

Automation of 3-Phase Motor and Assembly Line Using Allen-Bradley MicroLogix 1000 Programmable Logic Controllers (PLCs)

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Introduction

The automation of factory machines is commonly done using programmable logic controllers (PLCs). Hands-on PLC training stations are helpful to train students how to use and program PLCs. Two different PLC training setups have been designed, one automating a 3-phase AC motor-generator set and the other automating a portion of an assembly line. Both of these machines are automated using Allen-Bradley MicroLogix 1000 PLCs which have been programmed with ladder logic control programs.

Procedure

Phase I: PLC control of 3-phase AC motor-generator set

- ❖ Use 3-phase AC motor as experimentation platform for learning about the different I/O of the PLC
- ❖ Turn documentation of 3-phase motor control into a PLC training lab for future students



Image 1: 3-phase AC motor-generator set.

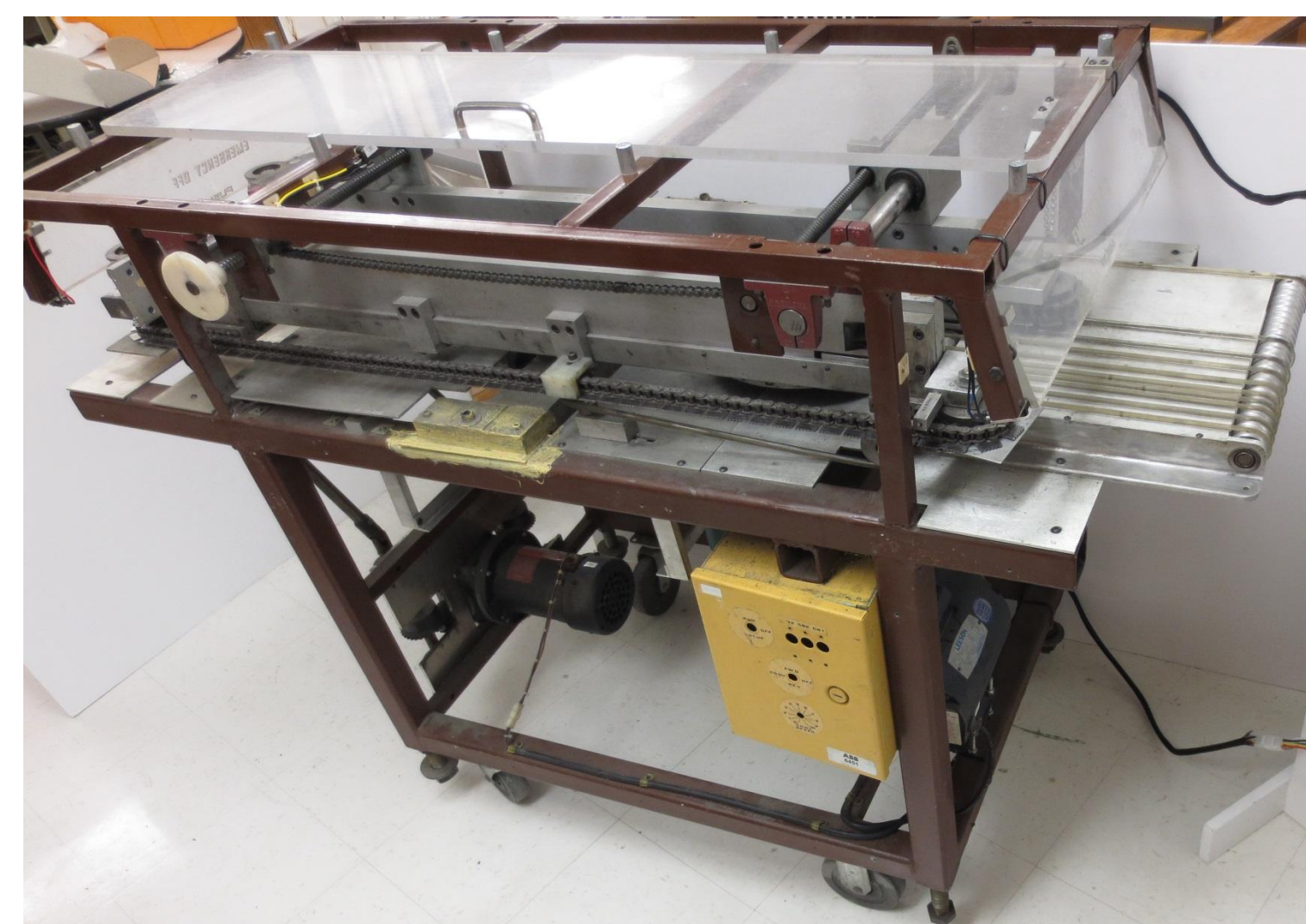


Image 2: Assembly line machine.

