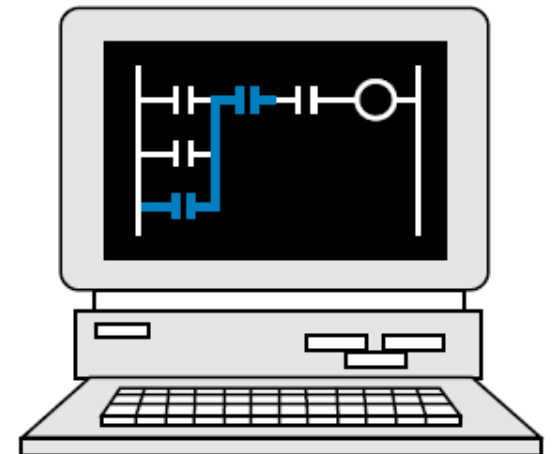


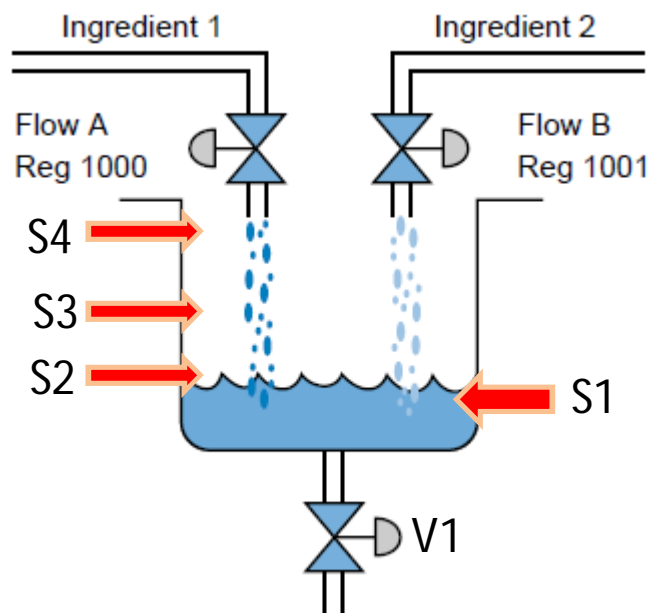
Teknik Otomasi

[PLC – Register & Fungsi Logika]

Eka Maulana, ST, MT, MEng.



Review Topik Sebelumnya

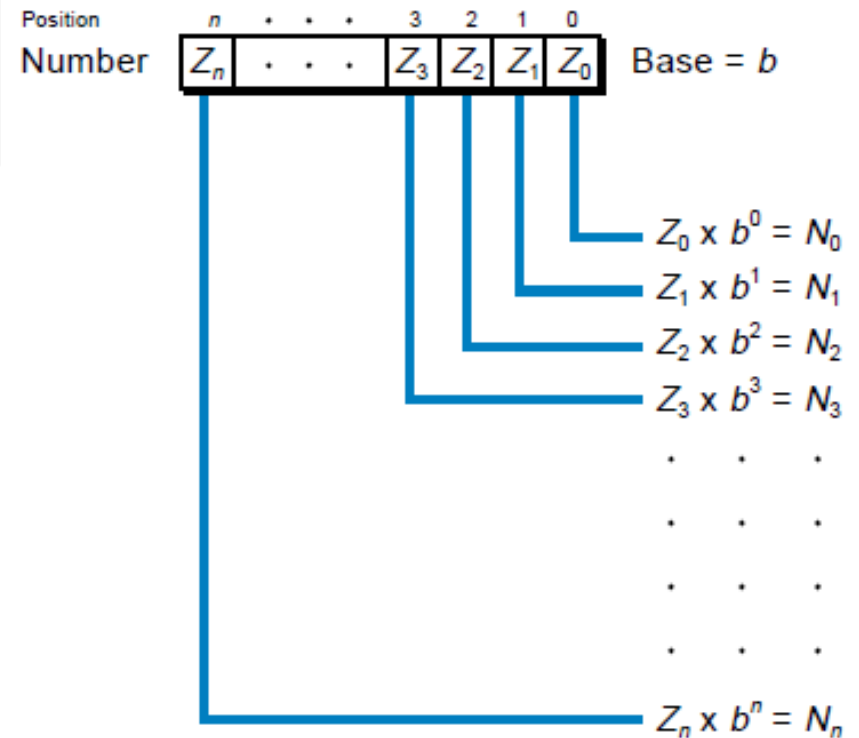
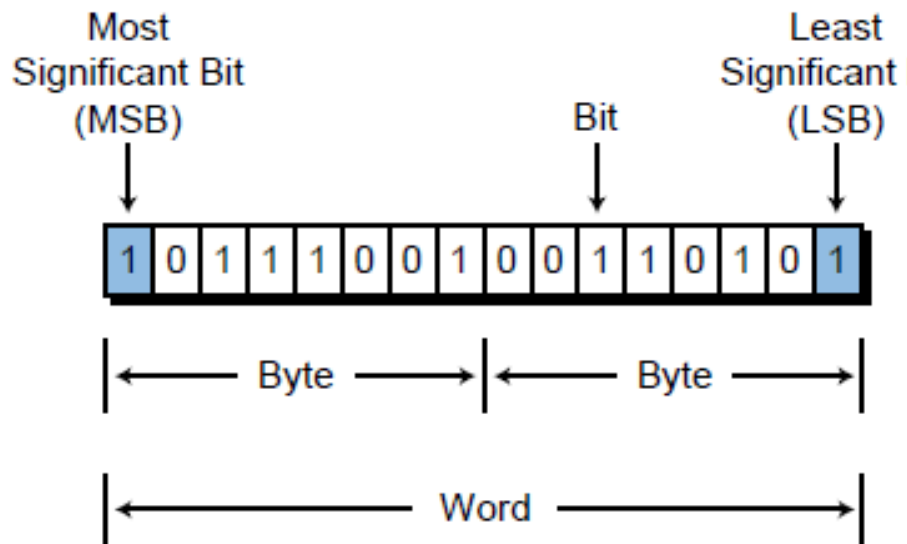


- Dalam bejana cairan kimia, Flow A akan mengalir jika cairan berada pada posisi S1 dan S2 hingga S3 aktif.
 - Flow B akan mengalir saat cairan melewati S3 hingga S4. Selanjutnya Valve V1 mengalir hingga cairan pada posisi S1-S2.
-

