Equipment Utilization Chart

The following equipment is required to perform the exercises in this manual.

Equipment		Exercise							
Model	**Description**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
3103 (or 8110 or 8134)	Industrial Controls Mobile Workstation	1	1	1	1	1	1	1	1
3112	Switches								1
3115-A	Pilot Lights	1	1	1	1	1	1	1	
3119	Dual Contactors								1
3125	Lockout Module	1	1	1	1	1	1	1	1
3127-2	Contactor								1
3128	Programmable Logic Controller								1
3129	Interposing Relays								1
3138	Control Transformer							1	1
3139	DC Power Supply	1	1	1	1	1	1	1	1
3149	Limit Switch						1	1	1
3174-3	Reversible AC Motor							1	1
3196 (or 8821)	AC Power Supply	1	1	1	1	1	1	1	1
6373-B	Background Suppression Photoelectric Switch	1	1					1	1
6374-B	Polarized Retroreflective Photoelectric Switch	1		1				1	1
6375-B	Inductive Proximity Switch					1		1	
6376-B	Capacitive Proximity Switch	1			1			1	1
6396	Reflective Block	1	1	1	1	1		1	1
8951-8	Connection Leads	1	1	1	1	1	1	1	1
8951-E	Connection Leads	1	1	1	1	1	1	1	1
38503	Magnetic Labels								1
76768	Filler Pot				1				

Sensor Selection Guide

What to know when selecting a sensor

- Distances

  Between the sensor and the target: _____

  Between the sensor and the background: _____

- Target

  Metallic or nonmetallic: _____

  Ferrous or non-ferrous: _____

  Opaque, transparent, translucent: _____

  Dimensions: _____

  Movements: _____

- Mounting requirements: _____
- Environment

  Ambient operating temperature, dust, oil, humidity: _____

- Supply voltage available: _____
- Response time: _____
- Sensor output type (load requirement) _____

  Transistor, relay, triac: _____

Basic Setup and Lockout/Tagout Procedures

This appendix is divided into three sections:

- Basic Setup procedure explains the basic operations that must be performed at the beginning of the exercise procedures.
- Lockout/Tagout procedure (de-energizing procedure) describes the lockout/tagout procedure used to de-energize the Industrial Controls Training System before setting up a circuit.
- Energizing procedure gives details on how to end a lockout/tagout procedure and energize the Industrial Controls Training System.

Basic setup procedure

This procedure is recommended at the beginning of every experiment. It insures that the system is safe prior to cabling specific circuits.

1. Make sure that the power switch of the power supply is set to the off position.

   The power supply should already be installed in the workstation.

2. Install the Lockout Module in the workstation.

3. Turn off the Lockout Module.

4. Connect the Lockout Module leads to the power supply terminals, respecting the phase sequence.

Lockout/tagout procedure (de-energizing procedure)

1. Turn off the Lockout Module.

2. Install the lockout hasp and the student padlocks and tags on the Lockout Module. Ask the instructor to install the lab padlock and tag as well.

3. Check that the Lockout Module switch cannot be opened. With a voltmeter, verify that no voltage is present between the Lockout Module output terminals to confirm that the circuit is de-energized. You may now set up your circuit.

Energizing procedure

1. Connect the green chassis terminals (on the modules) to the earth (ground) terminal of the Lockout Module.

2. Make sure the security guard is installed if you are using a motor.

3. Identify the push buttons, selector switches, and pilot lights with magnetic labels in accordance with the circuit schematic diagram.

4. Once the connections are made, ask for the instructor to check the circuit. When the circuit is correctly wired, notify all the people working around the workstation that the system will be energized.

5. Remove the lockout hasp, padlocks and tags.

   If you are using the Power Supply, Model 8821, make sure that the voltage control knob is set to 0%.

   AC and DC voltages (fixed or variable) are available on the Power Supply, Model 8821. For all exercises requiring AC voltage, use the AC variable output (terminals 4, 5 and 6).

6. Turn on the power supply and Lockout Module, and return to your exercise.

   If you are using the Power Supply, Model 8821, set the voltage control knob to 100%.

