Feyziye Mektepleri Vakfı•1885 IŞIK ÜNİVERSİTESİ

FACULTY of ENGINEERING and NATURAL SCIENCES

Department of Electrical and Electronics Engineering

Internship Report

<u>Student</u>

Number : 22ELEC1031

Name- Surname: Aytek AKSU

Program: Electrical and Electronics Engineering

Summer Practice Code: ELEC3920

Table of Contents

(List the important headings and subheadings in the report with page numbers.)

page no.

1. Internship Program and Approval Page

STUDENT

Number : 22ELEC1031

Name Surname : Aytek AKSU

Program : Electrical and Electronics Engineering

Summer Practice Company

Name, Address, Phone No:

Genel Makina Ticaret ve Sanayi A.Ş. (GMT)

Dilovası OSB. 4. Kısım Sakarya Cad. Dış kapı no: 6 GEBZE-KOCAELI

0216 593 0671

Confirming Authority, Title, Name-Surname:

Yönetim Kurulu Üyesi – Tunç Özkaya

Signature and Seal:

……………………………………………………

Summer Practice Activities – SUMMARY TABLE

Activity	Description of the Unit and Activities Work Performed	Starting Date	Ending Date	Number of Working Days
1	Orientation and EPLAN Training: Company facility introduction, occupational health and safety training, examination of electrical schematics in EPLAN Electric P8, analysis of crane automation projects and electrical panel design workflow	*25/08/2025*	*29/08/2025*	*5*
2	PLC Programming Fundamentals: Introduction to Programmable Logic Controllers and Schneider Electric hardware, software installation and configuration, motor drive setup using SoMove, implementation of basic ladder logic programs on Zelio Smart Relay	*01/09/2025*	*05/09/2025*	5
3	Advanced Logic Design: Development of optimized control logic including single-button start/stop systems, timer-based control implementation, 3-level hoist control with manual and automatic modes, binary counter design challenge	*08/09/2025*	*12/09/2025*	5
4	System Integration: Integration of TM241 PLC with HMI panel and VFD, ModBus TCP communication implementation, hybrid programming using multiple IEC languages, complete motor control system development and testing	*15/09/2025*	*19/09/2025*	5
….				
….				

Student Signature :...

Confirming Authority, Name-Surname Tunç Özkaya

Signature and Seal of Confirming Authority :...

2. Evaluation of Internship Activities

2.1. Preface:

This internship report documents my comprehensive training experience at Genel Makina Ticaret ve Sanayi A.Ş. (GMT) from August 25, 2025, to September 19, 2025. The primary objective was to gain practical, hands-on experience in industrial automation, specifically focusing on crane control systems and programmable logic controller programming.

Throughout the 20 working days, I progressed from foundational concepts to advanced system integration, following a structured learning path designed by the Engineering & Automation Department. My daily working hours were from 7:30 AM to 5:30 PM, providing comprehensive time for learning and practical application.

The training encompassed theoretical knowledge acquisition, software skills development, hardware configuration, and real-world project implementation. Key learning objectives included understanding electrical schematic design using industry-standard software, developing proficiency in PLC programming across multiple languages, configuring motor drives and human-machine interfaces, implementing industrial communication protocols, and understanding the complete lifecycle of automation projects.

This internship provided invaluable insights into the practical application of theoretical knowledge from my academic studies, exposing me to real-world engineering challenges, industry standards, and professional work environments. The hands-on experience of implementing complete projects from concept to working systems has been immensely satisfying and has confirmed my career direction in industrial automation.

2.2. Presentation of the Company:

Genel Makina Ticaret ve Sanayi A.Ş. (GMT) is a distinguished engineering company specializing in industrial automation and material handling solutions. As the official representative and strategic partner of DEMAG Cranes & Components, a globally recognized German leader in crane technology, GMT has established a strong reputation for delivering high-quality, reliable solutions to Turkish *industries.*

The company specializes in comprehensive design, manufacturing, installation, commissioning, and maintenance of industrial crane systems and automated material handling solutions. Their product portfolio spans overhead bridge cranes, gantry cranes, jib cranes, automated transport systems, and specialized lifting equipment for unique industrial requirements.

The Engineering & Automation Department represents the technological core of GMT's operations, responsible for electrical system design using EPLAN Electric P8, control system development through PLC programming and HMI configuration, motion control implementation for multi-axis crane movements, safety systems integration compliant with machinery directives, and energy efficiency solutions including regenerative braking systems.

GMT maintains strong partnerships with leading automation component manufacturers, particularly Schneider Electric, whose product ecosystem forms the foundation of most automation solutions. The company serves diverse industrial sectors including automotive manufacturing, steel production facilities, construction material production, logistics operations, aerospace industries, and general manufacturing facilities.

The company's mission emphasizes providing safe, efficient, and technologically advanced material handling solutions that enhance industrial productivity while maintaining the highest standards of quality and customer satisfaction. Their vision focuses on continuous innovation, adoption of Industry 4.0 principles, and sustainable engineering practices.

2.3. Evaluation of Internship Activities:

2.3.1. Orientation and EPLAN Training (Week 1)

Day 1: Company Introduction (25/08/2025)

My internship commenced with a comprehensive orientation program. The department manager provided an extensive overview of the company's operations, organizational structure, and my role within the engineering team. The facility tour covered the production workshop where electrical cabinets are assembled using modern CNC panel processing machines and automated wire cutting systems, the assembly area handling mechanical crane components and electrical system integration, the testing facility with load simulation equipment for verifying drive performance, and the engineering office with specialized software workstations.

Following the tour, we discussed the structured learning plan designed to provide progressive skill development from fundamental concepts to advanced system integration over the 20-day period.

Day 2: Safety Training (26/08/2025)

The second day focused entirely on mandatory Occupational Health and Safety training conducted by the company's certified safety officer. The comprehensive training covered general safety principles including risk assessment and hazard identification, electrical safety with emphasis on lockout-tagout procedures and arc flash hazards, workshop safety regarding proper tool usage and lifting techniques, personal protective equipment selection and usage, emergency procedures including evacuation routes and incident reporting, and chemical safety for materials used in panel assembly.

Upon completion, I received certification documenting my understanding of workplace safety requirements, necessary for any future site visits.

Day 3: EPLAN Electric P8 Introduction (27/08/2025)

Technical training began with EPLAN Electric P8, a specialized Computer-Aided Engineering software that serves as the industry standard for electrical project design. Unlike traditional CAD software, EPLAN is database-driven where every component, wire, and connection is stored as intelligent data, enabling automatic generation of bills of materials, cross-referencing throughout projects, terminal diagram generation, and cable list creation.
I examined several completed crane installation projects, learning the hierarchical project structure organized by function such as power distribution, motor control, and PLC I/O. The supervising engineer explained how power flows from the main factory busbar through circuit breakers, transformers, and distribution boards to motor feeders, and how control circuits operating at 24VDC are documented separately for safety and standardization.