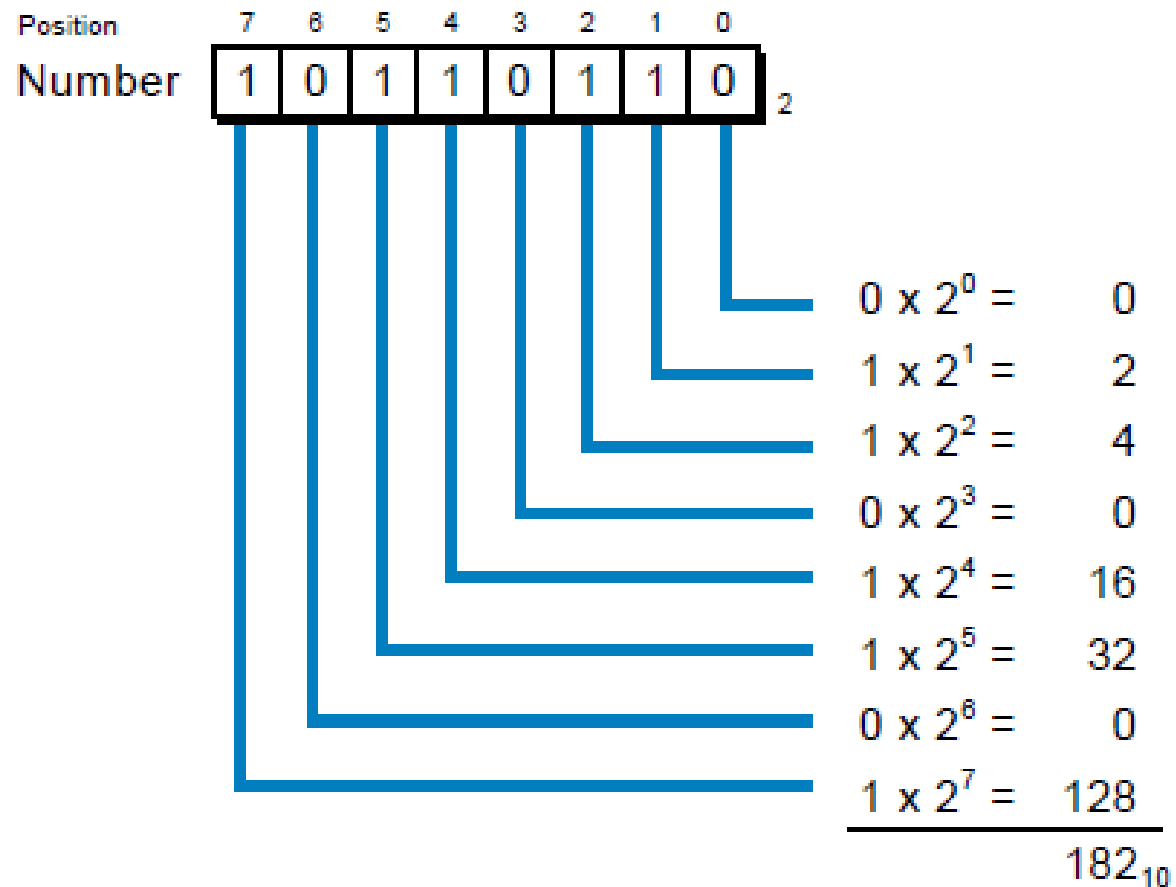
Topik

- Sistem Bilangan
 - Format Register
 - Gerbang Logika
 - Aljabar Boolean
 - Fungsi-Fungsi Khusus PLC
-

Sistem Bilangan



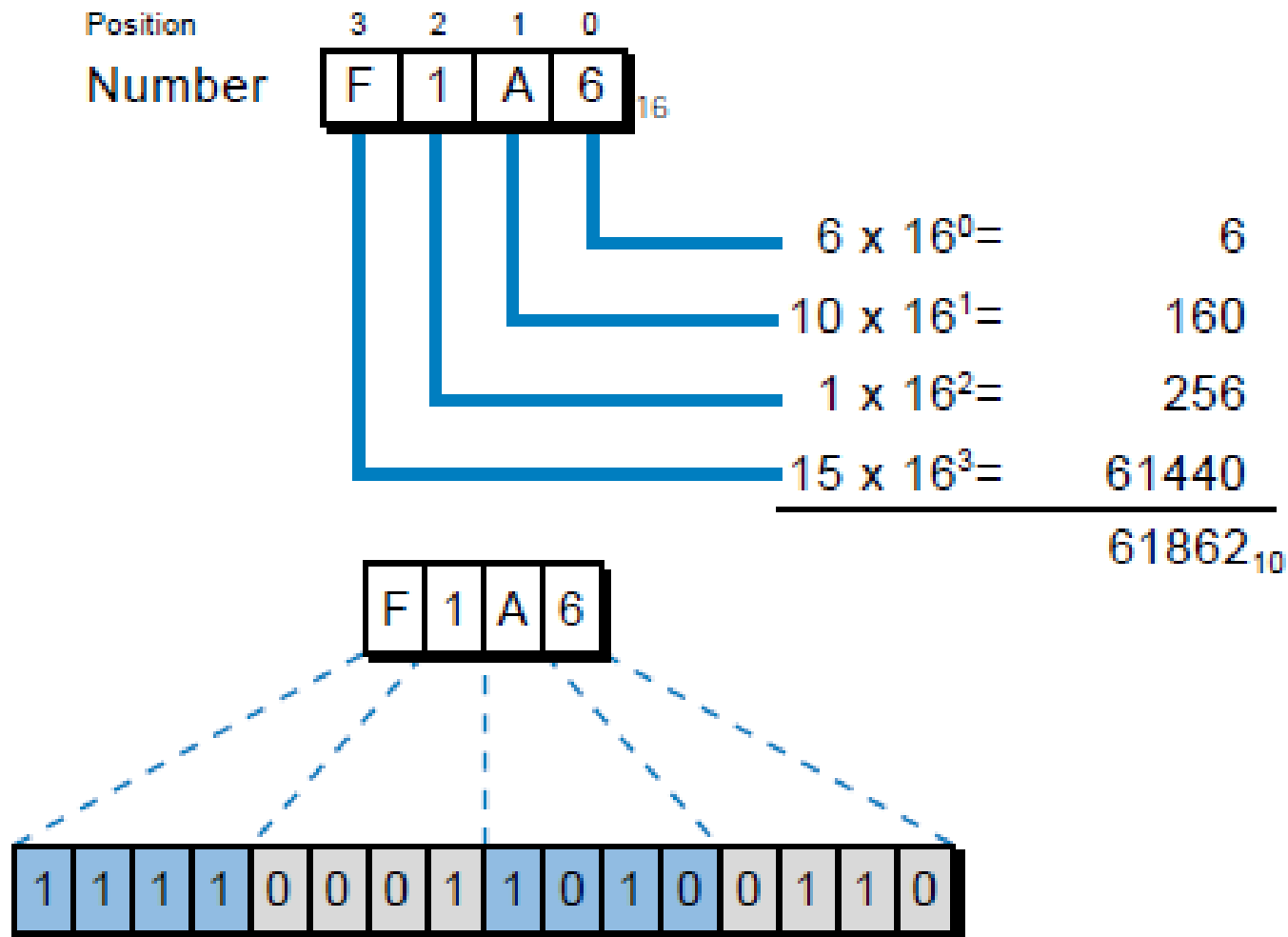
Sistem Biner



Sistem Biner pada PLC

1 (+V)	0 (0V)	Example
Operating	Not operating	Limit switch
Ringling	Not ringling	Bell
On	Off	Light bulb
Blowing	Silent	Horn
Running	Stopped	Motor
Engaged	Disengaged	Clutch
Closed	Open	Valve