Care of the Sensors Training System

- Keep the training system clean and dry. If, for some reason, water, oil, or another liquid is dropped or splashed on a sensor, wipe it off immediately with a damp cloth. Do not use strong cleansers of any kind on the sensors.

- Manipulate the sensors carefully. Many of them are delicate in nature and must be handled with care.

- Report any damaged or missing parts to your instructor immediately.

Electromagnetic Spectrum

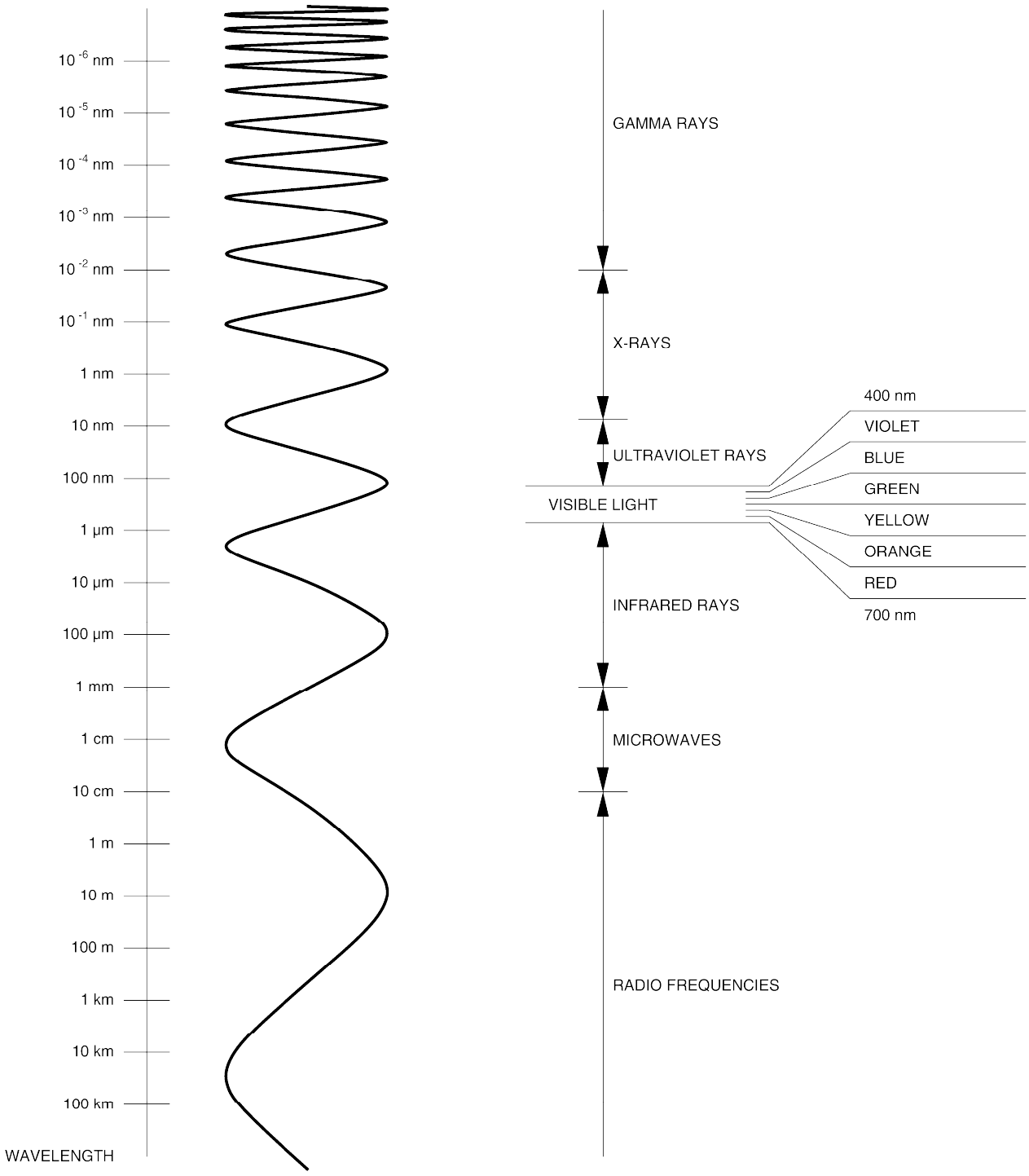
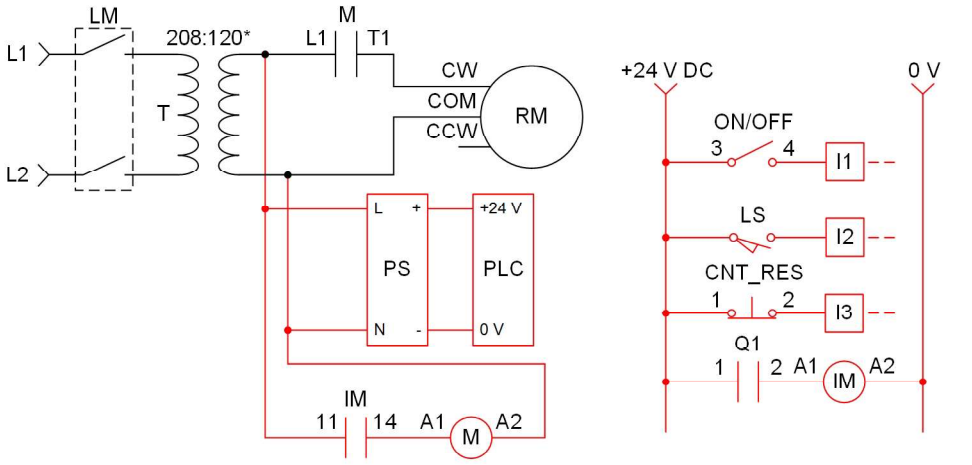


