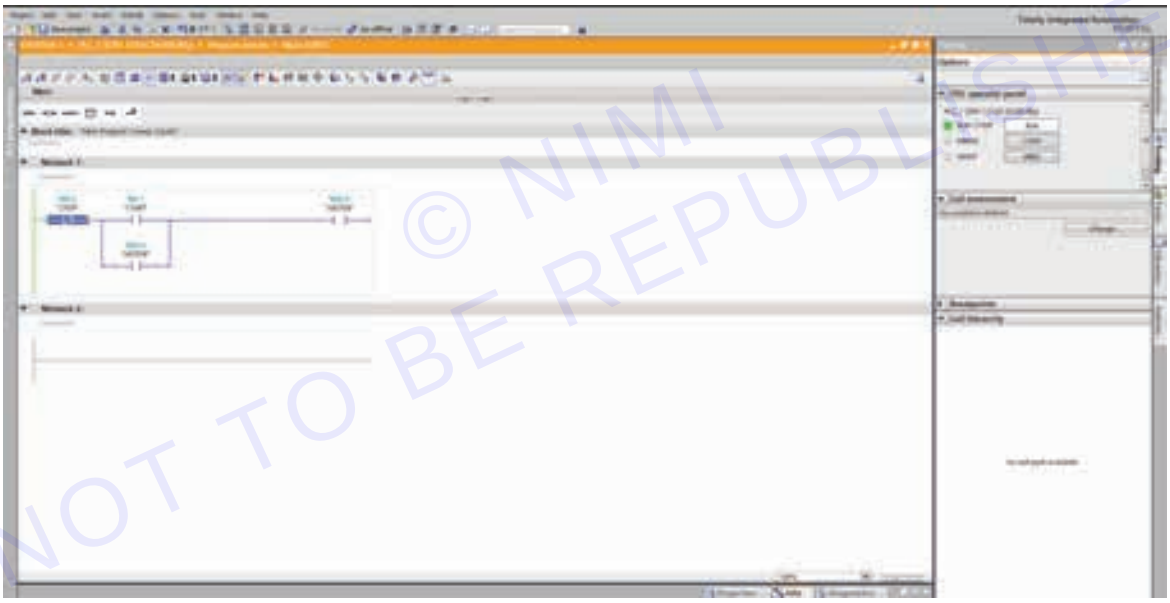


Fig 5



Result: Thus the steps involved in forcing the input output device from the software in the S7-1200 has been successfully demonstrated.

EXERCISE 186: Perform online editing of a rung/ network

Objectives

At the end of this exercise you shall be able to

- to create simple ladder logic program using software
- to demonstrate editing /creation of rung/ network from the software.

Requirements

Tools/Materials

- Power Supply - 1 No.
- Wiring Materials and connectors - 1 No.
- Communication Ports and cables - 1 No.
- PC/LAPTOP Latest configuration - 1 No.
- PLC for Programming - 1 No.

Procedure

Theory

Note: Most newer PLCs having its own configuration methods. Advised to follow respective user manual.(Most of the procedures are same), Considered Siemens PLC as an example.

Setting up your S7-1200 PLC using STEP 7 Basic

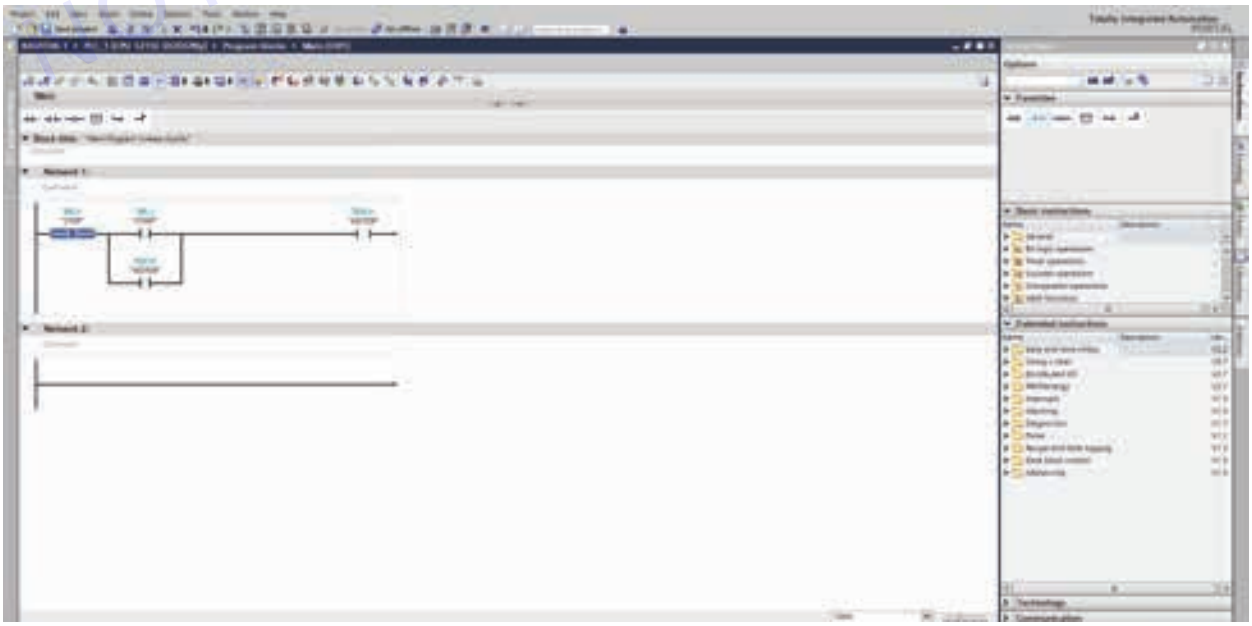
Configure your S7-1200 PLC and provide data to be monitored via an Open Platform Communications (OPC) connection.

Create a program in Main [OB1]

In the “Program blocks” folder of your PLC, double-click the “Main [OB1]” instruction. Copy the program shown in the next picture.

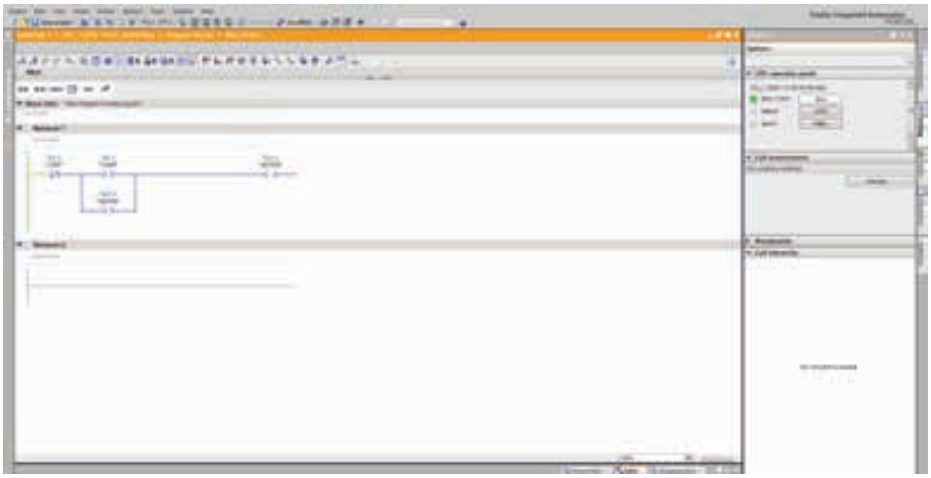
You will find the bit logic operations in the “Bit logic” folder in the “Instructions” pane on the “Instructions” task card. Drag’n’Drop the “Normally open contacts”, “the Output coil”, and the “Set/Reset flip-flop” into “Network 1” of your “Main [OB1]” work area, according to the picture shown below. Make sure that the input fields are configured in the same way as shown in the Fig 1.

Fig 1



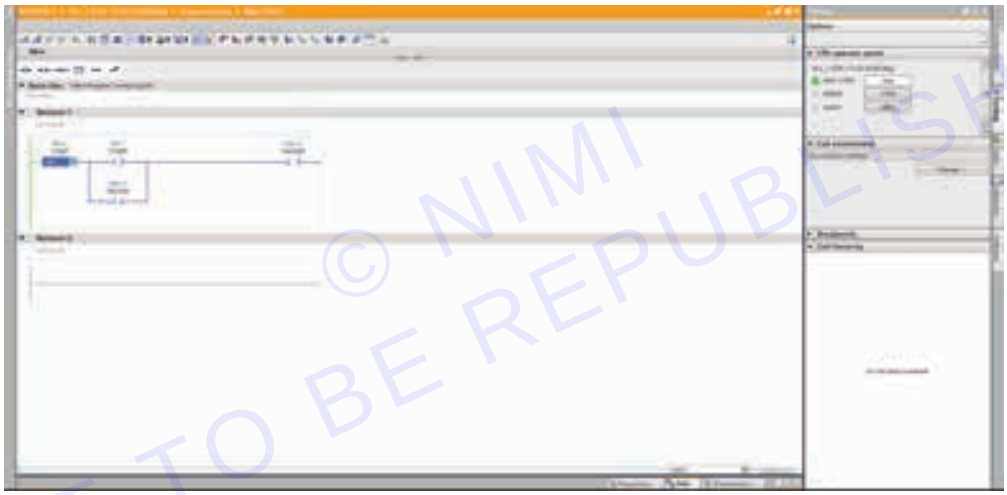
1 The program is online for editing in the network shown in the Fig 2.

Fig 2



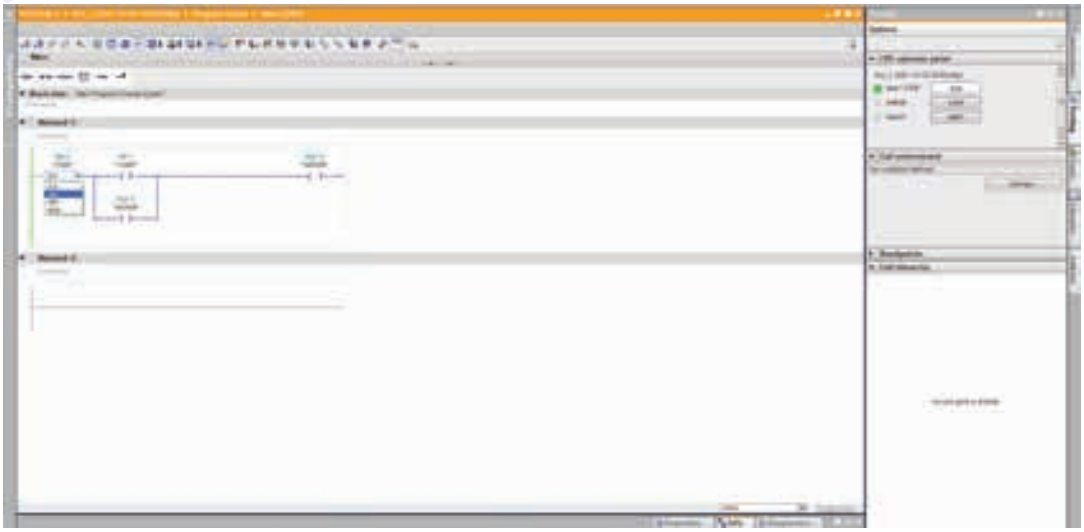
2 Right click on the specified IO Device when program is online for editing in the network shown in the Fig 3

Fig 3



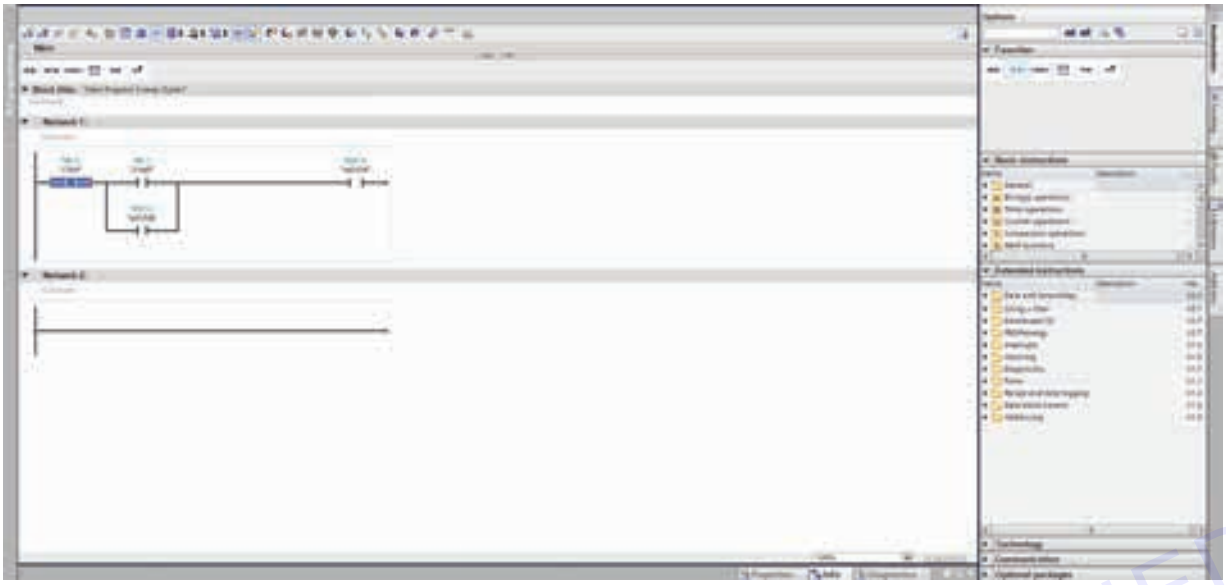
3 The possible IO devicees are listed in the drop down menu against down arrow as shown in Fig 4.

Fig 4



4. Select NO contact from the drop down menu in the ladder logic program and the Io device is changed from “NC” to “NO”as shown in Fig 5

Fig 5



Result: Thus the steps involved in creation and editing of Rung/Network was demonstrated successfully.

EXERCISE 187: Perepare data tables and monitor

Objectives

At the end of this exercise you shall be able to

- to create simple ladder logic program using software
- to demonstrate table creation from the software
- to demonstrate use of monitor command in PLC.

Requirements

Tools/ Materials

- Power Supply - 1 No.
- Wiring Materials and connectors - 1 No.
- Communication Ports and cables - 1 No.
- PC/LAPTOP Latest configuration - 1 No.
- PLC for Programming - 1 No.

Procedure

Theory

Note: Most newer PLCs having its own configuration methods.Advised to follow respective user manual.(Most of the procedures are same), Considered Siemens PLC as an example.

Setting up your S7-1200 PLC using STEP 7 Basic

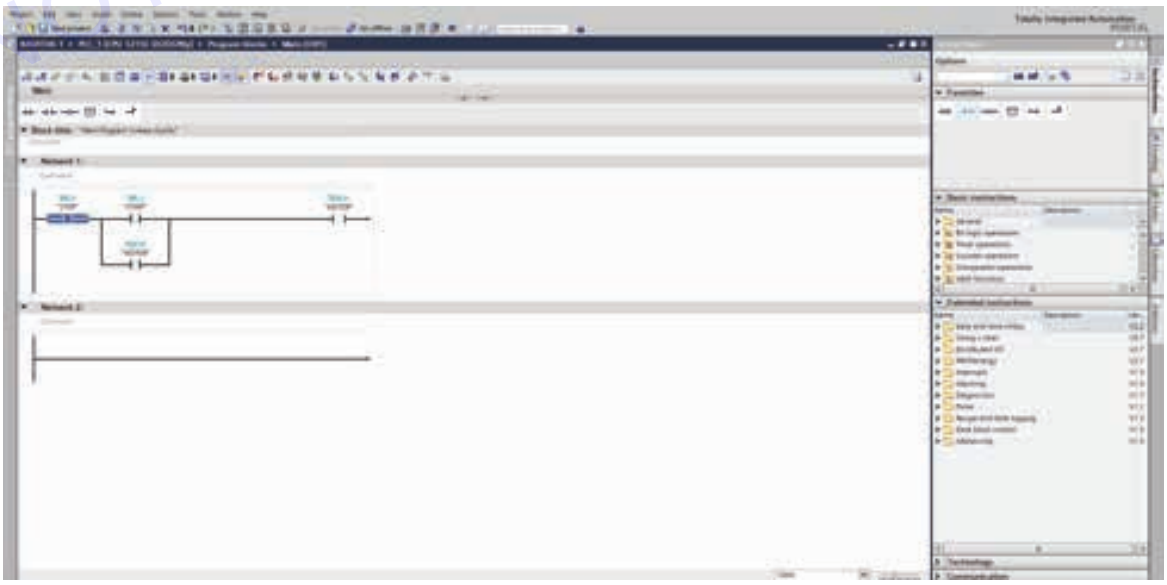
Configure your S7-1200 PLC and provide data to be monitored via an Open Platform Communications (OPC) connection.

Create a program in Main [OB1]

In the “Program blocks” folder of your PLC, double-click the “Main [OB1]” instruction. Copy the program shown in the next picture.

You will find the bit logic operations in the “Bit logic” folder in the “Instructions” pane on the “Instructions” task card. Drag’n’Drop the “Normally open contacts”, “the Output coil”, and the “Set/Reset flip-flop” into “Network 1” of your “Main [OB1]” work area, according to the picture shown below. Make sure that the input fields are configured in the same way as shown in the Fig 1.

Fig 1

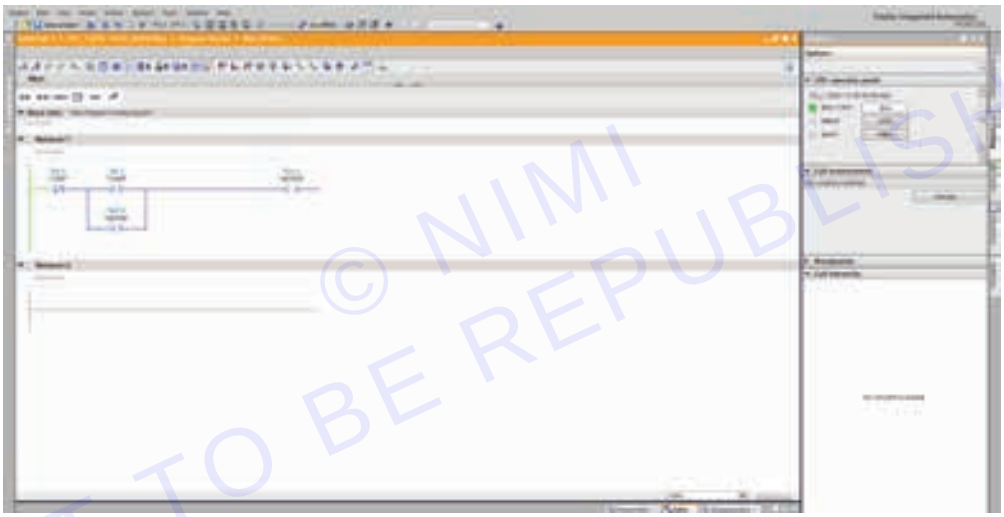


1 Click on the specified icon for monitor as shown in the Fig 2.

Fig 2

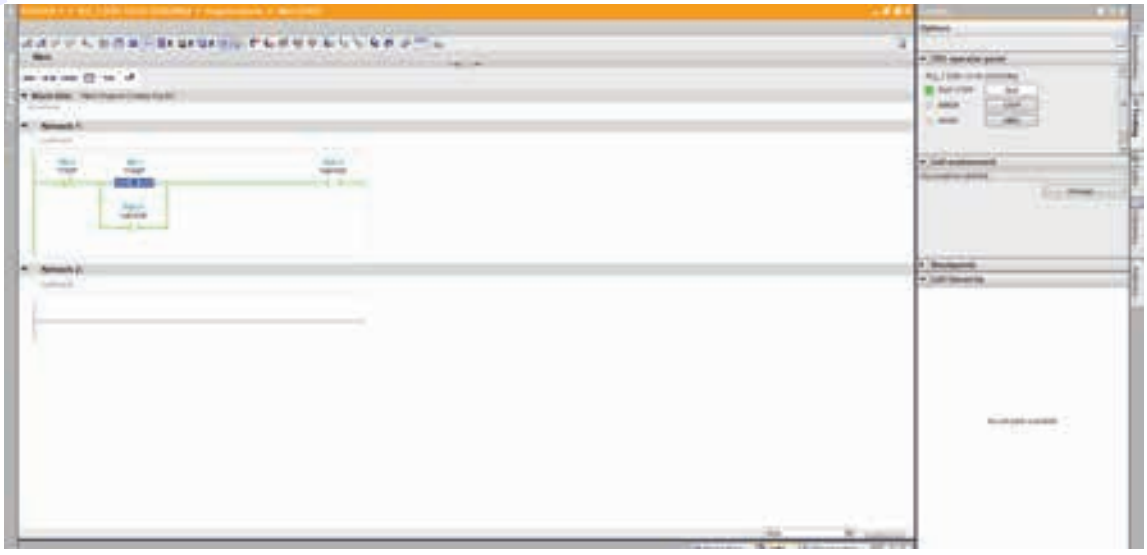
2 The signal flow status is clearly visible, programmer able to follow device energize status also as shown in Fig 3

Fig 3



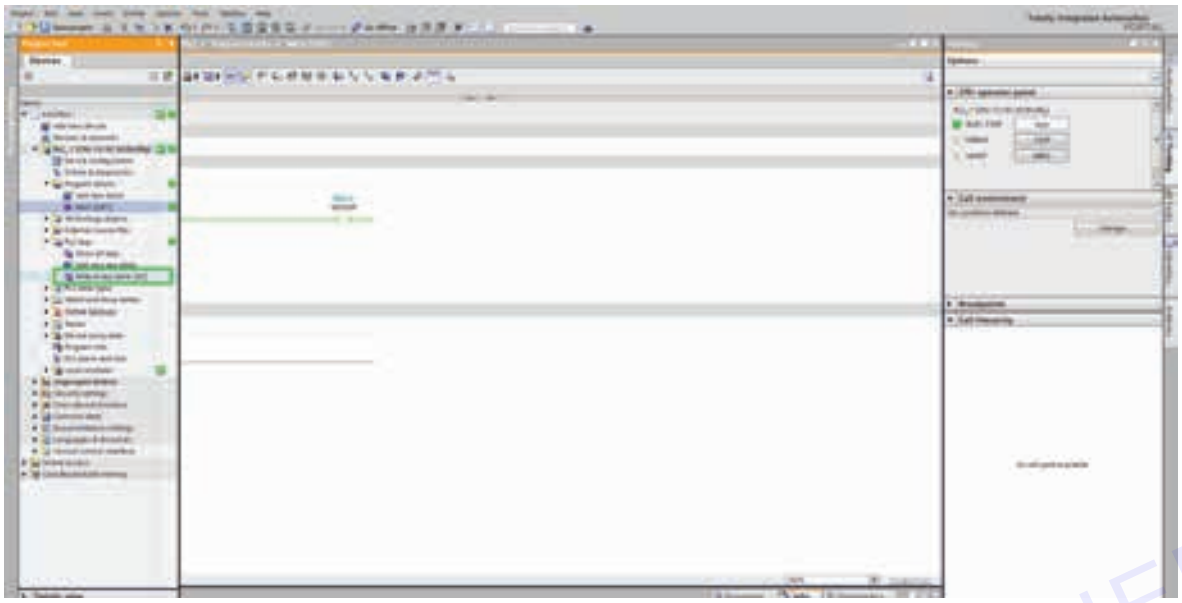
3 The signal flow status and Devize energize status is clearly visible, programmer able to follow device energize status as shown in Fig 4.

Fig 4



4 Select Default Tag table to create new table / to edit existing table as per the ladder logic program as shown in Fig 5

Fig 5



5 Default Tag table to created is shown in Fig 6, This table is created as per the ladder logic program is shown in Fig 1

Fig 6

Result: Thus the steps involved in using Monitor command and creation of table for the givel ladder logic program has been demonstrated successfully.

EXERCISE 188: Identification of different pneumatic and electro pneumatic components

Objectives

At the end of this exercise you shall be able to

- identify various Pneumatic and electro pneumatic components
- tabulate the symbols as per the ISO 1219.

Requirements

Tools/Materials

- Pneumatic trainer board - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- Pneumatic components - 1 Set.
- Electro Pneumatic components - 1 Set.

Procedure

Note: The instructor should explain the ISO symbols used for identification of all the components. Additionally, they should provide guidance on setting of the compressor air, specify the recommended limits for adjusting the pressure in the compressor. Furthermore, information on the number of ports and positions in the Valves. Pneumatic and electro-pneumatic components should be covered.

TASK 1: **Identification of Pneumatic and Electro Pneumatic Components**

1 Collect the pneumatic and electro-pneumatic components

2 Identify the pneumatic & Electro-Pneumatic components using ISO 1219 symbol.

3 Note down in the table.

Table

Sl No.	Components	Symbol

4 Get the result checked by the Instructor.

EXERCISE 189: Construct and control a Single Acting Cylinder

Objectives

At the end of this exercise you shall be able to

- select the components to construct and control a single acting cylinder
- construct the circuit on trainer board as per the diagram
- check the function of the circuit.

Requirements

Tools/Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- PU Tube - as reqd.
- Single Acting Cylinder - 1 No.
- 3/2 DC single solenoid valve - 1 No.
- FRL - 1 No.
- Push button switch - 1 No.
- Relay - 1 No.
- Connecting Cables - as reqd.

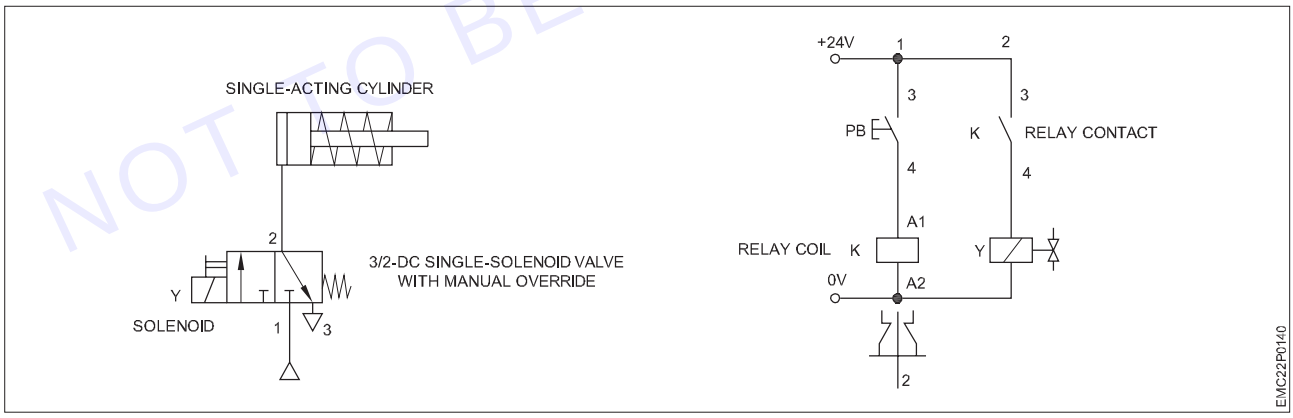
Procedure

TASK 1: **Select the components to construct and control the single acting cylinder**

1 Identify the components using ISO 1219 symbol

2 Check the DC supply by using the multi meter.

TASK 2a & 2b : **Construct the circuit and control the single acting cylinder**



A Pneumatic Connection

1 Ensure that you connected the compressed air outlet from the compressor to the input of the FRL unit.

This step is crucial for filtering, regulating, and lubricating the compressed air before it enters the pneumatic system

2 Adjust the regulator on the FRL to set the desired pressure, in this case, 6 bar.

Instructor should set the pressure limits on the compressor and FRL within the recommended range. Avoid to exceeding the maximum pressure capacity to prevent equipment failure and accidents.

3 Connect the output of the FRL to the input of the manifold. This manifold distributes the compressed air to various components in your pneumatic system.

4 Connect the input port (P) of the 3/2 Solenoid valve to the manifold. This valve controls the flow of compressed air to the next stage.

5 Connect the output port of the 3/2 Solenoid valve to the Single Acting Cylinder. This will control the air supply to the cylinder and determine its movement.

6 Instructor should check the connections properly

B Electric Connection

1 Connect one terminal of normally open (NO) contact (contact no.3) of the push button switch to the positive side (24V) of the power supply.

2 Connect the other terminal of NO contact (contact no.4) of the push button switch to the A1 terminal of the relay coil. This is typically the first coil input..

3 Connect the A2 terminal of the relay coil to the 0V (ground) of the power supply.

4 Connect one terminal of NO contact (contact no.3) of the relay to the positive side (24V) of the power supply.

5 Connect the other terminal of NO contact (contact no.4) of the relay to the solenoid coil. This is typically one of the terminals of the solenoid valve that controls the pneumatic actuator.

6 Connect the other terminal of the solenoid coil to the 0V (ground) of the power supply.

7 Ensure that all connections are secure and correct before proceeding.

8 Press and release the push button switch to serve as a manual control mechanism for the single- acting cylinder actuator

When the push button switch is pressed, it completes the circuit, energizing the relay coil, which in turn activates the solenoid valve connected to the single-acting cylinder. This allows compressed air to flow into the cylinder, causing it to extend or retract, depending on its design. Releasing the push button switch interrupts the circuit, de-energizing the relay coil and stopping the flow of compressed air to the cylinder, thus halting its movement.

9 Confirm with the instructor that the system is operating as expected and all connections are correct.

— — — — —

EXERCISE 190: Construct and control a Double Acting Cylinder

Objectives

At the end of this exercise you shall be able to

- select the components to construct and control the double acting cylinder
- construct the circuit on trainer board as per the diagram
- check the function of the circuit.

Requirements

Tools/ Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- FRL - 1 No.
- Double Acting Cylinder - 1 No.
- 5/2 DC single solenoid valve - 1 No.
- Push button switch - 1 No.
- Relay - as reqd.
- PU Tube - as reqd.
- Connecting Cables

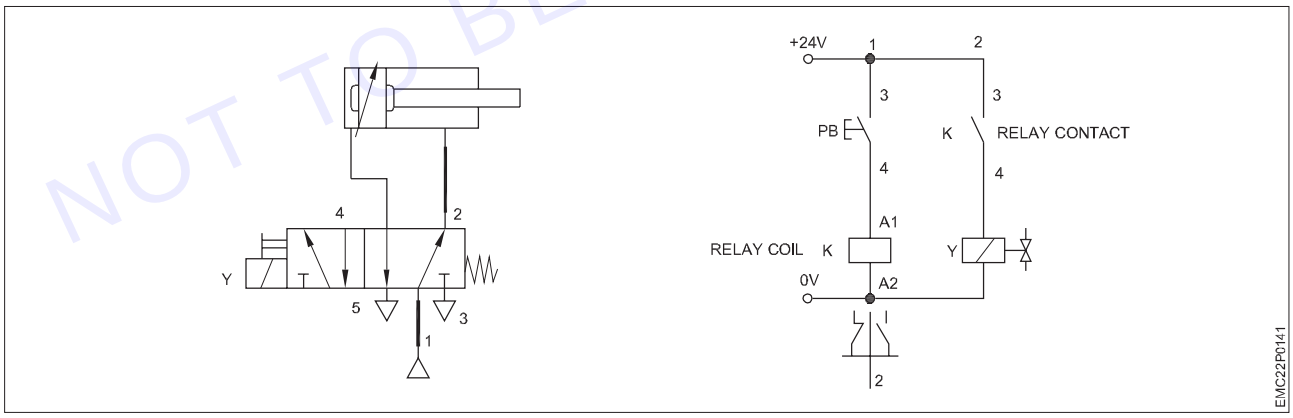
Procedure

TASK 1: **Select the components to construct and control the double acting cylinder**

1 Select the components to construct the circuit using ISO 1219 symbol.

2 Check the DC supply by using multi meter

TASK 2a & 2b : **Construct the circuit and control the double acting cylinder**



A Pneumatic Connection

1 Ensure that you connect the compressed air outlet from the compressor to the input of the FRL unit.

This step is crucial for filtering, regulating, and lubricating the compressed air before it enters the pneumatic system

2 Adjust the regulator on the FRL to set the desired pressure, in this case, 6 bar

Instructor should Set the pressure limits on the compressor and FRL within the recommended range. Avoid to exceed the maximum pressure capacity to prevent equipment failure and accidents.

3 Connect the output of the FRL to the input of the manifold. This manifold distributes the compressed air to various components in your pneumatic system.

4 Connect the input port (P) of the 5/2 Solenoid valve to the manifold. This valve controls the flow of compressed air to the next stage.

5 Connect Output port (Port No.2) of the 5/2 Single Solenoid valve to the Input (Piston Rod end side) port of the Double Acting Cylinder

6 Connect another Output port (Port No.4) of the 5/2 Single Solenoid valve to the Input (Piston head end side) port of the Double Acting Cylinder

7 Instructor should check the connections properly

B Electric Connection

1 Connect one terminal of the normally open (NO) contact (contact no.3) of the push button switch to the positive side (24V) of the power supply.

2 Connect the other terminal of the NO contact (contact no.4) of the push button switch to the A1 terminal of the relay coil. This is typically the first coil input..

3 Connect the A2 terminal of the relay coil to the 0V (ground) of the power supply.

4 Connect one terminal of the NO contact (contact no.3) of the relay to the positive side (24V) of the power supply.

5 Connect the other terminal of the NO contact (contact no.4) of the relay to the solenoid coil. This is typically one of the terminals of the solenoid valve that controls the pneumatic actuator.

6 Connect the other terminal of the solenoid coil to the 0V (ground) of the power supply.

7 Ensure that all connections are secure and correct before proceeding.

8 Press and release the push button switch to serve as a manual control mechanism for the single-acting cylinder actuator

When the push button switch is pressed, it completes the circuit, energizing the relay coil, which in turn activates the solenoid valve connected to the Double-acting cylinder. This allows compressed air to flow into the cylinder, causing it to extend or retract, depending on its design. Releasing the push button switch interrupts the circuit, de-energizing the relay coil and stopping the flow of compressed air to the cylinder, thus halting its movement.

9 Confirm with the instructor that the system is operating as expected and all connections are correct.

— — — — —

EXERCISE 191: Construct and control a double acting cylinder using series parallel circuits

Objectives

At the end of this exercise you shall be able to

- select the components to construct and control the Double Acting Cylinder using series and parallel circuits
- construct the circuit on trainer board as per the diagram
- check the function of the circuit.

Requirements

Tools/ Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- Double Acting Cylinder - 1 No.
- 5/2 DC single solenoid valve - 1 No.
- FRL - 2 Nos.
- Push button switch - 1 No.
- Relay - as reqd.
- PU Tube - as reqd.
- Connecting Cables

Procedure

TASK 1: **Select the components to construct and control a Double Acting Cylinder using series and parallel circuits**

1 Select the components to construct the circuit using ISO 1219 symbol.

2 Check the DC supply by using multi meter

— — — — —

TASK 2a & 2b :**Construct the circuit and control the a Double Acting Cylinder using series and parallel circuits**

A Pneumatic Connection

1 Connect the Compressor to the FRL

2 Set the FRL for 6 bar

3 Connect the FRL to the Manifold

4 Connect input port (Port No.1 or P) of the 5/2 Solenoid valve to the Manifold.

5 Connect Output port (Port No.2) of the 5/2 Solenoid valve to the Input (Piston Rod end side) of the Double Acting Cylinder

6 Connect another Output port (Port No.4) of the 5/2 Solenoid valve to the Input (Piston head end side) of the Double Acting Cylinder

Note: Instructor should check the connections properly

Instructor can set the pressure as per requirement

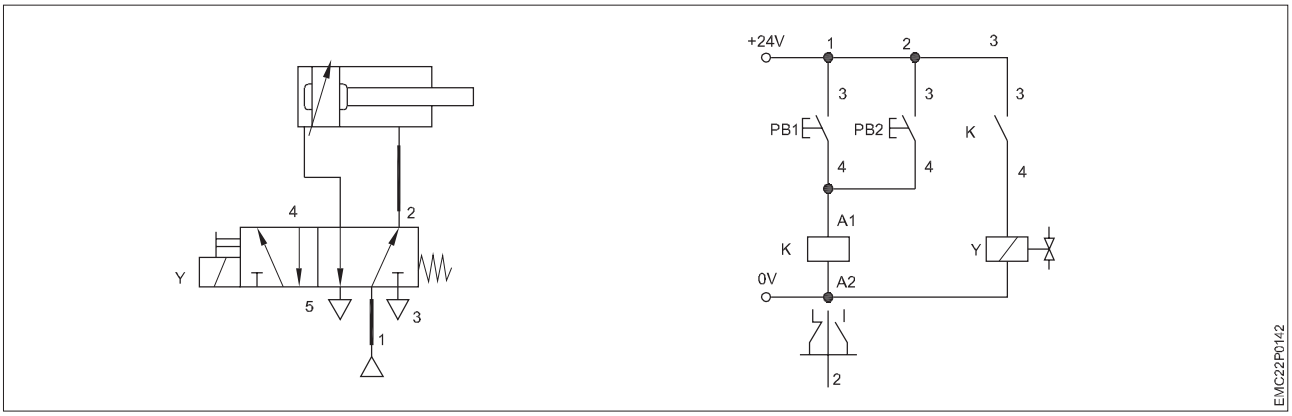
B Electric Connection – Parallel Operation

1 Connect the NO contact (contact no.3) of the Push button switch1 (PB1) to 24V of the power supply.

2 Connect another point of NO contact (contact no.4) of the Push button switch1 (PB1) to A1 of the Relay coil.

3 Connect the NO contact (contact no.3) of the Push button switch 2 (PB2) to 24V of the power supply.

4 Connect another point of NO contact (contact no.4) of the Push button switch 2 (PB2) to A1 of the Relay coil.



5 Connect A2 of the Relay coil to 0V of the power supply.

6 Connect the NO contact (contact no.3) of the Relay to 24V of the power supply.

7 Connect another point of NO contact (contact no.4) of the Relay to Solenoid coil.

8 Connect another point of the Solenoid coil to 0V of the power supply.

9 Get the connection checked by the Instructor.

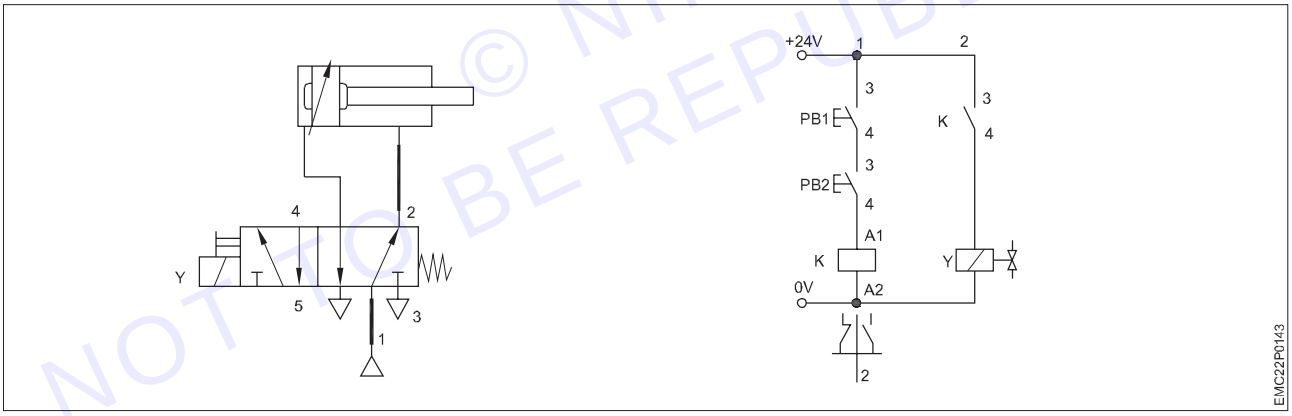
10 Switch on the Air supply.

11 Switch ON 24V DC power supply.

12 Observe the movement of double acting cylinder by press / release the PB1 & PB2.

13 Get the result checked by the Instructor.

C Electric Connection – Series Operation



1 Connect the NO contact (contact no.3) of the Push button switch1 (PB1) to 24V of the power supply.

2 Connect another point of NO contact (contact no.4) of the Push button switch1 (PB1) to NO contact (contact no.3) of the Push button switch 2 (PB2).