Hexadecimal

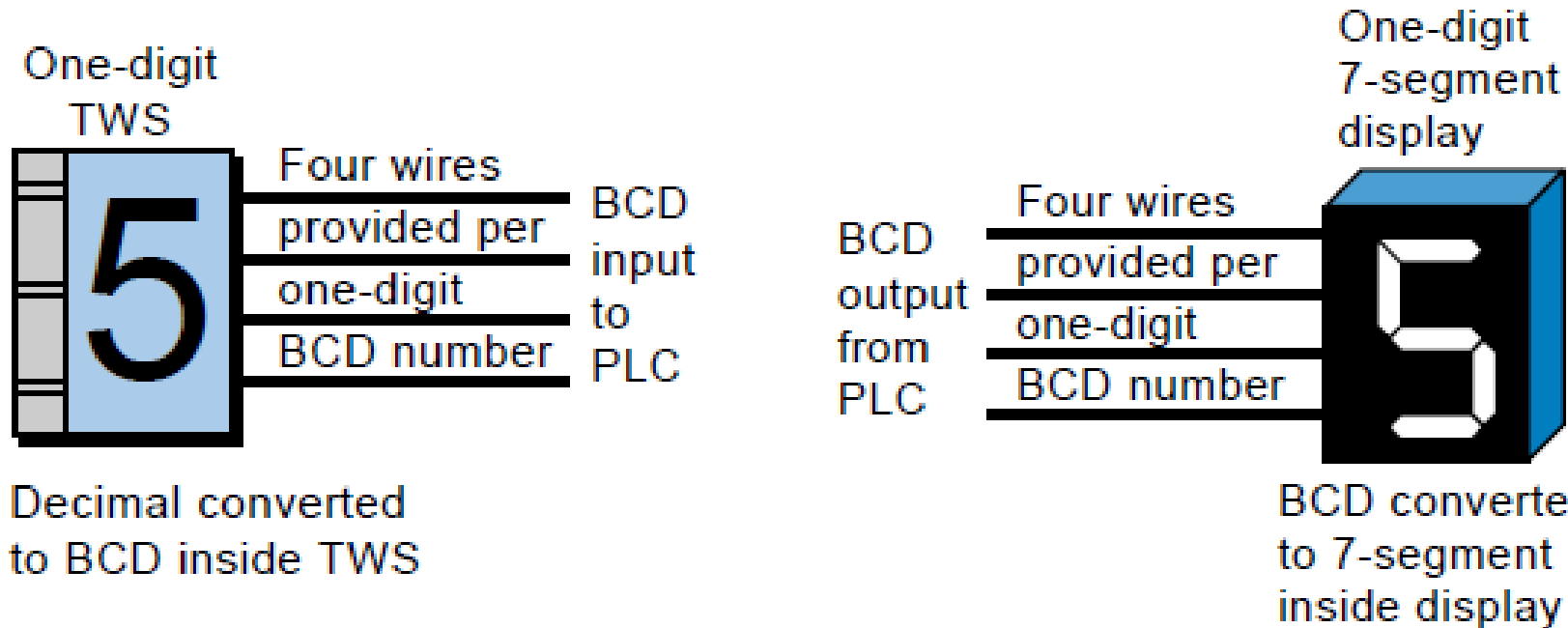


Binary Code Decimal

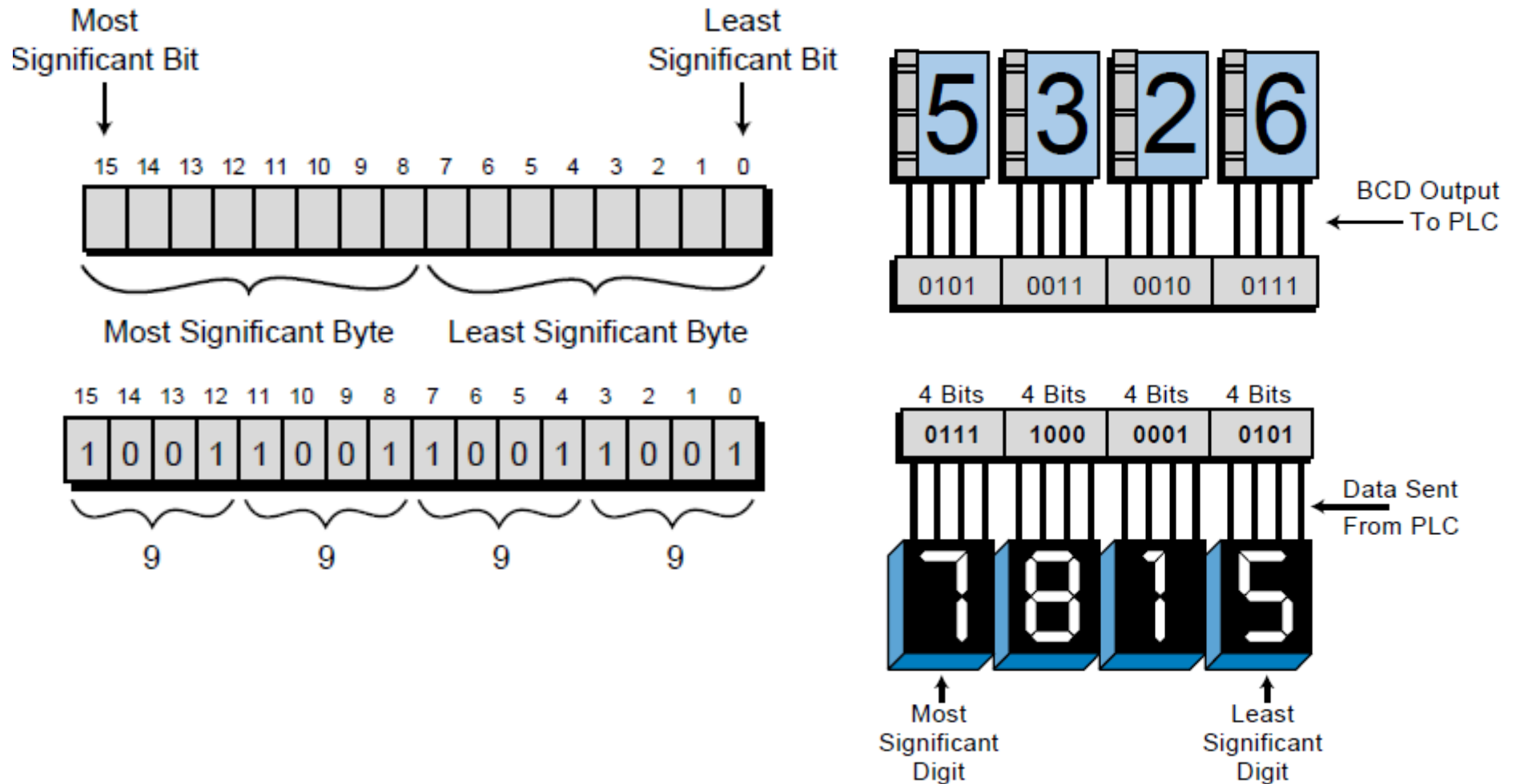
Decimal	Binary	BCD
0	0	0000
1	1	0001
2	10	0010
3	11	0011
4	100	0100
5	101	0101
6	110	0110
7	111	0111
8	1000	1000
9	1001	1001

BCD → 0111 0100 1001 0011
Decimal → 7 4 9 3

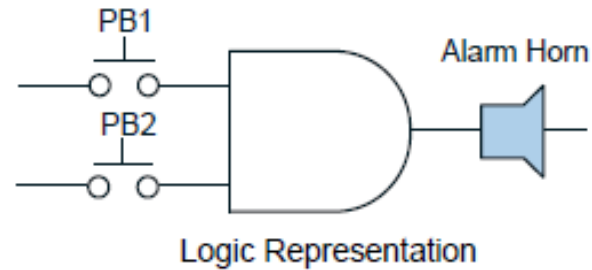
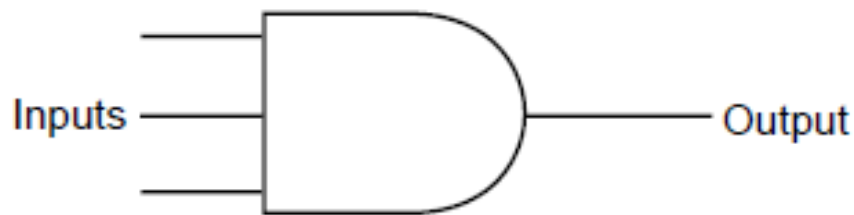
Input Output BCD pada PLC



Format Register

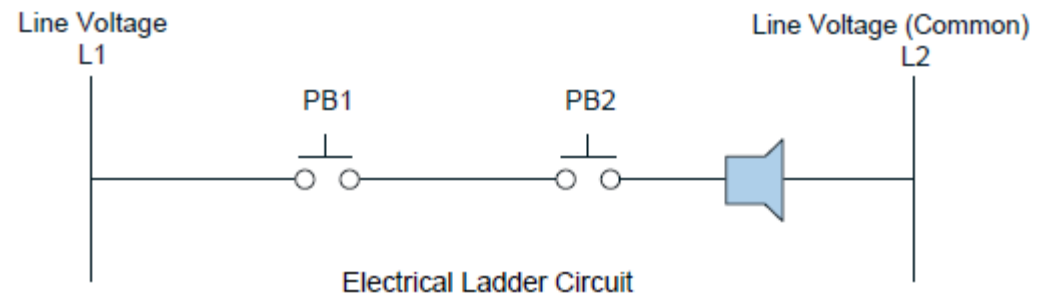


Fungsi Logika AND

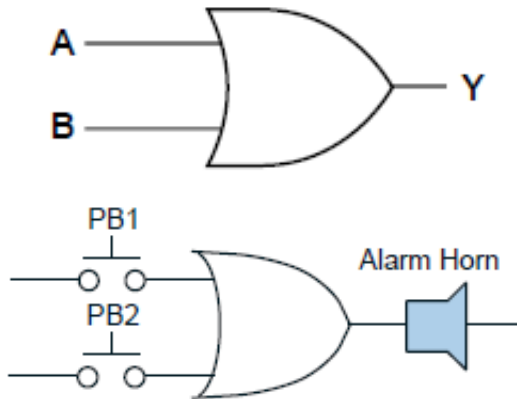


AND Truth Table		
Inputs		Output
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

PB1	PB2	Alarm Horn
Not pushed (0)	Not pushed (0)	Silent (0)
Not pushed (0)	Pushed (1)	Silent (0)
Pushed (1)	Not pushed (0)	Silent (0)
Pushed (1)	Pushed (1)	Sounding (1)



