TAKE 5!

Step by Step Practical Work

DEJ40033 PLC and Automation

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NORITA BINTI ALWI

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DEJ40033

PLC and Automation

Perpustakaan Negara Malaysia

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We hereby declare that this module is our original work. To the best of our knowledge, it contains no materials previously written or published by another person. However, if there is any, due acknowledgement and credit are mentioned accordingly in the e-book.

Abstrac

Ebook **Takes 5! Step by Step Practical Work DEJ40033 PLC and Automation** contains a complete guide developed specifically for use by lecturers and students as a preparation guide before undertaking DEJ40033 PLC and Automation course practical work. This guide contains 5 topics related to the practical work that needs to be carried out to meet the curriculum requirements of this course. It contains theoretical explanations, tutorial questions and step by step solutions. Hence, this guide is suitable to help students in fulfilling the needs of Student Learning Time (SLT), enhance understanding and able to carry out practical work successfully to prove that the learning outcomes of this course have been accomplished.

CONTENTS

Topic 1

Electromechanical Relay Application in Automation Controller

1.0 Electromechanical relay wiring connection

Definition:

An electromechanical relay is a type of relay which function using a magnetic field produced by an electromagnetic coil when a control signal is applied to it. It is called as electromechanical since it has moving contacts in the output circuit which are operated by applying an electrical signal

(Brian S.Elliott, 2007)

Electromechanical relay is one of most important component in electrical panel. It function as a switch which is used in controlling electrical circuit an automatically to turn on or off the contacts.

S K I L L S

Student able to applied the skill

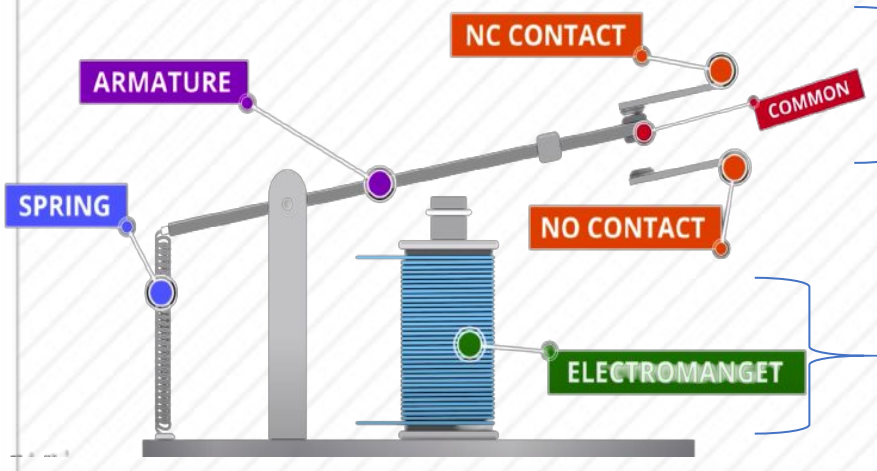
to wiring connection of the

electromechanical relay

control circuit

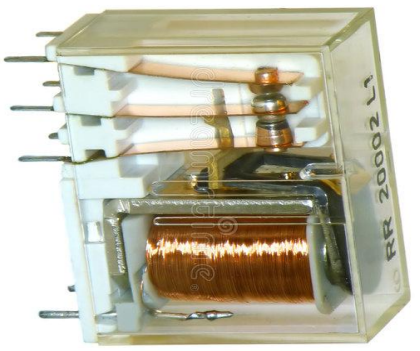
1.0 Electromechanical relay wiring connection

F U N C T I O N



OUTPUT CIRCUIT

INPUT & CONTROL CIRCUIT



Basically Electromechanical relay have 4 parts:

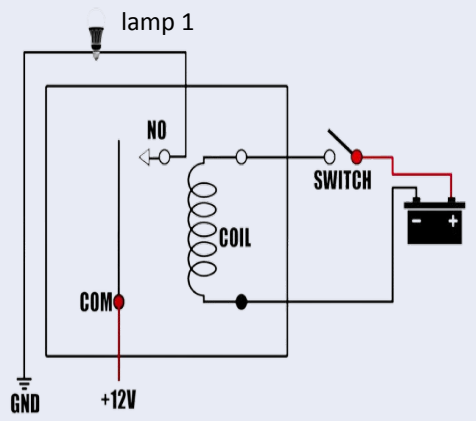
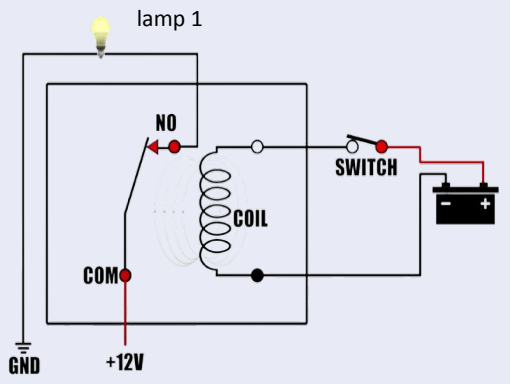
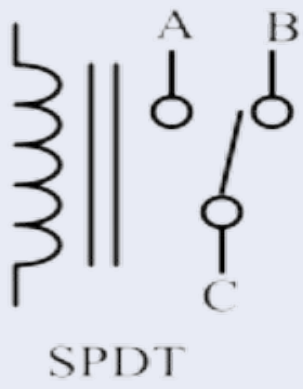
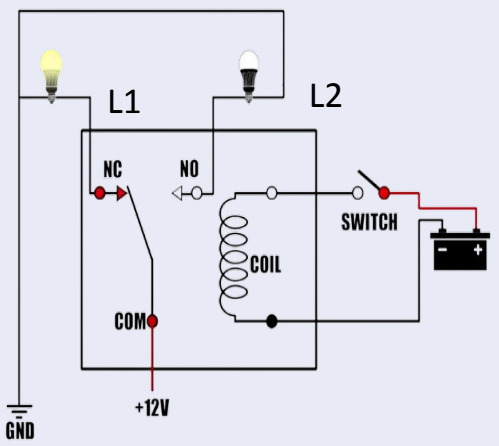
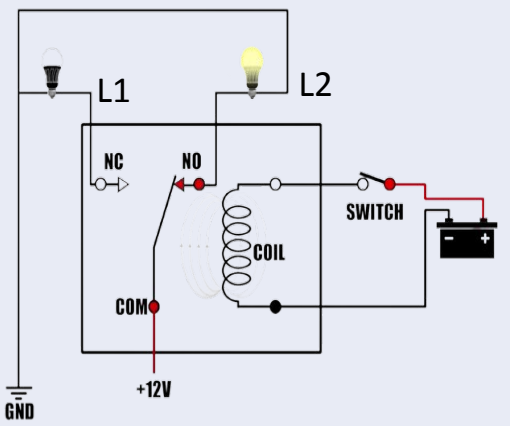
1. Coil (have two terminal contact for positive and negative for power supply)
2. Common contact
3. Normally open contact (NO) – This contact will not allow the flow of current unless the coil energized the contact become closed and the current will now flow through this contact
4. Normally closed contact (NC) – This contact will allow flow of current unless the coil energized the contact becomed open and the current will now stop flowing through this contact

How it work

1. When an input voltage is applied to the coil, it get energized magnetic field.
2. Thus when the armature moves towards the electromagnet, the moveable mechanical contact ate attached to the armature will pull the contact from NC to NO contact, making the current flow through this contact and making the output circuit switched on.
3. When the supply signal is removed, coil become an un-energized the contact will comes back to its original position making output circuit off.

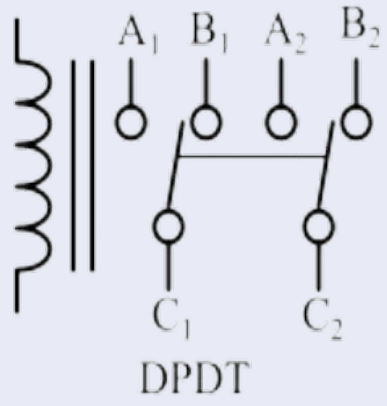
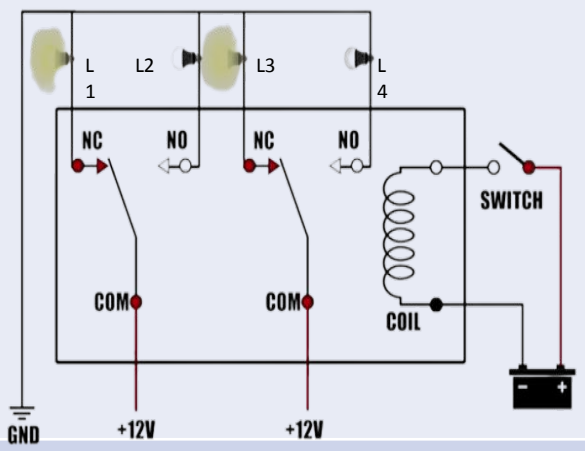
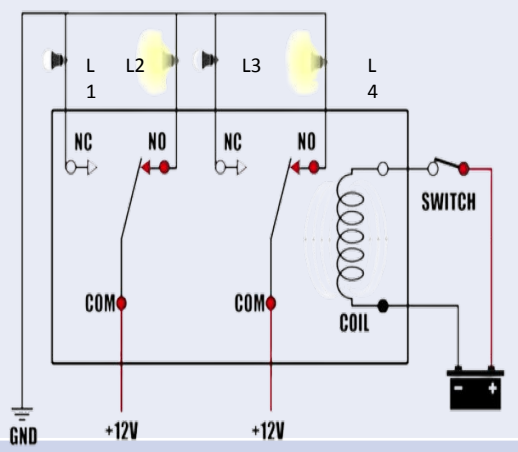
1.0 Electromechanical relay wiring connection

CLASSIFICATION OF RELAY

	CIRCUIT DIAGRAM EXPLANATION	
SYMBOL	COIL DE-ENERGIZED	COIL ENERGIZED
		
Single Pole Single Throw (SPST) A- Pole B- Throw	Lamp 1 in OFF condition while the coil is de-energize.	When switch are press, supply will flow to coil. Coil energize. Terminal Common will touch the Normally Open (NO) contact. The supply 12v can flow to the lamp and lamp will ON.
		
Single Pole Double Throw C- Pole A - throw NO B - throw NC	Lamp 1 is in ON condition while the coil is de-energize. The supply 12v flow through the common and NC contact	When switch are press, supply will flow to coil. Coil energize. Terminal Common will touch the Normally Open (NO) contact. The supply 12v can flow to the common and NO contact, lamp 2 is ON condition while Lamp 1 and lamp is OFF

1.0 Electromechanical relay wiring connection

CLASSIFICATION OF RELAY

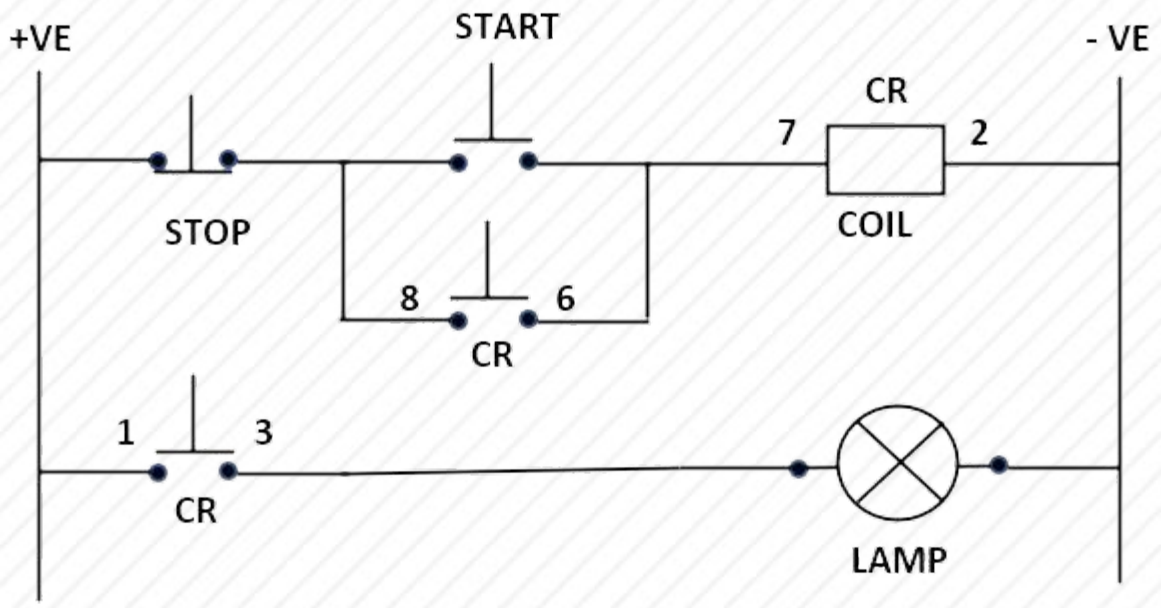
	CIRCUIT DIAGRAM EXPLANATION	
SYMBOL	COIL DE-ENERGIZED	COIL ENERGIZED
		
Double Pole Double Throw(DPDT) C1,C2 - Pole A1,A2 - throw NO B1,B2 - throw NC	Lamp 1 and L3 is in ON condition while the coil is de-energize. The supply 12v flow through the common and NC contact	When switch are press, supply will flow to coil. Coil energize. Terminal Common will touch the Normally Open (NO) contact. The supply 12v can flow to the common and NO contact, lamp 2 and lamp 4 is ON condition while Lamp 1 and lamp is OFF

1.0 Electromechanical relay wiring connection

T U T O R I A L

Q U E S T I O N

Based on Relay Ladder Logic (RLL), construct hardwired circuit in proper wiring connection by using DPDT relay.



S O L U T I O N

STEP 1
- Analyze the circuit

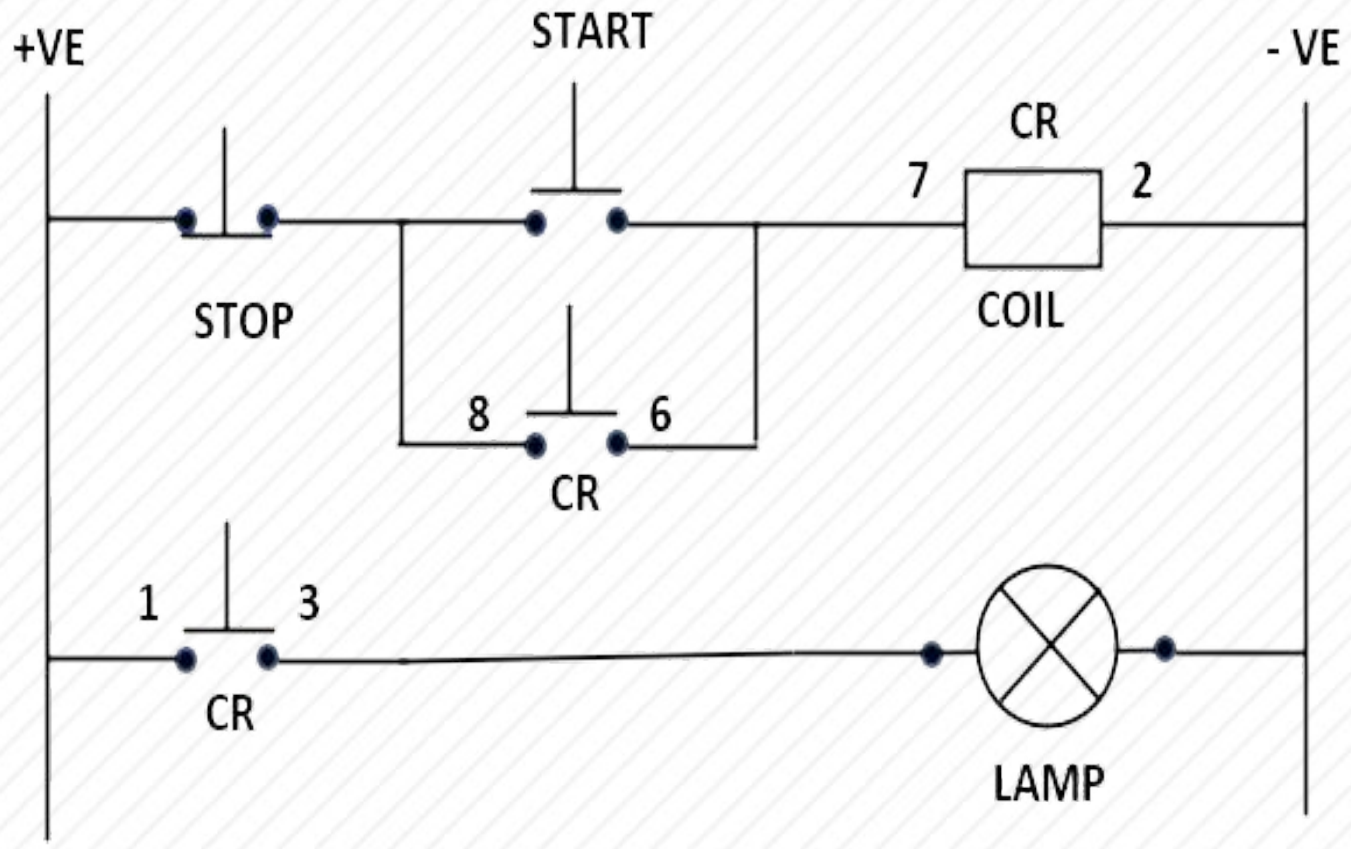
STEP 2
- List input output device
- Identify terminal of relay