3 Connect another point of NO contact (contact no.4) of the Push button switch 2 (PB2) to A1 of the Relay coil.

4 Connect A2 of the Relay coil to 0V of the power supply.

5 Connect the NO contact (contact no.3) of the Relay to 24V of the power supply.

6 Connect another point of NO contact (contact no.4) of the Relay to Solenoid coil.

7 Connect another point of the Solenoid coil to 0V of the power supply.

8 Get the connection checked by the Instructor.

9 Switch on the Air supply.

10 Switch ON 24V DC power supply.

11 Observe the movement of Double acting cylinder by press / release the PB1 & PB2.

12 Get the result checked by the Instructor

EXERCISE 192: Construct and perform bidirectional control a double acting cylinder

Objectives

At the end of this exercise you shall be able to

- select the components to construct bidirectional control of the double acting cylinder
- construct the circuit on trainer board as per the diagram
- check the performance of the circuit.

Requirements

Tools/ Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- FRL - 1 No.
- Double Acting Cylinder - 1 No.
- 5/2 DC double solenoid valve - 1 No.
- Push button switch - 1 No.
- Relay - as reqd.
- PU Tube - as reqd.
- Connecting cables

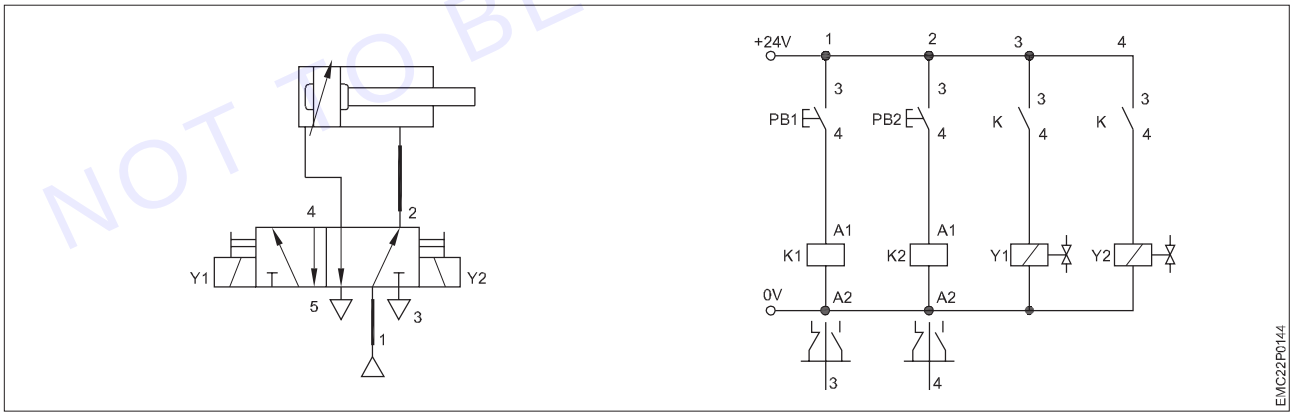
Procedure

TASK 1: **Select the components to construct bidirectional control of the double acting cylinder**

1 Select the components to construct the circuit using ISO 1219 symbol.

2 Check the DC supply by using multi meter

TASK 2 & 3 : **Construct the circuit for bidirectional control of the double acting cylinder A Pneumatic Connection**



A Pneumatic Connection

1 Connect the Compressor to the FRL

2 Set the FRL for 6 bar

3 Connect the FRL to the Manifold

4 Connect input port (Port No.1 or P) of the 5/2 Solenoid valve to the Manifold.

5 Connect Output port (Port No.2) of the 5/2 Solenoid valve to the Input (Piston Rod end side) of the Double Acting Cylinder

6 Connect another Output port (Port No.4) of the 5/2 Solenoid valve to the Input (Piston head end side) of the Double Acting Cylinder

Note: Instructor should check the connections properly

Instructor can set the pressure as per requirement

B Electric Connection

1 Connect the NO contact (contact no.3) of the Push button switch1 (PB1) to 24V of the power supply.

2 Connect another point of NO contact (contact no.4) of the Push button switch1 (PB1) to A1 of the Relay coil (K1).

3 Connect A2 of the Relay coil(K1) to 0V of the power supply.

4 Connect the NO contact (contact no.3) of the Relay (K1) to 24V of the power supply.

5 Connect another point of NO contact (contact no.4) of the Relay(K1) to Solenoid coil Y1.

6 Connect another point of the Solenoid coil Y1 to 0V of the power supply.

7 Connect the NO contact (contact no.3) of the Push button switch 2 (PB2) to 24V of the power supply.

8 Connect another point of NO contact (contact no.4) of the Push button switch 2 (PB2) to A1 of the Relay coil (K2).

9 Connect A2 of the Relay coil(K2) to 0V of the power supply.

10 Connect the NO contact (contact no.3) of the Relay (K2) to 24V of the power supply.

11 Connect another point of NO contact (contact no.4) of the Relay (K2) to Solenoid coil Y2.

12 Connect another point of the Solenoid coil Y2 to 0V of the power supply.

13 Get the connection checked by the Instructor.

14 Switch on the Air supply.

15 Switch ON 24V DC power supply.

16 Observe the movement of Double acting cylinder by press / release the PB1 & PB2.

17 Get the result checked by the Instructor.

— — — — —

EXERCISE 194: Construct and control the Oscillating motion of a double acting cylinder

Objectives

At the end of this exercise you shall be able to

- select the components to construct and control the oscillating motion of a double acting cylinder
- construct the circuit on trainer board as per the diagram
- check the function of the circuit.

Requirements

Tools/ Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- FRL - 1 No.
- Double Acting Cylinder - 1 No.
- 5/2 DC double solenoid valve - 1 No.
- Push button switch - 1 No.
- Relay - 2 Nos.
- Limit Switch - as reqd.
- PU Tube - as reqd.
- Connecting cables

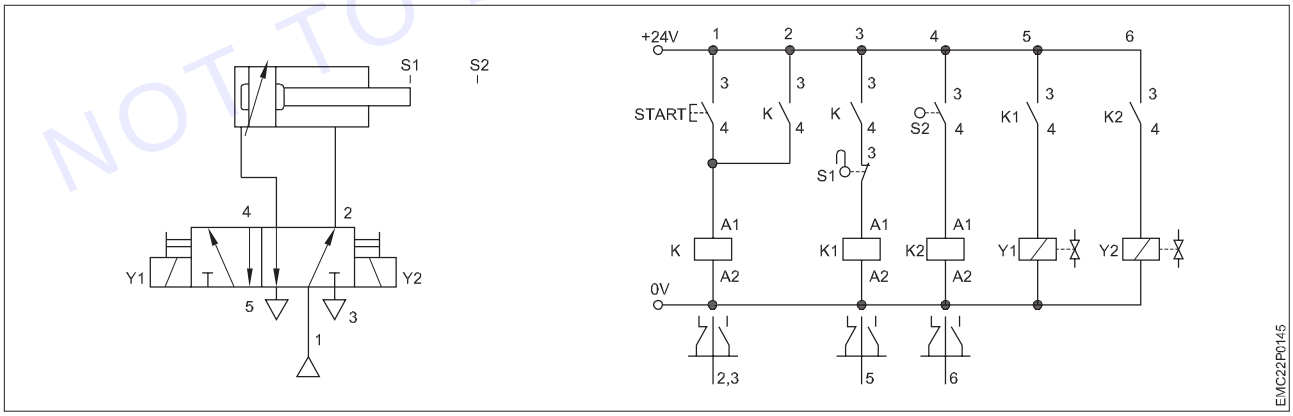
Procedure

TASK 1: **Select the components to construct and control the automatic return of a double acting cylinder**

1 Select the components to construct the circuit using ISO 1219 symbol .

2 Check the DC supply by using multi meter

TASK 2 & 3 : **Construct the circuit and control the oscillating motion of a double acting cylinder**



A. Pneumatic Connection

1 Connect the Compressor to the FRL

2 Set the FRL for 6 bar

3 Connect the FRL to the Manifold

4 Connect input port (Port No.1 or P) of the 5/2 Solenoid valve to the Manifold.

5 Connect Output port (Port No.2) of the 5/2 Solenoid valve to the Input (Piston Rod end side) of the Double Acting Cylinder

6 Connect another Output port (Port No.4) of the 5/2 Solenoid valve to the Input (Piston head end side) of the Double Acting Cylinder

7 Fix the Limit switch 1 at home position of the Cylinder piston Rod.

8 Fix the Limit switch 2 at extreme end position of the Cylinder piston Rod.

Note: Instructor should check the connections properly
Instructor can set the pressure as per requirement
Check the Limit switch position

B Electric Connection

1 Connect the NO contact (contact no.3) of the Push button switch (PB) to 24V of the power supply.

2 Connect another point of NO contact (contact no.4) of the Push button switch (PB) to the NO contact (contact no.4) of the Limit Switch 1.

3 Connect Common contact (contact no.1) of the Limit Switch1 to A1 of the Relay coil (K1).

4 Connect A2 of the Relay coil(K1) to 0V of the power supply.

5 Connect the NO contact (contact no.3) of the Relay (K1) to 24V of the power supply.

6 Connect another point of NO contact (contact no.4) of the Relay (K1) to Solenoid coil Y1.

7 Connect another point of the Solenoid coil Y1 to 0V of the power supply.

8 Connect the NO contact (contact no.4) of the Limit Switch 2 to 24V of the power supply.

9 Connect Common contact (contact no.1) of the Limit Switch 2 to A1 of the Relay coil (K2).

10 Connect A2 of the Relay coil(K2) to 0V of the power supply.

11 Connect the NO contact (contact no.3) of the Relay (K2) to 24V of the power supply.

12 Connect another point of NO contact (contact no.4) of the Relay (K2) to Solenoid coil Y2.

13 Connect another point of the Solenoid coil Y2 to 0V of the power supply.

14 Get the connection checked by the Instructor.

15 Switch on the Air supply.

16 Switch ON 24V DC power supply.

17 Observe the oscillation motion of the Double acting cylinder by press / release the PB

18 Get the result checked by the Instructor.

— — — — —

EXERCISE 195: Construct and control a single acting cylinder using latching circuit

Objectives

At the end of this exercise you shall be able to

- select the components to construct and control a single acting cylinder using latching circuit
- construct the circuit on trainer board as per the diagram
- check the function of the circuit.

Requirements

Tools/Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- PU Tube - as reqd.
- Single Acting Cylinder - 1 No.
- 3/2 DC single solenoid valve - 1 No.
- FRL - 1 No.
- Push button switch - 1 No.
- Relay - 2 Nos.
- Connecting cables

Procedure

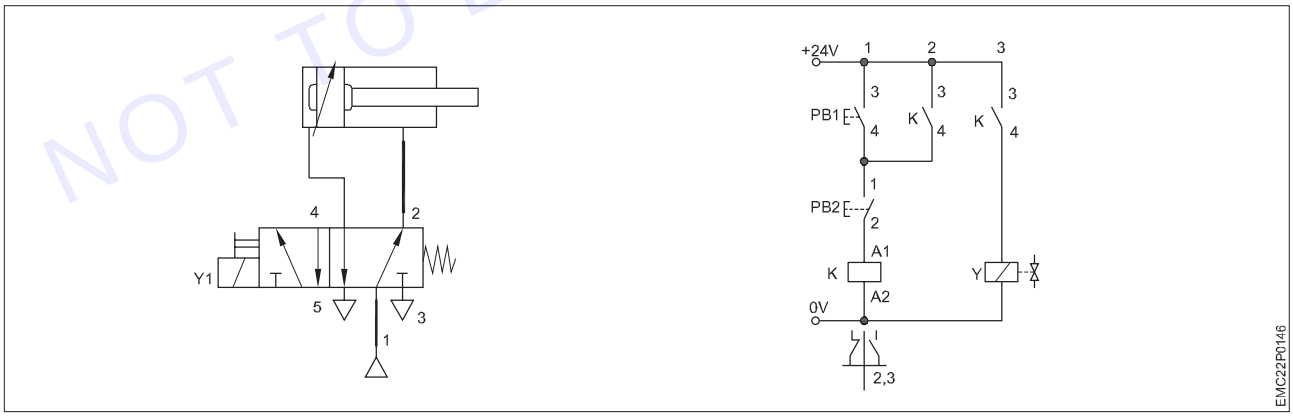
TASK 1: **Select the components to construct and control the single acting cylinder**

Using the Latching circuit

1 Identify the components using ISO 1219 symbol

2 Check the DC supply by using multi meter

TASK 2 & 3 : **Construct the circuit and control the oscillating motion of a double acting cylinder**



A Pneumatic Connection

1 Connect the Compressor to the FRL

2 Set the FRL for 6 bar

3 Connect the FRL to the Manifold

4 Connect input port (Port No.1 or P) of the 3/2 Solenoid valve to the Manifold.

5 Connect Output port of the 3/2 Solenoid valve to the Single Acting Cylinder

Note:- Instructor should check the connections properly

Instructor can set the pressure as per requirement

Instructor should check the relay coil connections

B Electric Connection

1 Connect the NO contact (contact no.3) of the Push button switch to 24V of the power supply.

2 Connect another point of the NO contact (contact no.4) of the Push button switch to A1 of the Relay coil.

3 Connect A2 of the Relay coil to 0V of the power supply.

4 Connect the NO contact (contact no.13) of the Relay to 24V of the power supply.

5 Connect another point of NO contact (contact no.14) of the Relay to the A1 of the Relay coil.

6 Connect the NO contact (contact no.23) of the Relay to 24V of the power supply.

7 Connect another point of NO contact (contact no.24) of the Relay to the Solenoid coil.

8 Connect another point of the Solenoid coil to 0V of the power supply.

9 Get the connection checked by the Instructor.

10 Switch on the Air supply.

11 Switch ON 24V DC power supply.

12 Observe the movement of single acting cylinder by press / release the push button switch.

13 Get the result checked by the Instructor.

— — — — —

EXERCISE 193&196: Construct and control Automatic return of a Double Acting Cylinder by Limit Switch

Objectives

At the end of this exercise you shall be able to

- select the components to construct and control automatic return of the double acting cylinder by Limit Switch
- construct the circuit on trainer board as per the diagram
- check the function of the circuit.

Requirements

Tools/ Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- FRL - 1 No.
- Double Acting Cylinder - 1 No.
- 5/2 DC double solenoid valve - 12 No.
- FRL - 1 No.
- Push button switch - 1 No.
- Relay - 2 Nos.
- Limit Switch - as reqd.
- PU Tube - as reqd.
- Connecting cables

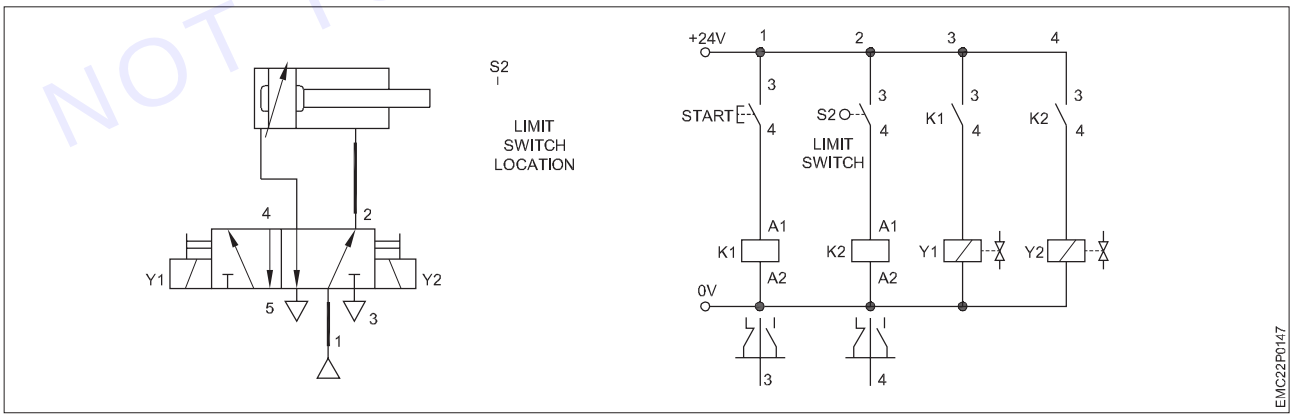
Procedure

TASK 1: **Select the components to construct and control the automatic return of a double acting cylinder**

1 Select the components to construct the circuit using ISO 1219 symbol

2 Check the DC supply by using multi meter

TASK 2 & 3: **Construct the circuit and control the automatic return of a double acting cylinder**



A Pneumatic Connection

1 Connect the Compressor to the FRL

2 Set the FRL for 6 bar

3 Connect the FRL to the Manifold

4 Connect input port (Port No.1 or P) of the 5/2 Solenoid valve to the Manifold.

5 Connect Output port (Port No.2) of the 5/2 Solenoid valve to the Input (Piston Rod end side) of the Double Acting Cylinder

6 Connect another Output port (Port No.4) of the 5/2 Solenoid valve to the Input (Piston head end side) of the Double Acting Cylinder

7 Fix the Limit switch S2 at extreme end position of the Cylinder piston Rod.

Note:- Instructor should check the connections properly
Instructor can set the pressure as per requirement
Check the Limit switch position

B Electric Connection

1 Connect the NO contact (contact no.3) of the Push button switch (PB) to 24V of the power supply.

2 Connect another point of NO contact (contact no.4) of the Push button switch (PB) to A1 of the Relay coil (K1).

3 Connect A2 of the Relay coil(K1) to 0V of the power supply.

4 Connect the NO contact (contact no.3) of the Relay (K1) to 24V of the power supply.

5 Connect another point of NO contact (contact no.4) of the Relay(K1) to Solenoid coil Y1.

6 Connect another point of the Solenoid coil Y1 to 0V of the power supply.

7 Connect the NO contact (contact no.4) of the Limit Switch to 24V of the power supply.

8 Connect Common contact (contact no.1) of the Limit Switch to A1 of the Relay coil (K2).

9 Connect A2 of the Relay coil(K2) to 0V of the power supply.

10 Connect the NO contact (contact no.3) of the Relay (K2) to 24V of the power supply.

11 Connect another point of NO contact (contact no.4) of the Relay (K2) to Solenoid coil Y2.

12 Connect another point of the Solenoid coil Y2 to 0V of the power supply.

13 Get the connection checked by the Instructor.

14 Switch on the Air supply.

15 Switch ON 24V DC power supply.

16 Observe the automatic return of the Double acting cylinder by press / release the PB

17 Get the result checked by the Instructor.

— — — — —

EXERCISE 197: Throttle a cylinder to adjust forward and return strokes

Objectives

At the end of this exercise you shall be able to

- select the components to construct the throttling of a double acting cylinder
- construct the circuit on trainer board as per the diagram
- check the function of the circuit.

Requirements

Tools/Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- FRL - 1 No.
- Double Acting Cylinder - 1 No.
- 5/2 DC single solenoid valve - 1 No.
- Push button switch - 1 No.
- Relay - 1 No.
- Throttle Valve - as reqd.
- PU Tube - as reqd.
- Connecting cables

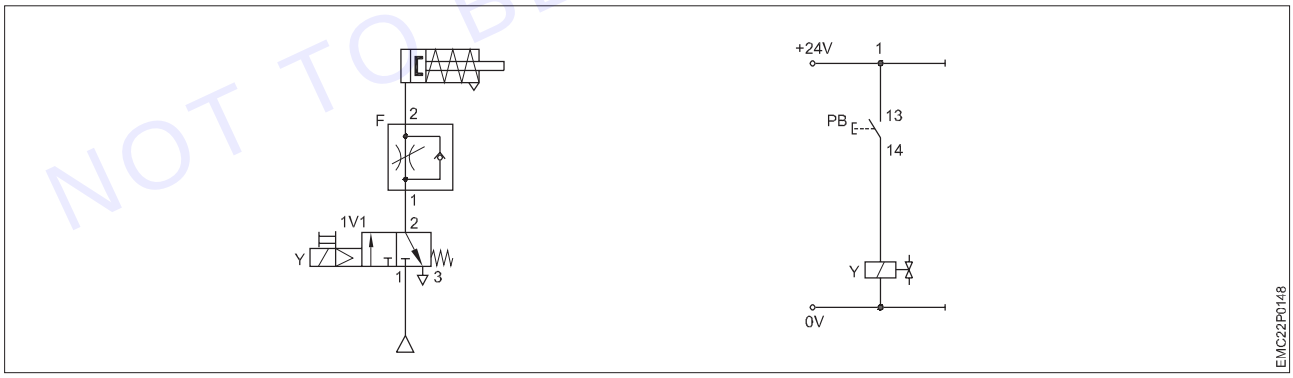
Procedure

TASK 1: **Select the components to construct and control the speed of a double acting cylinder**

1 Select the components to construct the circuit using ISO 1219 symbol

2 Check the DC supply by using multi meter

TASK 2 & 3 : **Construct the circuit and control the speed of a double acting cylinder**



A Pneumatic Connection

1 Connect the Compressor to the FRL

2 Set the FRL for 6 bar

3 Connect the FRL to the Manifold

4 Connect input port (Port No.1 or P) of the 5/2 Solenoid valve to the Manifold.

5 Connect Output port (Port No.2) of the 5/2 Single Solenoid valve to the Input port of the Throttle Valve.

6 Connect Output port of the Throttle valve to the Input (Piston Rod end side) port of the Double Acting Cylinder

7 Connect another Output port (Port No.4) of the 5/2 Single Solenoid valve to the Input (Piston head end side) port of the Double Acting Cylinder

Note:- Instructor should check the connections properly
Instructor can set the pressure as per the requirement

B Electric Connection

1 Connect the NO contact (contact no.3) of the Push button switch to 24V of the power supply.

2 Connect another point of the NO contact (contact no.4) of the Push button switch to A1 of the Relay coil.

3 Connect A2 of the Relay coil to 0V of the power supply.

4 Connect the NO contact (contact no.3) of the Relay to 24V of the power supply.

5 Connect another point of NO contact (contact no.4) of the Relay to Solenoid coil.

6 Connect another point of the Solenoid coil to 0V of the power supply.

7 Get the connection checked by the Instructor.

8 Switch on the Air supply.

9 Switch ON 24V DC power supply.

10 Observe the movement of double acting cylinder by press / release the push button switch and observe the speed variation of the Double acting cylinder by open / close the throttle valve.

11 Get the result checked by the Instructor.

— — — — —

EXERCISE 198: Construct and control a double acting cylinder by adjust the pressure as per the requirements

Objectives

At the end of this exercise you shall be able to

- select the components to construct and control a double acting cylinder by adjust the pressure
- construct the circuit on trainer board as per the diagram
- check the function of the circuit.

Requirements

Tools/Materials

- Pneumatic trainer board - 1 No.
- Digital multimeter with probes - 1 No.
- Regulated DC power supply 24V/2A - 1 No.
- Pneumatic Source - 1 No.
- FRL - 1 No.
- Double Acting Cylinder - 1 No.
- 5/2 DC single solenoid valve - 1 No.
- Push button switch - 1 No.
- Pressure Switch - 1 No.
- Relay - as reqd.
- PU Tube - as reqd.
- Connecting cables

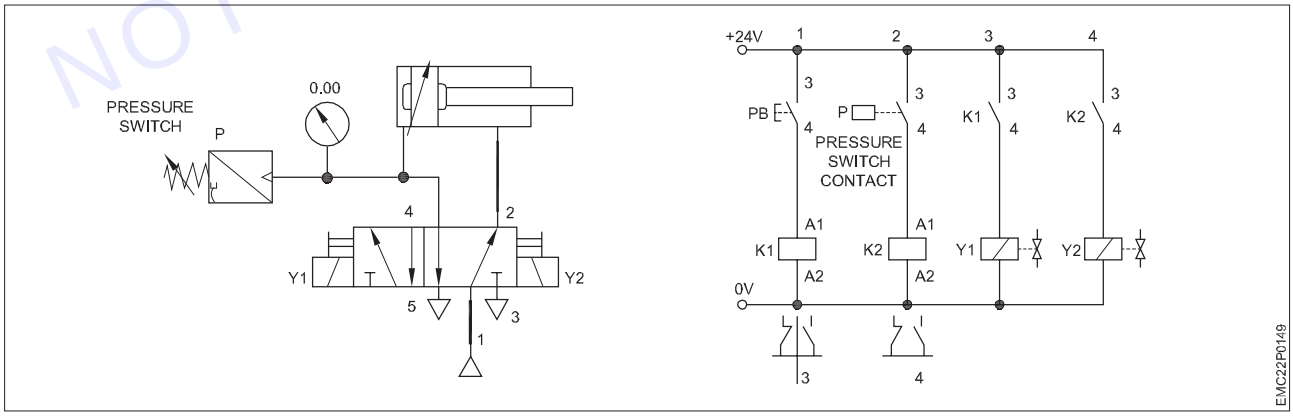
Procedure

TASK 1: **Select the components to construct and control the double acting cylinder by adjust the pressure**

1 Identify the components using ISO 1219 symbol.

2 Check the DC supply by using multi meter

TASK 2 &3 : **Construct the circuit and control the double acting cylinder by adjust the Pressure**



A Pneumatic Connection

1 Connect the Compressor to the FRL

2 Set the FRL for 6 bar

3 Connect the FRL to the Manifold

4 Connect input port (Port No.1 or P) of the 5/2 Solenoid valve to the Manifold.

5 Connect Output port (Port No.4) of the 5/2 Single Solenoid valve to the P1 terminal of the Pressure Switch, Gauge and the Input (Piston head end side) port of the Double Acting Cylinder

6 Connect another Output port (Port No.2) of the 5/2 Single Solenoid valve to the Input (Piston rod end side) port of the Double Acting Cylinder

Note:- Instructor should check the connections properly
Instructor can set the pressure as per the requirement

B Electric Connection

1 Connect the NO contact (contact no.3) of the Push button switch to 24V of the power supply.

2 Connect another point of the NO contact (contact no.4) of the Push button switch to A1 of the Relay coil (K1).

3 Connect A2 of the Relay coil (K1) to 0V of the power supply.

4 Connect the NO contact (contact no.3) of the Relay (K1) to 24V of the power supply.

5 Connect another point of NO contact (contact no.4) of the Relay (K1) to Solenoid coil Y1.

6 Connect another point of the Solenoid coil Y1 to 0V of the power supply.

7 Connect P1 of the Pressure switch to the 24V supply.

8 Connect P2 of the Pressure switch to the 0V supply.

9 Connect output terminal of the Pressure switch to A1 of the Relay coil (K2).

10 Connect A2 of the Relay coil (K2) to 0V of the power supply.

11 Connect the NO contact (contact no.3) of the Relay (K2) to 24V of the power supply.

12 Connect another point of NO contact (contact no.4) of the Relay (K2) to Solenoid coil Y2.

13 Connect another point of the Solenoid coil Y2 to 0V of the power supply.

14 Get the connection checked by the Instructor.

15 Switch on the Air supply.

16 Switch ON 24V DC power supply.

17 Observe the movement of double acting cylinder by press / release the push button switch,

18 Observe the speed variation of the Double acting cylinder by Loose / Tight the FRL Regulator Knob and set the pressure in the Pressure Switch.

19 Get the result checked by the Instructor.

— — — — —

MODULE 20: 3-Phase rectifier controlled & uncontrolled

EXERCISE 199: Construct and test three phase uncontrolled rectifiers (Half wave and Bridge Rectifiers)

Objectives

At the end of this exercise you shall be able to:

- to demonstrate input and output waveforms of half wave rectifiers
- To demonstrate input and output waveforms of bridge rectifiers.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- Desktop PC/lap Top Latest Specification - 1 No.
- Diodes - 6 Nos.
- Variable Resistive Load - 1 No.
- Three Phase AC Power Supply 220V - 1 No.
- DC Ammeter - 1 No.
- DC Voltmeter - 1 No.
- Oscilloscope - 1 No.
- Connecting Wires - as reqd.

Note:

Three-phase half-wave and full-wave rectifiers are employed in high-power applications where three-phase AC power is accessible. uncontrolled rectifiers have lower efficiency than more sophisticated controlled rectifiers.

Three-phase half-wave rectifier has the advantage of simplicity since it requires only three diodes. output voltage is lower than other types of rectifiers since only one of the three phases is used at a time.

Procedure

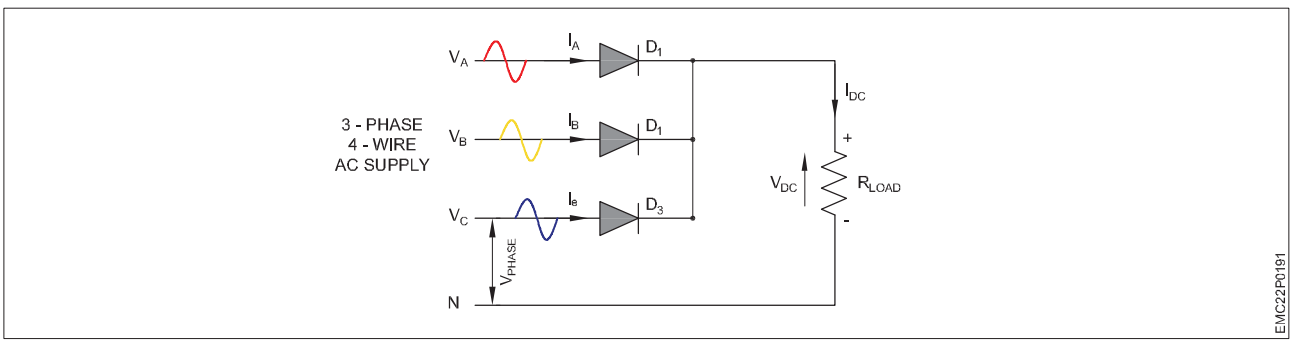
1 Wire up the half wave rectifier circuit after testing all the components.

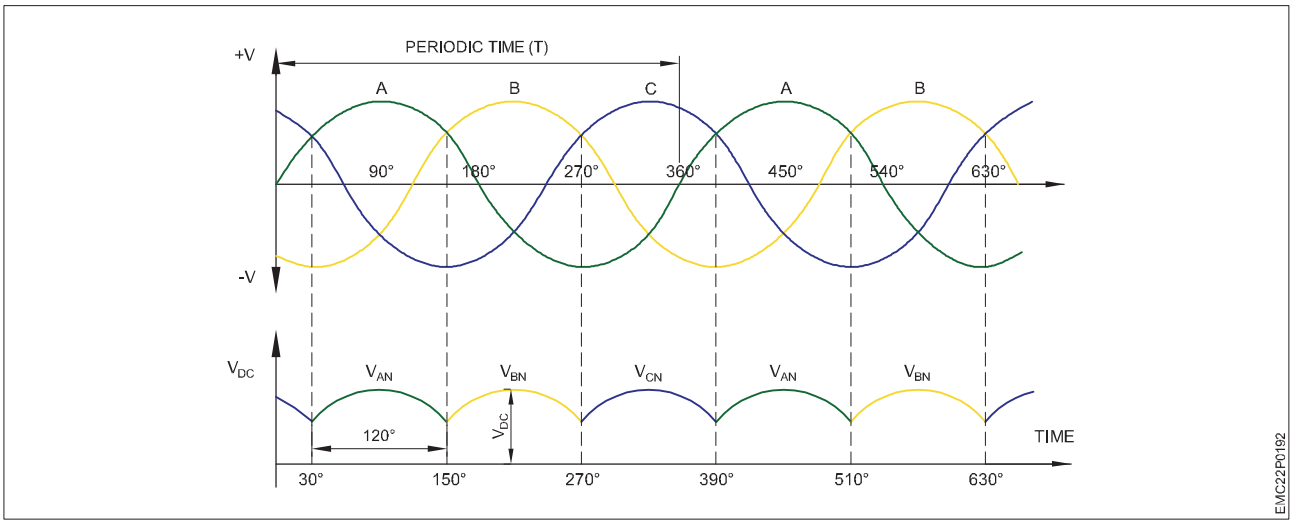
For a three-phase half-wave rectifier, the supply voltages VA VB and VC are balanced but with a phase difference of 120° giving:

$V_A = V_P \times \sin(\omega t - 0°)$

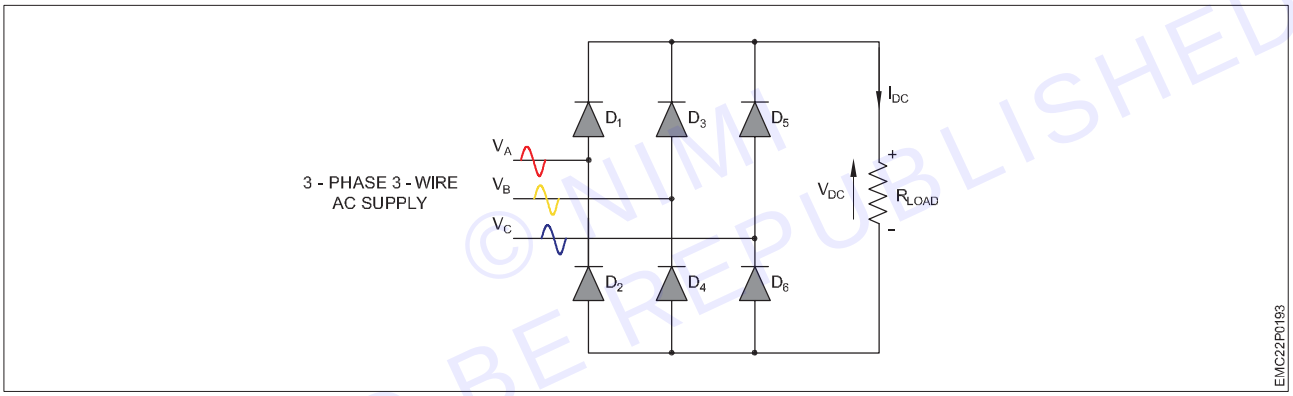
$V_B = V_P \times \sin(\omega t - 120°)$

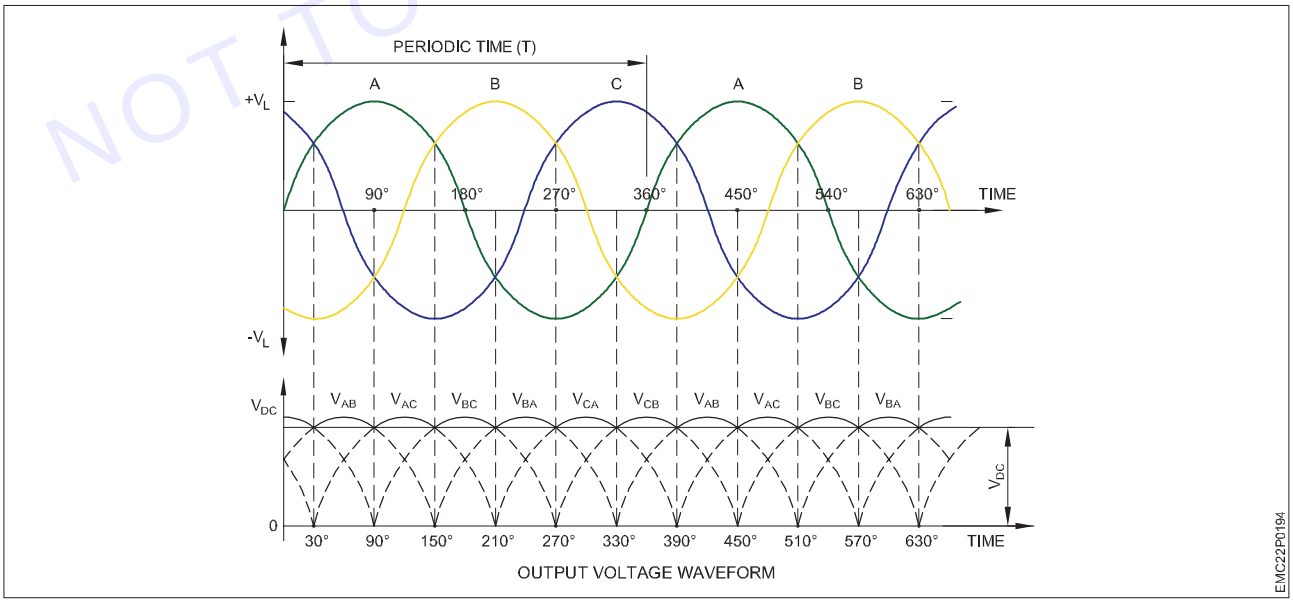
$V_C = V_P \times \sin(\omega t - 240°)$





2 Switch ON the main supply. Observe the transformer secondary voltage waveform and output voltage waveform across the load resistor,CRO screen.





3 Note down Vm and calculate Vrms and Vdc.

4 Calculate the ripple factor, rectifier efficiency, % regulation using formula.

In 3-phase power rectifiers, conduction always occurs in the most positive diode and the corresponding most negative diode. Thus as the three phases rotate across the rectifier terminals, conduction is passed from diode to diode.

Each diode conducts for 120° (one-third) in each supply cycle but as it takes two diodes to conduct in pairs, each pair of diodes will conduct for only 60° (one-sixth) of a cycle at any one time as shown above.

We can correctly say that for a 3-phase rectifier being fed by "3" transformer secondary, each phase will be separated by 360°/3 thus requiring 2 x 3 diodes.

Time period from 0° to 30°

$V_C > V_A > V_B \Rightarrow$ Diodes D_5 and D_4 are ON

Diode D_1 is OFF (Anode voltage V_A is lower than cathode voltage V_C)

Diode D_2 is OFF (Anode voltage V_B is lower than cathode voltage V_A)

Diode D_3 is OFF (Anode voltage V_B is lower than cathode voltage V_C)

Diode D_6 is OFF (Anode voltage V_B is lower than cathode voltage V_C)

So, the load voltage is equal to: $V_{load} = V_C - V_B$

Time period from 30° to 90°

$V_A > V_C > V_B \Rightarrow$ Diodes D_1 and D_4 are ON

Diode D_2 is OFF (Anode voltage V_B is lower than cathode voltage V_A)

Diode D_3 is OFF (Anode voltage V_B is lower than cathode voltage V_A)

Diode D_5 is OFF (Anode voltage V_C is lower than cathode voltage V_A)

Diode D_6 is OFF (Anode voltage V_B is lower than cathode voltage V_C)

So, the load voltage is equal to: $V_{load} = V_A - V_B$

Related Formula:

For half wave rectifier:

The peak input voltage vp, the average value of output waveform is:

Vdc = 3 x 1.732/2 x 3.14 x Vp = 0.827 x Vp

Vp = 1.414 x Vrms

Vrms = Vp/1.414

Where Vrms = rms value of input,

Vdc = average value of input

Vm=Peak value of input.

The average DC value of the output voltage waveform is:

Vdc = 3 x 1.732/3.14 x Vs = 1.65 x Vs

Where Vs is equal to VL /1.732

Ripple factor = Vrm fl/Vfl x 100%

For bridge rectifier:

Vdc = 3 x 1.732/3.14 x Vs=1.65 x Vs

Where Vs is equal to VL peak/1.732

VL is the maximum line to line voltage (VL*1.414)

Ripple factor =0.48

5 Repeat the above steps for bridge rectifier.

Result:

Hence, the construction and testing of three phase uncontrolled rectifier using diodes was verified and waveforms were drawn.

EXERCISE 200&201:Single phase Half controlled and Full Controlled rectifiers

Objectives

At the end of this exercise you shall be able to

- to obtain the characteristics of three-phase, half-wave, uncontrolled rectifier circuit feeding a resistive load
- the characteristics include (average load voltage and current, diode voltage and supply power factor)
- to obtain the characteristics of single-phase, full-wave, uncontrolled rectifier circuit feeding a resistive load
- the characteristics include (average load voltage and current, diode voltage and supply power factor).

Requirements

Tools/Equipments/Instruments

- Screw driver kit - 1 No.
- Combination plier - 1 No.
- Circuit tester - 1 No.
- Manual guide - 1 No.

