

# Module - III



"Programmable Logic Controllers"

(PLC)

① Dengi y  
Robul PSD  
Spamer-1  
anj OAMP,5

② Ex. 10.11  
PP 504

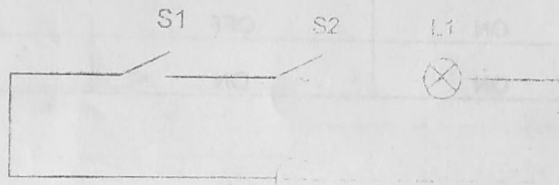
# PLC PROGRAMMING & APPLICATION

## EXERCISE - 1

### The Task

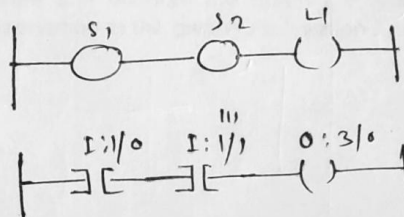
- ❖ Lamp should glow when both the switches S1 and S2 are ON.
- ❖ Lamp should not glow if any one of the switches is Off.

### Logic Circuit



### Procedure

1. Select switch at address I:1/0 as switch S1.
2. Select switch at address I:1/1 as switch S2.
3. Assign output to Output Module at address O:3/0.
4. Write program in LADDER representation.
5. Operate above mentioned switches and observe the output i.e. status of LED at address O:3/0. Tabulate your observation in the given Observation Table.

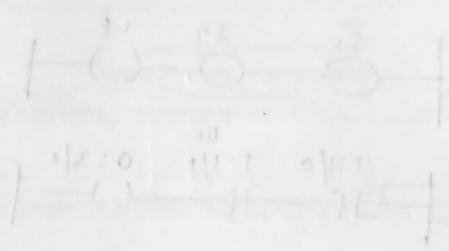


# PLC PROGRAMMING & APPLICATION

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**Observation Table 1**

S. NO	INPUT SWITCH POSITION		OUTPUT O:3/0 LAMP (ON/OFF)
	SWITCH S1 (I:1/0)	SWITCH S2 (I:1/1)	
01.	OFF	OFF	OFF
02	OFF	ON	OFF
03	ON	OFF	OFF
04	ON	ON	ON

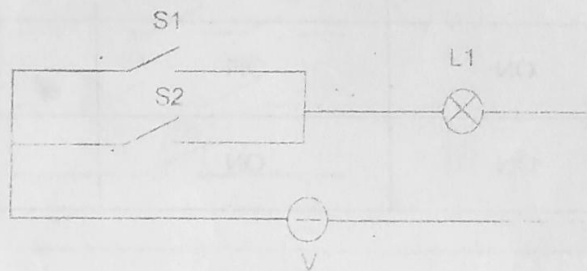


EXERCISE - 2

The Task

- ⊗ Lamp should not glow when both the switches S1 and S2 are OFF.
- ⊗ Lamp should glow if any one of the switches is ON.

Logic Circuit



Procedure

1. Select switch at address I:1/0 as switch S1.
2. Select switch at address I:1/1 as switch S2.
3. Assign output to Output Module at address O:3/0.
4. Write program in LADDER.
5. Operate above mentioned switches and observe the output i.e. status of LED at address O:3/0. Tabulate your observation in the given Observation Table 1.

# PLC PROGRAMMING & APPLICATION

Observation Table 1

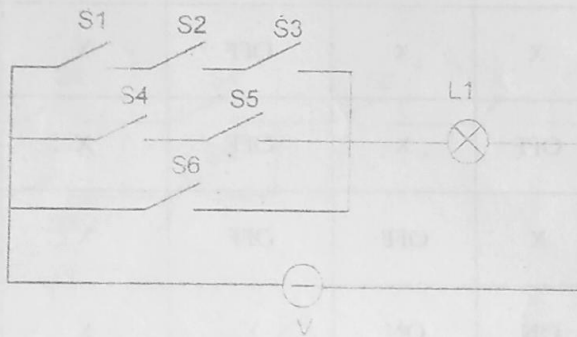
S. NO	INPUT SWITCH POSITION		OUTPUT O:3/0 LAMP ON/OFF
	SWITCH S1 (I:1/0)	SWITCH S2 (I:1/1)	
01.	OFF	OFF	OFF
02	OFF	ON	ON
03	ON	OFF	ON
04	ON	ON	ON

EXERCISE - 3

The Task

- ⊗ Lamp should glow only if switch (S1 AND S2 AND S3) OR (S4 AND S5) OR (S6) are ON.
- ⊗ Lamp should not glow if switch (S1 OR S2 OR S3) AND ( S4 OR S5) AND S6 are OFF.

Logic Circuit



Procedure

1. Select switch at address I/0, I/1, I/2, I/3, I/4, I/5 as switch S1, S2, S3, S4, S5 and S6 respectively.
2. Assign output to Output Module at address O:3/0.
3. Write program in LADDER.
4. Operate above mentioned switches and observe the output i.e. status of LED at address O:3/0. Tabulate your observation in the given Observation Table.