STEP 3
- Connect the component
- Run and Troubleshoot the circuit

1.0 Electromechanical relay wiring connection

S T E P 1

Analyze The Circuit

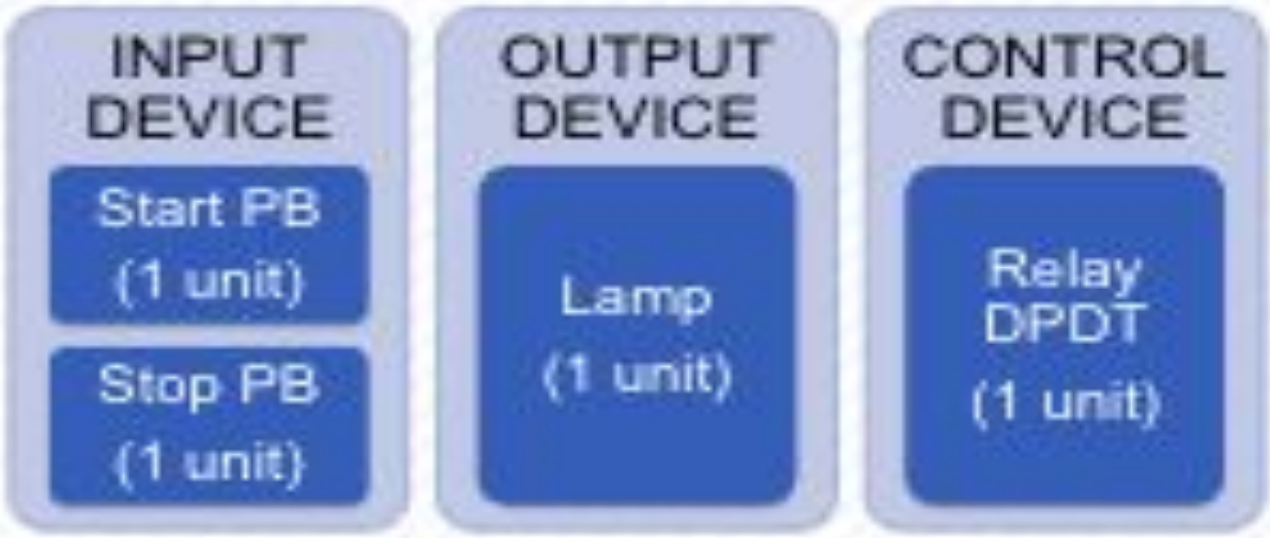


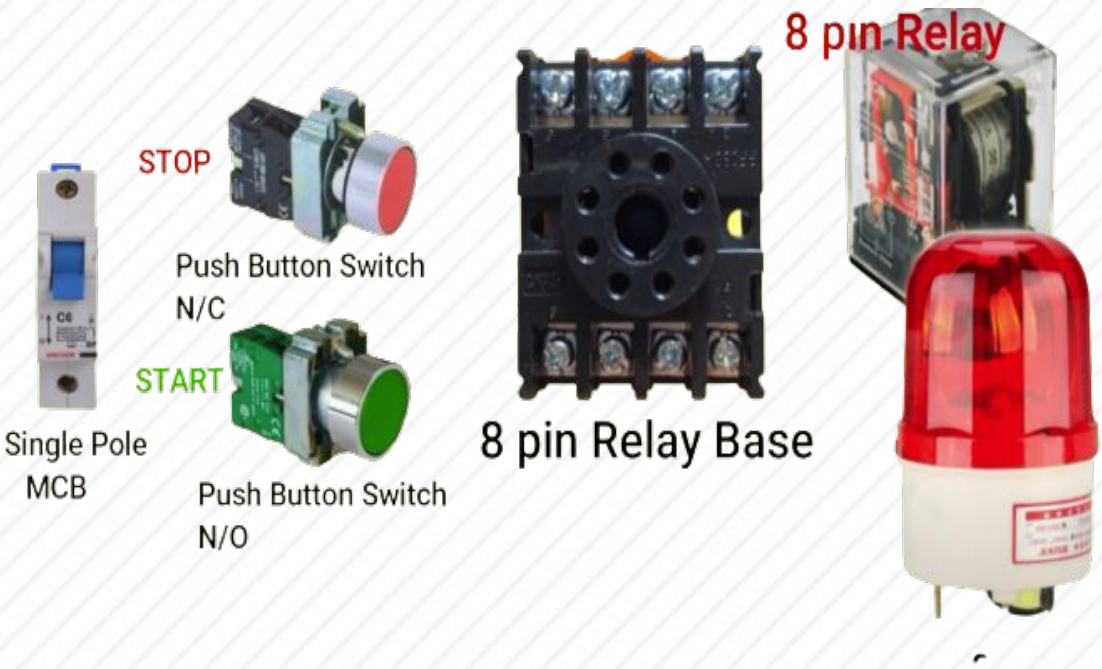
- Press **Start** push button(PB), supply 24vdc (+VE) will flow to the CR – coil relay.
- CR-coil relay will energize and pull the contact CR from NO to NC
- Current will flow from contact –CR to coil as a Holding circuit and another Contact CR will On the lamp.
- If release start PB the lamp still ON because the circuit have holding circuit.
- If **Stop** push button are press, It will cut current flow to the coil.
- Coil de-energize and contact back to original position, lamp will OFF.

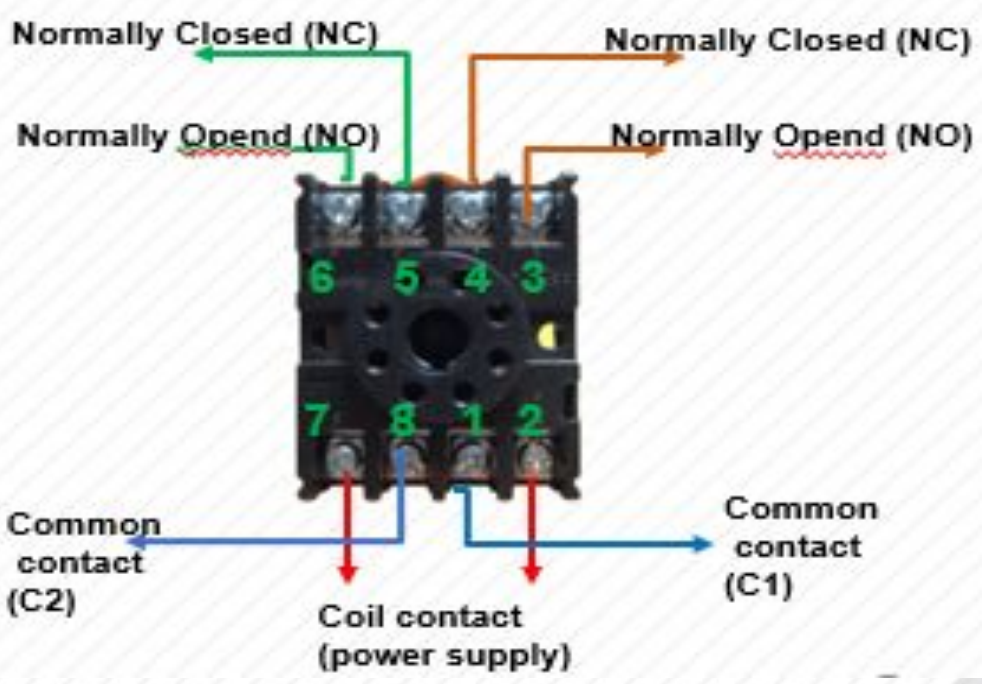
1.0 Electromechanical relay wiring connection

S T E P 2

List Input Output Device
Terminal of relay



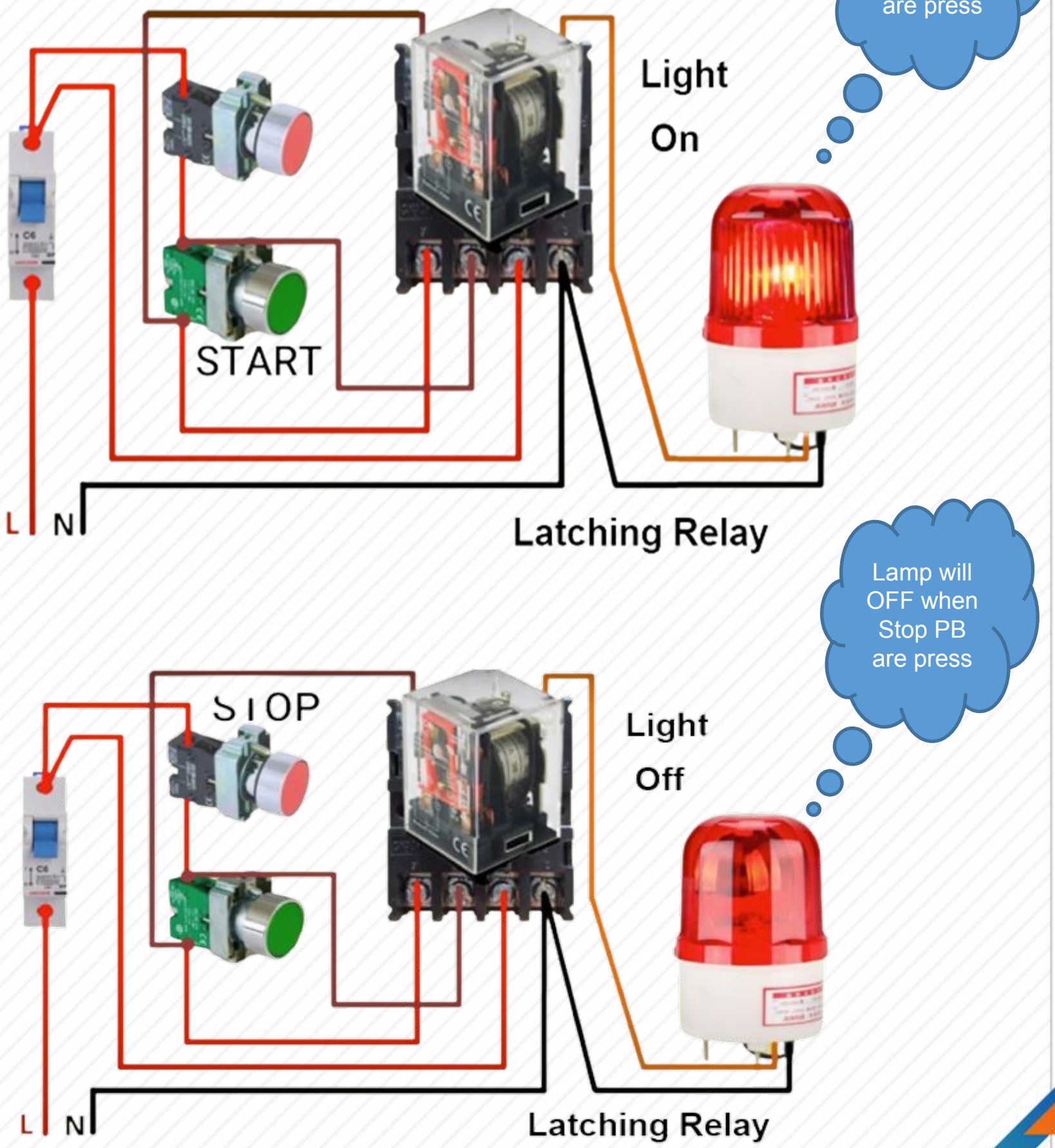




1.0 Electromechanical relay wiring connection

S T E P 3

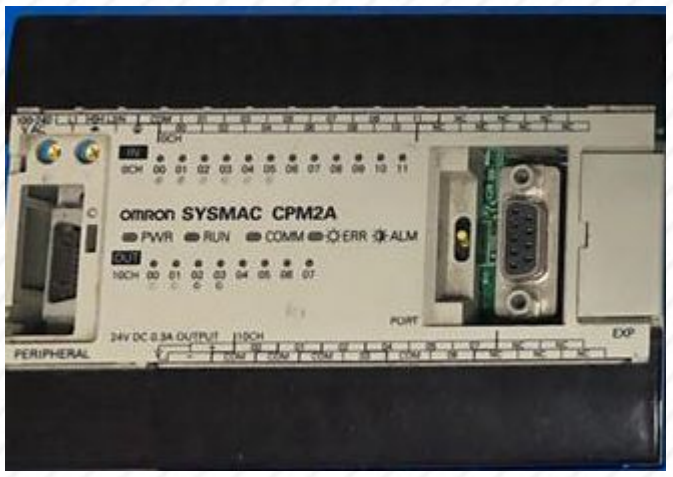
Connect the component
Run and Troubleshoot the circuit



Topic 2

Basic Instruction PLC

2.0 BASIC INSTRUCTION PLC



S K I L L S

Student able to applied the skill to construct the ladder diagram and mnemonic code

Definition:

According to the National Electrical Manufacturers Association (NEMA) PLC is a digital electronic equipment that uses memory and can be programmed to store the instructions of a specific function such as time, logic and arithmetic to control something. (Brian S.Elliott, 2007)

PLC have been used in industrial control to replace relay-based automation control system since 1969. It is atype of special computer that is used to control machines or processes. The use of PLC provides various facilities for the manufacturing industry in performing operations on automation processes, reducing production costs and increasing the quantity and quality of product. Advantage of PLC such as easy to program. easy to operate and resistant to vibration.

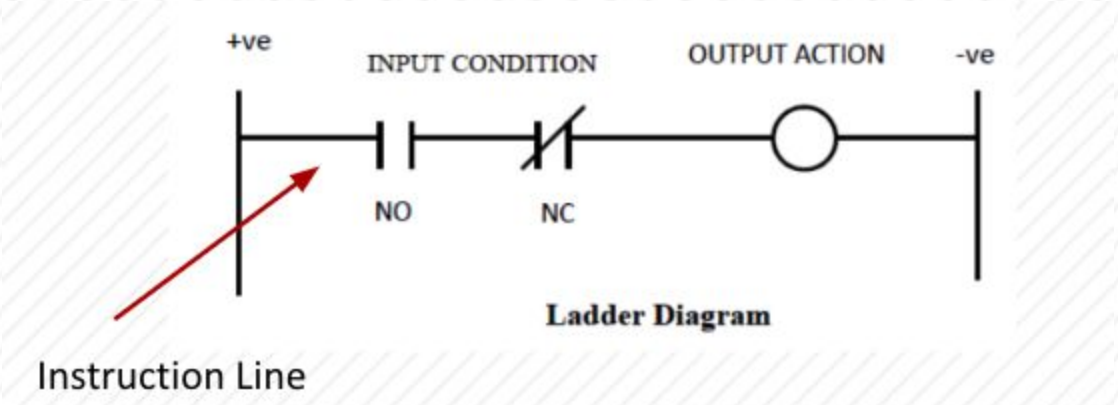
The types of PLC available in the market are as follows:

- Mitsubishi
- Omron
- Sharp
- Toshiba
- Siemen

Ladder Diagram

A ladder diagram is a one of international standard for programmable controller programming languages. In practical lab for this course we used PLC OMRON Sysmac CPM 2A . For program the operation we need to know how to create a ladder diagram (Sulaiman Subari, 2020).

Figure below show the construct of ladder diagram.