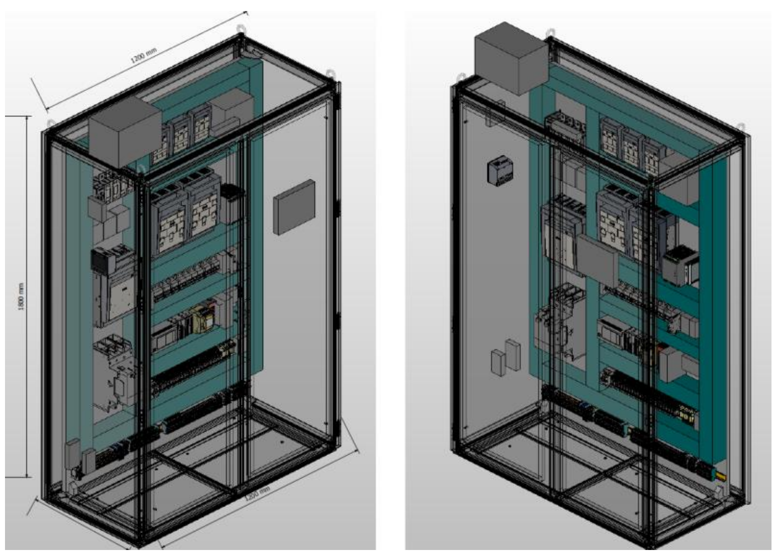

Figure 1 - EPLAN Panel Design

The software's integration with EPLAN Pro Panel allows 3D visualization of component placement within electrical enclosures, optimizing heat dissipation, maintenance accessibility, and wire routing efficiency.

Day 4: System Architecture Observation (28/08/2025)

The fourth day involved on-site observation of an actual crane system renewal project where a 15-year-old contactor-based control was being replaced with a modern VFD system with PLC control. This provided crucial context for understanding how theoretical designs translate to physical installations.
The crane's electrical architecture receives 400VAC three-phase power from the factory's busbar via conductor rail systems. One of the most fascinating aspects was the regenerative braking system explanation. Traditional crane systems waste significant energy by dissipating it as heat when lowering

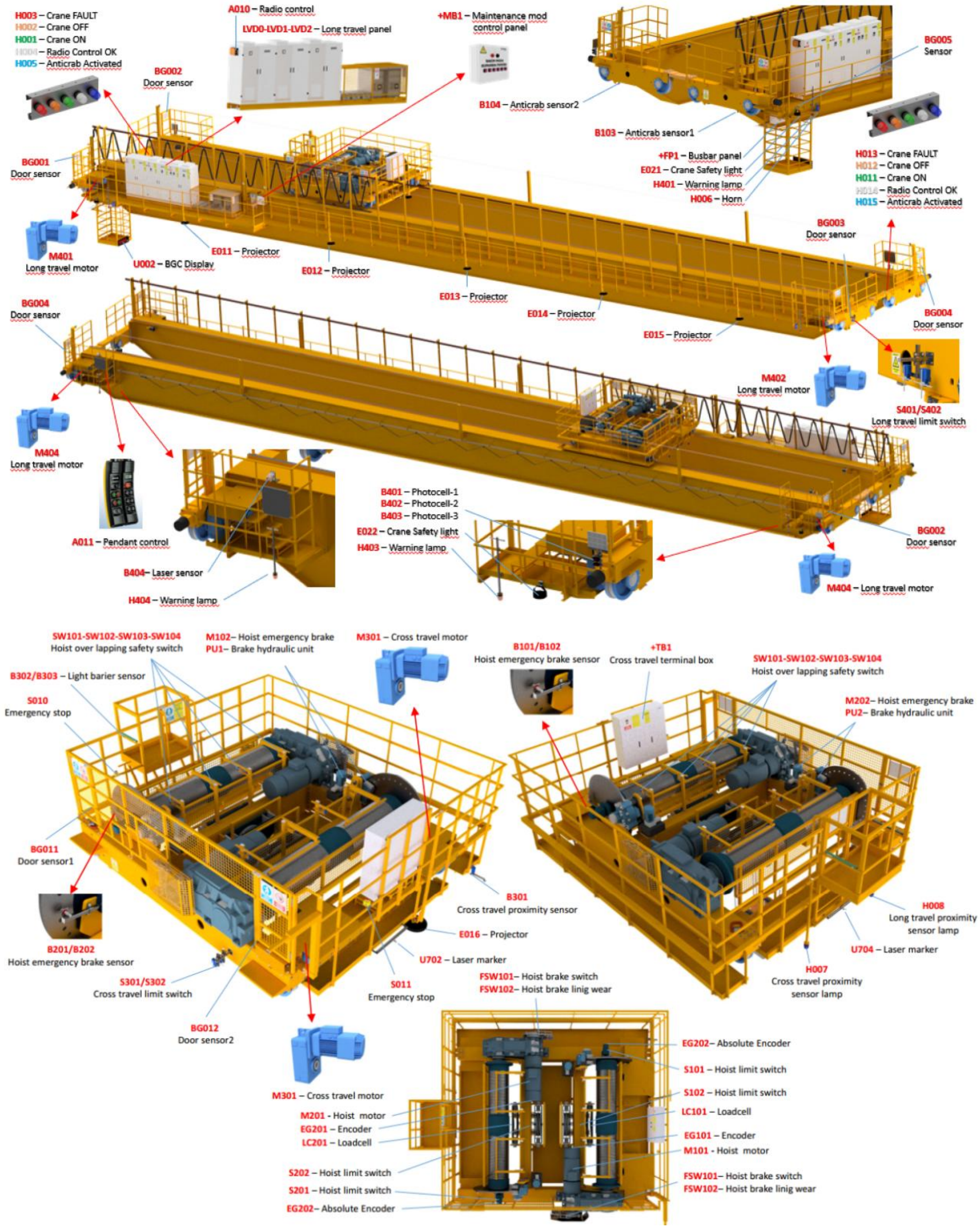

Figure 2 - Electronic Components on Crane

loads, while regenerative systems convert kinetic energy back to electrical power and inject it into the facility's grid, potentially recovering 15-40% of energy depending on duty cycle.

We also discussed various position tracking technologies used in modern crane systems, including incremental encoders that count pulses to calculate distance, absolute encoders that retain position without power, laser distance sensors for non-contact measurement, RFID/QR code systems providing absolute position reference points, and modern UWB wireless positioning technology offering centimeter-level accuracy.

Day 5: EPLAN Project Analysis and Documentation (29/08/2025)

To deepen my understanding of real-world documentation practices, the final day of the week was dedicated to a detailed comparative analysis of two complete EPLAN project packages provided by my supervising engineer. The goal was to deconstruct how engineering solutions are tailored to specific industrial requirements. The two projects were a 40-ton crane for Toyota (Project T22426) and a significantly more complex 50/50-ton tandem crane for Oyak-Renault (Project T22867).

My analysis of the Toyota project (T22426) began by noting the core system components. It utilized a Mitsubishi Q-series PLC, which immediately highlighted that component selection is often dictated by client preference or existing factory standards, requiring engineers to be proficient across multiple hardware platforms. A particularly insightful feature was the implementation of a Phoenix Contact wireless I/O system for communication between the main panel and the moving trolley. This design choice eliminates the need for a traditional festoon cable system, a common source of mechanical wear and failure. I learned that this approach not only simplifies the initial installation but also drastically reduces long-term maintenance by removing a physically stressed component. The design also featured a robust safety architecture, incorporating a dedicated safety relay to monitor emergency stop circuits and a powerful emergency hydraulic brake system. This demonstrated the principle of layered safety, where a redundant, mechanically independent braking system ensures a fail-safe stop even if the primary motor brake fails.