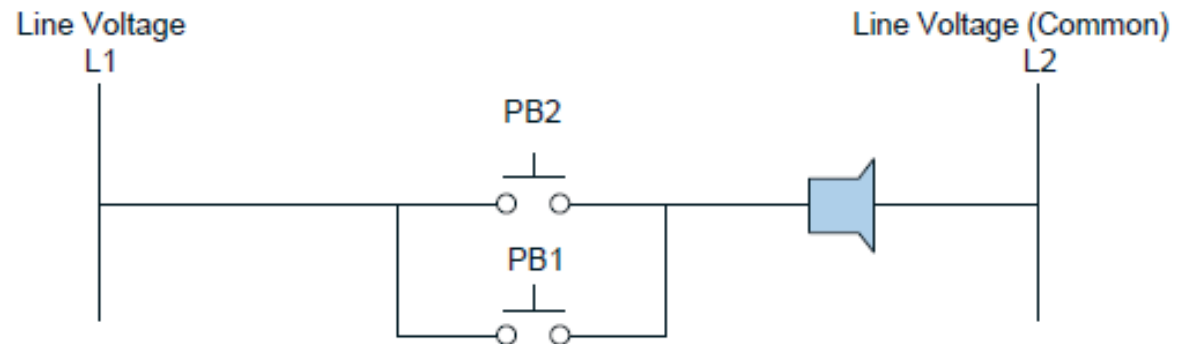
Fungsi Logika OR



Logic Representation

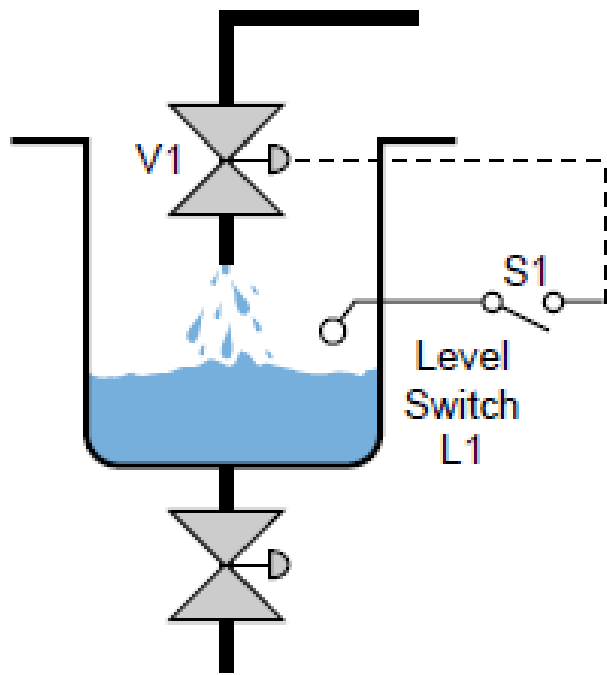
OR Truth Table		
Inputs		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

PB1	PB2	Alarm Horn
Not pushed (0)	Not pushed (0)	Silent (0)
Not pushed (0)	Pushed (1)	Sounding (1)
Pushed (1)	Not pushed (0)	Sounding (1)
Pushed (1)	Pushed (1)	Sounding (1)



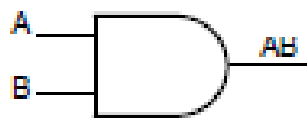
Electrical Ladder Circuit

Contoh Kasus



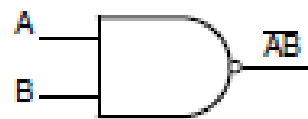
- Rancanglah Gerbang Logika, Tabel Kebenaran, dan Ladder Diagramnya jika Valve V1 akan ketia S1 ditekan dan L1 dalam kondisi tidak ON.

Gerbang Dasar



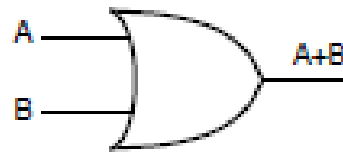
A	B	AB
0	0	0
0	1	0
1	0	0
1	1	1

AND



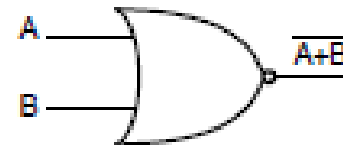
A	B	\overline{AB}
0	0	1
0	1	1
1	0	1
1	1	0

NAND



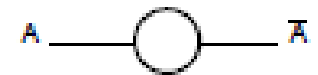
A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

OR



A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

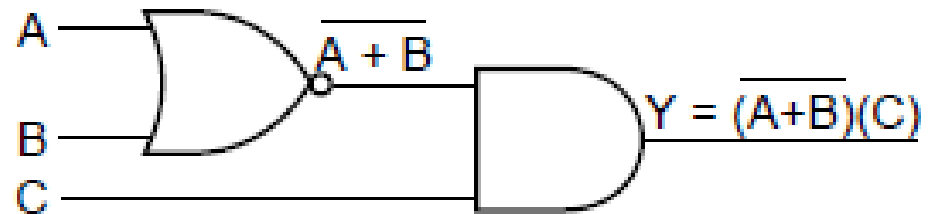
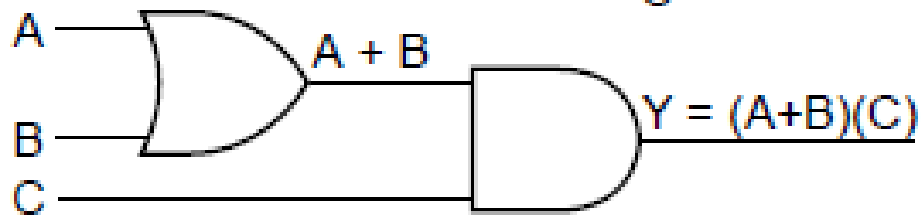
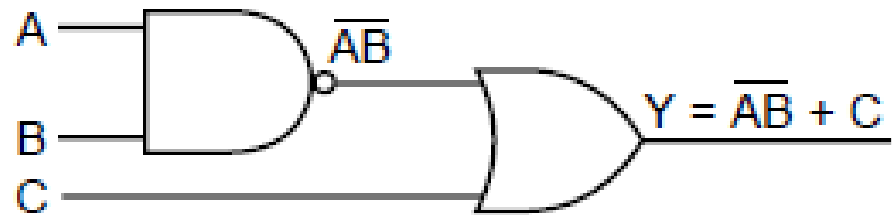
NOR