Phase II: PLC control of assembly line machine

- ❖ Develop a new circuit schematic for PLC control that makes use of the most I/O on the PLC
- ❖ Build mounts for all switches and controls
- ❖ Construct and wire user interface
- ❖ Develop a ladder logic control code
- ❖ Turn documentation on assembly line into PLC training labs for future students

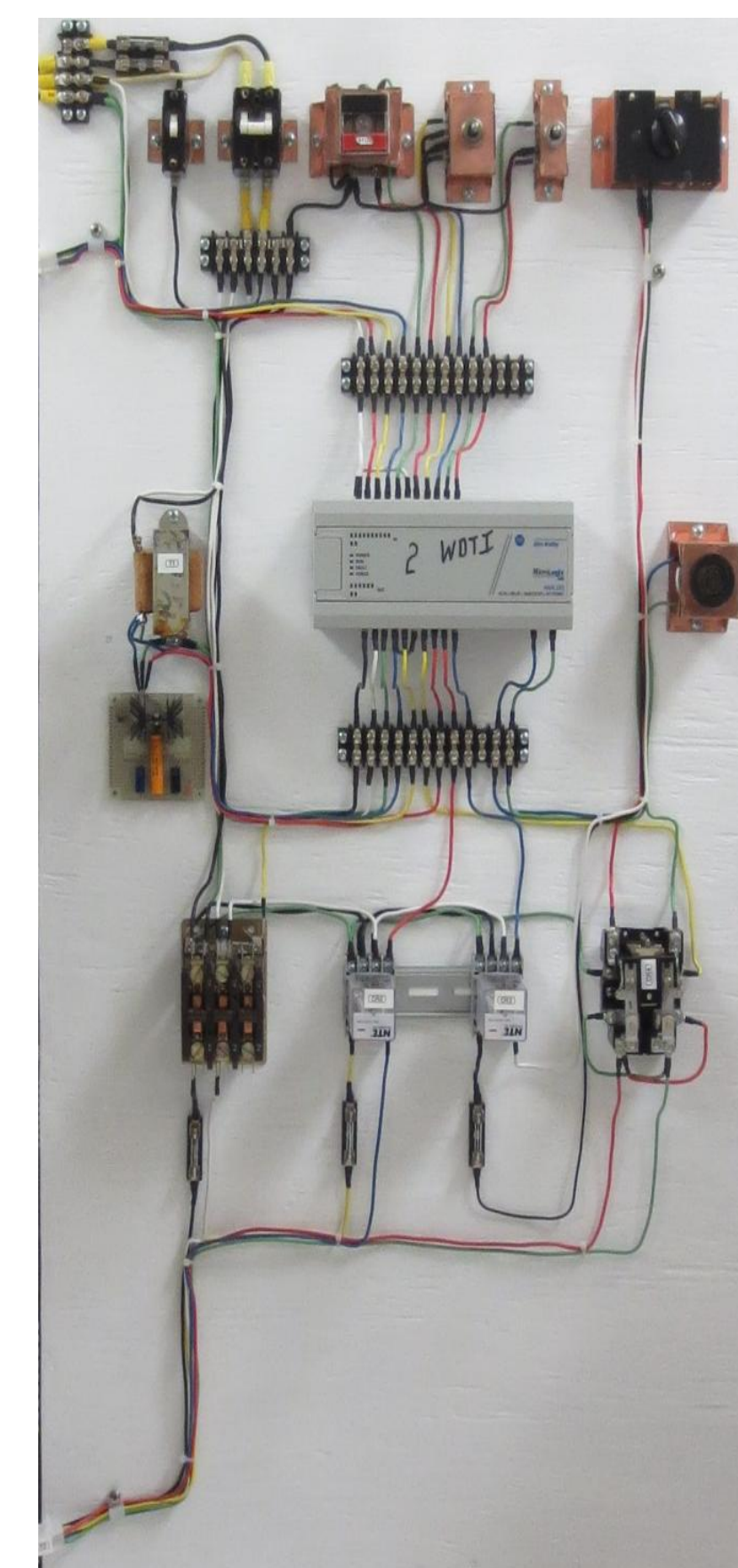


Image 3: Assembly line user interface.

