MENG 5335: Programmable Logic Controller_ Programmable Logic Controls Training System
Allen Bradley PLC Portable Training System
FCS-PLC-1461-AB Instruction Manual

Introduction

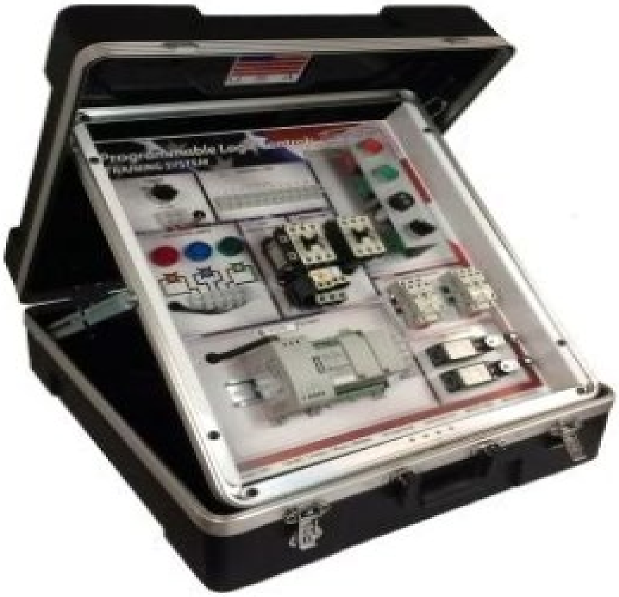


Figure 1. Allen Bradley PLC Micro 820 Training System (FCS-PLC-1461-AB)

This AB training system was designed to teach students and workers how to understand and troubleshoot Allen-Bradley Micro820 Programmable Logic Controls. The AB-Micro820 hands-on PLC training system includes real world components commonly found in the Manufacturing, Processing and Automation Industry.

Components

▪ 2 Industrial Limit Switches with Normally Closed (NC) & Normally Opened (NO) Contacts
▪ 2 Industrial Pushbutton Switches with 2 sets of NO and NC Contacts
▪ 1 Alarm Buzzer
▪ 1 Two-Position Industrial Selector Switch with 1 set of NO Contacts
▪ 3 Lights-Red, Blue & Green
▪ 2 Standard 8 pin Ice Cube Relays with sockets
▪ 1 IEC Motor Starter
▪ 1 IEC Contactor
▪ 1 PLC Ethernet Cable

AB-Micro820 Controller

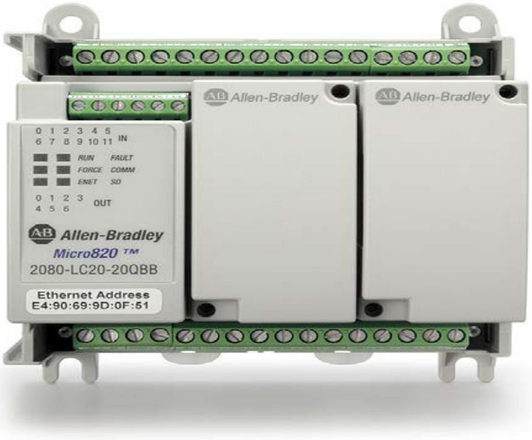


Figure 2: Controller Overview

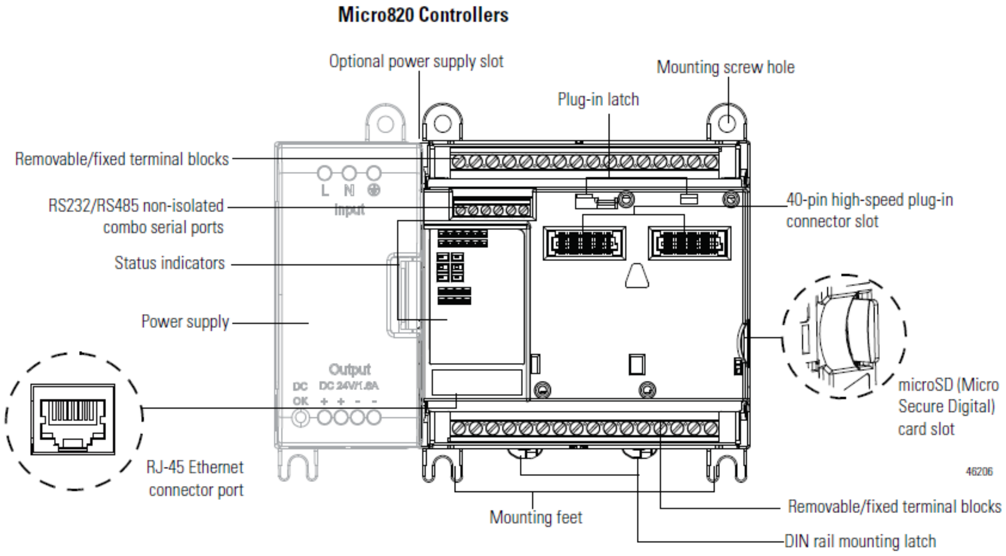

Micro820 Controllers
Optional power supply slot
Mounting screw hole
Plug-in latch
Removable/fixed terminal blocks
RS232/RS485 non-isolated combo serial ports
40-pin high-speed plug-in connector slot
Status indicators
Power supply
microSD (Micro Secure Digital) card slot
RJ-45 Ethernet connector port
Mounting feet
Removable/fixed terminal blocks
DIN rail mounting latch
L N
Input
Output
DC OK
DC 24V/1.6A
46206

Figure 3: Controller Schematic

Programming Software

Micro800-850 Controllers are programmed by Connected Components Workbench (CCW), which is a set of collaborative tools supporting the controllers. CCW is based on Rockwell Automation and Microsoft Visual Studio technology and offers controller programming, device configuration, integration with HMI editor, and design operator's interface applications. CCW provides a choice of programming languages (ladder diagram, function block diagram, structured text) with user defined function block support that optimizes machine control.

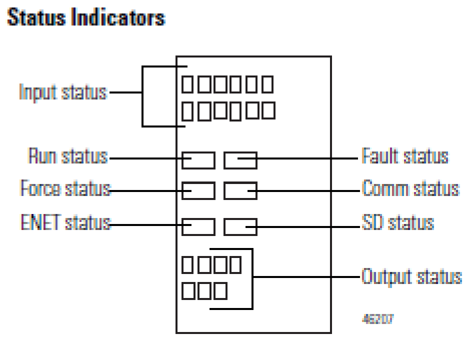


Figure 4: Status Indicators LEDs

Wiring Micro820 Controller

The controller is configured with **Sink Input** and **Source Output**. This indicates that the relay base Micro820 has its input transistor designed to take -24Vdc at its common and +24Vdc at input terminal respectively as shown below in **Fig.5**. The Sourcing Output indicates that the Micro820 has its output transistor designed to take +24Vdc at its common and output terminal, wired directly to the positive terminal of the Load as shown in **Fig.6**.

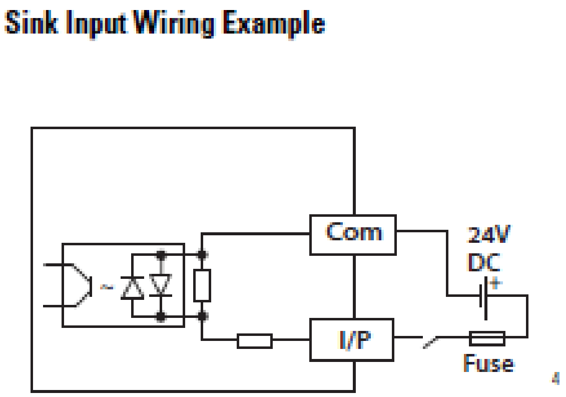


Figure 5: PLC Sinking Input

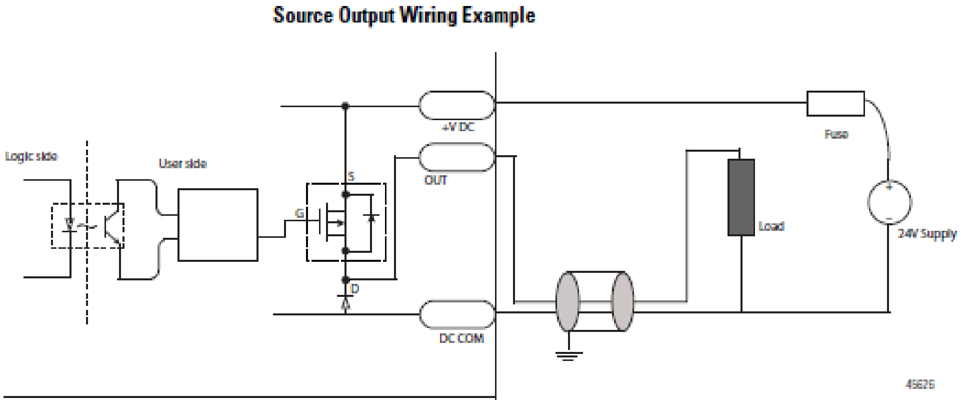
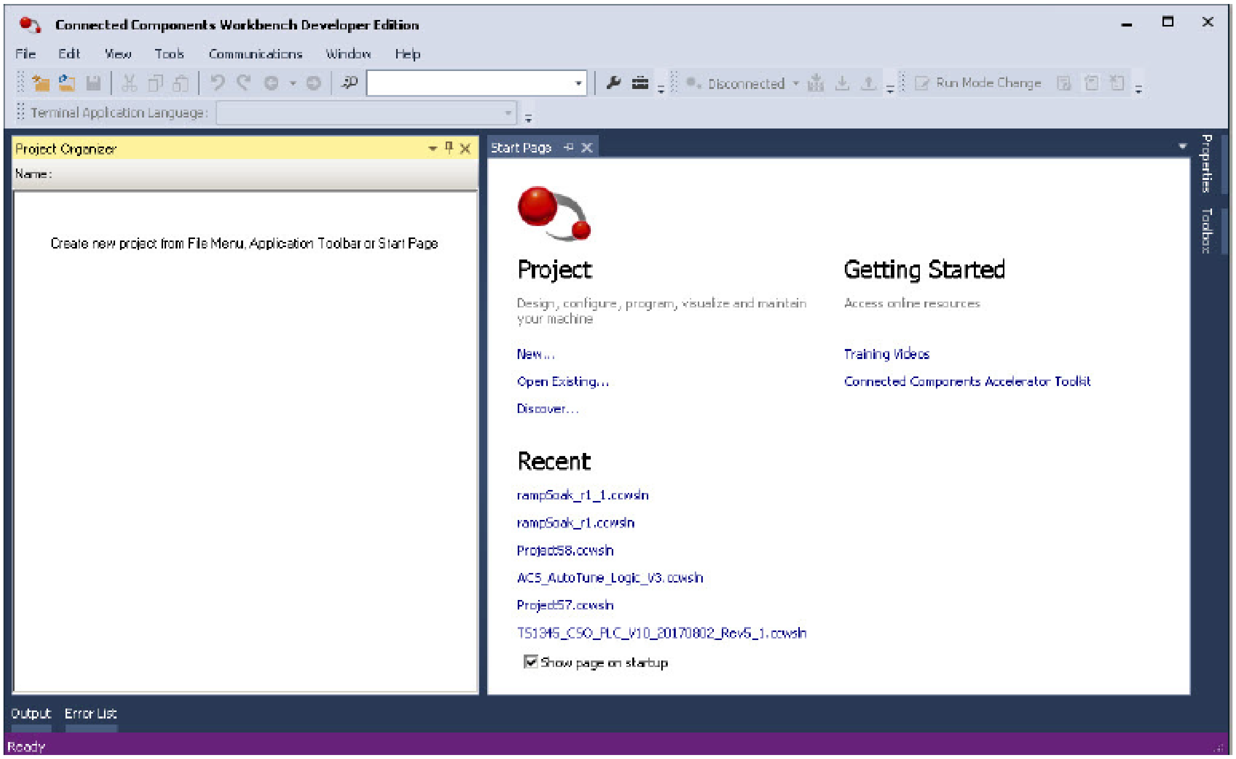


Figure 6: PLC sourcing Output

Quick Start Programming Guide

Start the already installed Connected Component Workbench (CCW) software by launching the program from Windows start Menu -> Rockwell Automation -> CCW -> Connected Component Workbench.



