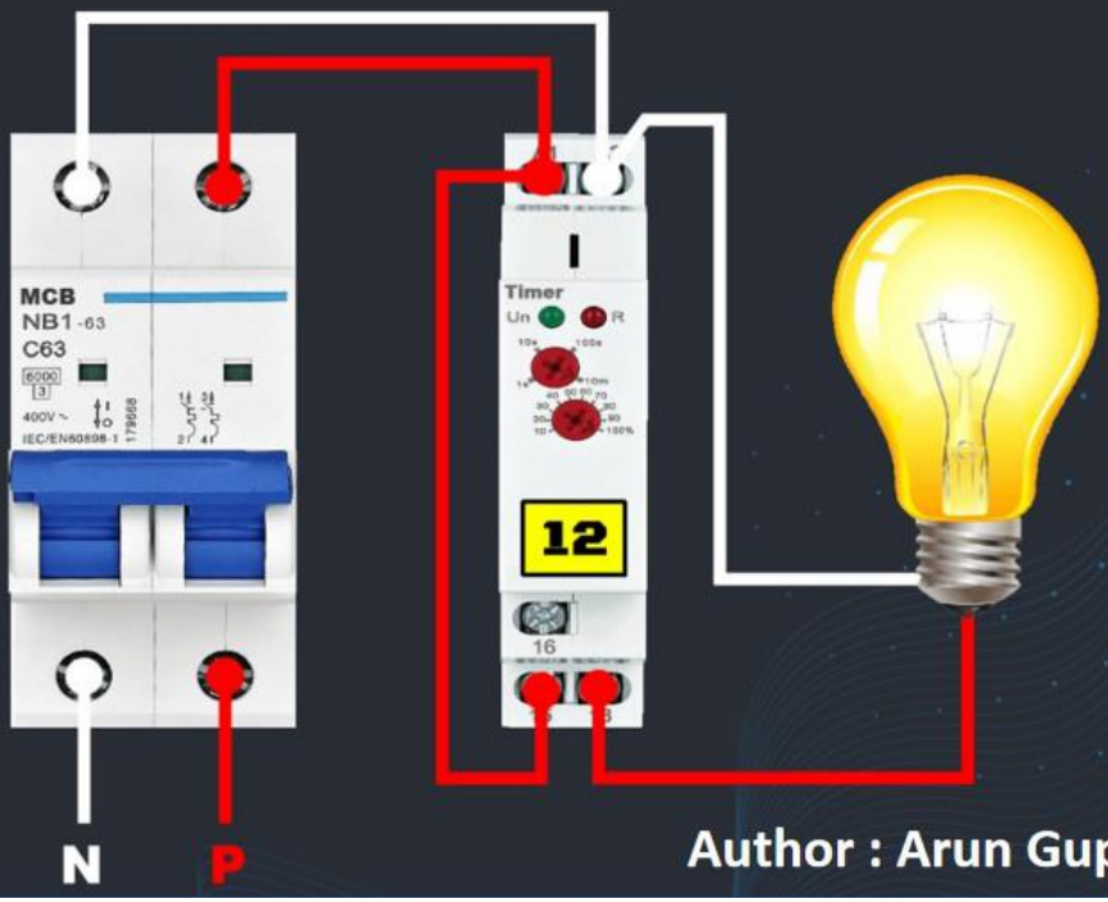
ELECTRICIAN A 2 Z WIRING BOOK

Empowering Electrician With Every Wire

100+
Circuit Diagram

All Starter Wiring Explained

Home Appliance Working and Wiring Explained



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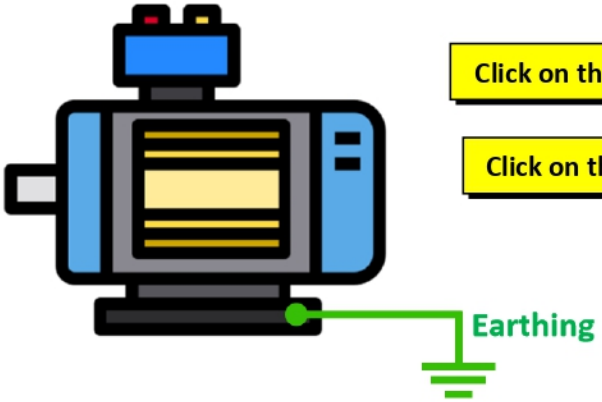
- Current Rating of Transformer = KVA x 1.4 (for 3 Phase 415Volt)
- No Load Current of Transformer =< 2% of Transformer Rated current
- Capacitor Current (Ic) = KVAR / 1.732 x Volt (Phase-Phase)
- 4No. earth pits per transformer (2No. for body and 2No. for neutral earthing

- Diesel Generator Set Produces = 3.87 Units (KWH) in 1 Litter of Diesel.
- Requirement Area of Diesel Generator = for 25KW to 48KW = 56 Sq.meter, 100KW = 65 Sq.meter.
- DG noise levels to be less than 75dBA at 1 meter.

Motor Earthing Wire Size

Earthing, also known as grounding, is a safety measure in electrical systems where conductive materials are connected to the Earth or a large conductive body to provide a safe path for fault currents to flow. It helps protect against electric shocks, and ensures compliance with safety standards in electrical installations.