Materials/Components

- Three-phase power supply 415V, 16A - 1 No.
- Three-phase resistive load 415V, 16A - 1 Nos.
- Variable Resistive Load 700mH - 1 No.
- Switched capacitive load 4kvar - 1 No.
- General purposes dual beam oscilloscope 0-30mhz - 1 No.
- AC/DC digital voltmeter/ammeter - 1 No.
- Moving iron voltmeter/ammeter - 1 No.
- Set of patched lead - 1 No.

Procedure

TASK 1 :

1 Connect the circuit shown :

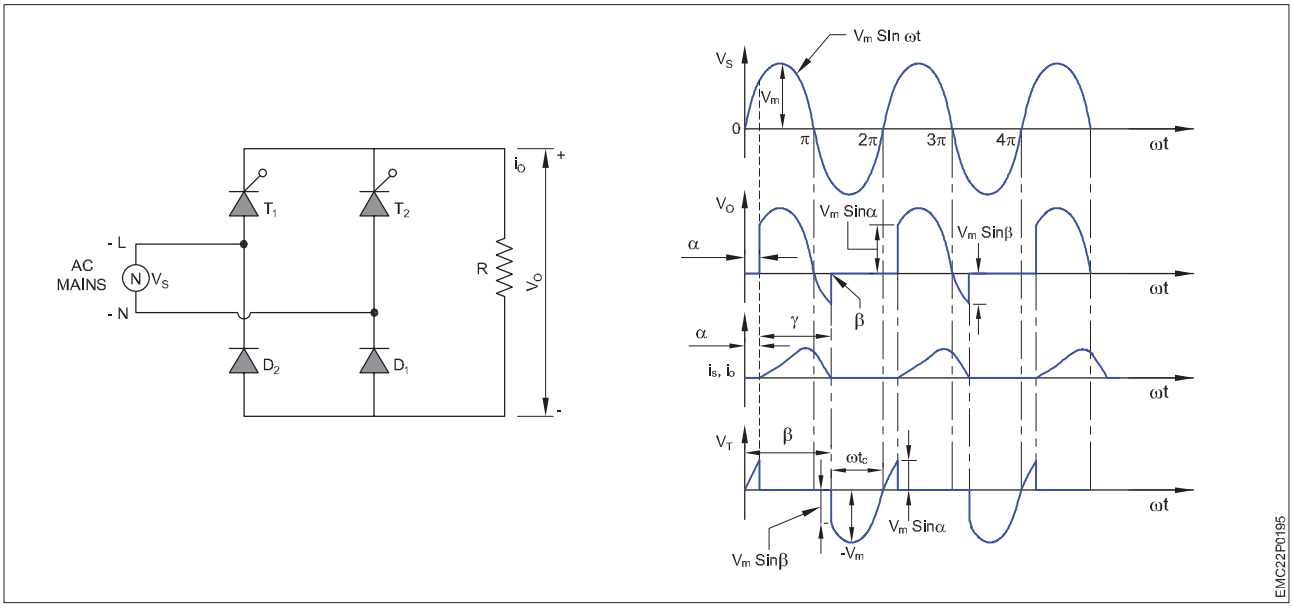
2 Draw the waveforms of the load voltage, load current and diode voltage

3 Compute the average values of the load voltage and current

4 Measure the average values of the load voltage and current

Table 1

	Average voltage	Average current
Computed values		
Measured values		



5 What is the frequency of the output load voltage?

_____

6 Compute the supply power factor

_____

7 The maximum value of the diode voltage is _____

Discussion

Discuss the following statements:

- Compare between the output voltage of this experiment with the pervious experiments.
- Explain the commutation process in this circuit.

_____

_____

Comment by the Student

_____

_____

_____

— — — — —

TASK 2 :

1 Measure the values of the average load voltage and current

2 Compute the values of the average load voltage and current

3 Draw the waveform of the load voltage and diode voltage. From the load voltage waveform, calculate:

Average load voltage, V_{av} =……

The frequency of the load voltage, f_o =……

Compare between the measured and computed values of the average load voltage.

_____

_____

From the diode waveform, the maximum diode voltage is _____

4 Measure and compute the RMS value of the load voltage

V_{rms} (measured) = _____, V_{rms} (computed) = _____

5 Calculate the supply power factor

pf = _____

Discussion

Discuss with a comparison the results obtained in Experiment(1) and the results of this experiment.

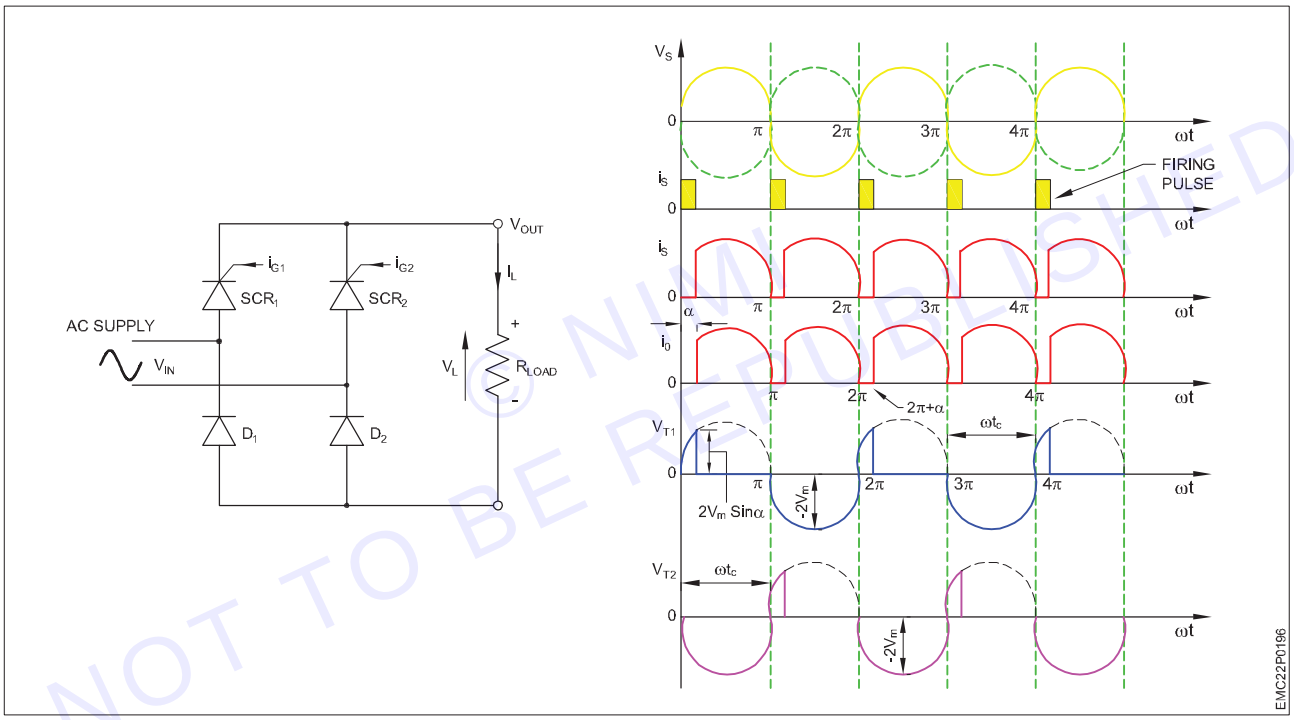
_____

_____

Comment by the Student

_____

_____



EXERCISE 202&203: Demonstrate and replace the faulty components in 3-phase controlled rectifiers

Objectives

At the end of this exercise you shall be able to

- to demonstrate and Identify the faulty components in 3-phase controlled rectifiers
- to demonstrate the procedures to replace the faulty components in 3-phase controlled rectifiers.

Requirements

Tools/ Equipments/ Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

Materials/ Components

- 3-Phase controlled Rectifier 1phase/ 3phase, 415V, 20A, 50Hz - 1 No.
- DMM Compatible to 10 HP motor - 1 No.
- DSO 30MHZ - as reqd.

Procedure

1 Warning

Operating personnel should observe the following before attempting to operate or adjust the rectifier:

- Do not tamper with AC power supply terminals of AC circuit within the rectifier unless the AC power, external to the unit, is turned “OFF”. Contact with this high voltage can produce sever or fatal shock.
- Do not exceed AC or DC ratings of the rectifier. Operating the rectifier at higher than nameplate ratings will result in eventual failure of the rectifier.
- If overload protection trips repeatedly, investigate and eliminate cause before attempting further operation of rectifier.
- If rectifier components overheat, or there is any evidence of electrical failure, turn rectifier “OFF” immediately. Do not attempt to operate rectifier until proper inspection and repairs have been completed.
- The positive DC output terminals should always be connected to the anodes. NEVER connect this positive DC terminal to the structure to be protected, as irreparable damage will occur to the structure.
- Return instruction manual and wiring diagrams to pocket provided on the inside of door. Do not place in bottom of rectifier and allow ventilation to be restricted.
- Oil immersed rectifiers must have the oil level maintained at the specified level for proper cooling of components and also to meet rigid requirements for Class 1, Group D hazardous areas.
- For three phase units, all similar (coarse or fine) voltage tap settings MUST be on the same “step” in all phases before AC power is turned “ON”. Operating the rectifier with destroy the transformer.
- Return instruction manual and wiring diagrams to pocket provided on the inside of door. Do not place in bottom of rectifier and allow ventilation to be restricted.

2 Routine checks prior to operation

Your Universal Rectifier was fully inspected, carefully tested and was in top operating condition at the time of shipment. Instances where damage has resulted in shipping, handling, storage or installation are rare but possible. As a result, the following routine checks of your Universal Rectifier as well as the external AC and DC circuits are recommended:

- VISUAL INSPECTION. Inspect unit for possible damage that may have resulted in shipping, handling or installation. If damage exists, do not attempt operation of rectifier until repairs have been complete.

- AC POWER SUPPLY. Check phase and voltage of AC power supply. These should correspond to AC ratings of the unit, which is stamped on the nameplate.
- DC CIRCUITS. Zero the DC meters. External DC load should be in proper operating condition. Connect ground bed (anodes) to positive (+) DC output terminal. Connect structure to be protected to negative (-) DC output terminals.
- CONNECTIONS. Make sure all connections to and in your Universal Rectifier are tight. Where Universal voltage tap changer is used, voltage tap adjusting knobs need only be hand tight.

3 To place your universal rectifier in the constant current operation:

When in operation, the actual DC voltage and current output of the Universal Rectifier are indicated by the meter select switch for the LCD meter on the instrument panel of the rectifier. Care should be taken that these meter readings do not exceed either the DC voltage or DC current ratings of the unit. If ratings are exceeded, simply turn the corresponding current adjust rheostat counter clockwise until unit is operating in designed limits.

- The voltage/current link bar must be on the current side. Turn all current adjust rheostats to highest setting (clockwise) and set all coarse and fine taps to a setting slightly above the current you want to maintain.
- Turn external AC power supply “ON”.
- Close circuit breaker or safety switch of rectifier (“ON” position).
- Check DC ammeter and voltage readings on instrument panel.

4 To adjust dc current:

The following steps should be followed in sequence observing precautions in steps I, II and III until desired DC current is attained.

- With the coarse and fine tap link bars set in the position slightly above the current you want, decrease output current adjust knob counter clockwise till desired current is obtained. The rectifier will now maintain the current setting.

5 To place your universal rectifier in the constant voltage operation:

When in operation, the actual DC voltage and current output of the Universal Rectifier are indicated by the meter select switch for the LCD meter on the instrument panel of the rectifier. Care should be taken that these meter readings do not exceed either the DC voltage or DC current ratings of the unit. If ratings are exceeded, simply step down the coarse and fine taps until unit is operating in designed limits.

- The voltage/current link bar must be on the voltage side. Note: all current adjust rheostats will now be out of the circuit. Set all coarse and fine taps to a desired setting.
- Turn external AC power supply “ON”.
- Close circuit breaker or safety switch of rectifier (“ON” position).
- Check DC ammeter and voltage readings on instrument panel.

6 General maintenance instructions

- Voltage, current and ambient temperature ratings of unit should not be exceeded.
- Routine cleanliness should be maintained.
- Adequate ventilation must be provided - screened openings should be kept free of obstructions.
- All electrical connections should be tight.
- Severe overloads can permanently damage rectifiers and special precautions may be required for abnormal or persistent overload exposures.
- For oil immersed units, oil should be inspected periodically. Oil should be replaced when contaminated.

7 Maintaining desired current and voltage

The rectifier unit will respond to electrical changes in the system external to the unit. Such as pronounced fluctuation of the AC line voltage or changes in ground bed resistance. Such changes can alter the operating

DC voltage and/or current output of the rectifier. Periodic inspections should be made to assure desired operation and prevent any overloading. Voltage adjustments should be made as required. A permanent record of the current and voltage readings should be maintained. Any pronounced change that is not attributable to current adjustment should be investigated.

8 Trouble shooting hints

A wiring diagram for use by experienced personnel is provided. Only experienced electrical personnel should attempt location and repair of electrical difficulties, should they occur. Some symptoms of elementary trouble and the possible remedy are as follows:

- No dc current or dc voltage output on just one zone. Check: fuse on auto board
- No dc current or dc voltage output on any zone.
- Check: ac overload protection for blown fuses (located behind main panel) or tripped circuit breaker. Check ac power supply.
- Dc voltage but no dc current reading.
- Check: dc ammeter. Check dc connections and external dc circuit for electrical continuity.
- Dc current reading but no dc voltage reading. Check: check dc voltmeter
- Maximum rated dc voltage cannot be attained.
- Check: check ac line voltage. Check current adjustment settings for maximum. Check accuracy of dc voltmeter.
- Maximum rated dc current cannot be obtained at maximum dc voltage.
- Check: check load resistance of external dc circuit. Check accuracy of dc ammeter.
- Check voltage across each thyristor , if faulty change the respective thyristor,

Result: Thus the demonstration on replacement of faulty components in the of faulty rectifiers have been done successfully.

EXERCISE 204: Test three phase, controlled rectifier for half wave and full wave using SCRs

Objectives

At the end of this exercise you shall be able to:

- to demonstrate three phase, controlled rectifier half wave using SCRs.
- to demonstrate three phase, controlled rectifier Full wave using SCRs.
- to draw the characteristics from observations.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.
- Ammeter/Voltmeter - 1 No.
- 3-phase Variac - 1 No.
- Multi-meter - 1 No.
- Type of Loads (R/R-L load) - 1 No.
- Patch Chord/ Connecting leads - 1 No.

Materials/ Components

- 3-phase Power modulator Kit - 1 No.
- DSO - 6 Nos.

Note:

Three phase converters are extensively used in industrial application up to 120kw level.

A full converters circuit, the thyristor is fired at an interval of π/3. The frequency of output ripple voltage is 6fs and the filtering requirement is less than that of three phase semi and half wave converters.

At ωt=π/6+α, thyristor T4 is already conducting and thyristor T1 is turned on during the interval (π/6+α) ≤ ωt ≤ (π/2+α), thyristor T1 is turned on and the line-to-line voltage, Vab=(Van-Vbn) appears across the load.

At ωt=T4 is turned off due to natural commutation. During the internal (π/2+α) ≤ ωt ≤ (π/2+α), thyristor T1and T6 conduct and the line-to-line voltage Vac appears the load. If the thyristor is numbered as shown in firing sequence is (1,6), (6,3), (3,2), (2,5), (5,4), and (4,1).

Formula Used

Semi-controlled Converter

$$Vdc = \frac{3\sqrt{3}\ Vm}{2\pi}(1+\cos\alpha)$$

Fully Controlled Converter

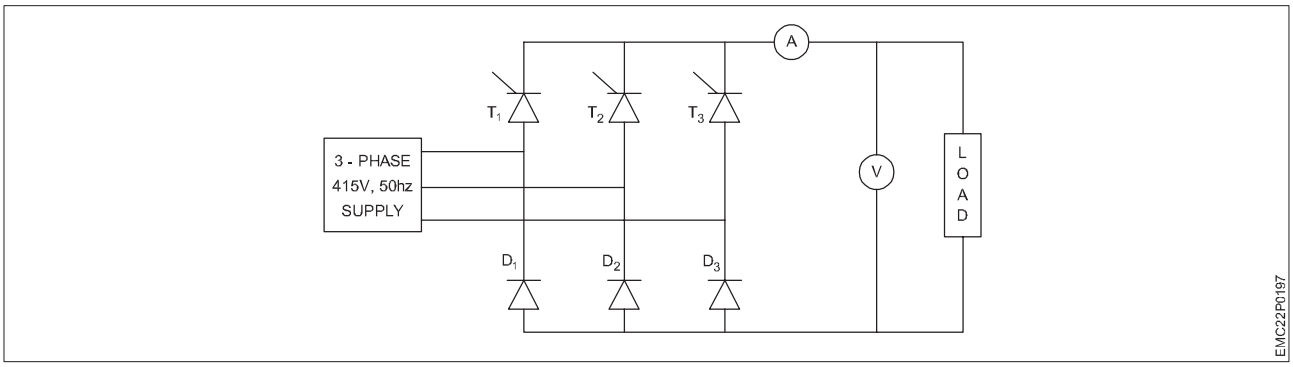
$$Vdc = \frac{3\sqrt{3}\ Vm}{\pi}\cos\alpha$$

Procedure

1 Connect the circuit as per circuit diagram.

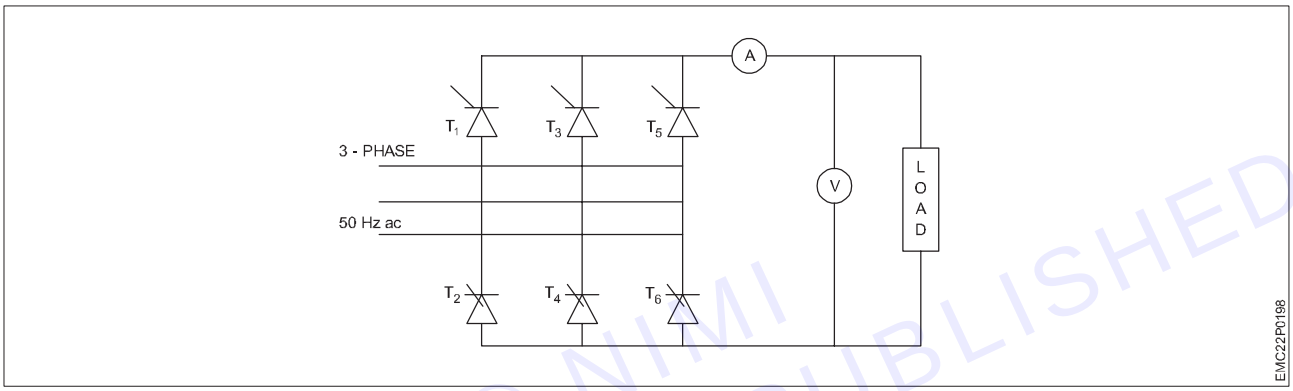
2 Vary the firing angle of the Thyristor Pairs to obtain different values of Voltage & current.

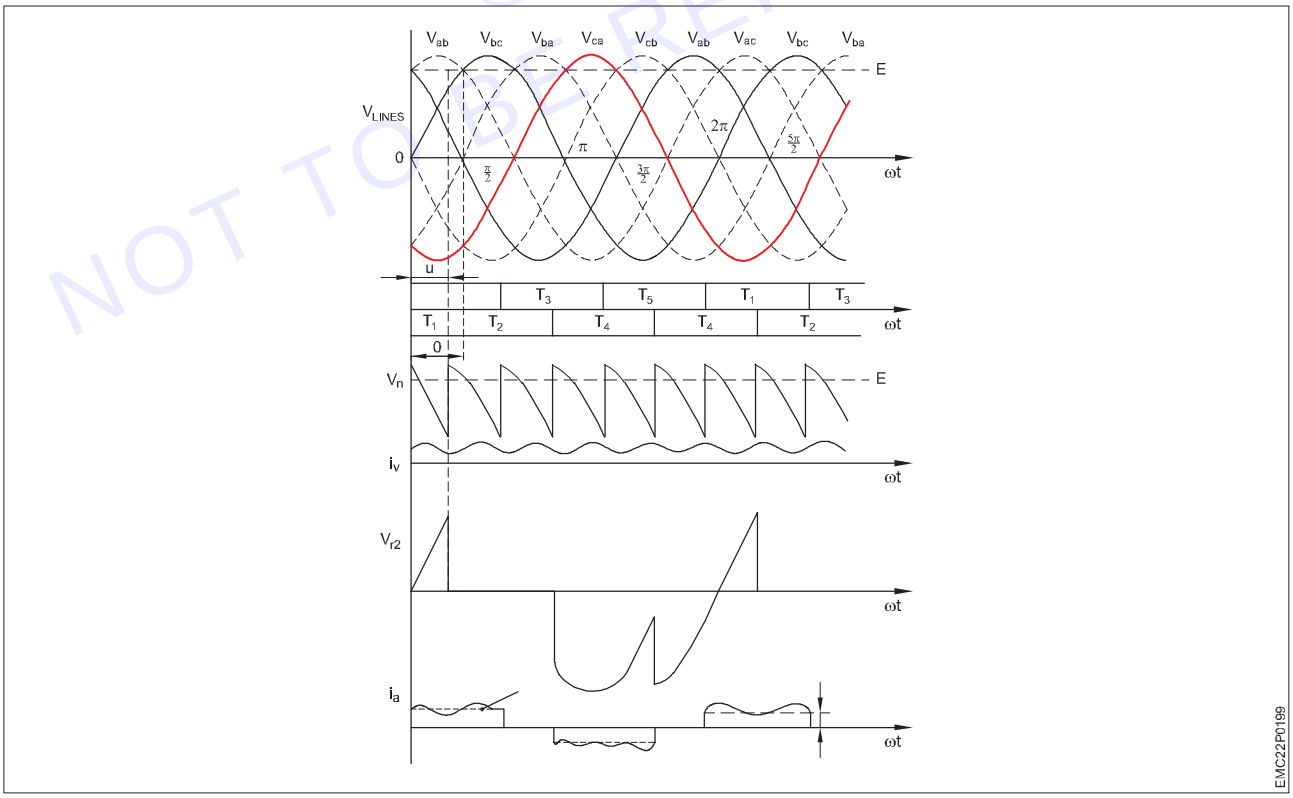
3 Record the output voltage & current.



4 Trace the waveform displayed in the DSO.

5 Repeat step 2 to 4 for R-L Load.





6 Calculate the Performance Parameters.

Observation table for semi-controlled converter

Sl. No	Vdc practical (V)	Idc Practical (A)	Firing Angle (degree)	Vdc Theoretical (V)	Idc Theoretical (A)	Vrms	Input Power Factor	TUF	η (%)
1									
2									
3									
4									
5									

Observation table for fully controlled converter

Sl. No	Vdc practical (V)	Idc Practical (A)	Firing Angle (degree)	Vdc Theoretical (V)	Idc Theoretical (A)	Vrms (v)	Input Power Factor	TUF	η (%)
1									
2									
3									
4									
5									

Result:

At the end we convert the 3 phase AC supply in to DC supply using by SCRs.

MODULE 21: Electrical control of AC/ DC machines & AC Drives

EXERCISE 205: Demonstrate unmarked Terminals of 3 phase induction motor

Objectives

At the end of this exercise you shall be able to:

- to known the unmarked 3 phase induction motor.

Requirements

Tools/Equipments/Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/Components

- Six terminal Induction motor
- Multimeter or Continuity Tester
- Single phase A.C supply
- A.C Voltmeter
- Center – zero galvanometer or milli voltmeter or milli ammeter
- Switch and wires
- Battery (1.5V or 3V)

Note:

Conducting Polarity test of new three phase Induction motor is necessary before running into operation. If the wrong polarity motor is supplied with three phase supply, the magnetic field distribution within the motor windings become uneven and the output torque becomes pulsating. The motor draws excessive currents leads to damage of the windings.

Suppose we have a new Induction motor without any marking of the leads, then we need to identify its polarity before using it. Usually six terminals from the three phases of an induction motor are available. If their polarity markings (A1, A2; B1, B2; C1, C2) are not known, then these can be found out by a polarity test on the induction motor.

Procedure

Polarity test induction motor

There are two methods to identify the Polarity of three phase Induction motor

1 finding polarity of AC supply.

2 finding polarity of DC supply

Finding polarity of induction motor-Method I (by A.C)

Step 1:

Continuity test to identify each of the winding terminals [AA BB CC]

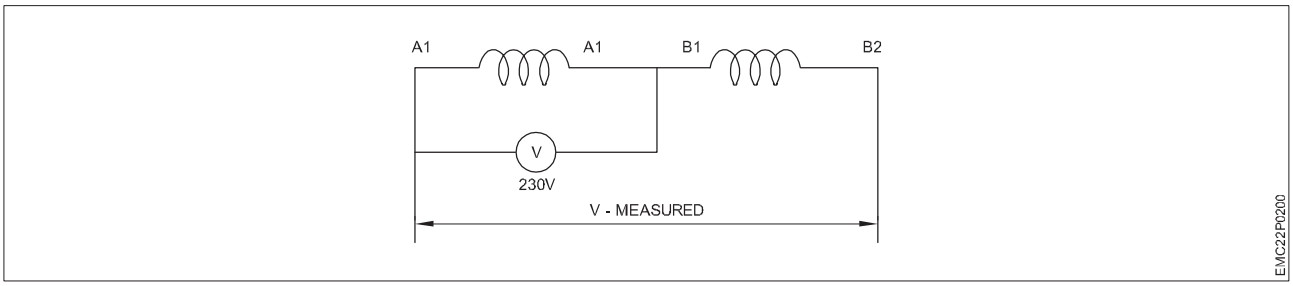
We can do this test with the help of Multimeter by checking continuity between any two terminals. If the two terminals belong to same winding a beep will come.

Do this procedure for all and identify terminals, then mark the terminals as AA, BB and CC.

Step 2:

Test to identify polarities [A1A2 B1B2 C1C2]

Take any two windings randomly and mark the terminals as A1 A2, B1 B2 (this is the assumption) as shown in figure.

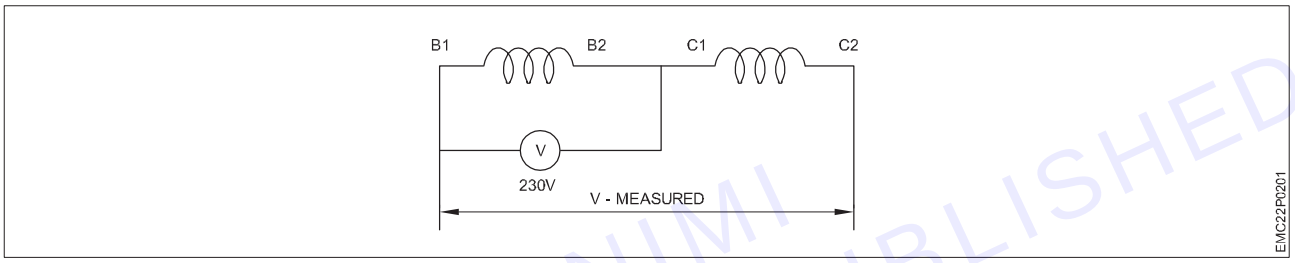


Now connect A2 with B1 so that the two windings are in series

Now apply 230V A.C between A1 and A2 and measure the voltage across A1 and B2.

If we notice the measured voltage is less than the applied voltage then our assumption is correct. Otherwise interchange the terminals A1 and A2 and repeat the process so that we can find the terminals A1, A2, B1 and B2

Now take the third winding mark it as C1, C2 (this is the assumption) and take second winding B1B2 (already known) connect B2 with C1 so that the two windings are in series as shown in Fig



Now apply 230V A.C between B1 and B2 and measure the voltage across B1 and C2

If we notice that the measured voltage is less than the applied voltage then our assumption is correct. Otherwise interchange the terminals C1 and C2 and repeat the process so that we can find the terminals B1, B2, C1 and C2.

Once we can identify all the terminals they are connected for Star or Delta fashion, for star connection join A2B2C2 or A1B1C1, for delta connection connect A2B1, B2C1 and A1C2.

Finding Polarity of Induction motor-Method (by D.C)

Procedure to identify terminals A1, A2 and B1, B2

1 Randomly choose one of phase winding terminals say A1 and A2

2 Connect the positive terminal of the battery to A1 and the negative terminal to A2 through switch

3 The meter is connected across one of the other two phase windings say B phase randomly

4 At the instant of closing the switch, observe the deflection of the meter pointer

5 If there is a positive or clockwise deflection, then the terminal connected to the positive of meter is B2 and connected the negative terminal is B1

6 If the deflection is in the opposite direction, then the polarities are B1 and B2 respectively

Procedure to identify other terminals C1, C2

1 Select the first winding with terminals say A1 and A2

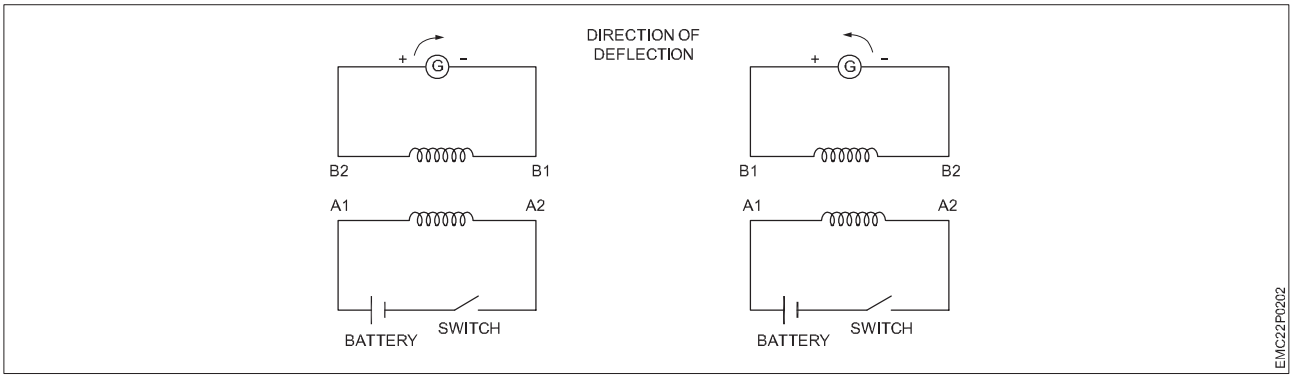
2 Connect the positive terminal of the battery to A1 and the negative terminal to A2 through switch

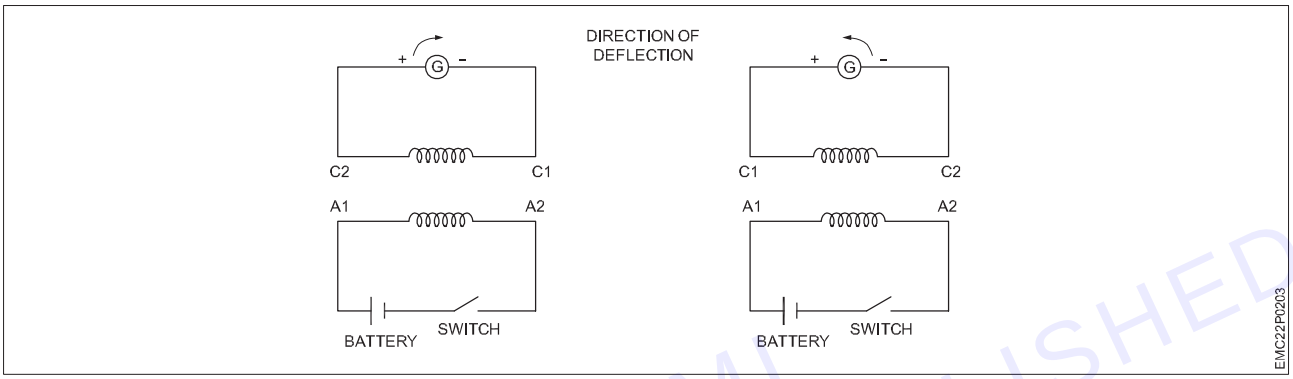
3 The meter is connected across the third phase winding

4 At the instant of closing the switch, observe the deflection of the meter pointer

5 If there is a positive or clockwise deflection, then the terminal connected to the positive of meter is C2 and connected the negative terminal is C1

6 If the deflection is in the opposite direction, then the polarities are C1 and C2 respectively





Result:

Thus the parts of a induction motor was physically verified.

EXERCISE 206&209&212: Construct a DoL starter with self hold contactor circuit and run a 3 Phase Induction Motor

Objectives

At the end of this exercise you shall be able to:

- To Connect contactors , Relays and contacts
- To Connect , operate and demonstrate an using DoL starter for 3 phase induction motor
- To Demonstrate function of self Holding contact in the DoL starter.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- Induction Motor - 1 No.
- Circuit Barker - 1 No.
- Push Button NO/NC - 1 No.
- Overload Relay - 1 No.
- Contactor - 1 No.

Procedure

A Direct On Line (DOL) or across the line starter applies the full line voltage to the motor terminals.

This is the simplest type of motor starter. A DOL motor starter also has protection devices and, in some cases, condition monitoring. Smaller sizes of direct on-line starters are manually operated; larger sizes use an electromechanical contactor (relay) to switch the motor circuit. Solid-state direct on line starters also exist.

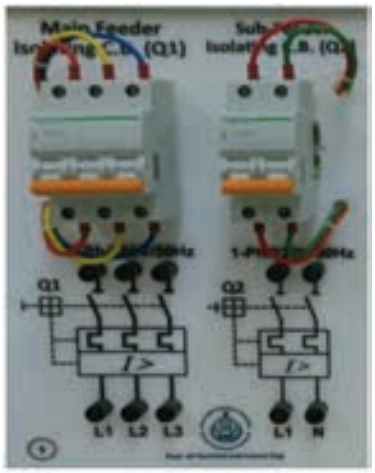
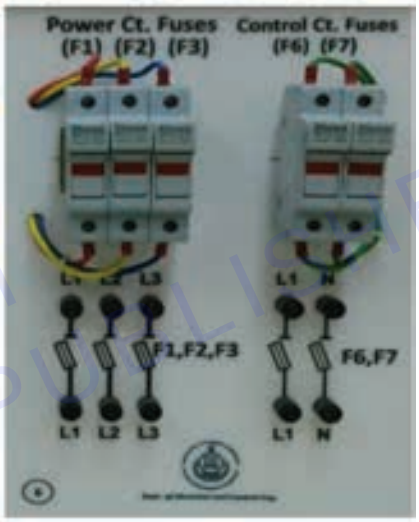
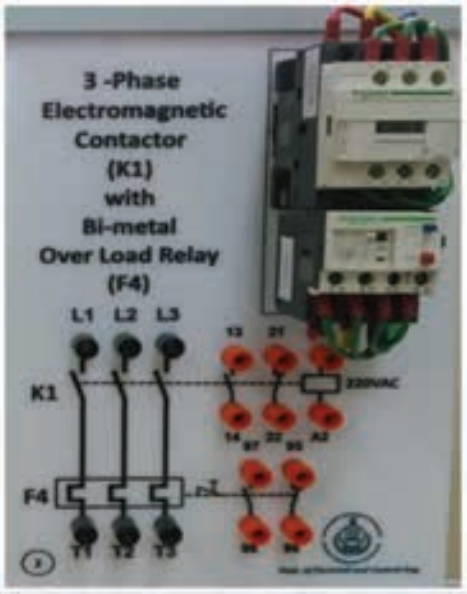
A direct on line starter can be used if the high inrush current of the started motor does not cause excessive voltage drop in the supply circuit. The maximum size of a motor allowed on a direct on line starter may be limited by the supply utility for this reason. For example, a utility may require rural customers to use reduced-voltage starters for motors larger than 4KW (5HP).

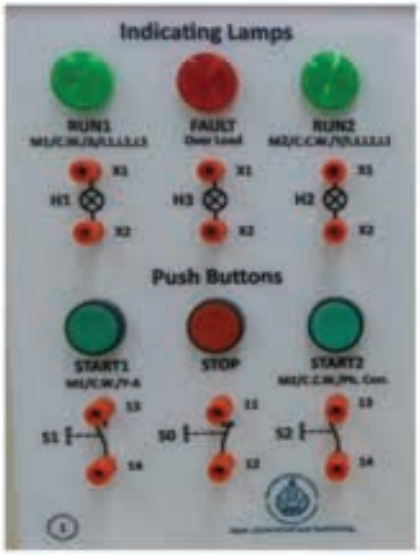
DOL starting is sometimes used to start small water pumps, compressors, fans and conveyor belts.

In the case of an asynchronous motor, such as the 3-phase squirrel-cage motor, the motor will draw a high starting current until it has run up to full speed. This starting current is typically 6-7 times greater than the full load current. To reduce the inrush current, larger motors will have reduced- voltage starters or variable speed drives in order to minimize voltage dips to the power supply, or series resistance and inductance can be added.

Instruments & Equipments

Name	Figure
Three phase induction motor	

Main and Sub feeder isolating circuit breakers (board #5)	
Power and control circuits fuses (board #6)	
Three phase electromagnetic contactor with bi-metal overload relay (board #2)	

Indicating lamps and Pushbuttons (board #1)	
Multimeter	
Digital stroboscope	

Wattmeter	

- Connect the circuits as shown in the diagram.
- Switch on the main and sub feeder isolating circuit breakers (Q1, Q2).
- Use the start and stop pushbuttons for motor operation.
- Measure the currant, voltage, power and the no load speed of the motor.

Results

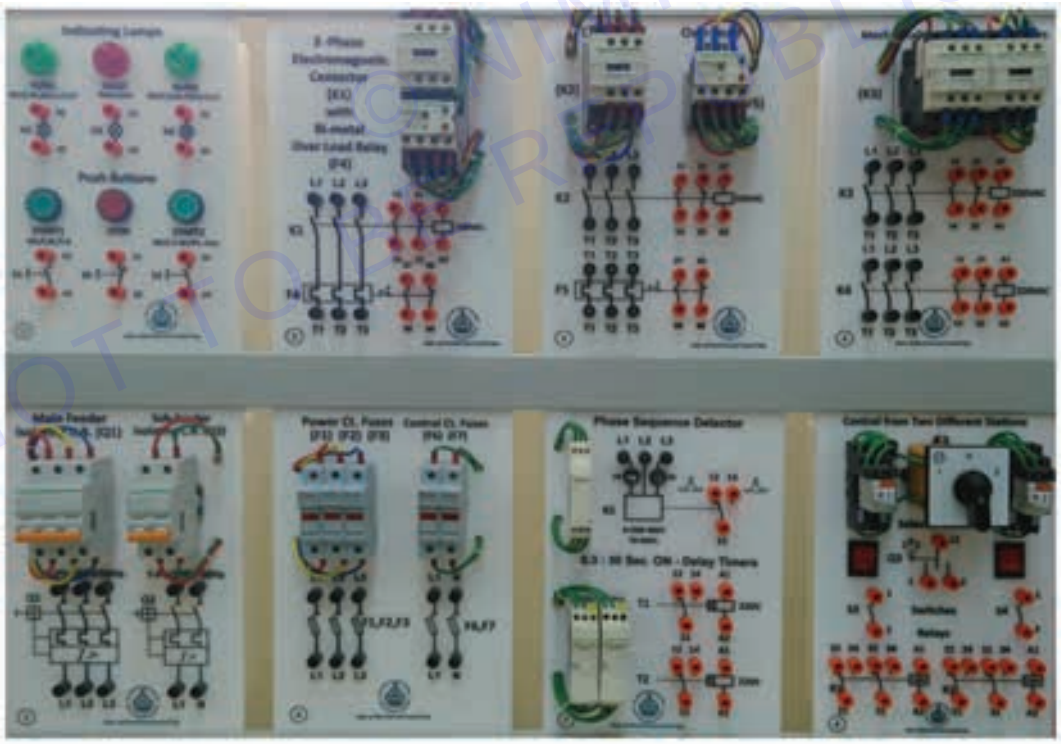
Current = _____A

Voltage = _____V

Power = _____W

Speed = _____FPS

Connect the power and control circuits on the following figure



Add your own comments

_____

Use internet /Book resources to provide advantages, disadvantages and then discuss different applications of DOL motor starter circuit

_____

EXERCISE 207: Familiarize with different types of AC motor and demonstrate the different parts

Objectives

At the end of this exercise you shall be able to:

- to demonstrate all parts of the AC motor.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- Induction Motor - 1 No.
- Circuit Barker - 1 No.
- Push Button NO/NC - 1 No.
- Overload Relay - 1 No.
- Contactor - 1 No.