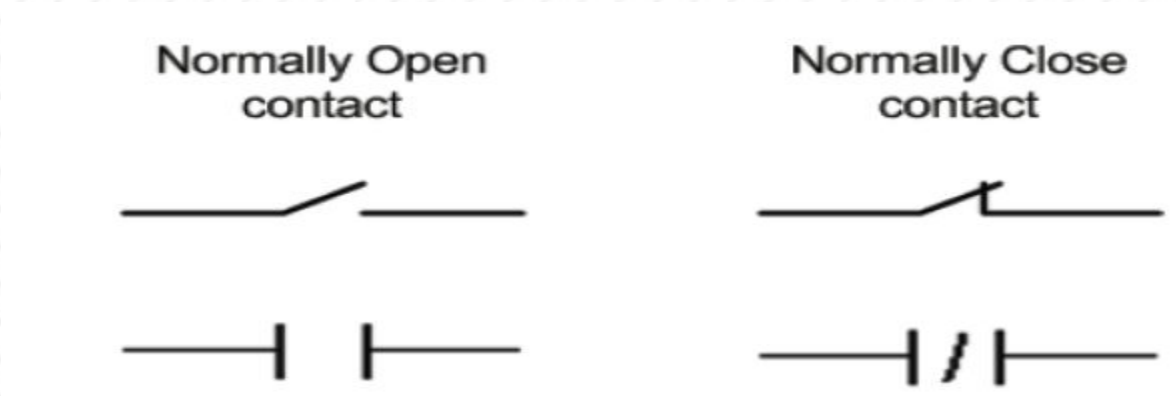


- Vertical line left and right use for supply 24vdc positive and negative side.
- Horizontal line use for **instruction line** , input and output condition will construct on this line.
- Input and output condition we only use symbol NO or NC only depends on operation process.
- Output condition only use the round symbol as a in figure above.

2.0 BASIC INSTRUCTION PLC

Normally Open (NO) and Normally Closed (NC) Contact

In ladder diagram NO and NC is common use for input condition contact. To create the program PLC , we need to know the suitable contact either use NO or NC. Its depend on the operation process so we must know the function of both contact. Figure below show the symbol of contact NO and NC.



NC - supply electricity will flow this contact until it is press, the contact will open so no electricity flow.

NC - no supply electricity flow through this contact until it is press, the contact will closed so electricity will flow.

contact	condition button	status contact	status output
NC	OFF	NC	Current Flow, lamp ON
NO	OFF	NO	No Current flow, Lamp OFF
NC	ON	NO	No Current flow, Lamp OFF
NO	ON	NC	Current Flow, lamp ON

Tips:

if you want “action” (turn ON when switch is closed (relay energizes) use NO contact

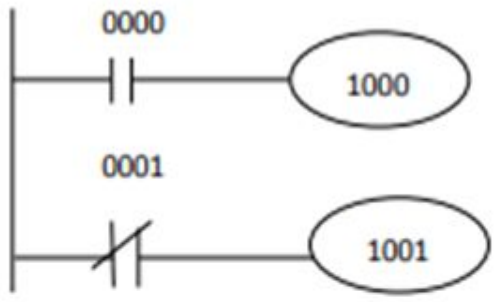
if you want “action” (turn ON) when switch is open (relay de-energizes) use NC contact

2.0 BASIC INSTRUCTION PLC

BASIC INSTRUCTION : LADDER DIGRAM &MNEMONIC CODE

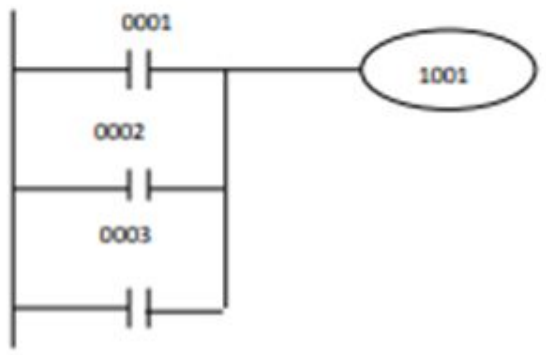
LADDER DIAGRAM	MNEMONIC CODE

LOAD & LOAD NOT



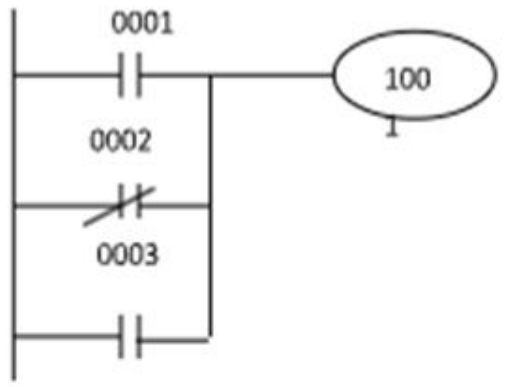
ADDRESS	INSTRUCTION	DATA
00000	LD	0000
00001	OUT	1000
00003	LD NOT	0001
00004	OUT	1001
00005	END	

OR



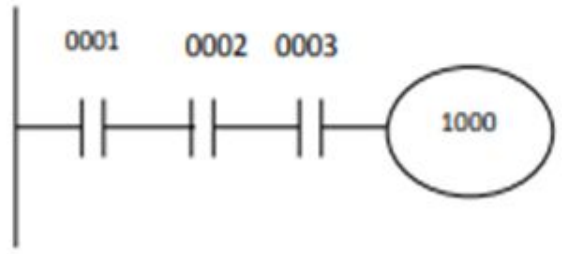
ADDRESS	INSTRUCTION	DATA
00000	LD	0001
00001	OR	0002
00003	OR	0003
00004	OUT	1001
00005	END	

OR NOT



ADDRESS	INSTRUCTION	DATA
00000	LD	0001
00001	OR NOT	0002
00003	OR	0003
00004	OUT	100
00005	END	

AND



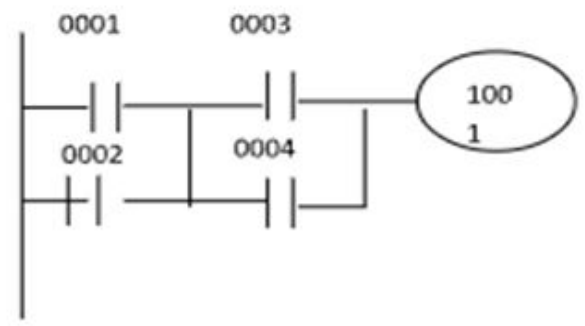
ADDRESS	INSTRUCTION	DATA
00000	LD	0001
00001	AND	0002
00003	AND	0003
00004	OUT	1000
00005	END	

BASIC INSTRUCTION : LADDER DIGRAM &MNEMONIC CODE

AND NOT

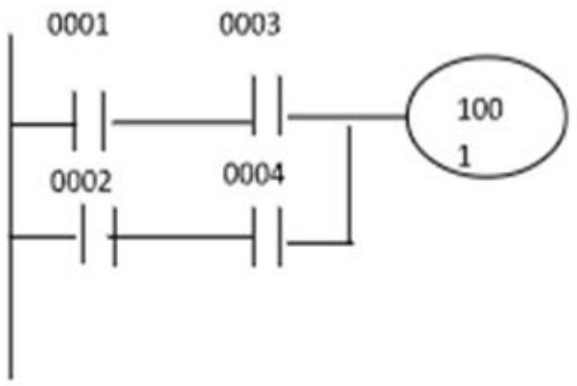
ADDRESS	INSTRUCTION	DATA
00000	LD	0000
00001	AND NOT	0001
00003	AND	0002
00004	OUT	100
00005	END	

AND LOAD



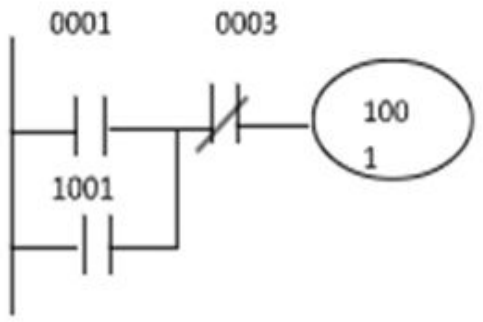
ADDRESS	INSTRUCTION	DATA
00000	LD	0001
00001	OR	0002
00003	LD	0003
00004	OR	0004
00005	AND LOAD	
00006	OUT	1001

OR LOAD



ADDRESS	INSTRUCTION	DATA
00000	LD	0001
00001	AND	0003
00003	LD	0002
00004	AND	0004
00005	OR LOAD	
00006	OUT	1001

Self-holding circuit

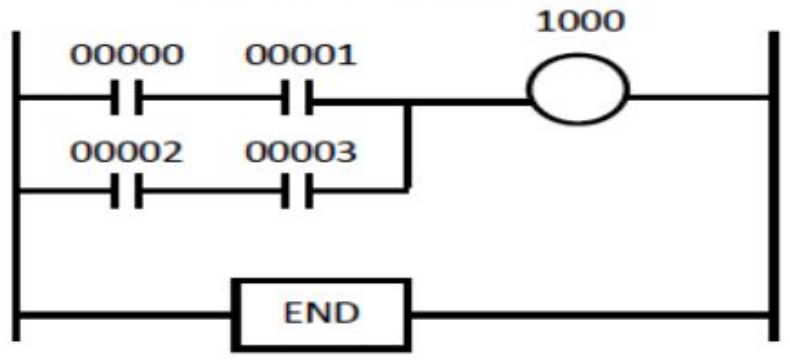


ADDRESS	INSTRUCTION	DATA
00000	LD	0001
00001	OR	1001
00003	AND NOT	0003
00006	OUT	1001
00007	END	

BASIC INSTRUCTION : LADDER DIGRAM &MNEMONIC CODE

OR LD - Instruction

Ladder Diagram

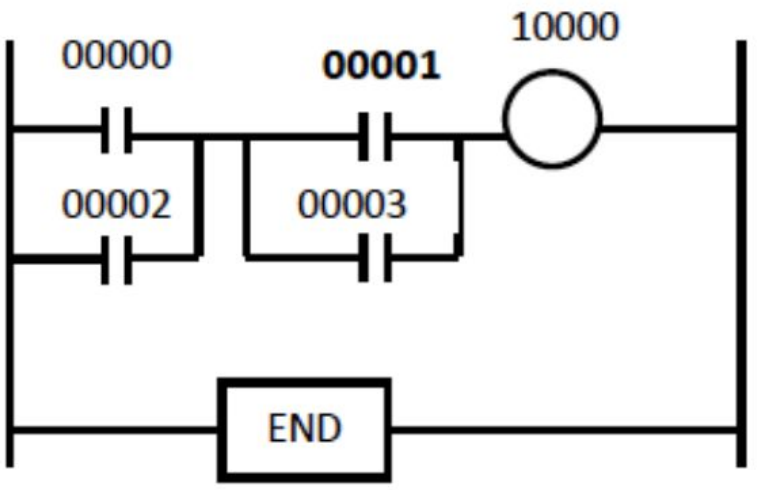


Mnemonic Code

Address	Instruction	Operand/Data
00000	LD	00000
00001	AND	00001
00002	LD	00002
00003	AND	00003
00004	OR LD	
00005	OUT	10000
00006	FUN 01	

AND LD - Instruction

Ladder Diagram

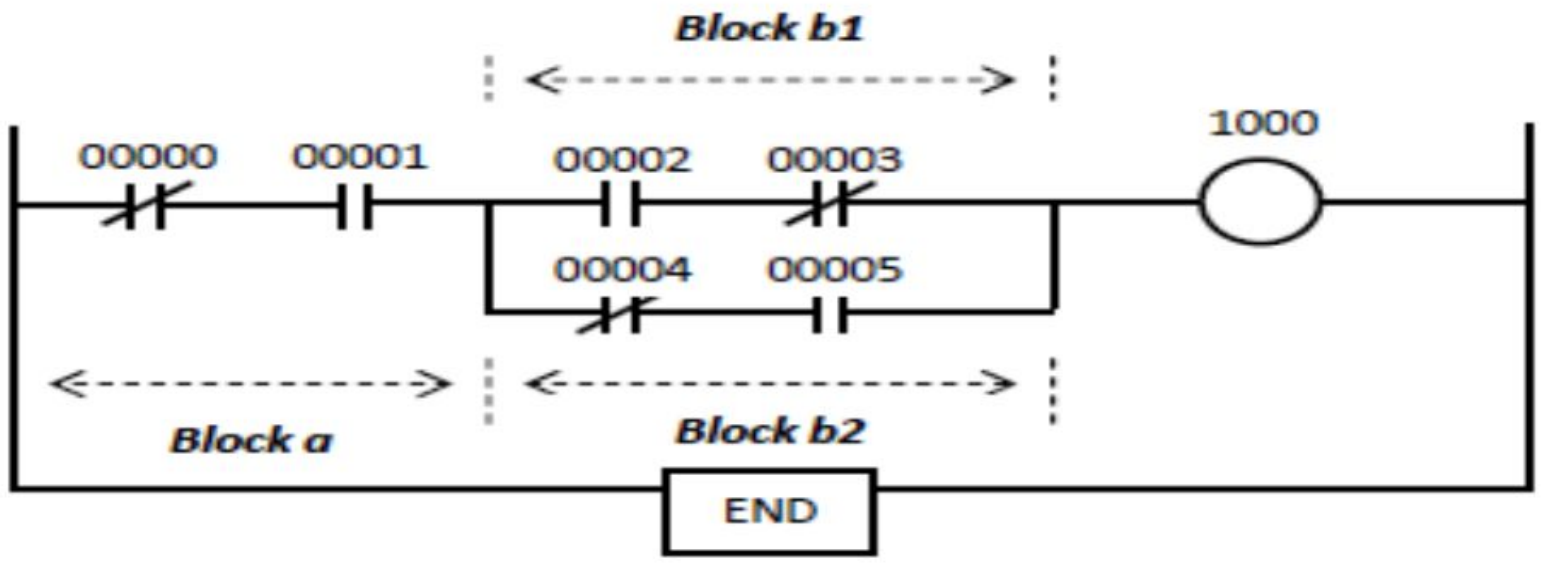


Mnemonic Code

Address	Instruction	Operand/ Data
00000	LD	00000
00001	OR	00002
00002	LD	00001
00003	OR	00003
00004	AND LD	
00005	OUT	10000
00006	FUN 01	

BASIC INSTRUCTION :
LADDER DIAGRAM & MNEMONIC CODE

Ladder Diagram



Mnemonic Code

Address	Instruction	Operand/Data
00000	LD NOT	00000
00001	AND	00001
00002	LD	00002
00003	AND NOT	00003
00004	LD NOT	00004
00005	AND	00005
00006	OR LD	
00007	AND LD	
00008	OUT	10000
00009	FUN 01	

