وزارة التعليم العالي والبحث العلمي
جامعة الفرات الاوسط التقنية
المعهد التقني كوفة
قسم التقنيات الكهربائية

Lesson 3

Logic Concepts

اهداف المحاضرة

سيكون الطالب بعد الانتهاء من المحاضرة قادرا على أن:

1. يتعرف على الدوائر المنطقية.
2. يفهم مخطط الجريان.
3. يتعرف على انواع الدوائر المنطقية وطرق تبسيطها.
4. تصميم دائرة منطقية كمثال تطبيقي بلغة LAD .

content

4-1 The Binary Concept

-Introduction

The binary concept is not a new idea; in fact, it is a very old one. It simply refers to the idea that many things exist only in two predetermined states. For instance, a light can be on or off.

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

Table. Binary concept using positive logic

4-2 LOGIC FUNCTIONS

The binary concept shows how physical quantities (binary variables) that can exist in one of two states can be represented as 1 or 0 and the results for a particular logic circuit will give us either logic 0 or 1.

4-2-1 THE AND FUNCTION

The letters A and B represent inputs to the controller. This mapping of outputs according to predefined inputs is called a truth table. Example 3-1 shows an application of the AND function.

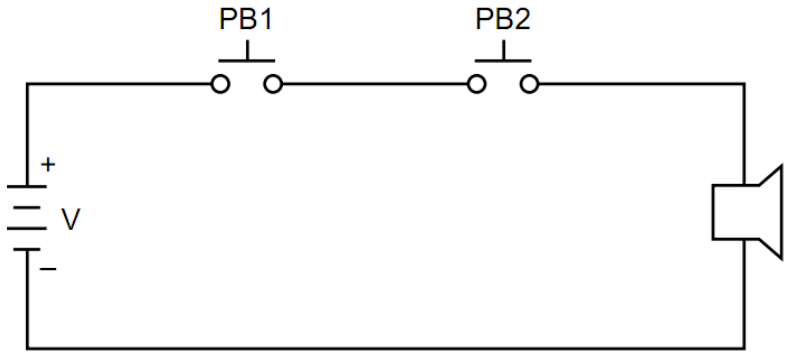
AND Truth Table

Inputs		Output
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

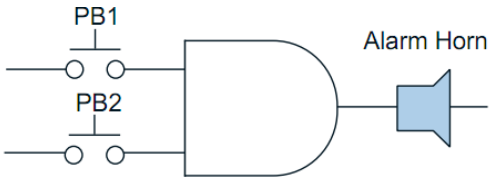
Figure 3-2. Two-input AND gate and its truth table.

EXAMPLE

Show the logic gate, truth table, and circuit representations for an alarm horn that will sound if its two inputs, push buttons PB1 and PB2, are 1 (ON or depressed) at the same time.



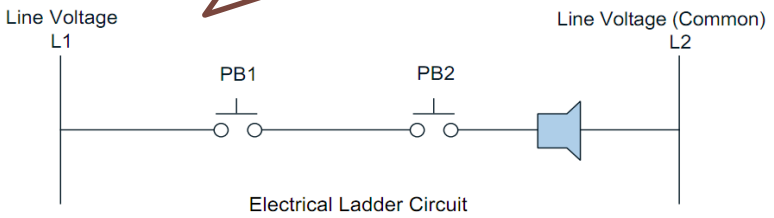
Electrical Circuit



Logic Representation

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)