## PLC PROGRAMMING & APPLICATION

**Observation Table**

SR. NO.	INPUT SWITCH POSITION						OUTPUT (O:3/0) LAMP ON/OFF
	S1 (I:1/0)	S2 (I:1/1)	S3 (I:1/2)	S4 (I:1/3)	S5 (I:1/4)	S6 (I:1/5)	
01	OFF	OFF	OFF	OFF	OFF	OFF	OFF
02	X	X	X	X	X	ON	ON
03	OFF	X	X	OFF	X	OFF	OFF
04	X	OFF	X	OFF	X	OFF	OFF
05	X	X	OFF	OFF	X	OFF	OFF
06	ON	ON	ON	X	X	X	ON
07	OFF	OFF	OFF	OFF	X	OFF	OFF
08	OFF	OFF	OFF	X	OFF	OFF	OFF
09	OFF	OFF	OFF	ON	ON	OFF	ON

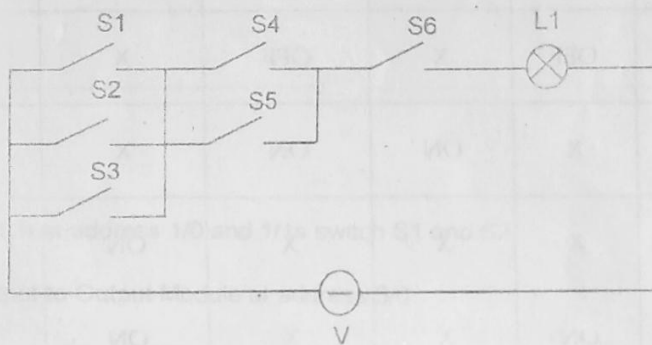
X = DON'T CARE CONDITON

EXERCISE - 4

The Task

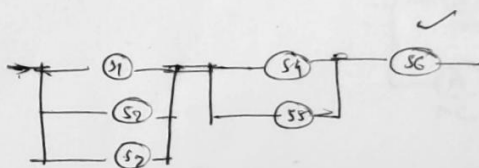
- ❖ Lamp should glow only if Switches (S1 OR S2 OR S3) AND (S4 OR S5) AND (S6) are ON.
- ❖ Lamp should not glow if switches (S1 AND S2 AND S3) OR (S4 AND S5) AND (S6) are OFF.

Logic Circuit



Procedure

1. Select switch at address I/0, I/1, I/2, I/3, I/4 and I/5 as switch S1, S2, S3, S4, S5 and S6 respectively.
2. Assign output to Output Module at address O:3/0 .
3. Write program in LADDER.
4. Operate above mentioned switches and observe the output i.e. status of LED at address O:3/0. Tabulate your observation in the given Observation Table.

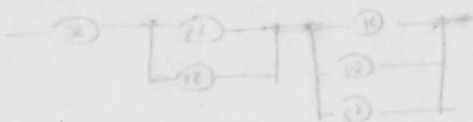


# PLC PROGRAMMING & APPLICATION

Observation Table

SR. NO.	INPUT SWITCH POSITION						OUTPUT (O:3/0) LAMP ON/OFF
	S1 (I:1/0)	S2 (I:1/1)	S3 (I:1/2)	S4 (I:1/3)	S5 (I:1/4)	S6 (I:1/5)	
01	OFF	OFF	OFF	OFF	OFF	OFF	OFF
02	X	X	X	X	X	OFF	OFF
03	ON	X	X	ON	X	ON	ON
04	X	OFF	X	OFF	X	OFF	OFF
05	X	X	ON	ON	X	ON	ON
06	ON	X	X	X	ON	ON	ON
07	X	ON	X	X	ON	ON	ON
08	X	X	ON	X	ON	ON	ON

X = DON'T CARE CONDITION



# PLC PROGRAMMING & APPLICATION

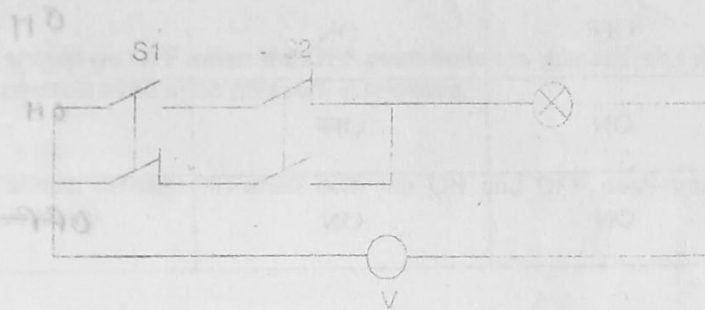
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## EXERCISE - 5

### The Task

- ☉ Lamp should glow only if any one switch i.e. S1 or S2 is ON.
- ☉ Lamp should not glow if both switches S1 and S2 are ON or OFF.