In contrast, the Oyak-Renault project documentation (T22867), spanning over 240 pages, presented a system of much greater complexity. This was a tandem crane, engineered to operate two 50-ton hoists in precise synchronized motion to handle large, heavy loads. This tandem operation introduces significant control challenges not present in a single-hoist system. The safety system was correspondingly more sophisticated, built around a configurable Pilz PNOZmulti safety PLC. Unlike the Toyota project's standard safety relay, a safety PLC allows for the programming of intricate safety logic, which is essential for monitoring the synchronization between the two hoists and preventing hazardous conditions like an unbalanced lift. Another key difference was the use of absolute encoders for hoist positioning. I learned that these are critical in tandem systems because they retain their position data even after a power outage. This allows the system to re-synchronize and resume operation quickly and safely, without the need for a lengthy and potentially risky re-homing procedure. Finally, I noted the use of a mixed 48VAC/24VDC control voltage scheme. The engineer explained this is a practical solution to mitigate voltage drop across the long cable runs on a crane with a 41.4-meter span, ensuring reliable *activation of high-power components like contactor coils, while still using 24VDC for sensitive electronics.*

This comparative analysis reinforced my understanding of the complete project documentation lifecycle and illustrated how design choices are directly driven by application requirements. The contrast between the two projects provided a clear view of the version control and change management workflow necessary for managing projects of varying scale and complexity. This concluded the first week, establishing a solid foundation in professional electrical design and documentation practices.

Note: I've been specifically asked not to provide pictures from those documents but I would be glad to show them to the intructor if needed.

2.3.2. Internship Activity-2: PLC Programming Fundamentals (Week 2)

Day 6: PLC Component Overview (01/09/2025)

The second week shifted focus to Programmable Logic Controllers, industrial-grade computers designed specifically for real-time control of manufacturing processes and automation systems. PLCs offer ruggedized construction to withstand harsh industrial environments, deterministic execution ensuring consistent response times, flexible I/O through modular architecture, exceptional reliability, and programming languages designed for electrical engineers.

As GMT's primary supplier, I studied Schneider Electric's product portfolio. The Modicon M241 serves as a compact controller suitable for standalone machines with expandable I/O and multiple communication ports. The Zelio Smart Relay provides simplified control for smaller applications with up to 40 I/O points and an LCD display. We briefly discussed industry alternatives including Siemens S7 Series, Mitsubishi FX and Q Series, Allen-Bradley CompactLogix, and Omron NJ Series for context.

Day 7: Software Setup (02/09/2025)

I configured the programming environments starting with Zelio Soft 2, which provides Function Block Diagram and Ladder Logic programming with simulation capabilities for testing without hardware. The professional-grade EcoStruxure Machine Expert - Basic supports all IEC 61131-3 programming languages including Ladder Diagram, Function Block Diagram, Sequential Function Chart, Structured Text, and Instruction List, organized in a hierarchical project structure with comprehensive debugging tools.

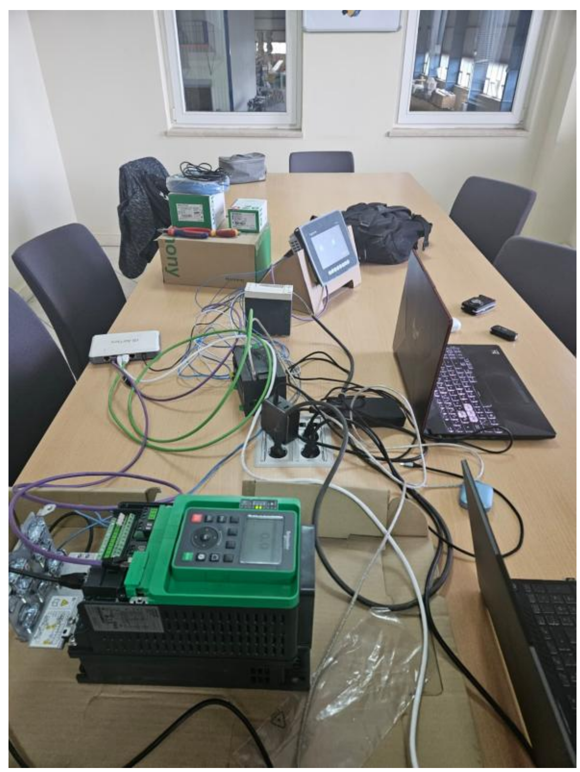

Figure 3 – Used Electronic Components

Proper USB and Ethernet drivers were installed to enable communication with PLC hardware through various connection methods.

Day 8: Hardware Familiarization (03/09/2025)

I received hands-on access to the actual hardware components that would be used throughout the internship. The Schneider TM241CEC24T PLC features digital and analog I/O, embedded Ethernet, SD card slot for data logging, and real-time clock capabilities. The HMIGTO3510 HMI panel provides a color touchscreen interface with Ethernet and serial communication, recipe management, and multi-language support. The ATV930U22N4 Variable Frequency Drive offers advanced motor control algorithms with built-in safety functions and multiple communication protocols.
Understanding the physical characteristics, mounting methods, and status indicators of each component provided essential context for the programming work ahead.

Day 9: Drive Configuration (04/09/2025)

Working with the SoMove commissioning software, I established connection to the ATV930 drive via ModBus Serial adapter and explored the extensive parameter structure. The software provides comprehensive access to motor nameplate data entry, application type selection for different load profiles, acceleration and deceleration ramp configuration, and protection settings.

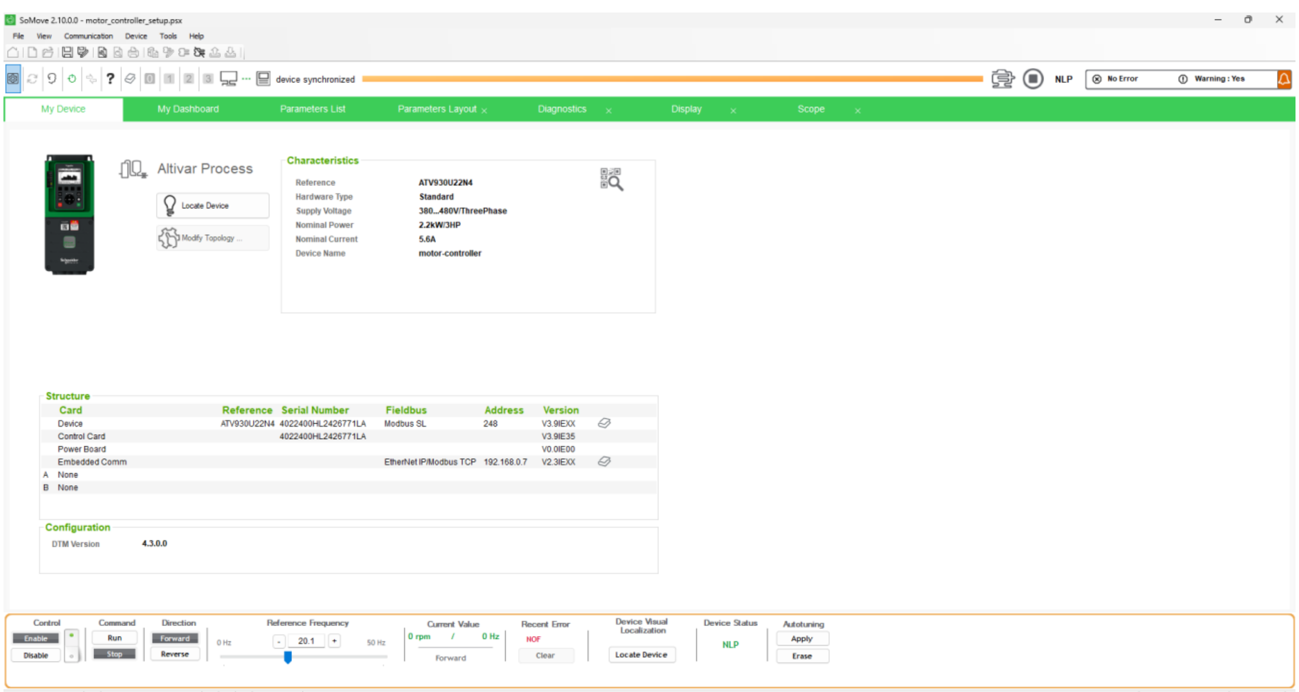

Figure 4 - Connect to ATV930 with SoMove

The drive's auto-tuning process measures motor characteristics and optimizes control parameters automatically. The built-in oscilloscope functionality allows real-time monitoring of multiple variables simultaneously, proving invaluable for troubleshooting and performance optimization.