Block a

Block b1

Block b2

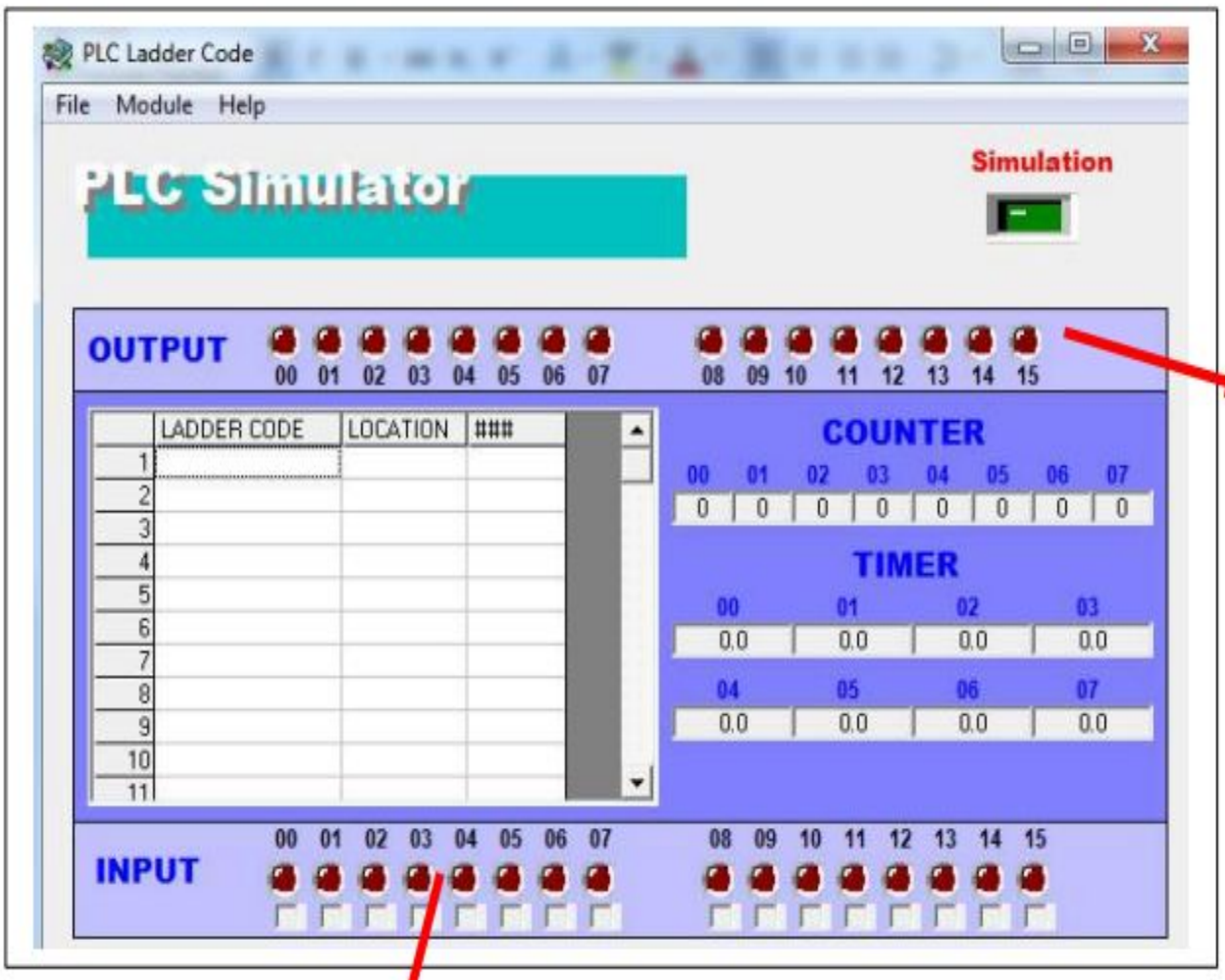
Block b2 + Block b1 = Block b

Block b, Block a

2.0 BASIC INSTRUCTION PLC

PLC SIMULATOR

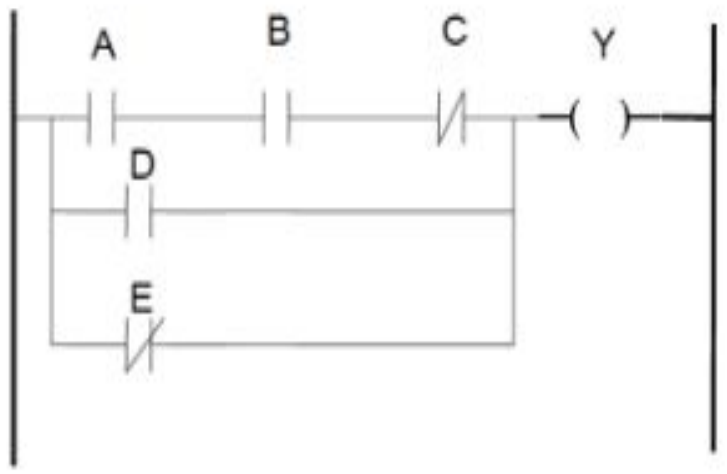
	DATA (PLC OMRON SYSMAC 2A)
input	0000-0915
output	1000-1915



TUTORIAL

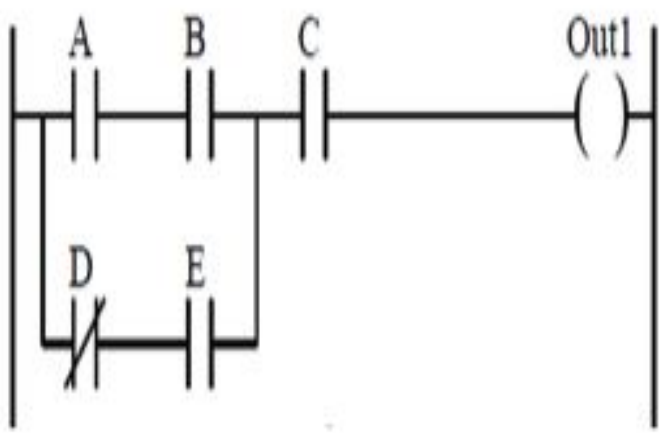
QUESTION 1

Construct the mnemonic code based on ladder diagram below:



MNEMONIC CODE

Address	Instruction	Data	
00000	LD	0000	A
00001	AND	0001	B
00002	AND NOT	0002	C
00003	OR	0003	D
00004	OR NOT	0003	E
00005	OUT	1000	Y
00006	FUN 01		

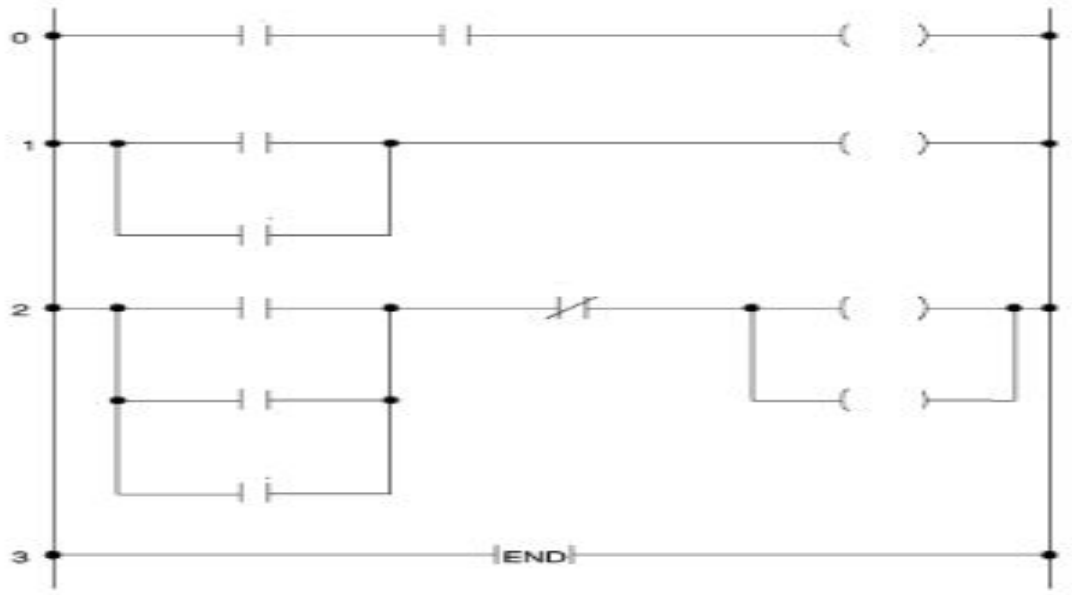


Address	Instruction	Data	
00000	LD	0000	A
00001	AND	0001	B
00002	LD NOT	0002	D
00003	AND	0003	E
00004	OR LD		C
00005	AND	0004	Y
00006	OUT	1000	
00007	FUN 01		

TUTORIAL

QUESTION 1

Construct the mnemonic code based on ladder diagram below:

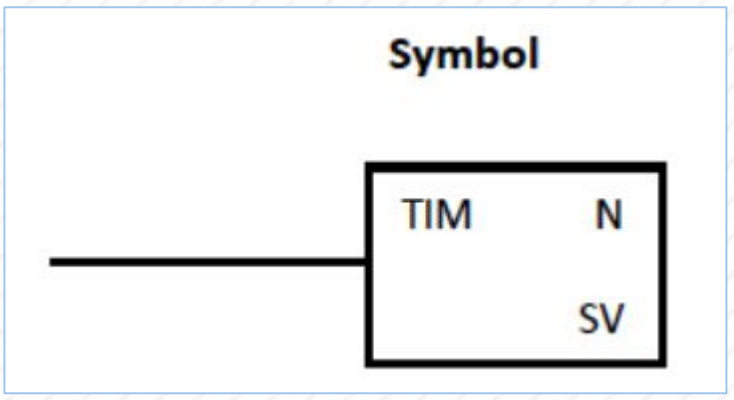


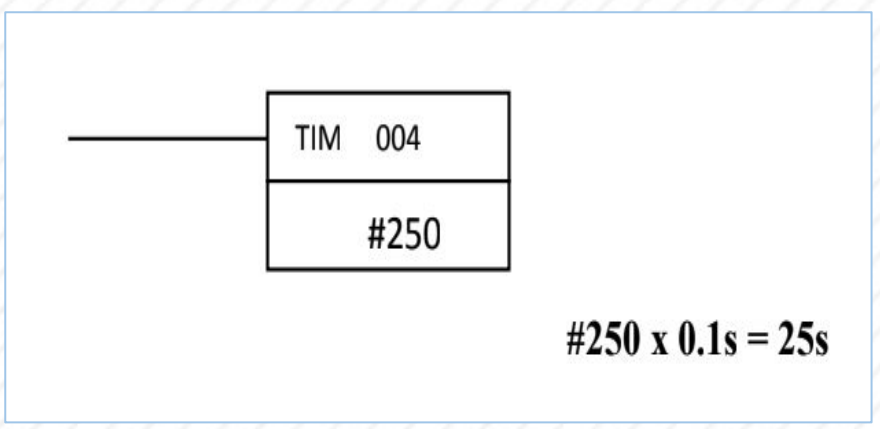
Address	Instruction	Data
00000		
00001		
00002		
00003		
00004		
00005		
00006		
00007		
00008		
00009		
00010		
0 0011		
00012		
00013		

Topic 3

Timer Instruction PLC

3.0 TIMER INSTRUCTION





- Timer is one of the instruction PLC.
- Timer numbers (N) is between 000 and 511.
- The set value (SV) is between 0000 to 9999 X 0.1second.
- TIMER is enabled/activated when the execution condition is ON and will be reset to set value (SV).
- When the execution condition is OFF. The set value (SV) of TIMER is the BCD between # 0000 to # 9999. For example, if TIMER be set to 5 seconds, then the set value (SV) is # 0050.

S K I L L S

Student able to applied the skill

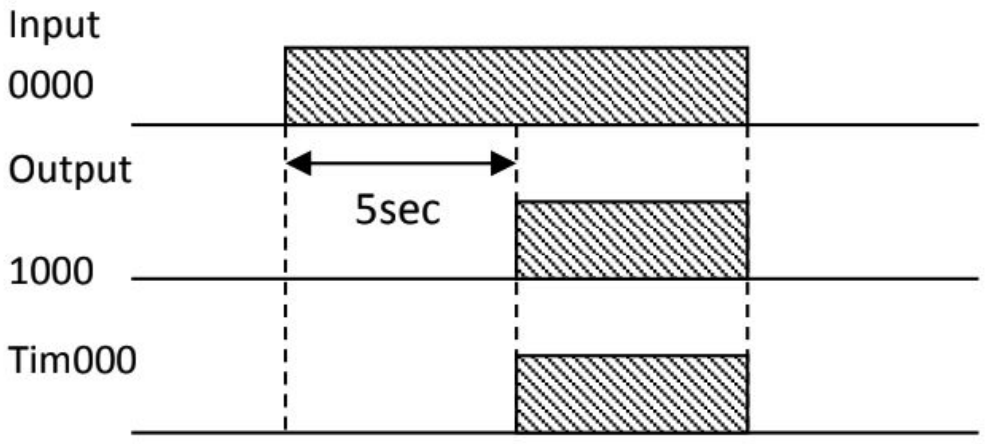
to construct the ladder diagram and

mnemonic code for timer Instruction

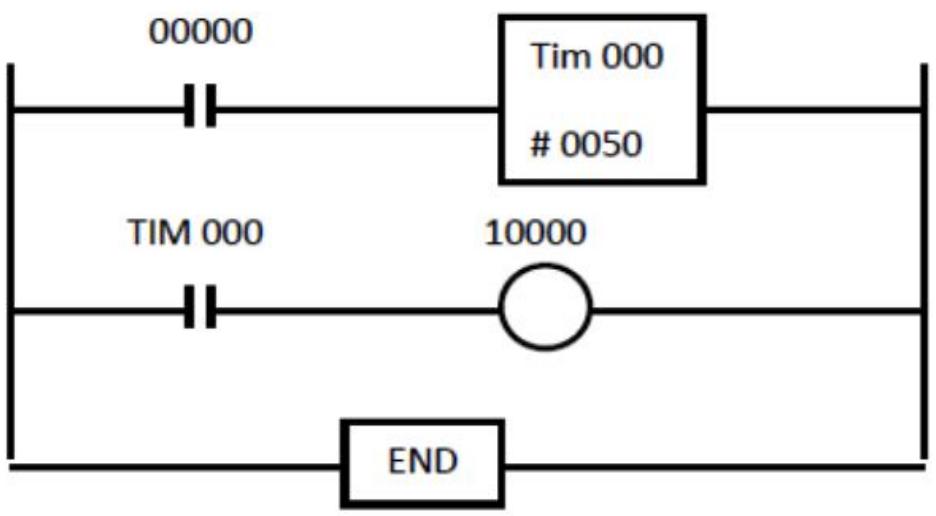
3.0 TIMER INSTRUCTION

Application 1: ON Delay Circuit (0000 AS A SWITCH)

Timing Diagram



Ladder Diagram



Mnemonic Code

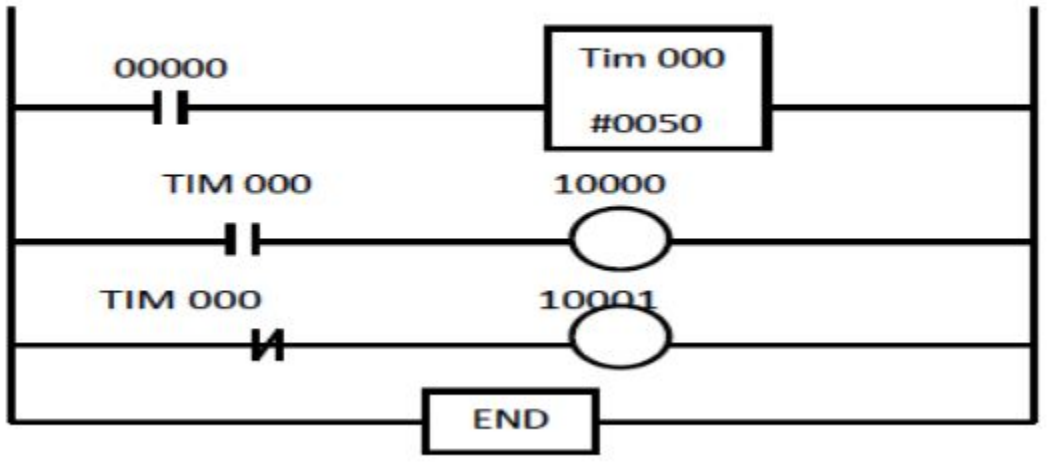
Address	Instruction	Operand/Data
00000	LD	00000
00001	TIM	000
		# 0050
00002	LD	TIM 000
00003	OUT	10000
00004	FUN 01	

Operating Condition:

When the input (LD 00000) is ON, the timer contact will be activated after 5 seconds. Next the output (OUT 10000) will be ON