Materials and Software

- ❖ Allen-Bradley MicroLogix 1000 Analog PLCs
- ❖ RSLinx Classic
- ❖ RSLogix Micro English
- ❖ OrCAD Capture CIS
- ❖ 3-phase AC motor-generator set
- ❖ Assembly line machine



Image 4: Allen-Bradley MicroLogix 1000 PLC.

Results

3-Phase Motor

- ❖ 3-phase motor control schematic makes use of analog inputs, analog outputs and AC relay outputs
- ❖ Control program consists of an on/off logic switch analog input and a 30s pulse logic switch analog input. The 30s pulse input executes a subroutine to turn the motor on and off every 30s. It also has a progress indicator on the analog output.

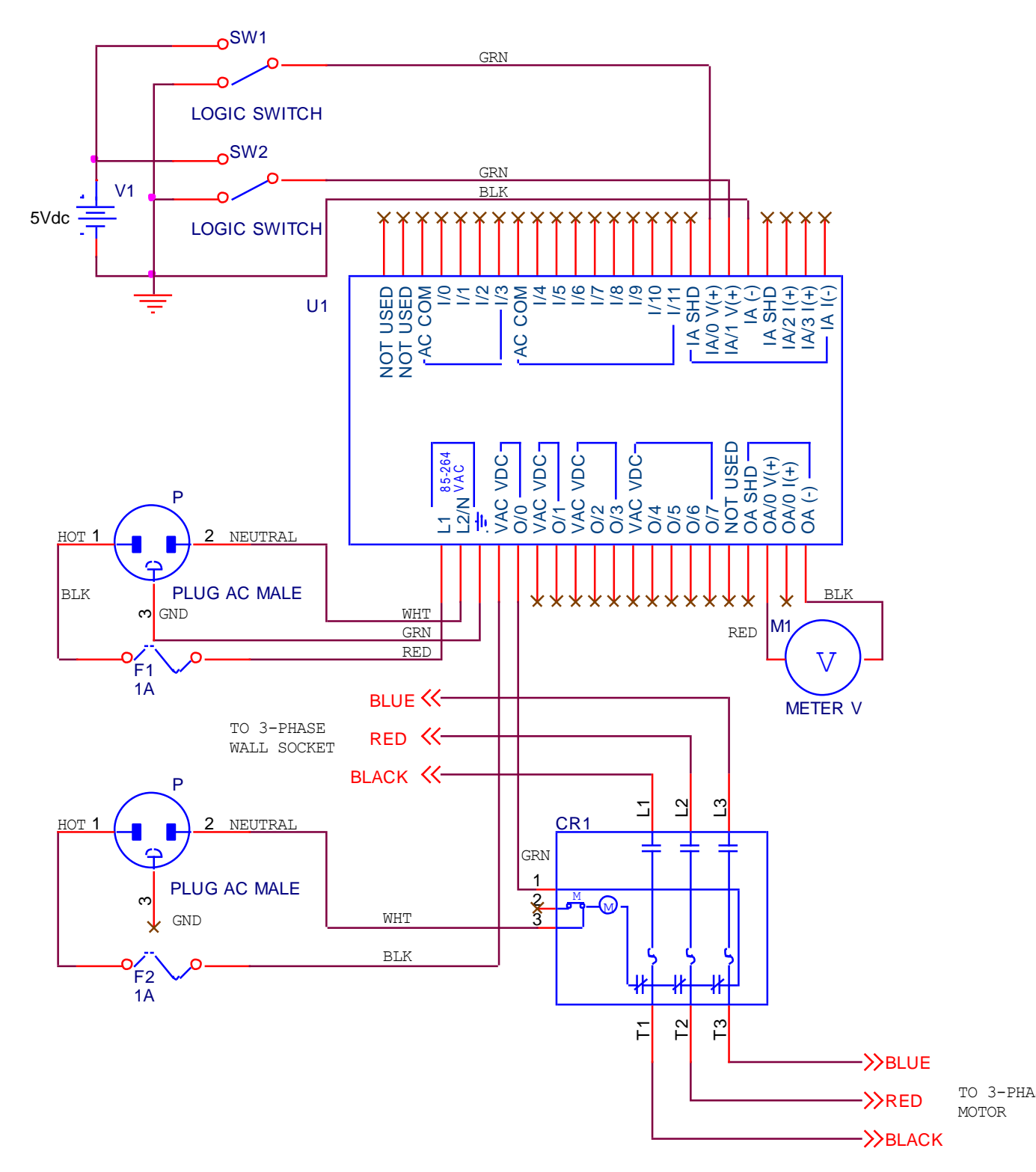


Image 5: Electrical schematic for PLC control of 3-phase motor.