Hint //Representation of AND gate in PLC without needed IC of AND gate



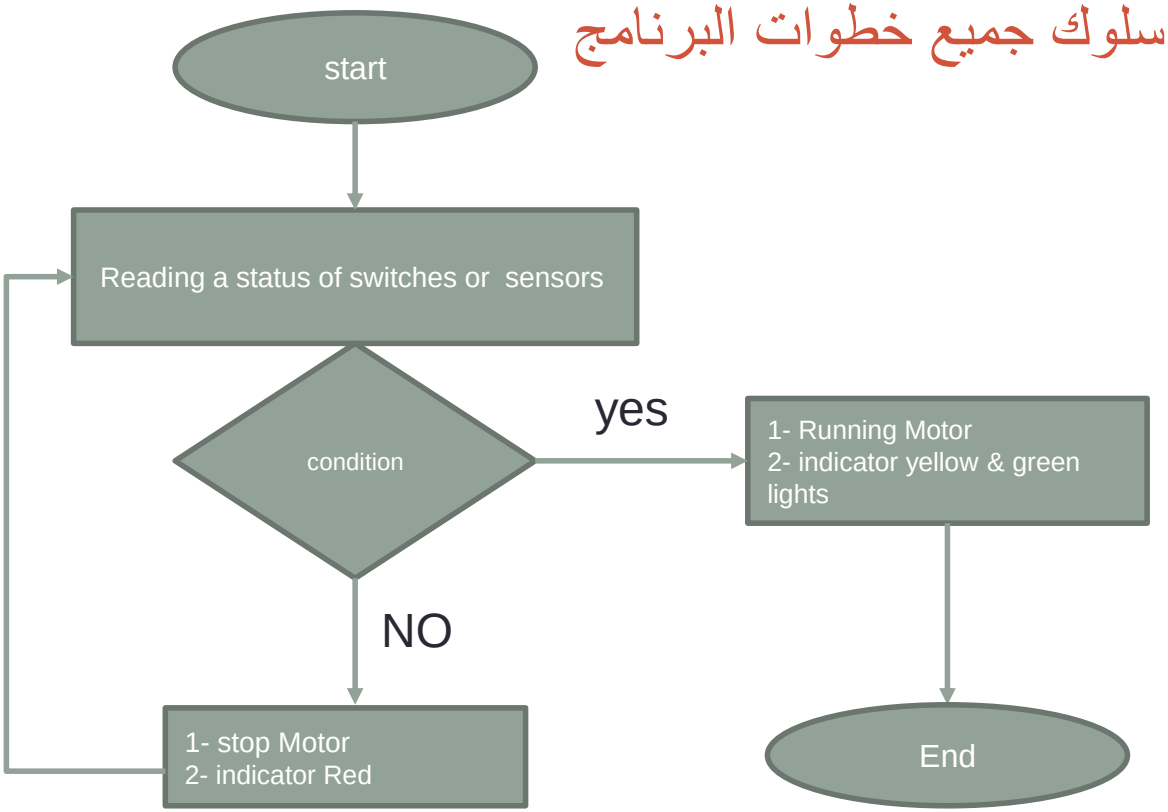
Electrical Ladder Circuit

Flow chart

A set of blocks that describe the behavior of all logical program steps.