Create new project from File Menu, Application Toolbar or Start Page

Design, configure, program, visualize and maintain your machine

Access online resources

rampSoak_r1_1.ccwsln

rampSoak_r1.ccwsln

Project58.ccwsln

ACS_AutoTune_Logic_V3.ccwsln

Project57.ccwsln

TS1345_CSO_PLC_V10_20170802_Rev5_1.ccwsln

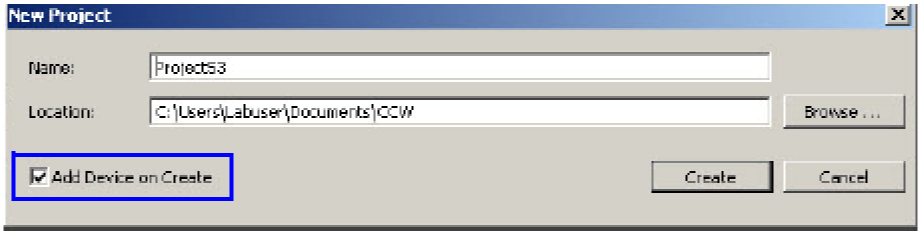
☑ Show page on startup

Figure 7: Default project layout

Create a CCW Project

To create a new project, do the following:

1. Click **New** under **Project** to create new project
2. Enter a name for your project and click create in the popped-up window. Select the **Add Device on Create** checkbox. This will open a Add Device dialog box for you to add a device to this project.



New Project

Name: Project53

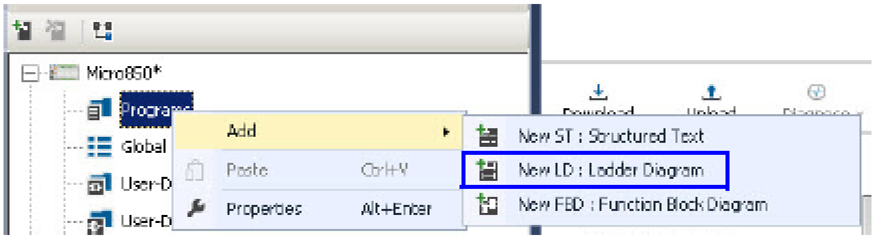
Location: C:\Users\Labuser\Documents\CCW

☑ Add Device on Create

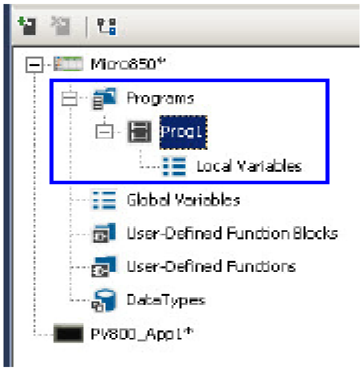
3. In the left panel, click the “+” sign on Micro820 to expand the list of catalogs and select the device to add to the Selection list. In this case, you will select 20BD-LCD20-20QWB from the list.

4. Click **Add To project** to complete device selection.

1. Right-click Programs under the Micro820 controller in the project organizer and select Add->New LD: Ladder Diagram

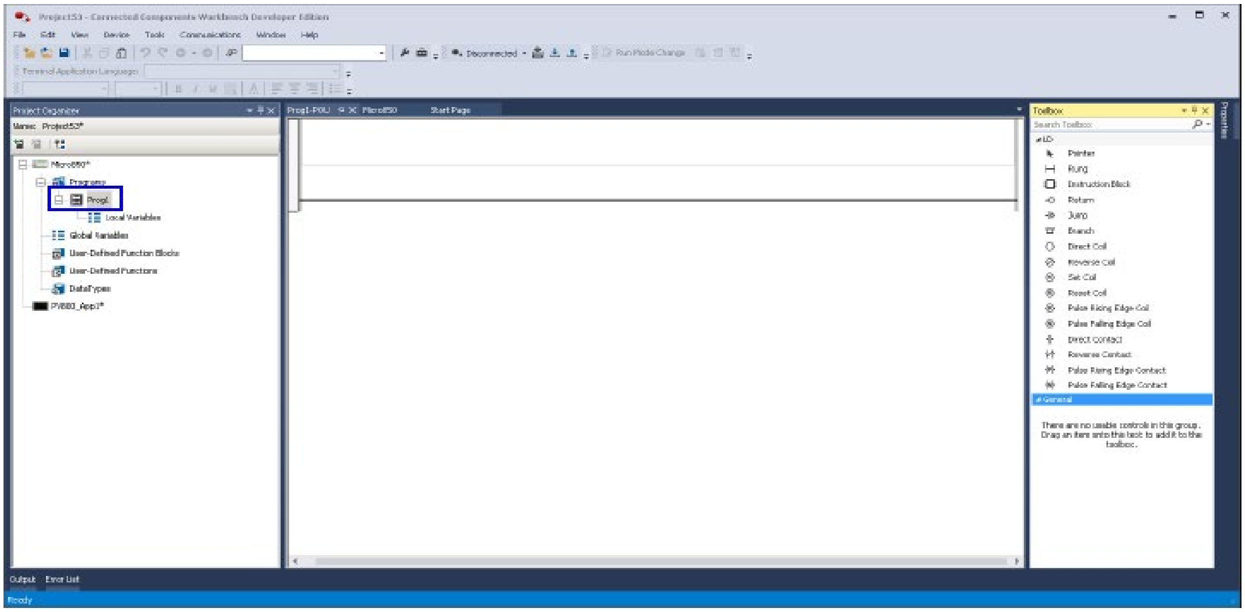


2. Observe that a new Ladder Diagram program called **Prog1** has been added under Programs



Note: *Micro800-850 controllers allow you to create multiple programs and use multiple types of programs (such as Structured Text or Function Block Diagram) in the same controller application.*

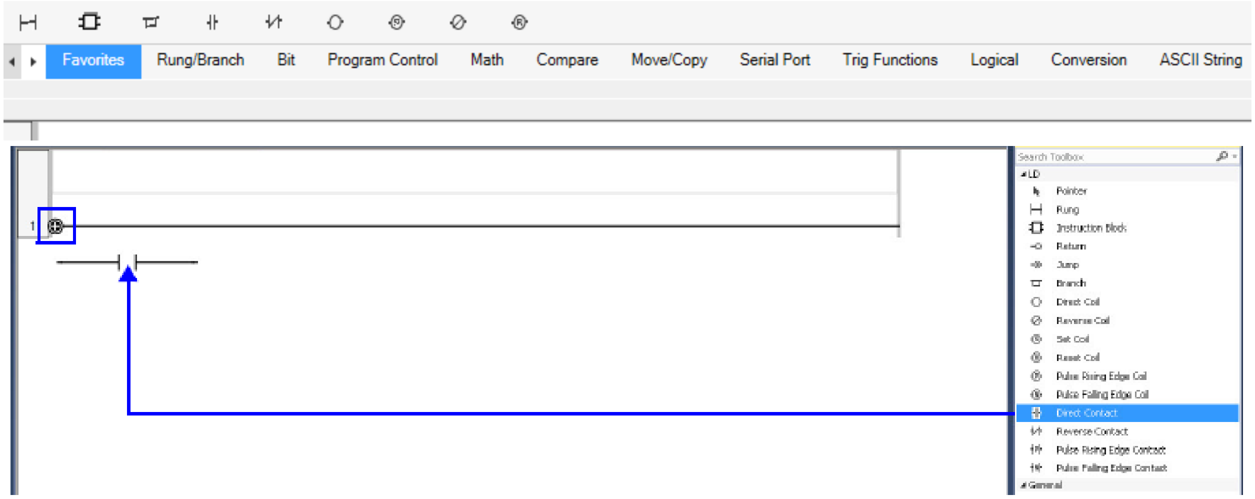
3. Double-click **Prog1.** A ladder diagram editor appears in the main project workspace with one empty rung.



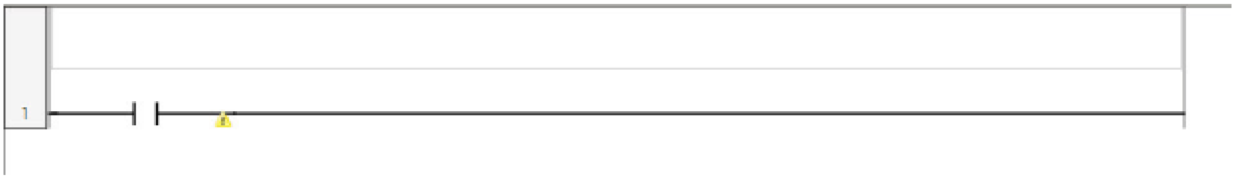
There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.

4. Right-click **Prog1** and select rename to change the name of the program.

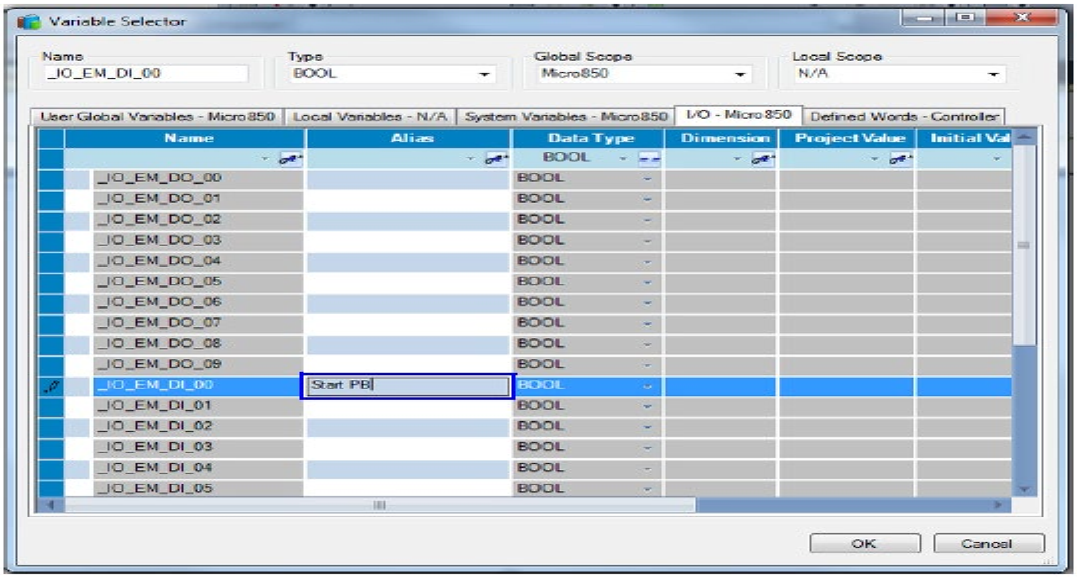
5. Locate the **Direct Contact** instruction in the Toolbox window and drag -and -drop it onto the left side of the rung.



Note: *The "+" icon on the rung indicates the location of a drop point for the instruction. After adding the instruction, your rung should look like the following.*



6. After inserting the Direct Contact instruction, the Variable Selector dialog box appears, and you can select the variable or I/O point to assign to this instruction. Each I/O point could be given desired name under the **Alias** column.



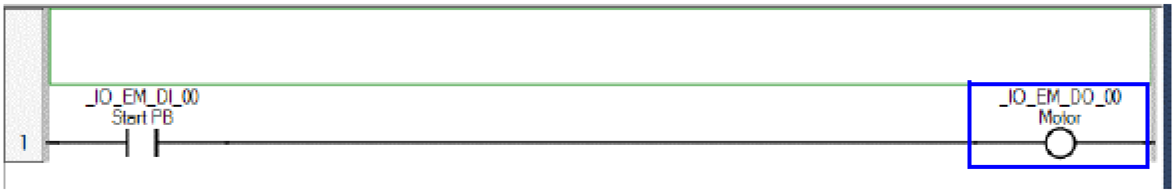
Variable Selector

Name: _IO_EM_DI_00
Type: BOOL
Global Scope: Micro850
Local Scope: N/A

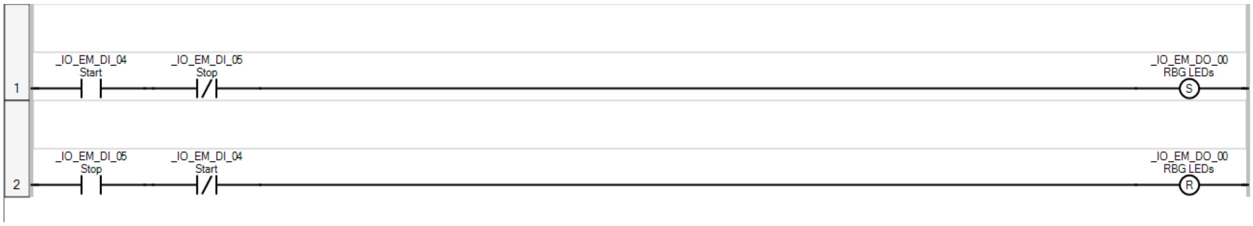
User Global Variables - Micro850 | Local Variables - N/A | System Variables - Micro850 | I/O - Micro850 | Defined Words - Controller

Name	Alias	Data Type	Dimension	Project Value	Initial Val
		BOOL			
_IO_EM_DO_00		BOOL			
_IO_EM_DO_01		BOOL			
_IO_EM_DO_02		BOOL			
_IO_EM_DO_03		BOOL			
_IO_EM_DO_04		BOOL			
_IO_EM_DO_05		BOOL			
_IO_EM_DO_06		BOOL			
_IO_EM_DO_07		BOOL			
_IO_EM_DO_08		BOOL			
_IO_EM_DO_09		BOOL			
_IO_EM_DI_00	Start PB	BOOL			
_IO_EM_DI_01		BOOL			
_IO_EM_DI_02		BOOL			
_IO_EM_DI_03		BOOL			
_IO_EM_DI_04		BOOL			
_IO_EM_DI_05		BOOL			

7. Locate the **Direct Output Coil** instruction in the Toolbox and drag-and -drop it onto the far-right side of the rung. Assign it to the embedded I/O point, _IO_EM_DO_00 with alias "Motor". Your rung should look like the following.