Procedure

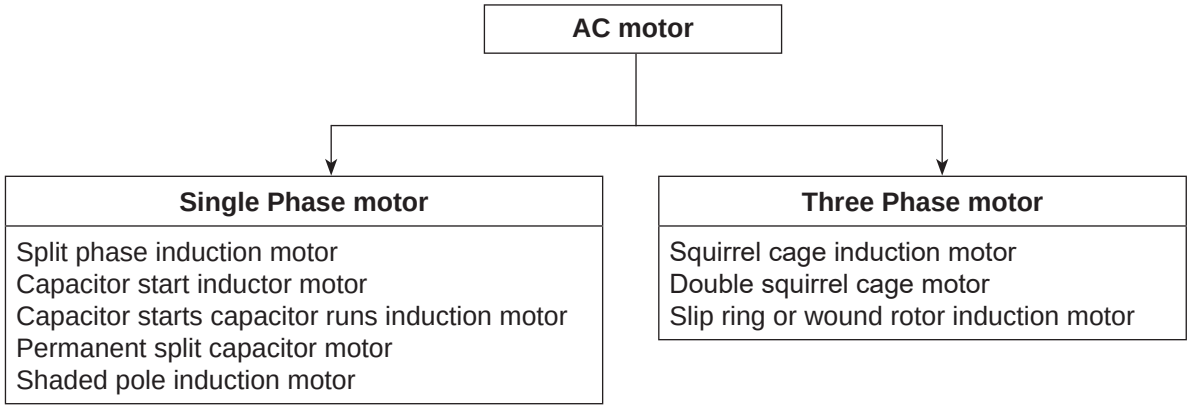
AC Motor: - An AC motor is an electric motor driven by an alternating current. The AC motor commonly consists of two basic parts an outside stator having coils supplied with alternating current to produce a rotating magnetic field and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

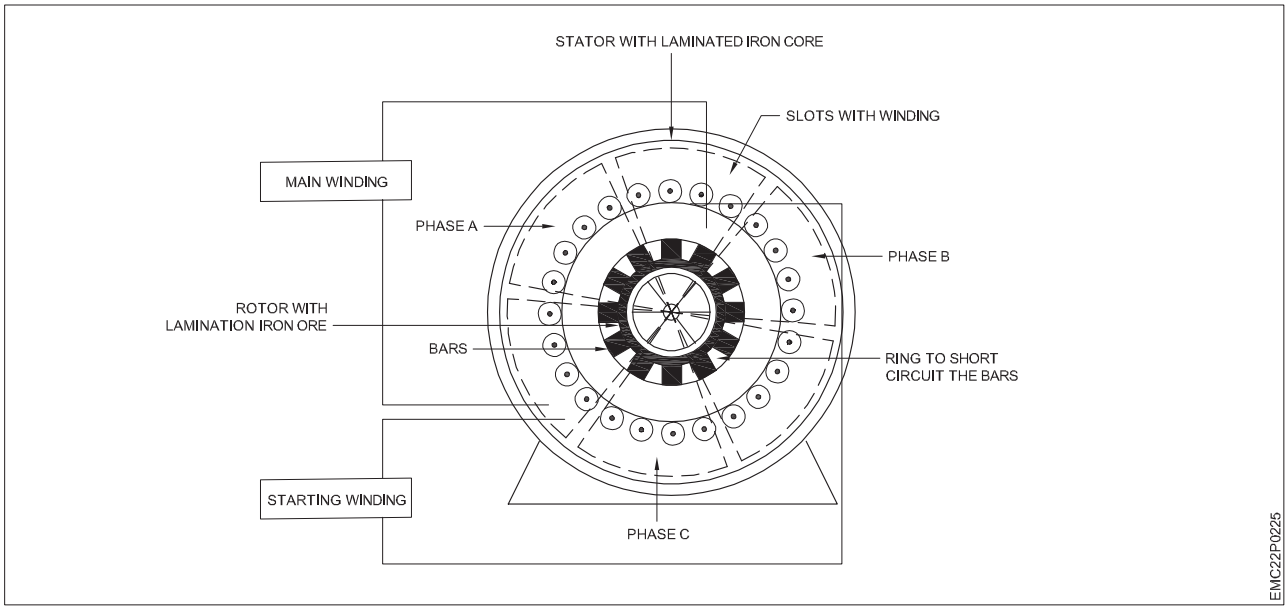
Less common, AC linear motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight-line configuration, producing linear motion instead of rotation.

Operating principles :- The two main types of AC motors are induction motors and synchronous motors. The induction motor always relies on a small difference in speed between the stator rotating magnetic field and the rotor shaft speed called slip to induce rotor current in the rotor AC winding. As a result, the induction motor cannot produce torque near synchronous speed where induction is irrelevant or ceases to exist. In contrast, the synchronous motor does not rely on slip induction for operation and uses either permanent magnets, salient poles or an independently excited rotor winding. The synchronous motor produces its rated torque at exactly synchronous winding that does not rely on the principles of slip induction of current. The supply frequency of sub to super multiple of the supply frequency.

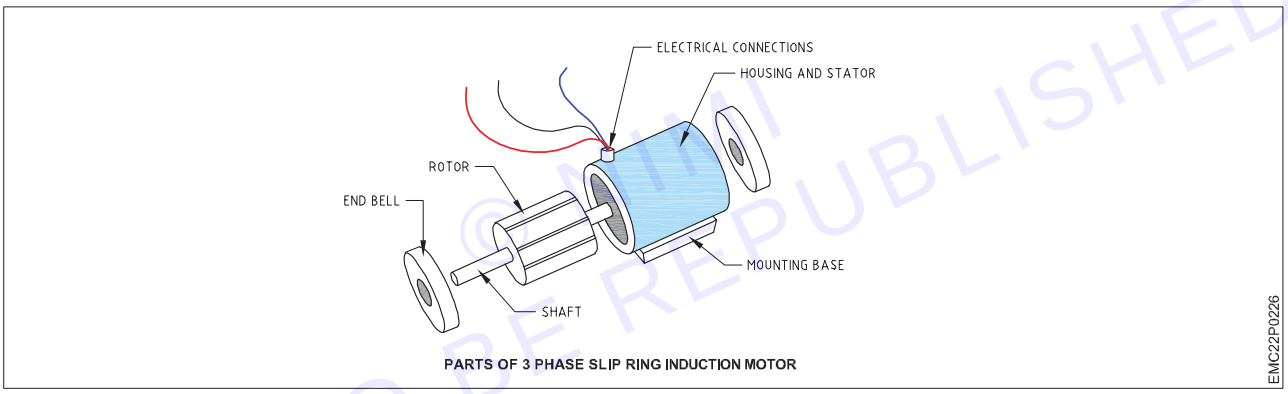
Other types of motors include eddy current motors and AC and DC mechanically commutated machines in which speed is dependent of voltage and winding connection.

Types of AC motor : -



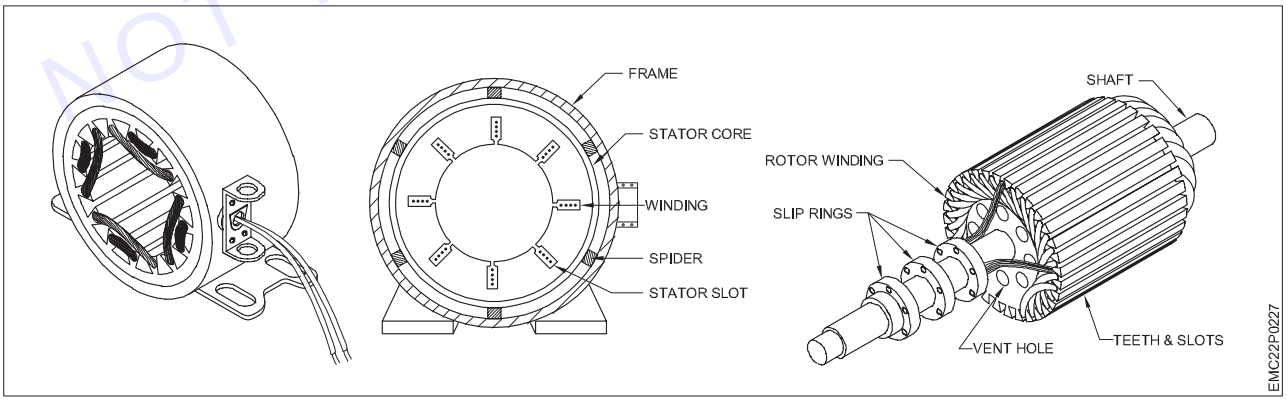


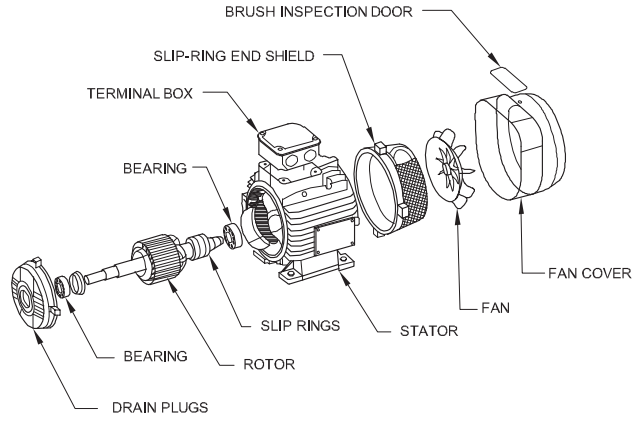
Parts of AC motor: -



PARTS OF 3 PHASE SLIP RING INDUCTION MOTOR

Parts of Three Phase Induction motor





PARTS OF 3 PHASE SLIP RING INDUCTION MOTOR

Stator: In 3 Phase motors parts, the stator is the most integral component. It is the stationary part that influences the rotor to move in the direction of magnetic fields. This part of 3 phase motor further has the following sub-division.

Core: Inside the stator, the laminated structure is present, which is known as the stator core. The stator core has paired slots depending on the number of poles of the electric motor. Some motors have 2 poles and 3 slots or 3 poles and 4 slots, etc. The speed of the motor is inversely proportional to the number of poles. If the number of poles is greater, the speed will be less and vice versa.

Stator frame: The outer covering of the stator is called the stator frame. The stator frame is made up of high-grade material and 100% stainless steel to protect internal parts. It also ensures long life and durability.

Stator winding: The stator winding generates magnetic fields in the stator. The three phases get excited when connected to the power supply and start producing magnetic fields. The stator windings are insulated and resistive to ensure protection in unfavourable conditions.

Rotor: Rotor is another important component in parts of 3 phase motor. The moving part the rotates in the direction of magnetic fields is called a rotor. The rotor of three phase motors carries the current to move the categories based on rotor structure.

Terminal Box: The terminal box is also prominent in 3 phase motor parts. The terminal box provides a three-phase power supply through an external electrical supply. The stator windings are connected to the terminal box via delta or star connection.

Fan: For heat dissipation and cooling, a fan is considered a significant part of 3 phase induction motors. It maintains the temperature and cools down other internal parts of 3 phase induction motor.

Slip ring or wound type: The wound type rotor generally consists of the slotted armature and slip rings. These motors provide high and constant starting torque therefore; these motors are widely used in heavy load industries because it allows external resistance to reduce initial current.

Result: Thus the different types and parts of Ac motors have been demonstrated.

EXERCISE 208&210: Construct a Semi automatic and fully automatic star delta starter, RUN a 3 Phase Induction Motor and Measure voltage and current in STAR and DELTA connections

Objectives

At the end of this exercise you shall be able to:

- to demonstrate all parts of the AC motor.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- Induction Motor - 1 No.
- Circuit Barker - 1 No.
- Push Button NO/NC - 1 No.
- Overload Relay - 1 No.
- Contactor - 1 No.

Procedure

The Star Delta starting method is a motor starting mechanism that minimizes the large amount of starting current that motors drawin. The Star Delta, as the name suggests basically involve seeding the motor with $1/\sqrt{3}$ (58%) of the full load current until it attains speed then applying the full load current.

It is required three contactors i.e., the Star Contactor (K3), the Delta Contactor (K4) and the Main Contactor (K1). However for the motor to be started in Star Delta, its internal connection at the terminal box has to be wired in Delta-giving it capability of receiving the full-load current at any instant.

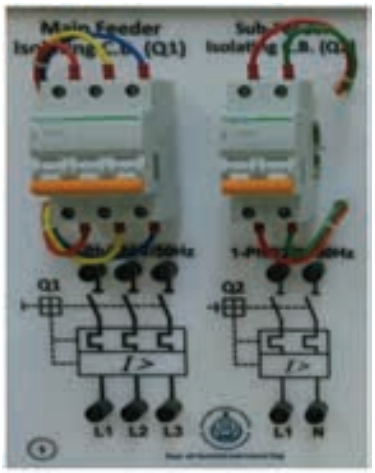
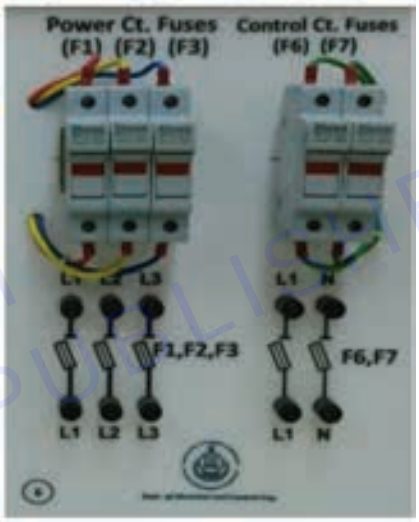
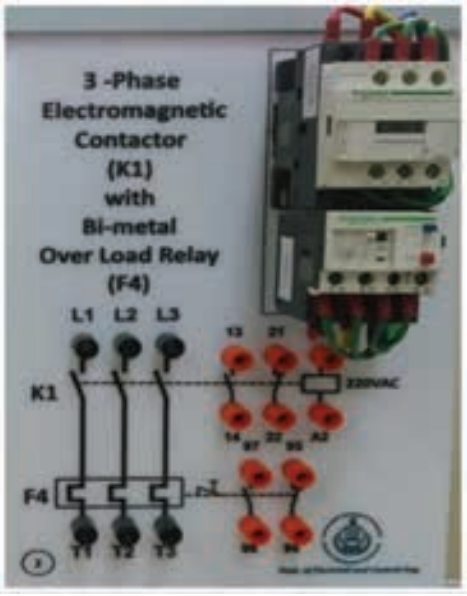
When the power is fed into the circuit, K1 allows current to flow to the motor. Current flows into the motor and out to the K3 which is the star-connected starter. After a specified period defined by the clock delay (usually 5 sec) the K4 (Delta) Closes and K3 opens to allow the motor to receive the full load current and run at delta.

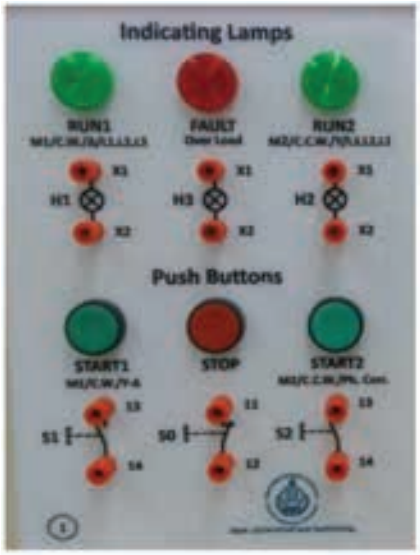
Traditionally, in many regions there was a requirement that all motor connections be fitted with a reduced voltage starter for motors greater than 4KW (5HP).This was to curb the high inrush of starting currents associated with starting induction motors.

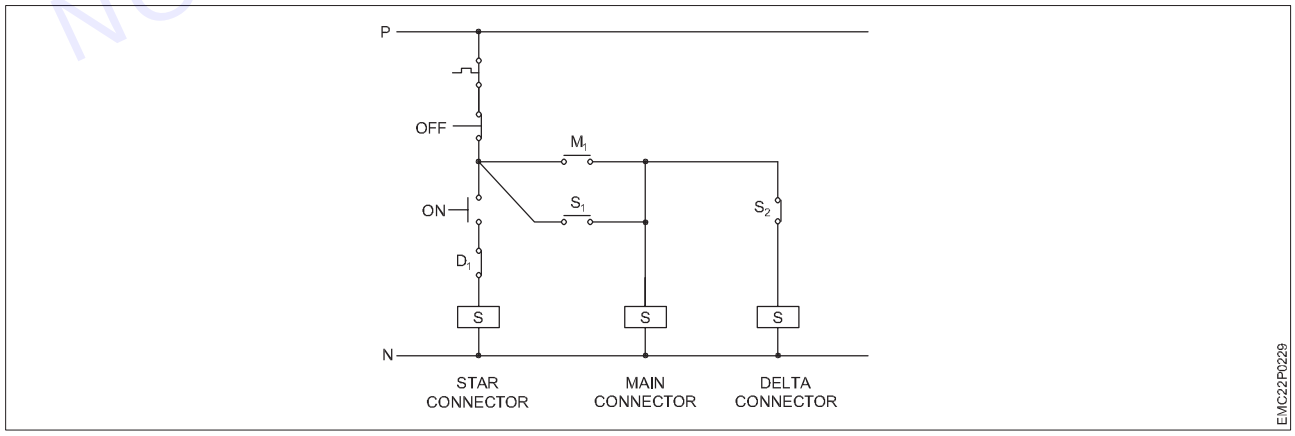
The star and delta contactors are mechanically interlocked i.e., if one of them is closed the other cannot close. This is done to avoid dead short circuit in case both the contactors closing simultaneously. Electrical interlocking has also been provided, by using contactors control contacts.

Instruments & Equipments

Name	Figure
Three phase induction motor	

Main and Sub feeder isolating circuit breakers (board #5)	
Power and control circuits fuses (board #6)	
Three phase electromagnetic contactor with bi-metal overload relay (board #2)	

Indicating lamps and Pushbuttons (board #1)	
Multimeter	



Connect the circuits as shown in the diagram.

Switch on the main and sub feeder isolating circuit breakers(Q1,Q2).

Use the start and stop push buttons for motor operation.

Measure the current firstly in star then in delta connections.

Results

Voltage & Current in star = _____A

Voltage & Current in delta = _____A

Add your own comments

_____

Use internet /book resources to provide advantages, disadvantages and then discuss different applications of star/delta motor starter circuit

_____

EXERCISE 211&213: Change the direction of rotation of Induction and perform Jog operation on a motor

Objectives

At the end of this exercise you shall be able to:

- to connect Contactors and relay
- to change the direction of a three phase induction motor rotation
- to perform Start, stop , Run and Jog on a 3 phase induction motor.

Procedure

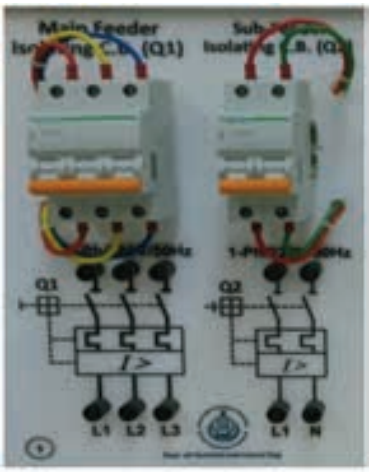
To change the direction a three phase induction machine rotation, two of its phases needs to be exchanged, thus changing the phase sequence form, say ABC to CBA.

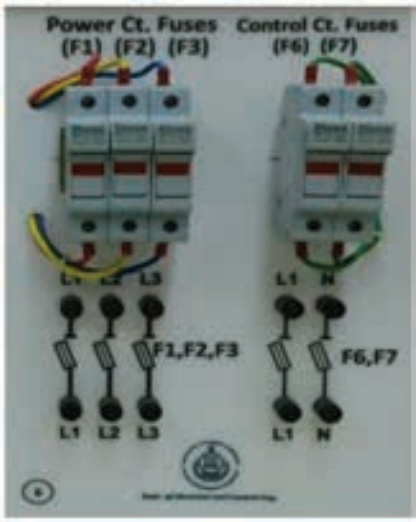
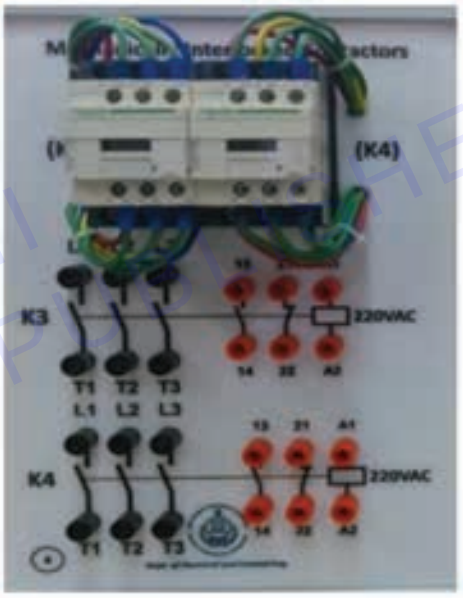
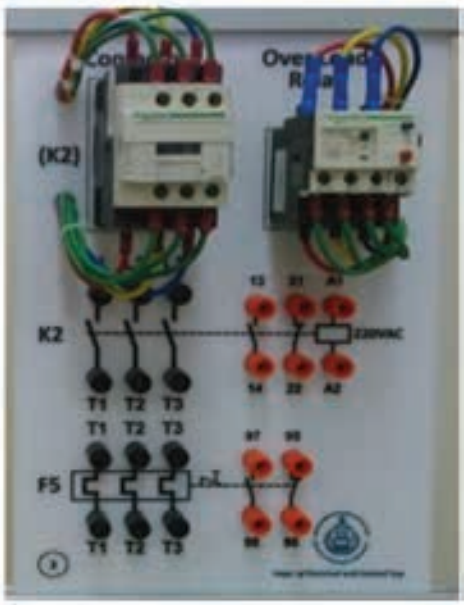
This can be accomplished by using two contactors, one for the forward or CW rotation and one for the reverse or CCW rotation.

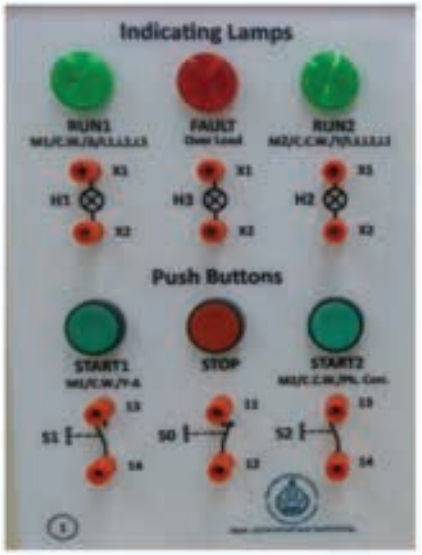
The forward and reverse contactors are mechanically interlocked i.e., if one of them is closed the other cannot close. This is done to avoid dead short circuit in case both the contactors closing simultaneously.

Also electrical interlocking could be provided using the contactors control contacts

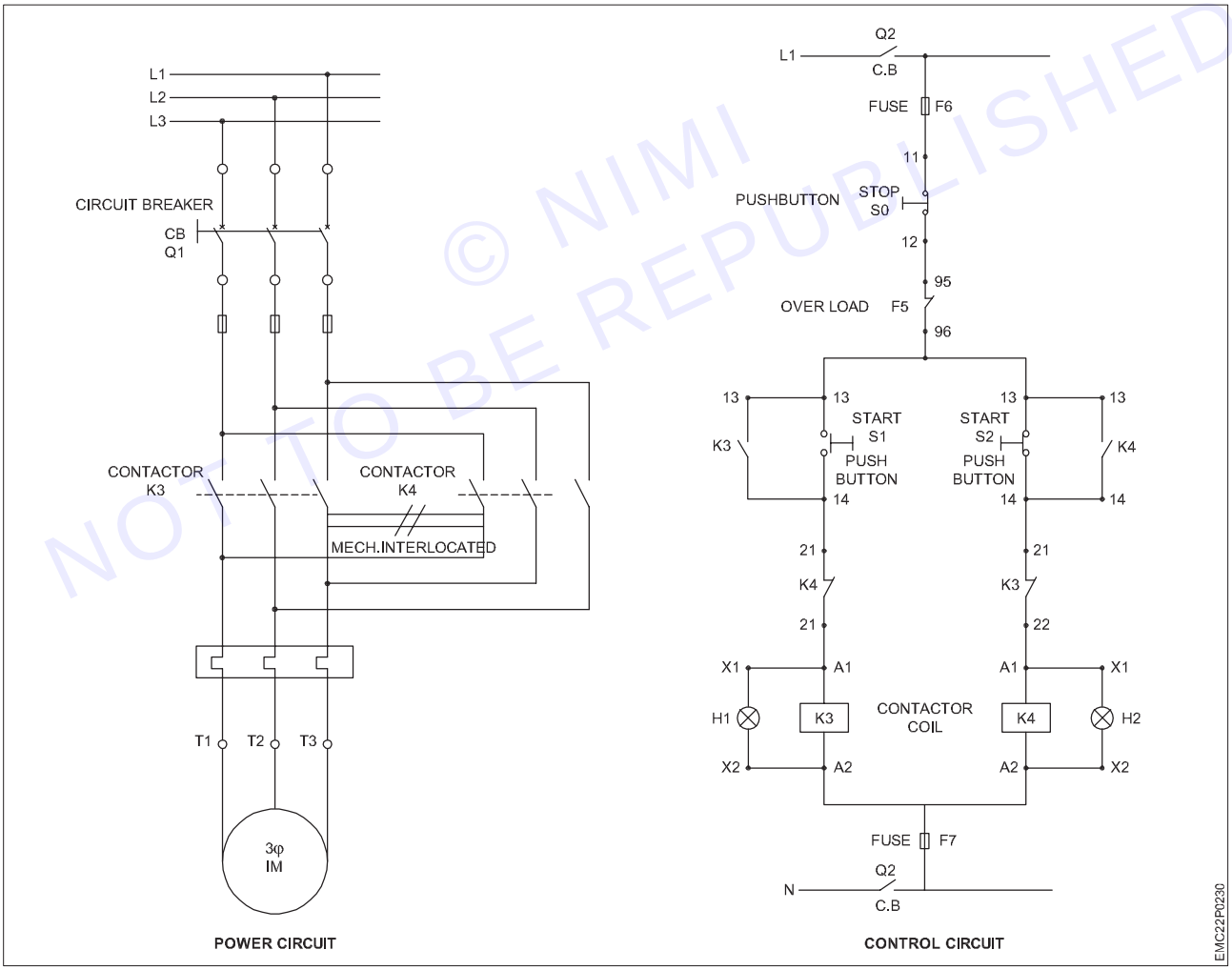
Instruments & Equipments

Name	Figure
Three phase induction motor	
Main and Sub feeder isolating circuit breakers (board #5)	

Power and control circuits fuses (board #6)	
Three phase mechanically interlocked contactors (board #4)	
Overload (board #3)	

Indicating lamps and Pushbuttons (board #1)	

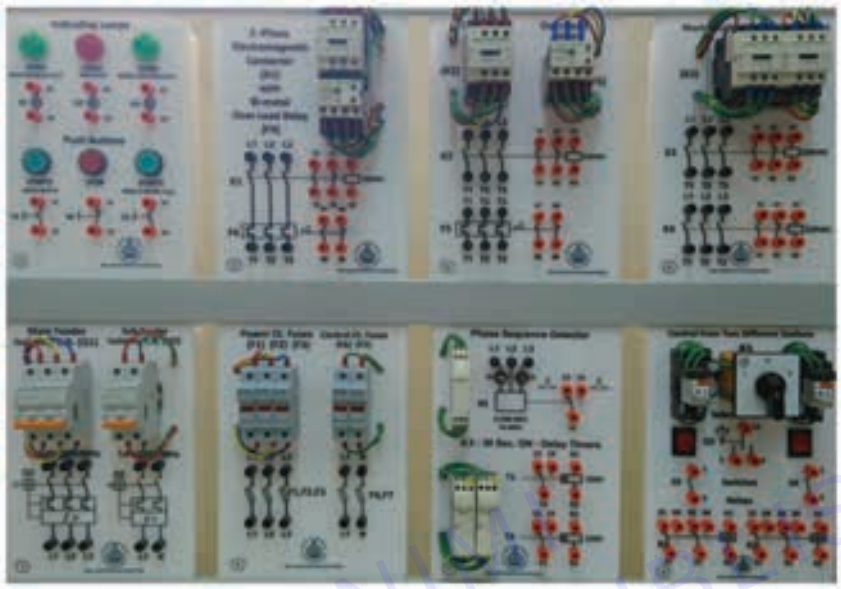
Connection



- Connect the circuits as shown in the diagram.
- Switch on the main and sub feeder isolating circuit breakers (Q1, Q2).
- Use the start and stop pushbuttons for motor operation.

- Press the forward direction pushbutton.
- Stop the motor and then press the reverse direction pushbutton to change the rotation of the motor.
- Press the Start and Stop button alternatively in short duration of time to perform JOG operation.
- Note down the response time of a motor in both the diections.

Connect the power and control circuits on the following figure



Add your own comments

_____

Use internet resources to provide advantages, disadvantages and then discuss different applications of forward/ reverse motor operation circuit

_____

EXERCISE 214: Understand all the information on a motor template

Objectives

At the end of this exercise you shall be able to:

- to study information on a motor template.

Note: A nameplate contains a large amount of useful information relating to the motor including the type RPM frame size and power of the motor. By the template we can easily recognize which type motor we are using.

Procedure

1 **Number of Phases:** This shows the type of power supply for which the motor is designed. There are single phase and three phase motors.

2 **Rated Operating Voltage:** This shows at which voltage is the motor is designed to operate most efficiently. Motors are designed to operate at +/-10% tolerance of this value.

Other parameters show on the nameplate including power factor efficiency, torque and current are at rated voltage and frequency. Using the motor at rated voltage and frequency. Using the motor outside this tolerance will most probably lead to different performance.

3 **Service Duty:** In this case S1 shows that this is a continuous duty motor that works at a cinstant load for enough time to reach temperature equilibrium.

The parameter Duty/Time rating represents the period of time during which the motor can run a its nameplate rating/rated load safely and indicates whether the motor is rated for continuous duty.

This is shown as “CONT” for continuous duty 24/7 but they can also have a short-time rating form 5 to 50 minutes. Most motors are rated for continuous duty.

The rating of the motor is the ambient temperature vs. the time it can operate at that temperature. The ELC break this down into ten ratings.

4 **Efficiency Code:** This shows the percentage of the input power that is actually converted to work output form the motor shaft. The motor will have a nominal efficiency shown on the plate. This is the average efficiency. The closer this value is to 100% the low the electricity consumption cost is going to be.

The four levels if motor efficiency are

- IE_1 - Standard Efficiency
- IE_2 - High Efficiency
- IE_3 - Premium Efficiency
- IE_4 - Super Premium Efficiency

5 **Frame Size:** This shown the frame size. The frame size determines the mounting dimensions such as the foot openings pattern and the shaft height.

The dimension of the electric motor based on the NEMA system for fractional hp motors have two digits and represent the shaft height from the base’s bottom in sixteenths of one inch.

For large motors the frame size has three digits. The first two digits stand for the shaft height in on quarter of an inch. The third digit is the bolt mounting holes dimension. The longer the motor body. The longer the distance between mounting bolt holes in the base. Finally, the letter is the type of frame.

The same concept applies for IEC type motors but the height is measured in millimetres instead of inches.

6 **Degree of Protection:** The IEC uses a two-digit ingress protection rating to measure how well the motor is protection form the environment. NEMA uses an enclosure description that is of a similar standard.

7 **Insulation Class:** The highest temperature in the motor's hottest spot has a serious impact on the life of the electric motor. The temperature that occurs at that spot is a combination of motor design temperature and the ambient temperature. The insulation class shows the motor's ability to withstand temperatures over time.

The motors have different insulation capabilities. The insulation cades show their thermal tolerance of ability to survive at a specified temperature for a period of time. The higher the designated code letter the greater the heat capability.

It is based on the highest temperature the material can withstand continuously without degrading of reducing motor life. IES specify 5 different types of insulation classes:

- Class A – 105c
- Class B – 130c
- Class E – 120c
- Class F – 155c
- Class H – 180c

8 **Temperature Rise:** Each class of insulation has a maximum motor winding temperature rise and a maximum temperature rating. In addition, a hot spot temperature rise is specified which pertains to motor windings that are surrounded by other windings.

9 **Frequency:** This shows the input electricity frequency that the motor is designed to operate at.

Usually for motors the input frequency is 50 to 60 Hz. If more than one frequency is marked on the nameplate then other parameters that will differ at different input frequencies have to be indicated on the nameplate as well.

10 **Motor Rated Power:** KW is an expression of the motor's mechanical output rating its ability to deliver the torque needed for the load at rated speed.

11 **Full Load Speed:** Full-load speed is the speed at which rated full-load torque is delivered at rated power output this speed is sometimes called slip-speed or actual rotor speed.

12 **Rated Operating Current:** this corresponds to the rated power output together with voltage and frequency. The current may deviate from the nameplate amperes if the phases are unbalanced of if the voltage turns out to be lower than indicated.

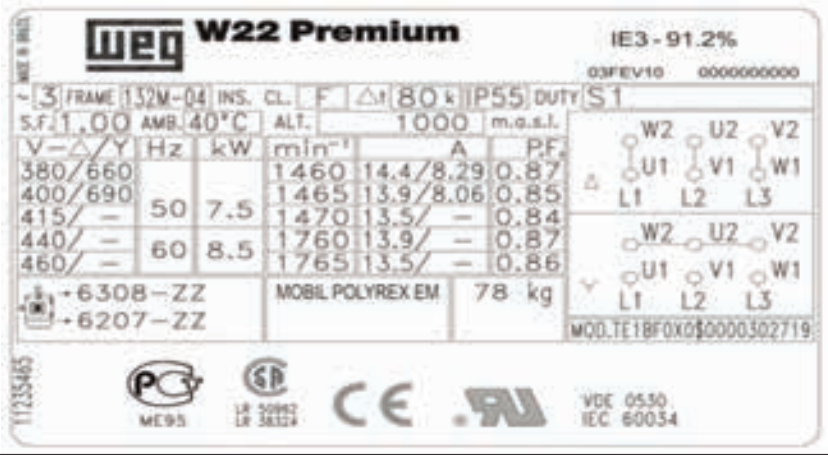
13 **Power Factor:** Power factor is indicated on the nameplate as either "PF" or cos φ. Power factor is an expression of the ratio of active power to apparent power expressed as a percentage.

14 **Ambient Temperature:** The maximum ambient temperature lists the temperature at which the motor can operate and still be within the tolerance of the insulation class at the maximum temperature rise.

15 **Altitude:** This indication shows the maximum height above sea level at which the motor will remain within its design temperature rise, meeting all other nameplate data.

16 **Motor Weight:** This shows the weight of the motor 78kg

17 **Serial Number:** This shows the serial number of the motor. As it is unique to the motor knowing this number can help when liaising with manufacturers or M&E companies about the type of motor you have.



EXERCISE 215: Familiarize with different types of DC motor and demonstrate the different parts

Objectives

At the end of this exercise you shall be able to:

- to demonstrate and study different parts of DC motor.

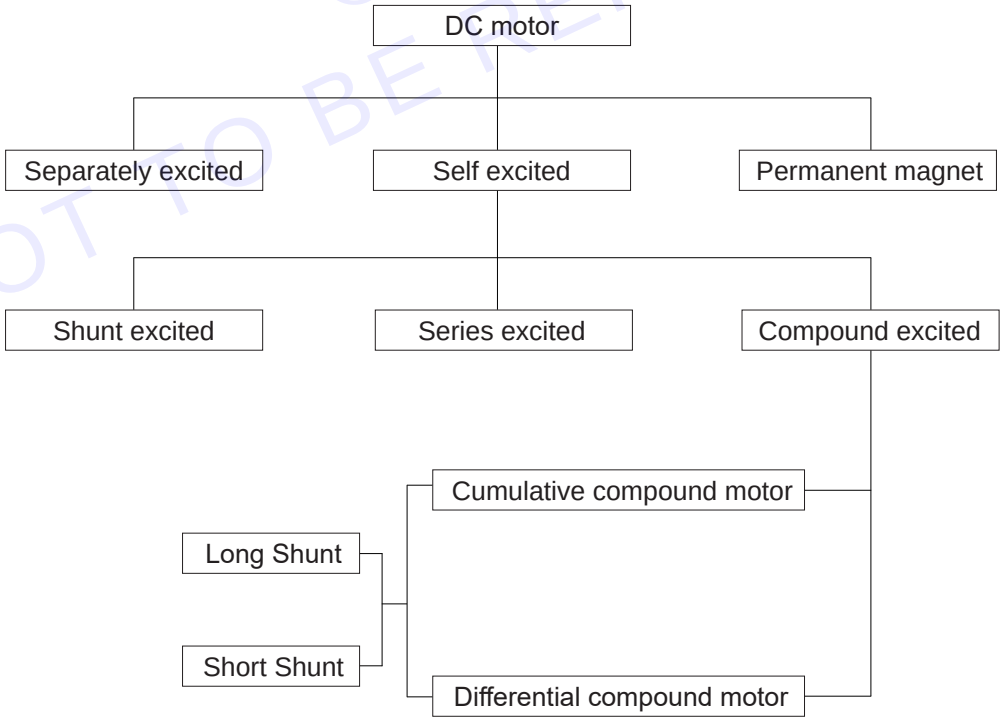
Note: A nameplate contains a large amount of useful information relating to the motor including the type RPM frame size and power of the motor. By the template we can easily recognize which type motor we are using.

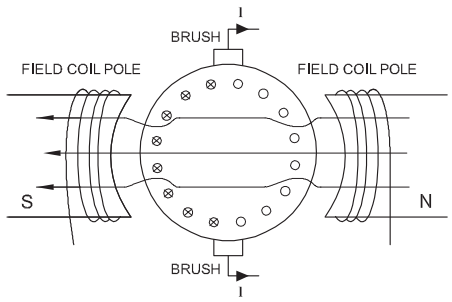
Procedure

1 **DC Motor:** A DC motor is an electrical motor that uses direct current to produce mechanical force; the most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current in part of the motor. DC motors were the first form of motors widely used, as they could be powered from existing direct current lighting.

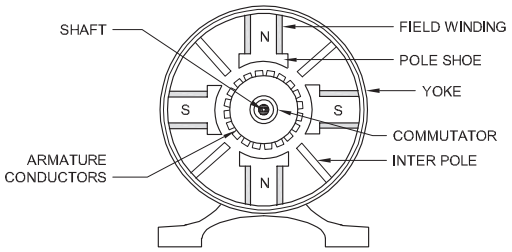
2 **Working Principle:** A DC motor is an electrical machine which converts electrical energy in to mechanical energy. The basic working principle of the DC motor is that whenever a current carrying conductor places in the magnetic field, it experiences a mechanical force. Its works on Fleming's left-hand rule and its magnitude decide the direction of this force.

Types of DC motor:





PRODUCTION OF TORQUE IN A DC MOTOR



DC MOTOR CONSTRUCTION PARTS

EMC22P0231

3 **Stator:** The field windings are one of the components in a DC motor that involves a stationary component like a stator. The primary aim of this is to procure materials.

4 **Rotor:** The rotor is the dynamic portion of the motor that produces that unit's mechanical revolutions.

5 **Brushes:** Brushes with a commentator act primarily as a connection to link the stationary electrical circuit to the rotor.

6 **Commentator:** It's a broken ring that's made up of copper segments. It's also one of the most significant components of a dc engine.

7 **Field Winding:** Field coils, commonly known as copper wires, are used to build these windings. These windings encircle the slots that run through the pole shoes.

8 **Armature Windings:** In a DC motor, there are two types of winding construction: lap and wave.