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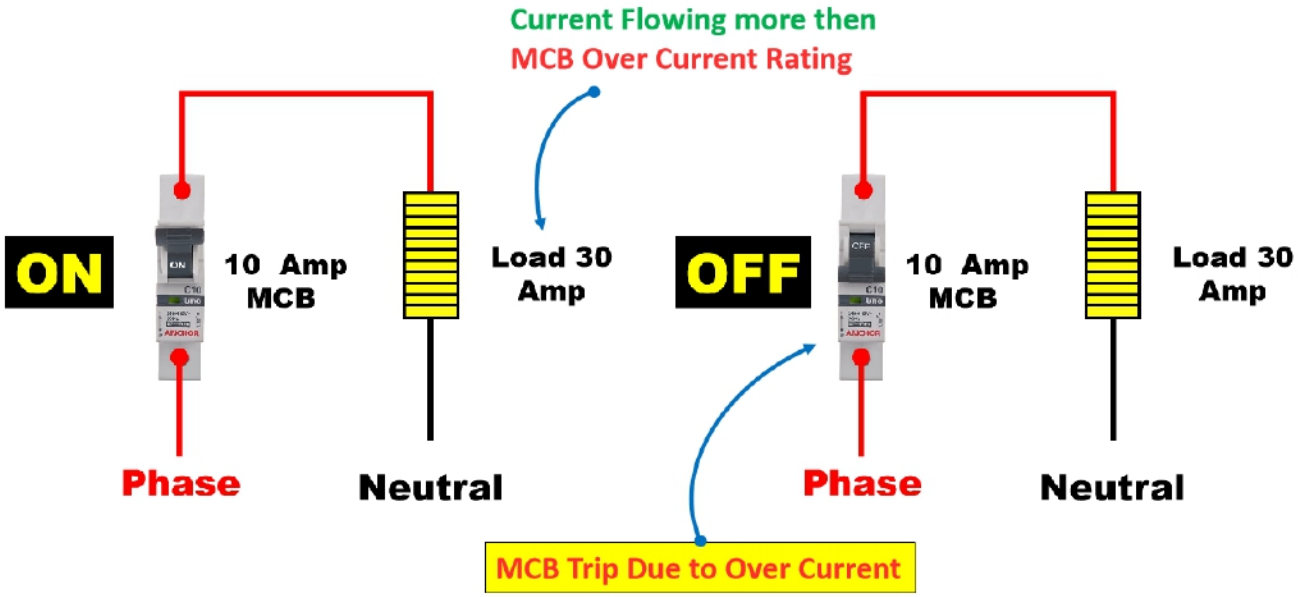
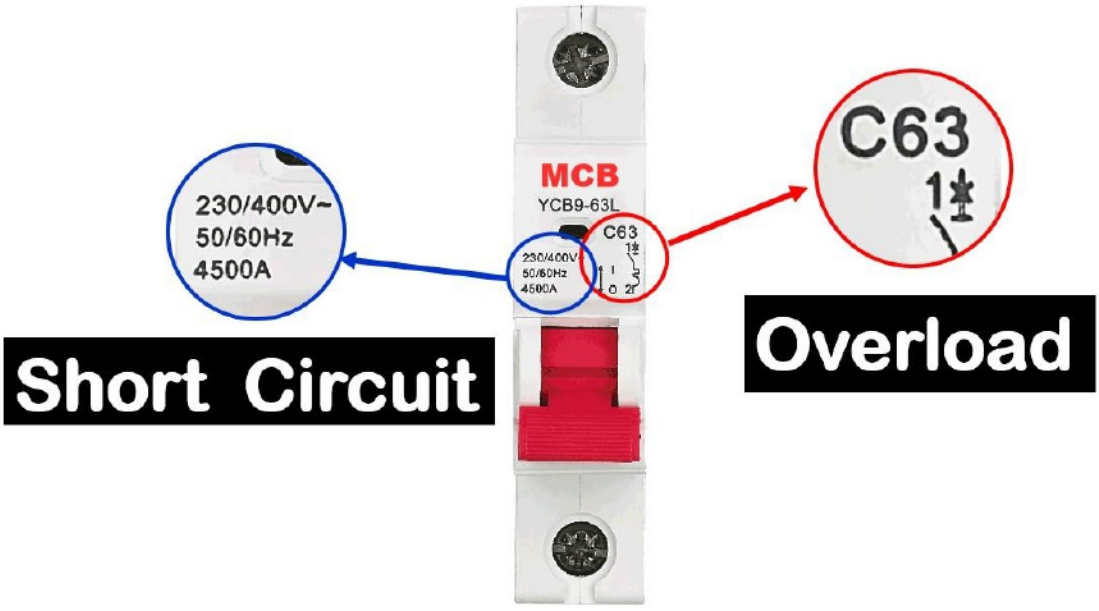
Size of Motor	Body Earthing
< 5.5 KW	4 Sq mm Copper Wire
5.5 KW to 22 KW	25×6 mm GI Strip
22 KW to 55 KW	40×6 mm GI Strip
>55 KW	50×6 mm GI Strip

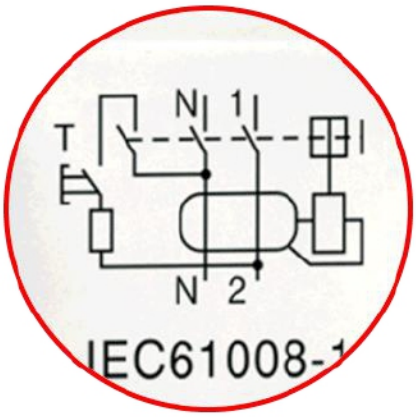


Short Circuit Protection:

- **Functionality**: A short circuit happens when a low-resistance path is created between the live wire and neutral or ground, causing a sudden surge in current. This surge can generate extreme heat, leading to fires or explosions if not quickly interrupted.



- **MCB Role**: The MCB responds almost instantaneously to the high current caused by a short circuit, trip the circuit and cutting off the power. This fast response is critical in preventing severe damage and ensuring the safety of the electrical system.



RCCB Symbol

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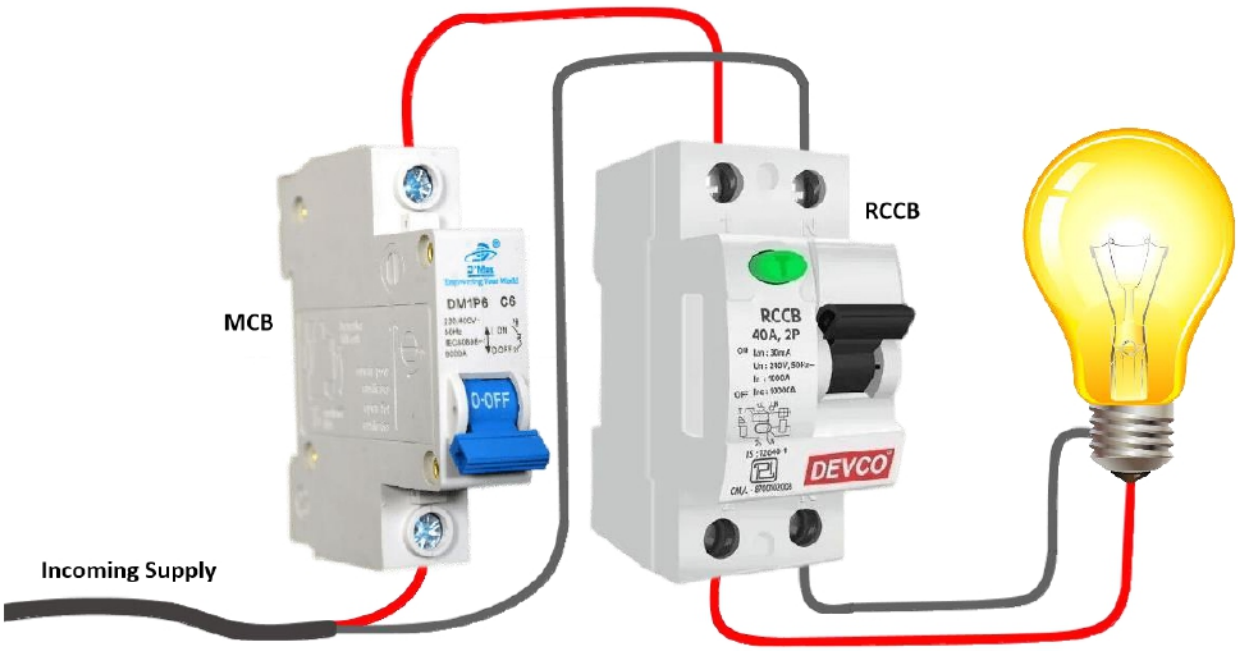
Basic Functionality

- **Detection of Current Imbalance**: The RCCB constantly monitors the current flowing through the live and neutral wires. Under normal conditions, the current entering the circuit via the live wire should equal the current returning via the neutral wire.