Assembly Line

- ❖ The electrical schematic for the assembly line makes use of the AC discrete inputs, the AC/DC relay outputs and the analog output
- ❖ The control program was written to simulate what could be used on an actual assembly line

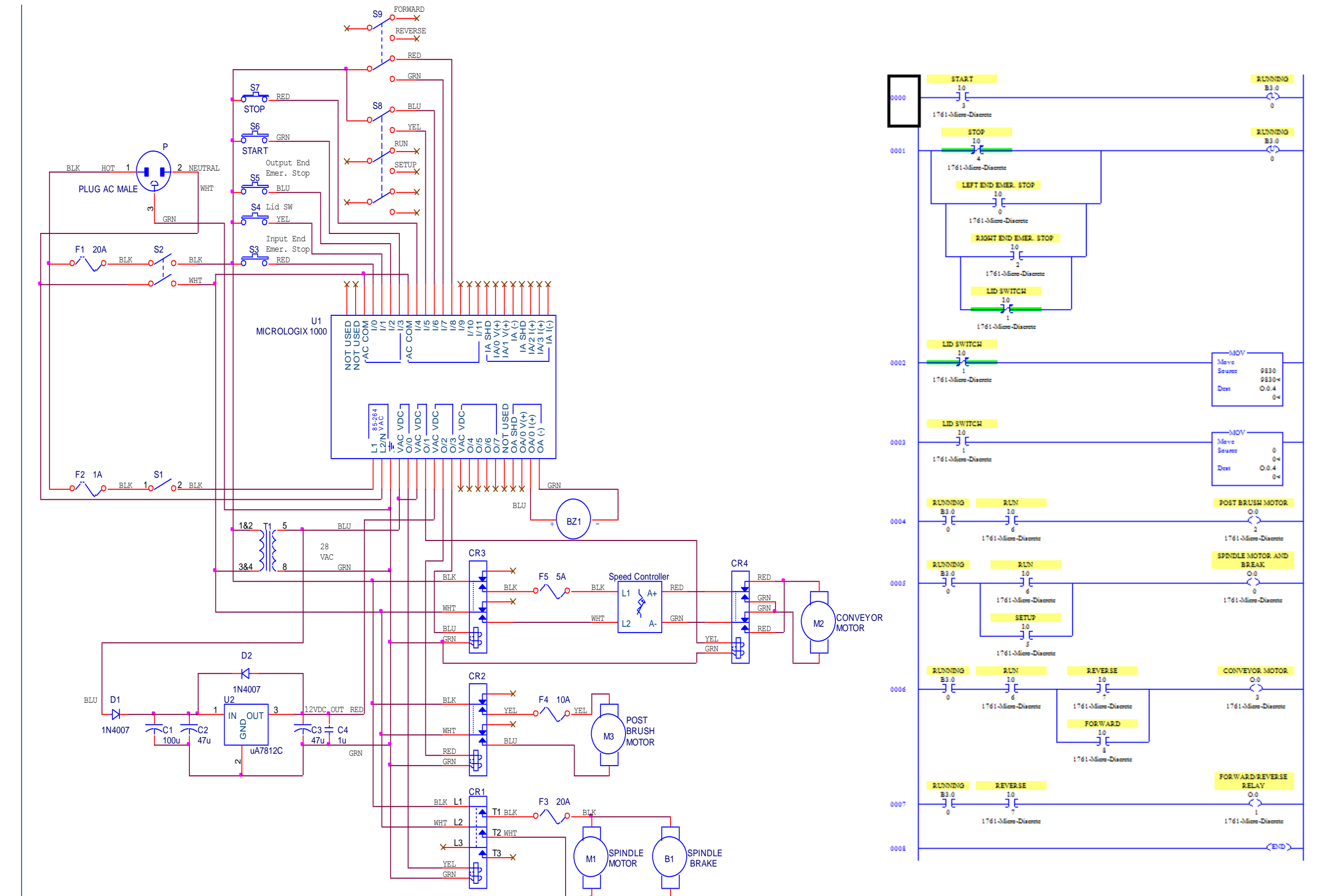


Image 8: Electrical schematic for PLC control of assembly line.