9 **Yoke:** A magnetic frame, such as a yoke is often made of cast iron or steel. It behaves similarly to a guard.

10 **Piles:** The pole heart and pile shoes are the two main components of the piles in the engine. These critical components are joined together by hydraulic force and attached to the yoke.

11 **Teeth/Slot:** For scratch protection, mechanical assistance, and external electrical insulation, non-conducting slit liners are often jammed among the slit walls as well as coils. Teeth refer to the magnetic fluid that occupies the holes in the slots.

12 **Result:** Thus, Now we can recognize all parts DC motor.

EXERCISE 216: Connect and run dc shunt motor using 3 point starter

Objectives

At the end of this exercise you shall be able to:

- to connect dc shunt motor using 3 point starter
- to run dc shunt motor using 3 point starter.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- Voltmeter 500V - 1 No.
- Ammeter (10-5) - 2 Nos.
- Tester - 1 No.
- Test lamp - 1 No.
- 3 Point starter - 1 No.
- Connecting Wire - as reqd.

Procedure

Working of 3 point stater

For starting the motor, handle is in the OFF position when the supply to the DC motor is switched on. Then handle is slowly moved against the spring force to make contact with stud No. 1. At this point, field winding of the shunt or the compound motor gets supply through the parallel path provided to starting the resistance, through No Voltage Coil. The high starting armature current thus gets limited because at starting entire resistance of the starter comes in series with the armature.

As the handle is moved further, it goes on making contact with studs 2, 3, 4, etc., thus gradually cutting off the series resistance from the armature circuit as the motor gathers speed. Finally, when the starter handle is in 'RUN' position, the entire starting resistance is eliminated, and the motor runs with normal speed.

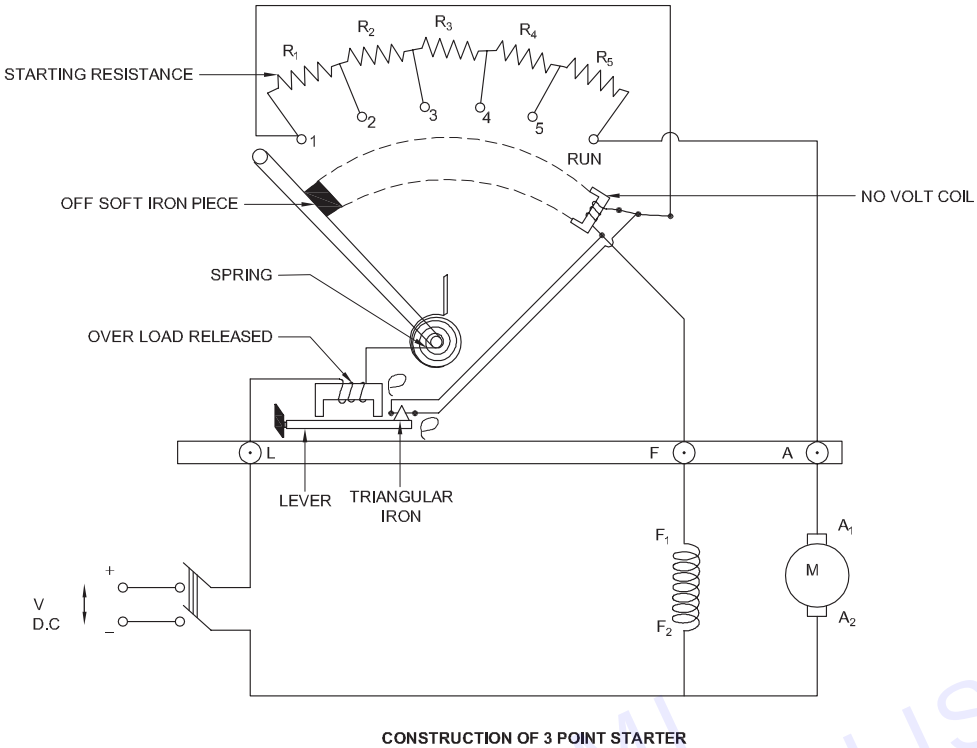
This is because as the speed increases, back emf is developed consequently to counter the supply voltage and reduces the armature current.

3 point starter consists of a resistance which is divided into several sections and includes three terminals namely L, A and F.

Here, L(line terminal) is connected to the positive supply, A (armature terminal) is connected to the armature winding, and F (field terminal) is connected to the field winding.

Apart from these, OLR (Overload release) and NVC (No Volt Coil) are also provided in the motor. These two acts as a protecting device for the motor.

- Draw the circuit diagram and check it.
- Indentify the terminals of motor and starter.
- Connect the A1 of motor to A point of starter.
- Connect the F1 of motor to F point of starter.
- Connect A2*F2 with negative terminal to supply.
- 'ON' the supply and gradually move the handle motor starters running.
- Continue the process of motor attain full speed.
- Check the RPM by tachometer.
- Check current and voltage.
- Disconnect the supply.



CONSTRUCTION OF 3 POINT STARTER

Result:

Thus, we know that construction and connection of 3 point starter and run the dc shunt motor with the help of 3 point starter

EXERCISE 217: Run and change the direction of dc shunt motor using 3 point starter

Objectives

At the end of this exercise you shall be able to:

- to connect dc shunt motor using 3 point starter
- to run and change the direction of rotation of dc shunt motor using 3 point starter.

Requirements

Tools/Equipments/Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/Components

- Voltmeter 500V - 1 No.
- Ammeter (10-5) - 2 Nos.
- Tester - 1 No.
- Test lamp - 1 No.
- 3 Point starter - 1 No.
- Connecting Wire - as reqd.

Procedure

Working of 3 point stater

For starting the motor, handle is in the OFF position when the supply to the DC motor is switched on. Then handle is slowly moved against the spring force to make contact with stud No. 1. At this point, field winding of the shunt or the compound motor gets supply through the parallel path provided to starting the resistance, through No Voltage Coil. The high starting armature current thus gets limited because at starting entire resistance of the starter comes in series with the armature.

As the handle is moved further, it goes on making contact with studs 2, 3, 4, etc., thus gradually cutting off the series resistance from the armature circuit as the motor gathers speed. Finally, when the starter handle is in 'RUN' position, the entire starting resistance is eliminated, and the motor runs with normal speed.

This is because as the speed increases, back emf is developed consequently to counter the supply voltage and reduces the armature current.

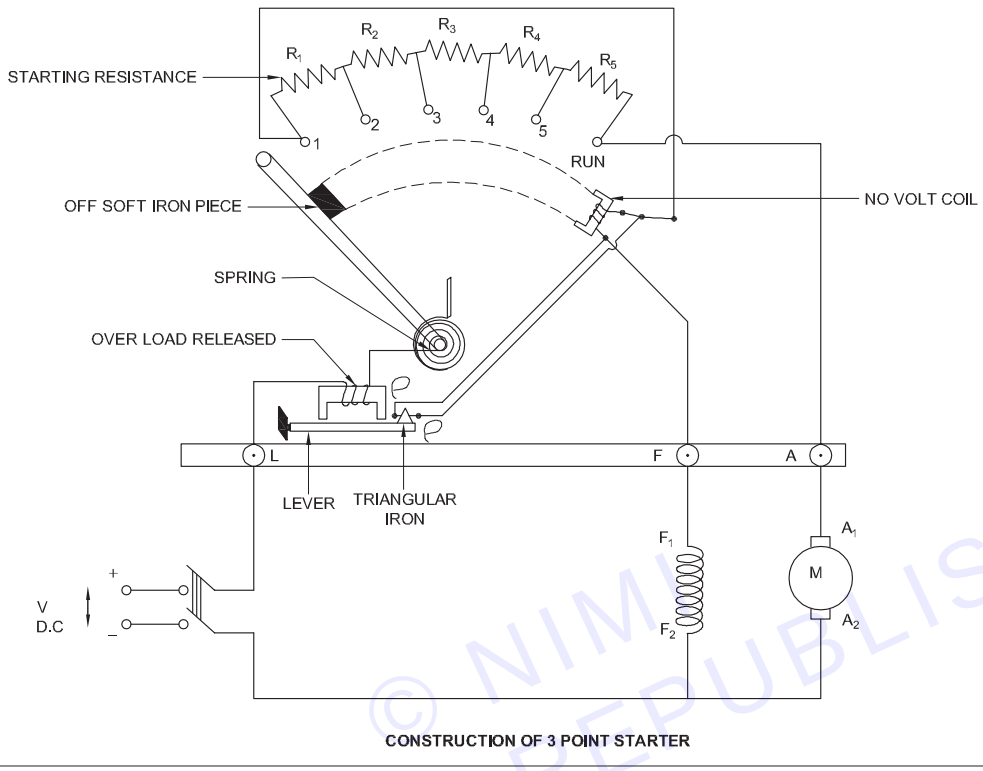
3 point starter consists of a resistance which is divided into several sections and includes three terminals namely L, A and F.

Here, L(line terminal) is connected to the positive supply, A (armature terminal) is connected to the armature winding, and F (field terminal) is connected to the field winding.

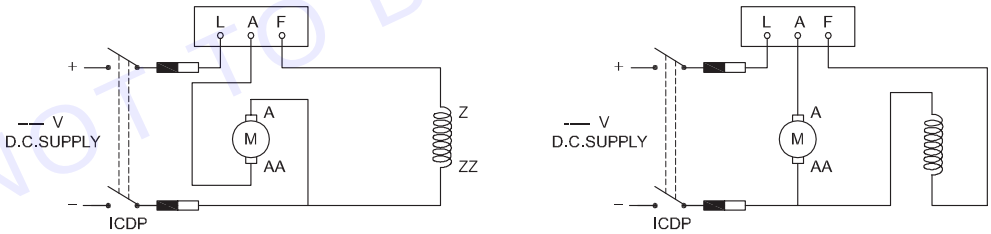
Apart from these, OLR (Overload release) and NVC (No Volt Coil) are also provided in the motor. These two acts as a protecting device for the motor.

- Draw the circuit diagram and check it.
- Indentify the terminals of motor and starter.
- Connect the A1 of motor to A point of starter.
- Connect the F1 of motor to F point of starter.
- Connect A2*F2 with negative terminal to supply.
- 'ON' the supply and gradually move the handle motor starters running.
- Continue the process of motor attain full speed.
- Check the RPM by tachometer.
- Check current and voltage.

- Change either field connection or Armature Connection as per the Fig 2.
- Observe the change in direction of rotation.
- Disconnect the supply.



CONSTRUCTION OF 3 POINT STARTER



Result:

Thus, we know that construction and connection of 3 point starter and run the dc shunt motor with the help of 3 point starter

EXERCISE 218&219: To control the speed of a D.C.shunt motor by Armature control method and field control method

Objectives

At the end of this exercise you shall be able to:

- Practice to control the speed of a D.C.shunt motor by Armature control method and field control method.

Requirements

Tools/Equipments/Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/Components

- Ammeter (M.C) 0-3A - 1 No.
- Voltmeter (M.C) 0-250V - 1 No.
- Rheostat Wire wound 500 ohms, 1.2 A - 1 No.
- Rheostat Wire Wound 38 ohms, 10 A - 1 No.
- Tachometer digital 0 – 9999 rpm - 1 No.
- D.C. shunt motor 3HP, 220 V, 12 A - 1 No.
- Connecting wires PVC insulated

Procedure

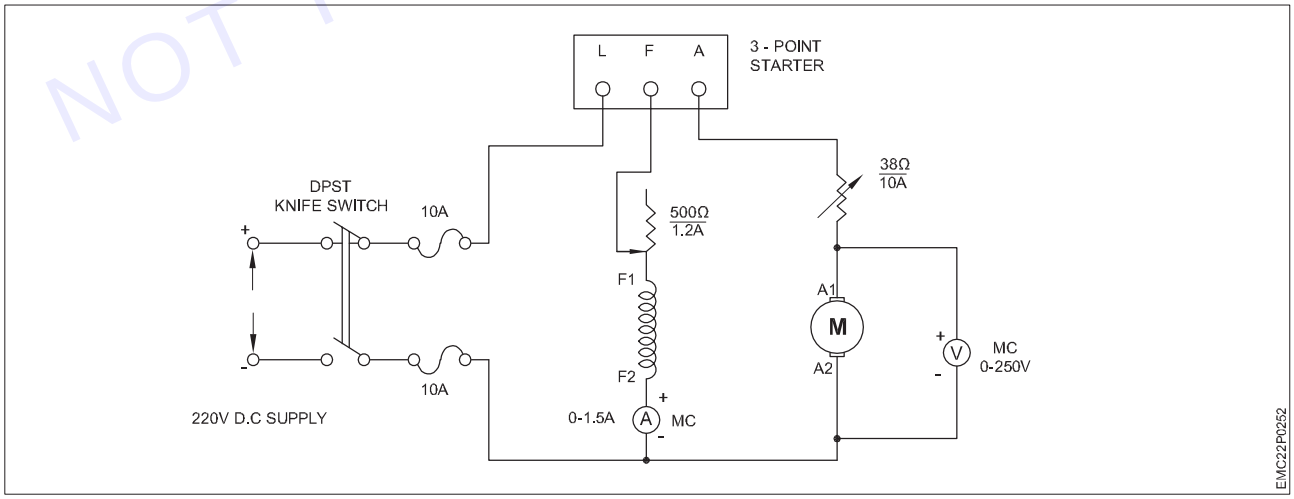
The speed of a DC shunt motor can be controlled by varying

- Flux/pole (Flux control method)
- Resistance of armature circuit (rheostat control method)
- Applied voltage(Voltage control method) Speed of a motor is given by the relation:

In Armature Control method

N ∞ Eb-IaRa

In field Control method



1 Fluxcontrolmethod:This methodis used when speeds above normal speeds are required. In the above equation (1) by decreasing the flux, the speed can be increased and vice versa. The flux of a dc motor can be changed by changing Ish with the help of a shunt field rheostat. The current in shunt field rheostat is less. I2R loss is small, so that rheostat is small in size. Armature or rheostat control method:- This method is used when speeds below theno-loadspeedsarerequired.Inthismethodthevoltageacrossthearmature is varied by increasing a variable rheostat in series with the armature circuit,asresistanceisincreased,potentialdifferenceacrossthearmatureisdecreased, there by decreasing the armature speed. This method is expensive (Cu loss more) and unsuitable for rapidly changing loads because for a given value of Rt, the speed will change with load.

2 Voltagecontrolmethod:-Thismethodisalsousedtocontrolthespeedsbelow theno-load speeds. In this method the shunt field of the motor is connected across the fixed supply and then by supplying different voltage to the armature different speeds are obtained. The control voltage is obtained from potential dividers, solid state rectifier and Ward-Leonard system.

3 For Armature voltage control method:-

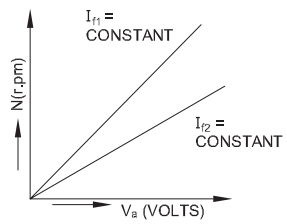
- The connections are made as shown in the circuit diagram.
- With the armature rheostat is CUTIN position, the field rheostat in CUTOUT position and the 3-point starter handle at its initial position, the D.C. supply switch is closed.
- The 3-point starter handle is moved clock wise gradually to cut out the resistance in armature circuit so that the motor starts and run sat some speed.
- The armature rheostat is brought to cut outposition so that rated voltage is applied across the armature.
- Thefieldcurrentisadjustedtoacertainvaluebyvaryingthefieldrheostat such that the motor runs at nearly rated speed.
- The armature rheostat is CUTIN gradually so that the armature voltage is varied in steps and the corresponding speeds are noted in the tabular column.
- Stepno.5isrepeateduntilthearmaturerheostatiscompletelyCUTIN.
- The field rheostat is brought back to CUTOUT position, the armature rheostat to CUTIN position and the D.C. supply switch is opened.

Armature voltage control

Table

Field current =

Sl.No	Armature voltage In Volts	Speed In rpm



EMC22P0253

4 For field control method:-

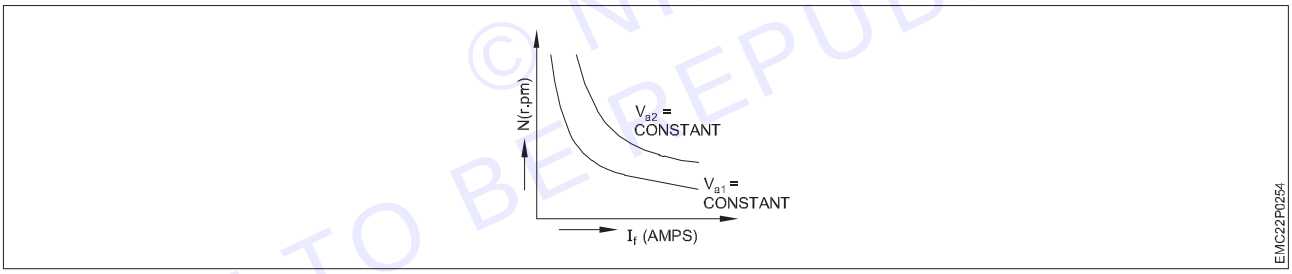
- Stepnos.1,2 &3of armature voltage control method are repeated.
- The armature rheostat is varied such that the rated voltage is applied across the armature terminals.
- The field rheostat is gradually cut in steps so that the field current is varied in steps of 0.05A and the corresponding value of speeds are noted.
- Step no.3 is repeated until the fieldrheo statis completely CUTIN.
- Step no.3 and 4 are repeated foranarmaturevoltageof200V.
- The field rheostat is brought back to CUT OUT ,the armature rheostat to CUT IN position and the supply switch is opened.

Field control method

Table

Armature voltage =

Sl.No	Field current In Volts	Speed In rpm



EXERCISE 220: Construct the circuit diagram for speed control of DC shunt motor (phase control method or ward Leonard method)

Objectives

At the end of this exercise you shall be able to:

- to demonstrate the speed control of DC shunt motor by using ward Leonard method
- to draw the speed torque characteristics of DC shunt motor.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screwdriver Set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- 1 HP three phase AC induction motor - 1 No.
- 1 HP DC shunt generator - 1 No.
- 1 HP DC shunt motor - 1 No.
- Three phase 3 pole MCB - 1 No.
- Star - delta starter - 1 No.
- DC MCB - 2 Nos.
- Rheostat 220s / 2A - 1 No.
- Ammeter (0 - 2)A - 2 Nos.
- Voltmeter (0- 300)V - 1 No.
- Fuse - 5 Nos.
- 1 HP three phase induction motor - 1 No.
- 1 HP DC shunt motor - 1 No.
- 1 HP DC shunt generator - 1 No.
- Ward leonard speed control system study trainer
- Ammeter (0 - 10)A MC - 1 No.
- Voltmeter (0 - 300)V MC - 1 No.

Procedure

This system is used where an unusually wide and very sensitive speed control is required as for colliery winders, electric excavators, elevators and the main drives in steel mills and blooming and paper mills. M1 is the main motor whose speed control is required. The field of this motor is permanently connected across the dc supply lines. By applying a variable voltage across its armature, any desired speed can be obtained. This variable voltage is supplied by a motor-generator set which consists of either a dc or an ac motor M2 directly coupled to generator G. The motor M2 runs at an approximately constant speed. The output voltage of G is directly fed to the main motor M1. The voltage of the generator can be varied from zero up to its maximum value by means of its field regulator. By reversing the direction

of the field current of G by means of the reversing switch RS, generated voltage can be reversed and hence the direction of rotation of M1. It should be remembered that motor generator set always runs in the same direction.

We know that, in DC Shunt motor, the back emf is given by

$$Eb = V - IaRa = \frac{\phi ZNP}{60A}$$

So Speed

$$N = (V-IaRa) / Z\phi P \times 60A \qquad (1)$$

$N \alpha 1/\phi$ and $N \alpha 1/Ra$ (N is speed in RPM) Where ϕ is flux per pole & Ra is armature resistance.

- Connect the circuit as shown in circuit diagram.
- At base speed motor armature is fed at rated voltage.
- Field current is adjusted to the maximum value.
- For obtaining speeds below base speed armature voltage is reduced.
- For obtaining speeds above base speed field is gradually weakened.

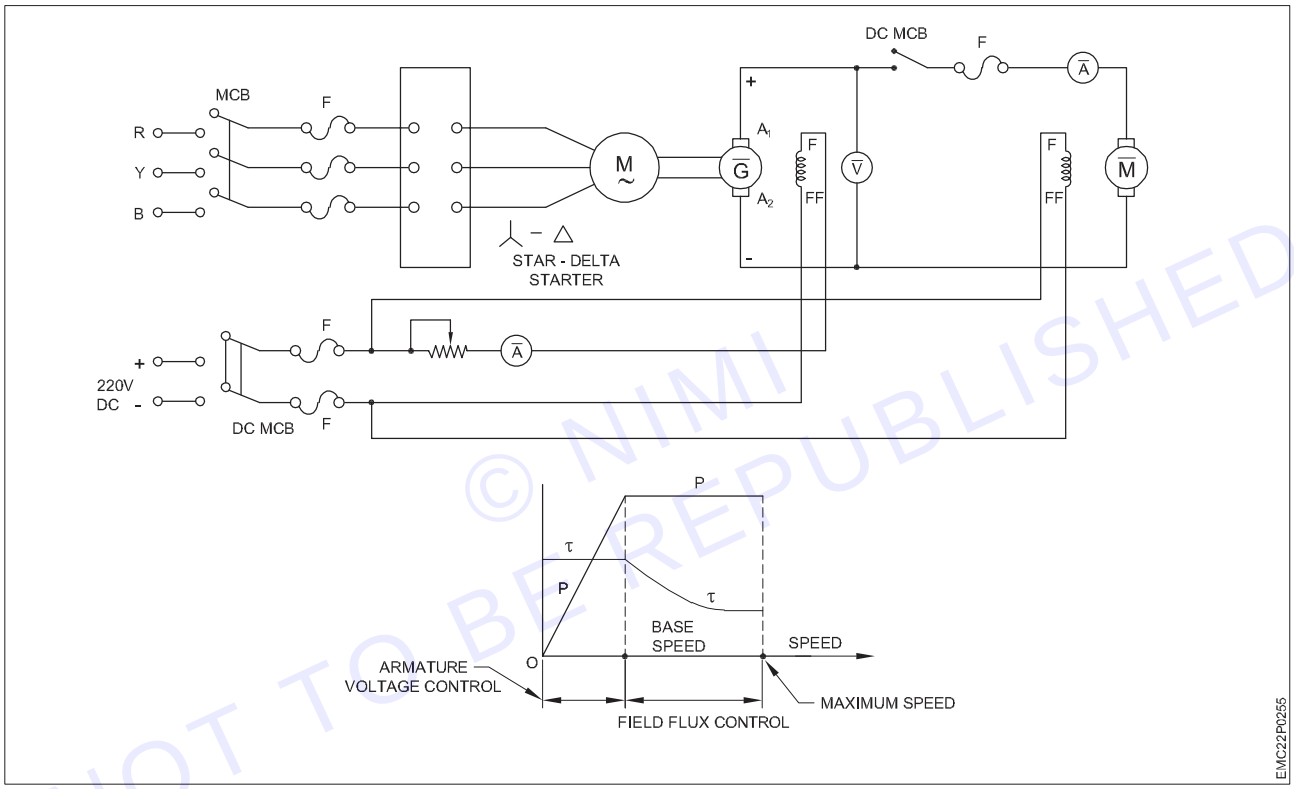
Observation table:

Table 1: Variation of speed below base speed.

Sl.No	Armature Voltage (V)	Speed(rpm)

Table 2: Variation of speed above base speed.

Sl.No	field Current (A)	Speed (rpm)



Result and discussions: Draw power vs speed and torque vs speed characteristics.

Precautions:

- All connections should be tight.
- Don't touch live terminals.
- Don't insert the resistance in field winding, when motor begins to start.
- Reading should be obtained carefully.

Pre experiment questions:

- What are different methods of speed control of DC motor?
- Draw Power vs Speed and Torque Vs speed Characteristics for Ward –Leonard method.?

Post experiment questions:

- Explain Power vs Speed and Torque Vs speed Characteristics for Ward –Leonard method.?
- In order to increase the speed above rated speed, which method of speed control is used in DC shunt motor?
- In order to decrease the speed below rated speed, which method of speed control is used in DC shunt motor?

EXERCISE 221: Construct the PWM circuit for the speed control of DC shunt motors

Objectives

At the end of this exercise you shall be able to:

- to demonstrate Introduction of PWM circuit
- to demonstrate DC shunt motors.

Requirements

Tools/ Equipments/ Instruments

- Neon tester
- Wire stripper
- Screw driver
- Combination plier
- Cotton clothes

Materials/ Components

- DC power supply
- MOSFET or PWM controller
- Diode (to protect against back EMF)
- Potentiometer (for speed control)
- DC shunt motor

Note:

- **PWM Control:** This could be a dedicated PWM controller or a microcontroller generating PWM signals. The duty cycle of the PWM signal determines the average voltage supplied to the motor, controlling its speed.
- **MOSFET:** If using a discrete MOSFET, it would be connected to the PWM control signal. MOSFETs are often preferred for their high switching speeds and efficiency in PWM applications.
- **Diode:** Connected across the motor terminals in reverse polarity to protect the circuit from back EMF generated by the motor when it is turned off. This diode allows the current to circulate safely when the motor is turned off, preventing damage to other components.
- **Potentiometer:** This is used for speed control. By adjusting the potentiometer, the voltage supplied to the PWM controller can be varied, thus changing the duty cycle of the PWM signal and consequently the motor speed.
- **DC Shunt Motor:** The motor to be controlled. It's connected between the positive supply and the MOSFET.

Procedure

1 Gather Components: Collect all the necessary components listed in the schematic diagram, including the DC power supply, MOSFET or PWM controller, diode, potentiometer, and the DC shunt motor.

2 Check Ratings: Make sure that all components are rated appropriately for the voltage and current requirements of the DC shunt motor. Check datasheets for MOSFETs and diodes to ensure they can handle the expected current and voltage.

3 Circuit Assembly:

- Connect the positive terminal of the DC power supply to the common terminal of the potentiometer.
- Connect one end of the potentiometer to the input pin of the PWM controller or MOSFET.
- Connect the other end of the potentiometer to the ground (GND) terminal of the power supply.
- Connect the output pin of the PWM controller or MOSFET to the positive terminal of the DC shunt motor.
- Connect the negative terminal of the DC shunt motor to the ground (GND) terminal of the power supply.
- Place the diode across the terminals of the motor, ensuring it is oriented correctly to allow current flow when the motor is turned off.

4 Power On: Turn on the DC power supply.

5 Adjust Potentiometer: Start with the potentiometer set to its minimum resistance position. Gradually increase the resistance by turning the potentiometer knob. This action should increase the duty cycle of the PWM signal, increasing the speed of the motor.

6 Observe Motor Speed: Observe the speed of the DC shunt motor as you adjust the potentiometer. You should notice the motor speed increasing as you increase the resistance.

7 Fine-tune Speed: Continue adjusting the potentiometer until you achieve the desired speed for your application. Take note of the potentiometer position or PWM duty cycle setting for future reference if you need to replicate the speed.

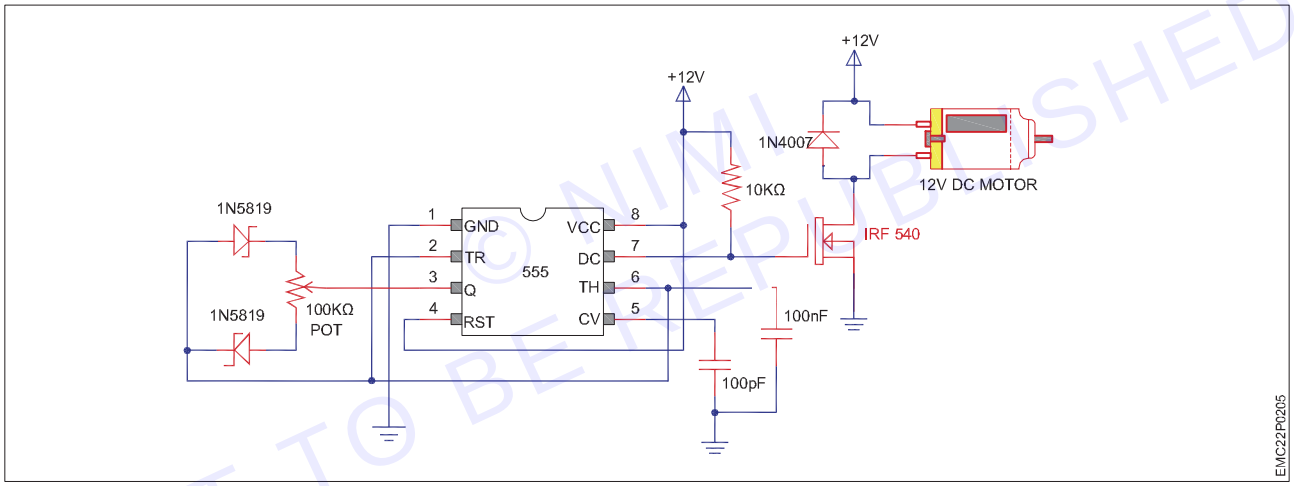
8 Safety Precautions: Ensure proper ventilation and cooling for the components, especially the MOSFET, as it may generate heat during operation. Avoid overloading the motor or the circuit beyond their rated capacities.

9 Testing and Calibration: Test the motor at different speeds to ensure smooth operation. Calibrate the potentiometer or PWM controller if necessary to achieve precise speed control.

10 Shutdown: When finished, turn off the DC power supply and disconnect the circuit if no longer in use.

Result:

We studied and verified the Construct the PWM circuit for the speed control of DC shunt motors.



EXERCISE 222: DC MOTOR

Objectives

At the end of this exercise you shall be able to:

- control the DC shunt motor using SCR chopper by using a trainer.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screw Driver set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- DC shunt motor
- Silicon Controlled Rectifier (SCR) Power supply
- Chopper circuit (which typically includes the SCR, gate triggering circuitry, freewheeling diode, and sometimes a snubber circuit)
- Control circuit (for controlling the firing angle of the SCR)
- Feedback sensor (optional, for closed-loop control)

Procedure

The chopper firing circuit gets signal from controller and then by supplying variable voltage to the armature of the motor the desired speed chopper is achieved. There are two different types of control loops, current controller and speed controller.

1 Operating Principle:

- The chopper circuit converts the fixed DC input voltage from the power supply into variable voltage pulses. The width of these pulses is controlled by adjusting the firing angle of the SCR.
- By controlling the width of the pulses, the average voltage applied to the motor armature can be varied, thereby controlling the speed of the DC shunt motor.
- When the SCR is triggered, it conducts, allowing current to flow through the motor. By adjusting the timing of the SCR firing, the effective voltage applied to the motor can be controlled.

2 Chopper Operation:

- The chopper circuit typically consists of an SCR, a gate triggering circuit (to control the SCR firing angle), a freewheeling diode (to allow current to continue flowing during off periods), and sometimes a snubber circuit (to protect the SCR from voltage spikes).
- The gate triggering circuit controls the firing angle of the SCR, determining when it turns on and off.
- As the firing angle is adjusted, the duty cycle of the chopped voltage changes, altering the average voltage applied to the motor.

3 Control Circuit:

- The control circuit is responsible for adjusting the firing angle of the SCR based on the desired speed of the motor.
- It may incorporate feedback from sensors such as tachometers or encoders to achieve closed-loop speed control.
- The control circuit may use techniques like pulse width modulation (PWM) to vary the firing angle and hence the motor speed.

4 Motor Speed Regulation:

- By adjusting the firing angle of the SCR, the average voltage applied to the motor can be controlled, thereby regulating its speed.

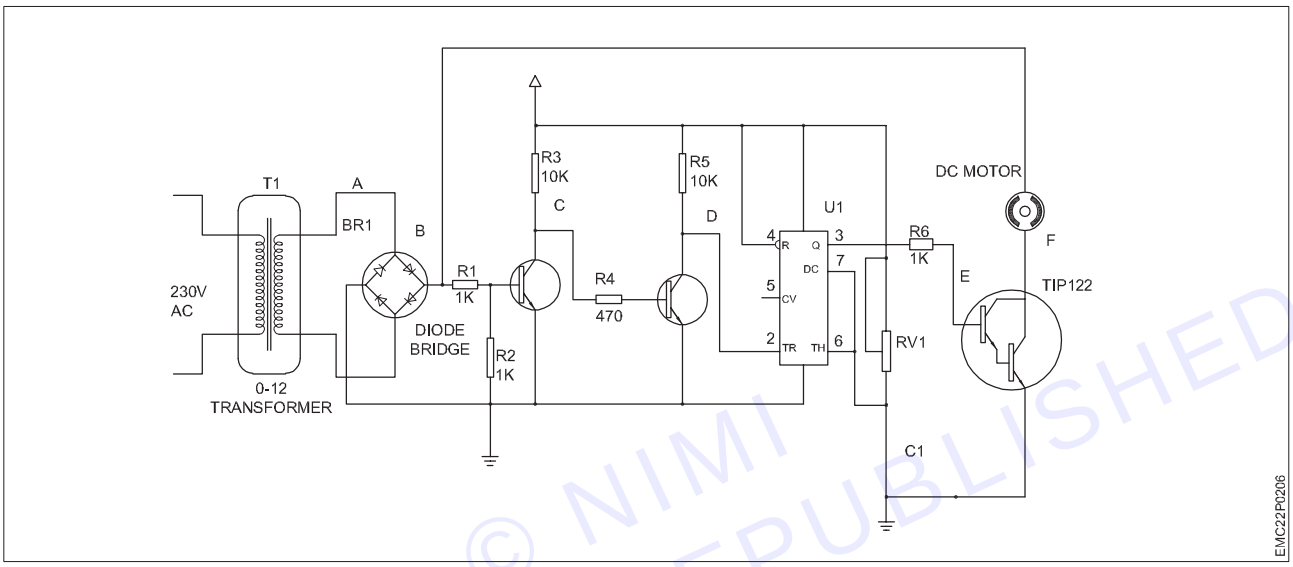
- Lowering the firing angle decreases the effective voltage applied to the motor, slowing it down, and vice versa.

5 Advantages:

- SCR chopper control offers smooth speed control over a wide range.
- It allows for efficient energy usage by controlling the motor's power consumption.

6 Applications:

- SCR chopper control is commonly used in applications where precise speed control of DC motors is required, such as in traction systems, industrial drives, and electric vehicle



7 Setup Components:

- Connect the DC shunt motor to the output terminals of the SCR chopper module.
- Connect the power supply to the input terminals of the SCR chopper module.
- Connect the control circuit to the SCR chopper module. If using a potentiometer, connect it to the control input of the chopper module. If using a microcontroller, ensure proper interfacing is done.

8 Power On:

- Turn on the power supply and set it to the desired voltage level.
- Ensure that all connections are secure and correct to avoid any short circuits or accidents.

9 Adjust Firing Angle:

- If using a potentiometer for manual control, adjust the potentiometer knob to vary the firing angle of the SCR.
- If using a microcontroller for automatic control, upload the control algorithm to the microcontroller and adjust any parameters as necessary.

10 Observe Motor Speed:

- As you adjust the firing angle of the SCR, observe the speed of the DC motor.
- Increasing the firing angle will increase the average voltage applied to the motor, resulting in higher speed, and vice versa.

11 Fine-tuning:

- Fine-tune the firing angle until you achieve the desired speed of the motor.
- Use a multimeter to measure the voltage and current to ensure they are within safe operating limits for the motor.

12 Test and Verify:

- Test the motor at different speeds to verify the performance of the SCR chopper

13 Safety Precautions:

- Always be cautious when working with electrical circuits and motors. Avoid short circuits and ensure proper insulation and grounding.
- Do not operate the motor beyond its rated voltage and current limits to prevent overheating and potential damage.

14 Shutdown:

- After testing, power off the system and disconnect any power sources.
- Ensure all components are safely disconnected and stored.

Results:

The primary result of the experiment is the ability to control the speed of the DC shunt motor. By adjusting the firing angle of the SCR, you can vary the average voltage applied to the motor, thereby regulating its speed. You should observe the motor speeding up or slowing down in response to changes in the firing angle.

— — — — —

EXERCISE 223: Study the AC drive set up and its connection

Objectives

At the end of this exercise you shall be able to:

- to study the AC drive set up
- to study the AC drive connection.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screw Driver set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- PLC-Any Brand-Dismountable latest specification - 1 No.

Procedure

The AC drive industry is growing rapidly and it is now more important than ever for technicians and maintenance personnel to keep AC drive installations running smoothly. AC drives change the speed of ac motor by changing voltage and frequency of the power supplied to the ac motor. In order to maintain proper power factor and reduce excessive heating of the motor, the name plate volts/hertz ratio must be maintained

AC Drive Operation principle

For understanding the basic principles behind AC drive operation requires understanding three basic section of AC drive: the Rectifier unit, DC Bus and the Inverter unit.

The supply voltage is firstly pass through a rectifier unit where in gets converted into AC to DC supply, the three phase supply is fed with three phase full wave diode where it gets converts into DC supply. The DC bus comprises with a filter section where the harmonics generated during the AC to DC conversion are filtered out. The last section consists of an inverter section which comprises with six IGBT where the filtered DC supply is being converted to quasi sinusoidal wave of AC supply which is supply to the ac motor connected to it.

From the ac motor working principle, we know that the synchronous speed of motor (rpm) is dependent upon frequency. Therefore by varying the frequency of the power supply through AC drive we can control the synchronous motor speed.

Basic of AC drives:

AC drive, inverter, converter and variable frequency drive are all terms that are often used in reference to equipment designed to control the speed of an AC motor. AC drives consist of the following sections. Power Section The power section of a basic AC drive circuit is composed of the following components.

The rectifier, often called a converter, with power semiconductor devices, coverts incoming AC power to DC.

rts the DC power to AC for variable speed control.

Constant V/F Ratio Operation

All AC drives maintain the output voltage - to - frequency (V/f) ratio constant at all speeds for the reason that follows. The phase voltage V, frequency f and the magnetic flux ϕ of motor are related by the equation:

$V = 4.444\ f\ N\ \phi m$ (or) $V/f = 4.444 \times N\ \phi m$

Where N = number of turns per phase.

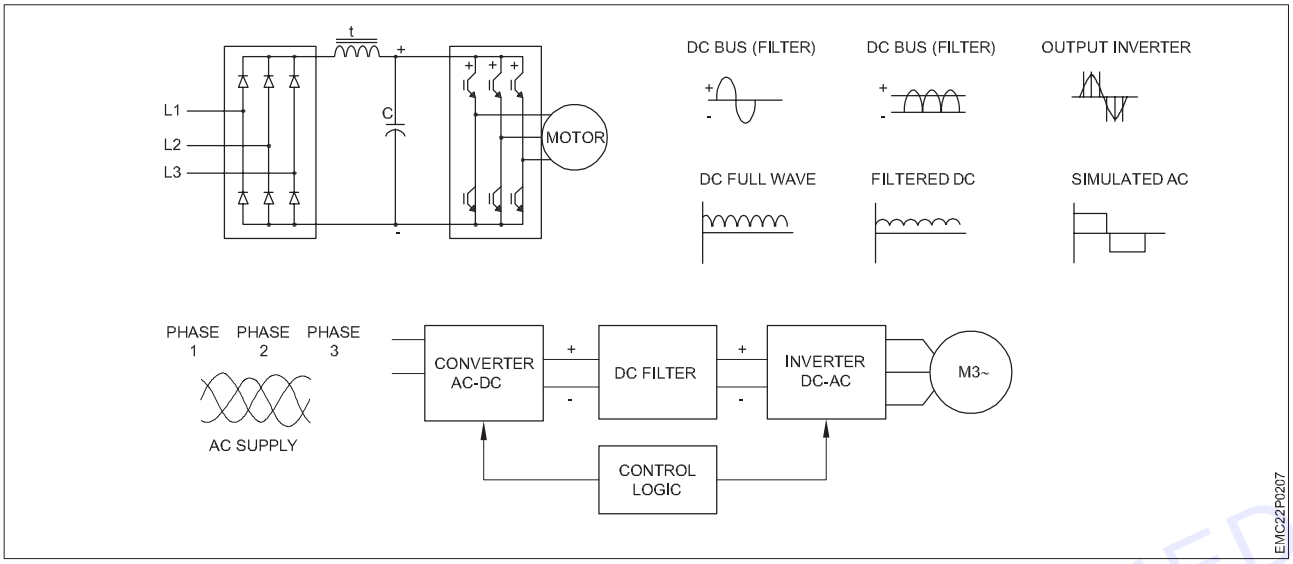
ϕm = magnetic flux

Formula:

Speed (rpm) = Frequency (Hertz) x 120 / No. of poles.