3.0 TIMER INSTRUCTION

Ladder Diagram



Mnemonic Code

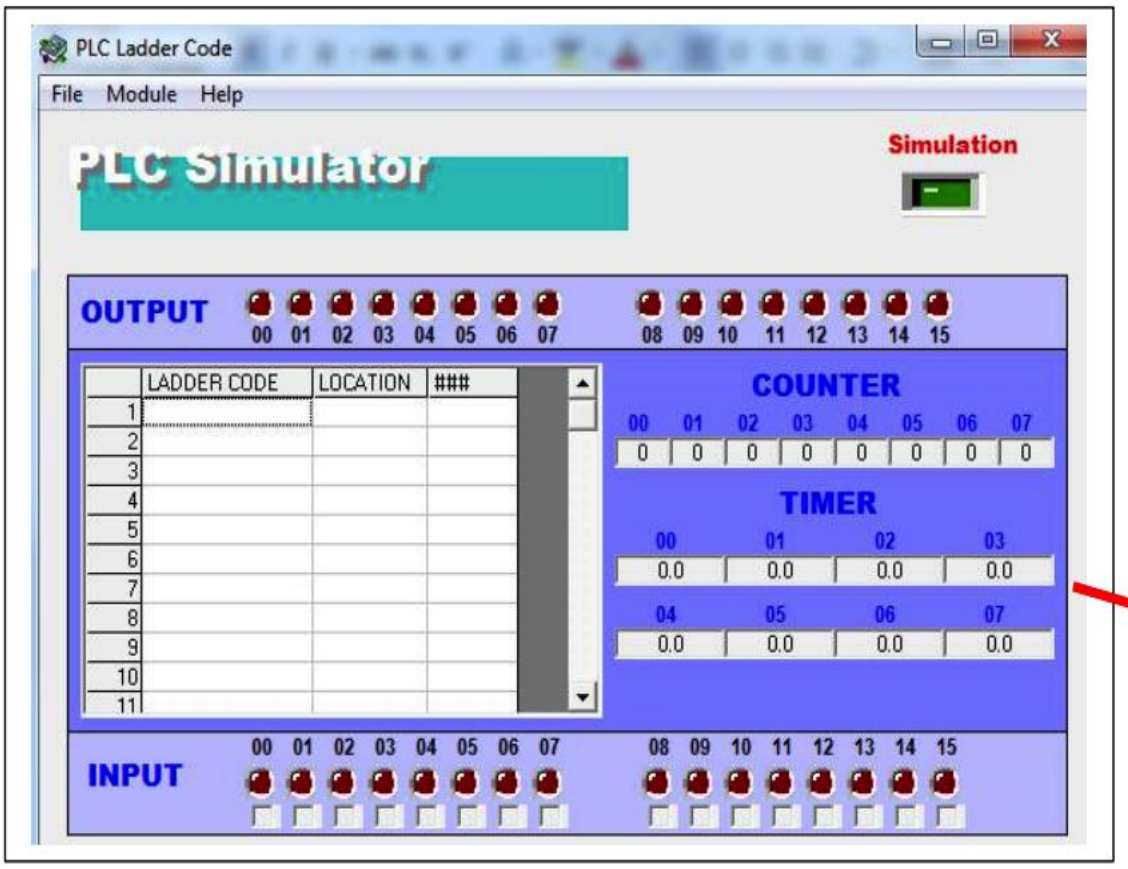
Address	Instruction	Operand/Data
00000	LD	00000
00001	TIM	000
		# 0050
00002	LD	TIM 000
00003	OUT	10000
00004	LD NOT	TIM 000
00005	OUT	10001
00006	FUN 01	

Operating Condition:

When the input (LD 00000) ON, the timer (TIM 000) will be activated after 5 seconds and the output (OUT 10000) will be ON. While the output (OUT 10 001) will be ON as soon as the supply is supplied and will be OFF after 5 seconds. Timer will continue to be active as long as the input 00000 state is ON

3.0 TIMER INSTRUCTION

PLC SIMULATOR

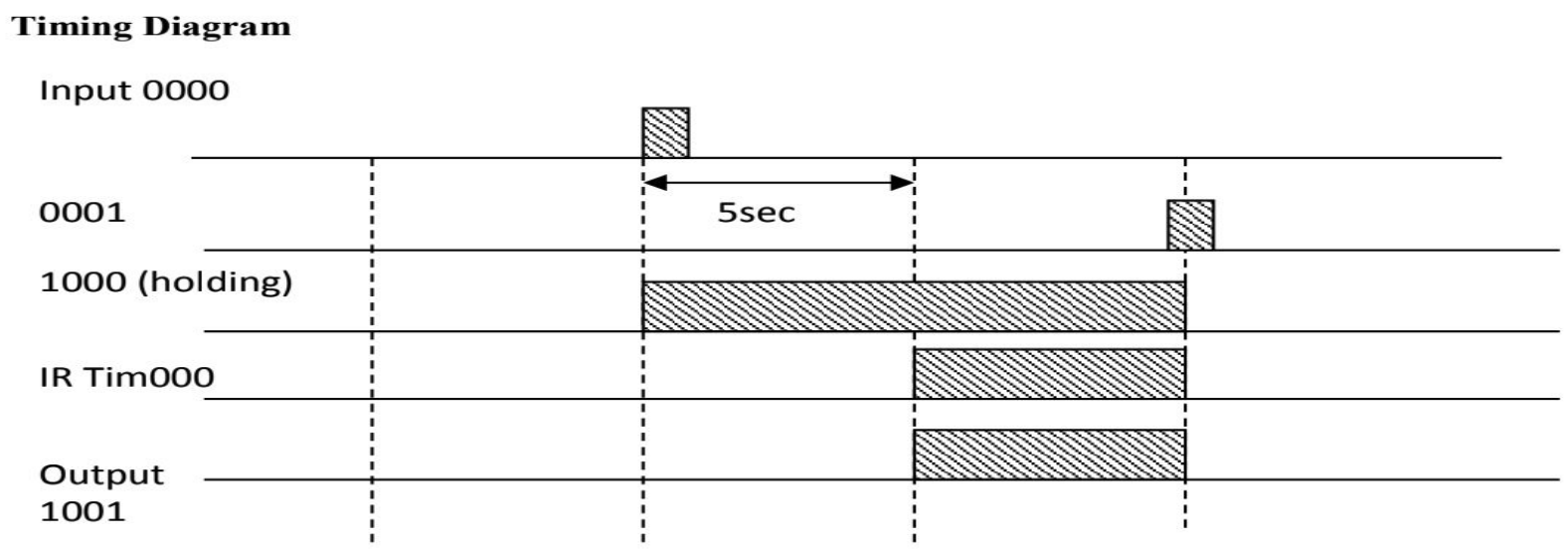


TIM 000- TIM 007

T U T O R I A L

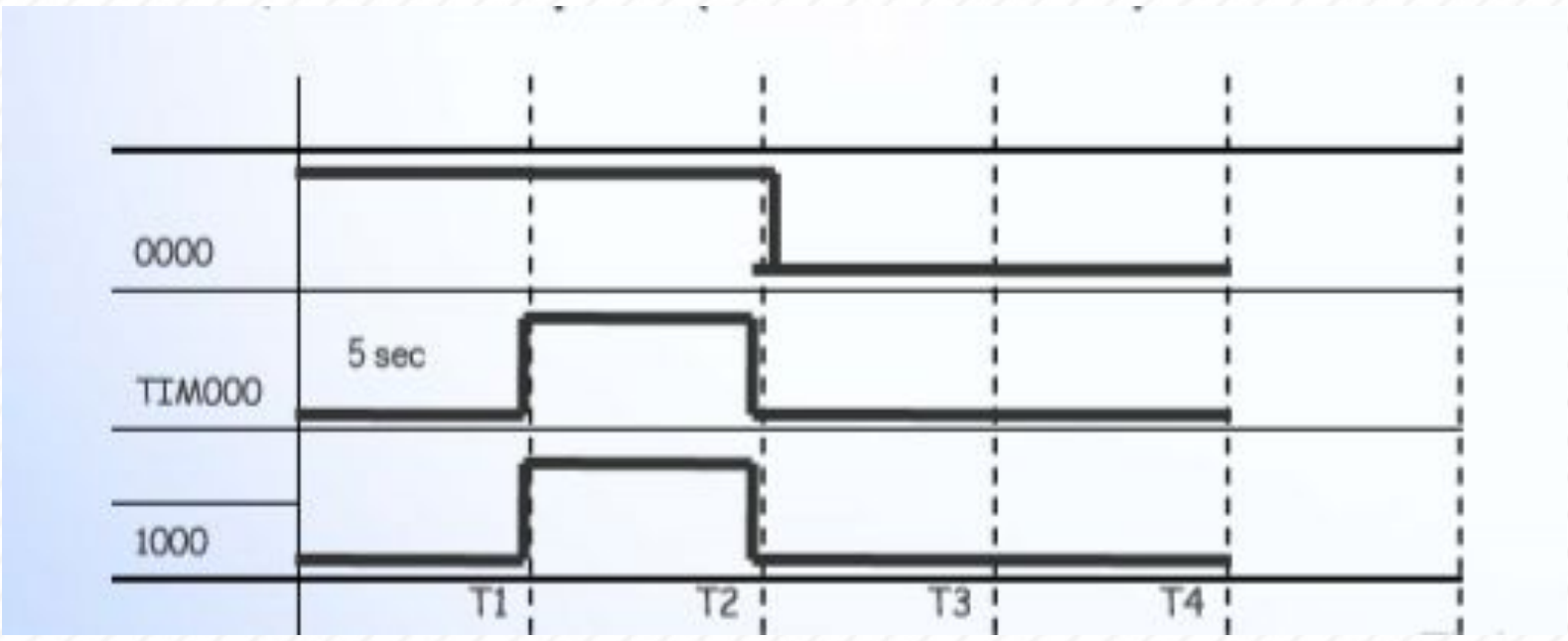
QUESTION 1:

Design ladder diagram if Application 1 is ON Delay Circuit. Use 0000 as a push button.



QUESTION 2:

Based on timing diagram below, explain the operation of process.



Operation:

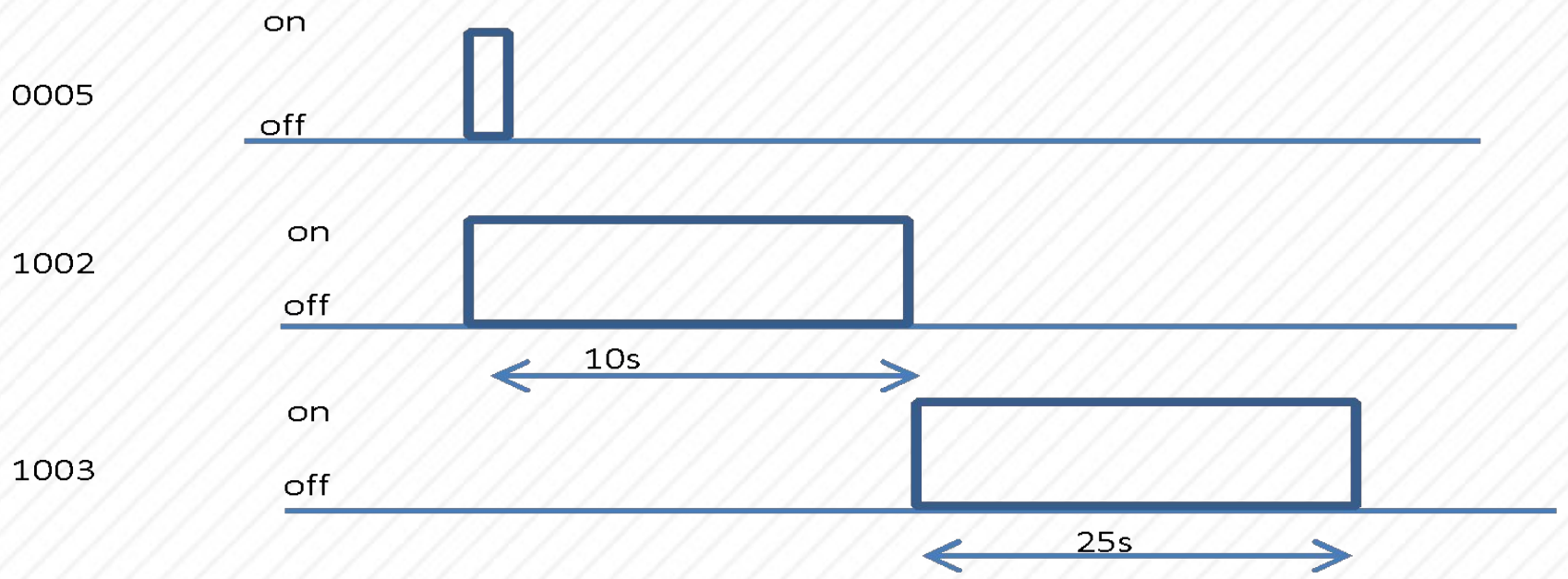
When the input (00000) is ON, the timer contact will be actived after 5 seconds. Next the output (10000) will be ON.

QUESTION 3:

Based on timing diagram below:

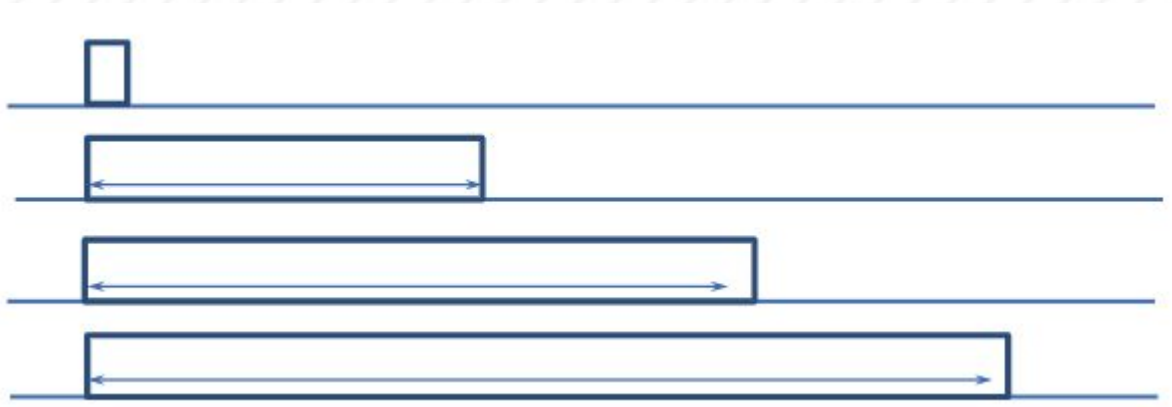
i. Design the ladder diagram

ii.Modify your ladder diagram, to operation of the process will repeat automatically.



QUESTION 4:

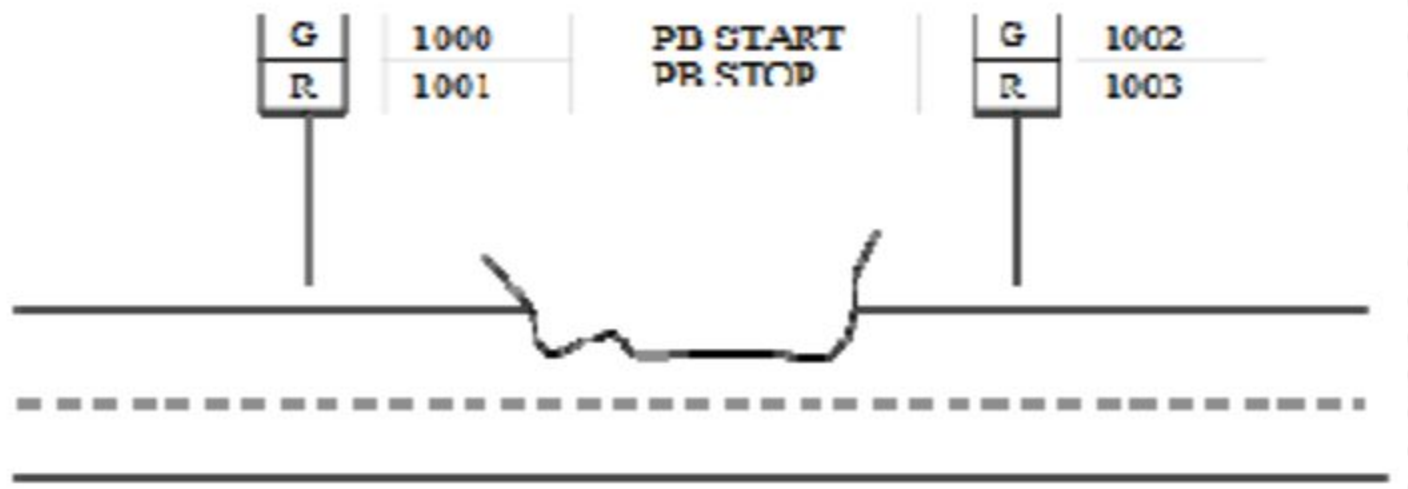
By using the basic timer instruction, design a ladder diagram which would produce a timing diagram as in figure below.



3.0 TIMER INSTRUCTION

QUESTION 5:

An emergency traffic light system has to be deployed due to landslide. When PB Start is pressed, system will start operate with 1000 and 1003 switch “ON”. After 10 seconds, both will “OFF” and 1001 and 1002 will “ON”.



Topic 4

Counter Instruction PLC

4.0 COUNTER INSTRUCTION

Counter is one of instruction PLC.