Figure 44. Electromagnetic spectrum.

Suggested Schematic Diagrams and Ladder Programs

This appendix provides suggested schematic diagrams and ladder programs for the projects proposed in Exercise 8. As mentioned, it is suggested that you design your own circuits and refer to this appendix only if necessary.



* 208: 120 FOR 120 V – 60 Hz NETWORK
380: 110 FOR 220 V – 50 Hz NETWORK
415: 110 FOR 240 V – 50 Hz NETWORK
380: 120 FOR 220 V – 60 Hz NETWORK

LEGEND

CNT_RES	=	COUNTER RESET PUSH BUTTON (MOMENTARY CONTACT)
Ix	=	PLC INPUT #x
IM	=	INTERPOSING RELAY FOR MAIN CONTACTOR (24 V DC COIL)
LS	=	LIMIT SWITCH
M	=	MAIN CONTACTOR
ON/OFF	=	ON/OFF SELECTOR SWITCH (MAINTAINED CONTACT)
PLC	=	PROGRAMMABLE LOGIC CONTROLLER
PS	=	DC POWER SUPPLY
Qx	=	PLC OUTPUT RELAY #x
RM	=	REVERSIBLE MOTOR (SINGLE PHASE)
T	=	CONTROL VOLTAGE TRANSFORMER

Figure 45. Suggested schematic diagram for Project (Figure 38).