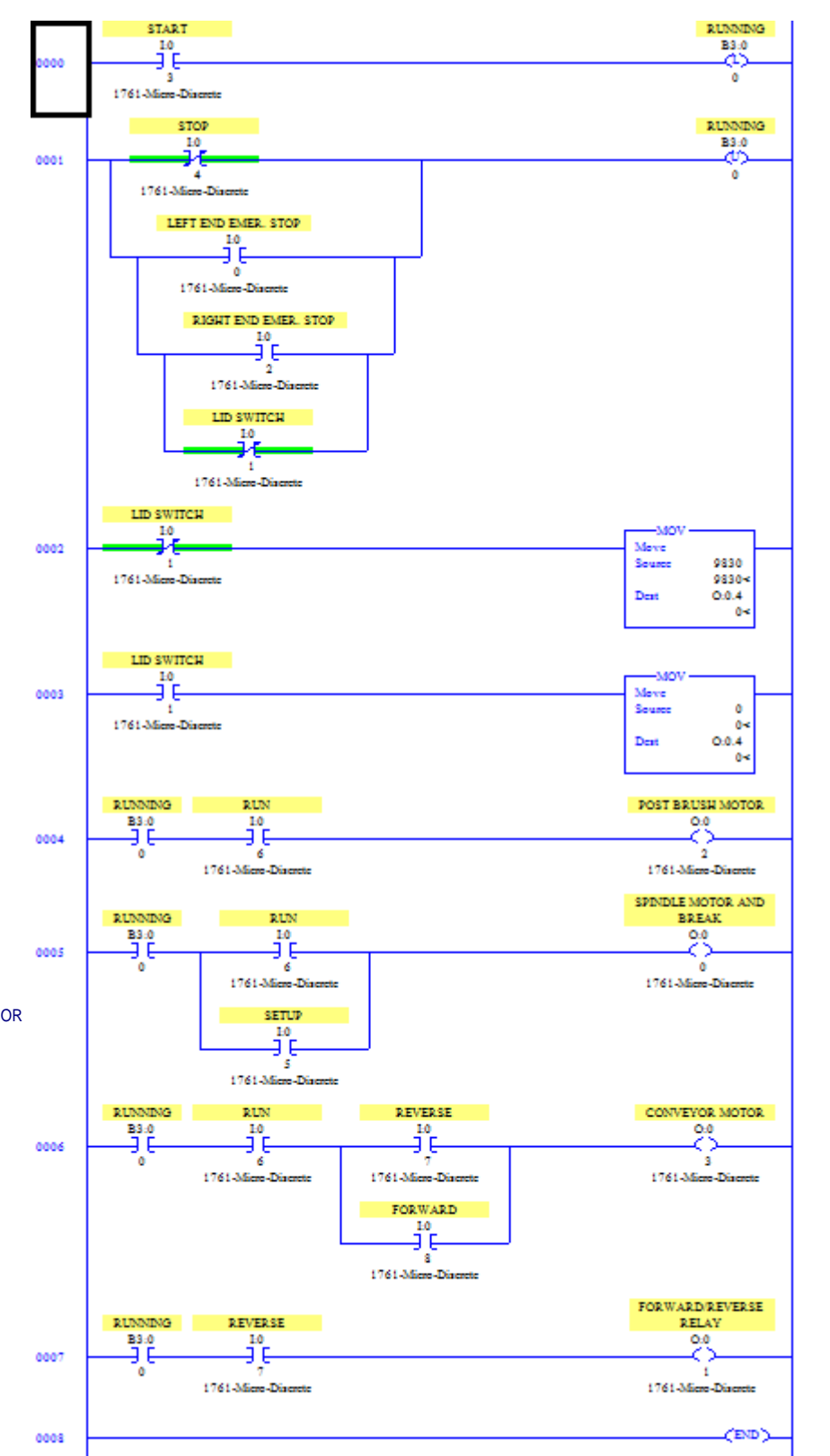


Image 9: Assembly line control code.