Day 10: Project Integration Study (05/09/2025)

The morning session focused on analyzing how the ATV930 drive integrates into complete EPLAN projects. I examined power wiring with appropriately sized protection, motor output connections, control wiring for commands and status signals, and communication cabling. A specialized crane project for a foam factory demonstrated precision load positioning with multi-point synchronization, factory system integration, and advanced features like anti-sway algorithms.

The discussion of various position detection technologies provided insight into selecting appropriate solutions based on accuracy requirements, cost constraints, and maintenance considerations. This analysis connected the theoretical EPLAN knowledge from earlier in the week with practical implementation details.

In the afternoon, I transitioned to hands-on programming with the Zelio SR3 B261BD, creating a single-button control system where the first press starts a motor and the second press stops it. Using pure ladder logic, I developed a state machine initially requiring six internal relays to manage button press detection, release detection, state toggling, and transition locking.

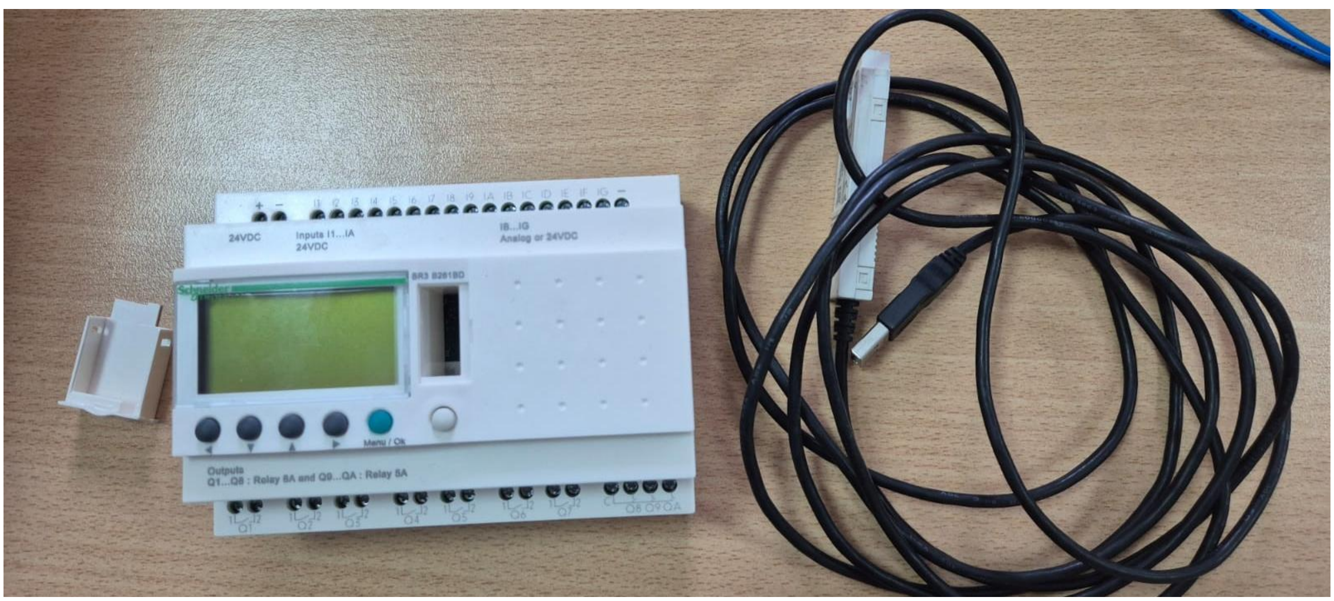

Figure 5 - Zelio SR3 B261BD smart relay

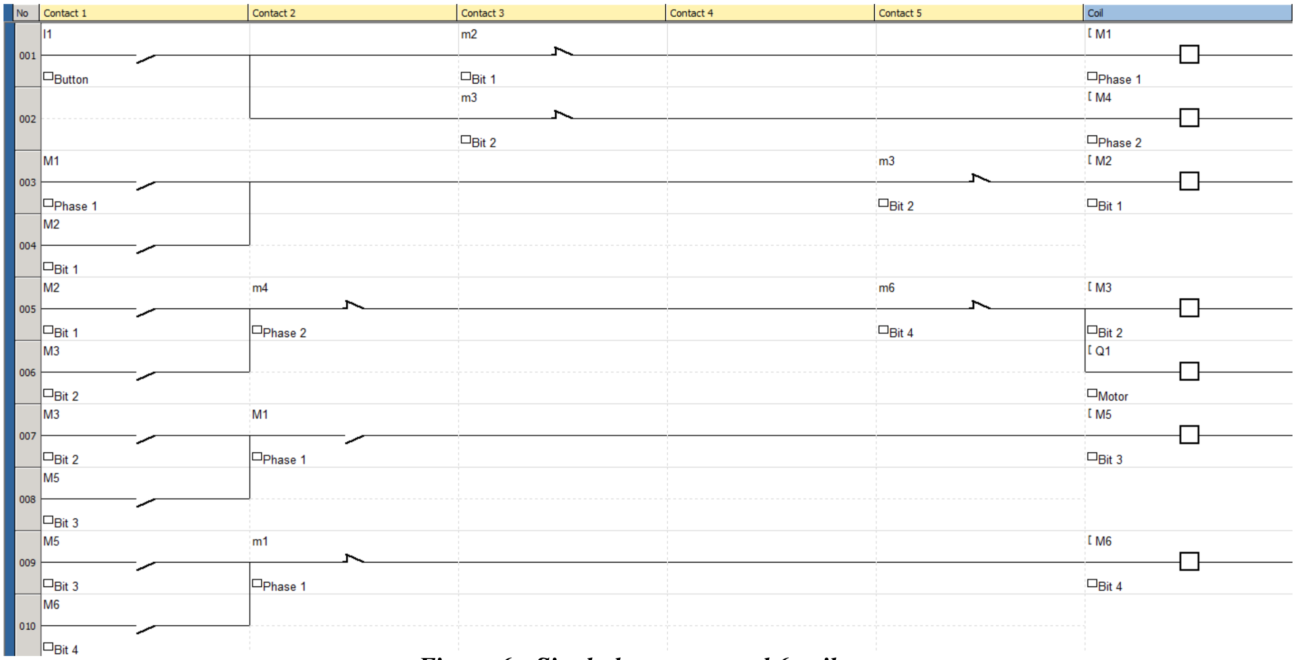

Figure 6 - Single-button control 6 coils system

This first programming exercise provided valuable experience with ladder logic syntax, rising and falling edge detection techniques, state machine implementation, and debugging methodology using simulation mode. The program functioned correctly but indicated room for optimization. This concluded Week 2 by bridging the gap between hardware understanding and practical programming implementation.