A	\overline{A}
0	1
1	0

NOT

Gerbang Kombinasi



Aturan Aljabar Boolean

Commutative Laws

$$A + B = B + A$$

$$AB = BA$$

De Morgan's Laws

$$\overline{(A + B)} = \overline{A} \overline{B}$$

$$\overline{(AB)} = \overline{A} + \overline{B}$$

$$\overline{\overline{A}} = A, \overline{1} = 0, \overline{0} = 1$$

$$A + \overline{AB} = A + B$$

$$AB + AC + \overline{BC} = AC + \overline{BC}$$

Associative Laws

$$A + (B + C) = (A + B) + C$$

$$A(BC) = (AB)C$$

Distributive Laws

$$A(B + C) = AB + AC$$

$$A + BC = (A + B)(A + C)$$

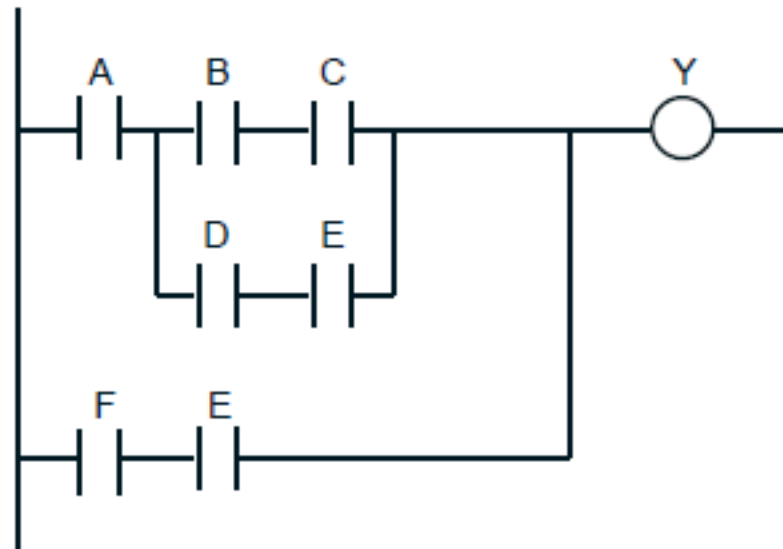
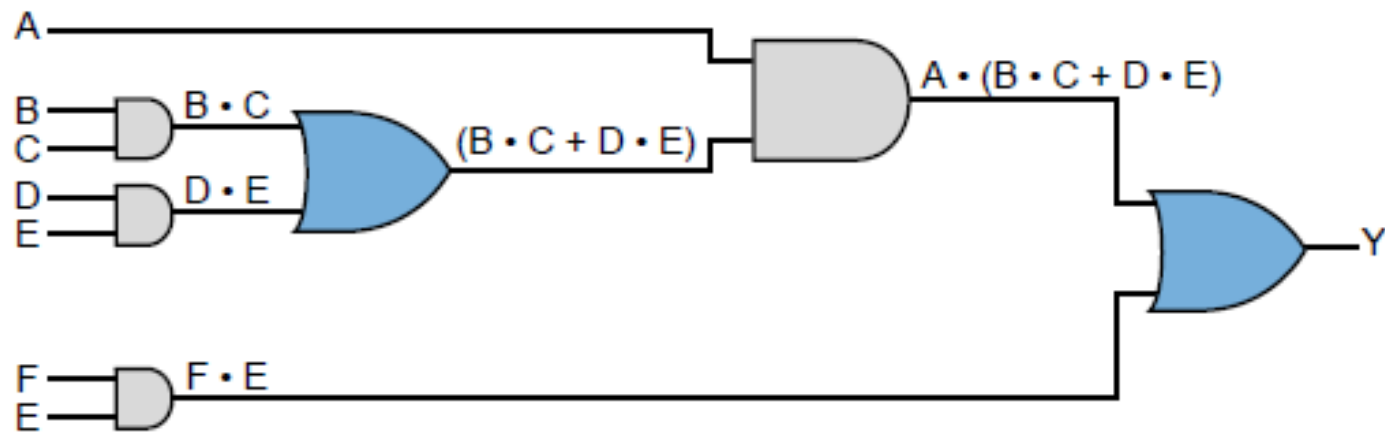
Law of Absorption