example

مجموعة من البلوكات التي تصف سلوك جميع خطوات البرنامج المنطقية



Flowchart

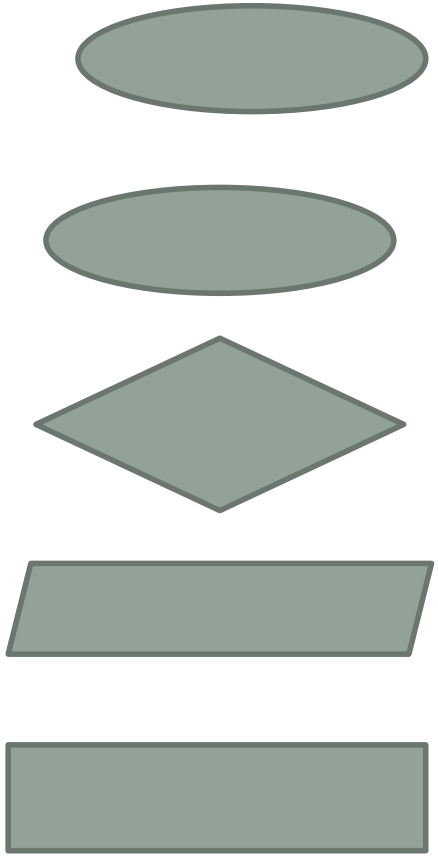
Start program

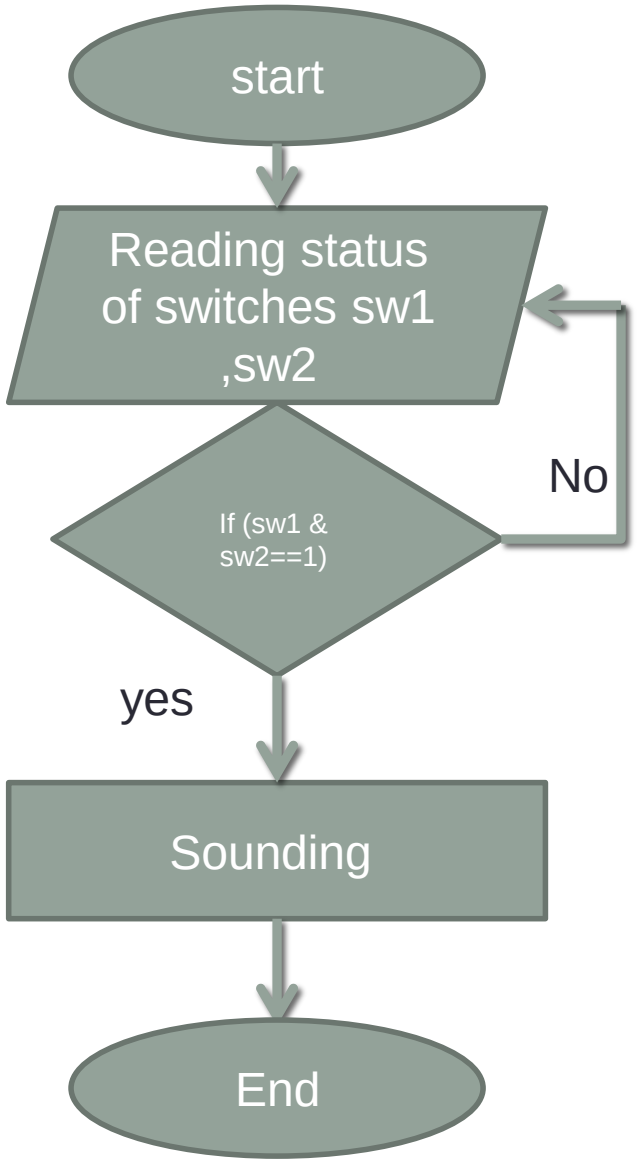
End program

Condition

Reading

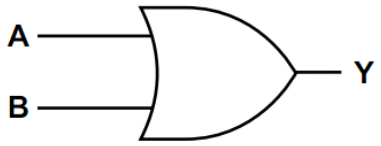
Writing





4-2-2 THE OR FUNCTION

The letters A and B represent inputs to the controller. This mapping of outputs according to predefined inputs is called a truth table. Example 3-1 shows an application of the OR function.



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

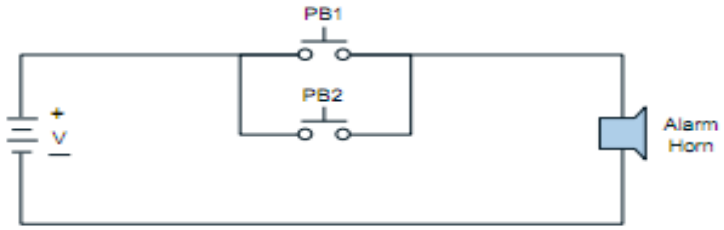
EXAMPLE

Show the logic gate, truth table, and circuit representations for an alarm horn that will sound if either of its inputs, push button PB1 **or** PB2, is 1 (ON or depressed)