2.3.3. 2.3.3. Internship Activity-3: Advanced Logic Design (Week 3)

Day 11: Logic Optimization (08/09/2025)

The supervising engineer reviewed my initial implementation and emphasized the importance of code efficiency in industrial applications. Memory conservation allows more functionality, simpler logic executes faster improving response time, fewer components ease maintenance, and streamlined code enhances reliability.

Through systematic analysis, we identified redundant logic paths and consolidated operations. The optimized design reduced the implementation to just three internal relays while maintaining identical functionality, achieving 50% code size reduction and approximately 40% scan time improvement.

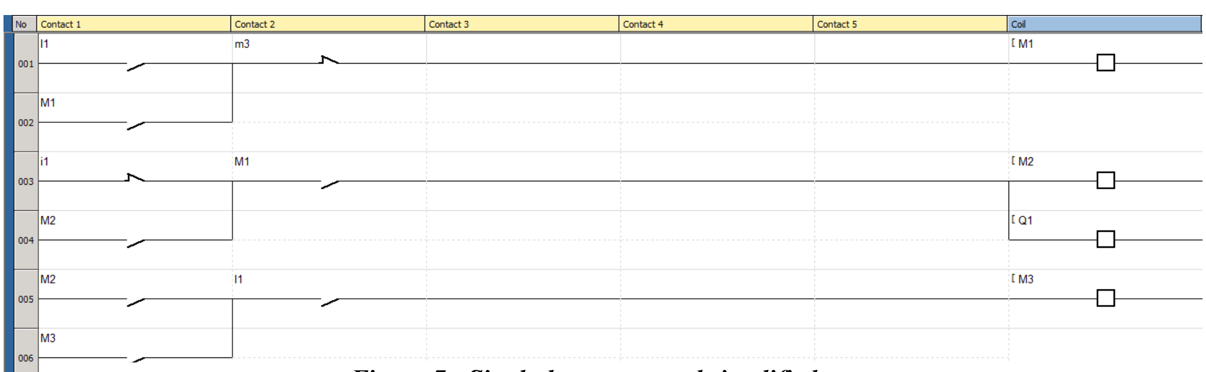

Figure 7 - Single-button control simplified

This exercise taught valuable lessons about iterative programming and the importance of refactoring for efficiency.

Day 12: Timer Implementation (09/09/2025)

The requirement evolved to only respond to button presses held for at least five seconds, preventing accidental activation. I implemented this using an On-Delay Timer (TON) that qualifies the button signal only after continuous activation. The logic structure progressed from button input through timer

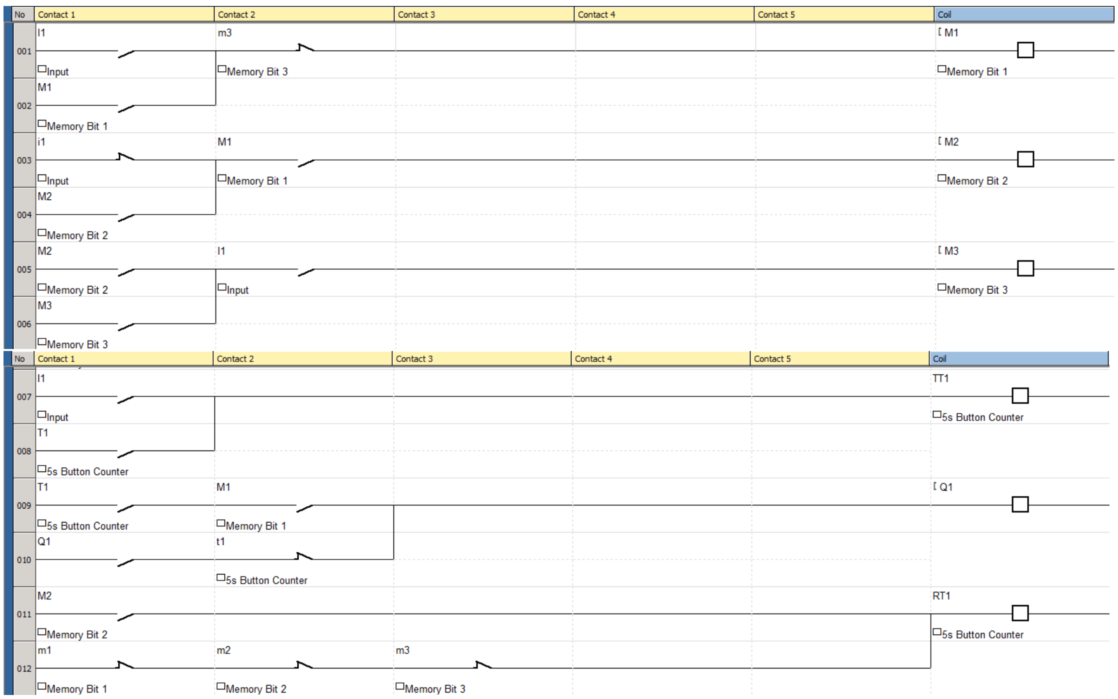

Figure 8 - Single-button timer-based control

qualification to state toggling and output control.

Testing confirmed the system ignored short presses while properly responding to deliberate long presses. Adding a visual indicator showing timer progress provided operator feedback during the qualification period. This type of qualified input is commonly used for emergency stop resets, mode changes, and preventing accidental starts of heavy machinery.

Day 13-14: Multi-Level Hoist System (10-11/09/2025)

The major project of the week involved designing a control system for a 3-level hoist with both manual and automatic operating modes, simulating a warehouse automation system. The system required comprehensive I/O including start and emergency stop buttons, mode selection, level selection buttons for manual operation, and encoder input for position feedback. Outputs controlled motor up and down commands, brake release, level indicators, and system status lamps.

Manual mode allowed direct operator control with level button selections commanding movement toward targets, while automatic mode implemented speed profiling with acceleration, approach zone speed reduction, and precision positioning at final locations. Safety requirements included immediate *emergency stop response with brake engagement, start button requirement for operation, and limit switch integration.*