- **Automatic Disconnection**: If the RCCB detects a difference between the live and neutral currents (even as small as 30mA), it assumes that some current is leaking to the ground (possibly through a

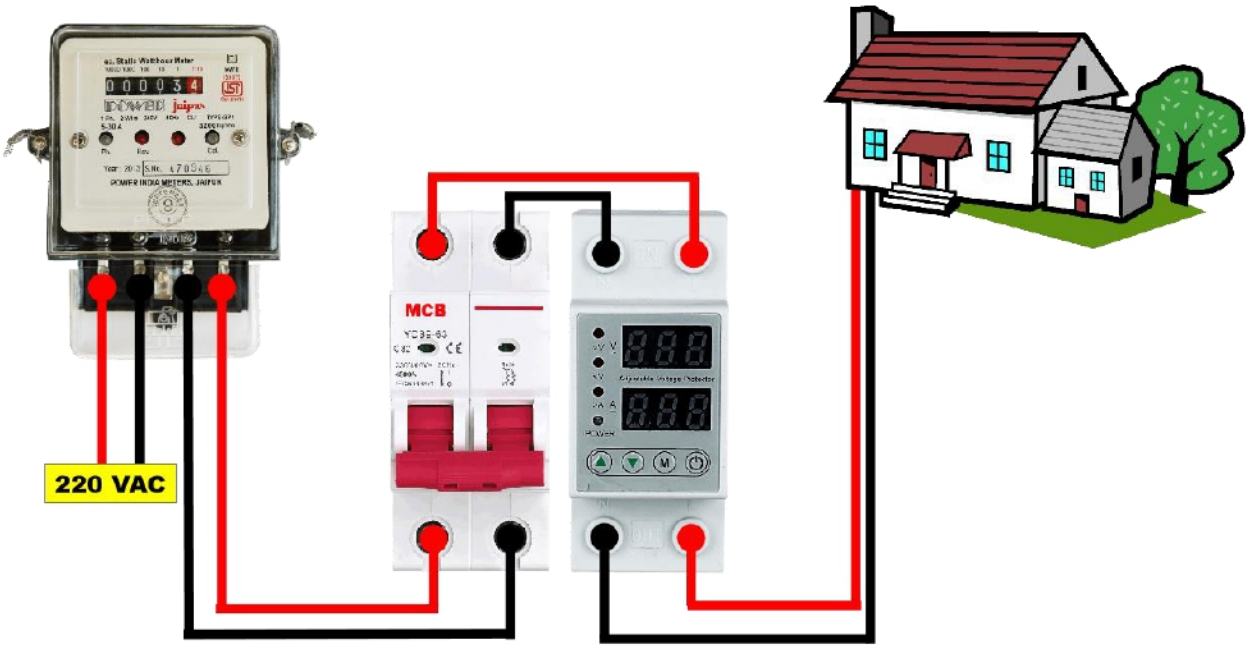
Key Functions

Voltage Monitoring:

- **Over-Voltage Protection:** The relay monitors the voltage and disconnects the load if the voltage exceeds a certain upper limit, protecting devices from damage caused by high voltage.
- **Under-Voltage Protection:** Similarly, the relay will disconnect the load if the voltage drops below a certain lower limit, preventing issues related to insufficient voltage supply.

Over current Protection:

- **Current Monitoring:** The relay measures the current flowing through the circuit. If the current exceeds the set limit, indicating an over current condition, the relay will disconnect the circuit to prevent damage to the connected equipment.
- **Short-Circuit Protection:** In case of a short circuit, the relay will immediately disconnect the power to prevent catastrophic damage to the system.



Wiring and Installation

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Input Connections:

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- Connect the **line (phase) wire** from the power supply to the input terminal of the relay.
- Connect the **neutral wire** to the corresponding input terminal.

Output Connections:

- The relay's output terminals are connected to the load (e.g., appliances, motors). The relay will control power to the load based on the voltage and current conditions.

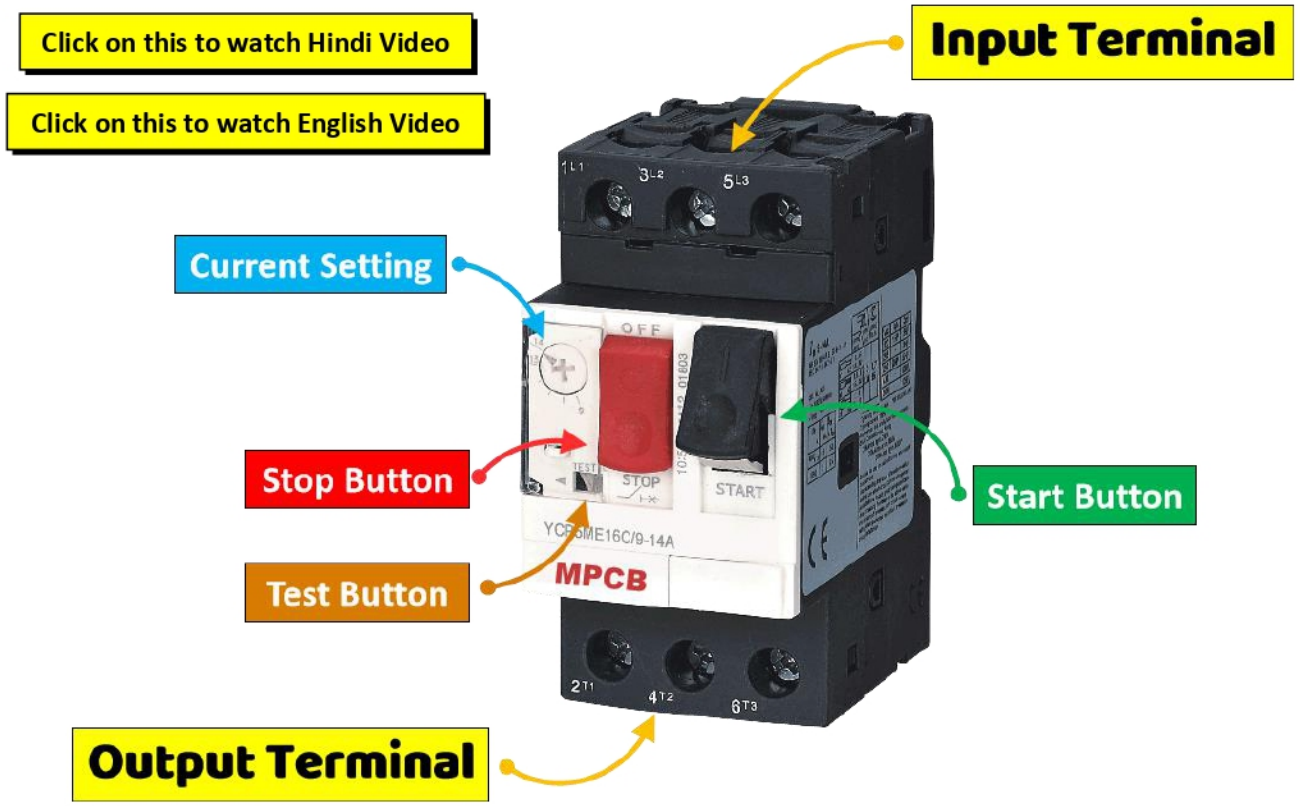
Setting the Thresholds:

- **Voltage Settings:** Adjust the upper and lower voltage limits according to the needs of your electrical system.
- **Current Settings:** Set the maximum allowable current limit to match the specifications of your equipment.

MPCB (Motor Protection Circuit Breaker)

Definition and Basic Functionality

An MPCB, or Motor Protection Circuit Breaker, is a specialized type of circuit breaker designed to protect electric motors from electrical faults such as overloads, short circuits, and phase failures. It is specifically engineered to meet the unique requirements of motor circuits, offering both thermal and magnetic protection that is finely tuned to the operating characteristics of motors.