$$A(A + B) = A + AB = A$$

Selesaikan dengan Gerbang Logika & Ladder Diagram persamaan berikut

$$Y = A \bullet (B \bullet C + D \bullet E) + (F \bullet E)$$

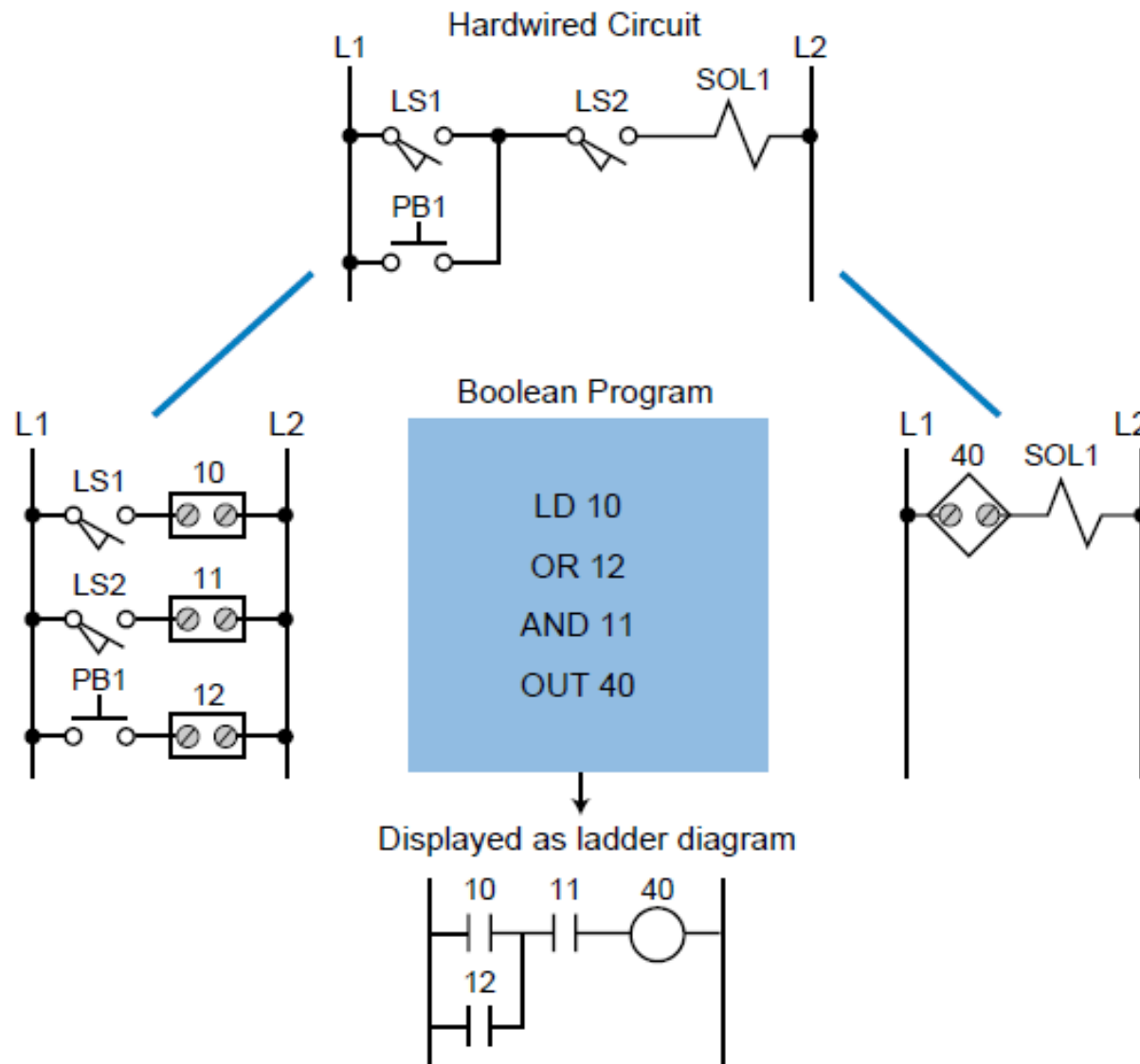
Logic Gate & Ladder



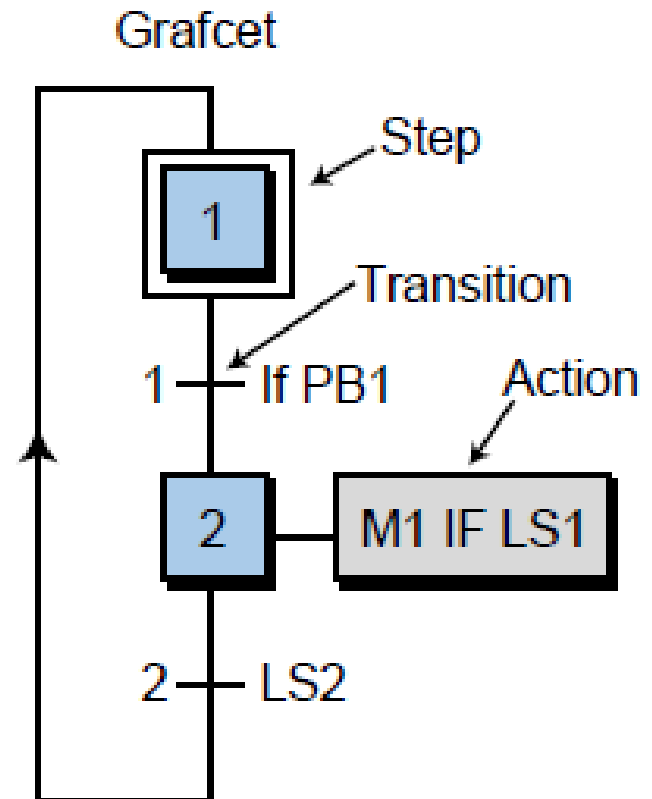
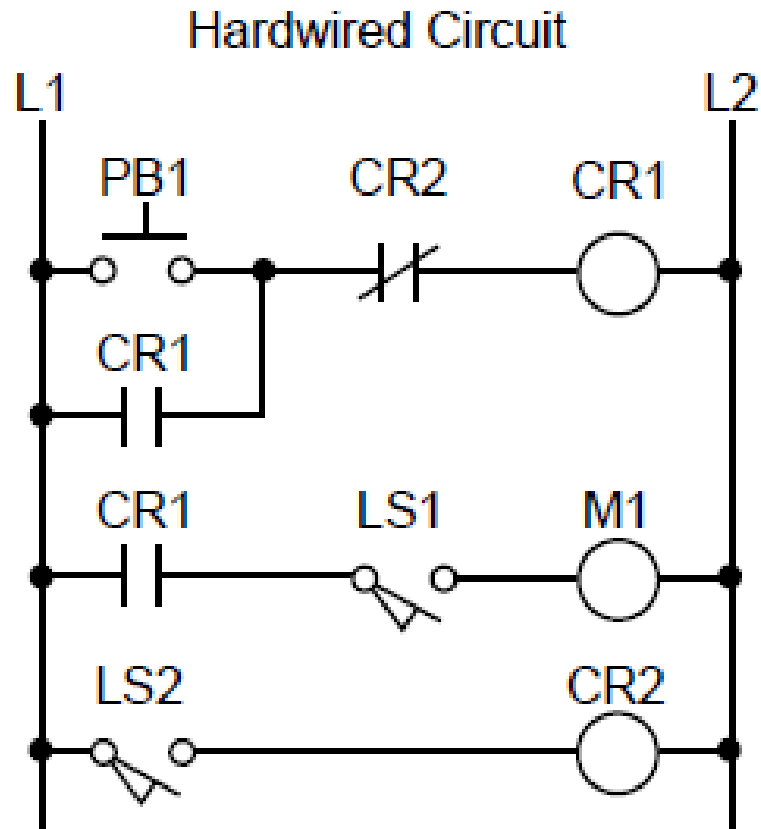
Ex.: Selesaikan dengan Gerbang Logika & Ladder Diagram

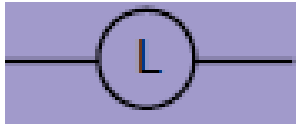
$$\begin{aligned} Y &= \overbrace{(A \bullet B \bullet C)}^{\text{1st line}} + \overbrace{(A \bullet D \bullet E)}^{\text{2nd line}} + \overbrace{(F \bullet E)}^{\text{3rd line}} + \overbrace{(F \bullet D \bullet B \bullet C)}^{\text{Reverse path}} \\ &= A \bullet (B \bullet C + D \bullet E) + F(E + D \bullet B \bullet C) \end{aligned}$$

Boolean Language

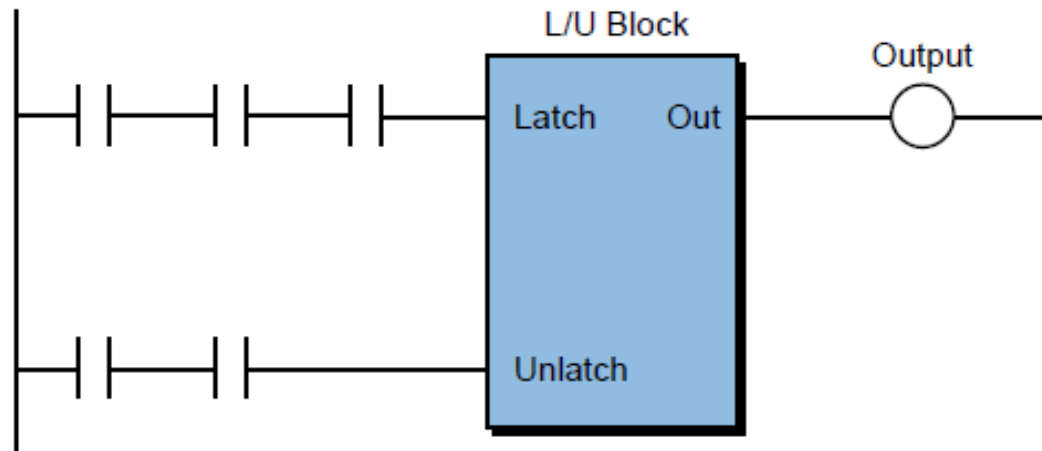
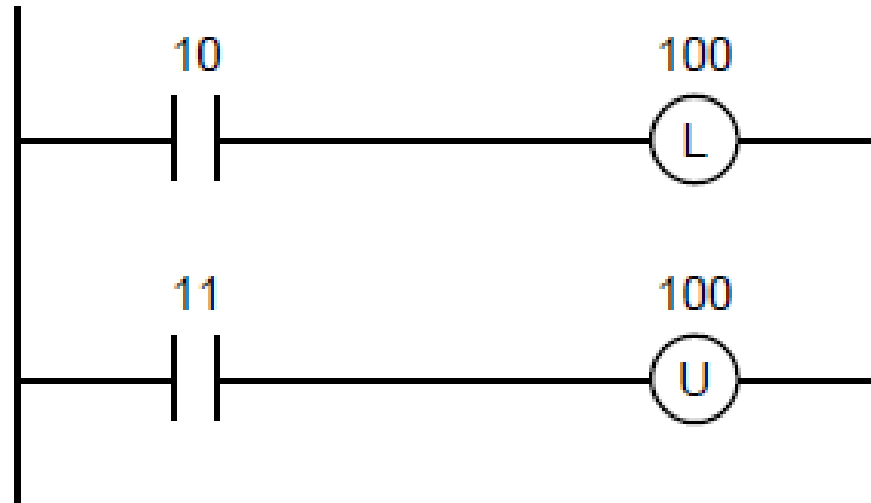
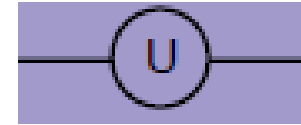


Grafcet

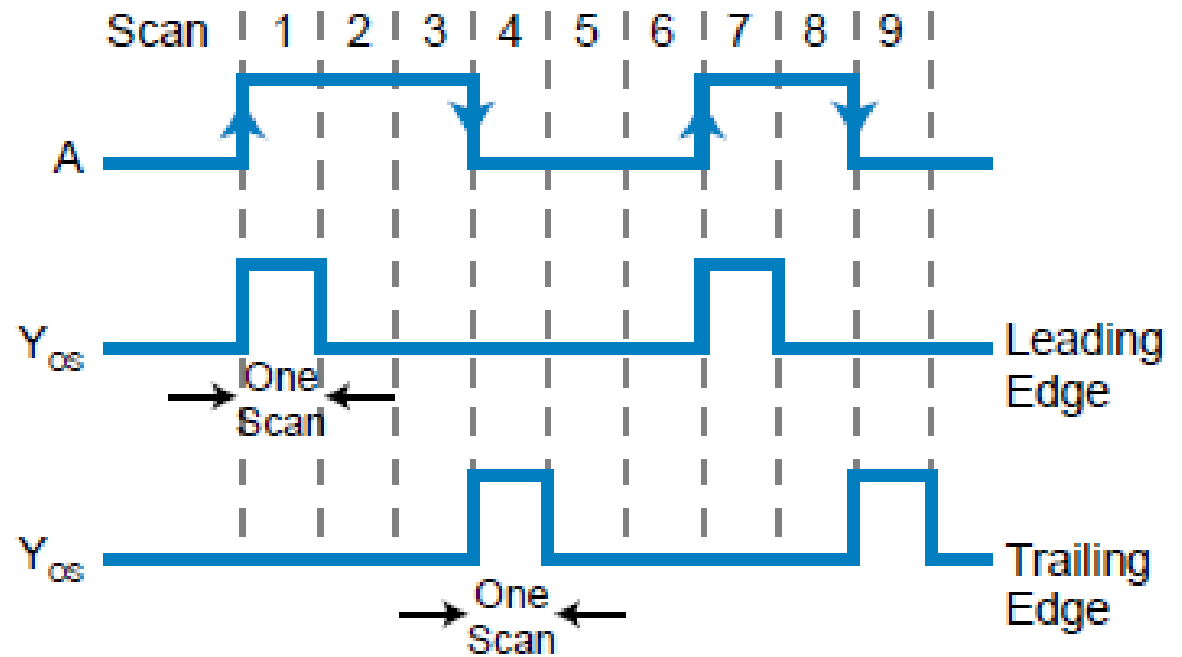
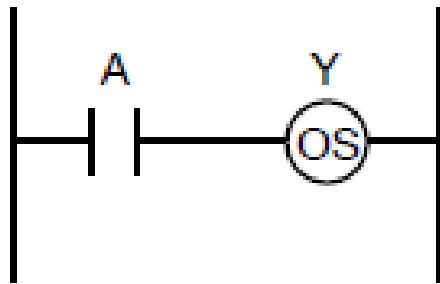
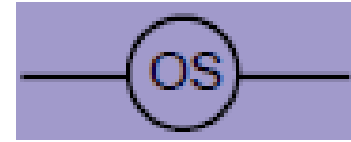