### Logic Circuit



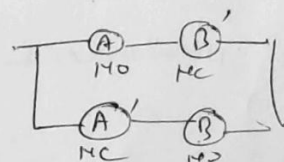
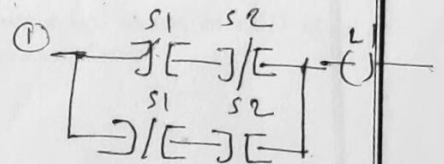
### Procedure

1. Select switch at address 1/0 and 1/1s switch S1 and S2.
2. Assign output to Output Module at address 3/0
3. Write program in LADDER.
4. Program in all the three methods of representation is given on the following page for your guidance.
5. Operate above mentioned switches and observe the output i.e. status of LED at address 3/0. Tabulate your observation in the given Observation Table 1.

$$A \oplus B$$

$$= AB' + A'B$$

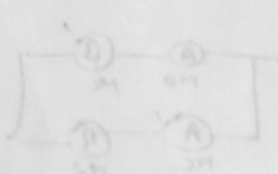
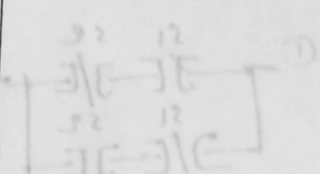
↓     ↓  
 opn   clse  
 clse   opn



# PLC PROGRAMMING & APPLICATION

Observation Table 1

S. NO	INPUT SWITCH POSITION		OUTPUT O:3/0) LAMP ON/OFF
	SWITCH S1 (I:1/0)	SWITCH S2 (I:1/1)	
01.	OFF	OFF	OFF
02	OFF	ON	ON
03	ON	OFF	ON
04	ON	ON	OFF



$$I1/0 + I1/1 = O3/0$$

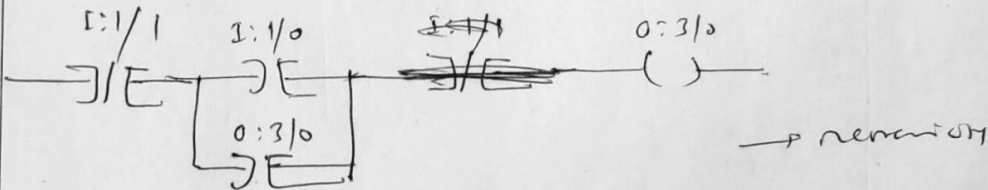
EXERCISE - 6

The Task

- ❖ Lamp should glow when ON push-button is pressed and it should remain in ON condition even if push-button is released.
- ❖ Lamp should go OFF when the OFF push-button is pressed and it should remain in OFF condition even when pressure is released.
- ❖ Lamp should remain OFF when both the ON and OFF push-buttons are pressed simultaneously.

Procedure

1. Select switch at address 1/0 as ON switch.
2. Select switch at address 1/1 as OFF switch.
3. Assign output to Output Module at address 3/0 .
4. Write program in LADDER.
5. Operate above mentioned switches and observe the output i.e. status of LED at address 3/0. Tabulate your observation in the given Observation Table.

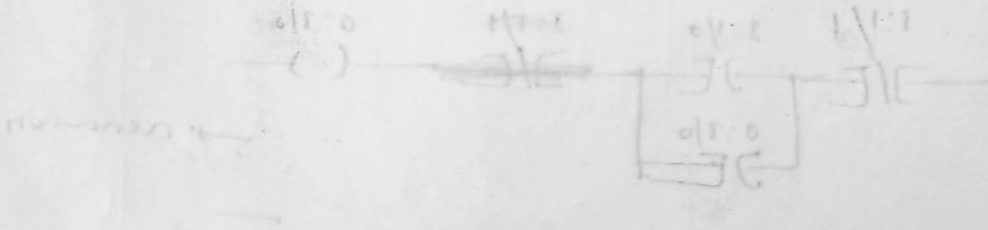


## PLC PROGRAMMING & APPLICATION

### Observation Table

When experimenting, follow the sequence given below.

S. NO	INPUT SWITCH POSITION		OUTPUT O:3/0 LAMP ON/OFF
	SWITCH S1 (I:1/0)	SWITCH S2 (I:1/1)	
01.	OFF	OFF	OFF
02	ON	OFF	ON
03	OFF	OFF	ON
04	OFF	ON	OFF
05	ON	ON	OFF
06	OFF	ON	OFF
07	OFF	OFF	OFF