Key Features and Benefits

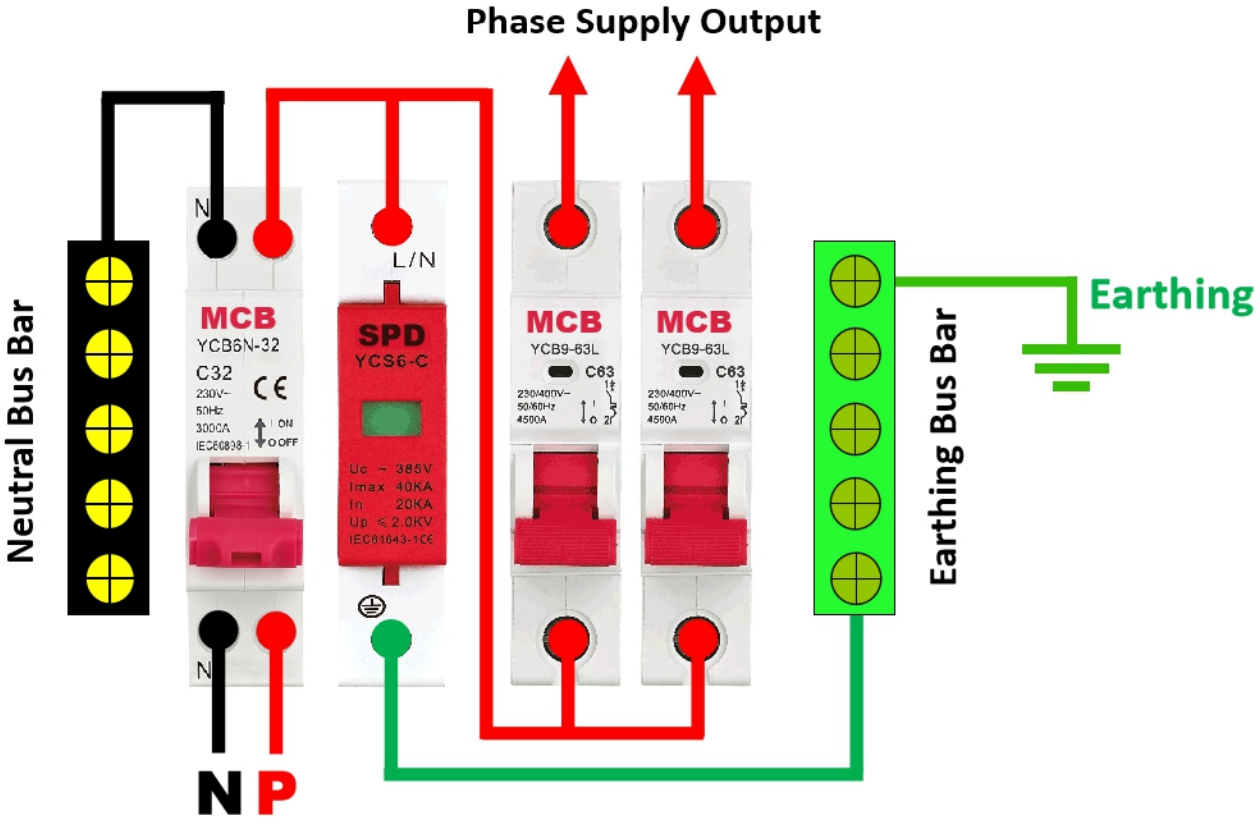
Overload Protection: MPCB are equipped with thermal protection that responds to excessive current drawn by a motor over a prolonged period. This prevents the motor from overheating, which could otherwise lead to insulation damage or even motor burnout.

Short-Circuit Protection: The magnetic protection feature of an MPCB reacts to sudden surges of high current, such as those caused by a short circuit. It rapidly disconnects the motor from the power supply, preventing damage to both the motor and the circuit.

Phase Failure Protection: In three-phase motor applications, the MPCB can detect phase imbalance or loss of a phase. A phase failure can cause severe mechanical stress and overheating in motors, and the MPCB protects against these conditions by Tripping the circuit.

2. **Neutral Wire (N):** If there is Neutral terminal on SPD then connect the neutral wire to the SPD neutral input terminal, usually labeled N.

3. **SPD Grounding:** The most important connection is the earthing or grounding wire. You'll connect this wire to the SPD earthing terminal, which is often marked with a ground symbol. This connection is vital because it allows the SPD to safely redirect any surge or fault current into the ground, protecting your devices from damage.



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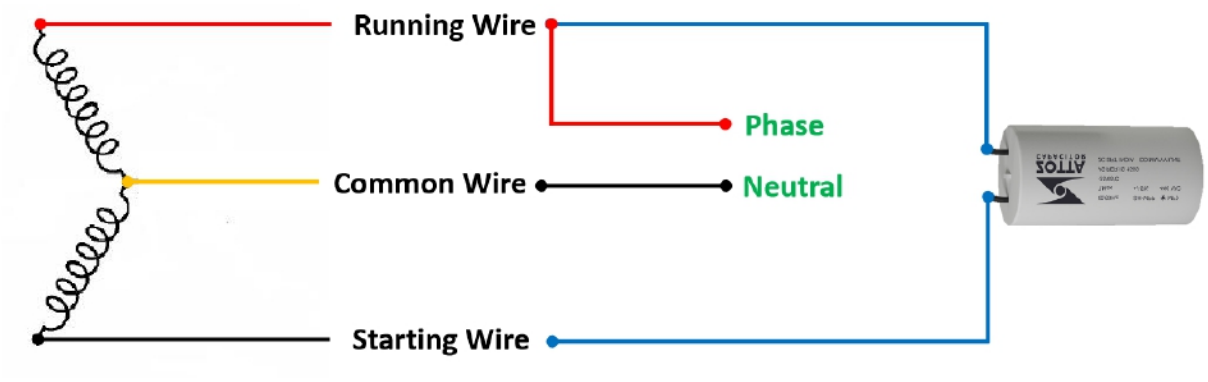
Wire Size Selection and Color-Coding In-House Wiring

