

Case Study: Electrical Design and Control System for Material Handling Equipment

Project Overview

The project focused on designing and implementing an electrical control system for material handling equipment. This involved developing detailed control circuit diagrams, selecting appropriate components, parameterizing Variable Frequency Drives (VFDs) and Programmable Logic Controllers (PLCs), and providing comprehensive documentation throughout the project.

Objectives

The project's main objectives were:

1. Develop comprehensive parameterization documents for VFDs, ensuring all settings are accurately configured.
2. Produce the necessary drawings and reports that outline the design and operational aspects of the control system.
3. Provide detailed technical documentation to support the project and facilitate its implementation.

Scope

The project entailed several key activities:

Design and Drafting

Create both 2D and 3D drawings for the control circuits and panel layouts. The 2D drawings provide a schematic representation of the control system, while the 3D drawings offer a realistic view of the panel and component arrangement.

Component Selection and Configuration

Choose components and circuits from a predefined database based on the job specifications. This ensures that the selected parts are suitable for the project's requirements and operational needs. Configure the VFDs and PLCs according to the specifications to optimize their performance and integration within the control system.

Documentation and Support

Provide ongoing support for all documentation needs, including maintaining detailed records of designs, configurations, and technical specifications.

Design and Engineering Process

The following procedure was followed to achieve the project objectives:

Initial Assessment and Requirements Gathering

- Review the job specification document and compare it with top-level reference drawings to identify any discrepancies or gaps in the project scope.
- Examine mechanical drawings related to equipment, hydraulics, pneumatics, and battery-operated tools to ensure alignment with the electrical design.
- Discuss any additional inputs needed with the mechanical team and generate Engineering Change Requests (ECRs) if modifications are required based on these discussions.

Detailed Design

- Develop 2D schematics and panel layout drawings, either from scratch or using existing library data, adhering to organizational standards.
- Choose components based on quotations and job specifications, and generate appropriate BOM reports to facilitate purchasing and construction activities.
- Replace obsolete components with modern equivalents in both the drawings and models to ensure the design remains current and effective.
- Design and model the 3D cable routing from the control panel to the equipment, including planning for field piping and installation.
- Create a parameterization document for VFDs by selecting mandatory settings from the datasheets to ensure optimal performance.

Implementation

- Work with the installation team to ensure the successful startup of the equipment and proper installation of all components.
- Offer continuous support for documentation throughout the project, updating records to reflect the current status and any changes made.

Results and Outcomes

The project produced several key deliverables essential for the electrical design and control system of the material handling equipment:

Deliverables

1. **Complete 2D Schematics and Panel Layout Drawings**
2. **3D Cable Routing with BOM Reports**
3. **VFD Parameterization Document**
4. **Control Write-up Document**

Business Benefits

Enhanced Clarity and Precision: Complete 2D schematics and panel layout drawings ensure precise and clear representation of the electrical design, reducing errors during implementation.

Efficient Cable Management: 3D cable routing with BOM reports aids in efficient cable management and procurement, streamlining the installation process and minimizing delays.

Optimized Performance: The VFD parameterization document provides detailed settings to optimize the performance of variable frequency drives, leading to improved system efficiency and energy savings.

Comprehensive Control Documentation: The control write-up document offers a thorough overview of the control system, facilitating easier troubleshooting and maintenance, and ensuring a smoother operational workflow.

Conclusion

This case study demonstrates a structured approach to designing and implementing an electrical control system for material handling equipment, ensuring that all project tasks are completed efficiently and effectively.