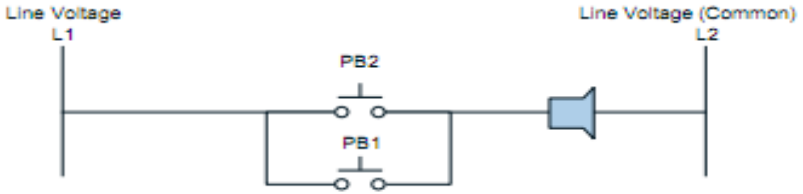
SOLUTION

Logic Representation

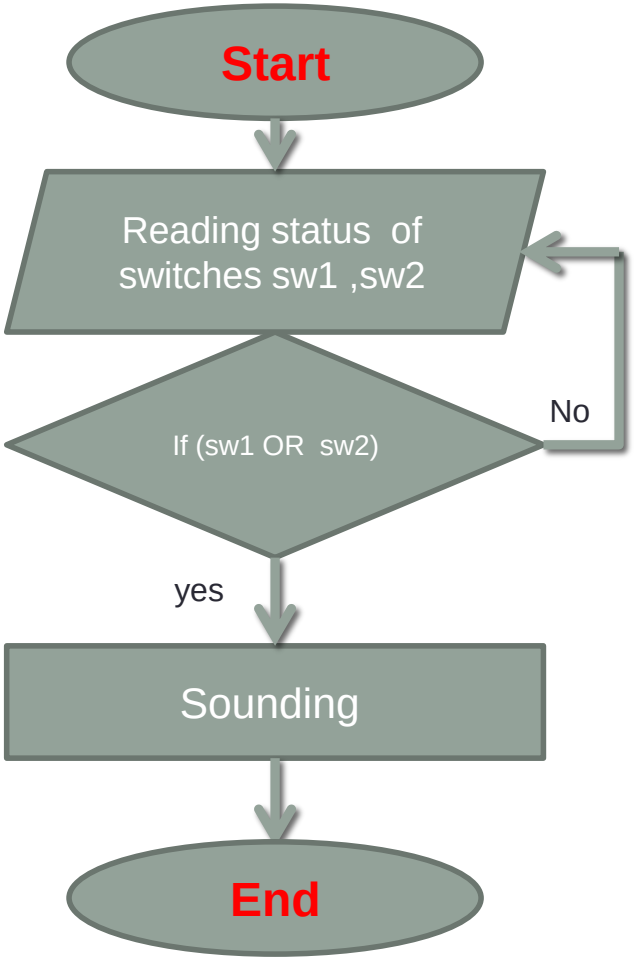
PB1	PB2	Alarm Horn
Not pushed (0)	Not pushed (0)	Silent (0)
Not pushed (0)	Pushed (1)	Sounding (1)
Pushed (1)	Not pushed (0)	Sounding (1)
Pushed (1)	Pushed (1)	Sounding (1)



Electrical Circuit



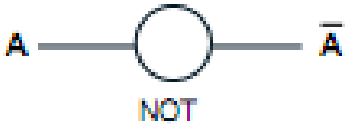
Electrical Ladder Circuit



4-2-3 THE NOT FUNCTION

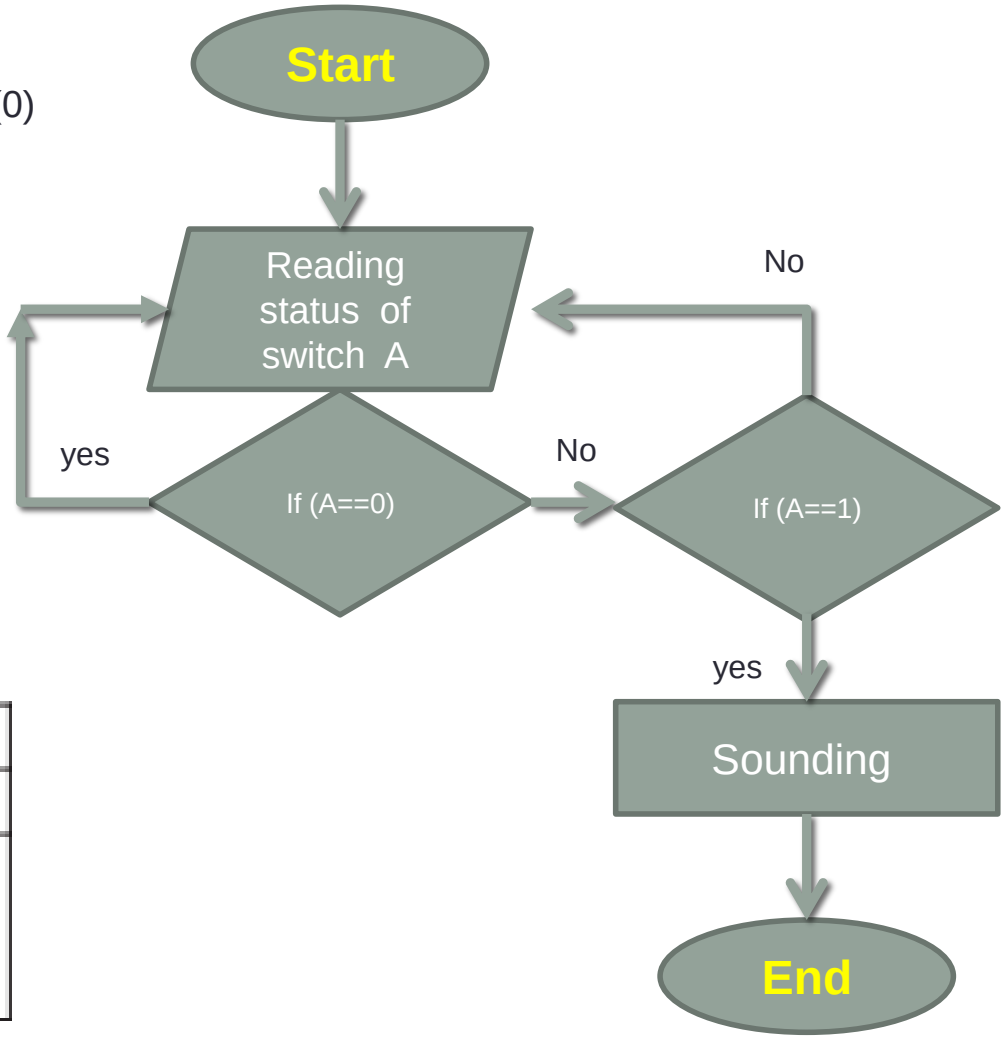
The NOT output is TRUE (1) if the input is FALSE (0)