# PLC PROGRAMMING & APPLICATION

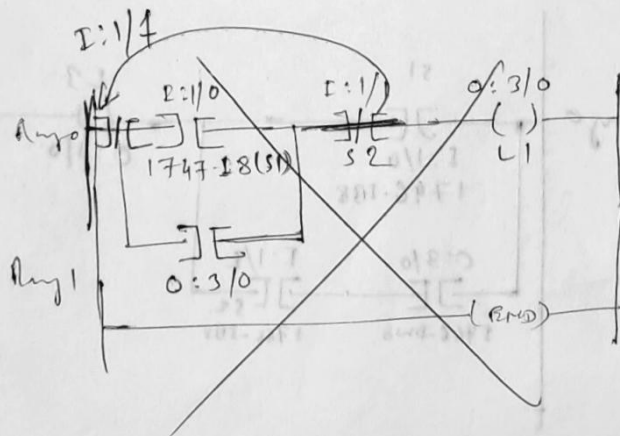
## EXERCISE - 7

### The Task

- ❖ Lamp should glow when ON push-button is pressed and it should remain in ON condition even if pressure on the push button is released.
- ❖ Lamp should go OFF when the OFF push-button is pressed and it should remain in OFF condition even when pressure on the push button is released.
- ❖ Lamp should remain in ON condition when both the ON and OFF push buttons are pressed simultaneously.

### Procedure

1. Select switch at address 1/0 as ON switch.
2. Select switch at address 1/1 as OFF switch.
3. Assign output to Output Module at address 3/0 .
4. Write program in LADDER
5. Operate above mentioned switches and observe the output i.e. status of LED at address 3/0 Tabulate your observations in the given Observation Table.

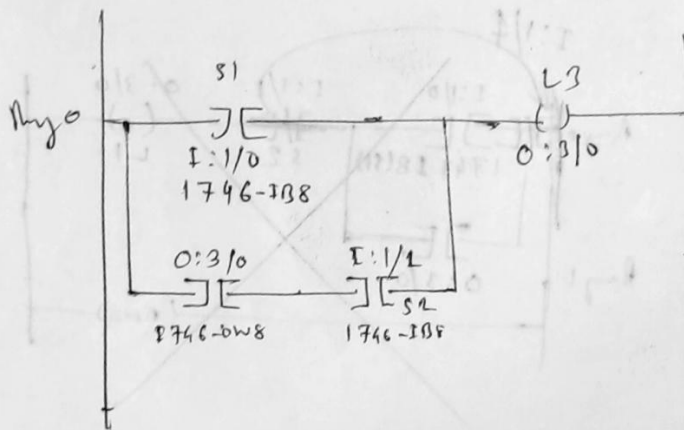


## PLC PROGRAMMING & APPLICATION

### Observation Table

When experimenting, follow the sequence given below.

S. NO	INPUT SWITCH POSITION		OUTPUT O:3/0 LAMP ON/OFF
	SWITCH S1 (I:1/0)	SWITCH S2 (I:1/1)	
01.	OFF	OFF	
02	ON	OFF	
03	OFF	OFF	
04	OFF	ON	ON
05	ON	ON	ON
06	ON	OFF	ON
07	OFF	OFF	ON



# PLC PROGRAMMING & APPLICATION

## EXERCISE - 8

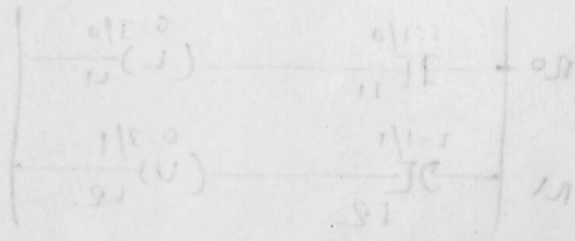
latching  
Latching  
Latch &  
unlatching coils

### The Task

- ☉ Lamp should glow when the Set switch is made ON and it should remain in glowing condition even when the Set switch is made OFF.
- ☉ Lamp should go off when the Reset switch is made ON and it should remain in off condition even when the Reset switch is made OFF.
- ☉ Lamp shouldn't glow when both the Set and Reset switches are made ON simultaneously.

### Procedure

1. Select switch at address 1/0 as Set switch.
2. Select switch at address 1/1 as Reset switch.
3. Assign output to Output Module at address 3/0.
4. Write program in LADDER.
5. Operate above mentioned switches and observe the output i.e. status of LED at address 3/0. Tabulate your observation in the given Observation Table.

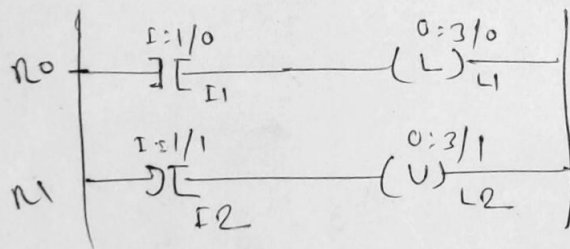


## PLC PROGRAMMING & APPLICATION

### Observation Table

When experimenting, follow the sequence given below.