Counters are used to calculate the count down from the set value (SV) on the execution condition on the counting pulse (CP) when it is changed from OFF to ON

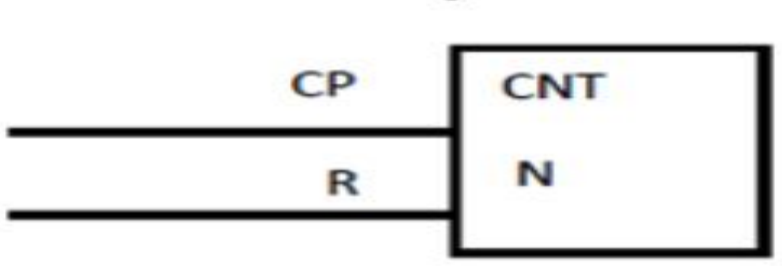
Counter numbers are range from 000 to 511.

The set value (SV) is range 0000 to 9999.

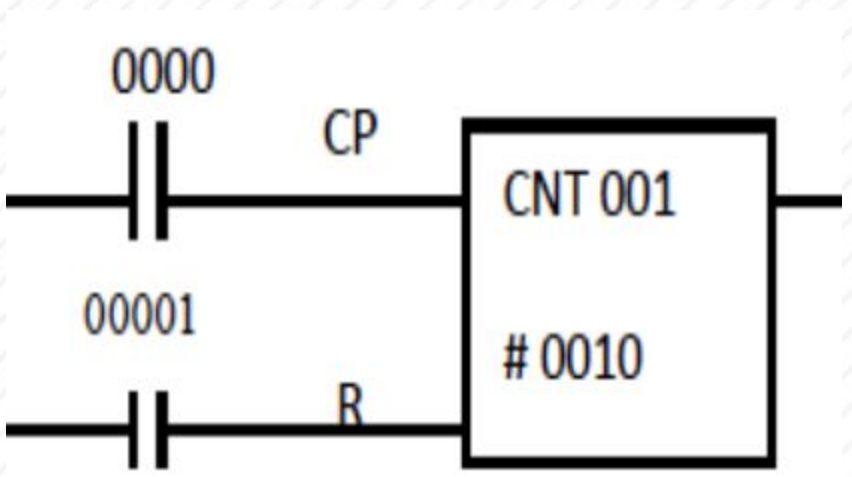
Counters will reset to the reset (R).

(Sulaiman Subari, 2020)

Symbol



N : Counter Number
SV: Set Value
CP:Counter point (Input)
R:Reset

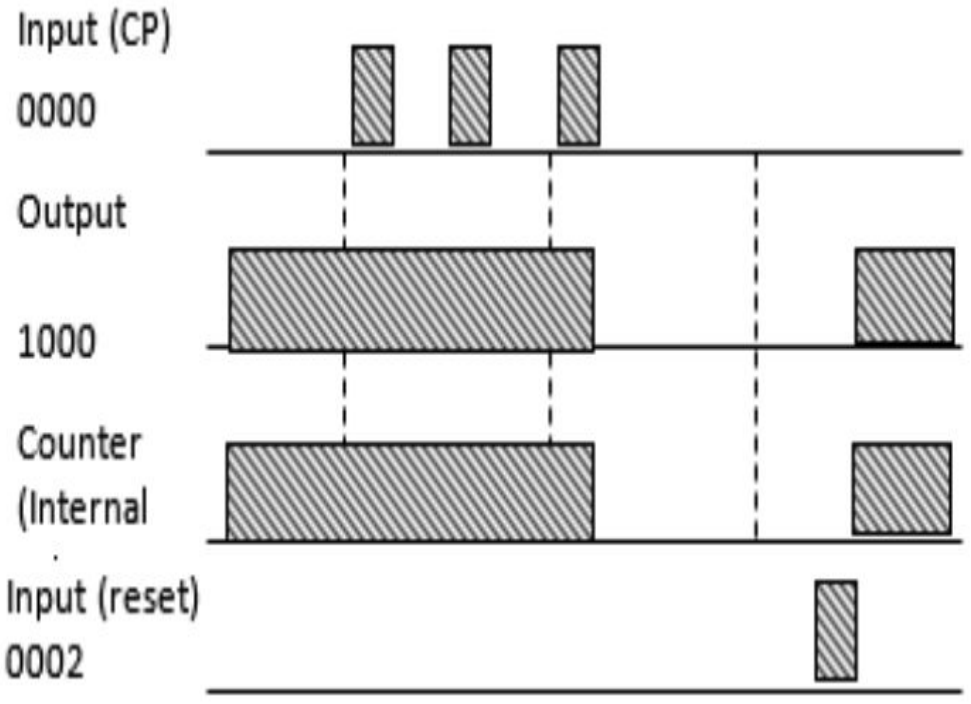


S K I L L S

Student able to applied the skill
to construct the ladder diagram and
mnemonic code for counter Instruction

4.0 COUNTER INSTRUCTION

Application 2: OFF Delay Circuit (0000 AS A SWITCH/SENSOR)

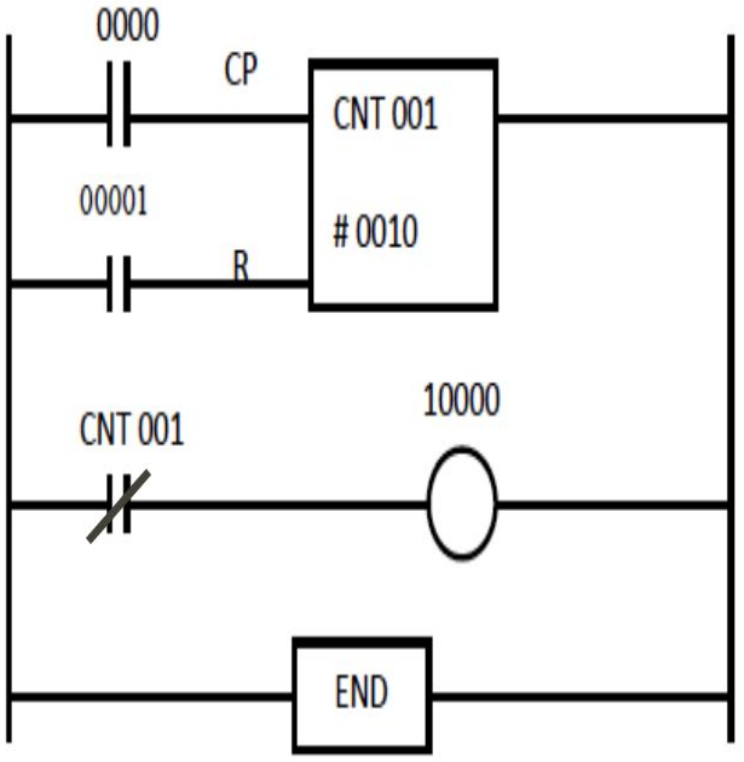


Operation:

The Output is ON , When Counter receive 3 times input signal (0000),

the output will OFF.

Press (0002) , the output will ON again

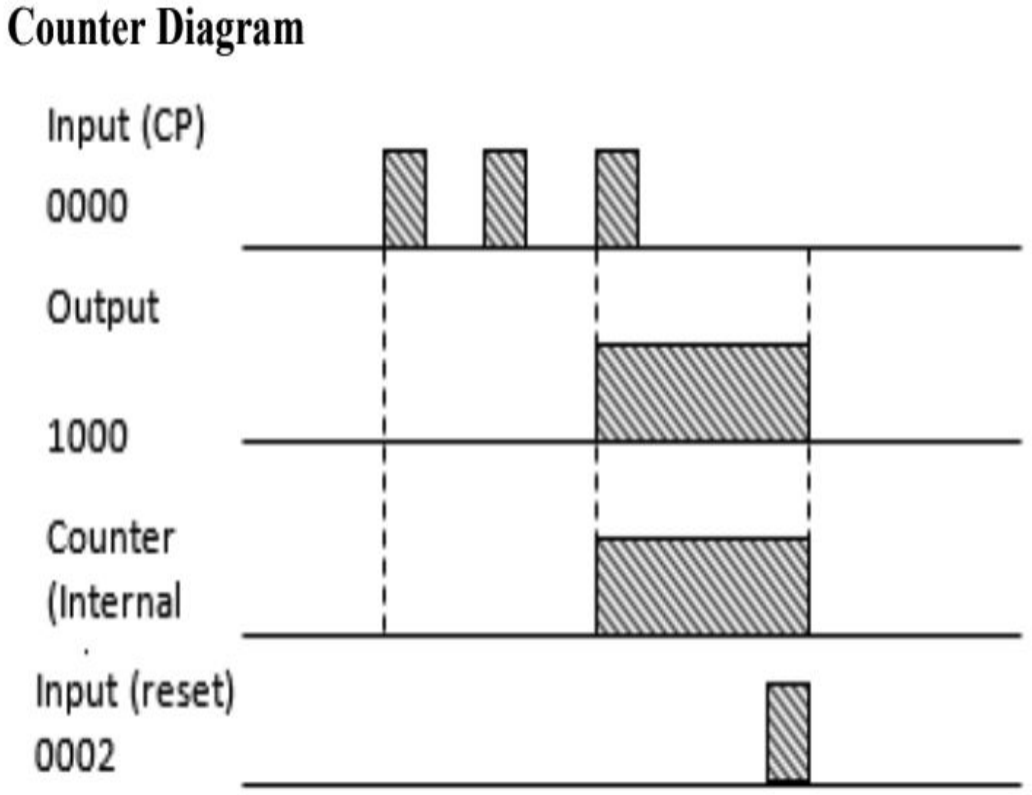


Mnemonic Code

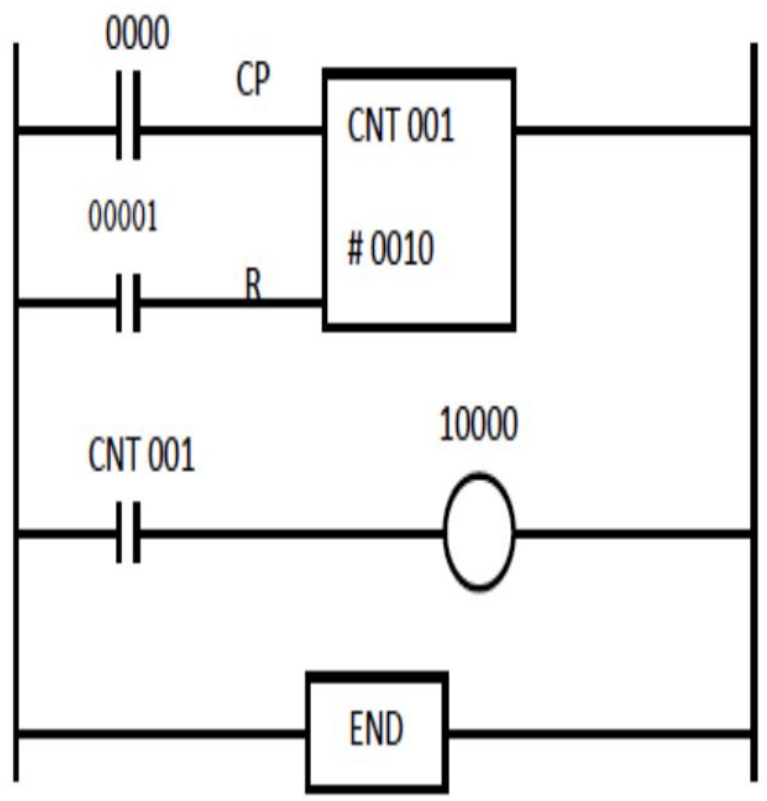
Address	Instruction	Operand/Data
00000	LD	00000
00001	LD	00001
00002	CNT	000
		#0010
00003	LD NOT	CNT 001
00004	OUT	10000
00005	FUN 01	

4.0 COUNTER INSTRUCTION

Application 1: ON Circuit (0000 AS A SWITCH/SENSOR)



Operation:
When Counter receive 10 count input
signal (0000), the output will ON.
Press (0001) , the output will OFF



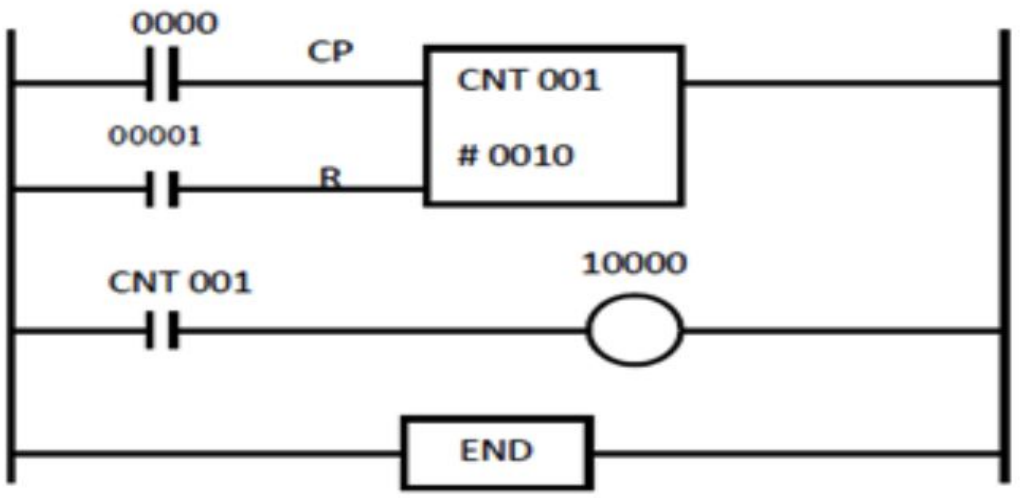
Mnemonic Code

Address	Instruction	Operand/Data
00000	LD	00000
00001	LD	00001
00002	CNT	000
		#0010
00003	LD	CNT 001
00004	OUT	10000
00005	FUN 01	

4.0 COUNTER INSTRUCTION

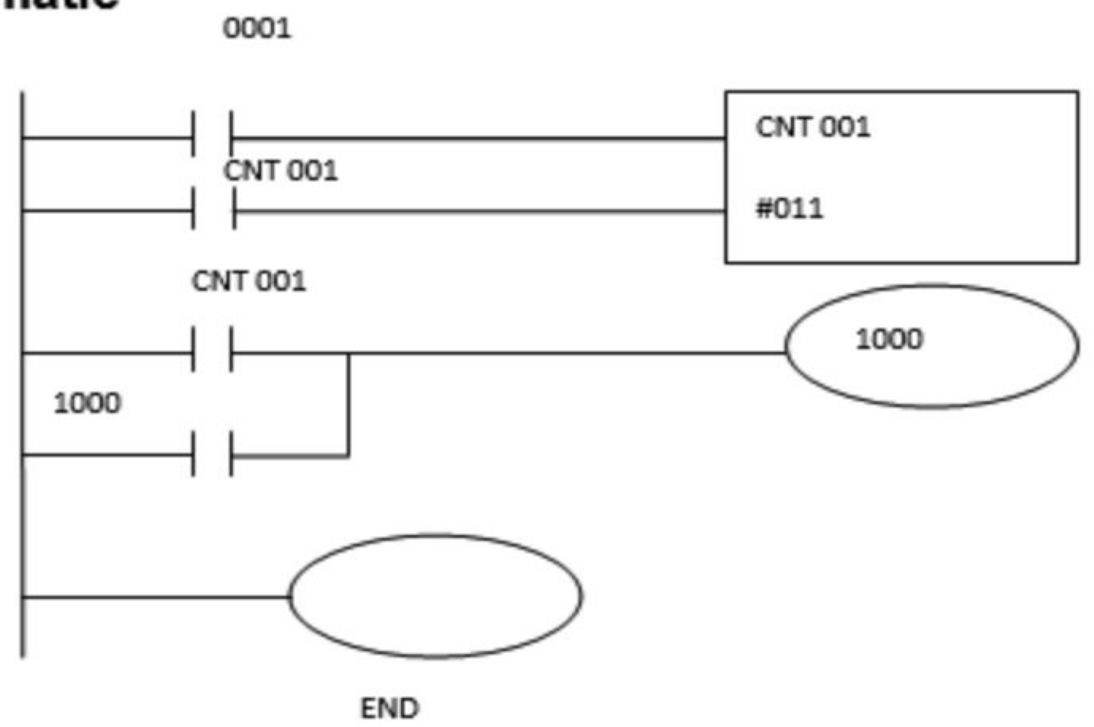
Two method for Counter-Reset

Manual Reset



Manual Reset- use any data input device such as stop push button, switch and limit switch