Color Coding of Wires

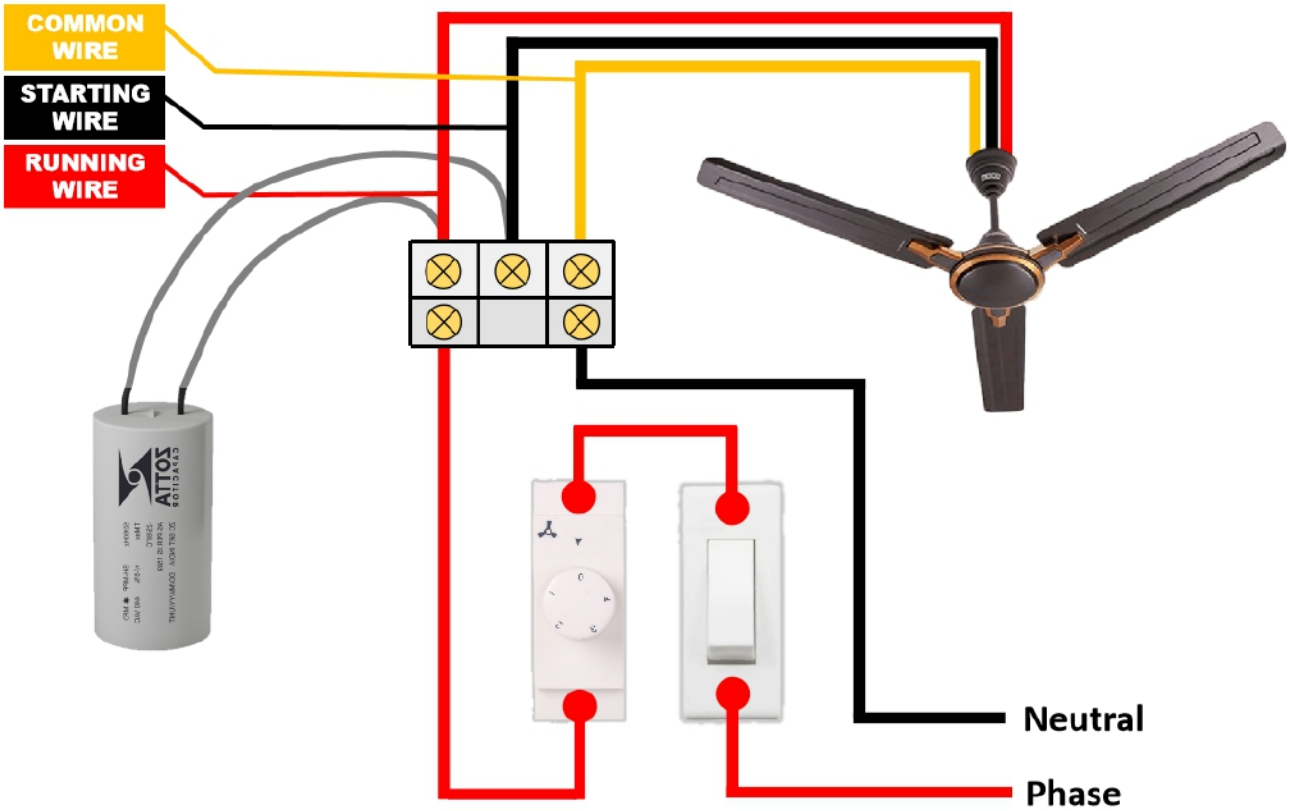
Color coding of wires in house wiring is essential for safety, making it easier to identify the purpose of each wire in the electrical system. Standard color codes help electricians and homeowners avoid mistakes during installation and troubleshooting.

Sl No.	Designation of Conductors		Alphanumeric Notation	Graphical Symbol	Colour
1	Supply ac system	Phase 1	L1		Red

Provide Power Supply:



1. Connect the **phase supply** to the **remaining running wire** (the one not connected to the common wire).
2. Connect the **neutral supply** to the **common wire** (the one where the starting and running wires were connected together).
3.



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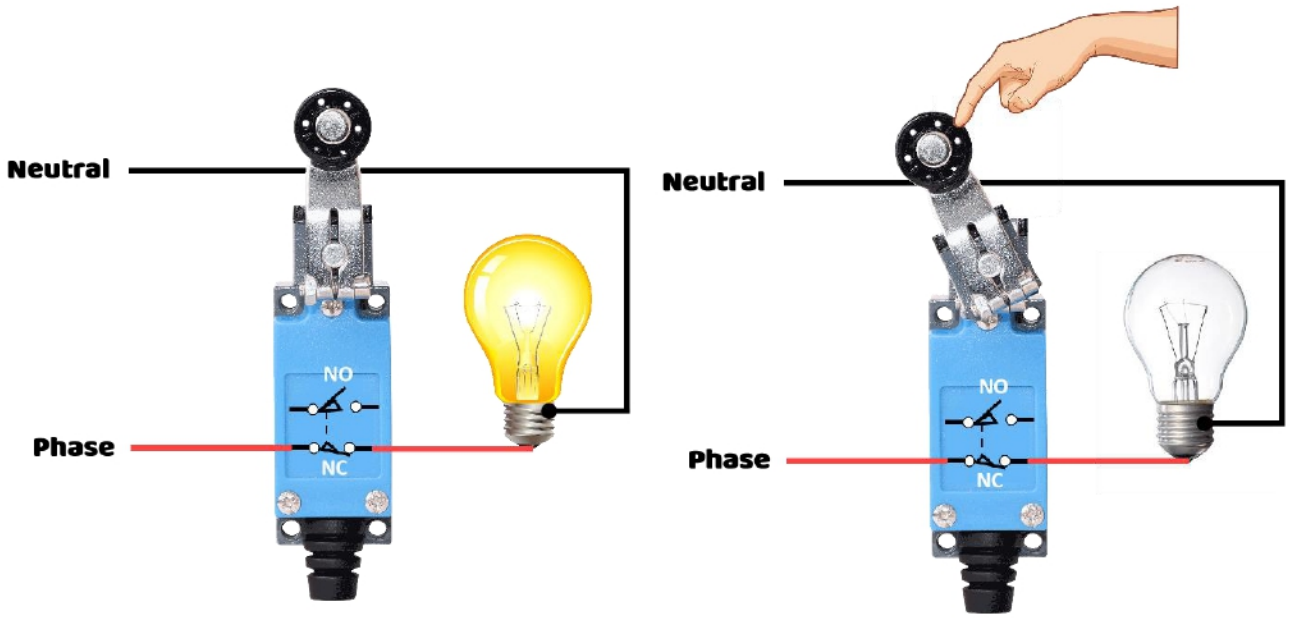
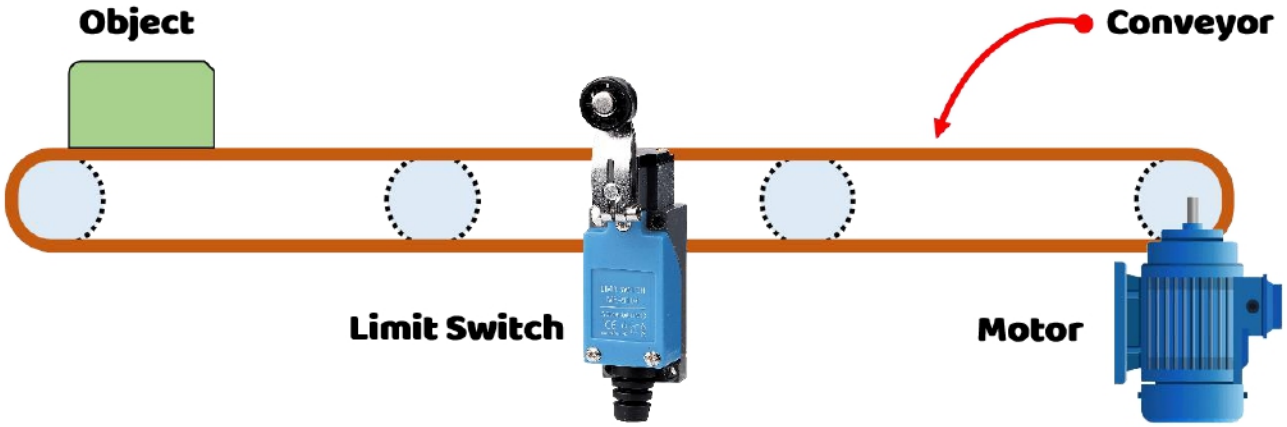
This configuration ensures that the capacitor creates the necessary phase shift to start the fan, and the fan operates efficiently once running.

When you turn on the fan, the capacitor creates a phase difference between the starting and running windings, allowing the motor to start and continue running efficiently.



2. **Applications**: NC contacts are used in safety applications where the switch should deactivate the circuit when a machine part reaches a certain position, cutting off power to prevent damage.

