**PROJECT ABSTRACT**

# Forward-Reverse Motor Control Panel with Electrical and Mechanical Interlocking

*A DOL forward-reverse starter panel for three-phase motors with dual contactors, electrical plus mechanical interlocking and overload protection — built-to-order with panel, demo motor, report, PPT and viva kit.*

## 01. Title

Forward-Reverse Motor Control Panel with Electrical and Mechanical Interlocking

## 02. Introduction / Background

Reversing a three-phase motor means swapping two phases — and if the forward and reverse contactors ever close together, the result is a dead phase-to-phase short across the supply. Every industrial reversing starter therefore uses two independent safeguards: electrical interlocking, where each contactor's coil circuit passes through the other's normally-closed auxiliary contact, and a mechanical interlock block that physically prevents both armatures from pulling in. Students draw these circuits in exams but rarely wire one, so the difference between the power circuit and the control circuit — and why both interlocks exist — stays abstract. This project builds the complete panel on a steel enclosure: two contactors with a mechanical interlock kit, overload relay, phase-failure relay, push-button station, and a small three-phase motor so direction reversal is visible.

## 03. Problem Statement

Reversing-starter theory is examined on paper, but the safety-critical interlocking is never wired or tested by the student. The project builds the real panel so the learner wires both power and control circuits, proves live that the interlocks block simultaneous closure, and can explain exactly which failure each interlock guards against.

## 04. Objectives

- Wire the dual-contactor reversing power circuit with correct phase swapping.
- Implement electrical interlocking via cross-wired NC auxiliary contacts.
- Fit a mechanical interlock block between the contactors.
- Provide thermal overload and phase-failure protection for both directions.
- Build a push-button station with forward/reverse/stop and emergency stop.
- Demonstrate direction reversal on a small three-phase motor.
- Prove both interlocks with a dedicated verification test.
- Deliver the complete student kit: panel, motor, wiring docs, report, PPT and viva Q&A.;

## 05. Proposed Methodology

The system is developed in three stages. (1) Power circuit: two 3-pole contactors wired so the reverse contactor swaps two phases, with the mechanical interlock kit fitted between them. (2) Control circuit: 230 V coil logic through stop, overload NC, phase-failure contact, cross-wired

NC auxiliaries for interlocking, NO auxiliaries for seal-in, and the push-button station. (3) Verification: the interlock test procedure attempts to energize the opposing contactor while one is closed — electrically and mechanically — proving the block; overload setting is matched to the motor FLC at commissioning.

## 06. System Architecture / Working

Pressing FORWARD energizes contactor K1 through the interlocked control chain; K1 seals itself in, opens its NC auxiliary in K2's coil circuit (electrical block), and the mechanical block physically bars K2's armature. STOP drops K1; REVERSE then energizes K2, which connects the motor with two phases swapped. Pressing REVERSE while K1 is closed does nothing — demonstrated live. The overload relay trips both directions on sustained overcurrent; the phase-failure relay drops the control supply on any lost phase.

## 07. Hardware / Software Requirements

- 2× 3-pole power contactors with mechanical interlock kit
- Thermal overload relay, adjustable to motor FLC
- Phase-failure / single-phasing preventer relay
- Push-button station: forward / reverse / stop / mushroom emergency stop
- Auxiliary contact blocks (NO + NC) for seal-in and interlocking
- Direction indicator lamps; steel enclosure approx. 50 × 40 cm (design)
- Small three-phase induction motor, approx. 0.25–0.5 HP (design)
- 230 V AC control; 415 V three-phase power at demo scale
- No software — pure electromechanical control logic

## 08. Expected Outcomes

A working reversing starter on which the examiner presses REVERSE mid-forward-run and nothing happens (interlocks proven), then STOP → REVERSE produces visible rotation reversal. Overload and phase-failure trips are demonstrated on demand. Contactor and protection settings are commissioned to the demo motor with the supplied procedure.

## 09. Applications

- Teaching reversing-starter power and control circuits
- Demonstrating industrial interlocking safety practice
- Training in panel wiring to industrial conventions
- Understanding overload and single-phasing protection

## 10. Future Scope

- PLC-based version of the same interlock logic
- Star-delta + reverse combined starter notes
- VFD-based reversal comparison study
- Limit-switch integration for conveyor applications