WHERE,

Frequency = Electrical Frequency of the power supply in Hz. No. of Poles = Number of electrical poles in the motor stator.



1 Connect the converter to Dc filter

2 Connect the Dc filter to inverter

3 Connect the inverter to 3 Phase induction motor

4 Turn on the power

5 Moniter the process in control logic in plc

6 Turn off the power

Result:

After we know the setup and connection of AC drives.

EXERCISE 224: Demonstrate different cable and connector used in the AC drive setup

Objectives

At the end of this exercise you shall be able to:

- to demonstrate various Input and output modules of PLC
- to demonstrate various indicators for status of PLC.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screw Driver set 150mm - 1 No.
- Wire Stripper - 1 No.

Materials/ Components

- Electric Source - 1 No.
- Power Processor - 1 No.
- Motor - 1 No.
- Load - 1 No.
- Sensor - 1 No.
- Controller - 1 No.

Procedure

In an AC drive setup, various types of cables and connectors are used. Here are some of them:

Power Cables: These are used to connect the AC drive to the power source. The type of power cable used depends on the power requirements of the AC drive.

Motor Cables: These cables connect the AC drive to the motor. They are designed to handle the high voltage and current requirements of the motor.

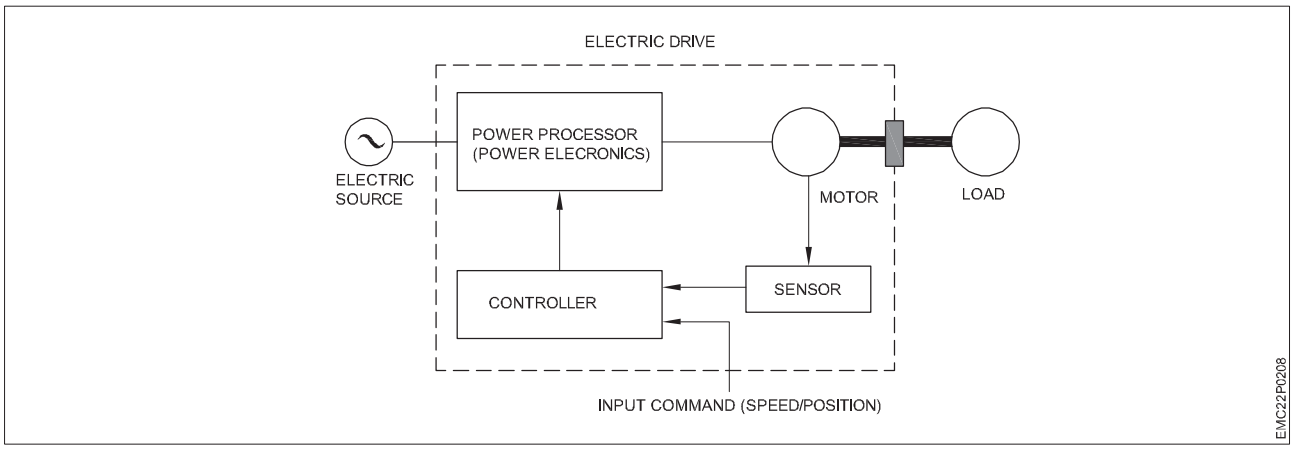
Control Cables: These are used to connect the AC drive to the control system. They carry signals for controlling the operation of the drive.

Communication Cables: These cables are used for communication between the AC drive and other devices in the system. They can be used for data transfer and monitoring purposes.

IEC Connectors: IEC connectors are used mostly for AC power input.

Barrel Connectors (Coaxial Power Connector): These are commonly used for power supply purposes.

The specific types of cables and connectors used can vary depending on the specific AC drive model and the requirements of the setup. Always refer to the manufacturer's guidelines when setting up an AC drive system.



That all connector have a gender male and female. The male refers to the connector that plugs and the female refers to the connector that are plugged into, connectors also have a polarity-polarity sensitive connectors are designed to be plugged in a specific orientation while polarity insensitive connector can be plugged and unplugged in any direction

To prevent inductive coupling, keep the signal wire pairs twisted all the way up to the terminals.

1 Strip the outer insulation of the cable and ground the bare shield 360 degrees under the clamp.

2 Connect the conductors to the correct control terminals.

3 For double-shielded cables, twist also the grounding conductors of each pair in the cable together and connect the bundle to terminal SCR (1).

4 Mechanically attach the control cables on the outside of the drive

Result:

AC drives reduce thermal and mechanical stresses on motors and belts. AC drive installation is as simple as connecting the power supply

— — — — —

EXERCISE 225: Demonstrate various input and output terminals of the drive unit, operator panel and display unit

Objectives

At the end of this exercise you shall be able to:

- to demonstrate various Input and Output terminals of the drive unit
- to demonstrate operator panel
- to demonstrate Display unit.

Requirements

Tools/Equipments/Instruments

- Push button - 1 No.
- Selector Switch - 1 No.
- Relay - 1 No.
- Encoder - 1 No.
- Pressure transmitter - 1 No.
- Temperature sensor - 1 No.

Materials/Components

- Desktop/ Laptop (Latest specification) - 1 No.
- Pointer - 1 No.

Procedure

1 Drive Unit:

The drive unit is a critical part of machinery and automation systems. It controls the motion of motors, servos, or actuators.

The drive unit, often referred to as a Variable Frequency Drive (VFD), has several important

It is also known as a power train or propulsion system,

Terminals:

Input Terminals: These are typically labelled as R/L1, S/L2, and T/L3.

Output Terminals: These are usually labelled as U/T1, V/T2, and W/T3.

DC Bus Terminals: These are usually located between the input and output terminals and are labelled as + and -."

2 Operator Panel:

An operator panel, also known as a Machine Operator's Panel, is used to perform general machine operations. It can be used for:

Moving axes manually in JOG mode.

Switching between operation modes.

Starting and stopping programs.

Adjusting the federate.

3 Display Unit:-

A display unit, often referred to as a Human Machine Interface (HMI), provides a visual representation of the status of a control system with real-time data acquisition. It can also act as the centralized control unit for manufacturing lines.

Display Units typically show:-

- Motor speed
- Current

- Voltage
- Fault Codes
- Parameter value

Related Formula:

The basic formula for drive units involves understanding the relationship between speed, torque, and power:

Power (P) = Torque (T) × Angular Velocity (ω)

Where:

Power (P) is measured in watts (W).

Torque (T) is measured in newton-meters (Nm).

Angular Velocity (ω) is measured in radians per second (rad/s).

- Identify the input and output terminals.
- Identify the other parts.
- Differentiate different modules
- Brief each module on its working and uses.

Tabulation:-

_____

_____

Calculation:

_____

_____

Result:

Thus, the various input and output terminals of Drive unit, Operator panel and Display Unit were identified.

Also, the find out the terminals of Drive unit, Operator panel and Display unit.

— — — — —

EXERCISE 226: Demonstrate Familiarization with PMU and different terminals of Micro master AC Drive

Objectives

At the end of this exercise you shall be able to:

- to demonstrate familiarization with Phase Measurement Unit
- to demonstrate the different terminals of Micro master AC Drive

Requirements

Tools/ Equipments/ Instruments

- Phasor Measurement Unit - 1 No.
- instrument transformer - 1 No.
- gaps receiver - 1 No.
- phasor date concentrators - 1 No.
- communication infrastructure - 1 No.

Materials/ Components

- Desktop/ Laptop (Latest specification) - 1 No.
- PLC-Any Brand-Dismountable - 1 No.
- Pointer - 1 No.

Procedure

PMU (Phasor Measurement Unit):- A Phasor Measurement Unit (PMU), also known as a synchrophasor, plays a crucial role in electric systems by enhancing operators' visibility into the vast grid network. Let's delve into what PMUs are and how they contribute to grid reliability.

PMUs capture samples from waveforms in quick succession and reconstruct the phasor quantity, resulting in a measurement called a synchrophasor.

These synchronized measurements are crucial because any frequency imbalances (due to supply-demand mismatches) can stress the grid and potentially cause power outages.

PMU also measure the frequency in the power grid.

1 Micro master AC Drive Overview:

The Micro master AC Drive is a type of variable frequency drive (VFD) manufactured by siemens. It is used to control the speed and torque of AC motors in various industrial applications.

These drives are commonly used for pumps, fans, conveyors, and other machinery.

2 Terminal Identification:

The Micro master AC Drive has several terminals, each serving a specific purpose. Here are some

Key terminals:

Power Supply Terminals:-

L/L1, N/L2, L3: These terminals connect to the power supply. They carry dangerous

voltages even when the inverter is not operational.

U1/L1, V1/L2, W1/L3: These terminals are also part of the power supply connection.

Motor Terminals:-

U, V, W: These terminals connect to the motor phases.

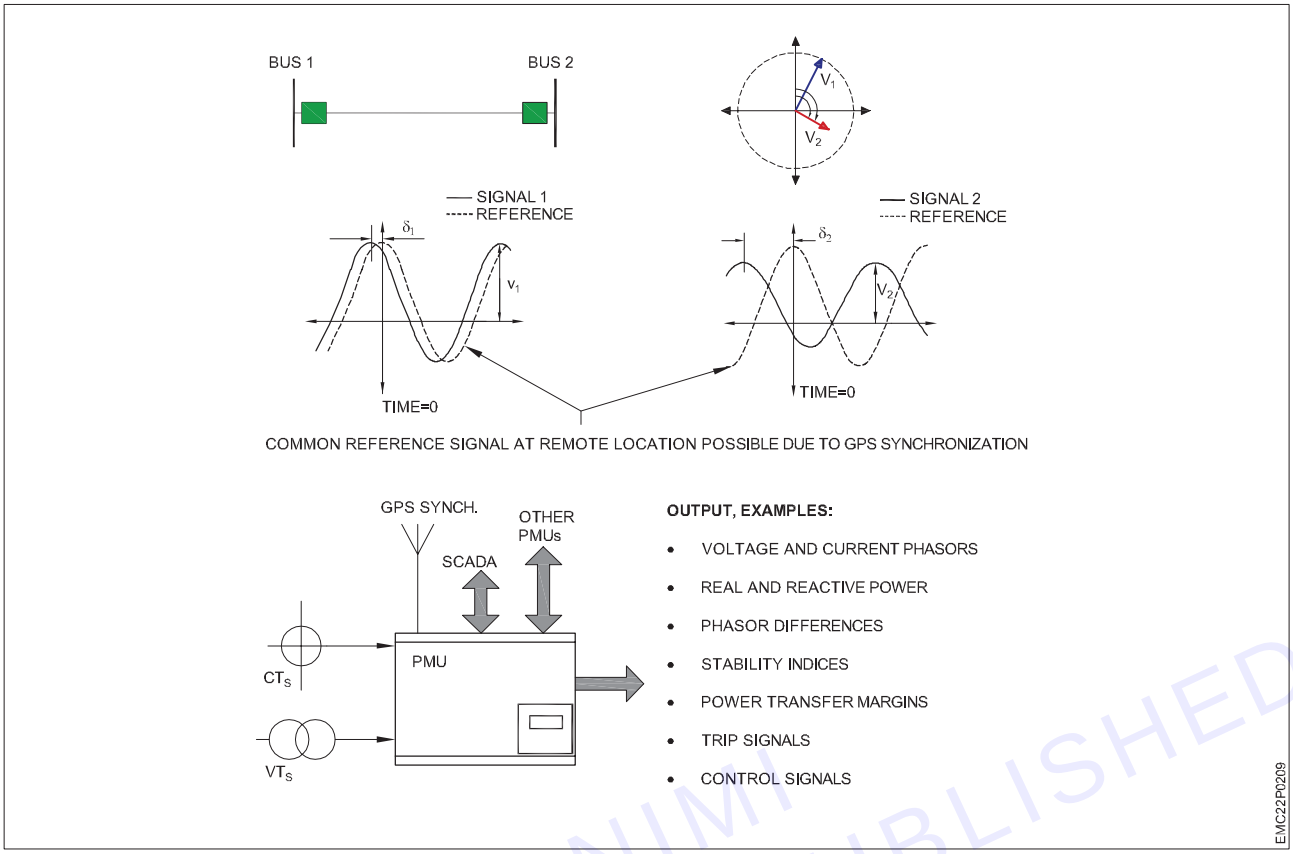
U2/T1, V2/T2, W2/T3: These are additional motor terminals, depending on the frame size of the drive.

Other Terminals:-

DC+/B+, DC-, B-: These terminals relate to the DC bus voltage.

DC/R+: This terminal is used for braking resistors.

C/L+ and D/L-: These are additional terminals for specific functions.



Related Formula:

A phasor is represented as:

F=Amej(ωt+ψ)

Where:

(F) is the phasor quantity.

(Am) is the magnitude at the specified frequency.

(omega) is the angular frequency.

(t) is time.

(psi) is the phase angle at the specified frequency

- Identify the terminals of Micro master AC Drive.
- Brief each terminals of Micro master AC Drive.
- Differentiate Different modules.

Tabulation:

Calculation:

Result:

Thus, the formularization with PMU was done by safely and right.

Also the different terminals of micro master AC Drive.

EXERCISE 227-230: Demonstration - Access parameter number, Familiarization with parameter, Parameter values for various operation and Commissioning of Micro Master Drive -420

Objectives

At the end of this exercise you shall be able to:

- demonstration-Access parameter number & values of micro master drive -420
- familiarization with parameter of micro master drive -420
- parameter values for various operation of micro master drive -420
- commissioning parameter numbers and values of micro master drive -420.

Requirements

Tools/Equipments/Instruments

- Combination Plier 250mm - 1 No.
- Screw Driver set 150mm - 1 No.
- Wire Stripper

Materials/Components

- Micro Master Drive -420

Procedure

An AC drive is a device used to control the speed of an electrical motor in order to: enhance process control. reduce energy usage and generate energy efficiently. decrease mechanical stress on motor control applications. Optimize the operation of various applications relying on electric motors.

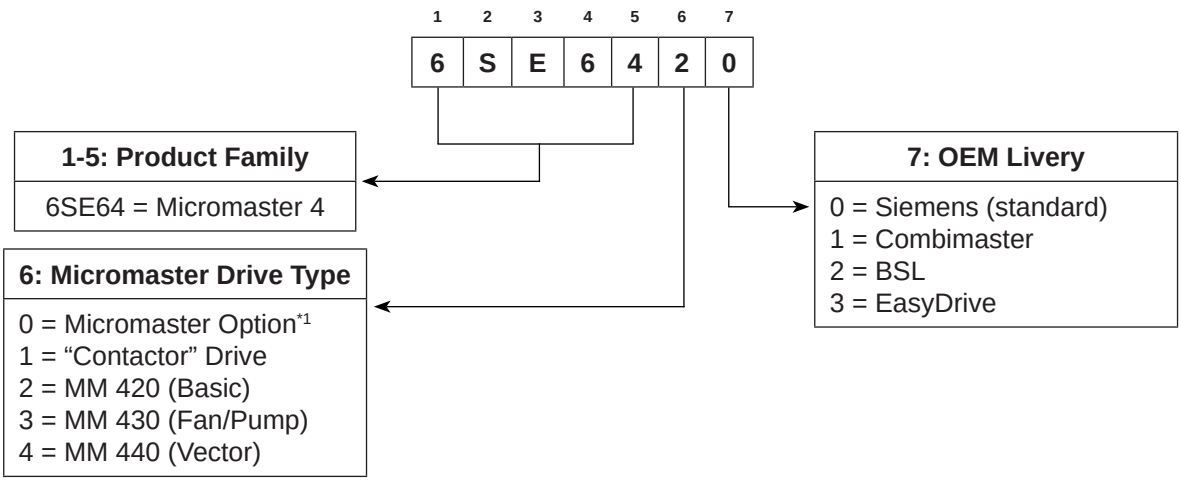
1 AC drives are used to steeples speed control of squirrel cage induction motors mostly used in process plants due to its ruggedness and maintenance free long life.

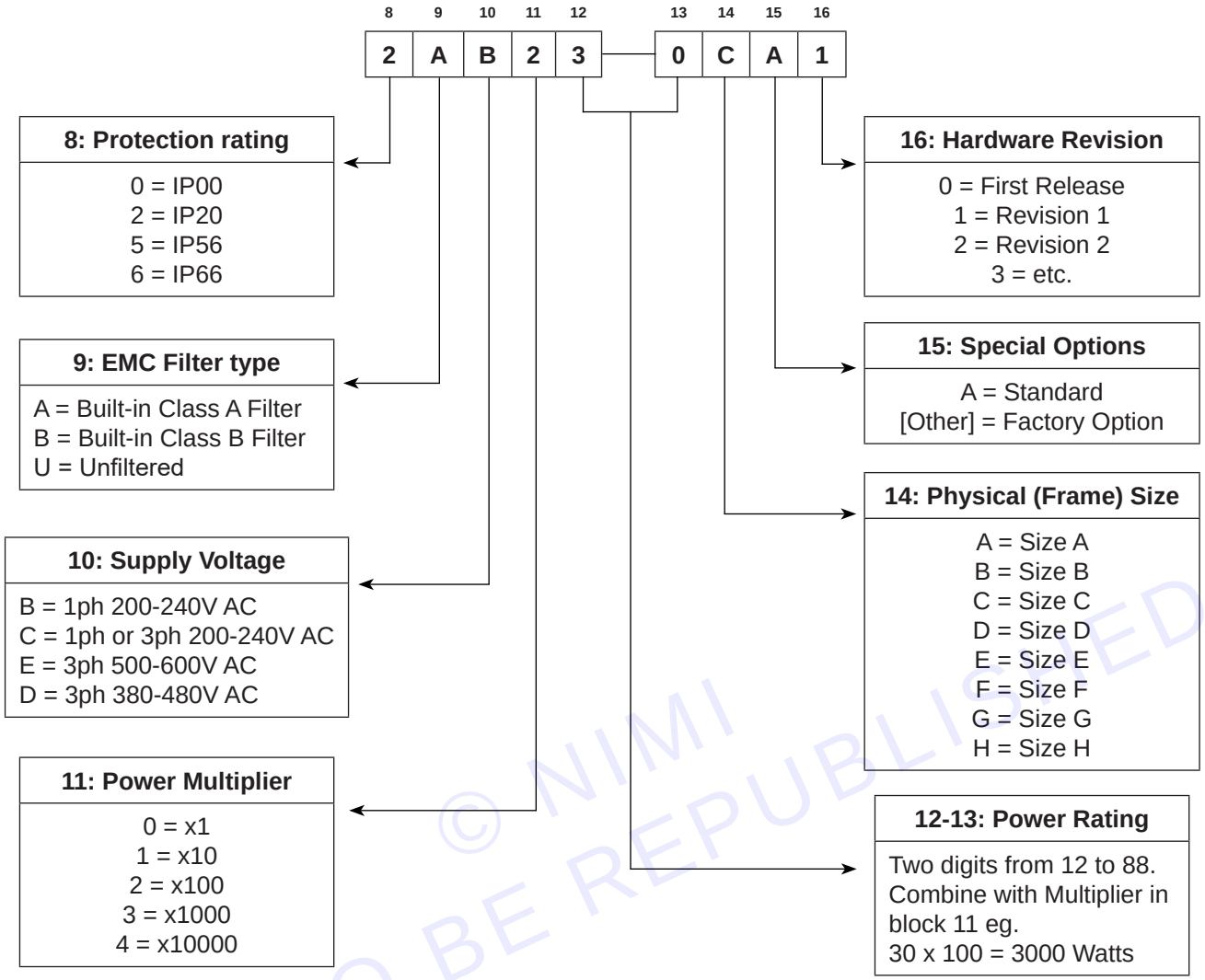
2 AC drive control speed of ac motor by varying output voltage and frequency through sophisticated microprocessor controlled electronics device.

3 AC drive consists of Rectifier and inverter units. Rectifier converts AC in DC voltage and inverter converts DC voltage back in AC voltage.

Part Numbers Explained

Siemens Micromaster 420, 430, 440 Frequency Inverters





Introduction to MICROMASTER System Parameters

1 Parameter number

Indicates the relevant parameter number. The numbers used are 4-digit numbers in the range 0000 to 9999. Numbers prefixed with an "r" indicate that the parameter is a "read-only" parameter, which displays a particular value but cannot be changed directly by specifying a different value via this parameter number (in such cases, dashes "-" are entered at the points "Unit", "Min", "Def" and "Max" in the header of the parameter description.

All other parameters are prefixed with a "P". The values of these parameters can be changed directly in the range indicated by the "Min" and "Max" settings in the header.

[index] indicates that the parameter is an indexed parameter and specifies the number of indices available.

2 Parameter name

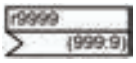
Indicates the name of the relevant parameter.

Certain parameter names include the following abbreviated prefixes: BI, BO, CI, and CO followed by a colon.

These abbreviations have the following meanings:

BI = P9999 (0) Binector input, i.e. parameter selects the source of a binary signal

BO = r9999 Binector output, i.e. parameter connects as a binary signal

CI =  Connector input, i.e. parameter selects the source of an analog signal

CO =  Connector output, i.e. parameter connects as an analog signal

CO/BO =  Connector/Binector output, i.e. parameter connects as an analog signal and/or as a binary signal

To make use of BiCo you will need access to the full parameter list. At this level many new parameter settings are possible, including BiCo functionality. BiCo functionality is a different, more flexible way of setting and combining input and output functions. It can be used in most cases in conjunction with the simple, level 2 settings.

The BiCo system allows complex functions to be programmed. Boolean and mathematical relationships can be set up between inputs (digital, analog, serial etc.) and outputs (inverter current, frequency, analog output, relays, etc.).

3 CStat

Commissioning status of the parameter.

Three states are possible:

Commissioning C

Run U

Ready to run T

This indicates when the parameter can be changed. One, two or all three states may be specified. If all three states are specified, this means that it is possible to change this parameter setting in all three inverter states

4 P-Group

Indicates the functional group of the particular.

Parameter P0004 (parameter filter) acts as a filter and focuses access to parameters according to the functional group selected.

5 Datatype

The data types available are shown in the table below.

Notation	Meaning
U16	16-bit unsigned
U32	32-bit unsigned
I16	16-bit integer
I32	32-bit integer
Float	Floating point

6 Active

Indicates whether

- Immediately changes to the parameter values take effective immediately after they have been entered, or
- Confirm the “P” button on the operator panel (BOP or AOP) must be pressed before the changes take effect.

7 Unit

Indicates the unit of measure applicable to the parameter values

8 QuickComm

Indicates whether or not (Yes or No) a parameter can only be changed during quick commissioning, i.e. when P0010 (parameter groups for commissioning) is set to 1 (quick commissioning).

9 Min

Indicates the minimum value to which the parameter can be set.

10 Def

Indicates the default value, i.e. the value which applies if the user does not specify a particular value for the parameter.

11 Max

Indicates the maximum value to which the parameter can be set.

12 Level

Indicates the level of user access. There are four access levels: Standard, Extended, Expert and Service. Level 4 parameters are only for service purposes and not visible with BOP/AOP. The number of parameters that appear in each functional group depends on the access level set in P0003 (user access level).

13 Description

The parameter description consists of the sections and contents listed below. Some of these sections and contents are optional and will be omitted on a case- to-case basis if not applicable.

Description: Brief explanation of the parameter function.

Diagram: Where applicable, diagram to illustrate the effects of parameters on a characteristic curve, for example

Settings: List of applicable settings. These include Possible settings, Most common settings, Index and Bitfields

Example: Optional example of the effects of a particular parameter setting.

Dependency: Any conditions that must be satisfied in connection with this parameter. Also any particular effects, which this parameter has on other parameter(s) or which other parameters have on this one.

Warning / Caution / Notice / Note:

Important information which must be heeded to prevent personal injury or damage to equipment / specific information which should be heeded in order to avoid problems / information which may be helpful to the user

More details: Any sources of more detailed information concerning the particular parameter.

Operators

The following operators are used in the parameter list to represent mathematical interrelationships:

Arithmetic operators

+ Addition
- Subtraction
* Multiplication
/ Division

Comparison operators

> Greater than
>= Greater than / equal to
< Less than
<= Less than / equal to

Equivalence operators

== Equal to
!= Not equal to

Logical operators

&& AND logic operation
|| OR logic operation

Quick commissioning (P0010 = 1)

The following parameters are necessary for quick commissioning (P0010 = 1)

Par.-No.	Name	Access level	Cstat
P0100	Europe / North America	1	C
P0300	Select motor type	2	C
P0304	Motor voltage rating	1	C
P0305	Motor current rating	1	C
P0307	Motor power rating	1	C
P0308	Motor cosPhi rating	1	C
P0309	Motor efficiency rating	1	C
P0310	Motor frequency rating	1	C
P0311	Motor speed rating	1	C
P0320	Motor magnetizing current	3	CT
P0335	Motor cooling	2	CT
P0640	Motor overload factor [%]	2	CUT
P0700	Selection of command source	1	CT
P1000	Selection of frequency setpoint	1	CT
P1080	Min. frequency	1	CUT
P1082	Max. frequency	1	CT
P1120	Ramp-up time	1	CUT
P1121	Ramp-down time	1	CUT
P1135	OFF3 ramp-down time	2	CUT
P1300	Control mode	2	CT
P1910	Select motor data identification	2	CT
P3900	End of quick commissioning	1	C

When P0010 = 1 is chosen, P0003 (user access level) can be used to select the parameters to be accessed. This parameter also allows selection of a user-defined parameter list for quick commissioning.

At the end of the quick commissioning sequence, set P3900 = 1 to carry out the necessary motor calculations and clear all other parameters (not included in P0010 = 1) to their default settings.

Note: This applies only in Quick Commissioning mode.

Reset to Factory default

To reset all parameters to the factory default settings; the following parameters should be set as follows:

Set P0010 = 30 Set P0970 = 1

Note: The reset process takes approximately 10 seconds to complete.

Binector Input Parameters

ParNo	Parameter name
P0731	BI: Function of digital output 1
P0800	BI: Download parameter set 0
P0801	BI: Download parameter set 1
P0810	BI: CDS bit 0 (Local / Remote)
P0840	BI: ON/OFF1
P0842	BI: ON reverse/OFF1
P0844	BI: 1. OFF2
P0845	BI: 2. OFF2
P0848	BI: 1. OFF3
P0849	BI: 2. OFF3
P0852	BI: Pulse enable
P1020	BI: Fixed freq. selection Bit 0
P1021	BI: Fixed freq. selection Bit 1
P1022	BI: Fixed freq. selection Bit 2
P1035	BI: Enable MOP (UP-command)
P1036	BI: Enable MOP (DOWN-command)
P1055	BI: Enable JOG right
P1056	BI: Enable JOG left

ParNo	Parameter name
P1074	BI: Disable additional setpoint
P1110	BI: Inhibit neg. freq. setpoint
P1113	BI: Reverse
P1124	BI: Enable JOG ramp times
P1140	BI: RFG enable
P1141	BI: RFG start
P1142	BI: RFG enable setpoint
P1230	BI: Enable DC braking
P2103	BI: 1. Faults acknowledgement
P2104	BI: 2. Faults acknowledgement
P2106	BI: External fault
P2200	BI: Enable PID controller
P2220	BI: Fixed PID setp. select Bit 0
P2221	BI: Fixed PID setp. select Bit 1
P2222	BI: Fixed PID setp. select Bit 2
P2235	BI: Enable PID-MOP (UP-cmd)
P2236	BI: Enable PID-MOP (DOWN-cmd)

Connector Input Parameters

ParNo	Parameter name
P0771	CI: DAC
P1070	CI: Main setpoint
P1071	CI: Main setpoint scaling
P1075	CI: Additional setpoint
P1076	CI: Additional setpoint scaling
P2016[4]	CI: PZD to BOP link (USS)

ParNo	Parameter name
P2019[4]	CI: PZD to COM link (USS)
P2051[4]	CI: PZD to CB
P2253	CI: PID setpoint
P2254	CI: PID trim source
P2264	CI: PID feedback

Binector Output Parameters

ParNo	Parameter name
r2032	BO: CtrlWrd1 from BOP link (USS)
r2033	BO: CtrlWrd2 from BOP link (USS)
r2036	BO: CtrlWrd1 from COM link (USS)

ParNo	Parameter name
r2037	BO: CtrlWrd2 from COM link (USS)
r2090	BO: Control word 1 from CB
r2091	BO: Control word 2 from CB

Connector Output Parameters

ParNo	Parameter name
r0020	CO: Freq. setpoint before RFG
r0021	CO: Act. frequency
r0024	CO: Act. output frequency

ParNo	Parameter name
r0025	CO: Act. output voltage
r0026	CO: Act. DC-link voltage
r0027	CO: Act. output current

ParNo	Parameter name
r0034	CO: Motor temperature (i2t)
r0036	CO:Inverter overload utilization
r0037	CO: Inverter temperature [°C]
r0039	CO: Energy consumpt. meter [kWh]
r0067	CO: Act. output current limit
r0071	CO: Max. output voltage
r0078	CO: Act. current Isq
r0084	CO: Act. air gap flux
r0086	CO: Act. active current
r0395	CO: Total stator resistance [%]
r0755	CO: Act. ADC after scal. [4000h]
r0947[8]	CO: Last fault code
r0948[12]	CO: Fault time
r0949[8]	CO: Fault value
r1024	CO: Act. fixed frequency
r1050	CO: Act. Output freq. of the MOP
r1078	CO: Total frequency setpoint
r1079	CO: Selected frequency setpoint
r1114	CO: Freq. setp. after dir. ctrl.
r1119	CO: Freq. setpoint before RFG

ParNo	Parameter name
r1170	CO: Frequency setpoint after RFG
r1242	CO: Switch-on level of Vdc-max
r1315	CO: Total boost voltage
r1337	CO: V/f slip frequency
r1343	CO: Imax controller freq. output
r1344	CO: Imax controller volt. output
r1801	CO: Act. pulse frequency
r2015[4]	CO: PZD from BOP link (USS)
r2018[4]	CO: PZD from COM link (USS)
r2050[4]	CO: PZD from CB
r2110[4]	CO: Warning number
r2224	CO: Act. fixed PID setpoint
r2250	CO: Output setpoint of PID-MOP
r2260	CO: PID setpoint after PID-RFG
r2262	CO: Filtered PID setp. after RFG
r2266	CO: PID filtered feedback
r2272	CO: PID scaled feedback
r2273	CO: PID error
r2294	CO: Act. PID output

Connector/Binector Output Parameters

ParNo	Parameter name
r0019	CO/BO: BOP control word
r0052	CO/BO: Act. status word 1
r0053	CO/BO: Act. status word 2
r0054	CO/BO: Act. control word 1
r0055	CO/BO: Act. control word 2
r0056	CO/BO: Status of motor control

ParNo	Parameter name
r0722	CO/BO: Binary input values
r0747	CO/BO: State of digital outputs
r0751	CO/BO: Status word of ADC
r0785	CO/BO: Status word of DAC
r1204	CO/BO: Status word:Flying start
r2197	CO/BO: Monitoring word 1

2 Parameter Description

Note: Level 4 Parameters are not visible with BOP or AOP. They are only for service purposes.

Common parameters

r0000	Drive display	Min: -
	Datatype: U16 Unit: -	Def: -
	P-Group: ALWAYS	Max: -
	Displays the user selected output as defined in P0005.	
Note:Pressing the "Fn" button for 2 seconds allows the user to view the values of DC link voltage, output frequency, output voltage, output current, and chosen r0000 setting (defined in P0005).		

r0002	Drive state			Min:	-
		Datatype: U16	Unit: -	Def:	-
	P-Group: COMMANDS			Max:	-
	Displays actual drive state. Possible Settings: 0 Commissioning mode (P0010 != 0) 1 Drive ready 2 Drive fault active 3 Drive starting (DC-link precharging) 4 Drive running 5 Stopping (ramping down) Dependency: State 3 visible only while precharging DC link, and when externally powered communications board is fitted.				
P0003	User access level			Min:	0
	CStat: CUT	Datatype: U16	Unit: -	Def:	1
	P-Group: ALWAYS	Active: first confirm	QuickComm.: No	Max:	4
	Defines user access level to parameter sets. The default setting (standard) is sufficient for most simple applications. Possible Settings: 0 User defined parameter list - see P0013 for details on use 1 Standard: Allows access into most frequently used parameters. 2 Extended: Allows extended access e.g. to inverter I/O functions. 3 Expert: For expert use only. 4 Service: Only for use by authorized service personal - password protected.				
P0004	Parameter filter			Min:	0
	CStat: CUT	Datatype: U16	Unit: -	Def:	0
	P-Group: ALWAYS	Active: first confirm	QuickComm: No	Max:	22
	Filters available parameters according to functionality to enable a more focussed approach to commissioning. Possible Settings: 0 All parameters 2 Inverter 3 Motor 7 Commands, binary I/O 8 ADC and DAC 10 Setpoint channel / RFG 12 Drive features 13 Motor control 20 Communication 21 Alarms / warnings / monitoring 22 Technology controller (e.g. PID) Example: P0004 = 22 specifies that only PID parameters will be visible.				

Dependency: The parameters are sub-divided into groups (P-Group) according to their functionality. This increases the transparency and allows a parameter to be quickly searched for. Furthermore, parameter P0004 can be used to control the ability to be visualized for the operator panel.

Value	P-Group	Group	Parameter area
0	ALWAYS	All parameters	
2	INVERTER	Drive inverter parameters	0200 0299
3	MOTOR	Motor parameters	0300 ... 0399 + 0600 0699
7	COMMANDS	Control commands, digital I/O	0700 .... 0749 + 0800 ... 0899
8	TERMINAL	Analog inputs/outputs	0750 0799
10	SETPOINT	Setpoint channel and ramp-function gen.	1000 1199
12	FUNC	Drive inverter functions	1200 1299
13	CONTROL	Motor open-loop/closed-loop control	1300 1799
20	COMM	Communications	2000 2099
21	ALARMS	Faults, warnings, monitoring functions	2100 2199
22	TECH	Technological controller (PID controller)	2200 2399

Parameters marked "Quick Comm: Yes" in the parameter header can only be set when P0010 = 1 (Quick Commissioning).

P0005	Display selection			Min:	2
	CStat: CUT	Datatype: U16	Unit: -	Def:	21
	P-Group: FUNC	Active: first confirm	QuickComm: No	Max:	4000
	Selects display for parameter r0000 (drive display). Common Settings: 21 Actual frequency 25 Output voltage 26 DC link voltage 27 Output current Notice: These settings refer to read only parameter numbers (“rxxxx”). Details: See relevant “rxxxx” parameter descriptions.				
P0006	Display mode			Min:	0
	CStat: CUT	Datatype: U16	Unit: -	Def:	2
	P-Group: FUNC	Active: first confirm	QuickComm: No	Max:	4
	Defines mode of display for r0000 (drive display). Possible Settings: 0 In Ready state alternate between setpoint and output frequency. In run display output frequency 1 In Ready state display setpoint. In run display output frequency. 2 In Ready state alternate between P0005 value and r0020 value. In run display P0005 value 3 In Ready state alternate between r0002 value and r0020 value. In run display r0002 value 4 In all states just display P0005				

Note:

- **When inverter is not running, the display alternates between the values for "Not Running" and "Running".**
- **Per default, the setpoint and actual frequency values are displayed alternately.**

P0007	Backlight delay time			Min:	0
	CStat: CUT	Datatype: U16	Unit: -	Def:	0
	P-Group: FUNC	Active: first confirm	QuickComm: No	Max:	2000
	Defines time period after which the backlight display turns off if no operator keys have been pressed. Value: P0007 = 0: Backlight always on (default state). P0007 = 1 - 2000: Number of seconds after which the backlight will turn off.				
P0010	Commissioning parameter			Min:	0
	CStat: CT	Datatype: U16	Unit: -	Def:	0
	P-Group: ALWAYS	Active: first confirm	QuickComm: No	Max:	30
	Filters parameters so that only those related to a particular functional group are selected. Possible Settings: 0 Ready 1 Quick commissioning 2 Inverter 29 Download 30 Factory setting Dependency: - Reset to 0 for inverter to run. - P0003 (user access level) also determines access to parameters.				

Note:

P0010 = 1

The inverter can be commissioned very quickly and easily by setting P0010 = 1. After that only the important parameters (e.g.: P0304, P0305, etc.) are visible. The value of these parameters must be entered one after the other. The end of quick commissioning and the start of internal calculation will be done by setting P3900

= 1 - 3. Afterward parameter P0010 and P3900 will be reset to zero automatically.

P0010 = 2

For service purposes only.

P0010 = 29

To transfer a parameter file via PC tool (e.g.: DriveMonitor, STARTER) parameter P0010 will be set to 29 by the PC tool. When download has been finished PC tool resets parameter P0010 to zero.

P0010 = 30

When resetting the parameters of inverter P0010 must be set to 30. Resetting of the parameters will be started by setting parameter P0970 = 1. The inverter will automatically reset all its parameters to their default settings. This can prove beneficial if you experience problems during parameter setup and wish to start again. Duration of factory setting will take about 60 s.

P0011	Lock for user defined parameter			Min:	0
	CStat: CUT	Datatype: U16	Unit: -	Def:	0
	P-Group: FUNC	Active: first confirm	QuickComm.: No	Max:	65535
	Details: See parameter P0013 (user defined parameter)				
P0012	Key for user defined parameter			Min:	0
	CStat: CUT	Datatype: U16	Unit: -	Def:	0
	P-Group: FUNC	Active: first confirm	QuickComm: No	Max:	65535
	Details: See parameter P0013 (user defined parameter).				
P0013 [20]	User defined parameter			Min:	0
	CStat: CUT	Datatype: U16	Unit: -	Def:	0
	P-Group: FUNC	Active: first confirm	QuickComm.: No	Max:	65535
	Defines a limited set of parameters to which the end user will have access. Instructions for use: 1 Set P0003 = 3 (expert user) 2 Go to P0013 indices 0 to 16 (user list) 3 Enter into P0013 index 0 to 16 the parameters required to be visible in the user-defined list. The following values are fixed and cannot be changed: - P0013 index 19 = 12 (key for user defined parameter) - P0013 index 18 = 10 (commissioning parameter filter) - P0013 index 17 = 3 (user access level) 4 Set P0003 = 0 to activate the user defined parameter. Index: P0013[0] : 1st user parameter P0013[1] : 2nd user parameter P0013[2] : 3rd user parameter P0013[3] : 4th user parameter P0013[4] : 5th user parameter P0013[5] : 6th user parameter P0013[6] : 7th user parameter P0013[7] : 8th user parameter P0013[8] : 9th user parameter P0013[9] : 10th user parameter P0013[10] : 11th user parameter P0013[11] : 12th user parameter P0013[12] : 13th user parameter P0013[13] : 14th user parameter P0013[14] : 15th user parameter P0013[15] : 16th user parameter P0013[16] : 17th user parameter P0013[17] : 18th user parameter P0013[18] : 19th user parameter P0013[19] : 20th user parameter Dependency: First, set P0011 (“lock”) to a different value than P0012 (“key”) to prevent changes to user-defined parameter. Then, set P0003 to 0 to activate the user-defined list. When locked and the user-defined parameter is activated, the only way to exit the user-defined parameter (and view other parameters) is to set P0012 (“key”) to the value in P0011 (“lock”).				
P0014 [3]	Store mode			Min:	0
	CStat: UT	Datatype: U16	Unit: -	Def:	0
	P-Group: -	Active: first confirm	QuickComm: No	Max:	1
	Sets the store mode for parameters (“volatile” (RAM) or “nonvolatile” (EEPROM)). Possible Settings: 0 Volatile (RAM) 1 Nonvolatile (EEPROM) Index: P0014[0] : Serial interface COM link P0014[1] : Serial interface BOP link P0014[2] : PROFIBUS /				

Note: CB

1 **With the BOP the parameter will always be stored in the EEPROM.**

2 **P0014 itself will always be stored in the EEPROM.**

3 **P0014 will not be changed by performing a factory reset (P0010 = 30 and P0971 = 1).**

4 **P0014 can be transferred during a DOWNLOAD (P0010 = 29).**

5 **If "Store request via USS/CB = volatile (RAM)" and "P0014[x] = volatile (RAM)", you can make a transfer of all parameter values into the nonvolatile memory via P0971.**

6 **If "Store request via USS/CB" and P0014[x] are not consistent, the setting of P14[x] = "store nonvolatile (EEPROM)" has always higher priority.**

Store request via USS/CB	Value of P0014[x]	Result
EEPROM	RAM	EEPROM
EEPROM	EEPROM	EEPROM
RAM	RAM	RAM
RAM	EEPROM	EEPROM

EXERCISE 231: Installation of AC Drive(MicroMaster-420)

Objectives

At the end of this exercise you shall be able to:

- To install Siemens MicroMaster-420 Ac drive to control single phase/ three phase induction motor
- To understand installation procedures as per manufacturer manual.