Applications: Limit Switch Commonly used in conveyor systems, to detect the position of products, or in machinery to determine the end of travel.



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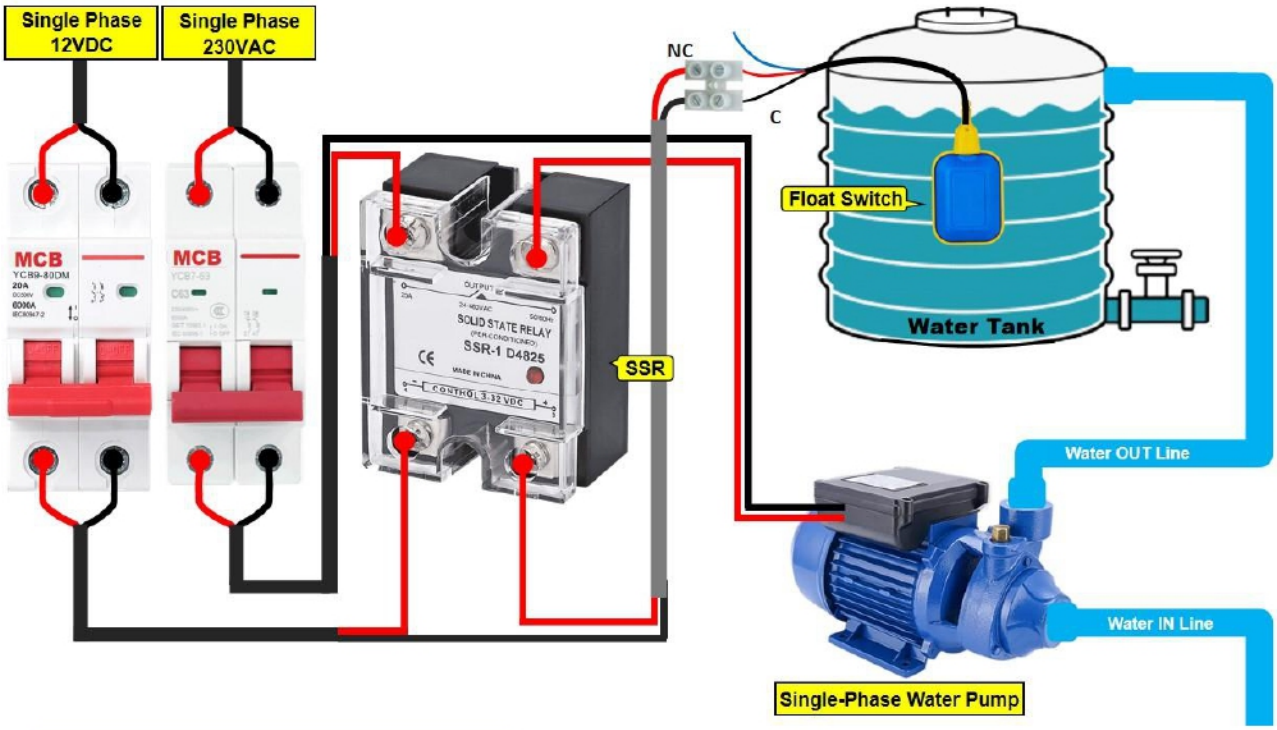
Limit Switch Wiring Diagram:

1. NO Contact Wiring

In this wiring, the NO contact of the limit switch is connected in series with a load (e.g., a lamp or motor). When the limit switch is actuated, the NO contact closes, allowing current to flow and powering the load.

Pump Connection with Float Switch:

If you want to control a pump using a float switch, you can enhance safety and reliability by incorporating a Solid-State Relay (SSR) into the circuit. In this setup, the float switch is used to turn the SSR on and off, while the SSR provides the power supply to the pump.



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The advantage of using an SSR is that it can be triggered by a low-voltage DC signal, typically between 3 to 32 VDC. This means the float switch can safely control the pump without directly handling the high-voltage power supply, reducing the risk of electrical current leaking into the water. The SSR acts as an intermediary, safely isolating the control circuit from the pump's power circuit, ensuring that the system is both effective and safe for liquid environments.

Wiring Diagram:

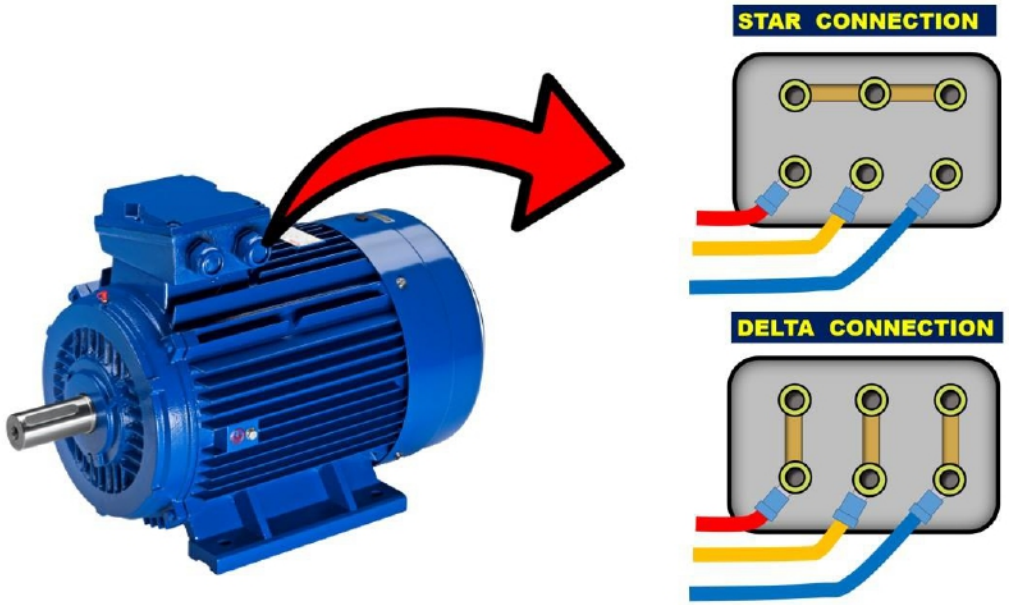
The wiring diagram provided below illustrates how to control a pump using a float switch and a Solid-State Relay (SSR). In this setup:

Float Switch: The float switch is connected to the control input terminals of the SSR. It senses the water level and, based on its position, sends a low-voltage DC signal (3 to 32 VDC) to the SSR.

Solid State Relay (SSR): The SSR receives the low-voltage signal from the float switch and, in turn, controls the high-voltage AC power supply to the pump. When the float switch activates the SSR, the relay allows power to flow to the pump, turning it on.

Pump: The pump is connected to the output terminals of the SSR. When the SSR is activated by the float switch, it completes the circuit and powers the pump.