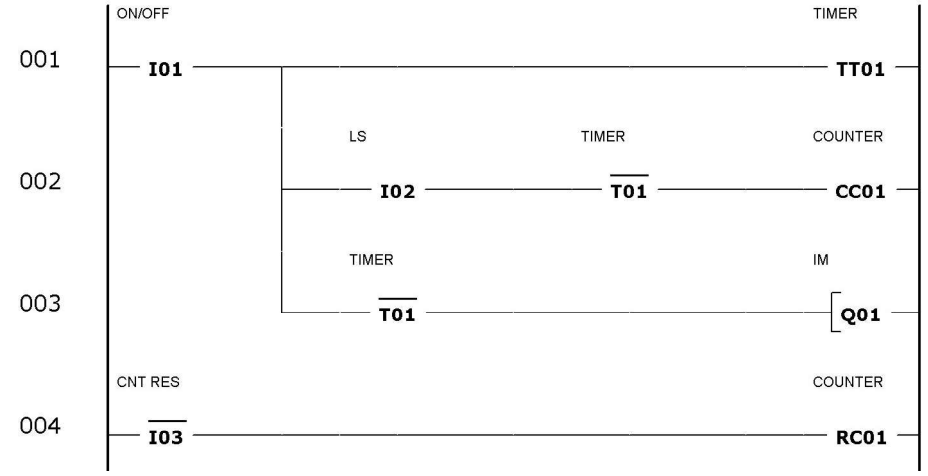
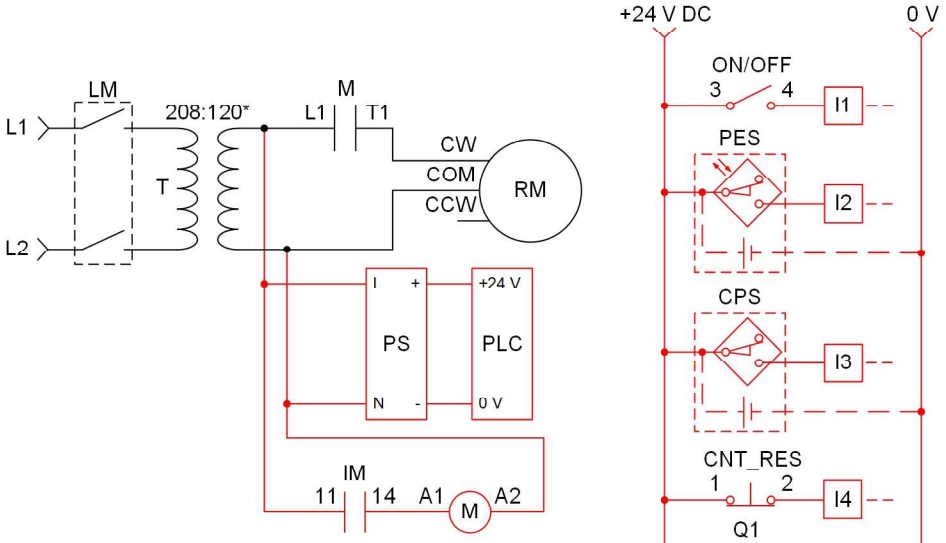


Figure 46. Suggested ladder program for Project 1 (Figure 39).



* 208: 120 FOR 120 V – 60 Hz NETWORK
380: 110 FOR 220 V – 50 Hz NETWORK
415: 110 FOR 240 V – 50 Hz NETWORK
380: 120 FOR 220 V – 60 Hz NETWORK

LEGEND

CNT_RES = COUNTER RESET PUSH BUTTON (MOMENTARY CONTACT)
CPS = CAPACITIVE PROXIMITY SWITCH
Ix = PLC INPUT #x
IM = INTERPOSING RELAY FOR MAIN CONTACTOR (24 V DC COIL)
M = MAIN CONTACTOR
ON/OFF = ON/OFF SELECTOR SWITCH (MAINTAINED CONTACT)
PES = BACKGROUND SUPPRESSION PHOTOELECTRIC SWITCH
PLC = PROGRAMMABLE LOGIC CONTROLLER
PS = DC POWER SUPPLY
Qx = PLC OUTPUT RELAY #x
RM = REVERSIBLE MOTOR (SINGLE PHASE)
T = CONTROL VOLTAGE TRANSFORMER

Figure 47. Suggested schematic diagram for Project 2 (Figure 40).

