# Star Delta Starter with PLC And Current Transformer

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**Abstract-**

**This project presents a Star Delta Starter (SDS) using Programmable Logic Controller (PLC) and current transformer for efficient control of induction motors in industrial applications. The PLC executes a programmed logic sequence, seamlessly transitioning the motor from star to delta configuration after sensing the current. This not only reduces the starting current, minimizing stress on the electrical system, but also enhances safety and efficiency. In this project the basic concepts of Programmable logic controller (PLC) and its applications are discussed. The hardware set up of 3 phase star delta starting of induction motor using PLC is implemented. Both the description of hardware and software is presented in this project. The flexibility and efficient controllability of plc helps in the growth of automation. Most induction motors are started directly on line, but when very large motors are started that way, they cause a disturbance of voltage on the supply lines due to large starting current surges. To limit the starting current surge, large induction motors are started at reduced voltage and then have full supply voltage reconnected when they run up to near rotated speed.**

**Keywords: Star Delta Starter, Programmable Logic Controller (PLC), Induction Motors, Industrial Automation, Voltage Surge Control, Motor Starting Methods.**

## INTRODUCTION

Monitoring and inspection of several processes is becoming dominant part of the automation technique in any industry. So the automation is basically the delegation of human control function to technical equipment's for increasing productivity and quality, reducing costs, increasing safety in working conditions. PLC forms one of the computerized machines and hence regarded as the heart of automated control system. The first PLC came into existence which was MODICON 084‟ and since the Dick Morley was one of the dedicated members working with the association so he is credited with the invention of PLC and known as "father of PLC". The product range now has been extended to 984 in its appearance. Earlier sequencers, cam timers, electromechanical relays were used for controlling and interlocking purposes. The control panel consists of thousands of wires which interconnects many relays to operate the various machines. So in case of error, machines have to be stopped and complete rewiring is required which is not only hectic job but also costs more. Also time was wasted in finding out errors and even distance control was not possible. Because of such problems the relays were replaced by PLCs. The control diagram for star delta starting of three phase induction motor for forward as well as reverse direction.

## MOTIVATION

The motivation behind this project stems from the need to address the challenges associated with starting large induction motors in industrial settings. Directly starting these motors on-line often leads to significant voltage disturbances and current surges, which can strain the electrical system and compromise operational efficiency and safety. By implementing a Star Delta Starter (SDS) ) using Programmable Logic Controller (PLC) and current transformer, the project aims to provide a solution that not only reduces starting current surges but also minimizes stress on the electrical infrastructure. Through a programmed logic sequence, the PLC seamlessly transitions the motor from star to delta configuration after sensing the current, ensuring a smooth and controlled start-up process. This approach not only enhances the safety and efficiency of motor operation but also contributes to the overall growth of automation by leveraging the flexibility and efficient

controllability offered by PLCs. By addressing these challenges, the project ultimately seeks to optimize the performance and reliability of induction motors in industrial applications, thereby improving productivity and reducing downtime.

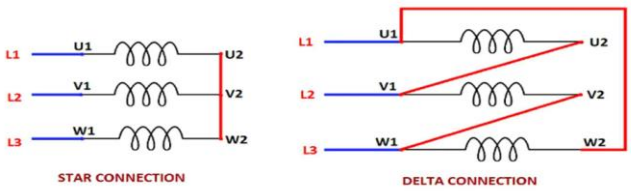
## PROBLEM DEFINATION

The problem addressed by this project lies in the inefficient and potentially hazardous starting methods for large induction motors in industrial environments. When these motors are started directly on-line, they draw a significant starting current surge, causing voltage disturbances that strain the electrical system and jeopardize operational stability. This not only leads to potential equipment damage but also compromises safety and efficiency. To mitigate these issues, the project focuses on implementing a Star Delta Starter (SDS) using Programmable Logic Controller (PLC) and current transformer. By seamlessly transitioning the motor from star to delta configuration after sensing the current, this solution aims to reduce the starting current surge, alleviate stress on the electrical infrastructure, and enhance overall safety and efficiency of motor operation. The problem definition thus revolves around the need for a more controlled and optimized starting method for large induction motors in industrial applications, addressing concerns related to electrical system stability, equipment longevity, and operational safety.

## OBJECTIVE

1. Implement a Star Delta Starter (SDS) using Programmable Logic Controller (PLC) and current transformer.
2. Develop a programmed logic sequence to seamlessly transition the motor from star to delta configuration after sensing the current.
3. Reduce the starting current surge of large induction motors to minimize stress on the electrical system.
4. Enhance safety by implementing a controlled and optimized starting method for industrial motors.
5. Improve operational efficiency by mitigating voltage disturbances caused by motor starting.
6. Provide a hardware setup and software description for the 3-phase star delta starting of induction motors using PLC.
7. Explore and discuss the basic concepts of Programmable Logic Controller (PLC) and its applications in industrial automation.
8. Demonstrate the flexibility and efficient controllability of PLCs in motor control applications.
9. Contribute to the growth of automation by leveraging advanced control technologies for industrial processes.
10. Optimize the performance and reliability of induction motors in industrial applications, leading to increased productivity and reduced downtime..