Motor Terminal Connection in Star and Delta



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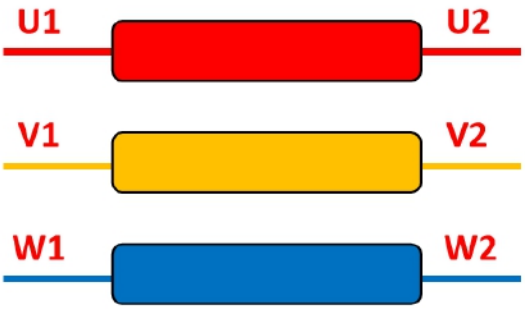
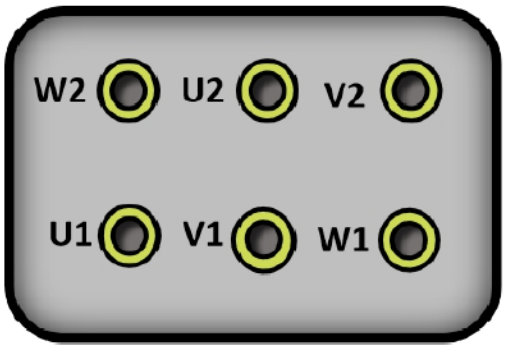
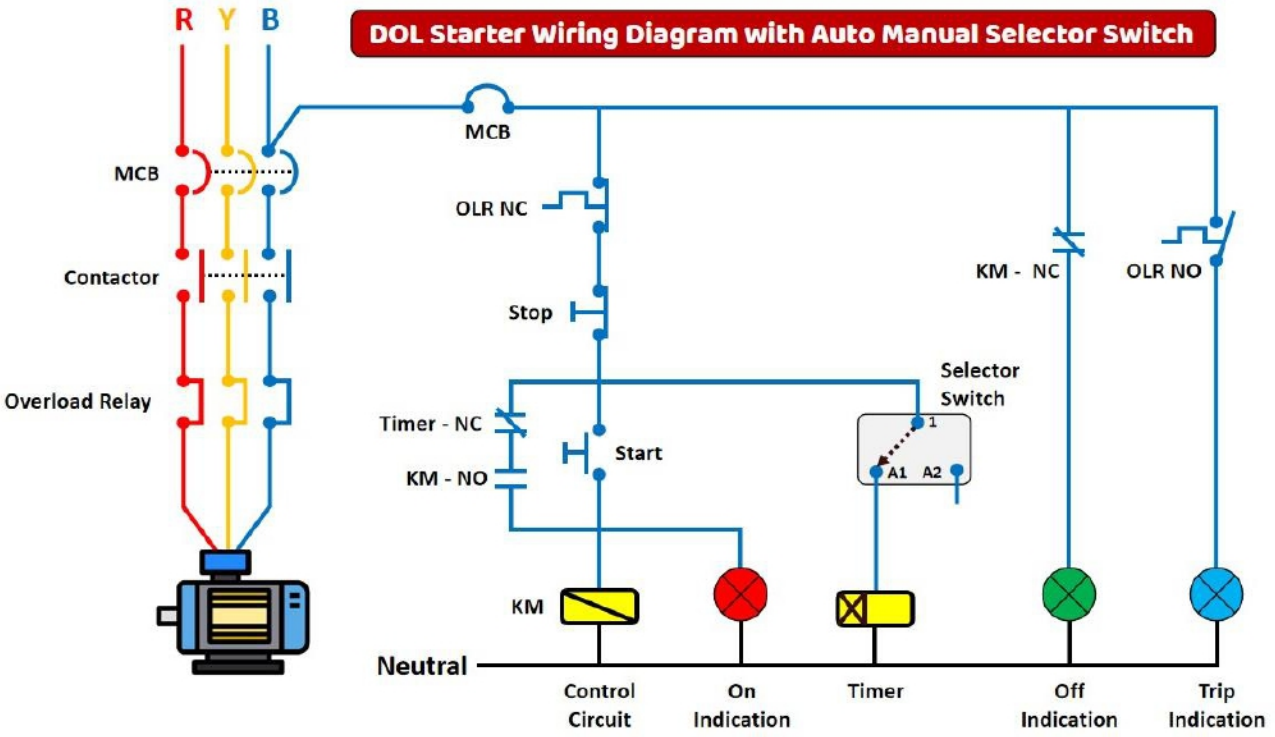
Three-Phase Motor Winding Terminal





- **Three Windings:** The motor has three windings, typically labeled as U1-U2, V1-V2, and W1-W2. Each winding is associated with one phase of the three-phase power supply.
- **Terminals:** The motor's six terminals correspond to the start and end points of these windings: U1, V1, W1 (start points), and U2, V2, W2 (end points).

Star (Y) Connection: In a star connection, the motor windings are connected between phase terminals and a common neutral point. This configuration reduces the voltage across each winding compared to a delta connection. Star connections are often used for motors with lower starting torque requirements and where reduced starting current is beneficial.



- **Manual Mode**:
  - When the selector switch is in the "Manual" position, the motor can be started by pressing the start push button. The motor will continue to run until the stop button is pressed, giving the operator full control.

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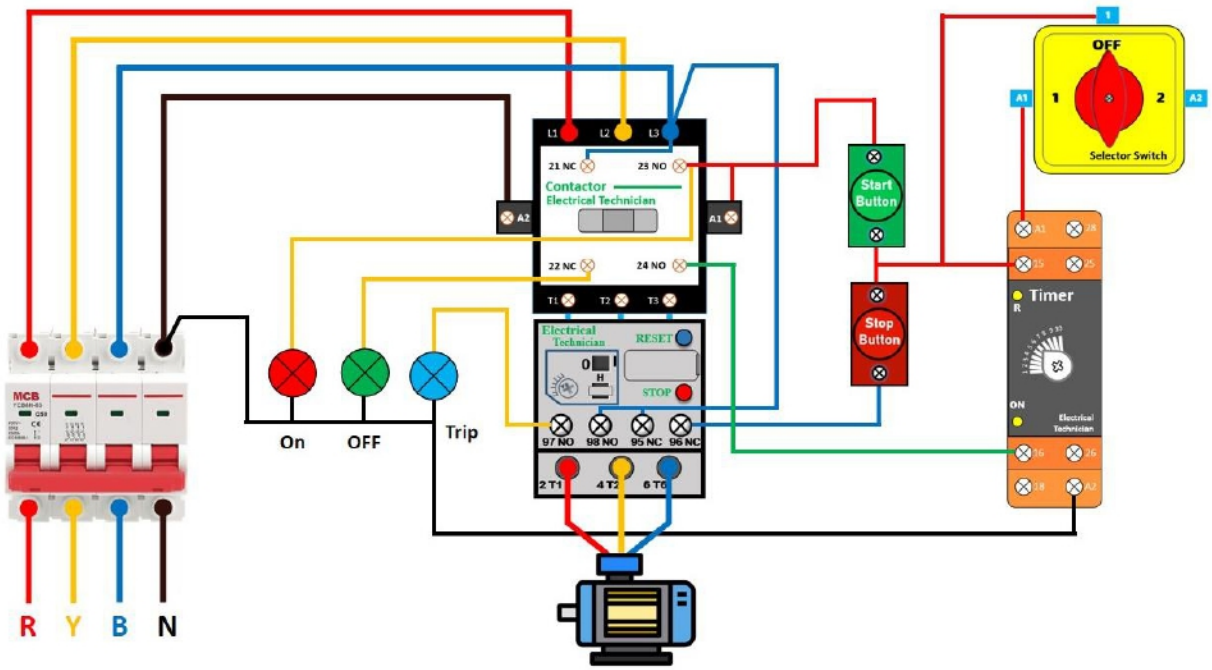

- **Auto Mode**:
  - When the selector switch is in the "Auto" position, the motor's operation is controlled by an on-delay timer. Once the start button is pressed, the timer activates and runs the motor for a predetermined period before automatically turning it off.