S. NO	INPUT SWITCH POSITION		OUTPUT O:3/0 LAMP ON/OFF
	SWITCH S1 (I:1/0)	SWITCH S2 (I:1/1)	
01.	OFF	OFF	OFF
02	ON	OFF	ON
03	OFF	OFF	ON
04	OFF	ON	OFF
05	OFF	OFF	OFF
06	ON	ON	OFF
07	OFF	OFF	OFF



# PLC PROGRAMMING & APPLICATION

EX-9

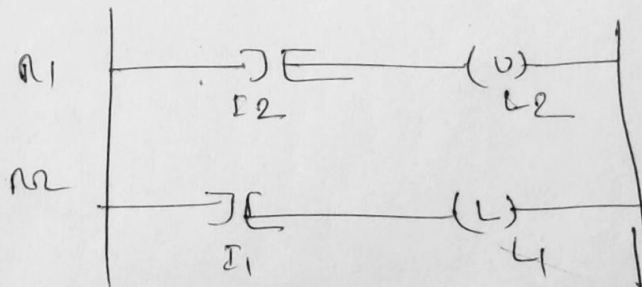
## EXERCISE - 9

### The Task

- ❖ Lamp should glow when the Set switch is made ON and it should remain in glowing condition even when the Set switch is made OFF.
- ❖ Lamp should go off when the Reset switch is made ON and it should remain in off condition even when the Reset switch is made OFF.
- ❖ Lamp should glow when both the Set and Reset switches are made ON simultaneously.

### Procedure

1. Select switch at address I:1/0 as Set switch.
2. Select switch at address I:1/1 as Reset switch.
3. Assign output to Output Module at address O:3/0.
4. Write program in all the LADDER representation.
5. Operate above mentioned switches and observe the output i.e. status of LED at address O:3/0. Tabulate your observations in the given Observation Table.

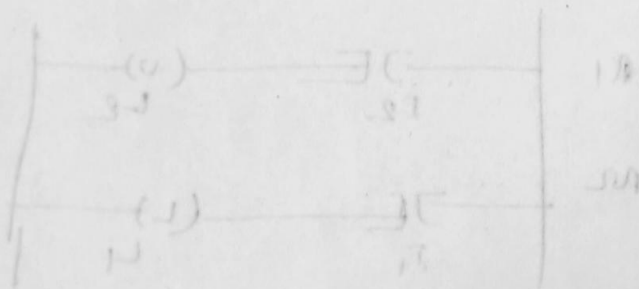


## PLC PROGRAMMING & APPLICATION

### Observation Table

When experimenting, follow the sequence given below.

S. NO	INPUT SWITCH POSITION		OUTPUT O:3/0 LAMP ON/OFF
	SWITCH S1 (I:1/0)	SWITCH S2 (I:1/1)	
01.	OFF	OFF	OFF
02	ON	OFF	ON
03	OFF	OFF	ON
04	OFF	ON	OFF
05	OFF	OFF	OFF
06	ON	ON	ON
07	OFF	OFF	ON



Priority 2/2

# PLC PROGRAMMING & APPLICATION

Ex-10

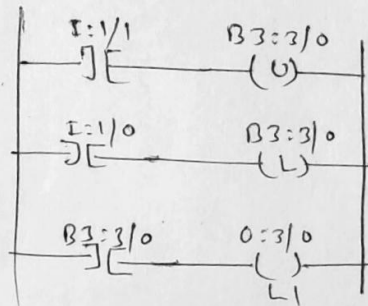
## EXERCISE - 10 (Set-Reset with Set priority and using Flag)

### The Task

- ❖ Lamp should glow when the Set switch is made ON and it should remain in glowing condition even when the Set switch is made OFF.
- ❖ Lamp should go off when the Reset switch is made ON and it should remain in off condition even when the Reset switch is made OFF.
- ❖ Lamp should glow when both the Set and Reset switches are made ON simultaneously.

### Procedure

1. Select switch at address I:1/0 as Set switch.
2. Select switch at address I:1/1 as Reset switch.
3. Assign output to Output Module at address O:3/0.
4. Write program in all the LADDER representation .
5. Operate above mentioned switches and observe the output i.e. status of LED at address O:3/0. Tabulate your observations in the given Observation Table.

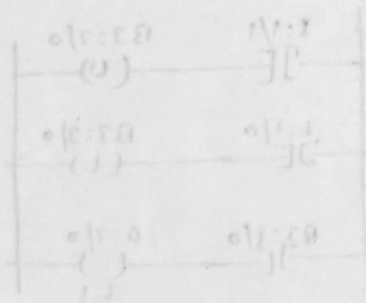


## PLC PROGRAMMING & APPLICATION

### Observation Table

When experimenting, follow the sequence given below.

S. NO	INPUT SWITCH POSITION		OUTPUT O:3/0 LAMP ON/OFF
	SWITCH S1 (I:1/0)	SWITCH S2 (I:1/1)	
01.	OFF	OFF	off
02	ON	OFF	on
03	OFF	OFF	off
04	OFF	ON	off
05	OFF	OFF	off
06	ON	ON	on
07	OFF	OFF	on



# PLC PROGRAMMING & APPLICATION

## EXERCISE - 11 (Set-Reset with Reset priority and using Flag)

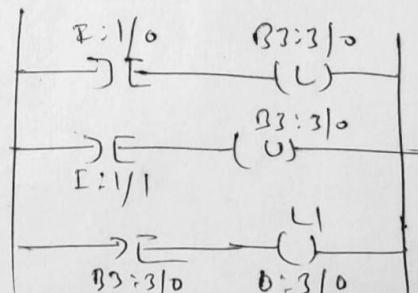
R27-11

### The Task

- Lamp should glow when the Set switch is made ON and it should remain in glowing condition even when the Set switch is made OFF.
- Lamp should go off when the Reset switch is made ON and it should remain in off condition even when the Reset switch is made OFF.
- Lamp shouldn't glow when both the Set and Reset switches are made ON simultaneously.