Reset Automatic



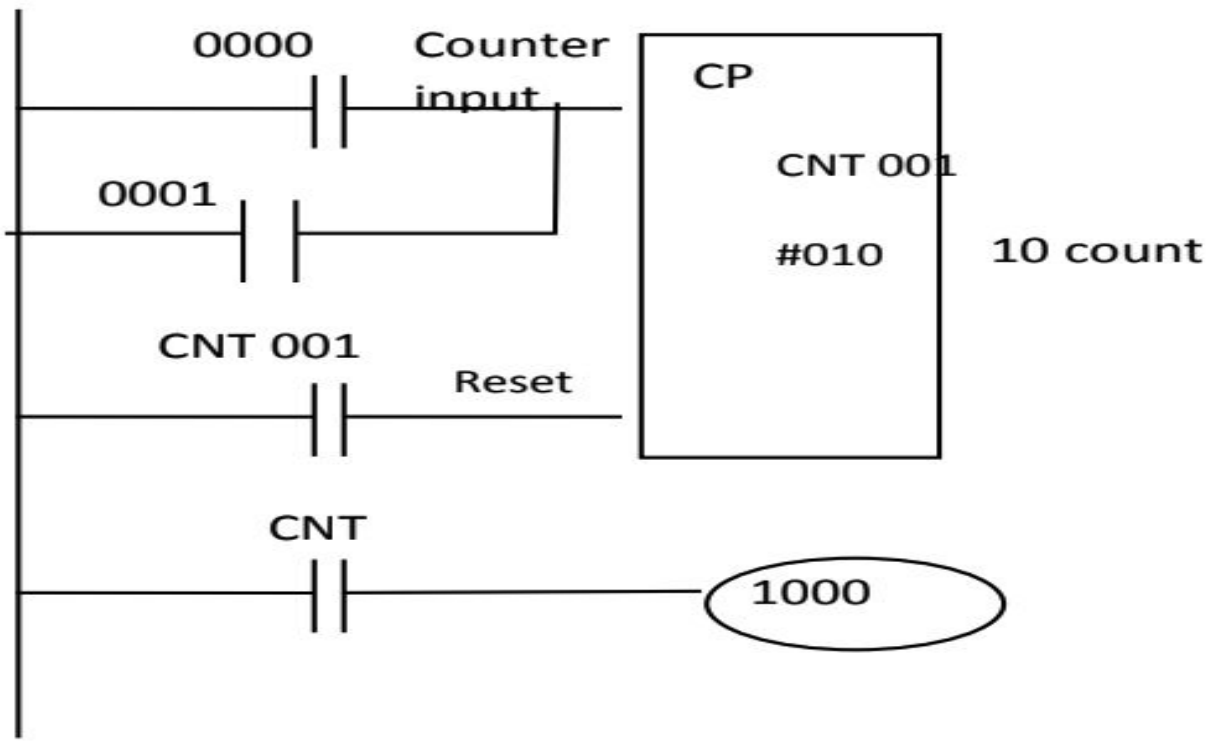
Automatic Reset- use any data internal Relay (IR) such as IR Timer, IR Counter, IR output. Function automatically to reset counter

4.0 COUNTER INSTRUCTION

T U T O R I A L

Q U E S T I O N 1

Based on ladder diagram , write the mnemonic code.



S O L U T I O N

Address	Instruction	Data

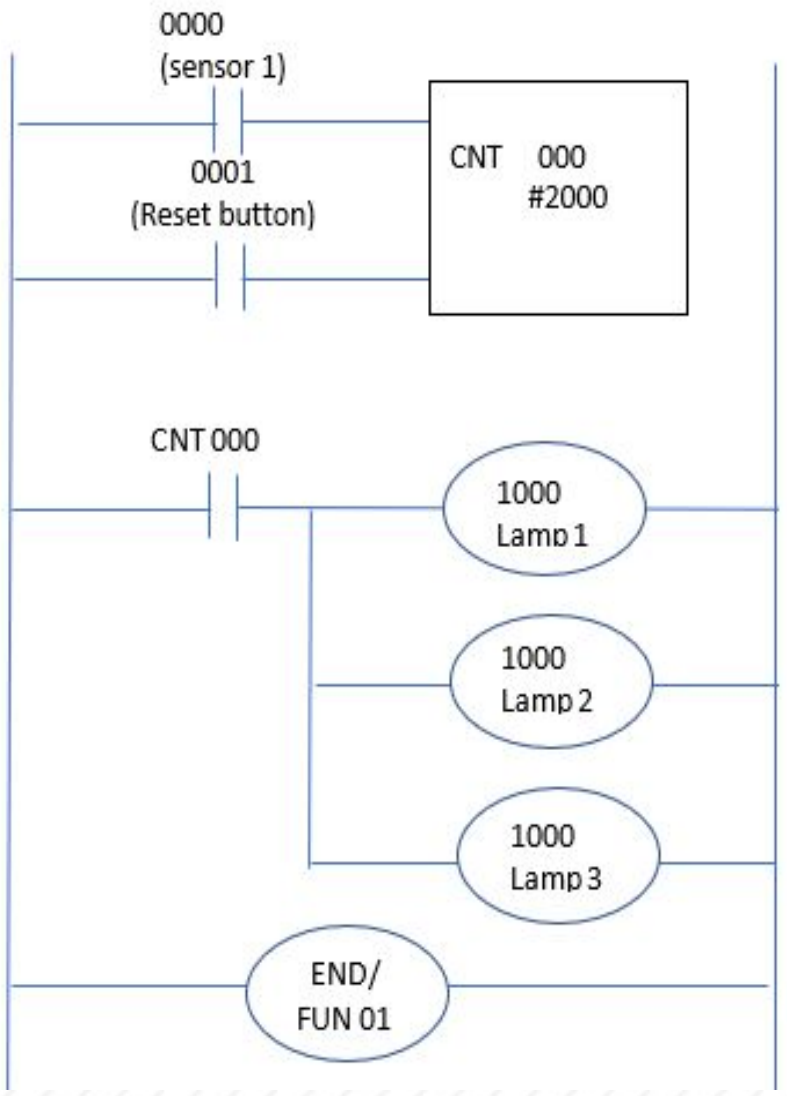
5. DUAL SYSTEM CONVEYOR 1

TUTORIAL

QUESTION 2

Design the ladder diagram to count until 2000 counts. Lamp 1, lamp 2 and lamp 3 ON.

SOLUTION



CNT 000 will receive signal from sensor 1 and counting up to 2000.

After that CNT 000 will active and transmit the signal to IR CNT 000 and trigger Lamp 1, Lamp 2 and Lamp 3 To ON.

Lamp 1, lamp 2 and lamp 3 will ON after receive signal from IR CNT 000. The lamps will OFF after reset button are press.

5. DUAL SYSTEM CONVEYOR 1

TUTORIAL

QUESTION 2

Design the ladder diagram to count until 20000 counts. Lamp 1, lamp 2 and lamp 3 ON.

SOLUTION

- Set value (SV) for one CNT is #9999.
- For SV 20000 we need more than one CNT.
- To design the ladder diagram, we need following procedure below:

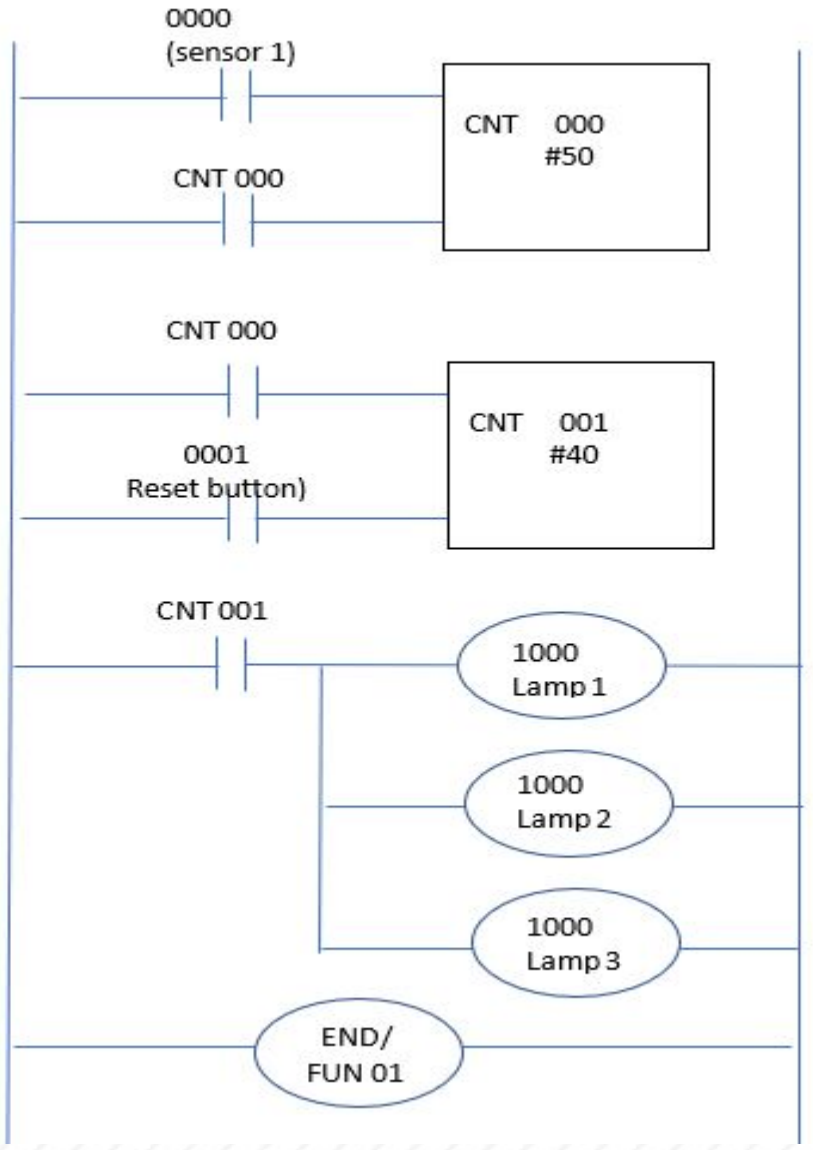
  i. number of multiply 20000

  50 x 400 =20000 (we need 2 CNT , each set value is #50 dan #400)

  40 x 500 =20000 (we need 2 CNT , each set value is #50 dan #400)

  2 x 20 x 500 =20000 (we need 2 CNT , each set value is #50 dan #400)

  ii. Choose any number from step (i) above.
- the ladder diagram as figure below:



CNT 000 will receive signal from sensor 1 and counting of 50.

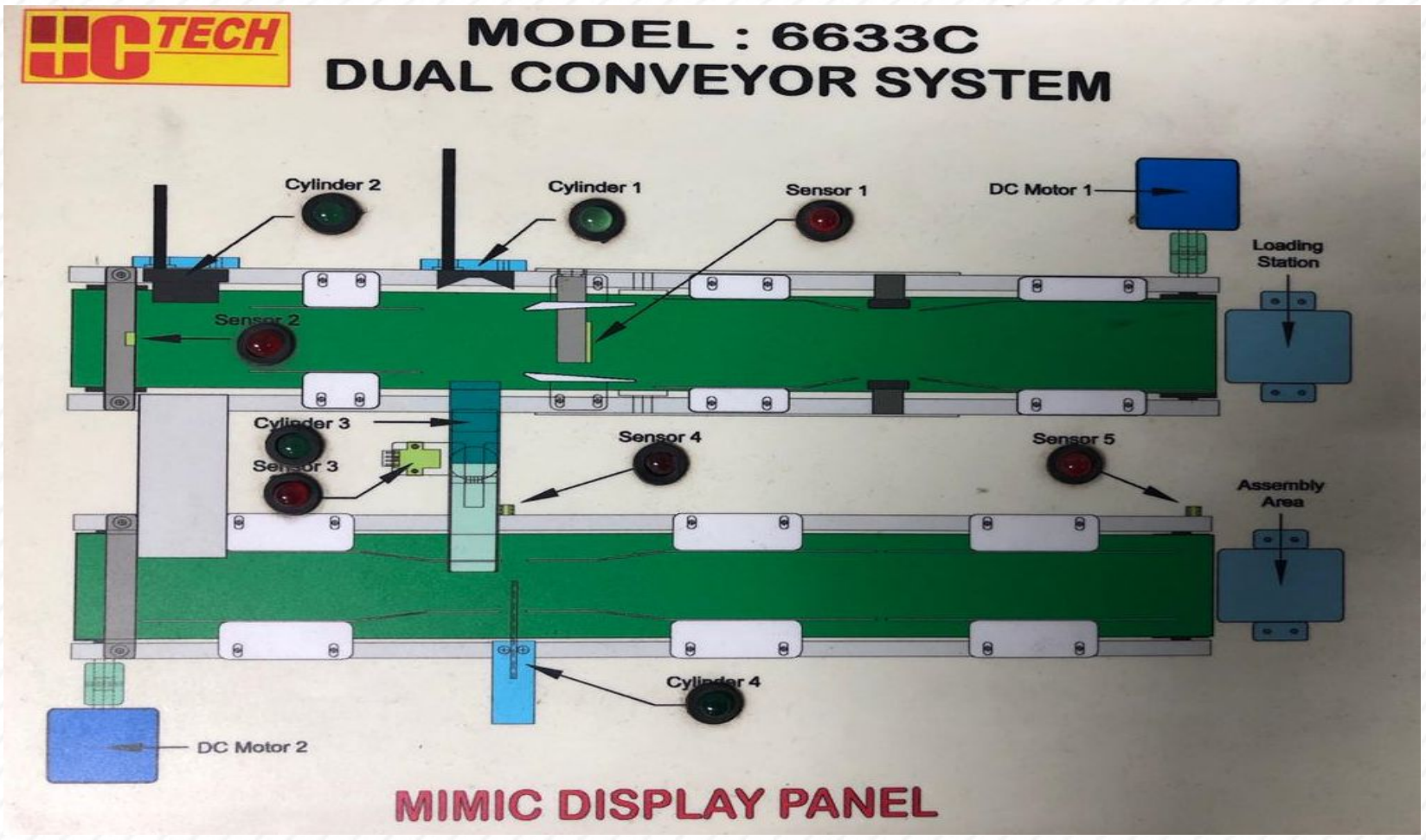
After that CNT 000 will active and transmit the signal to CNT 001. At the sometime, CNT 000 will reset automatically. The Process to receive signal from sensor 1 will repeat until count 20000.

CNT 001 will active to ON the Lamp 1, lamp 2 and lamp 3 after receive signal from CNT 000 for 40 times.

Lamp 1, lamp 2 and lamp 3 will ON after receive signal from CNT 001. The lamps will OFF after reset button are press.

Topic 5
Dual Conveyor System

5. DUAL SYSTEM CONVEYOR 1



Dual Conveyor System is an industrial control training system using application PLC. This conveyor system can implement a combination of timer and counter instruction.

This topic will discuss about the PLC Application in industry using Dual Conveyor System. This unit introduces student to example of writing PLC program like ladder diagram, mnemonic code and sequence function - basic instruction, Timer Instruction and Counter Instruction 4 is needed to help

S K I L L S

Student able to applied the skill

to construct the ladder diagram, mnemonic code

and run the Dual Conveyor System using PLC

instruction.

5. DUAL SYSTEM CONVEYOR 1

Preparation for Operation Dual Conveyor System - PLC application

STEP 1

Determine the machine sequence of operation

Firstly, you need to determine the sequence of operation machine equipment or process. The movement of the controlled system is constantly monitored by the input devices that give a specified condition and send a signal to the programmable controller. Then programmable controller output a signal to the external output devices which actually controls the movement of the controlled system.

STEP 2

Assignment of input and output device

Secondly all external input and output to be connected to the PLC. Assigned the data to the Input and Output devices you will using, this IMPORTANT because the actual wiring, ladder diagram will follow the data of PLC. ,

STEP 3

Writing the program and programming into memory

Create the ladder diagram to control the system
Write the mnemonic code
Enter the program in the memory either by programming conole or software tool.