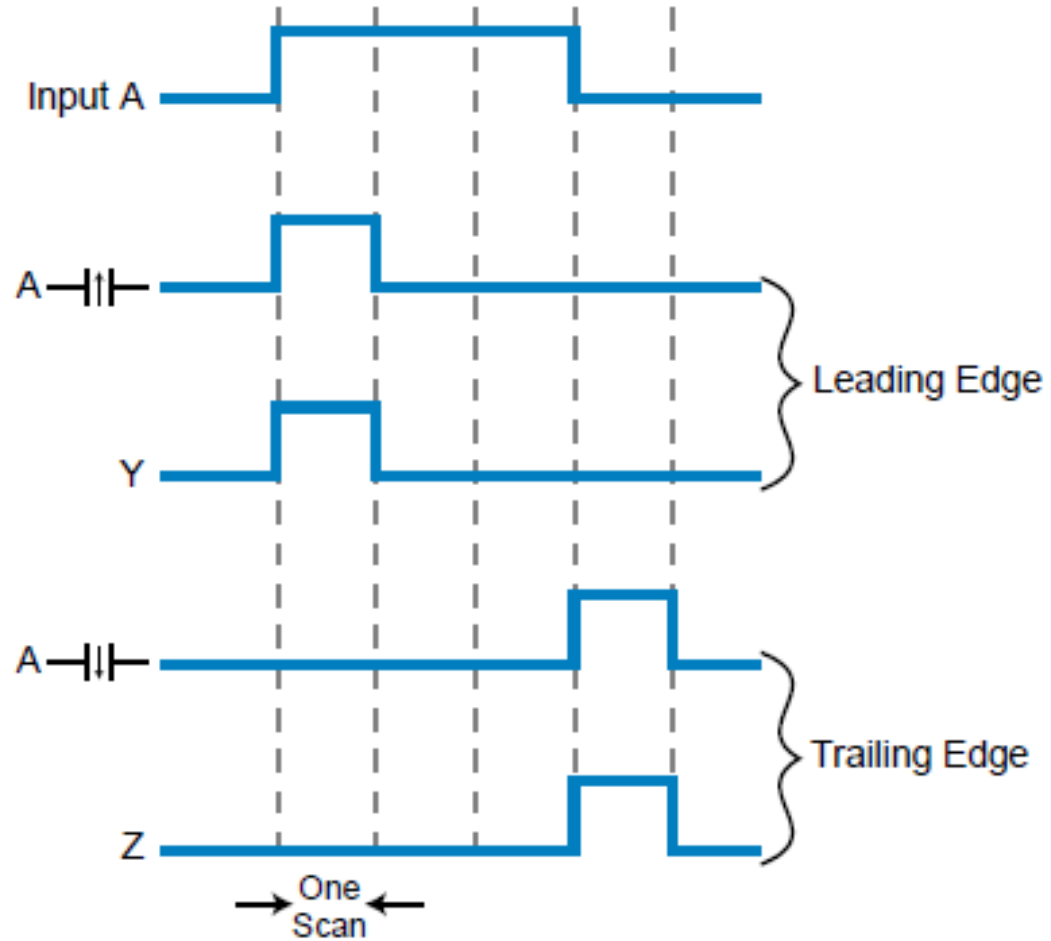
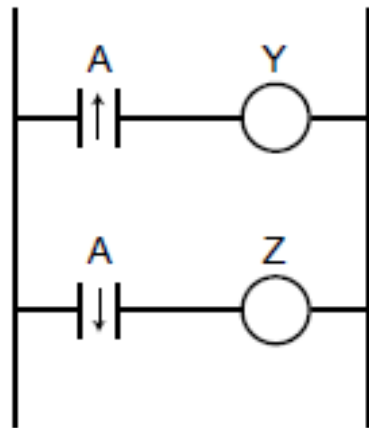
Latch & Unlatch



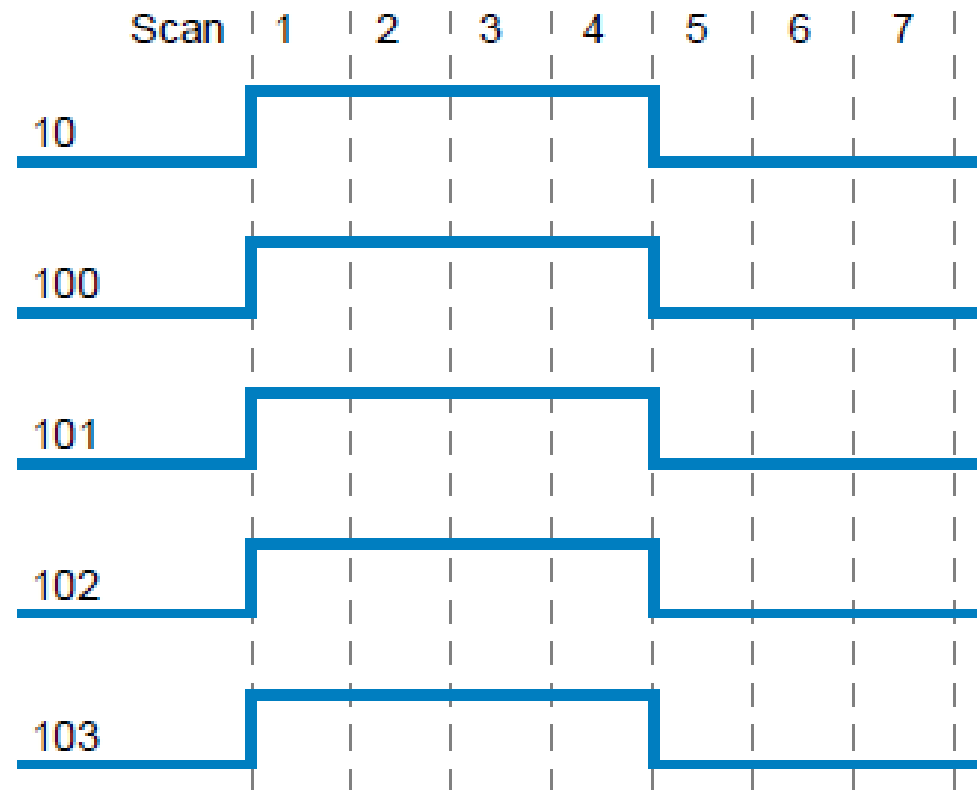
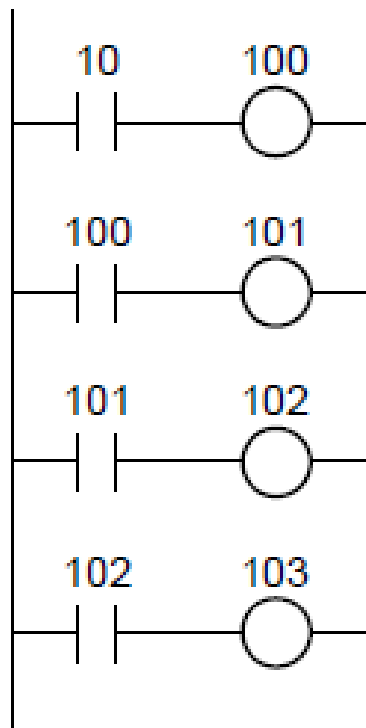
One-Shot Output