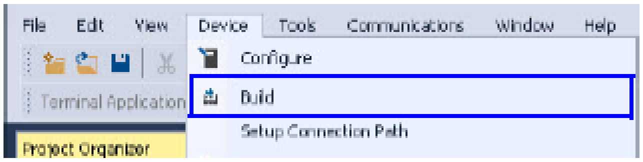


For example, shown in the figure below is a Ladder Logic program to turn on a LED light when the start button is pressed and turn it off when the stop button is pressed on the simulator.

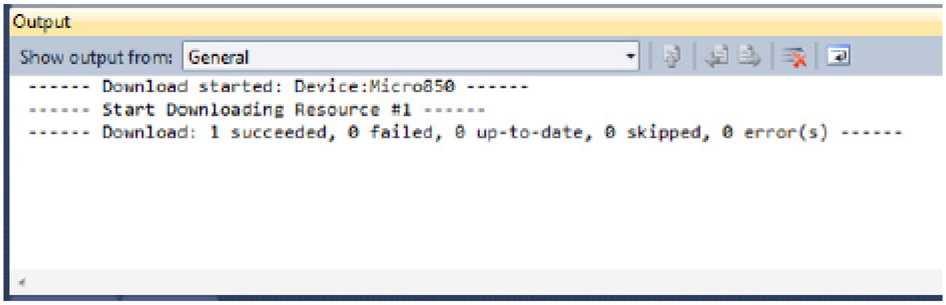


NOTE: *Save the project by selecting File-> Save Project As, then save project under desired name and click OK.*

8. Build and download the project to the Micro Controller by clicking Device->Build.



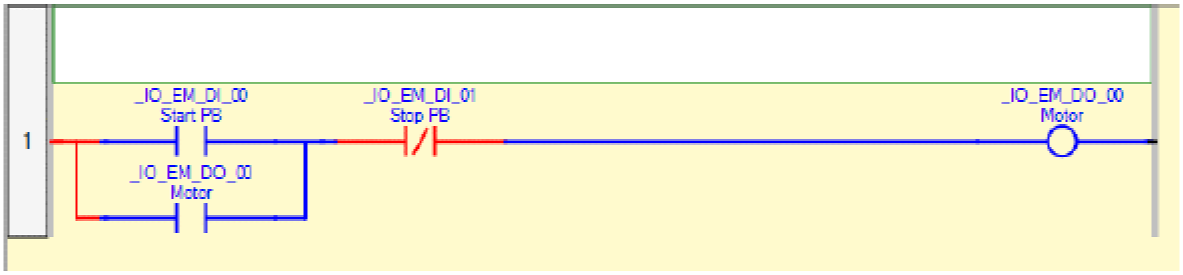
9. The output window and status bar show the status of the build. Then connect the PC to your Micro Controller via ethernet cable.
10. Download your project to your Micro820 controller by right clicking the controller in your Project Organizer and select **Download**.
11. To run the program, change the controller to **RUN mode** after downloading the project and observe the messages in the Output window. The Output window will indicate that the Download has been successful.



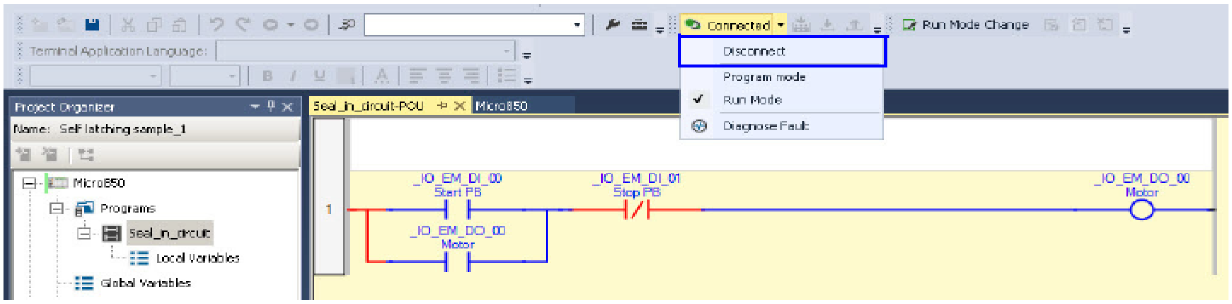
Show output from: General

```
------ Download started: Device:Micro850 ------
------ Start Downloading Resource #1 ------
------ Download: 1 succeeded, 0 failed, 0 up-to-date, 0 skipped, 0 error(s) ------
```

You can monitor your program on CCW visually in real time and watch values change in the program as you should observe the Ladder Diagram changes color as the inputs and outputs change state.



Note: *Always remember to disconnect the PLC before making any modification on the program by clicking the connect button and selecting disconnect as shown in the figure below.*



[illegible]

Note: *Diverse Instructions are available in Micro800-850 controllers for various use for functional requirements and suitability.*

Programmable Logic Controller Training System Wiring Guide

PLC training system wiring and connections with Lab. manual examples

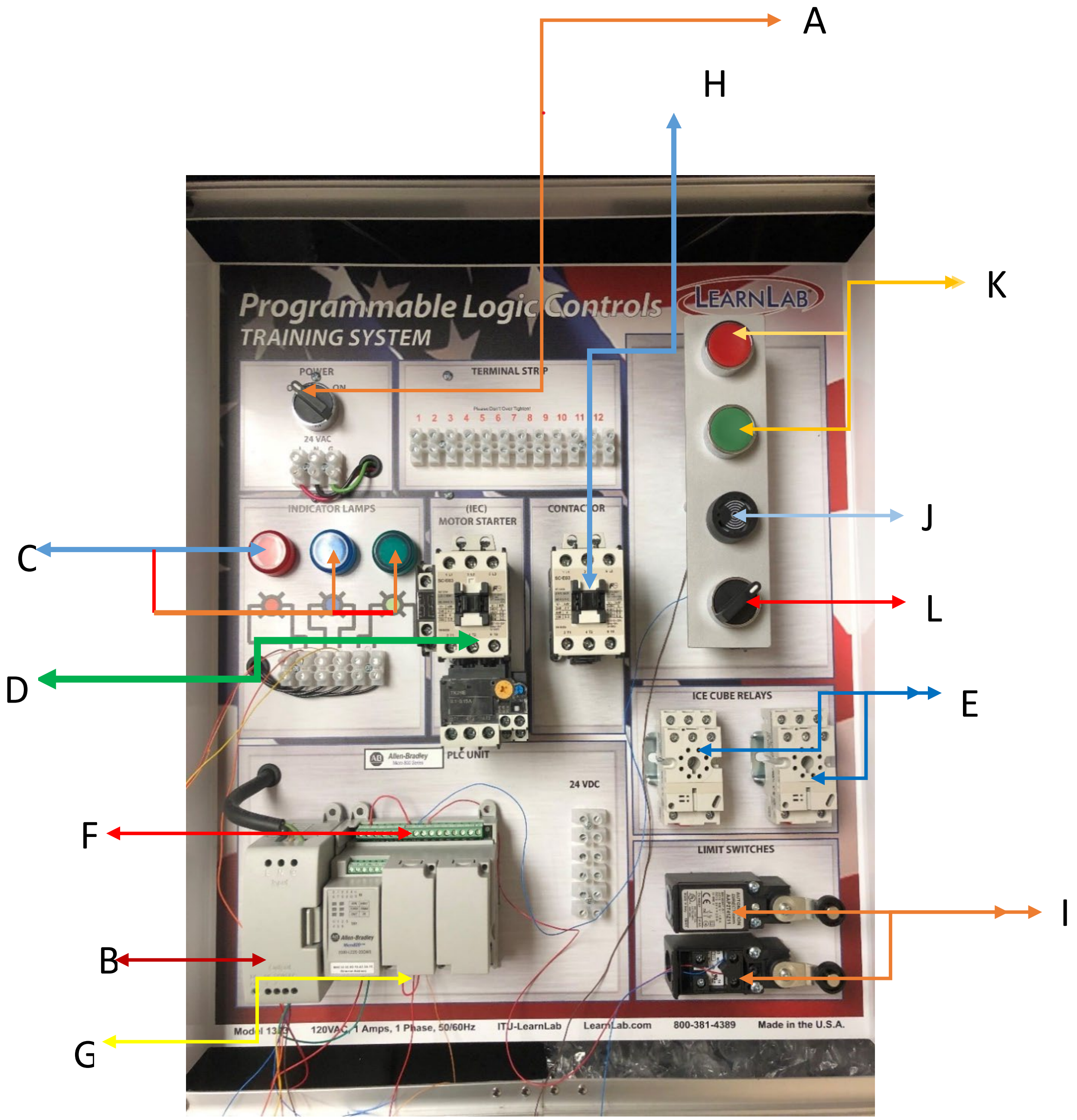


Figure 1(a) Portable PLC training system interface.

Components List

Components	Description
A	Training system power selector switch(on/off)
B	24v DC power supply unit (±24v DC Terminals)
C	3 LED indicators (2 terminals each)
D	IEC motor starter
E	2 cube relay blocks (sockets for relays)
F	PLC input terminal block (i00-i11)
G	PLC output terminal block(o00-o06), PLC 24v dc power supply
H	IEC contactor
I	2 Industrial Limit switches (1 NO (green), 1 NC contact)
J	Alarm Buzzer
K	2 Push buttons (1 NO (green), 1 NC (red) contact)
L	1 Selector switch (1 NO (green) contact)

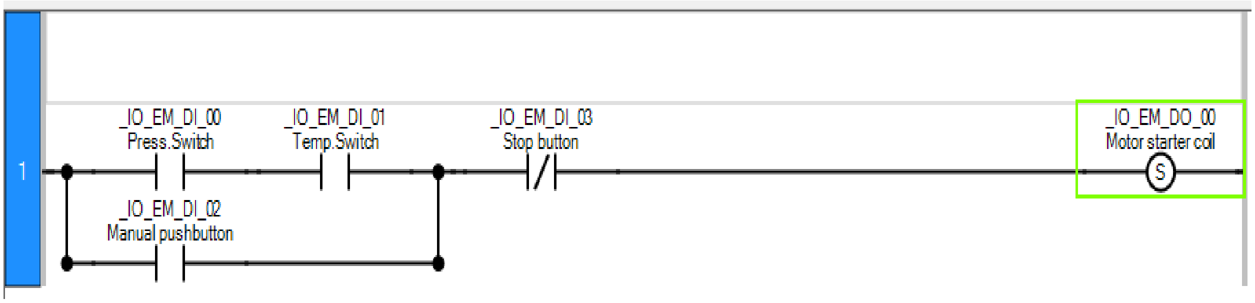
CHAPTER 1

PLC overview

Exercise 1-1(a)

1 pressure switch, 1 Temperature switch,1 manual push button, 1 stop button, 1 motor starter coil.

Ladder Logic Program on Connected component workbench software.



Wiring on PLC training system

Note: *Micro820 controller was designed to have a SINKING INPUT and SOURCING OUTPUT. The controller must be powered via 24v supply and wired in conformity with the design below before wiring for any project design.*

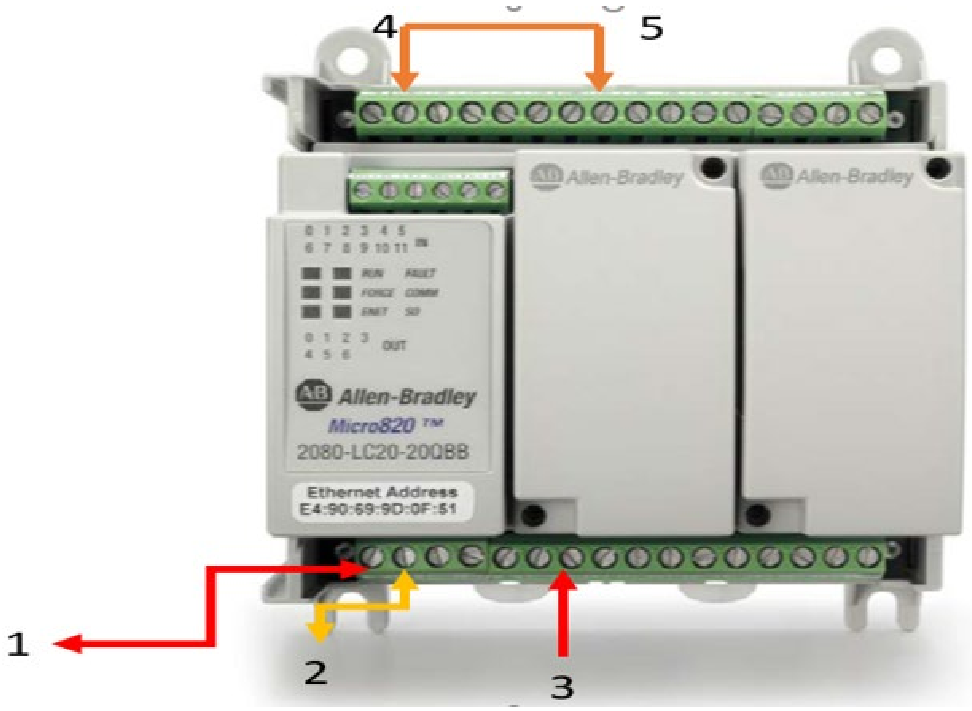


Figure 1(b) Micro820 controller

Micro820 controller	
1.	+24v DC power supply (positive terminal)
2.	Negative terminal of DC power supply.
3.	+24v DC power supply connected to output block COM terminal.
4.	Internally wired -24v DC terminal.
5.	-24v DC power supply connected to input block COM terminal.