### Procedure

1. Select switch at address I:1/0 as Set switch.
2. Select switch at address I:1/1 as Reset switch.
3. Assign output to Output Module at address O:3/0.
4. Write program in all the three methods of representation .
5. Enter program in PC using programming unit in block OB1 in any one of the three methods of representation.
6. Operate above mentioned switches and observe the output i.e. status of LED at address O:3/0. Tabulate your observation in the given Observation Table.



## PLC PROGRAMMING & APPLICATION

### Observation Table

When experimenting, follow the sequence given below.

S. NO	INPUT SWITCH POSITION		OUTPUT Q2.0 LAMP ON/OFF
	SWITCH S1 (I0.0)	SWITCH S2 (I0.1)	
01.	OFF	OFF	off
02	ON	OFF	on
03	OFF	OFF	on
04	OFF	ON	off
05	OFF	OFF	off
06	ON	ON	off
07	OFF	OFF	off

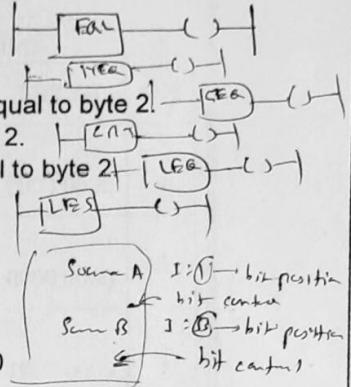
Compare command

## PLC PROGRAMMING & APPLICATION

### EXERCISE - 12

#### The Task

- o Lamp L1 should glow only if the byte 1 and 2 is equal.
- o Lamp L2 should glow only if the byte 1 and 2 is not equal.
- o Lamp L3 should glow only if the byte 1 is greater than or equal to byte 2.
- o Lamp L4 should glow only if the byte 1 is greater than byte 2.
- o Lamp L5 should glow only if the byte 1 is less than or equal to byte 2.
- o Lamp L6 should glow only if the byte 1 is less than byte 2.



#### Procedure :

1. Select switches at address 1/0 to 1/7 as input byte 1 i.e. I:1.0
2. Select switches at address 2/0 to 2/7 as input byte 2 i.e. I:2.0
3. Assign outputs to output module O:3.0
4. Write the program in Ladder.
5. Enter program in PC using programming unit in LADDER
6. Operate the above mentioned switches in the order given in the Observation Table and note the output i.e. the status of LEDs at the address 2.0 to 2.5 (S5), 4.0 TO 4.5 (S7)
7. Tabulate your observations in the given Observation Table.

## PLC PROGRAMMING & APPLICATION

**Observation Table**

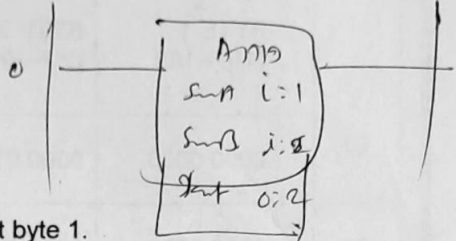
SR. NO	INPUTS		OUTPUTS (LED ON / OFF)						REMARKS
	BYTE 1	BYTE 2	O:3/0 =!	O:3/1 )	O:3/2 (>=)	O:3/3( )	O:3/4 (<=)	O:3/5 (<)	
1.	0000 0000	0000 0000							
2.	0000 0000	0000 0001							
3.	0000 0001	0000 0000							
4.	0110 0001	0110 0100							
5.	0110 0100	0110 0001							
6.	0110 0100	0110 0100							

# PLC PROGRAMMING & APPLICATION

## EXERCISE - 13

### The Task

- o Addition of byte 1 and 2



### Procedure

1. Select switches at address 1/0 to 1/7 as input byte 1.
2. Select switches at address 2/0 to 2/7 as input byte 2.
3. Assign outputs to output word 3.
4. Write program in LADDER
6. Operate the above mentioned switches in the order given in the Observation Table and note the output i.e. the status of LEDs at the address O:3/0 to 3/7
7. Tabulate your observations in the given Observation Table.