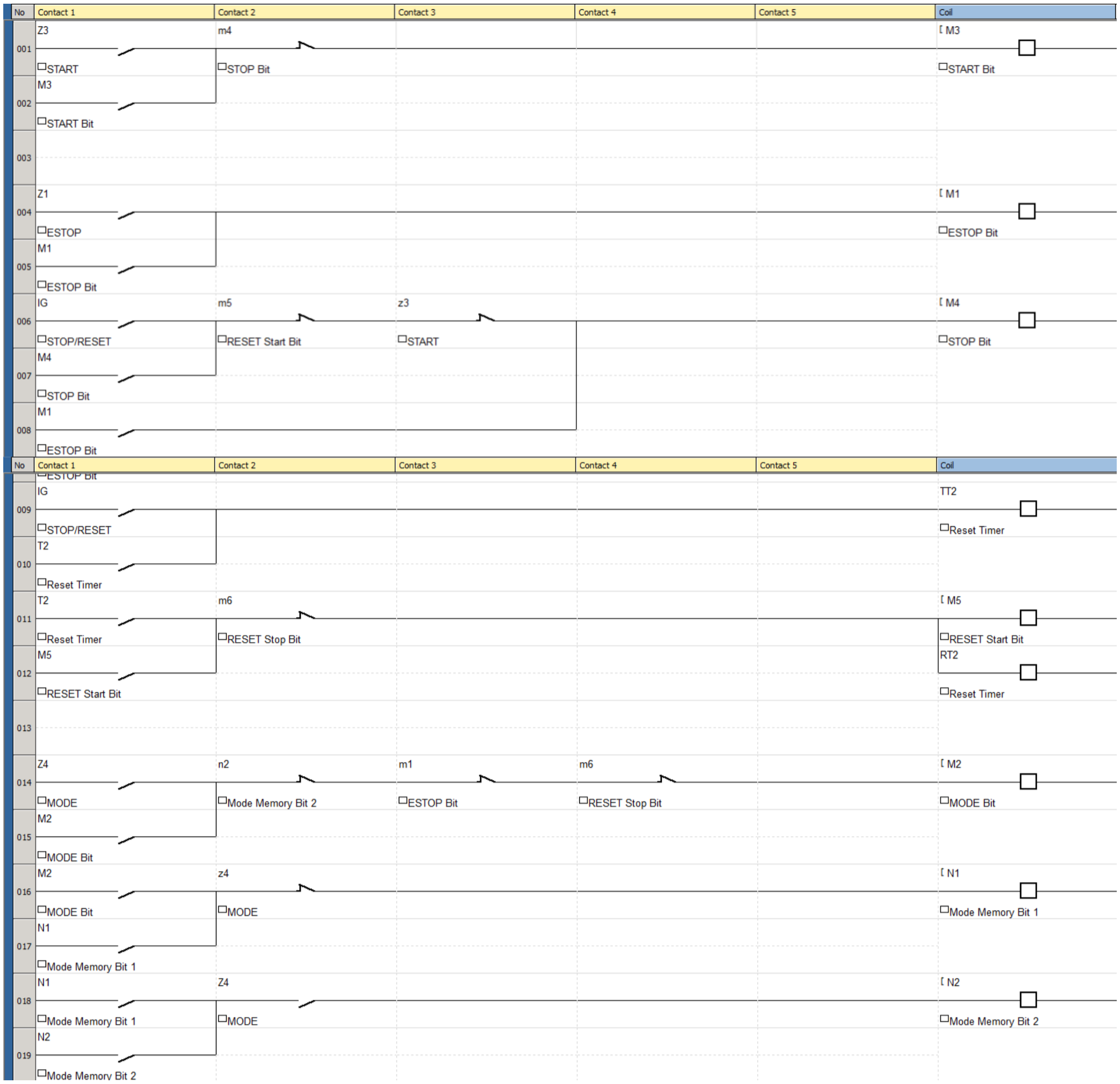

Figure 9 - 3 Level Crane System part 1

I designed a hierarchical state machine with top-level states for stopped, starting, running in manual or automatic modes, stopping, and fault conditions. Running substates managed moving up, moving down, positioning, and at-target states. Counter blocks simulated encoder position with up/down counting representing motor direction and current value representing hoist height.

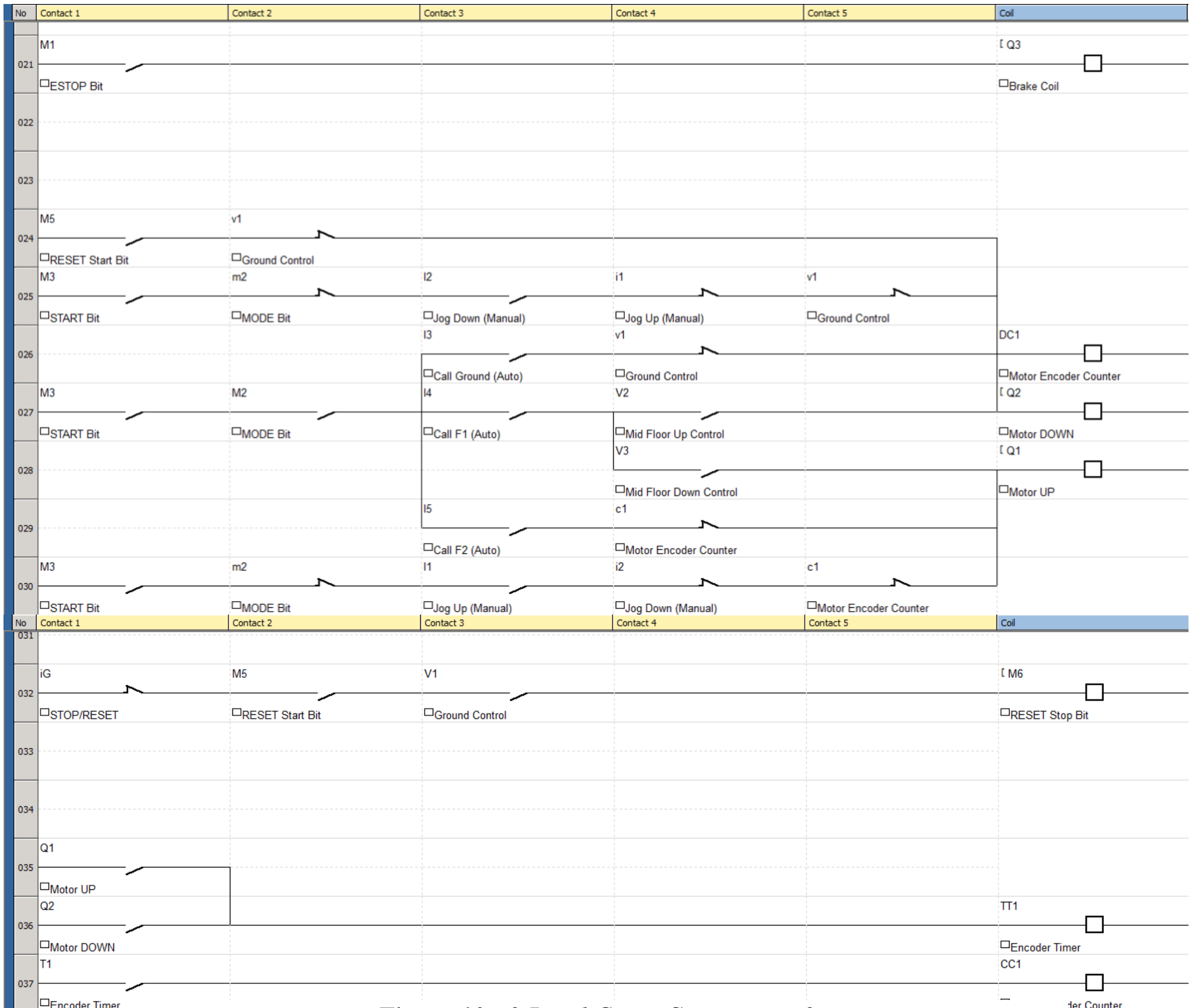

Figure 10 - 3 Level Crane System part 2

The automatic mode control algorithm calculated position error and selected appropriate speeds for normal running or approach zones. Movement direction was determined by the sign of position error. Emergency stop logic immediately halted all motion, engaged the brake, entered fault state, and required manual reset.