Figure 3-5. Symbol for the NOT function.



NOT Truth Table	
Input	Output
A	$\bar{A}$
0	1
1	0

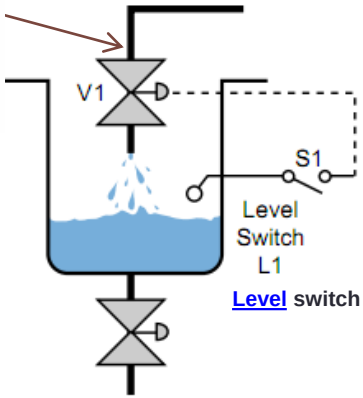
Figure 3-6. NOT gate and its truth table.



EXAMPLE

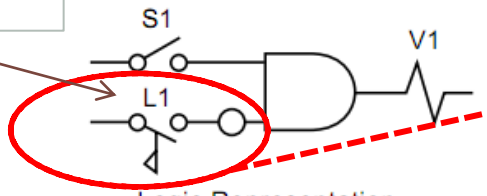
Show the logic gate, truth table, and circuit representation for a solenoid valve (V1) that will be open (ON) if selector switch S1 is ON and if level switch L1 is NOT ON (liquid has not reached level).

solution



Level switch

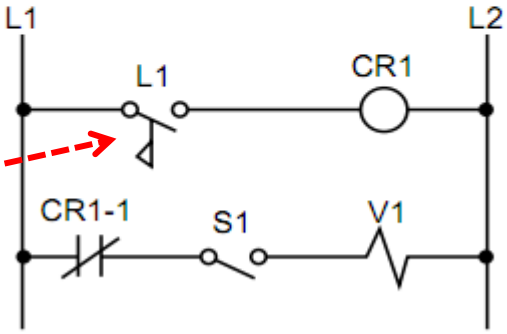
If S1 is ON and if L1 not reached level water ,but you have to see the Node to Reverse state of L1 to 1



Logic Representation

S1	L1 ($\overline{L1}$)		V1
0	0	1	0
0	1	0	0
1	0	1	1
1	1	0	0

Truth Table



Electrical Ladder Circuit

4-3 Principles of Boolean Algebra and Logic

1. Basic Gates. Basic logic gates implement simple logic functions. Each logic function is expressed in terms of a truth table and its Boolean expression.

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

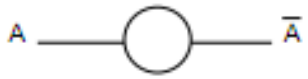
NAND

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

Thank you