For this exercise, the elements involved are represented by the following components on the PLC training system:

- Pressure switch = **Selector switch (L)**
- Temperature switch = **NO contact on Limit switch (I)**
- Manual push button = **Green push button (K, NO contact)**
- Motor starter = **D (24v DC powered starter coil),**
- Stop button **= Red push button (K NC contact)**

Circuit Diagram Components wiring to PLC

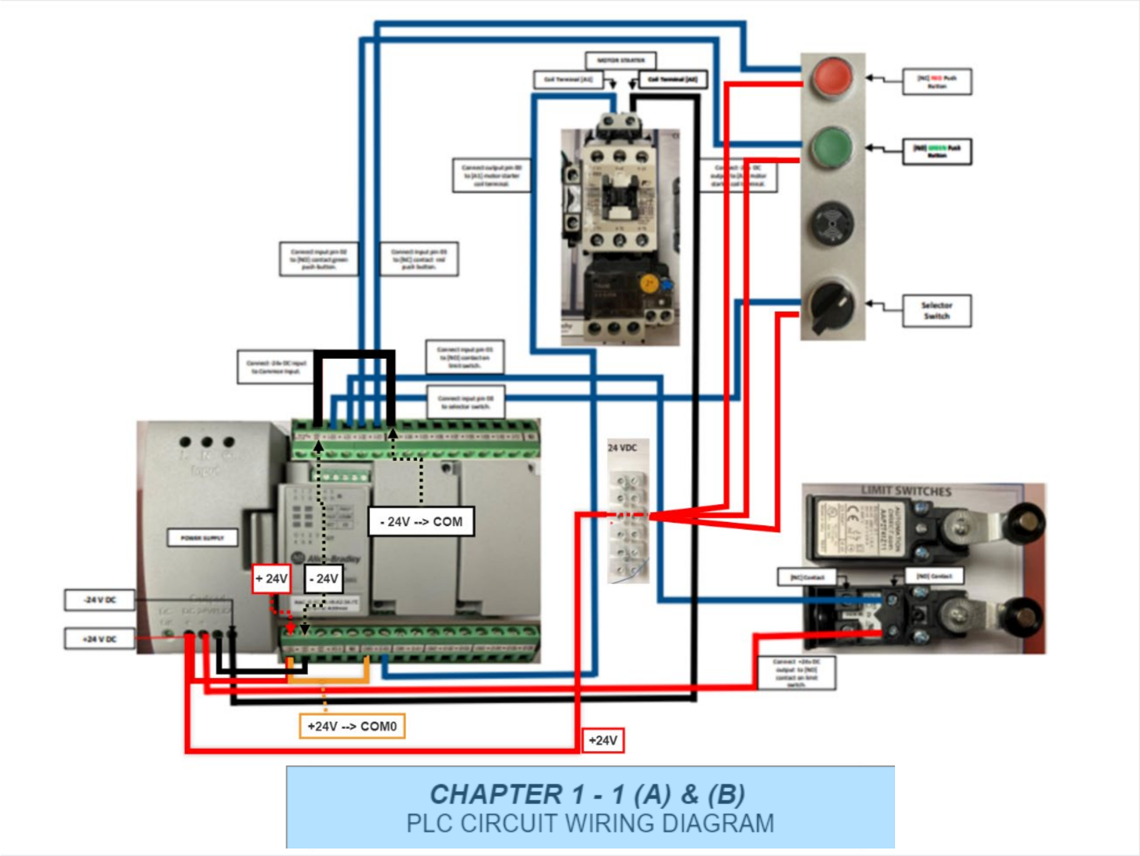
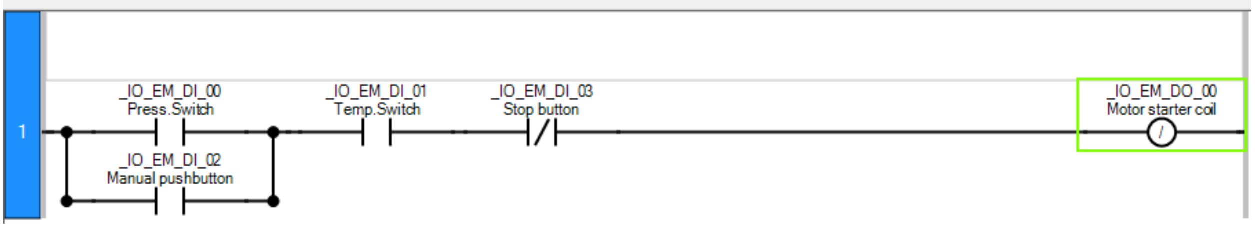

MOTOR STARTER
Coil Terminal [A1]
Coil Terminal [A2]
[NC] RED Push Button
[NO] GREEN Push Button
Selector Switch
Connect output pin 00 to [A1] motor starter coil terminal.
Connect input pin 02 to [NO] contact green push button.
Connect input pin 03 to [NC] contact red push button.
Connect -24v DC input to Common input.
Connect input pin 01 to [NO] contact on limit switch.
Connect input pin 00 to selector switch.
24 VDC
LIMIT SWITCHES
- 24V --> COM
POWER SUPPLY
+ 24V
- 24V
-24 V DC
+24 V DC
[NC] Contact
[NO] Contact
Connect +24v DC output to [NO] contact on limit switch.
+24V --> COM0
+24V
CHAPTER 1 - 1 (A) & (B)
PLC CIRCUIT WIRING DIAGRAM

Figure (1-1a)

The Ladder Logic program written above is then run on the PLC, it will be observed that either the **Green manual push button(K)** or both the **Selector switch(L)** and the **Limit switch(I)** will energize the Motor starter coil while the **RED manual push button** de-energizes the coil.

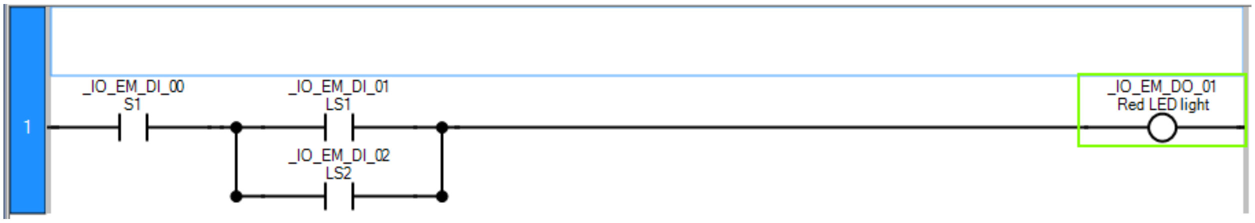
Exercise 1-1(b)

Ladder Logic Program on Connected component workbench software.



NOTE: *Wiring same as Figure(1-1a) above*

Exercise 1-5



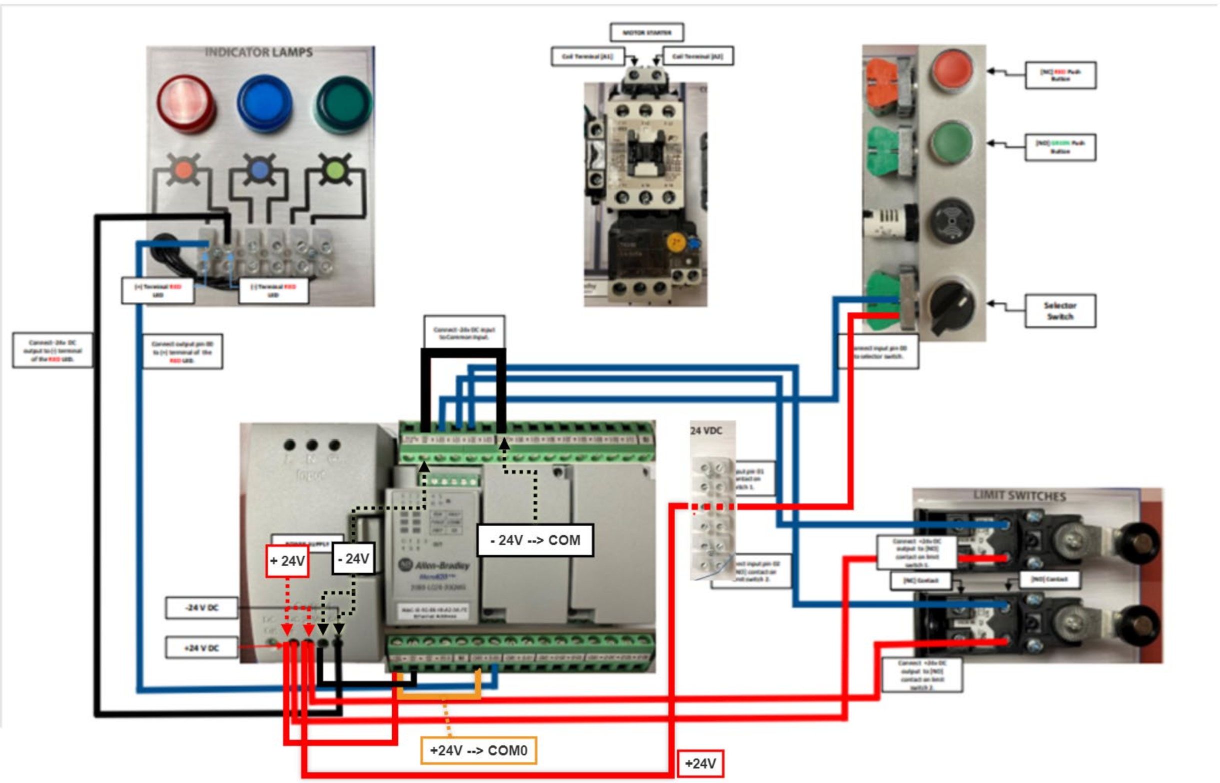
For this exercise, the elements involved are represented by the following components on the PLC training system:

- S1 = **Selector switch (L)**
- LS1= **NO contact on Limit switch 1 (I)**
- LS2 = **NO contact on Limit switch 2 (I)**

Components wiring to PLC

Note: *The SINKING INPUT AND SOURCING OUTPUT DEFAULT WIRING SHOULD BE DONE AT ALL TIME BEFORE COMPONENTS WIRING*

Circuit Diagram Components wiring to PLC



INDICATOR LAMPS
MOTOR STARTER
Coil Terminal [A1]
Coil Terminal [A2]
[NC] RED Push Button
[NO] GREEN Push Button
Selector Switch
(+) Terminal RED LED
(-) Terminal RED LED
Connect -24v DC output to (-) terminal of the RED LED.
Connect output pin 00 to (+) terminal of the RED LED.
Connect -24v DC input to Common input.
Connect input pin 00 to selector switch.
24 VDC
Connect input pin 01 to [NO] contact on limit switch 1.
Connect input pin 02 to [NO] contact on limit switch 2.
LIMIT SWITCHES
Connect +24v DC output to [NO] contact on limit switch 1.
[NC] Contact
[NO] Contact
Connect +24v DC output to [NO] contact on limit switch 2.
- 24V --> COM
+ 24V
- 24V
-24 V DC
+24 V DC
+24V --> COM0
+24V

CHAPTER 1 - 5
PLC CIRCUIT WIRING DIAGRAM

Figure (1-5)

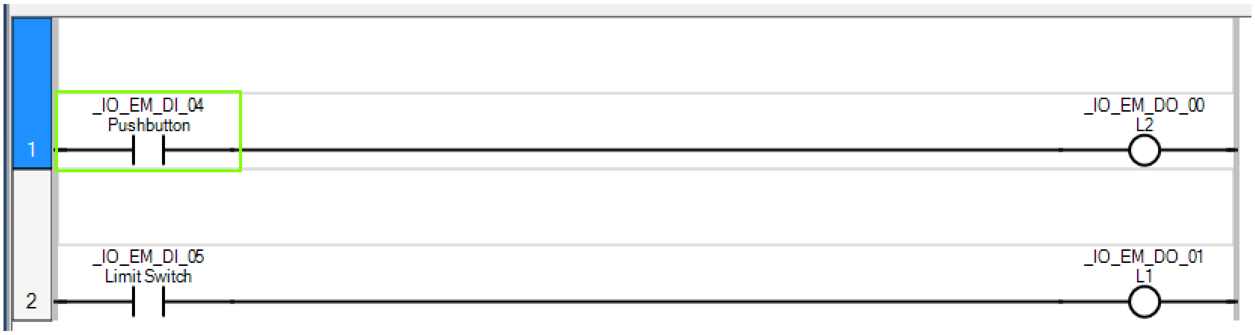
The Ladder Logic program written above is then run on the PLC, it will be observed that the **RED LED LIGHT** would be energized when **SELECTOR SWITCH(L)** and either **LIMIT SWITCH 1 or 2** is depressed.