## PLC PROGRAMMING & APPLICATION

**Observation Table**

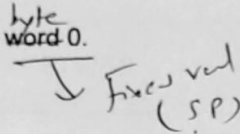
SR. NO	INPUTS		OUTPUTS
	BYTE 1 (1/7—1/0)	BYTE 2 (2/7—2/0)	(O:3.0) WORD 3 (3/7—3/0)
01.	0000 0000	0000 0101	0000 0101
02.	0001 0000 (16)	0011 1100 (60)	0100 1100 (76)
03.	0100 1111 (75)	0011 1110 (62)	<del>0101 0101</del> 1110 (101)
04.	0010 1101	1010 0011	<del>0101 0000</del> 0111 0000
05.	00111 1111	0000 1111	01000 1110

# PLC PROGRAMMING & APPLICATION

## EXERCISE - 14

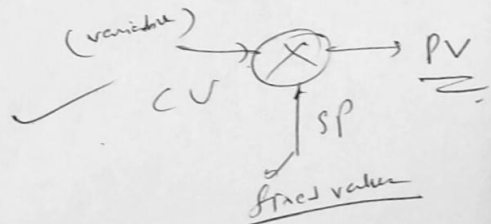
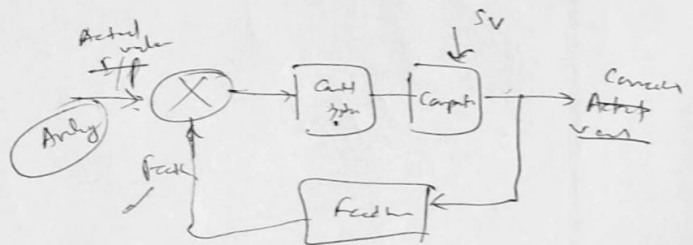
### The Task

- o Addition of fixed point number +00198 to word 0.



### Procedure

1. Select switches at address 1/0 to 1/7 as input word 1.
2. Assign outputs to output word 3 (i.e. LEDs at address 3/0 to 3/7).
3. Write the program in LADDER.
4. Operate the above mentioned switches in the order given in the Observation Table and note the output i.e. the status of LEDs at the address 3/0 to 3/5.
5. Tabulate your observations in the given Observation Table.



## PLC PROGRAMMING & APPLICATION

### Observation Table

Binary Form of +30298 = 1100 0110

SR. NO	INPUTS	OUTPUTS
	(I:1.0) Byte 1 (1/7—1/0)	(O:3.0) Byte 3 (3/7—3/0)
01.	0000 0000	
02.	0000 0100	
03.	0000 1111	
04.	0001 1101	
05.	0001 1111	

# PLC PROGRAMMING & APPLICATION

## EXERCISE - 14

### The Task

- Addition of fixed point number +00198 to word 0.

### Procedure

1. Select switches at address 1/0 to 1/7 as input word 1.
2. Assign outputs to output word 3 (i.e. LEDs at address 3/0 to 3/7 ).
3. Write the program in LADDER.
4. Operate the above mentioned switches in the order given in the Observation Table and note the output i.e. the status of LEDs at the address 3/0 to 3/5.
5. Tabulate your observations in the given Observation Table.

# Observation Table

Binary Form of +30298 = 1100 0110

SR. NO	INPUTS		OUTPUTS
	(I:1.0) Byte 1 (1/7—1/0)		(O:3.0) Byte 3 (3/7—3/0)
01.	0000 0000		
02.	0000 0100		
03.	0000 1111		
04.	0001 1101		
05.	0001 1111		

**CRISP**

Centre for Research & Industrial Staff Performance



# PLC PROGRAMMING & APPLICATION

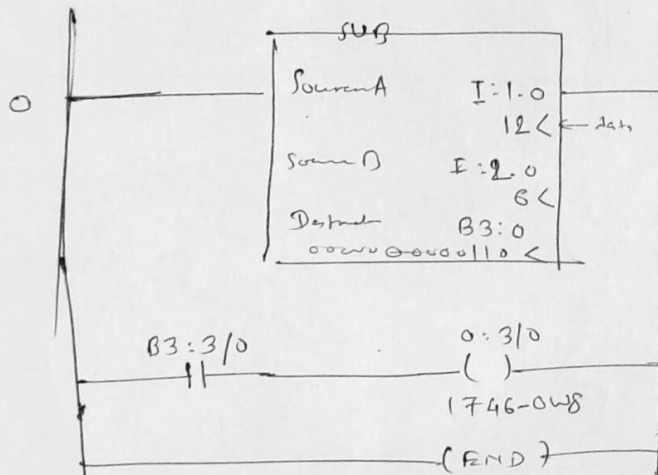
## EXERCISE - 15

### The Task

- o Subtract byte 1 from byte 2

### Procedure :

1. Select switches at address 1/0 to 1/7 as input byte 1.
2. Select switches at address 2/0 to 2/7 as input byte 2.
3. Assign outputs to output word 3.
4. Write program in LADDER.
5. Operate the above mentioned switches in the order given in the Observation Table and note the output i.e. the status of LEDs at the address 3/0 to 3/5.
6. Tabulate your observations in the given Observation Table.