Changing the Running Direction of a 3-Phase Induction Motor:

If your motor is running in the wrong direction and you need to correct it, to change the direction of a 3-phase induction motor, you need to reverse the sequence of any two of the three phase connections. Here's how you can do it:

Identify Phase Connections:

1. A 3-phase motor has three input connections labeled as U1, V1, and W11. These connections are connected to the three-phase power supply L1, L2, L3.

Reverse Any Two Phases:

To change the direction of the motor, swap the connections of any two of the three phase wires. For example, if the motor is connected as follows:

1. **L1 -> U1**
2. **L2 -> V1**
3. **L3 -> W1**

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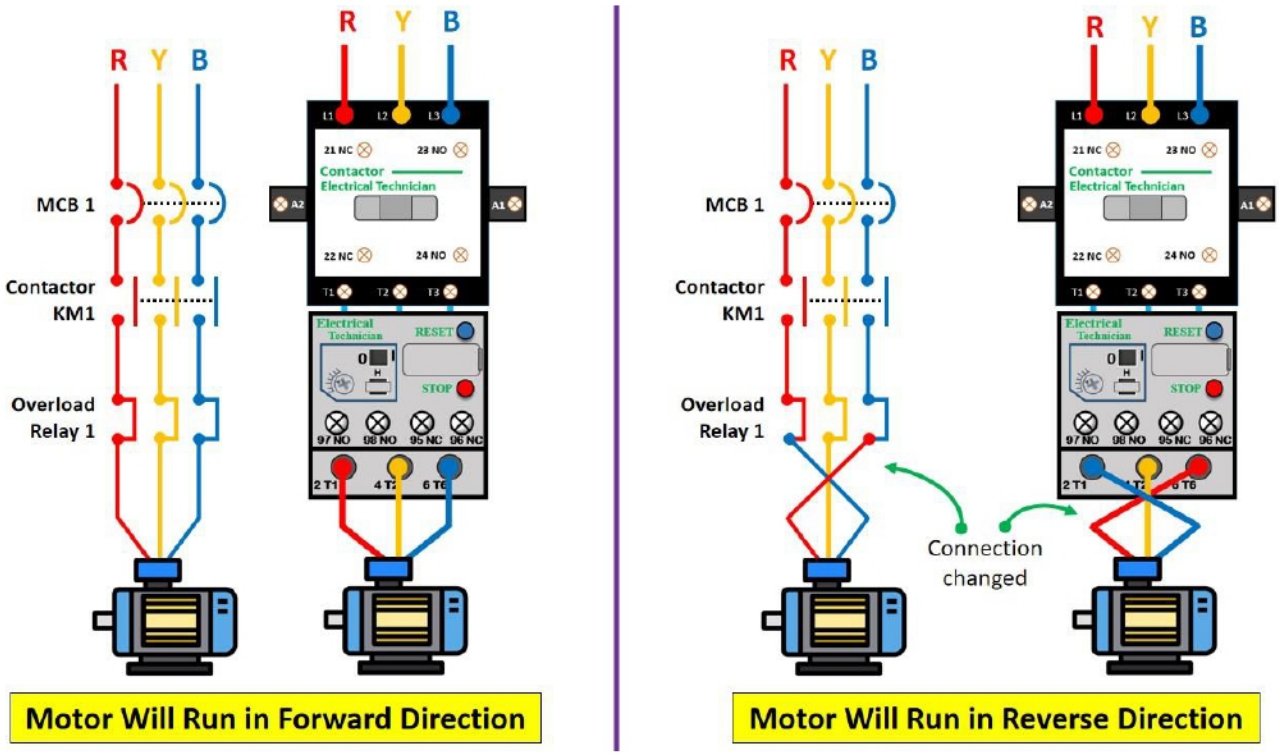
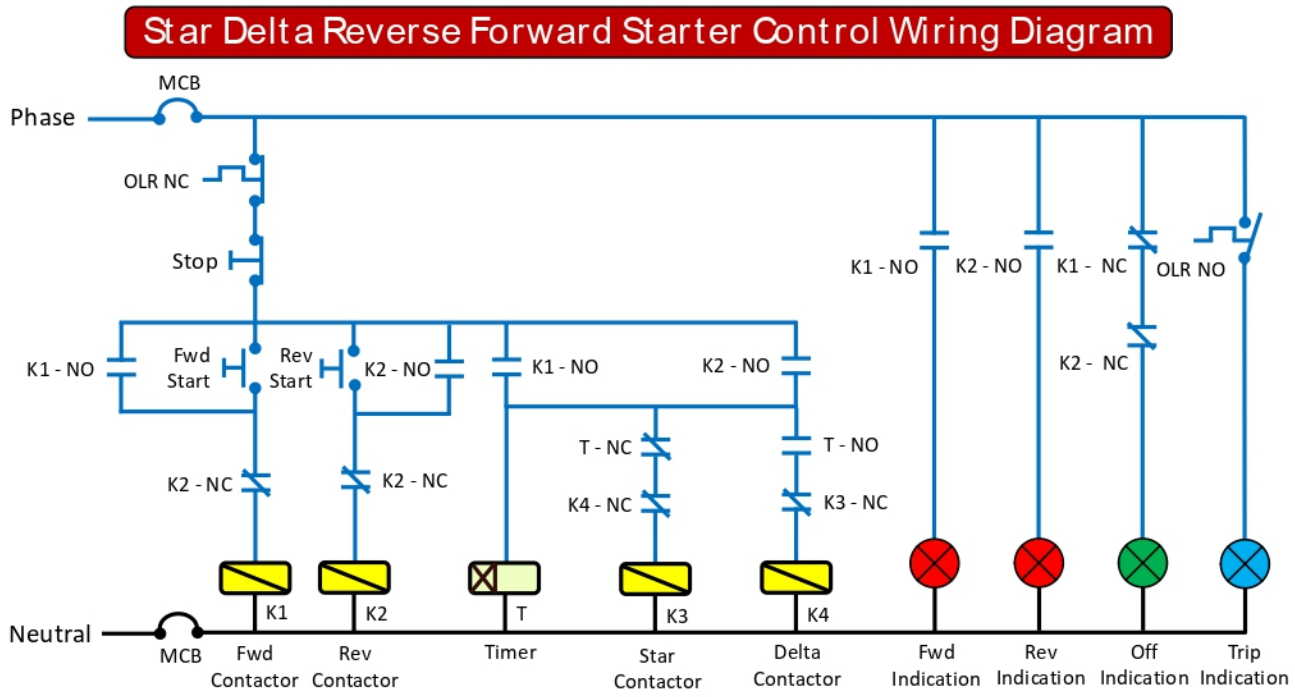


You can reverse the connections by changing it to:

1. **L3 -> U1**
2. **L2 -> V1**
3. **L1 -> W**



The Star-Delta Reverse Forward Starter with Start Forward and Start Reverse buttons provides precise control over motor direction and speed. The control wiring ensures smooth operation, transitions between star and delta configurations, and prevents any conflict between forward and reverse operations. The system is versatile and reliable, suitable for applications requiring directional control and reduced inrush current during motor startup.

PLC and HMI Wiring to Run a Motor as a DOL Starter:

In a Direct-On-Line (DOL) motor starter setup using a Programmable Logic Controller (PLC) and Human-Machine Interface (HMI), the system integrates automation and monitoring to enhance control over motor operations. Below is a detailed explanation of how this setup is wired and functions.