CHAPTER 2

PLC Hardware Components

Exercise 2-1

- **1 Green pushbutton [NC contact (red) side “K”]**
- **1 NO limit switch [NO contact of “I”]**
- **L2= Red LED**
- **L1=Blue LED**



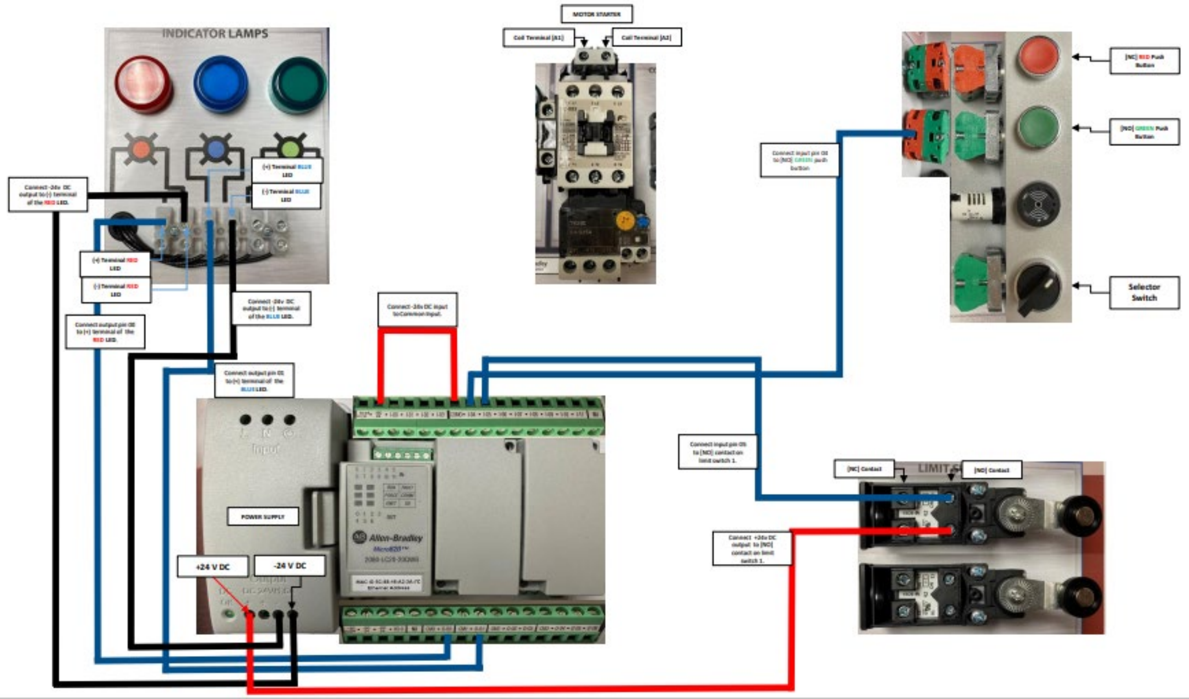

INDICATOR LAMPS
Connect -24v DC output to (-) terminal of the RED LED.
(+) Terminal BLUE LED
(-) Terminal BLUE LED
(+) Terminal RED LED
(-) Terminal RED LED
Connect -24v DC output to (-) terminal of the BLUE LED.
Connect output pin 00 to (+) terminal of the RED LED.
Connect output pin 01 to (+) terminal of the BLUE LED.
POWER SUPPLY
+24 V DC
-24 V DC
Input
Allen-Bradley
Micro820
MOTOR STARTER
Coil Terminal (A1)
Coil Terminal (A2)
Connect -24v DC input to Common input.
Connect input pin 04 to [NO] GREEN push button
[NC] RED Push Button
[NO] GREEN Push Button
Selector Switch
Connect input pin 05 to [NO] contact on limit switch 1.
[NC] Contact
[NO] Contact
LIMIT S
Connect +24v DC output to [NO] contact on limit switch 1.

Figure (2-1)

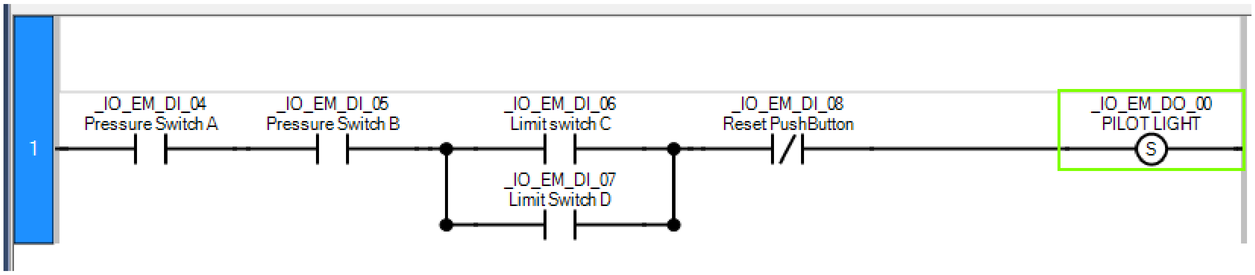
Results: *Red LED light is energized as soon as PLC is powered, Blue LED light is energized through input from Limit switch.*

CHAPTER 4

Fundamentals of Logic

Exercise 4-1

Normally open pressure switch A **[Selector switch L],** Normally open pressure switches B **[NO “green” contacts of K1],** Normally open limit switches C & D **[NO contacts of “I”],** Normally open reset button **[NO “green” contacts of K2],** Pilot Light (RED LED Light



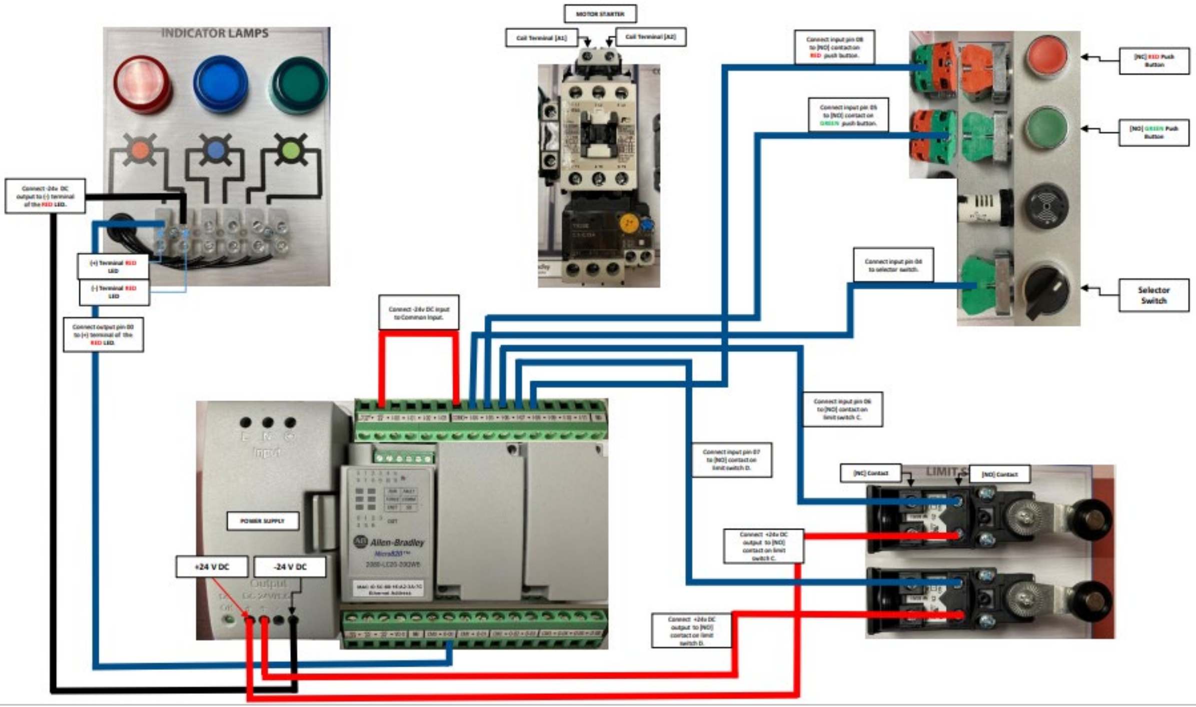
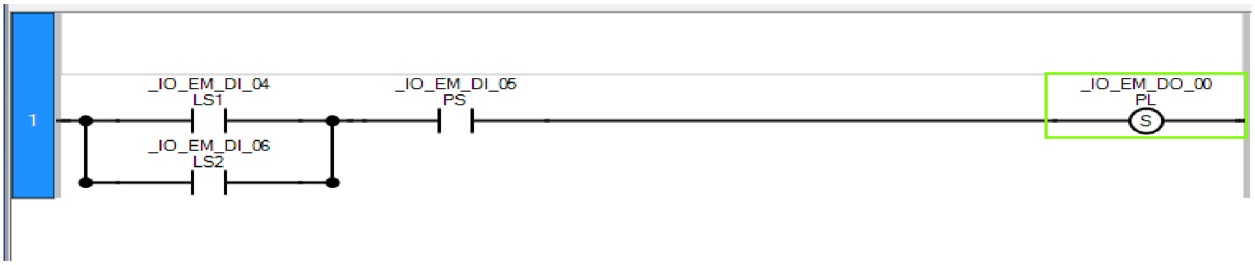

INDICATOR LAMPS
MOTOR STARTER
Coil Terminal (A1)
Coil Terminal (A2)
Connect -24v DC output to (-) terminal of the RED LED.
(+) Terminal RED LED
(-) Terminal RED LED
Connect output pin 00 to (+) terminal of the RED LED.
Connect -24v DC input to Common Input.
Connect input pin 08 to [NO] contact on RED push button.
Connect input pin 05 to [NO] contact on GREEN push button.
Connect input pin 04 to selector switch.
[NC] RED Push Button
[NO] GREEN Push Button
Selector Switch
Connect input pin 06 to [NO] contact on limit switch C.
Connect input pin 07 to [NO] contact on limit switch D.
[NC] Contact
LIMIT S
[NO] Contact
POWER SUPPLY
+24 V DC
-24 V DC
Input
Output
Allen-Bradley
Micro820™
Connect +24v DC output to [NO] contact on limit switch C.
Connect +24v DC output to [NO] contact on limit switch D.