Requirements

Tools/Equipments/Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

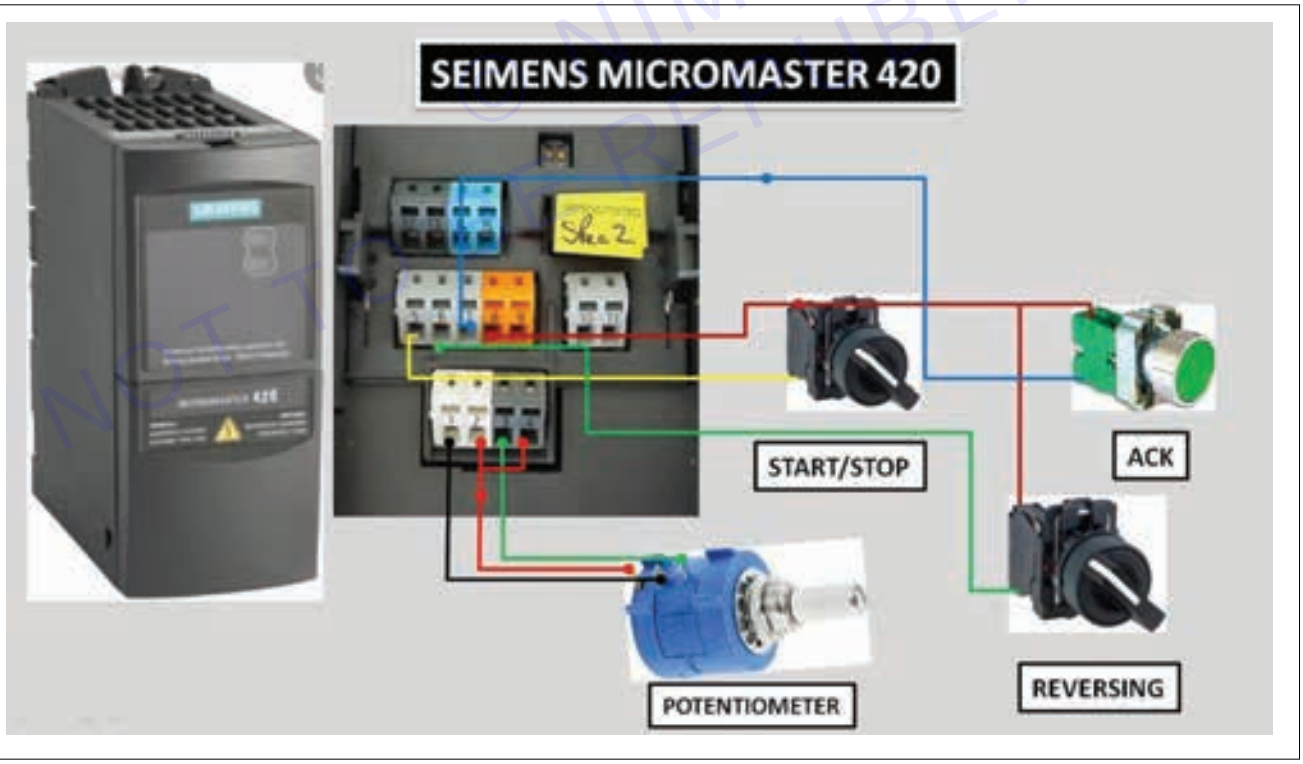
Materials/Components

- 3-Phase Induction Motor 10HP,415V,20A,50Hz - 1 No.
- AC drive- MicroMaster-420 Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.

Procedure

When installing the inverter after a period of storage please refer to Section2 of the Operating Instructions

DDIP-Switch1is not used.



Note:

Motors above11k Ware normally configured 400V Delta or 690V Star. Motor should be connected appropriately according to the output voltage of the inverter. For further information refer to the Operating Instructions of the motor.

The inverters are designed to operate in an industrial environment where a high level of EMI can be expected. Usually, good installation practices will ensure safe and trouble-free operation. If you encounter problems, follow the guidelines stated below.

Actions toTake

Ensure that all equipment in the cubicle is well grounded using short, thick grounding cable connected to a common star point or bus bar ,Make sure that any control equipment connected to the inverter (such as a PLC) is connected to the same ground or star point as the inverter via a short,thick link Connect the return ground from the motors,directly to the ground connection(PE) on the associated inverter.

Flat conductors are preferred as they have lower impedance at higher frequencies Terminate the ends of the cables neatly, ensuring that unscreened wiresareas short as possible Separate the control Cables from the power connections as much as possible,using separate trucking, if necessary at 900 right angles.Whenever possible,use screened leads for the connections to the control circuitry

Ensure that contactors inside the cubicle are suppressed, either with R-C suppressors for AC contactors, flywheel, diodes, for DC contactors fitted to the coils. Varistor suppressors are also effective. This is important when the contactors are controlled from the inverter relay Use screened or armored connections for the motor connections and ground the screen at both ends using cable clamps.

Warning

Safety regulations must not be compromised when The MM420 is supplied with a Status Display Panel(SP).

Default parameter settings cover the following requirements:

The motor rating data, Voltage, Current and Frequency are all compatible with the inverter data. (A standard Siemens motor is recommended).

Linear V/f motors peed, controlled by an analogue potentiometer.

Maximum speed 3000rpm /minute with 50Hz, Controllable using a potentiometer via the inverter, analogue inputs Ramp-uptime /Ramp-down time=10s

If more complex application settings are required, please refer to the parameter listing in the Operating Instructions.

For changing parameters you need one of the optional modules" Basic Operator Panel" (BOP), "Advanced Operator Panel" (AOP) or communication options.

See Operating Instructions and Reference Manual.

Results:

Thus the installations of MicroMaster-420 from Siemens have been installed successfully.

EXERCISE 232&235:Commissioning and parameter programming of AC Drive (Micro Master - 420)

Objectives

At the end of this exercise you shall be able to:

- to commissioning and quick commissioning of AC drive(MicroMaster-420) to control single phase/ three phase induction motor
- to understand parameter programming of AC drive(MicroMaster-420).

Requirements

Tools/Equipments/Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

Materials/Components

- 3-Phase Induction Motor 10HP,415V,20A,50Hz - 1 No.
- AC drive- MicroMaster-420 Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.

Procedure

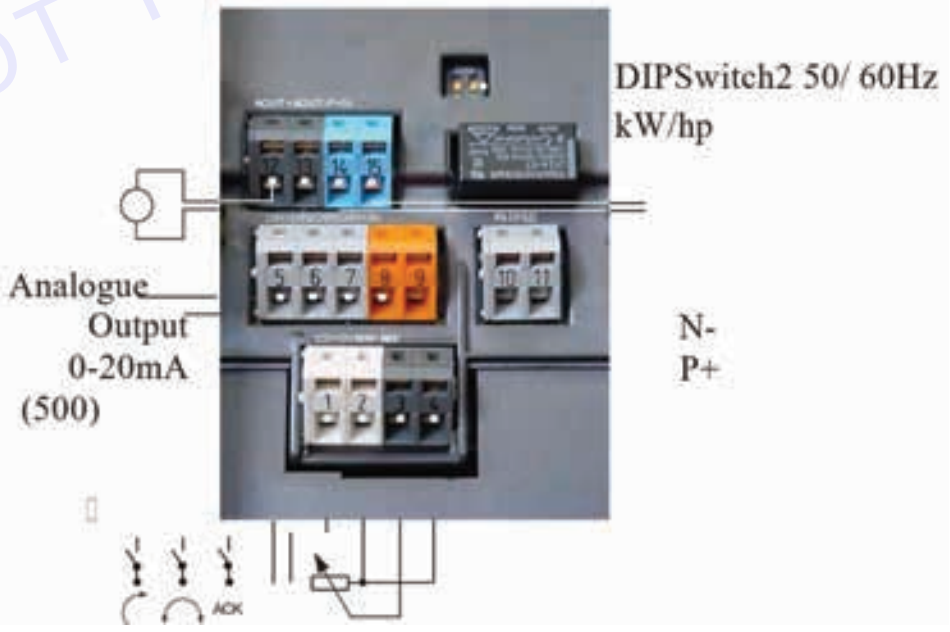
For replacing the SDP by an Operator Panel see Section6

Note:

Frequency setting: The inverter is delivered as follows: DDIPswitch2:

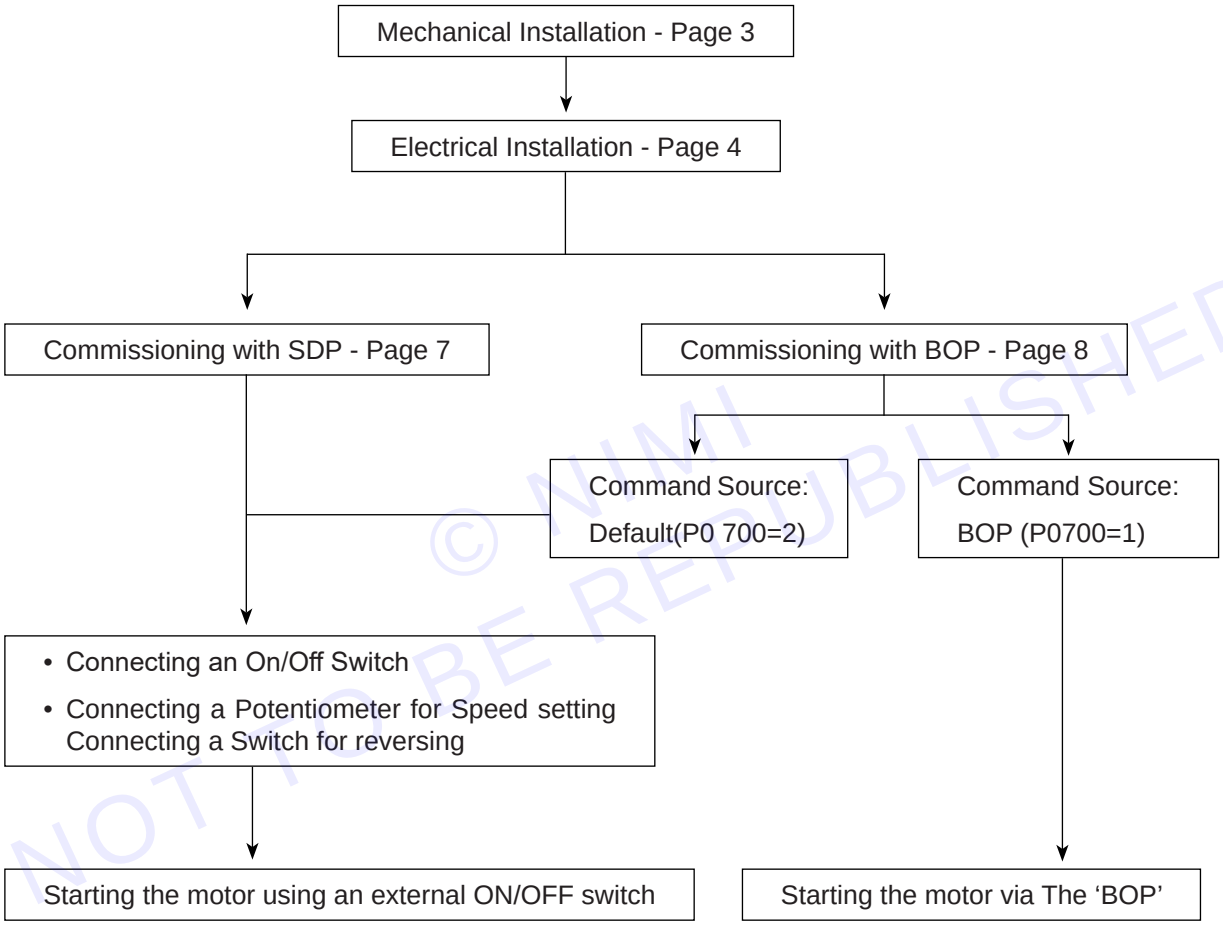
Off position: Europe and faults(50Hz,kW etc.)

On position: North America an defaults(60Hz,hpetc.) DDIP switch1: Not for customer use.



Default Settings

Digital inputs	Terminals	Parameter	Default operation
1	5	P0701= '1'	ON right
2	6	P0702= '12'	Reverse
3	7	P0703= '9'	Fault Acknowledge
Output relay	10/11	P0731= '52.3'	Fault Indication
Analogue Output	12/13	P0771= '21'	Output Frequency



Commissioning with the Status Display Panel

When commissioning the MICROMASTER 420 with the Status Display Panel(SDP),the drive application must be covered by the default settings of your MICROMASTER420.

Connect On/Off Switch to the terminals 5 and 8

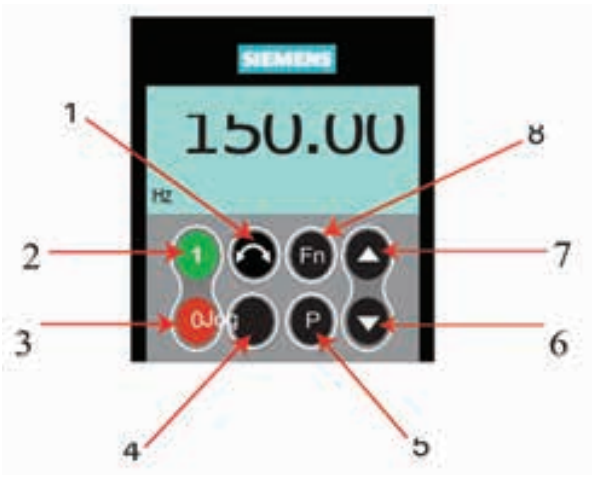
Connect switch for reversing direction to the terminals6 and 8(Optional) Connect Switch for fault reset to the terminals 7 and 8 (Optional) Connect analog frequency display to the terminals 12 and13(Optional) Connect Output relay to the terminals10 and11(Optional)

Connect a 5.0kΩ Potentiometer for speed control to the terminals1to 4

The Inverter is now ready for starting. With the Basic Operator Panel, which is available as an option, the user can change the default settings of the MM420 to meet particular application requirements. Using the BOP, it is possible to access level one, two and three parameter sets.

The BOP hosts the following features:

Speed, frequency, motor direction and current etc. displayed as required For direct control, the BOP is mounted directly on to the front panel of the inverter For “Quick Commissioning” of the inverter, the Getting Started Guide should be used. For other methods of commissioning, see the Operating Instructions or Reference Manual.



1 Change Direction : Changes the direction of rotation of the motor. Reverse is indicated by a mines (-) sign.

2 Start Inverter: This button starts the inverter. This button is Disabled by default. To enable this button set P0700 to 1.

3 Stop Inverter: This button stops the motor in the time set in P1121(Ramp-downtime).

4 Jog Motor: While the inverter has no output this button Causes the motor to start and run at the preset jog frequency. The inverter stops when the button is released.

5 Access Parameters: Pressing this button allows the user to access The parameters in the selected user access level.

6 Decrease Value: Pressing this button decreases the displayed value. To change the frequency set point via the BOP set P1000=1 (when P0700 = 1).

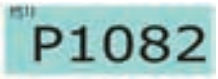
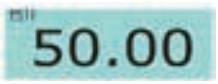
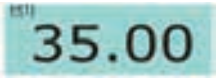
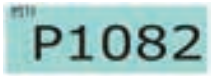
7 Increase Value: Pressing this button increases the displayed value. To change the frequency set point via the BOP set P1000=1 (when P0700 = 1).

8 Functions: This button can be used to view additional Information. See Section5.1.2 on page 42 of the MICROMASTER 420 Operating Instructions.

Changing parameters and settings using a‘BOP’/‘AOP’

The following description shows how to change the parameter P1082. Use this description as a guide for setting any parameters using the ‘BOP’.

Step	Result on display
1 Press to access parameters	r
2 Press until P0010 is displayed Press to access P0010	P0010
3 Value level Press to set P0010=1Press To save and exit	0

Step	Result on display
4 Value level	
5 Press until P1082 is displayed	
6 Valueleves Press to access P1082	
7 Press to select desired maximum frequency. Press to save and exit	
8 Value level Press to return to P0010	
9 Press to access P0010 Value level	
10 Press to return value to P0010 = 0 Press to save and exit	
11 Press to return or 0000 Press to exit Parameterization The LCD will alternate between actual frequency and the requested frequency set point.	

The required maximum frequency has now been stored.

The following parameters must be followed through in their entirety to ensure optimized and efficient operation of the inverter. Please note that P0010 must be set to‘1= Quick Commissioning ’ to allow this procedure to be carried out.

Result: Thus the commissioning and parameter programming of MM420 has been completed with BoP panel.

EXERCISE 233: Quick commissioning of AC Drive (Micro Master - 420)

Objectives

At the end of this exercise you shall be able to:

- to Quick commissioning of AC Drive(MicroMaster-420) to control single phase/ three phase induction motor.
- to understand parameter programming of AC Drive (MicroMaster-420).

Requirements

Tools/Equipments/Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

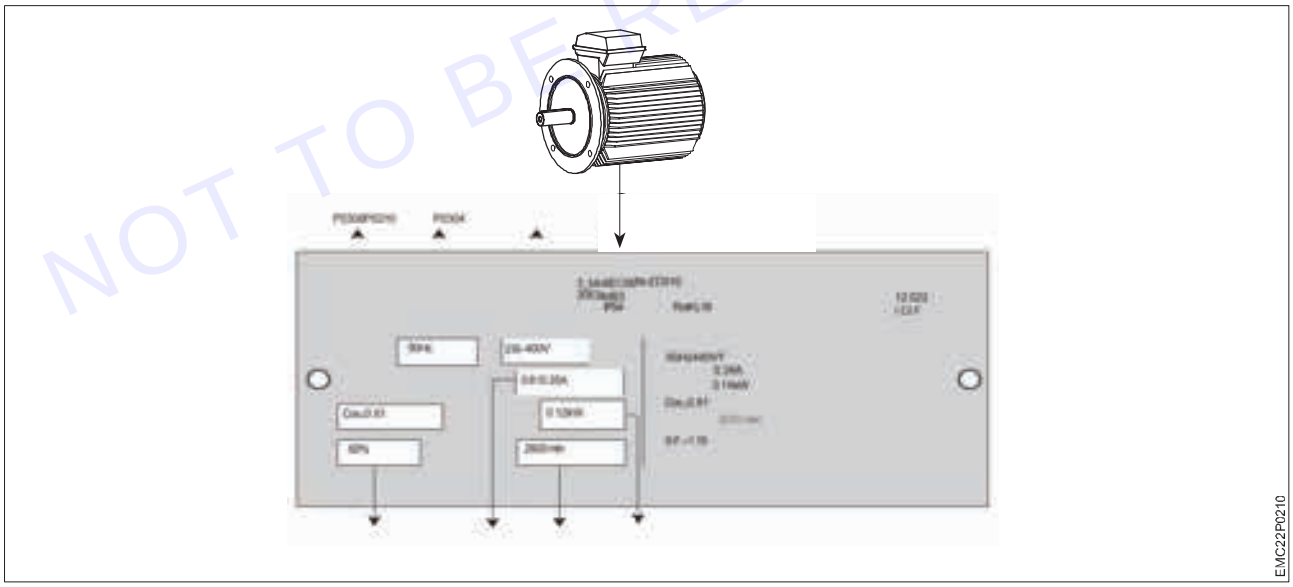
Materials/Components

- 3-Phase Induction Motor 10HP,415V,20A,50Hz - 1 No.
- AC drive- MicroMaster-420 Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.

Procedure

Motor Data for "Quick Commissioning"

To achieve optimum performance, the MICRO MASTER 420 Must have there relevant rated motor data set into the correct parameters. The diagram below indicates the data needed from the motor rating plate and the parameters that need to be set to store the information.



Starting/Stopping the mtor using a'BOP' (P0700=1), (P1000=1)

1 Press the green(RUN)button to start the motor.

2 Press the'UP'button while the motor is turning and motors peed increases to50Hz.

3 When the inverter reaches 50Hz, press the'DOWN'button. Motor speed and display are decreased.

4 Change the direction of rotation with the FORWARD/REVERSE button.

5 The red button STOPS the motor.

Commissioning with the Advanced Operator Panel (AOP)

The Advanced Operator Panel(AOP),which is available as an option, has all the functionality of a Basic Operator Panel and at the same time includes the following features:

Communication via RS232 interface Expanded language facility.

Diagnostic menu and fault finding assistance, Explanation of active parameters, faults etc.

Speed, frequency, motor direction and current value sets displayed Capacity to store and download up to10 parameter sets

Additional Control Applications

The MICROMASTER 420 can also be controlled by the following means: Digital inputs/ Analogue inputs

Serial Link via USS Protocol

Automated system via PROFIBUS connection

Changing single digits in Parameter values

For changing the parameter value rapidly, the single digits of the display can be changed by performing the following actions:

1 Ensure you are in the parameter value changing level (see" Changing parameters with BOP").

2 Press (function button),this causes the right-hand digit to blink.

3 Change the value of this digit by pressing /.

4 Press (function button) again causes the next digit to blink.

5 Perform steps2 to 4 until the required value is displayed.

6 Press the to leave the parameter value changing level and store the value.

With the Status Display Panel

The operating status of the inverter is indicated by the green and red LEDs on the Status Display Panel. These LEDs indicate the following warnings and fault states.

Green	Yellow	Priority Display	Drive Status Definitions
OFF	OFF	1	Mains Not present
OFF	ON	8	Inverter Fault-other than one is slisted below
ON	OFF	13	Inverter Running
ON	ON	14	Ready to run-standby
OFF	Flashing - R1	4	Fault Over current
Flashing - R1	OFF	5	Fault Overvoltage
Flashing - R1	ON	7	Fault Motor Over temperature
ON	Flashing - R1	8	Fault Inverter over temperature
Flashing– R1	Flashing- R1	9	Warning Current limit-BothLEDs Flashing same Time
Flashing - R1	Flashing - R1	11	Other Warnings-BothLEDsFlashing Alternately
Flashing - R1	Flashing - R2	6/10	Under voltage Trip/Under voltage warning
Flashing - R2	Flashing - R1	12	Drive is not in ready state--Display State>0

Green	Yellow	Priority Display	Drive Status Definitions
Flashing – R2	Flashing – R2	2	ROM Failure-Both LEDs Flashing same time
Flashing – R2	Flashing – R2	3	RAM Failure-Both LEDs Flashing Alternately
R1 - Ontime900mSec.R2- Ontime300mSec.			

With Operator Panels (BOP&AOP)

The following fault codes for the Basic Operator and Advanced Operator Panels indicate the status of the inverter:

Over current (FaultF0001)

BOP/AOP Fault code	Status of MICROMASTER420 Inverter
F0001	Over current
F0002	Over voltage
F0004	Inverter over temperature (internal PTC)
F0011	Motor over temperature by I^2t calculation

Ramp up time set too short. Increase P1120 accordingly.

Voltage boost too high. Reduce parameters P1310,P1311andP1312 to prevent excessive magnetization of the motor.

Overvoltage (FaultF0002)

Ramp down time set too short-IncreaseP1121accordingly.

Result: Thus the Quick commissioning of MM-420 has been completed.

EXERCISE 234: Commissioning of AC Drive (Micro Master - 420) with Default settings

Objectives

At the end of this exercise you shall be able to:

- to commissioning of AC drive (Micro Master-420) with default settings to control single phase/ three phase induction motor.

Requirements

Tools/Equipments/Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

Materials/Components

- 3-Phase Induction Motor 10HP,415V,20A,50Hz - 1 No.
- AC drive- MicroMaster-420 Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.

Procedure

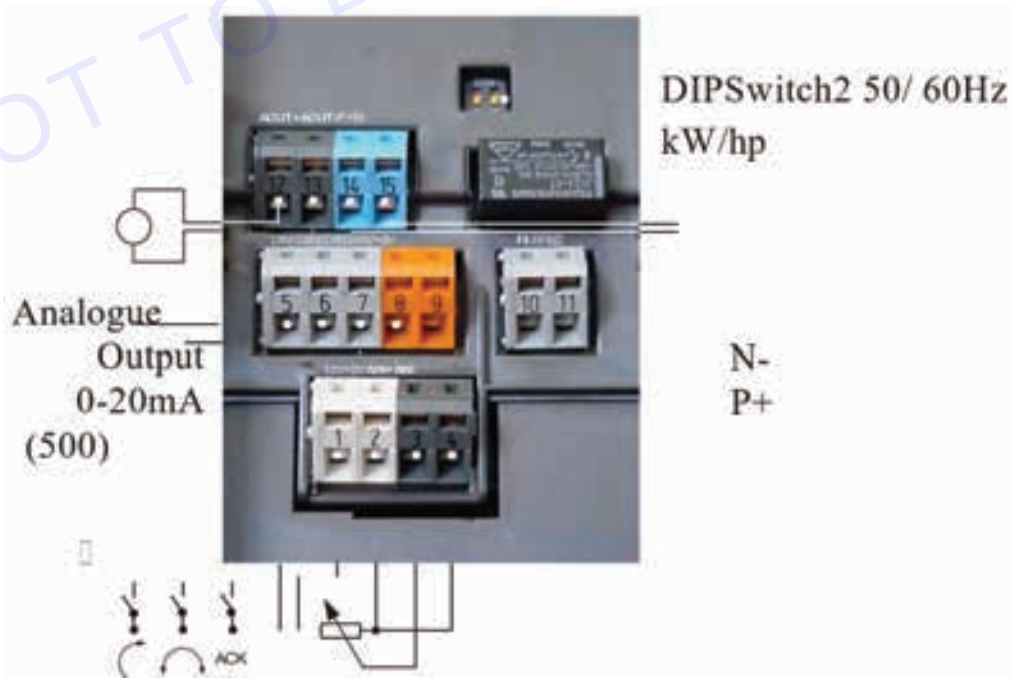
For replacing the SDP by an Operator Panel see Section6

Note:

Frequency setting: The inverter is delivered as follows: DDIPswitch2:

Off position: Europe and faults(50Hz,kW etc.)

On position: Indian defaults(50Hz,hpetc.) DDIP switch1: Not for customer use.



Default Settings

Digital inputs	Terminals	Parameter	Default operation
1	5	P0701='1'	ON right
2	6	P0702='12'	Reverse
3	7	P0703='9'	Fault Acknowledge
Output relay	10/11	P0731='52.3'	Fault Indication
Analogue Output	12/13	P0771='21'	Output Frequency

RESET Using P0010&P0970

When resetting the inverter P0010must be set to 30 (Factory Setting), it is then possible to set P0970 to'1'.The inverter will automatically reset all its parameters to their default settings.

§Denotes parameters that contain more detailed lists of possible settings for use in specific applications. Please refer to the Reference Manual and Operating Instructions on the CD

*Motor related parameters–please refer to motor rating plate drawing.

Result: Thus the Default settings of AC Drive(MicroMaster-420) with Default settings have been successfully completed.

EXERCISE 236: ON/OFF, Forward/ Reverse, Jog(R)/ Jog(L), Braking and speed control of AC motor using AC Drive(MicroMaster-420)

Objectives

At the end of this exercise you shall be able to:

- to ON/OFF, Forward /Reverse , Jog(R)/ Jog(L), Braking and speed control of AC motor using AC Drive (Micro Master - 420).

Requirements

Tools/Equipments/Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

Materials/Components

- 3-Phase Induction Motor 10HP,415V,20A,50Hz - 1 No.
- AC drive- MicroMaster-420 Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.

Procedure

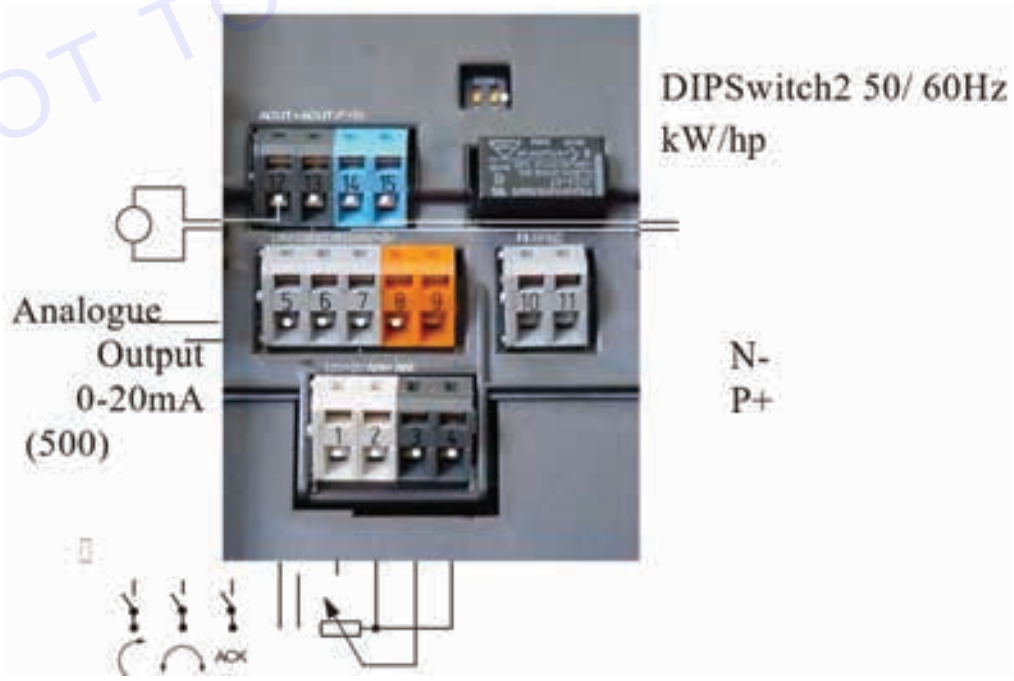
For replacing the SDP by an Operator Panel see Section6

Note:

Frequency setting: The inverter is delivered as follows: DDIPswitch2:

Off position: Europe and faults(50Hz,kW etc.)

On position: North America an defaults(60Hz,hpetc.) DDIP switch1: Not for customer use.



Default Settings

Digital inputs	Terminals	Parameter	Default operation
1	5	P0701='1'	ON right
2	6	P0702='12'	Reverse
3	7	P0703='9'	Fault Acknowledge
Output relay	10/11	P0731='52.3'	Fault Indication
Analogue Output	12/13	P0771='21'	Output Frequency

1 Change Direction: Changes the direction of rotation of the motor. Reverse is indicated by a mines (-) sign.

2 Start Inverter: This button starts the inverter. This button is Disabled by default. To enable this button set P0700 to 1.

3 Stop Inverter: This button stops the motor in the time set in P1121(Ramp-downtime).

4 Jog Motor: While the inverter has no output this button Causes the motor to start and run at the preset jog frequency. The inverter stops when the button is released.

5 Access Parameters: Pressing this button allows the user to access The parameters in the selected user access level.

6 Decrease Value: Pressing this button decreases the displayed value. To change the frequency set point via the BOP set P1000=1 (when P0700 = 1).

7 Increase Value: Pressing this button increases the displayed value. To change the frequency set point via the BOP set P1000=1 (when P0700 = 1).

8 Functions: This button can be used to view additional Information. See Section5.1.2 on page 42 of the MICROMASTER 420 Operating Instructions.

Result: Thus the ON/OFF , Forward /Reverse , Jog(R)/ Jog(L), Braking and speed control of AC motor using AC Drive(MicroMaster-420) has been tested successfully.

MODULE 22: Servo motor

EXERCISE 237: Control servo motor

Objectives

At the end of this exercise you shall be able to:

- to learn the basic specifications of a servo motor
- to demonstration how to control a Servo Motor using a 555 timer IC.

Requirements

Tools/Equipments/Instruments

- Combination Plier 250mm - 1 No.
- Screw Driver set 150mm - 1 Set.
- Wire Stripper - 1 Set.

Materials/Components

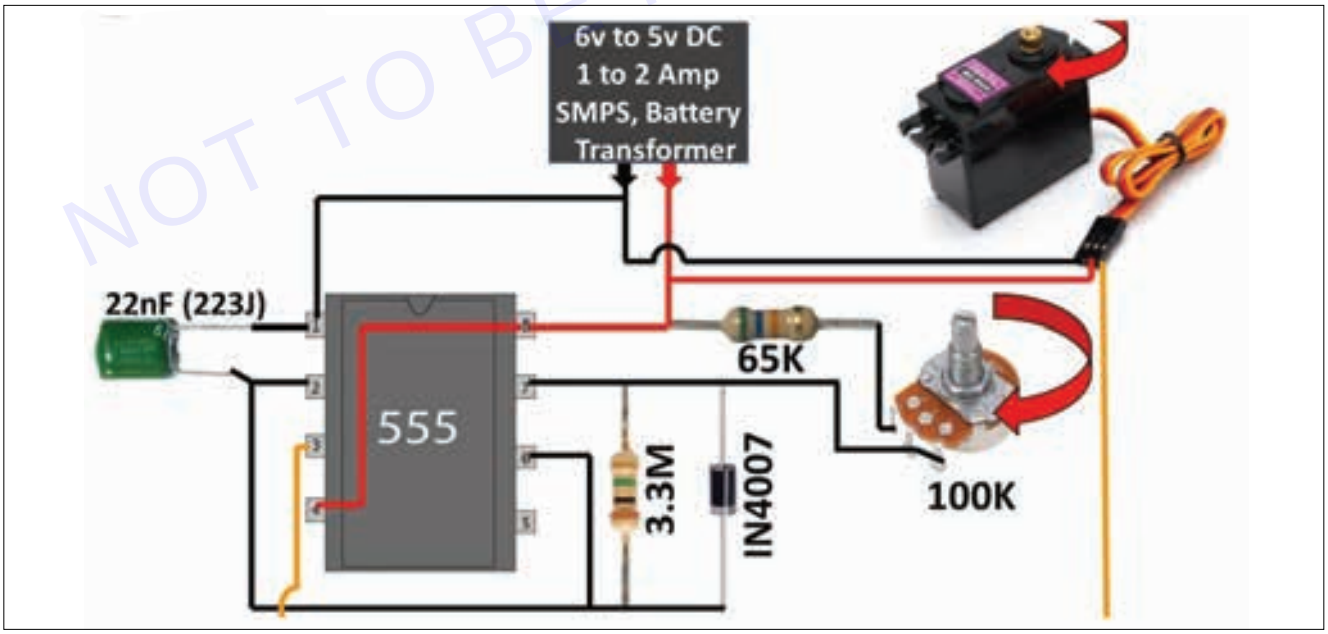
- Servo motor - 1 No.
- 555 Timer - 1 No.
- 6 Volt battery - 1 No.
- Two push-buttons resistors - 2 Nos.
- One transistor 1K, 4.7K, 33K, 10K, 68K, BC547) - 5 Nos.
- Capacitors 0.1uf - 1 No.

Procedure

The servo motor is a closed-loop mechanism that incorporates positional feedback in order to control the rotational or linear speed and position. The motor is controlled with an electric signal, either analog or digital, which determines the amount of movement which represents the final command position for the shaft.

Working Principle:

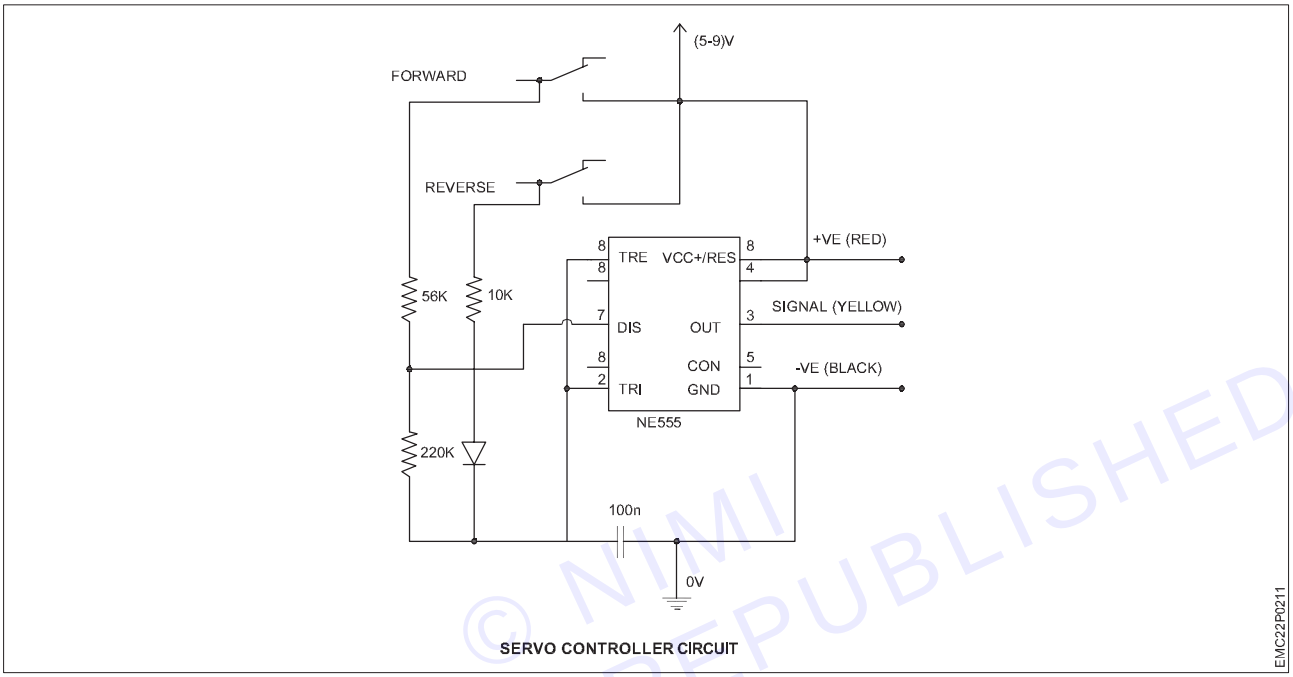
The position sensors provide a feedback signal corresponding to the present position of the load. This sensor is normally a potentiometer that produces the voltage corresponding to the absolute angle of the motor shaft through gear mechanism.



Advantages:

- The speed control characteristics of this motor are good.
- They generate less amount of heat.
- They offer high efficiency, more torque per weight, reliability & reduced RF noise.

- They need less maintenance.
- They have a longer life expectancy in the nonexistence of a commutator.
- These motors are capable of handling higher current surges in industrial machinery.
- At high speeds, they offer more constant torque.
- These are highly reliable.
- They provide high-speed performance.
- These are well-suitable to unstable load applications.



SERVO CONTROLLER CIRCUIT

Disadvantages:

- AC servo motor control is more difficult.
- These motors can be broken by constant overload.
- Gearboxes are frequently necessary to transmit power at high speeds.

Procedure:

Gather all the material required to make the project. List of components is already provided above. Connection all parts according to the circuit diagram and layout given above.