## STAR DELTA MOTOR STARTER




The above figure shows the winding connections in star and delta configuration one by one. It can be seen that in star connection, one end of all three windings are shorted to make star point while other end of each winding is connected to power supply. In delta configuration, the windings are connected such that to make a close loop. The connection of each winding is shown in above figure. In actual motor the three phase connections are provided in the following order as shown

## LITERATURE SURVEY

[1] Akshay P. Shinde, Kiran S.Shendge Plc automation of star delta starter for using induction motor. the basic concepts of Programmable logic controller (PLC) and its applications are discussed. The hardware set up of 3 phase star delta starting of induction motor using PLC is implemented. Both the description of hardware and software is presented in this project. The flexibility and efficient controllability of plc helps in the growth of automation.
[2] Ayibapreye, Priye, Edwin, "Automatic star-delta starter using relays and adjustable electronic timer for induction motor" Concept of star delta starter by using relay, adjustable electronic starter and I.M.
[3] Ravi Parmar Star Delta Controlling of Motor Using PLC The main aim of this paper is to study and learn how to connect the three phase Motor star/delta. IN this paper the basic concept of programmable logic controller (plc) are discussed. the three phase Motor is conversion to the delta connection by programmable logic controller (plc), after converted to the delta connection of three phase Motor continues with the same speed and power.
[4] Prof. Sudhir Phulambrikar, "Implementation of PLC Based Star Delta Starter for Starting and Direction Control of Three Phase Induction Motor" In this paper the basic concepts of Programmable logic controller (PLC) and its applications are discussed. The hardware set up of 3 phase star delta starting of induction motor using PLC is implemented. Both the description of hardware and software is presented in this paper. The flexibility and efficient controllability of plc helps in the growth of automation.
[5] Ali Thaeer Hammid, "Star Delta Starter Motor System in Allen-Bradley PLC" induction motors are widely used in industries and most times get burnt upon the start of the motor.This project is designed to provide low voltage start to induction motors. This is achieved by using star to delta conversion. Star/Delta starters are probably the most common reduced voltage starters in the 50 Hz industrial motors. Star-delta is used to reduce the start current applied to the motor then after some time full load current is applied to the motor.

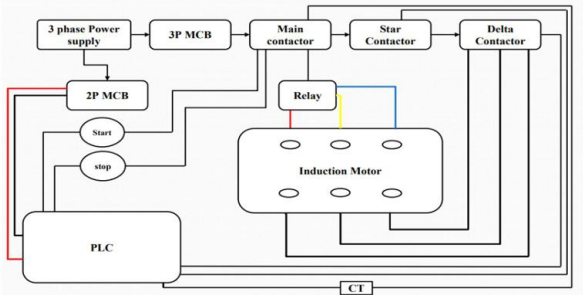
## PROJECT SCOPE

The project scope encompasses the design, implementation, and evaluation of a Star Delta Starter (SDS) using Programmable Logic Controller (PLC) and current transformer technology for efficient control of induction motors in industrial applications. This includes developing a programmed logic sequence to seamlessly transition the motor from star to delta configuration after a after sensing current, there by reducing the starting current surge and minimizing stress on the electrical system. The scope also involves providing a comprehensive hardware setup and software description for the 3-phase star delta starting of induction motors using PLC. Additionally, the project aims to explore and discuss the basic concepts of PLC and its applications in industrial automation, demonstrating the flexibility and efficient controllability of PLCs in motor control applications. The evaluation process will involve assessing the safety, efficiency, and reliability of the implemented system, contributing to the growth of automation and optimizing the performance of induction motors in industrial settings.

## PLC-BASED STAR-DELTA STARTER WITH CURRENT TRANSFORMER AND BLOCK DIAGRAM

A Star Delta Starter (also known as Wye Delta Starter) is a common method used for starting three-phase induction motors. It is primarily used to reduce the starting current of the motor during its startup phase. When the motor is started in a star configuration, it draws less current compared to when it starts in a delta configuration. When a Star Delta Starter is controlled using a PLC (Programmable Logic Controller), the operation becomes automated and more flexible. Here is a general outline of how a Star Delta Starter using a PLC and current transformer might work. The PLC initializes the system by ensuring all safety interlocks are in place and checking for any faults in the system. Upon receiving a start command, typically from an operator or a control panel, the PLC initiates the motor starting sequence. The PLC activates the contactors to connect the motor windings in a star configuration. This reduces the starting current drawn by the motor. After the star connection is established, the PLC sense the current. This allows the motor to stabilize in the star configuration and ensures that it reaches a safe speed before transitioning to the delta connection. Once the current is stabilize, the PLC deactivates the star connection and activates the contactors to switch the motor