STEP 4

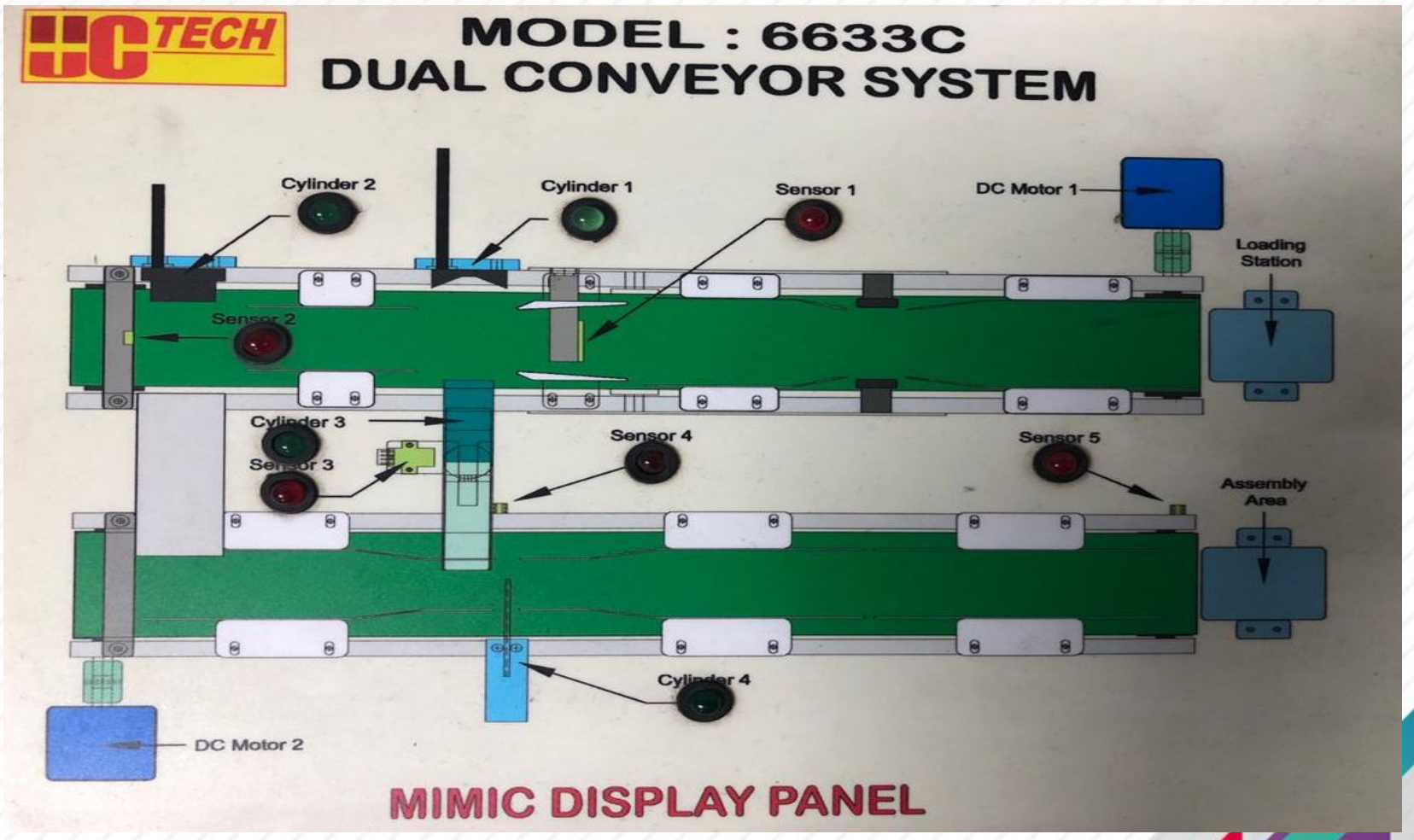
Run and Troubleshoot the system

Before test the program, thoroughly ensure that the input and output program are correctly connected according to the I/O assignment. Any error you can check the ladder diagram, mnemonic code, I?O data and I?O wiring.

5. DUAL SYSTEM CONVEYOR 1

List of Data Input Output Device Dual Conveyer System

Input	Data	Output	Data
Emergency Button	0000	Buzzer	1000
Start PB	0001	Cylinder 1	1002
Stop PB	0002	Cylinder 2	1003
Reset PB	0003	Cylinder 3	1004
Toggle Switch Run	0004	Cylinder 4	1005
Toggle Switch Conveyer 1	0005	Motor Conveyer 1	1006
Toggle Switch Conveyer 1	0006	Motor Conveyer 2	1007
Sensor 1	0007		
Sensor 2	0008		
Sensor 3	0009		
Sensor 4	00010		
Sensor 5	00011		



5. DUAL SYSTEM CONVEYOR 1

T U T O R I A L

Q U E S T I O N 1

Construct ladder diagram Dual Conveyer System using functional timer and counter instruction following sequence of operations:

Sequence 1:
i. Conveyor 1 will ON after Start Push Button are Press.
ii.After 10 seconds Conveyor 2 ON
iii. Conveyor 1 and Conveyor 2 will stop after Stop Push Button are press

S O L U T I O N

STEP 1
•• Determine the sequence of process

STEP 2
•• List input output device and data

STEP 3
•• write the ladder diagram and mnemonic code

**Run the program

5. DUAL SYSTEM CONVEYOR 1

S T E P 1

Determine the sequence operation

Note: List out sequence operation based on operation given

1. **Press Start Push Button, Motor conveyor 1 ON**
2. **After 10 seconds, Motor conveyor 2 ON**
3. **Press Stop Push Button, Motor conveyor 1 and motor conveyor 2 OFF**

S T E P 2

List input output device and data

Note: Refer the input output data Dual Conveyor System

Input Device	Data	Output Device	Data
Start Push Button	0001	Motor Conveeyor 1	1006
Stop Push Button	0002	Motor Conveyor 2	1007

S T E P 3

Write ladder diagram and mnemonic code based on step 1 and step 2

5. DUAL SYSTEM CONVEYOR 1

T U T O R I A L

Q U E S T I O N 2

Construct ladder diagram Dual Conveyer System using functional timer and counter instruction following sequence of operations:

Sequence 1:
i. Conveyor 1 will ON after Start Push Button are Press.
ii.After sensor 1 count 10 products Conveyor 2 ON
iii. Conveyor 1 and Conveyor 2 will stop after sensor 5 detect 10 products.
iv. Stop Push Button as a emergency button

S O L U T I O N

STEP 1
•• Determine the sequence of process

STEP 2
•• List input output device and data

STEP 3
•• write the ladder diagram and mnemonic code

5. DUAL SYSTEM CONVEYOR 1

S T E P 1

Determine the sequence operation

Note: List out sequence operation based on operation given

1. **Press Start Push Button, Motor conveyor 1 ON**
2. **After ensor 1 detect 10 products Motor conveyor 2 ON**
3. **After sensor 5 detect 5 products, Motor conveyor 1 and motor conveyor 2 OFF**

S T E P 2

List input output device and data

Note: Refer the input output data Dual Conveyor System

Input Device	Data	Output Device	Data
Start Push Button	0001	Motor Conveeyor 1	1006
Stop Push Button	0002	Motor Conveyor 2	1007
Sensor 1	0007		
Sensor 5	0011		

S T E P 3

Write ladder diagram and mnemonic code based on step 1 and step 2

5. DUAL SYSTEM CONVEYOR 1

T U T O R I A L

Q U E S T I O N 3

Construct ladder diagram Dual Conveyer System using functional timer and counter instruction following sequence of operations:

Sequence 1:
i. Conveyor 1 will ON after Start Push Button are Press.
ii. Conveyor 2 will On after 10 seconds Conveyor 1 ON
iii. Sensor 5 will count 50 product
iv. After that the buzzer will ON, Conveyor 1 and Conveyor 2 will OFF automatically
iv. Stop Push Button use to stop the buzzer

S O L U T I O N

STEP 1
•• Determine the sequence of process

STEP 2
•• List input output device and data

STEP 3
•• write the ladder diagram and mnemonic code

5. DUAL SYSTEM CONVEYOR 1

S T E P 1

Determine the sequence operation

Note: List out sequence operation based on operation given

1. **Press Start Push Button, Motor conveyor 1 ON**
2. **After 10 seconds Motor conveyor 2 ON**
3. **After sensor 5 detect 50 products, Motor conveyor 1 and motor conveyor 2 OFF , Buzzer will ON**
4. **Press stop push button to stop the buzzer**

S T E P 2

List input output device and data

Note: Refer the input output data Dual Conveyor System

Input Device	Data	Output Device	Data
Start Push Button	0001	Motor Conveeyor 1	1006
Stop Push Button	0002	Motor Conveyor 2	1007
Sensor 5	0011		

S T E P 3

Write ladder diagram and mnemonic code based on step 1 and step 2

Topic 6

INSTALLING, MAINTENANCE AND TROUBLESHOOTING OF PLC

6.0 INSTALLING, MAINTENANCE AND TROUBLESHOOTING OF PLC

Installation Technique

i. Site Installation Condition Consideration.

- To reduce damage to the automation control systems, serious
- consideration should be given to the following during PLC installation and wiring :
- Avoid installing PLC at places that has:
- Direct exposure to sunlight.
- Environment temperature exceeds range of 0°C to 55°C.
- Relative humidity over range 10% to 90% RH.
- Condensation occur due to sudden temperature change.
- Contains flammable and poisonous gases .
- Contains water, oil, chemical dust.
- Vibration occurs easily.

ii. Panel/Cabinet Installation Consideration.

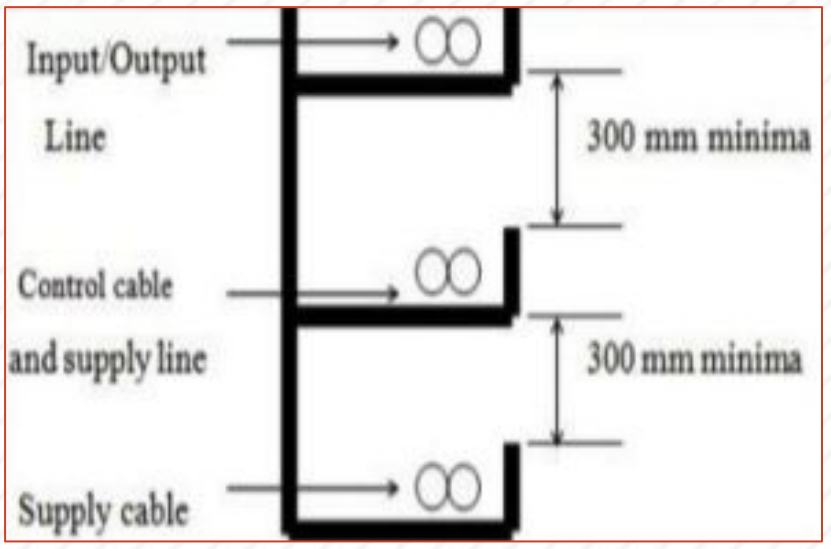
- Install the PLC in the panel / cabinet with the following characteristics
- Enough space for air circulation.
- Cooling fan.
- Device that produces heat is place under the PLC.
- Not containing high voltage equipment.
- Power line situated approximately 200 mm from the PLC
- For safety requirement all PLC must be installed with some distance from
- higher voltage source.
- All panel must be grounded

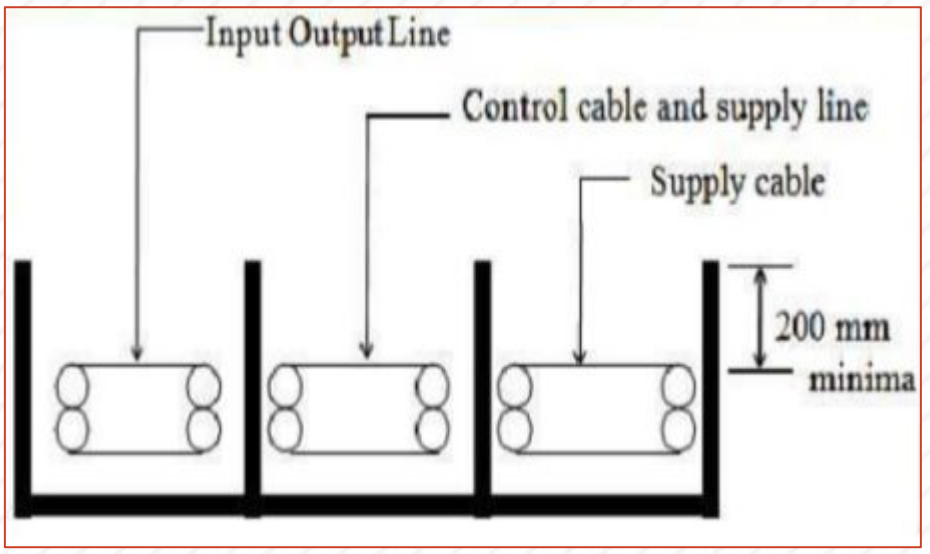
Petruzella, F.D.(2017)

6.0 INSTALLING, MAINTENANCE AND TROUBLESHOOTING OF PLC

Types of wiring method

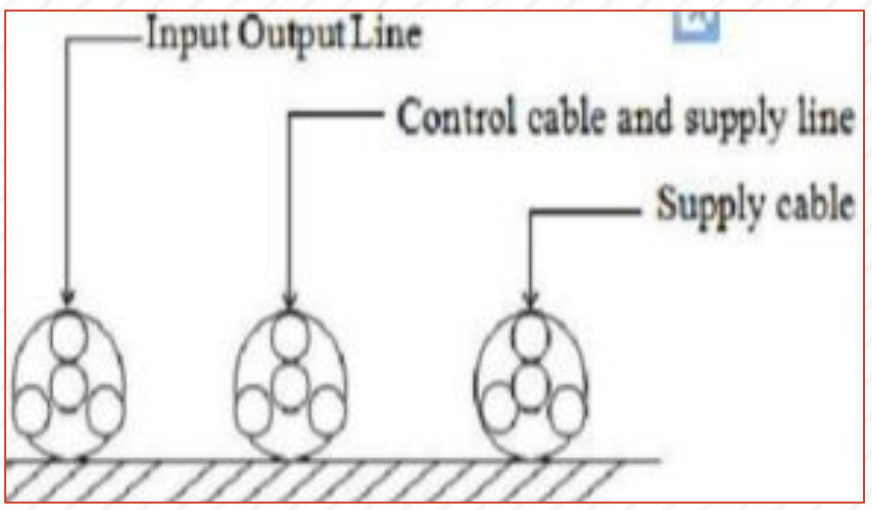
1.Handing Ducts Wiring Method





2. Floor Ducts Wiring Method

3. Conduit Wiring Method



6.0 INSTALLING, MAINTENANCE AND TROUBLESHOOTING OF PLC

WIRING PRECAUTION CONSIDERATION

Follows the wiring instructions as shown below:

- Use the cable as short as possible.
- Use a single line and do not connect between cables to extend it. Avoid making sharp curve on the cable.
- Distance control system space and control wiring from high energy wiring.
- Separate input wiring, output wiring and other types of wiring.
- Separate AC and DC wiring.
- Establish a good grounding for all components.
- Ensure the wire is the correct gauge and have proper size to handle the maximum possible current.
- Each field wire and its termination point should be labeled using a reliable labeling method.
- Use wire bundling technique to simplify the connections to each I/O module. Input, power, and output bundles carrying the same type of signals should be kept in separate ducts, when possible, to avoid interference.

6.0 INSTALLING, MAINTENANCE AND TROUBLESHOOTING OF PLC

PLC maintenance and troubleshooting methods.

PLC EXTERNAL FAULTS

i. Input/output equipment damage (sensors and actuator)

- 60% - 80% damage in the automation control system usually occurs due to the input and output devices faulty.
- The possibility of this damage is caused by:
  a. Sensor in the cylinder vary from the original position.
  b. Sensor internal contact failure damage.
  c. Sensor burns due to over current.
  d. Motor coil or solenoid valve burns due to over
  e. current

ii. Wiring Damage

Likey aused by:

- Conductor in the cable disconnected/fault.
- Loosen screw; at input and output terminals.
- Conductor oxidized

iii. Communication connection Damage

Can be caused by:

- Conductor in the communication cable disconnected/fault. Terminal connection
- pin bent or broken.
- Loose pin connection.
- Interference occur in the communication cable caused by motor, coil, high voltage, sloppy soldering.
- Short circuit occurs between conductors in the communication cable

iv.Power Supply Failure

- Power failure occurred in the automation control system when the supply voltage dropped below 85% of the rated value.
- This situation will cause the PLC to stop immediately.

PLC INTERNAL FAULTS

Can be caused by:

- Relay or transistor in the PLC unit/output module burn.
- Optocoupler at the unit/input module not working.
- Fuse burnt .
- Weak storage battery.
- Micro-electronic component (microprocessor, RAM, ROM) burnt.
- Programming error

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Pessen, D.W.(2011). Industrial Automation: Circuit Design and Components Singapore:John Wiley & Sons

Sulaiman Subari (2020). Programmable Logic Control (PLC). Politeknik Port Dickson

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