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**Observation Table**

SR. NO.	INPUTS		OUTPUTS
	Byte 2 (2/7—2/0)	Byte 1 (1/7—1/0)	(I:3.0) Byte 3 (3/7—3/0)
01.	0101 0000	0011 1010	
02.	1111 1101	1010 0011	
03.	1010 0101	1010 0101	
04.	0011 1110	1100 1111	
05.	0111 1111	1111 0101	

## PLC PROGRAMMING & APPLICATION

### EXERCISE - 16

#### The Task

- Subtract fixed point number +0198 from word 1

#### Procedure

1. Select switches at address 1/0 to 1/7 as input word 1
2. Assign outputs to output word 3 (i.e. LEDs at address 3/0 to 3/7 ).
3. Write the program in LADDER
4. Operate the above mentioned switches in the order given in the Observation Table and note the output i.e. the status of LEDs at the address 2.0 to 2.5.
5. Tabulate your observations in the given Observation Table.

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### Observation Table

Binary Form of + 30298 = 1100 0110

SR. NO.	INPUTS		OUTPUTS
	(I:1.0) Word 1 (1/7 to 1/0)		(O:3.0) Byte 3 (3.7--3.0)
01.	1000 1001		
02.	1111 1101		
03.	0111 0110		
04.	0011 1110		
05.	0101 0000		

# PLC PROGRAMMING & APPLICATION

## EXERCISE - 17

Timer  
T0H

### The Task

- Lamp should glow when start switch S1 is made ON.
- Lamp should not remain in glowing condition longer than 15 sec.
- Lamp should go off immediately when start switch S1 is made off or reset switch S2 is made ON even before the expiry of 15 sec time.

### Procedure

1. Select switch at address 1/0 as start switch S1.
2. Select switch at address 1/1 as reset switch S2.
3. Assign output to O/P module at address 3/0.
4. For the above given task select appropriate timer function and timer no. 1.
5. Write program in LADDER.
7. Operate the above mentioned switches in the order given in the Observation Table and note the output i.e. the status of LED at the address 3/0.
8. Tabulate your observations in the given Observation Table.

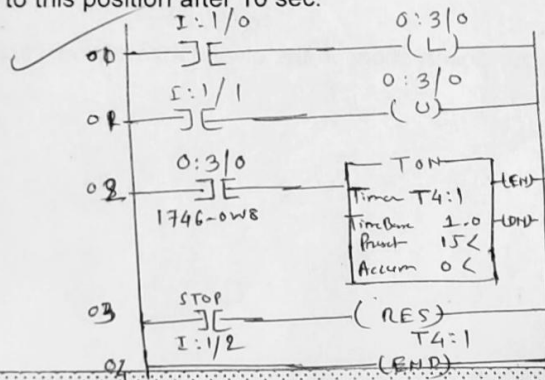
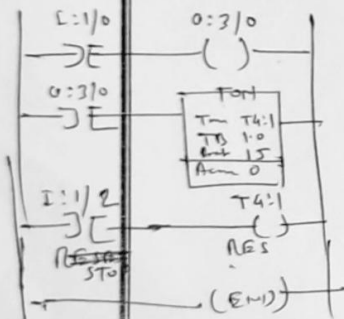
# PLC PROGRAMMING & APPLICATION

## Observation Table

When experimenting, follow the sequence given below.

SR. NO.	INPUT SWITCH POSITION		OUTPUT LAMP ON/OFF	REMARKS
	START SWITCH (I:1/0)	RESET SWITCH (I:1/2)		
01	OFF	OFF	off	
02	OFF	ON	off	
03	ON	ON	on	
04	ON	OFF	on	
05	OFF	OFF	off	
06	ON	OFF	on	
07	OFF	OFF	off	
08	ON/OFF*	OFF	off	
09	ON	ON*	on	

\* Bring switch to this position after 10 sec.



## EXERCISE - 21

### The Task

- o Lamp should glow immediately when start switch S1 is made ON and it should remain in glowing condition as long as start switch S1 is ON.
- o When start switch S1 is made OFF, lamp should go off after the delay of 25 sec.
- o Lamp should go OFF immediately when reset switch S2 is made ON.

### Procedure

1. Select switch at address I/0 as start switch S1.
2. Select switch at address I/1 as reset switch S2.
3. Assign output to Output Module at address O/0.
4. For the above given task select timer function as Off Delay Timer & timer no 1.
5. Write program in LADDER.
6. Operate the above mentioned switches and note the Output i.e. status of LED at address
7. Tabulate your observation in the given Observation Table.

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### Observation Table

When experimenting, follow the sequence given below.

SR. NO.	INPUT SWITCH POSITION		OUTPUT	REMARKS
	START SWITCH (I:1/0)	RESET SWITCH (I:1/1)	(O:3/0) LAMP ON/OFF	
01	OFF	OFF		
02	ON	OFF		
03	OFF	OFF		
04	ON	OFF		
05	ON	ON		
06#	OFF	OFF		
07	ON/OFF*/ON*	OFF		
08	ON	ON/OFF*/ON*		

\* - Bring switch to this position after 10 sec. delay

# - First operate start switch