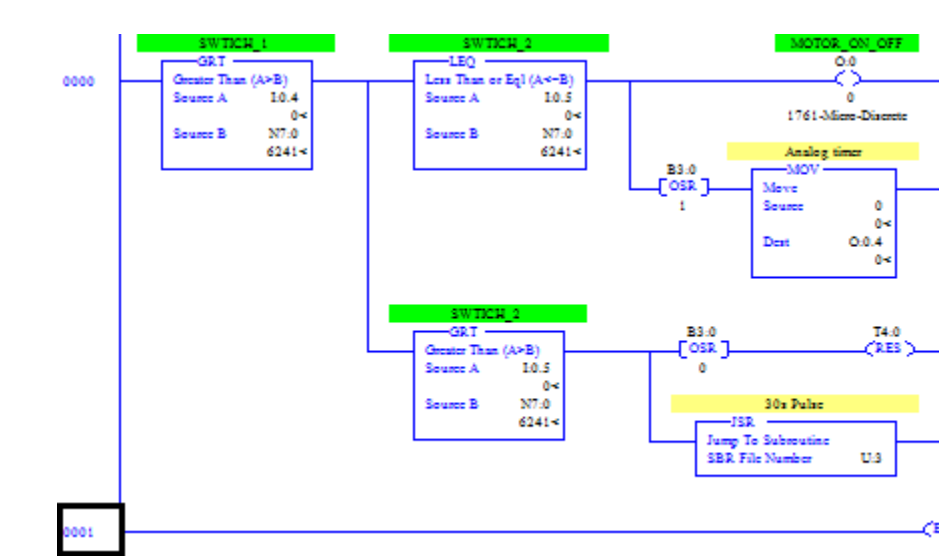


Image 6: Main program: Reads logic switches to turn on/off motor or to execute the 30s Pulse Sub-Routine.

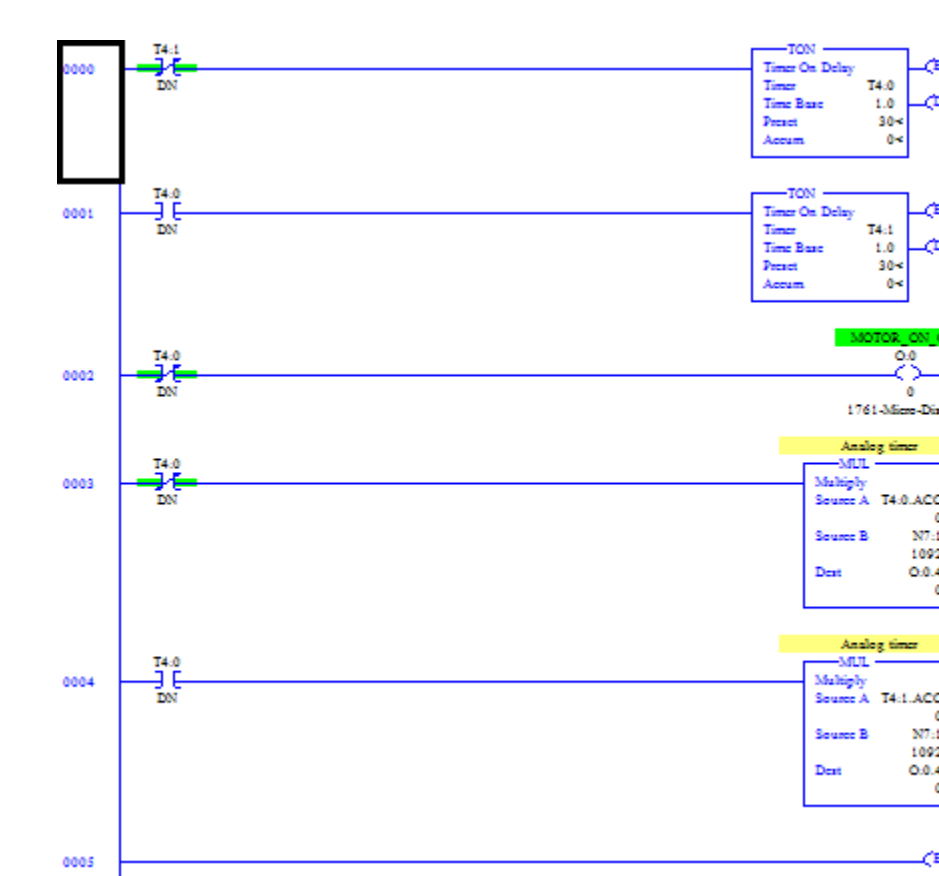


Image 7: 30s Pulse Sub-Routine: Sends 30s on/off pulses to 3-phase motor and increases the analog output from 0-10V as time of the pulse increases from 0-30s.

Conclusions

The construction and testing of the 3-phase motor-generator set and assembly line is complete and ready for implementation in the fall. The PLC wiring schematics were chosen to give students experience programming with each type of I/O on this PLC. The wiring schematic for the assembly line includes multiple types of power sources to give students experience working with the different types.

Future Work

Control labs will be written for both machines to train students how to program in ladder logic and to give them hands on experience with wiring and programming PLCs. For the assembly line, the implementation of the speed controller through the analog inputs and outputs will be designed.

Acknowledgements

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