Figure (4-1)

Exercise 4-5



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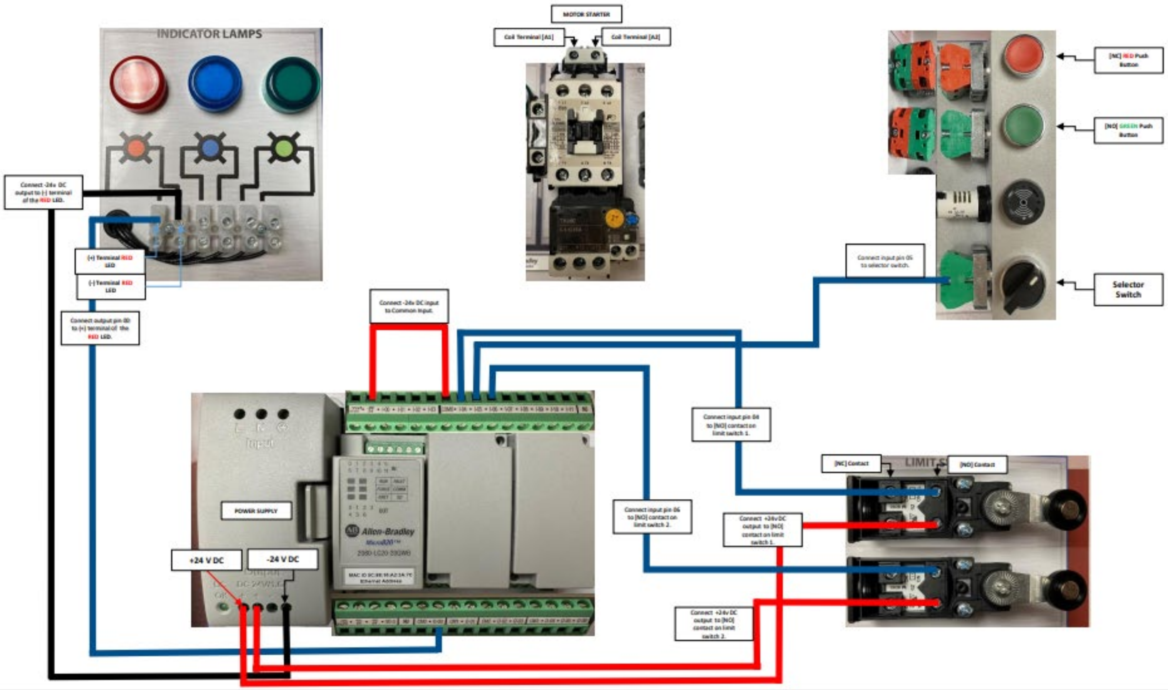
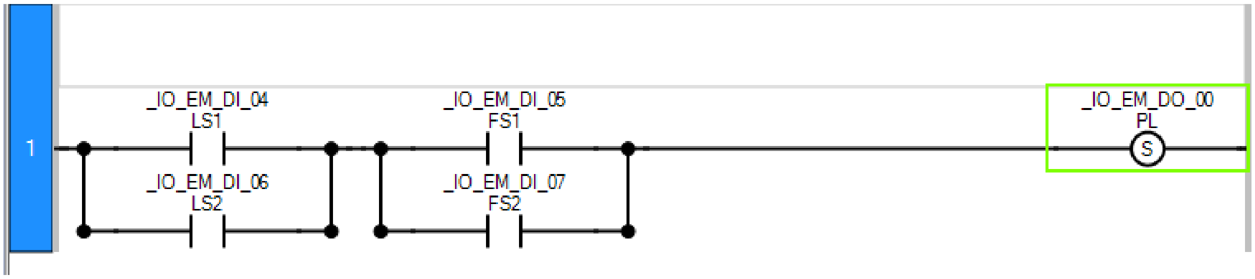
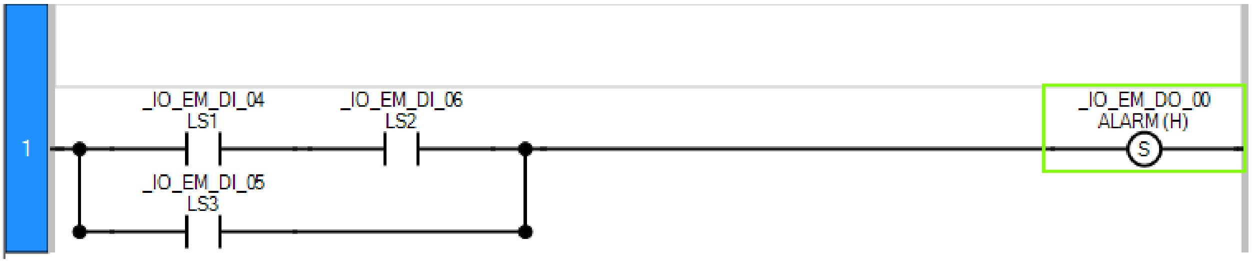

INDICATOR LAMPS
MOTOR STARTER
Coil Terminal [A1]
Coil Terminal [A2]
[NC] RED Push Button
[NO] GREEN Push Button
Selector Switch
Connect -24v DC output to (-) terminal of the RED LED.
(+) Terminal RED LED
(-) Terminal RED LED
Connect output pin 00 to (+) terminal of the RED LED.
Connect -24v DC input to Common Input.
Connect input pin 05 to selector switch.
Connect input pin 04 to [NO] contact on limit switch 1.
Connect input pin 06 to [NO] contact on limit switch 2.
Connect +24v DC output to [NO] contact on limit switch 1.
Connect +24v DC output to [NO] contact on limit switch 2.
[NC] Contact
[NO] Contact
POWER SUPPLY
+24 V DC
-24 V DC
Allen-Bradley
Micro820

Figure (4-5)