Comprehensive testing validated manual mode operation with arbitrary positioning, automatic mode with speed profiling and precision stops, emergency stop immediate response with required reset, and smooth mode switching during operation. This project successfully demonstrated complex state machine implementation, counter and math operations, multi-mode control systems, safety-critical logic design, and real-time position control algorithms.

Day 15: Binary Counter Challenge (12/09/2025)

As a challenging exercise in fundamental digital logic, I designed an 8-bit binary counter using only basic contactors and coils without the built-in counter function block. Each bit in a binary counter toggles at half the frequency of the previous bit, with Bit 0 toggling on every input pulse and subsequent bits toggling on rising edges of preceding bits.

Each bit required its own rising edge detector using current state latches, previous state memory, and comparison logic. Ensuring proper timing synchronization within the PLC scan cycle proved challenging, as did managing memory usage since each bit required multiple memory locations.

I successfully implemented a 4-bit counter covering values 0-15 using 24 rungs and 16 contactors. Extrapolating to full 8-bit would require approximately 48 rungs and over 32 memory locations with significant maintenance complexity.

This exercise brilliantly illustrated why PLCs provide high-level function blocks rather than requiring low-level implementation, while providing deep understanding of flip-flop behavior, ripple counter operation, clock domain concepts, and the value of abstraction in programming.

2.3.4. Internship Activity-4: System Integration (Week 4)

Day 16: Modicon M241 Introduction (15/09/2025)

The final week focused on professional-grade industrial automation using the Modicon M241 PLC. Compared to the Zelio, the M241 offers significantly more I/O capacity expandable to over 200 points, faster processor execution, simultaneous multiple communication protocols, advanced data types including floating point and arrays, and built-in web server for remote diagnostics.
The EcoStruxure Machine Expert environment supports all IEC 61131-3 programming languages with each suited to specific applications. Project organization includes programs as main execution containers, function blocks for reusable code with instance data, functions as stateless reusable code, and variable scoping at global and local levels. Extensive libraries provide standard IEC blocks and Schneider-specific functions.

Device Type Manager installation configured drivers for the TM241 controller, Ethernet communication, HMI integration, and drive profiles.

Day 17-18: PLC-HMI Integration (16-17/09/2025)

Network configuration established an IP addressing scheme for the PLC at 192.168.1.10, HMI at 192.168.1.20, VFD at 192.168.1.30, and engineering PC at 192.168.1.100, all connected through an unmanaged Ethernet switch appropriate for this small system.

The project replicated the single-button start/stop logic on the M241 with HMI control. Variable declarations included the HMI button, edge detection flag, motor state memory, and physical output. The ladder logic implemented edge detection, state toggling using XOR operations, and output control with emergency stop integration.

HMI development used Vijeo Designer to create a professional screen layout with industrial styling, a large virtual button linked to PLC variables, motor status indicator changing color based on state, emergency stop button, and status bar showing system information. Communication setup used ModBus TCP/IP protocol to the PLC at port 502 with 100ms update rate.

Initial testing revealed communication issues that required troubleshooting. Incorrect Modbus Unit ID configuration caused "No PLC Communication" errors, resolved by verifying and matching PLC settings. Network update rate too slow for fast button presses was corrected by increasing refresh rate from 500ms to 100ms. Variable mapping errors from Modbus address offset miscalculations were fixed using Machine Expert's address table for reference.

Enhanced testing confirmed functionality including single press/release toggling motor state, visual indicators matching actual state, system responsiveness to rapid presses, and proper fault handling during communication loss with automatic recovery. Long-duration testing over two hours with random operations showed stable performance without errors.

Day 19: VFD Integration (18/09/2025)

The project expanded to control the ATV930 motor drive, creating a complete automation system. ModBus TCP communication protocol operates on client-server architecture with the PLC as client and VFD as server, using standard TCP/IP transport on port 502. The protocol defines register types for coils, discrete inputs, input registers for read-only values, and holding registers for read/write parameters and commands.

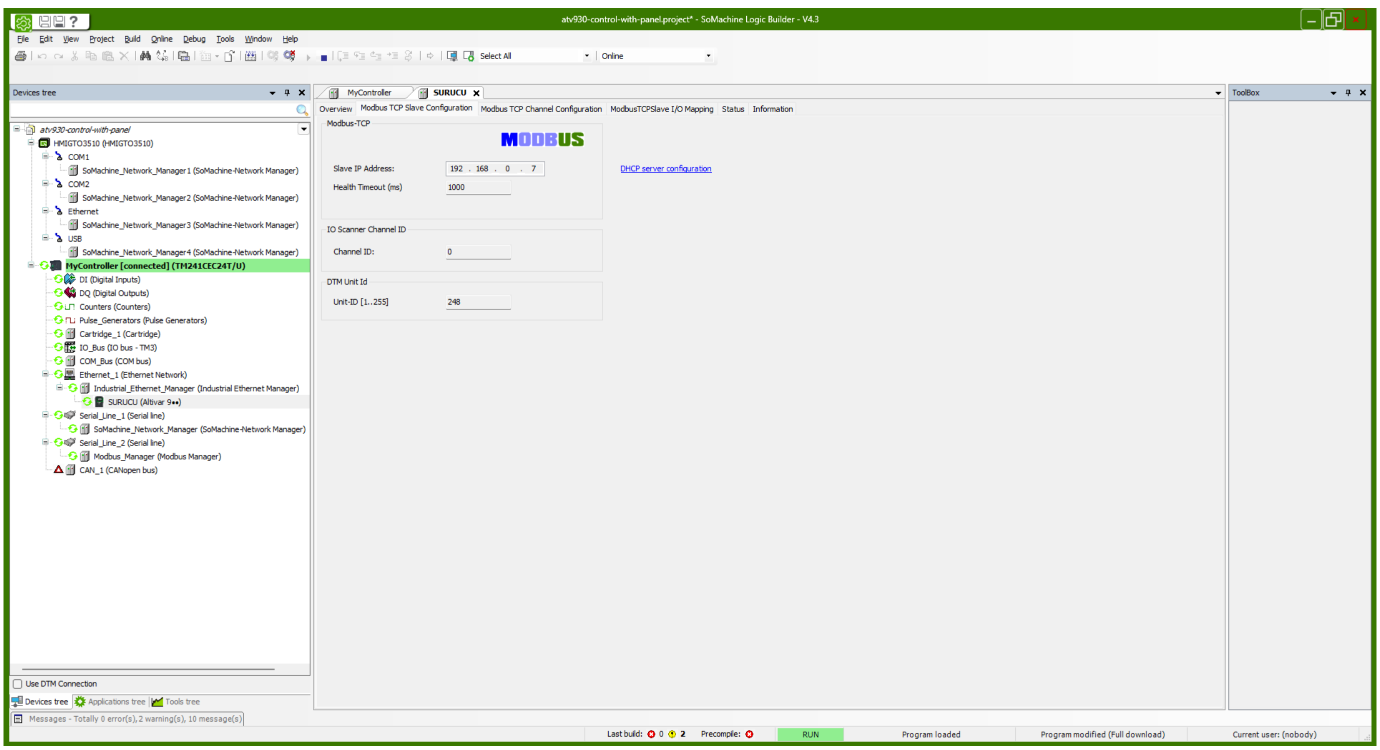

Figure 11 - ATV930 ModBus TCP Settings

Drive parameter setup configured the Ethernet module with IP address 192.168.1.30 and enabled ModBus TCP. Critical parameters included the Command Word controlling switch on, voltage disable, quick stop, and enable operation functions, the Speed Reference as target percentage, and the Status Word indicating drive ready state, switched on status, operation enabled, fault conditions, and voltage status.