windings into a delta configuration. The motor is now running in the delta configuration, and the PLC monitors its operation. It may also implement protections such as overcurrent protection, overload protection, and phase imbalance protection. Upon receiving a stop command, the PLC initiates the motor stopping sequence. This may involve gradually reducing the motor speed, disconnecting power to the motor, and performing any necessary post-stop actions. Throughout the operation, the PLC continuously monitors the system for faults such as overcurrent, phase imbalance, and motor overheating. If a fault is detected, the PLC takes appropriate action, such as stopping the motor and indicating the fault to the operator. The PLC provides status indications to the operator, showing whether the motor is running, stopped, or if any faults are present. Using a PLC for controlling a Star Delta Starter provides several advantages, including flexibility in programming, improved monitoring and diagnostics, and the ability to integrate with other control systems. It also allows for easy customization and adaptation to specific application requirements**.**




## ADVANTAGES

1. Reduced Starting Current Surge: By implementing a star delta starter using PLC and current transformer, the project effectively reduces the initial surge of current during motor startup. This minimizes stress on the electrical system and prevents potential voltage disturbances.

2. Enhanced Safety: The controlled and optimized starting method provided by the project significantly enhances safety in industrial environments. By mitigating sudden voltage fluctuations and current surges, the risk of equipment damage and electrical hazards is reduced, ensuring a safer working environment for personnel.

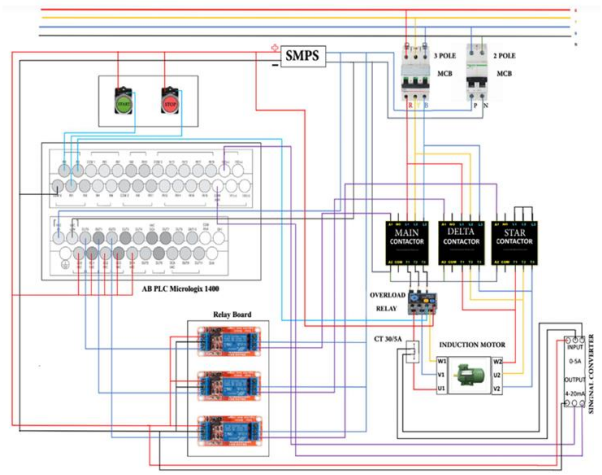
3. Improved Efficiency: The project contributes to improved operational efficiency by streamlining the motor starting process. By transitioning from star to delta configuration after sensing the current, the system optimizes energy consumption and reduces operational costs.

4. Extended Equipment Lifespan: With reduced stress on the electrical system and smoother motor startup, the project helps extend the lifespan of both the induction motors and associated equipment. This leads to decreased maintenance requirements and increased overall reliability of the industrial machinery.

5. Comprehensive Hardware and Software Integration: The project provides a comprehensive solution by integrating both hardware and software components. This ensures seamless communication and operation between the PLC-based control system and the motor, facilitating easier implementation and maintenance.

6. Flexibility and Adaptability: Leveraging PLC technology allows for flexible and adaptable control strategies. The programmed logic sequence can be easily modified or adjusted to accommodate different motor types, operational requirements, and environmental conditions, providing scalability and versatility in industrial applications.

## WIRING DRAWING




## RESULT

## CONCLUSION

In conclusion, the "Star Delta Starter with PLC And Current Transformer" project successfully addresses the challenges associated with the starting sequence of induction motors in industrial applications. The integration of a Programmable Logic Controller (PLC) offers a sophisticated and automated solution, providing a controlled transition from the star to delta configuration with current sensing and preset time delay. This project significantly reduces the starting current, mitigating voltage drops and enhancing the overall efficiency and safety of motor operation. The Safety measures, including emergency stop functionality and fault detection, contribute to a secure operational environment. Furthermore, the project contributes to energy savings by optimizing the motor start-up process, aligning with the industry's focus on sustainability and resource efficiency. The adaptability of the system to various industrial settings ensures its versatility and applicability in diverse operational scenarios. The reliability and robustness of the motor control system are paramount, with the PLC-based solution demonstrating resilience under different operating conditions. Comprehensive documentation and training resources are provided to ensure proper utilization and maintenance, fostering the longevity of the implemented solution. In essence, the " Star Delta Starter with PLC And Current Transformer " project stands as a technologically advanced and cost-effective solution that

not only meets the objectives outlined but also aligns with the broader goals of enhancing industrial automation, efficiency, and safety.

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