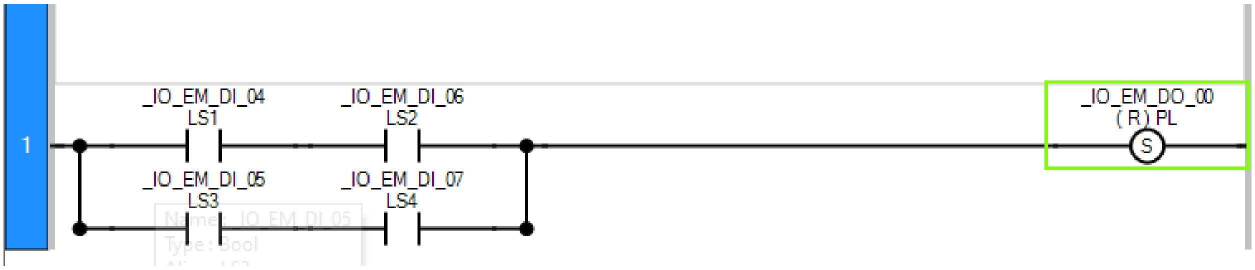
Exercise 4-6



Exercise 4-7



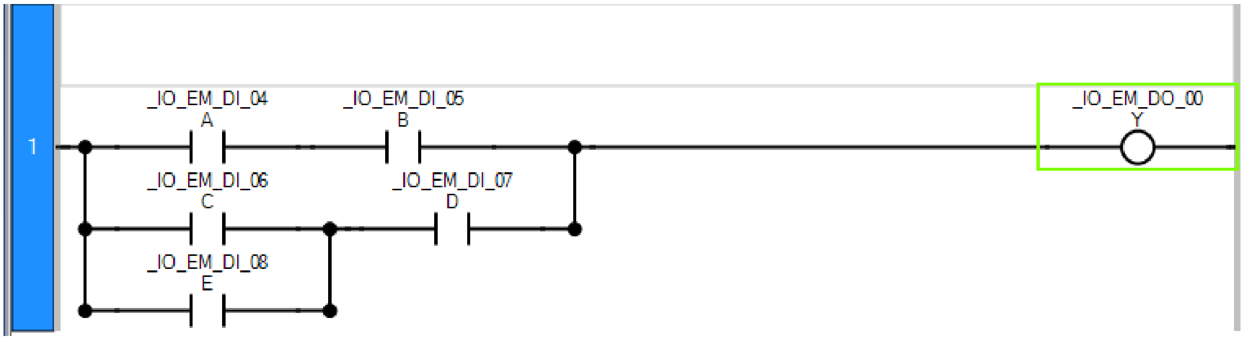
Exercise 4-8



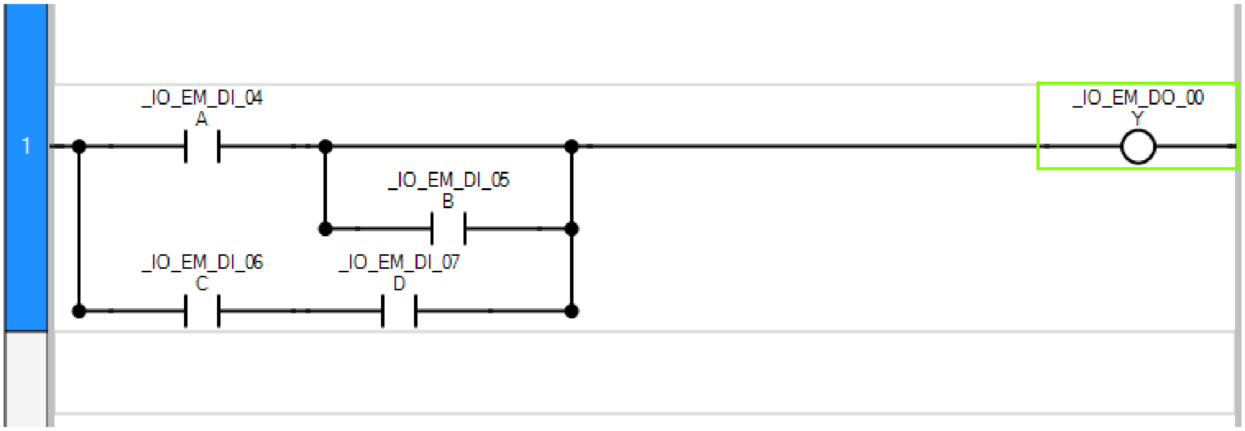
CHAPTER 5

Basics of PLC Programming

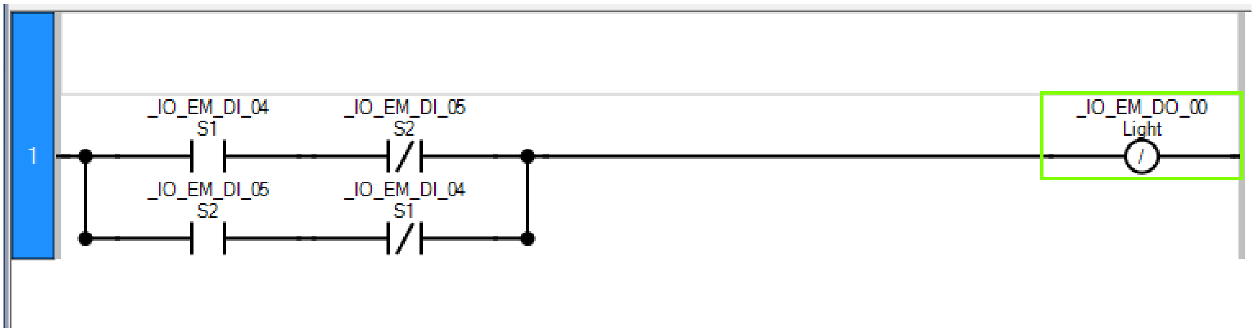
Exercise 5_2



Exercise 5_3



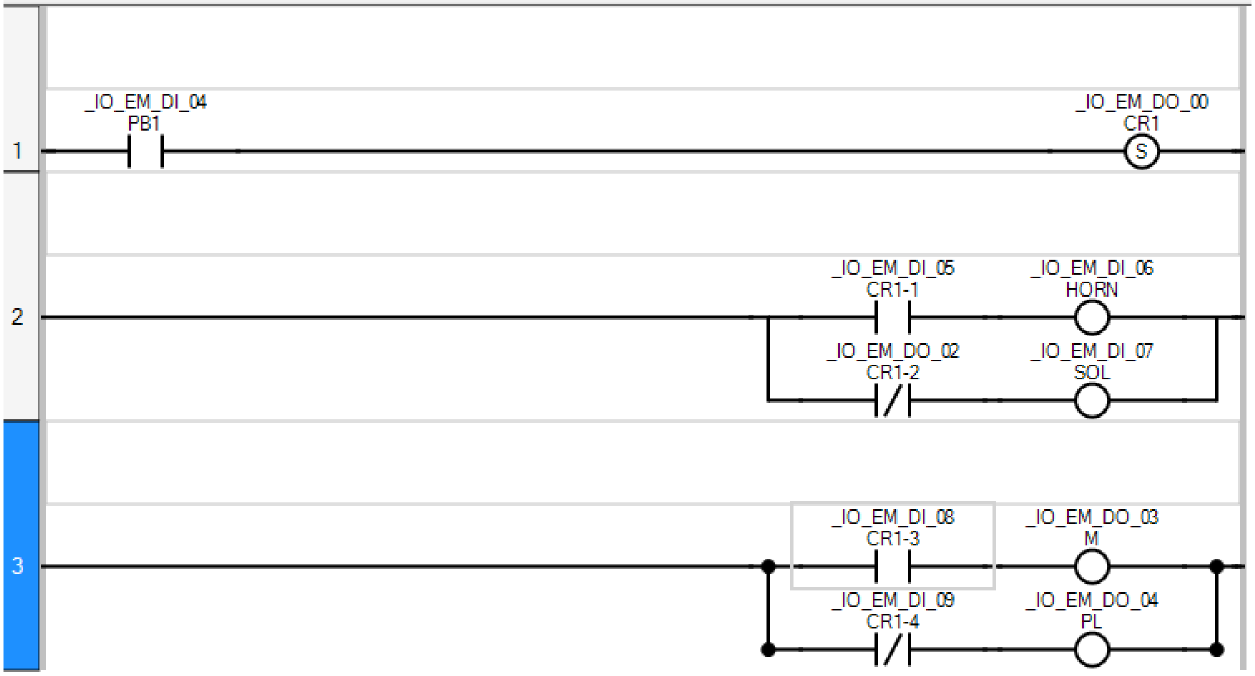
Exercise 5_14



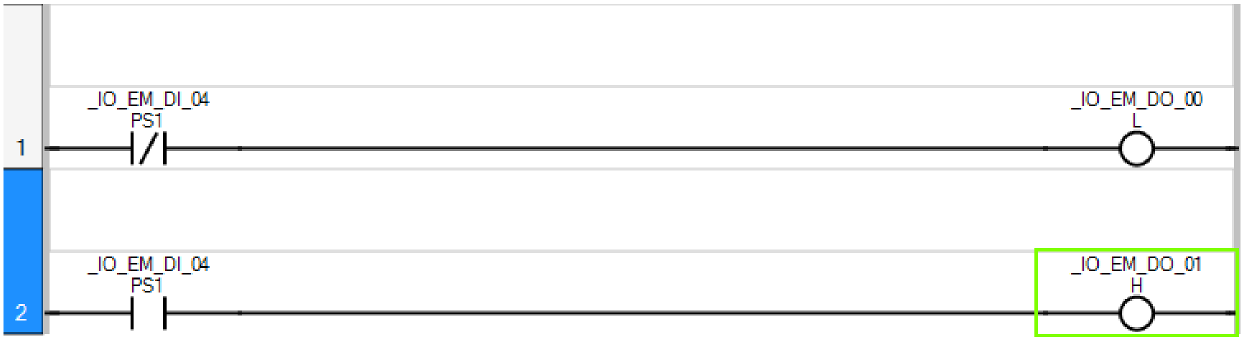
CHAPTER 6

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs

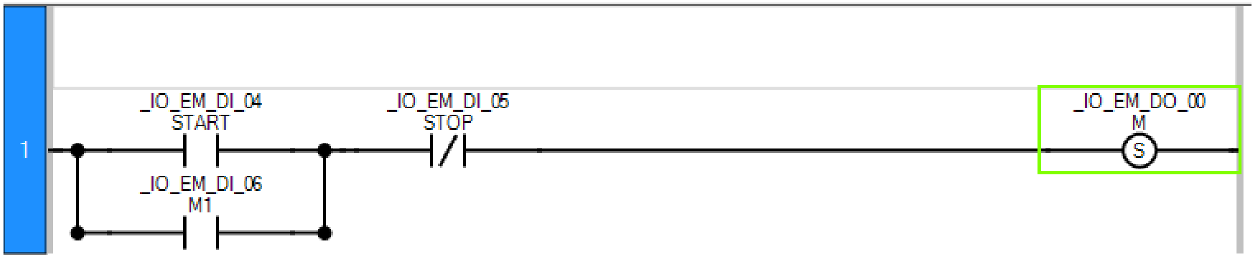
Exercise 6_1



Exercise 6_2



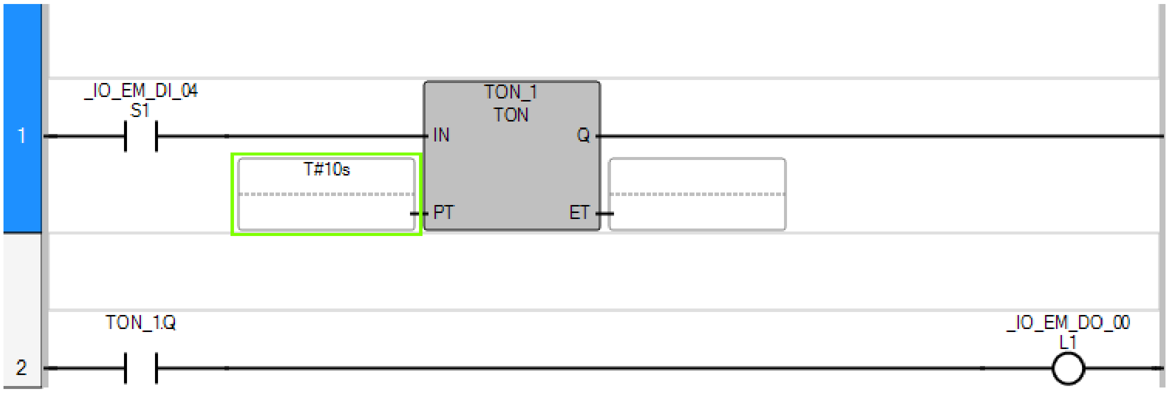
Exercise 6_15



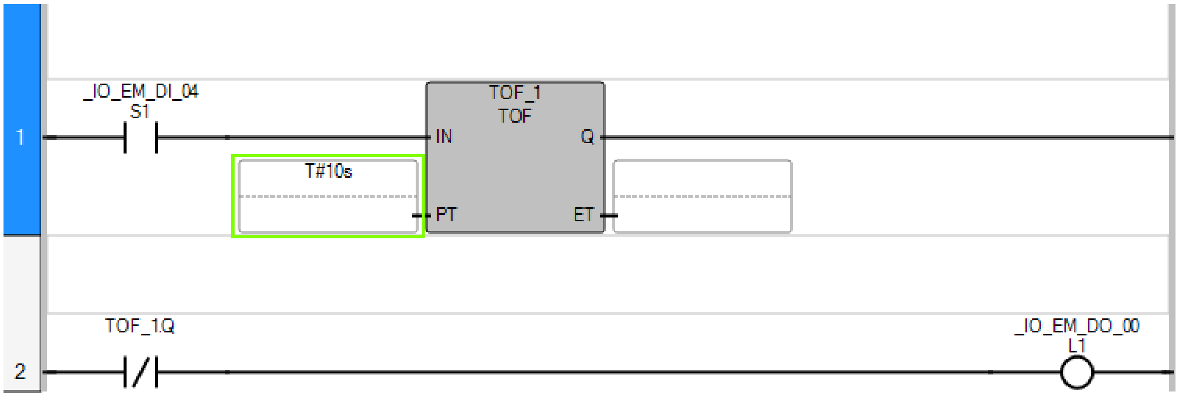
CHAPTER 7

Programming Timers

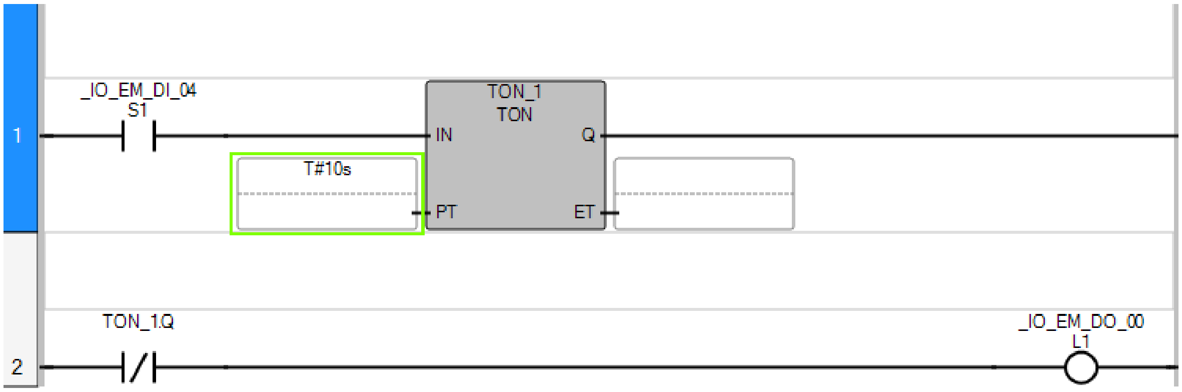
Exercise 7_1



Exercise 7_2



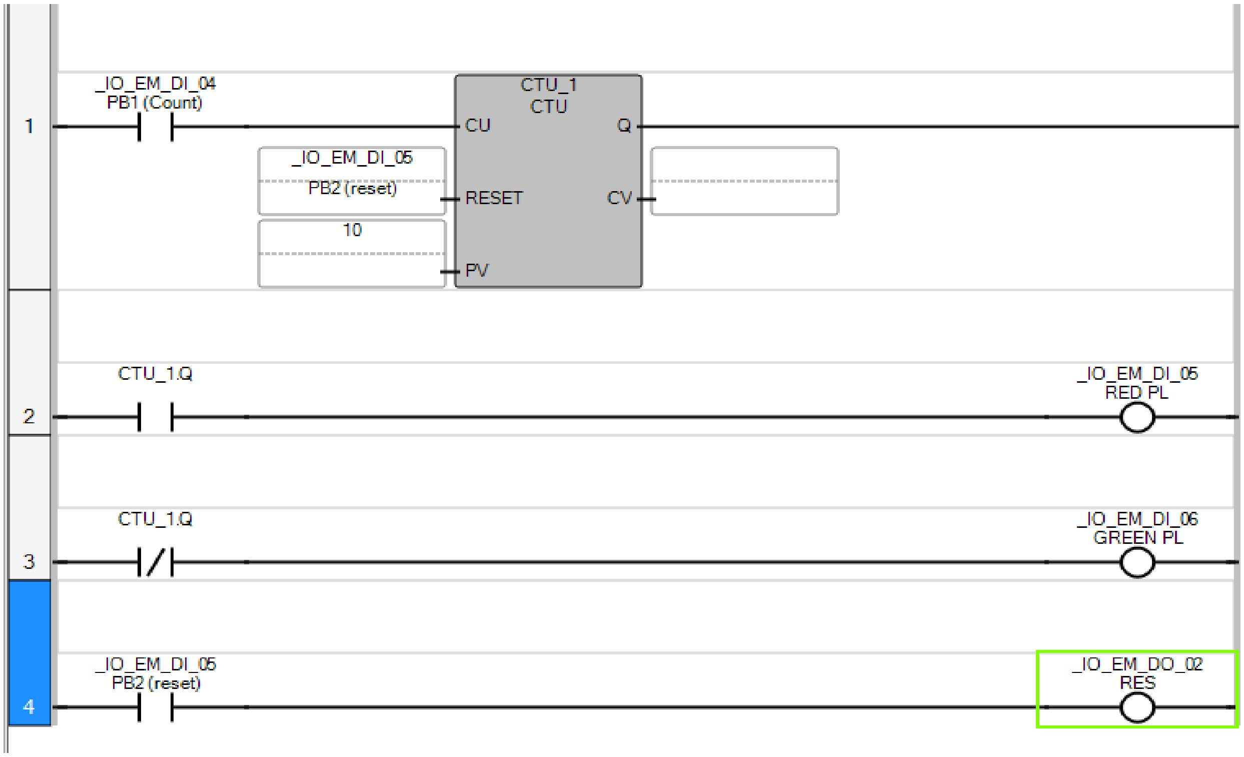
Exercise 7_4



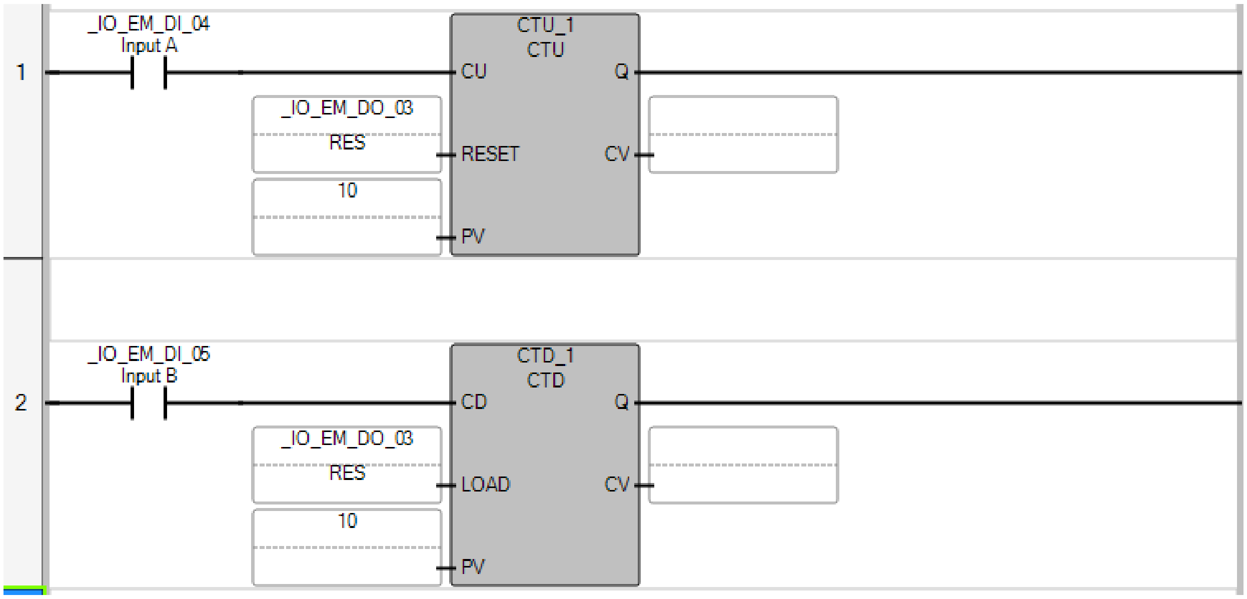
CHAPTER 8