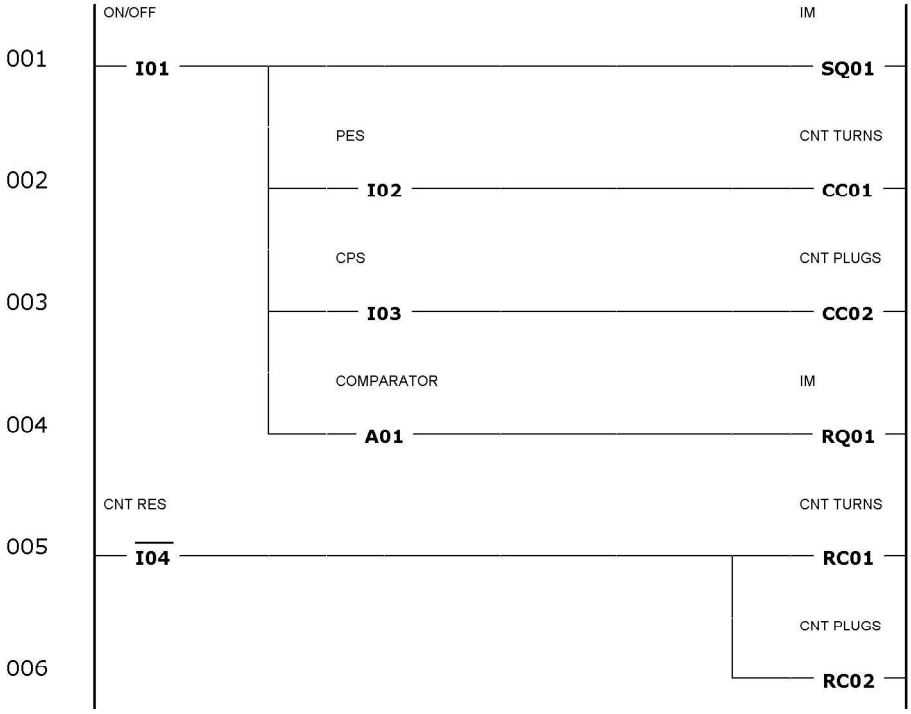
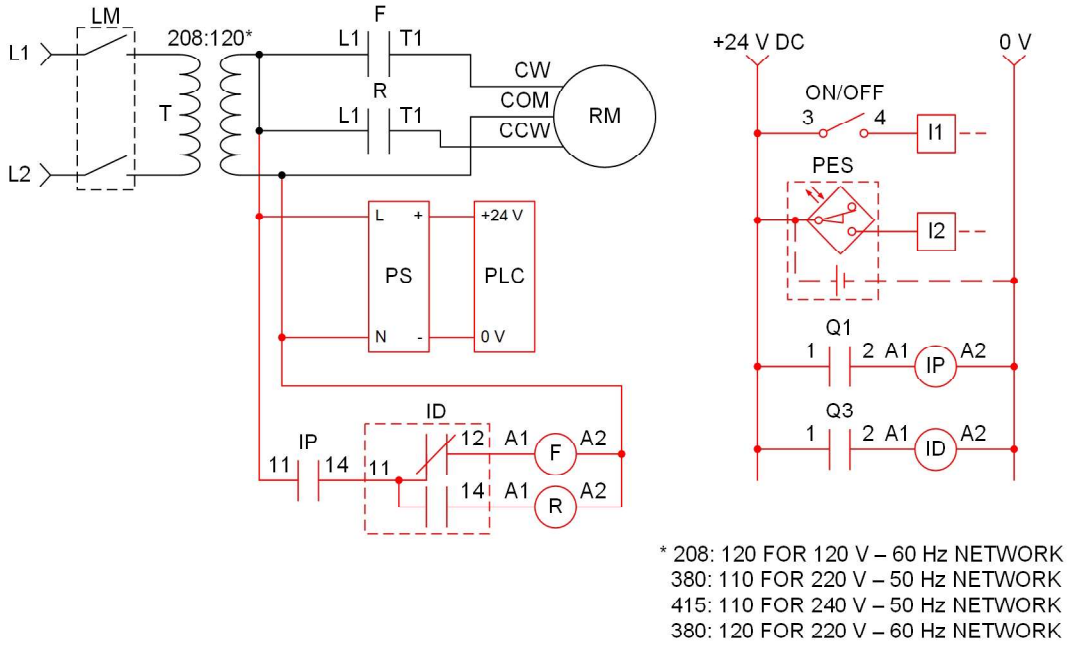


Figure 48. Suggested ladder program for Project 2 (Figure 41).



* 208: 120 FOR 120 V – 60 Hz NETWORK
380: 110 FOR 220 V – 50 Hz NETWORK
415: 110 FOR 240 V – 50 Hz NETWORK
380: 120 FOR 220 V – 60 Hz NETWORK

LEGEND

F	=	FORWARD DIRECTION CONTACTOR
Ix	=	PLC INPUT #x
ID	=	INTERPOSING RELAY FOR MOTOR DIRECTION (24 V DC COIL)
IP	=	INTERPOSING RELAY FOR MOTOR POWER (24 V DC COIL)
ON/OFF	=	ON/OFF SELECTOR SWITCH (MAINTAINED CONTACT)
PES	=	BACKGROUND SUPPRESSION PHOTOELECTRIC SWITCH
PLC	=	PROGRAMMABLE LOGIC CONTROLLER
PS	=	DC POWER SUPPLY
Qx	=	PLC OUTPUT RELAY #x
R	=	RESERVE DIRECTION CONTACTOR
RM	=	REVERSIBLE MOTOR (SINGLE PHASE)
T	=	CONTROL VOLTAGE TRANSFORMER

Figure 49. Suggested schematic diagram for Project 3 (Figure 42).