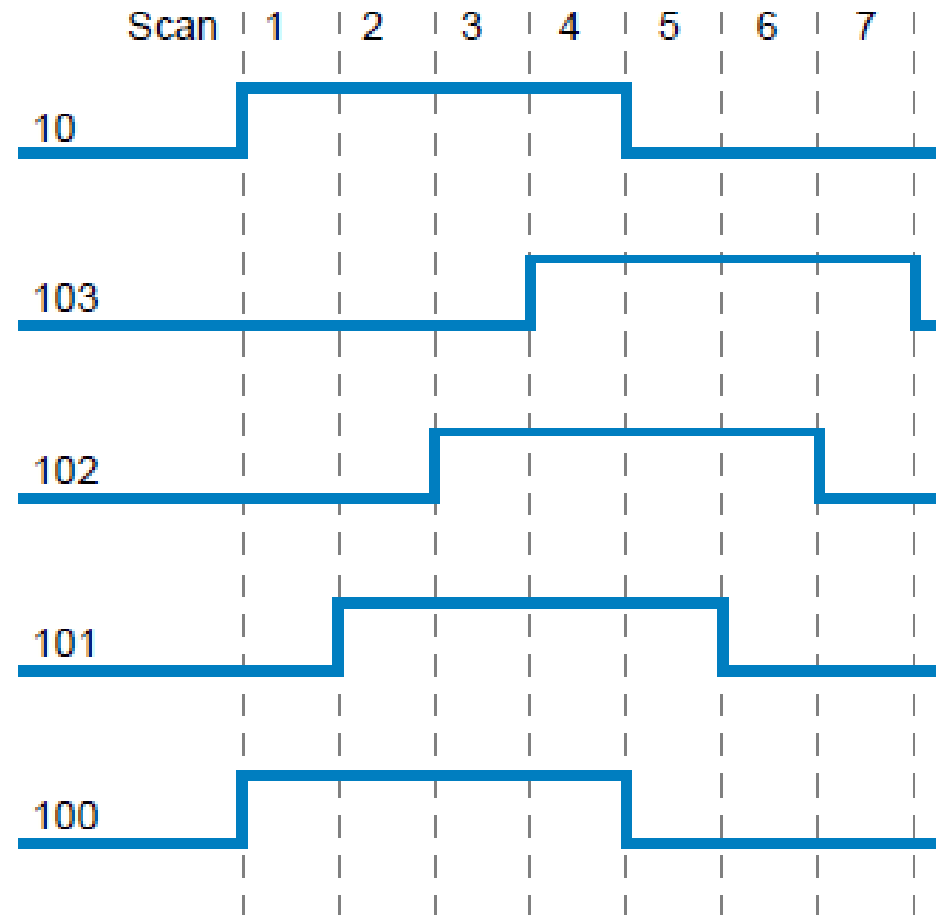
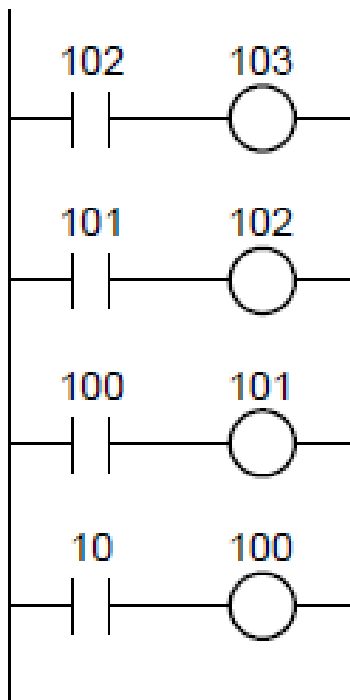
Transitional Contact



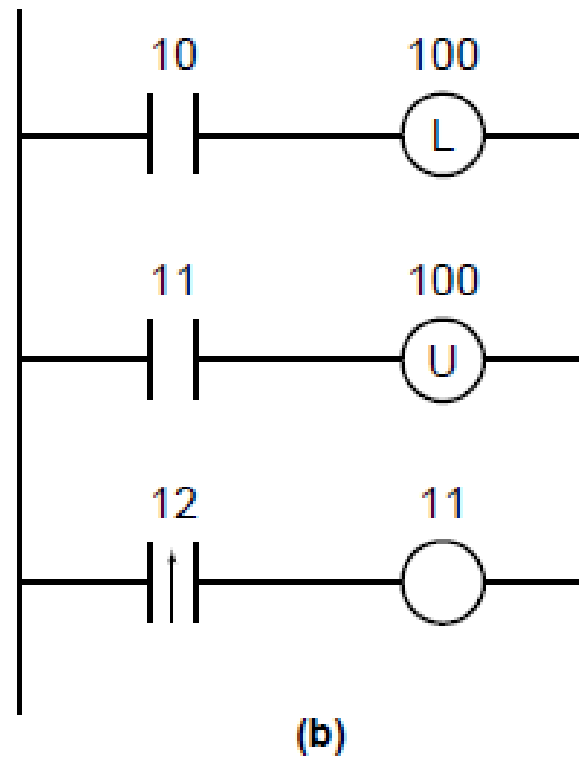
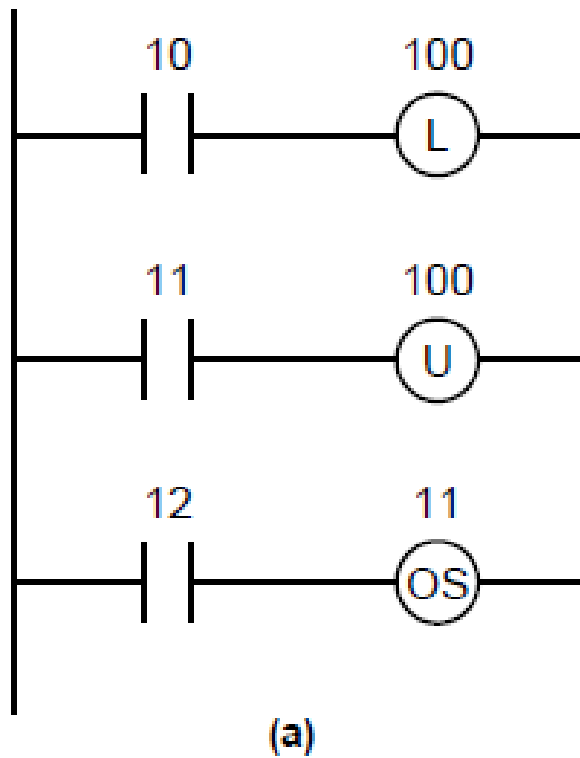
Evaluasi Ladder Diagram



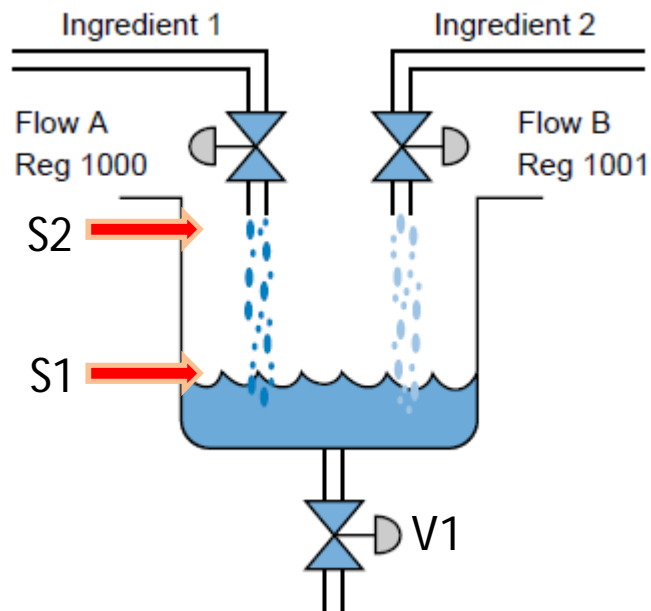
Evaluasi Ladder Diagram #2



One-Shot vs. Transitional Contact



Review Topik Sebelumnya



- Dalam bejana cairan kimia, Flow A akan mengalir jika cairan berada pada posisi dibawah S1.
- Flow B akan mengalir saat cairan melewati S2. Selanjutnya Valve V1 mengalir hingga cairan pada posisi dibawah S1.