Programming Counters

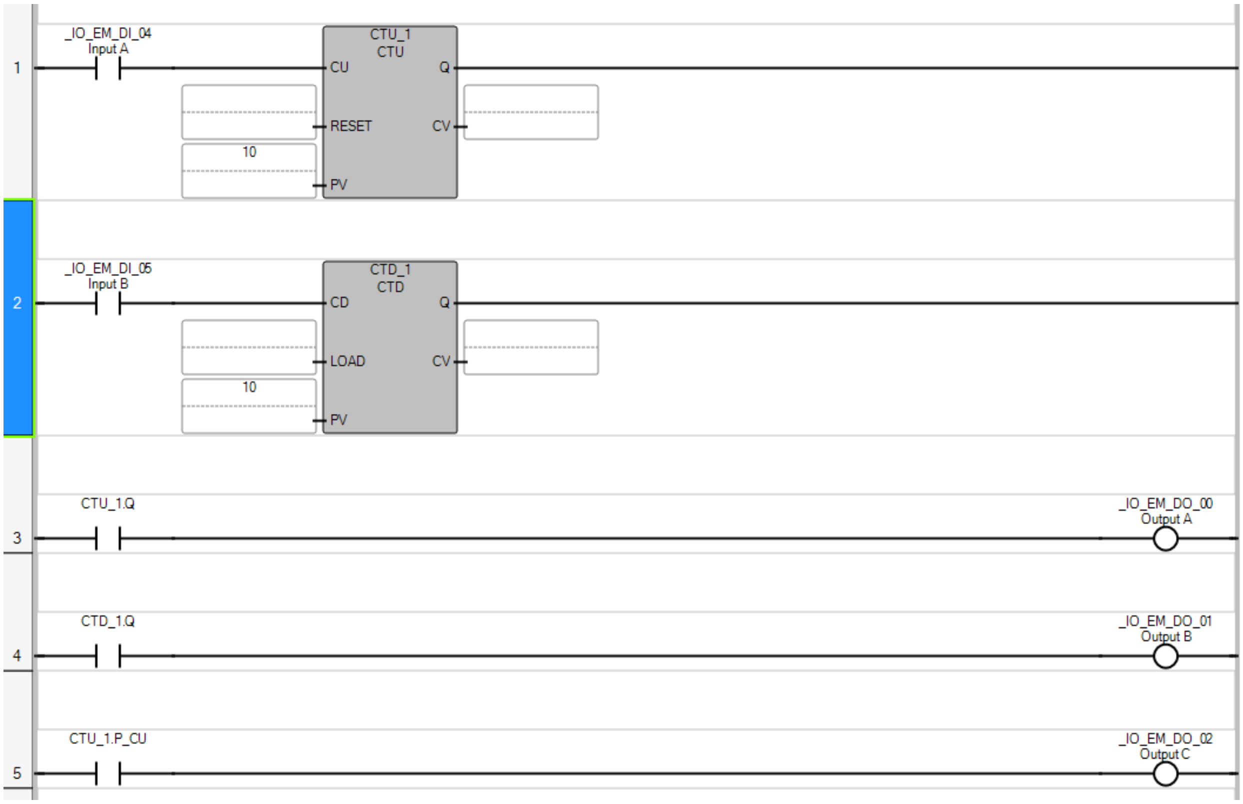
Exercise 8_1

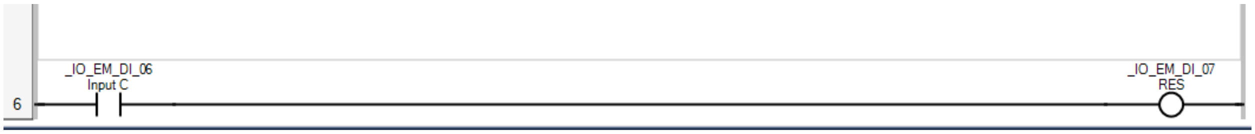


Exercise8_6

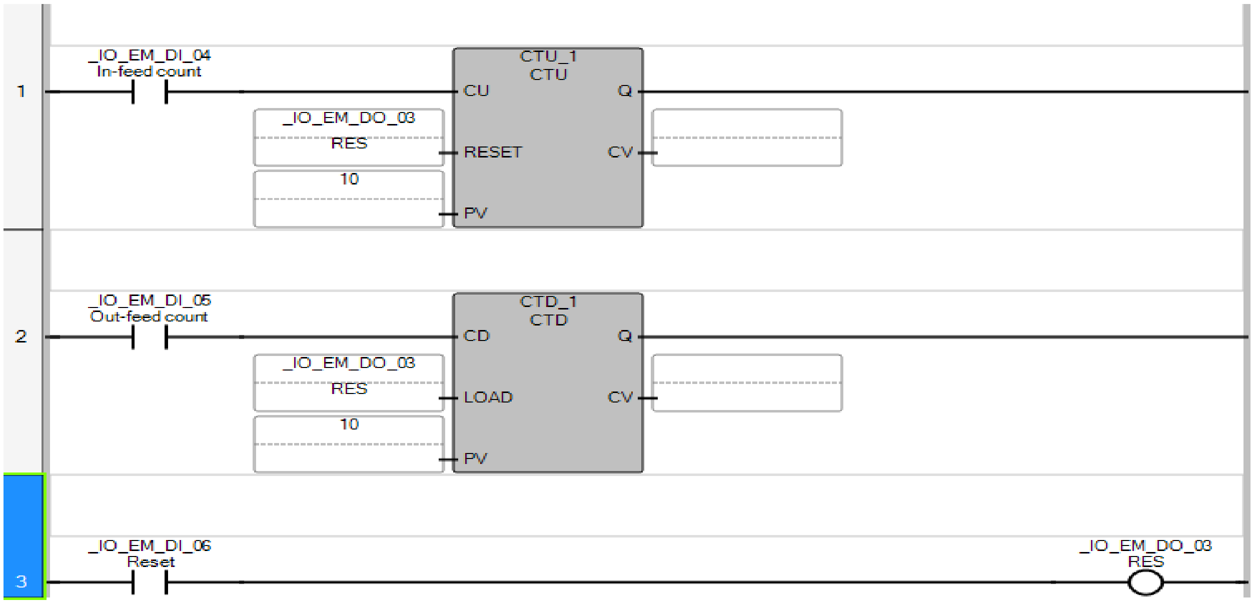


Exercise8_6_b





Exercise8_7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RES
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PV
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Out-feed count
CTD_1
CTD
CD
Q
_IO_EM_DO_03
RES
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CV
10
PV
3
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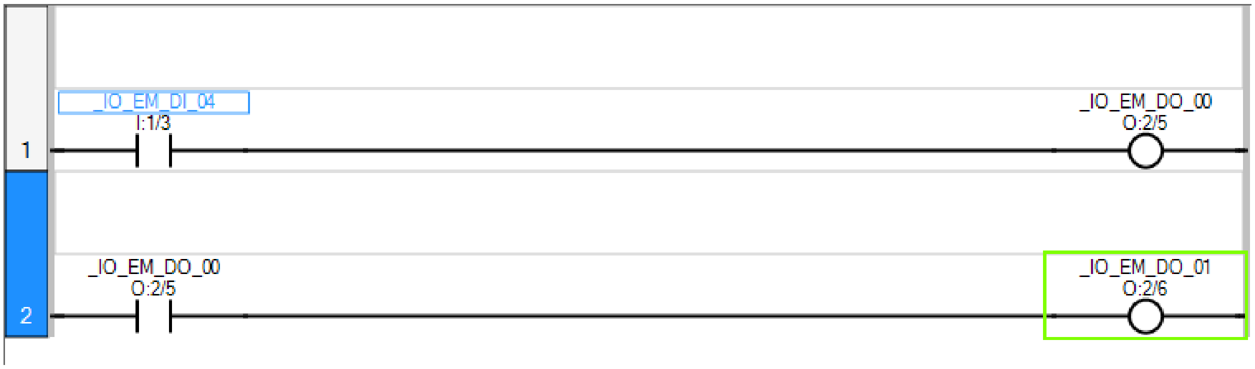
Reset
_IO_EM_DO_03
RES

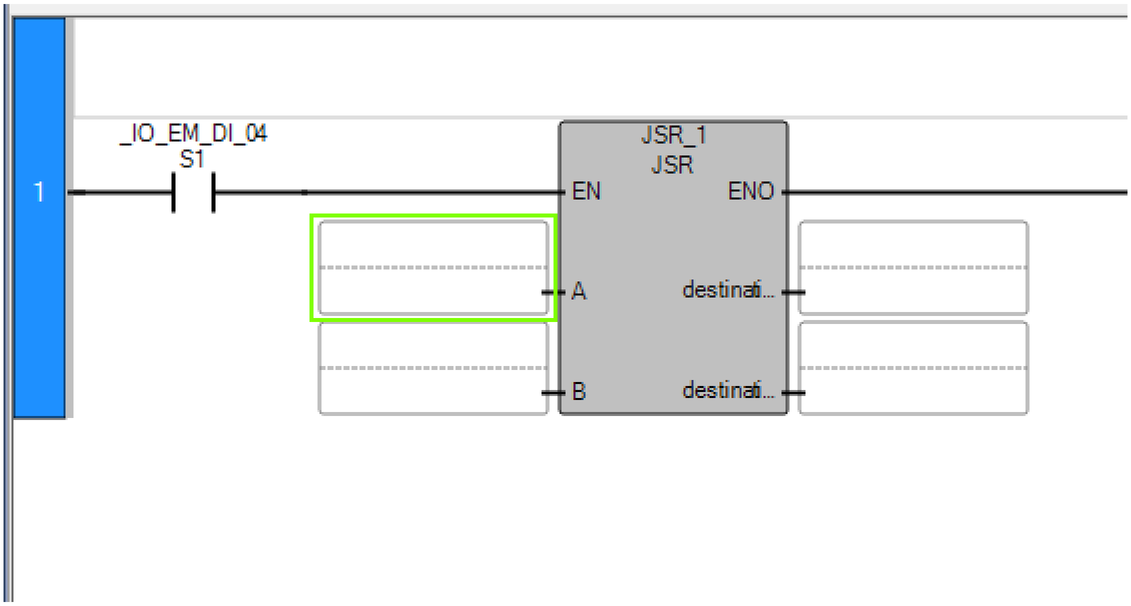
CHAPTER 9

Program Control Instructions

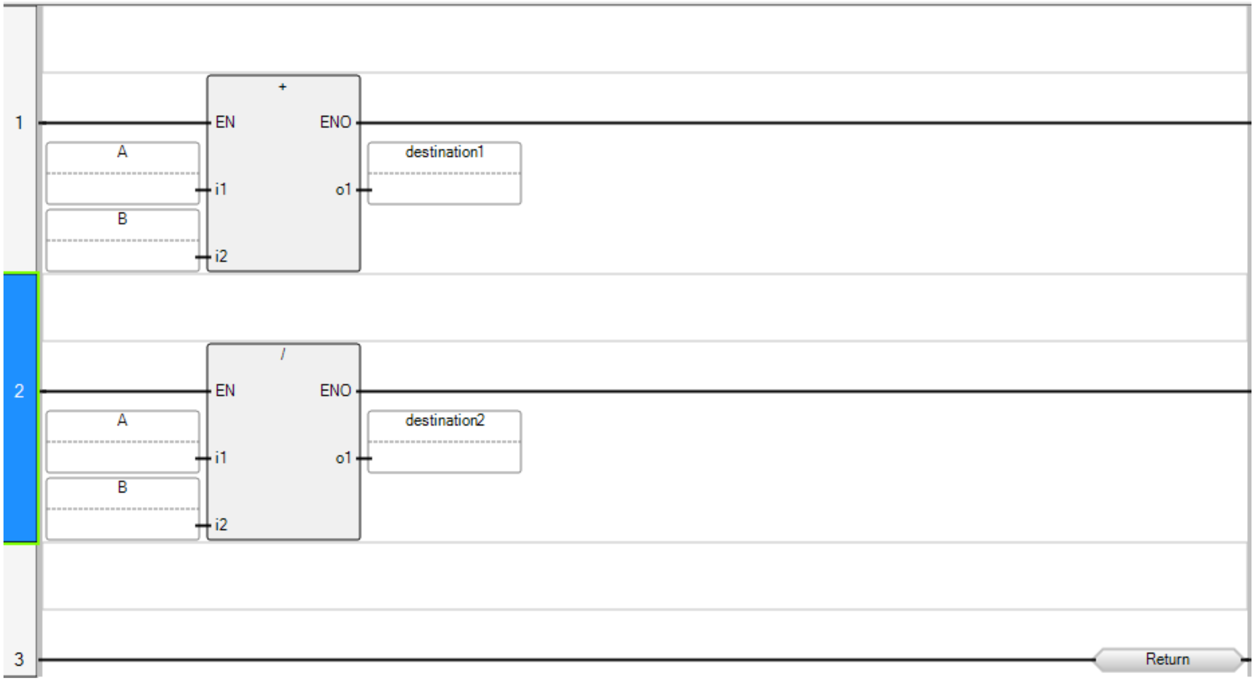
Exercise 9_5



Exercise 9_11.1



Exercise 9_11.2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3
Return