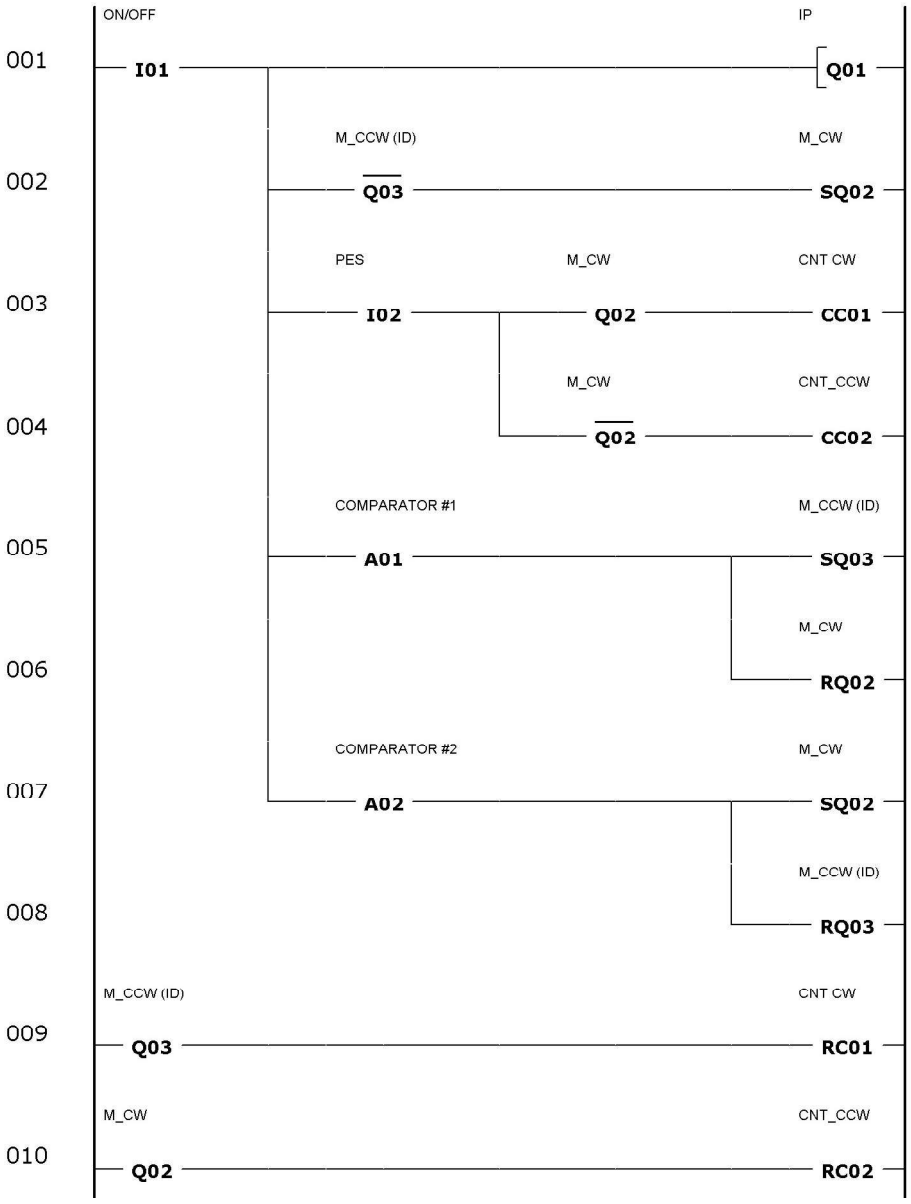


Figure 50. Suggested ladder program for Project 3 (Figure 43).

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