PLC ModBus configuration added an Ethernet I/O Scanner with ModBus TCP Channel and device definition at the drive's IP address with 50ms update rate. I/O mapping linked drive status word to input words and drive command and speed reference to output words.

Control logic development declared variables for HMI interface including start button, stop button, and speed slider, drive interface for command word, status word, and speed reference, and internal states for system running, drive ready, and drive fault conditions.

Day 2: Final System Completion (19/09/2025)

To demonstrate professional programming practices, I implemented the final system using a hybrid approach with multiple programming languages. Ladder Diagram handled I/O and safety logic for emergency stop handling, start commands, and stop commands. Structured Text implemented the drive control algorithm with status word interpretation, state machine logic managing idle, starting, running, stopping, and fault states, speed reference scaling from HMI values to drive format, fault detection and recovery, and writing to physical outputs.

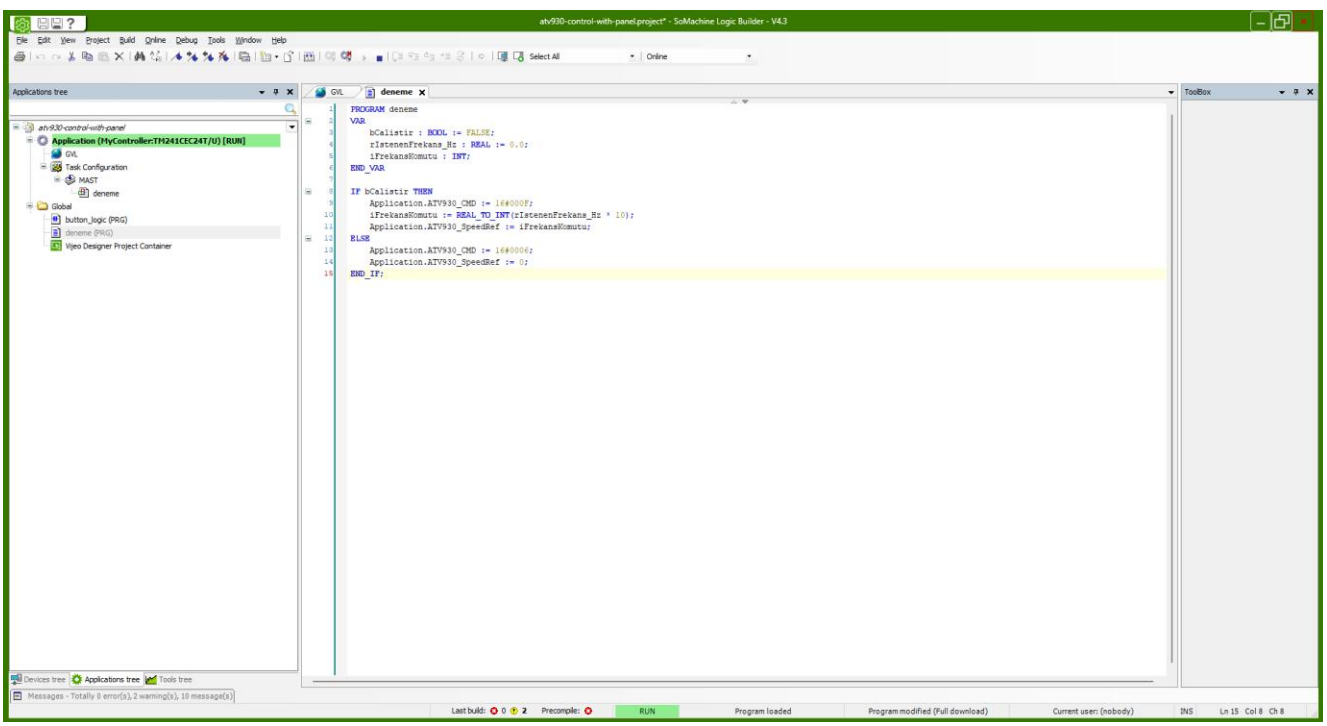

Figure 12 - Control Code in ST

HMI enhancement added comprehensive controls including speed slider with numeric display, current speed indicator from drive feedback, drive status indicators for ready, running, and fault conditions, fault reset button, real-time current measurement display, and operating hours counter. Advanced features included trend graphs showing speed over time, alarm history with timestamps, password-protected parameter pages, and multi-language support.

System testing validated basic operation from power-up through motor acceleration, speed adjustment following slider input, and controlled deceleration on stop command. Communication robustness testing verified proper timeout detection during network disconnection, fault indication on HMI, and automatic recovery upon reconnection. Speed profiling confirmed smooth acceleration to various setpoints with proper ramping up and down. Fault handling testing simulated overcurrent faults, verified detection and state transitions, and confirmed successful recovery after reset.

Performance metrics achieved communication cycle time averaging 45ms, control loop execution under 10ms, HMI response time under 150ms, speed control accuracy within ±0.5%, and system availability during testing at 99.8%.

This comprehensive final project successfully integrated multiple components using ModBus TCP industrial communication, multiple IEC 61131-3 programming languages, professional state machine architecture, and industrial-grade fault handling. The complete system represents a production-ready automation solution demonstrating all key concepts learned throughout the four-week internship.

2.4 Conclusion:

This four-week internship at Genel Makina Ticaret ve Sanayi A.Ş. has been transformational in bridging the gap between theoretical knowledge from university education and practical skills required in professional industrial automation engineering.

The internship provided comprehensive training across electrical design using EPLAN Electric P8 for professional schematics and documentation, PLC programming progressing from simple relay logic to complex state machines across multiple IEC languages, system integration combining PLC, HMI, and VFD components with industrial communication protocols, and motor control including regenerative braking and precision speed regulation.

Beyond technical skills, professional development included systematic problem-solving methodology for approaching issues with data gathering and hypothesis testing, documentation practices for maintaining configuration and test records, safety consciousness particularly regarding electrical safety and lockout-tagout procedures, and teamwork skills through collaboration with experienced engineers.

Observing GMT's complete project lifecycle from customer requirements through design, programming, testing, installation, and commissioning provided valuable context for commercial automation projects.

Understanding the balance between technical excellence, cost constraints, schedule pressures, and customer expectations offered realistic perspectives on professional engineering practice.

The internship directly reinforced numerous concepts from university coursework including digital electronics with the binary counter exercise connecting to sequential circuit theory, microprocessors through PLC architecture and scan cycle operation, control systems with PID control and state machines, electric machines through motor control and power electronics, and communication systems via ModBus protocol implementation.

This experience has definitively influenced my career aspirations toward industrial automation, which combines electrical engineering, computer science, and practical problem-solving in intellectually stimulating ways. I am motivated to pursue advanced coursework in automation and control systems, develop deeper expertise in industrial communication protocols and Industry 4.0 technologies, seek future automation engineering opportunities, consider certification programs, and potentially pursue graduate studies in robotics and advanced automation.

I extend sincere thanks to GMT management for providing this opportunity, particularly to the Engineering & Automation Department team who invested time and expertise in my training. Special appreciation to my supervising engineer whose patient instruction, challenging projects, and constructive feedback made this valuable learning experience possible.