Once you have built the circuit, you can test it by pressing the two push buttons. These two push buttons will move the motor clockwise and anticlockwise

555 Timer IC

The 555 timer IC is a highly versatile and popular integrated circuit that is used extensively in electronic circuits for generating, timing and oscillator applications. It was introduced in the late 1970s and is available in various packaging options. The IC contains twenty-five transistors, two diodes, and fifteen resistors, which are configured to provide a wide range of functions such as astable, monostable, and bistable multivibrators. The IC can operate in a wide range of frequencies from a few Hertz to several hundred kHz and is widely used in electronic projects including timer circuits, tone generators, and pulse generators. It is easy to use, inexpensive, and readily available, making it an essential component in many electronic circuits

Results:

A servo motor tester is an essential tool for testing the functionality of servo motors before integrating them into robotics and electronics projects. Building this tester is a great way to hone your skills in electronics and robotics, and with the help of a 555 IC, you can create a highly efficient and accurate tester. By following the steps in this article or in the video, you can easily create your servo motor tester and ensure that your servo motors work correctly.

EXERCISE 238: Connect servo motor with drive control (SINAMICS V90)

Objectives

At the end of this exercise you shall be able to:

- to connect siemens SINAMICS V90 servo drive to control Servo motor
- to understand installation procedures as per manufacturer manual.

Requirements

Tools/ Equipments/ Instruments

- Combination Plier 250mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

Materials/ Components

- Servo Moto 1phase/ 3phase ,415V, 20A,50Hz - 1 No.
- Servo Drive- SINAMICS V90) Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.
- V-Assistant software / commissioning tool - 1 No.
- TIA portal software through Sinamics S7 controller - 1 No.

Procedure

Servo Drive with Servo Motor:

The SINAMICS V90 servo drive is integrated with digital input/output interface, pulse train interface and analog interface. It can be connected either to a Siemens controller like S7- 200, S7-1200 or S7-200 SMART, or to a third-party controller. Absolute position information can be read from the servo drive by the PLC via RS485 port. A configuration software tool, SINAMICS V-ASSISTANT, can be installed on a PC. The PC can communicate with SINAMICS V90 servo drive with a USB cable for performing parameter settings, trial run, status display monitoring, gain adjustments, and so on.

1 Sinamics V90 Servo drive.
2 Fuse (Type E) switch (optional).
3 Line filter (optional).
4 DC power supply 24V (optional)
5 External braking resistor (optional).
6 Simotics S-1FL6 servo motor.
7 RS485 interface cable.
8 USB / Mini USB cable.
9 SD / Micro SD card
10 Host controller (SIMATIC S7-1200).
11 Set point (Modbus) cable, 50 pins, 1 m.
12 Set point cable, 50 pins, 0.5 m (PN).
13 Encoder cable.
14 Shielding plate (in V90 package).
15 Hose clamp (attached on power cable).
16 Power cable.
17 Brake cable.

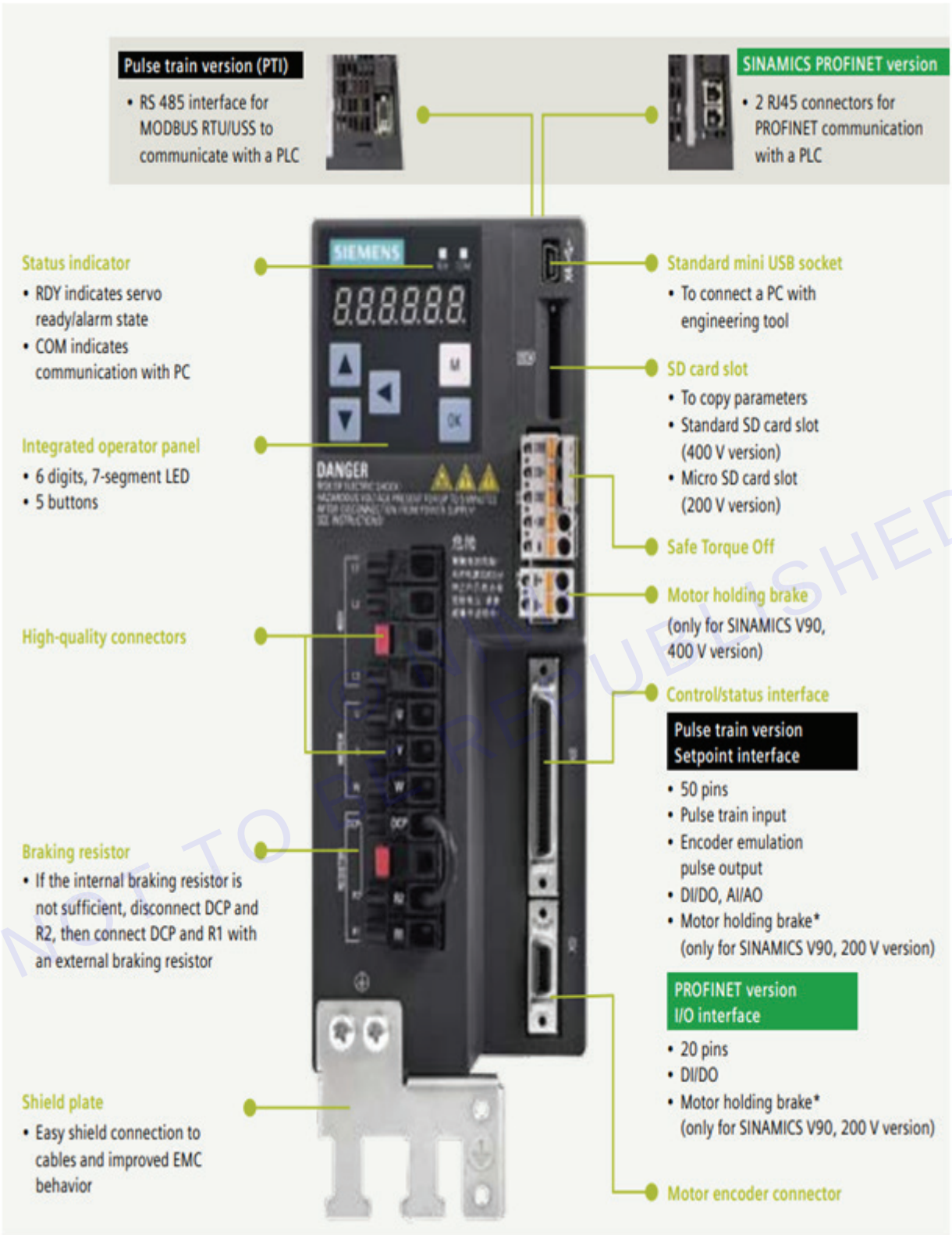
The following illustration shows an example of the SINAMICS V90 servo Commissioning purpose when the servo drive is powered on for the first time, you can perform a test run with the BOP or the engineering tool SINAMICS V-ASSISTANT to check:

- Whether the mains supply has been connected correctly.
- Whether the 24 V power supply has been connected correctly.
- Whether the cables (power cable, encoder cable, and brake cable) between the servo drive and the servo motor have been connected correctly.
- Whether the motor speed and direction of rotation are correct.

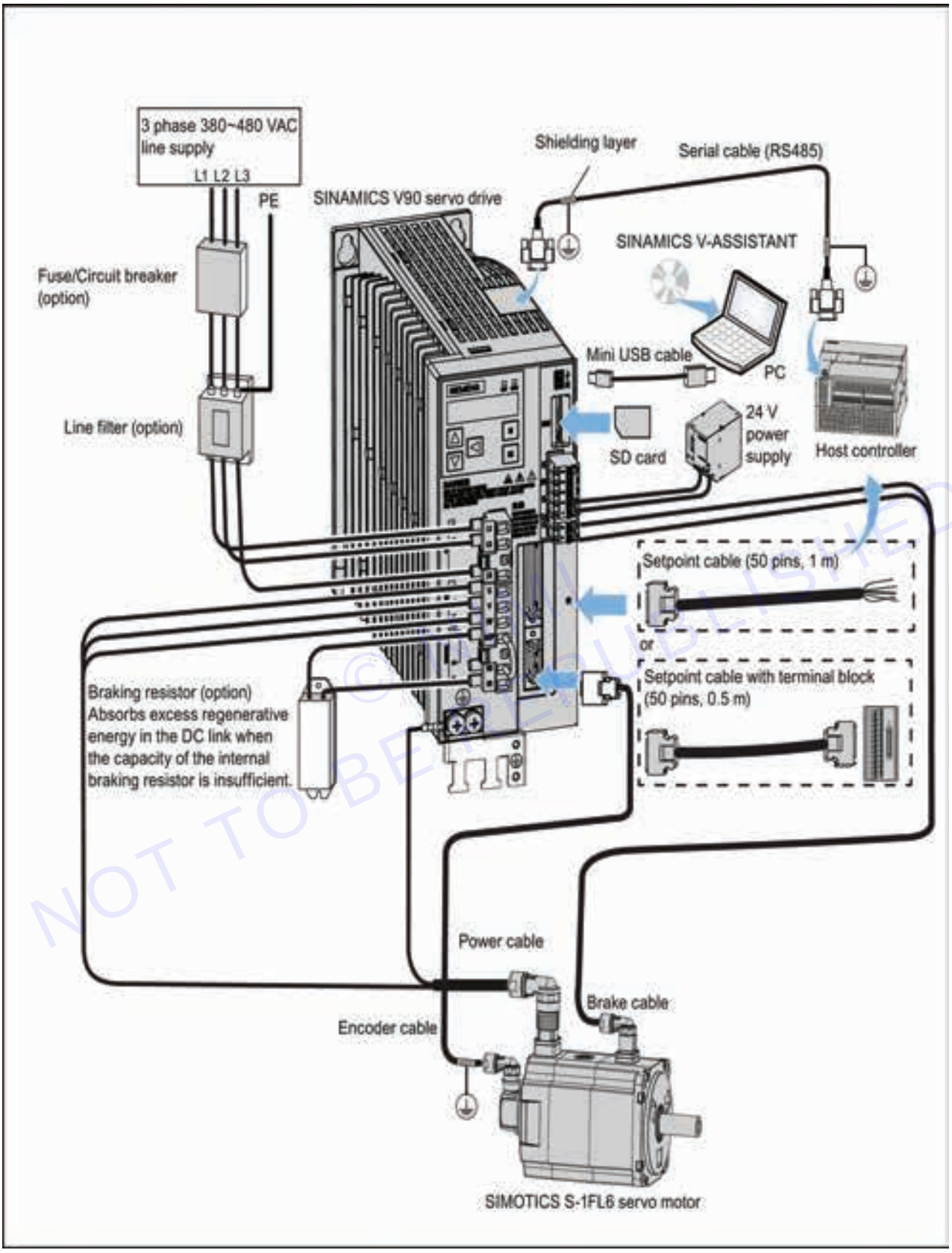
Prerequisite:

- The servo drive is connected to the servo motor without load.
- No PLC is connected to the drive system.

Result: Thus the Connection of servo motor with SINAMICS V90 servo drive was successfully established.



* Motor holding brake signal (only for SINAMICS 200 V version). The SINAMICS V90, 200 V version requires an external relay to connect the motor holding brake.



EXERCISE 239: Connect servo motor with computer through servo drive

Objectives

At the end of this exercise you shall be able to:

- to connect servo motor with servo drive using siemens SINAMICS V90 software.

Requirements

Tools/Equipments/Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

Materials/Components

- Servo Motor 1phase/ 3phase, 415V, 20A, 50Hz - 1 No.
- Servo Drive- SINAMICS V90) Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.
- V-Assistant software / commissioning tool - 1 No.
- TIA portal software through Sinamics S7 controller - 1 No.

Procedure

Servo Drive with Servo Motor:

The SINAMICS V90 servo drive is integrated with digital input/output interface, pulse train interface and analog interface. It can be connected either to a Siemens controller like S7- 200, S7-1200 or S7-200 SMART, or to a third-party controller. Absolute position information can be read from the servo drive by the PLC via RS485 port. A configuration software tool, SINAMICS V-ASSISTANT, can be installed on a PC. The PC can communicate with SINAMICS V90 servo drive with a USB cable for performing parameter settings, trial run, status display monitoring, gain adjustments, and so on.

1 Sinamics V90 Servo drive.
2 Fuse (Type E) switch (optional).
3 Line filter (optional).
4 DC power supply 24V (optional)
5 External braking resistor (optional).
6 Simotics S-1FL6 servo motor.
7 RS485 interface cable.
8 USB / Mini USB cable.
9 SD / Micro SD card
10 Host controller (SIMATIC S7-1200).
11 Set point (Modbus) cable, 50 pins, 1 m.
12 Set point cable, 50 pins, 0.5 m (PN).
13 Encoder cable.
14 Shielding plate (in V90 package).
15 Hose clamp (attached on power cable).
16 Power cable.
17 Brake cable.

Illustration shows an example of the SINAMICS V90 servo Commissioning purpose when the servo drive is powered on for the first time, you can perform a test run with the BOP or the engineering tool SINAMICS V-ASSISTANT to check:

- Whether the mains supply has been connected correctly.
- Whether the 24 V power supply has been connected correctly.
- Whether the cables (power cable, encoder cable, and brake cable) between the servo drive and the servo motor have been connected correctly.
- Whether the motor speed and direction of rotation are correct.

Prerequisite:

- The servo drive is connected to the servo motor without load.
- No PLC is connected to the drive system.

Step	Description	Remarks
1	Connect necessary units and check wiring.	It is necessary to connect the following cables: • Power cable • Encoder cable • Brake cable • Line supply cable • 24 VDC cable Check: • Is the device or cable damaged? • Do the connected cables have excessive pressure, load or tension? • Are the connected cables put on sharp edges? • Is the line supply within the permissible range? • Are all the terminals firmly and correctly connected? • Are all the connected system components well grounded? Refer to “Connecting (Page 55)”.
2	Switch on the 24 V power supply.	
3	Check the servo motor type. • If the servo motor has an incremental encoder, input motor ID (p29000). • If the servo motor has an absolute encoder, the servo drive can identify the servo motor automatically.	Fault F52984 occurs when the servo motor is not identified. You can find the motor ID from the motor rating plate. Go to "Motor components (Page 25)" for detailed descriptions about motor rating plate. Refer to "Basic operations (Page 113)" for information about how to change a parameter with the BOP.
4	Check the direction of motor rotation. The default direction of rotation is CW (clockwise). You can change it by setting the parameter p29001 if necessary.	p29001=0: CW p29001=1: CCW
5	Check the Jog speed. The default Jog speed is 100 rpm. You can change it by setting the parameter p1058.	
6	Save parameters.	For detailed information about the parameter setting / saving with the BOP, refer to the sections "Basic operations (Page 113)" or "Saving parameters (RAM to ROM) (Page 119)".
7	Clear faults and alarms.	Refer to "Diagnostics (Page 249)".
8	For the BOP, enter the Jog menu function and press the UP or DOWN button to run the servo motor. For the engineering tool, use the Jog function to run the servo motor.	For detailed information about Jog with the BOP, refer to Section "Jog (Page 118)". For detailed information about Jog with SINAMICS V-ASSISTANT, refer to SINAMICS V-ASSISTANT Online Help.

Commissioning in pulse train position control mode (PTI)

Step	Description	Remarks
1	Switch off the mains supply.	
2	Power off the servo drive and connect it to the controller (for example, SIMATIC S7-200 SMART) with the signal cable.	The digital signals CWL, CCWL and EMGS must be kept at high level (1) to ensure normal operation. Refer to "Standard application wirings (factory setting) (Page 73)" and "Connection examples with PLCs (Page 77)".
3	Power on the servo drive.	
4	Check current control mode by viewing value of the parameter p29003. Pulse train input position control mode (p29003=0) is the factory setting of SINAMICS V90 servo drives.	Refer to "Compound controls (Page 125)".
5	Configure necessary digital input signals by setting the following parameters: • p29301[0]: DI1 • p29302[0]: DI2 • p29303[0]: DI3 • p29304[0]: DI4 • p29305[0]: DI5 • p29306[0]: DI6 • p29307[0]: DI7 • p29308[0]: DI8	The factory settings are: • p29301[0]: 1 (SON) • p29302[0]: 2 (RESET) • p29303[0]: 3 (CWL) • p29304[0]: 4 (CCWL) • p29305[0]: 5 (G-CHANGE) • p29306[0]: 6 (P-TRG) • p29307[0]: 7 (CLR) • p99308[0]: 10 (TLIM1) Refer to "Digital inputs/outputs (DIs/DOs) (Page 61)".
6	Select a pulse input channel by setting parameter p29014.	• p29014=0: high-speed 5 V differential pulse train input • p29014=1: 24 V single end pulse train input 24 V single end pulse train input is the factory setting. Refer to "Selecting a setpoint pulse train input channel (Page 133)".

Commissioning in internal position control mode (IPos)

Step	Description	Remarks
1	Switch off the mains supply.	
2	Power off the servo drive and connect it to the controller (for example, SIMATIC S7-200 SMART) with the signal cable.	The digital signals CWL, CCWL and EMGS must be kept at high level (1) to ensure normal operation. Refer to "Standard application wirings (factory setting) (Page 73)" and "Connection examples with PLCs (Page 77)".
3	Power on the servo drive.	
4	Switch to the internal position control mode by setting p29003=1.	Refer to "Compound controls (Page 125)".

Step	Description	Remarks
5	Save the parameter and restart the servo drive to apply the settings of the internal position control mode.	
6	Configure necessary digital input signals by setting the following parameters: • p29301[1]: DI1 • p29302[1]: DI2 • p29303[1]: DI3 • p29304[1]: DI4 • p29305[1]: DI5 • p29306[1]: DI6 • p29307[1]: DI7 • p29308[1]: DI8	The factory settings are: • p29301[1]: 1 (SON) • p29302[1]: 2 (RESET) • p29303[1]: 3 (CWL) • p29304[1]: 4 (CCWL) • p29305[1]: 5 (G-CHANGE) • p29306[1]: 6 (P-TRG) • p29307[1]: 21 (POS1) • p29308[1]: 22 (POS2) Refer to "Digital inputs/outputs (DIs/DOs) (Page 61)". **Note: If your encoder is an incremental encoder, you must configure the digital input signal REF or SREF according to your selection of referencing mode.** Refer to "Referencing (Page 151)".
7	Configure the fixed position setpoint (p2617[0] to p2617[7]) according to mechanism.	• Fixed position setpoint 1: p2617[0] • Fixed position setpoint 2: p2617[1] • Fixed position setpoint 3: p2617[2] • Fixed position setpoint 4: p2617[3] • Fixed position setpoint 5: p2617[4] • Fixed position setpoint 6: p2617[5] • Fixed position setpoint 7: p2617[6] • Fixed position setpoint 8: p2617[7] Refer to "Setting fixed position setpoint (Page 147)".
8	Check and select a positioning mode by setting parameter p29241.	• p29241=0: incremental • p29241=1: absolute • p29241=2: absolute, positive (only for a rotary axis with modulo correction) • p29241=3: absolute, negative (only for a rotary axis with modulo correction) Refer to "Selecting a positioning mode - absolute/ incremental (Page 149)".

Step	Description	Remarks
9	Check the encoder type and perform referencing: • For an incremental encoder, choose a referencing mode by setting parameter p29240 and perform referencing. • For an absolute encoder, adjust the encoder with the BOP menu function "ABS". Refer to "Adjusting an absolute encoder (Page 124)".	Five referencing modes are available for the incremental encoder: • p29240=0: with digital input signal REF • p29240=1 (default): external referencing cam (REF) and encoder zero mark • p29240=2: only encoder zero mark • p29240=3: external referencing cam (CCWL) and encoder zero mark • p29240=4: external referencing cam (CWL) and encoder zero mark. Refer to "Referencing (Page 151)".
10	Clear faults and alarms.	Refer to "Diagnostics (Page 249)".
11	Trigger the digital signal SON to be high level.	
12	Select a fixed position setpoint by configuring the digital inputs POS1, POS2 and POS3, then start positioning with the triggering signal P-TRG.	POS3 : POS2 : POS1 0 : 0 : 0: fixed position setpoint 1 (p2617[0]) 0 : 0 : 1: fixed position setpoint 2 (p2617[1]) 0 : 1 : 0: fixed position setpoint 3 (p2617[2]) 0 : 1 : 1: fixed position setpoint 4 (p2617[3]) 1 : 0 : 0: fixed position setpoint 5 (p2617[4]) 1 : 0 : 1: fixed position setpoint 6 (p2617[5]) 1 : 1 : 0: fixed position setpoint 7 (p2617[6]) 1 : 1 : 1: fixed position setpoint 8 (p2617[7]) Refer to "Selecting a fixed position setpoint and starting positioning (Page 160)".
13	The system commissioning in internal position control mode ends.	You can check the system performance. If it is not ok, you can adjust it. Refer to "Tuning (Page 195)".

Result: Thus the Connection of servo motor with computer and SINAMICS V90 servo drive was successfully established and tested various parameters.

EXERCISE 240: Connect servo motor with computer through servo drive and perform parameter programming

Objectives

At the end of this exercise you shall be able to:

- to connect servo motor with servo drive using siemens SINAMICS V90 software and perform parameter programming.

Requirements

Tools/Equipments/Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

Materials/Components

- Servo Motor 1phase/ 3phase, 415V, 20A, 50Hz - 1 No.
- Servo Drive- SINAMICS V90) Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.
- V-Assistant software / commissioning tool - 1 No.
- TIA portal software through Sinamics S7 controller - 1 No.

Procedure

Servo Drive with Servo Motor:

The SINAMICS V90 servo drive is integrated with digital input/output interface, pulse train interface and analog interface. It can be connected either to a Siemens controller like S7- 200, S7-1200 or S7-200 SMART, or to a third-party controller. Absolute position information can be read from the servo drive by the PLC via RS485 port. A configuration software tool, SINAMICS V-ASSISTANT, can be installed on a PC. The PC can communicate with SINAMICS V90 servo drive with a USB cable for performing parameter settings, trial run, status display monitoring, gain adjustments, and so on.

Parts of servo drive- refer exercise 238 .

Commissioning –refer 239

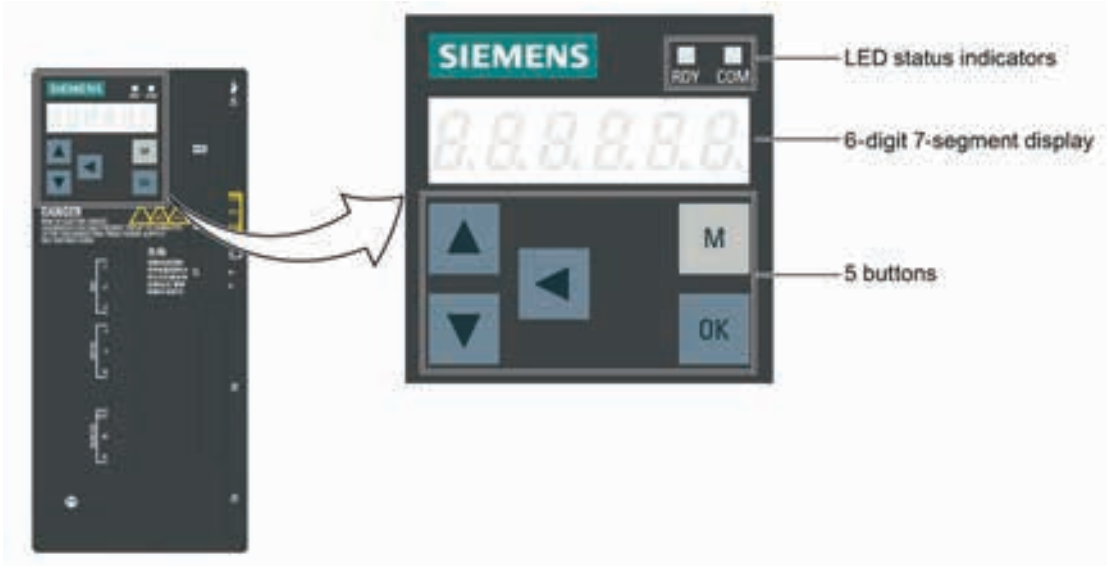
Illustration shows an example of the SINAMICS V90 servo Commissioning purpose when the servo drive is powered on for the first time, you can perform a test run with the BOP or the engineering tool SINAMICS V-ASSISTANT to check:

- Whether the mains supply has been connected correctly.
- Whether the 24 V power supply has been connected correctly.
- Whether the cables (power cable, encoder cable, and brake cable) between the servo drive and the servo motor have been connected correctly.
- Whether the motor speed and direction of rotation are correct.

Prerequisite:

- The servo drive is connected to the servo motor without load.
- No PLC is connected to the drive system.

The SINAMICS V90 servo drive is designed with a Basic Operator Panel (BOP) on the front panel of the servo drive



You can use the BOP for the following operations:

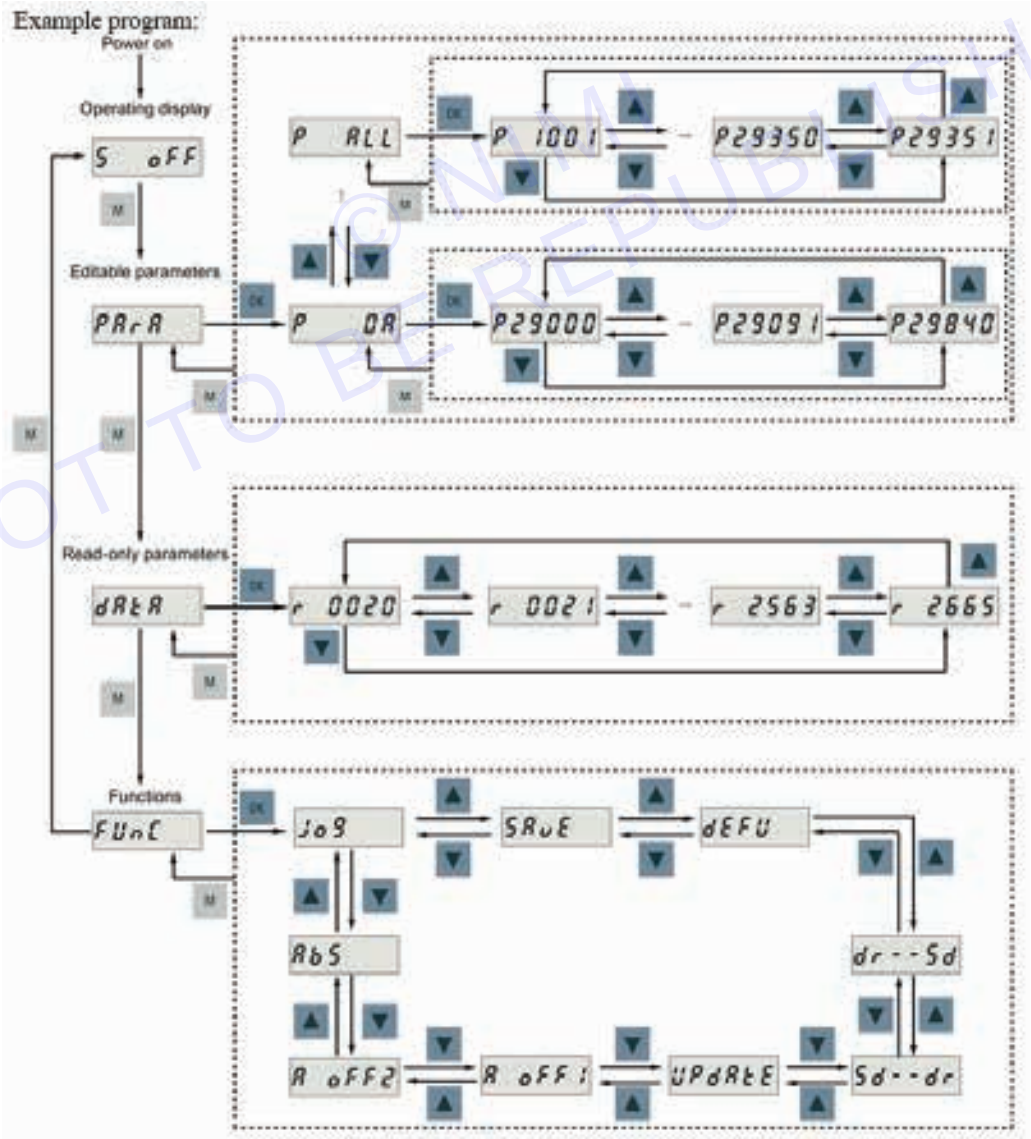
- Standalone commissioning
- Diagnosis
- Parameter access
- Parameter settings
- SD card operations
- Drive restart

The parameter program steps in V90 drive

Display	Example	Description	Remarks
Save	SAvE	Save data in drive	Refer to "Save parameters in the servo drive (Page 119)".
defu	dEFU	Restore drive to default settings	Refer to "Reset parameters to default values (Page 119)".
dr--sd	dr--Sd	Save data from drive to SD card	Refer to "Copy parameters from the servo drive to an SD card (Page 120)".
sd--dr	Sd--dr	Upload data from SD card to drive	Refer to "Copy parameters from an SD card to the servo drive (Page 121)".
Update	UPdAtE	Update firmware	Refer to "Update firmware (Page 122)".
A OFF1	A oFF1	Adjust AI1 offset	Refer to "Adjust AI offset (Page 122)".
A OFF2	A oFF2	Adjust AI2 offset	Refer to "Adjust AI offset (Page 122)".
ABS	AbS	The zero position has not been set	Refer to "Set zero position (Page 124)".
A.B.S.	A.b.S.	The zero position has been set	Refer to "Set zero position (Page 124)".
r xxx	r 40	Actual speed (positive direction)	

r -xxx	r -40	Actual speed (negative direction)	
T x.x	t 0.4	Actual torque (positive direction)	
T -x.x	t -0.4	Actual torque (negative direction)	
DCxxx.x	dC549.0	Actual DC link voltage	
Con		The communication between the SINAMICS V-ASSISTANT and the servo drive is established. In this case, the BOP is protected from any operations except clearing alarms and acknowledging faults.	

Result: Thus the Connection of servo motor SINAMICS V90 servo drive was successfully established and tested with parameter programming.



EXERCISE 241: Connect servo motor with computer through servo drive and perform speed control and Torque control of motor

Objectives

At the end of this exercise you shall be able to:

- to connect servo motor with Servo Drive using Siemens SINAMICS V90 software and perform speed control and Torque control of motor.

Requirements

Tools/Equipments/Instruments

- Combination plier 200mm - 1 No.
- Screw Driver set with neon tester 10mm- max - 1 Set.
- Spanner set 6mm to 32mm - 1 Set.

Materials/Components

- Servo Motor 1phase/ 3phase, 415V, 20A, 50Hz - 1 No.
- Servo Drive- SINAMICS V90) Compatible to 10 HP motor - 1 No.
- Connecting wires as required - as reqd.
- V-Assistant software / commissioning tool - 1 No.
- TIA portal software through Sinamics S7 controller - 1 No.

Procedure

Servo Drive with Servo Motor:

The SINAMICS V90 servo drive is integrated with digital input/output interface, pulse train interface and analog interface. It can be connected either to a Siemens controller like S7- 200, S7-1200 or S7-200 SMART, or to a third-party controller. Absolute position information can be read from the servo drive by the PLC via RS485 port. A configuration software tool, SINAMICS V-ASSISTANT, can be installed on a PC. The PC can communicate with SINAMICS V90 servo drive with a USB cable for performing parameter settings, trial run, status display monitoring, gain adjustments, and so on.

- Parts of servo drive- refer exercise 238 .
- Commissioning –refer 239

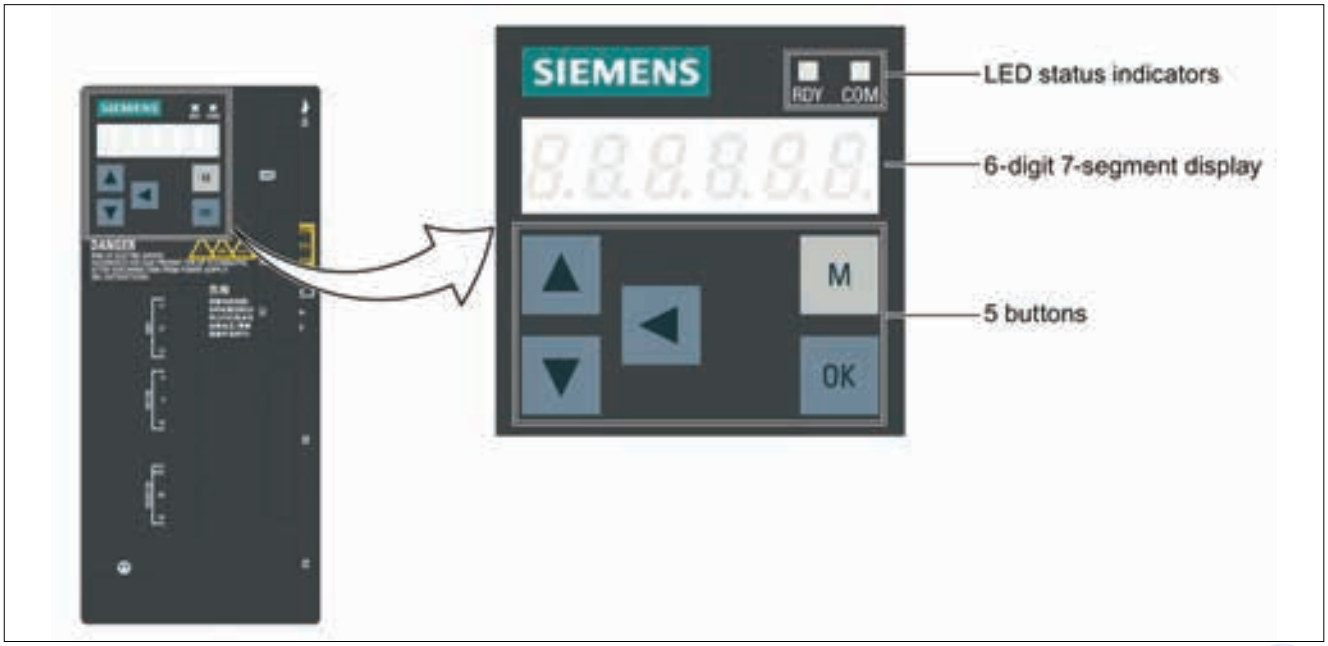
Illustration shows an example of the SINAMICS V90 servo Commissioning purpose when the servo drive is powered on for the first time, you can perform a test run with the BOP or the engineering tool SINAMICS V-ASSISTANT to check:

- Whether the mains supply has been connected correctly.
- Whether the 24 V power supply has been connected correctly.
- Whether the cables (power cable, encoder cable, and brake cable) between the servo drive and the servo motor have been connected correctly.
- Whether the motor speed and direction of rotation are correct.

Prerequisite:

- The servo drive is connected to the servo motor without load.
- No PLC is connected to the drive system.

The SINAMICS V90 servo drive is designed with a Basic Operator Panel (BOP) on the front panel of the servo drive:



You can use the BOP for the following operations:

- Standalone commissioning
- Diagnosis
- Parameter access
- Parameter settings
- SD card operations
- Drive restart

Commissioning in speed control mode (S)

Step	Description	Remarks
1	Switch off the mains supply.	
2	Power off the servo drive and connect it to the controller (for example, SIMATIC S7-200 SMART) with the signal cable.	The digital signals CWL, CCWL and EMGS must be kept at high level (1) to ensure normal operation. Refer to "Standard application wirings (factory setting) (Page 73)" and "Connection examples with PLCs (Page 77)".
3	Power on the servo drive.	
4	Switch to the speed control mode by setting p29003=2.	Refer to "Compound controls (Page 125)".
5	Restart the servo drive to apply the settings of the speed control mode.	

Step	Description	Remarks
6	Configure necessary digital input signals by setting the following parameters: • p29301[2]: DI1 • p29302[2]: DI2 • p29303[2]: DI3 • p29304[2]: DI4 • p29305[2]: DI5 • p29306[2]: DI6 • p29307[2]: DI7 • p29308[2]: DI8	The factory settings are: • p29301[2]: 1 (SON) • p29302[2]: 2 (RESET) • p29303[2]: 3 (CWL) • p29304[2]: 4 (CCWL) • p29305[2]: 12 (CWE) • p29306[2]: 13 (CCWE) • p29307[2]: 15 (SPD1) • p29308[2]: 16 (SPD2) Refer to "Digital inputs/outputs (DIs/DOs) (Page 61)".
7	Configure speed setpoint.	You can select the external analog speed setpoint or one of seven fixed speed setpoints by configuring the digital signals SPD3, SPD2 and SPD1. SPD3 : SPD2 : SPD1 0 : 0 : 0: external analog speed setpoint (analog input 1) 0 : 0 : 1: fixed speed setpoint 1 (p1001) 0 : 1 : 0: fixed speed setpoint 2 (p1002) 0 : 1 : 1: fixed speed setpoint 3 (p1003) 1 : 0 : 0: fixed speed setpoint 4 (p1004) 1 : 0 : 1: fixed speed setpoint 5 (p1005) 1 : 1 : 0: fixed speed setpoint 6 (p1006) 1 : 1 : 1: fixed speed setpoint 7 (p1007) Refer to "Configuring speed setpoint (Page 162)".
8	If the external analog speed setpoint is used, configure the maximum analog speed setpoint corresponding to 10 V by setting parameter p29060.	
9	Clear faults and alarms.	Refer to "Diagnostics (Page 249)".
10	Change SON status to be high level (1) and the servo motor starts running according to configured speed setpoint.	The actual speed of the servo motor can be viewed from the BOP operating display. The default display is the actual speed. Refer to "Actual status display (Page 112)".
11	The system commissioning in speed control mode ends.	You can check the system performance. If it is not ok, you can adjust it. Refer to "Tuning (Page 195)".

Commissioning in torque control mode (T)

Step	Description	Remarks
1	Switch off the mains supply.	
2	Power off the servo drive and connect it to the controller (for example, SIMATIC S7-200 SMART) with the signal cable.	The digital signals CWL, CCWL and EMGS must be kept at high level (1) to ensure normal operation. Refer to "Standard application wirings (factory setting) (Page 73)" and "Connection examples with PLCs (Page 77)".
3	Power on the servo drive.	
4	Switch to the torque control mode by setting p29003=3.	Refer to "Compound controls (Page 125)".
5	Restart the servo drive to apply the settings of the torque control mode.	
6	Configure necessary digital input signals by setting the following parameters: • p29301[3]: DI1 • p29302[3]: DI2 • p29303[3]: DI3 • p29304[3]: DI4 • p29305[3]: DI5 • p29306[3]: DI6 • p29307[3]: DI7 • p29308[3]: DI8	The factory settings are: • p29301[3]: 1 (SON) • p29302[3]: 2 (RESET) • p29303[3]: 3 (CWL) • p29304[3]: 4 (CCWL) • p29305[3]: 12 (CWE) • p29306[3]: 13 (CCWE) • p29307[3]: 18 (TSET) • p29308[3]: 19 (SLIM1) Refer to "Digital inputs/outputs (DIs/DOs) (Page 61)".
7	Select torque setpoint by configuring the digital input signal TSET.	• TSET = low level (0): external analog torque setpoint (analog input 2) • TSET = high level (1): fixed torque setpoint
8	If the external analog torque setpoint is used, configure the scaling (percentage of the rated torque) for analog torque setpoint corresponding to 10 V by setting parameter p29041[0].	Refer to "Torque control with external analog torque setpoint (Page 170)".
9	If the fixed torque setpoint is used, input your desired torque setpoint value into parameter p29043.	Refer to "Torque control with fixed torque setpoint (Page 171)".
10	Clear faults and alarms.	Refer to "Diagnostics (Page 249)".
11	Change SON status to be high level (1) and the servo motor starts running according to configured torque setpoint.	The actual torque of the servo motor can be viewed from the BOP operating display. The default display is actual speed. You can change it by setting p29002=2. Refer to "Actual status display (Page 112)".
12	The system commissioning in torque control mode ends.	You can check the system performance. If it is not ok, you can adjust it. Refer to "Tuning (Page 195)".

Result: Thus the Connection of servo motor with computer and SINAMICS V90 servo drive was successfully established and Performed speed control and Torque control of motor.