

Programming fundamental

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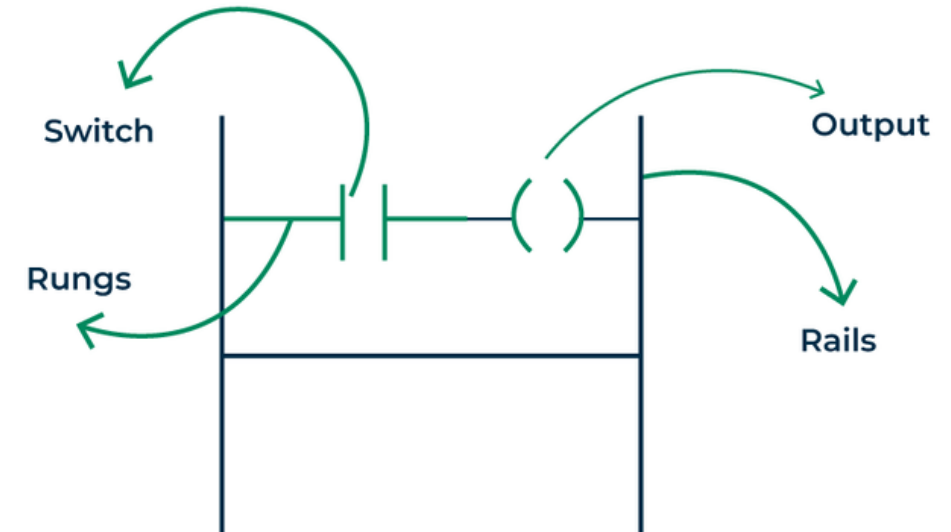
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Ladder logic

Ladder logic

■ Logic Structure

Ladder logic is basically a program that is represented by a graphical diagram, which is based on a circuit diagram of relay logic. This program contains two vertical lines called 'rails' and horizontal lines called 'rungs' which makes it look like a perfect ladder. The graphical representation of an ladder logic program is called as Ladder Logic diagram(LLD).



Each rung has switches and output coil. Switches can perform OR, AND and NOT operation, and through these basic logic operation we can make any programming logic in PLC.

Ladder logic

■ Logic Components

Normally-Open



Normally-Closed



Coil/Output



Rising pulse



Falling pulse



Normally open switch or contact is open when not actuated

Normally closed switch/contact is closed when not actuated.

Output/Coil devices are such as motor, valve, indicator, lights etc.

Rising pulse execute when state change from LOW to HIGH or OFF to ON

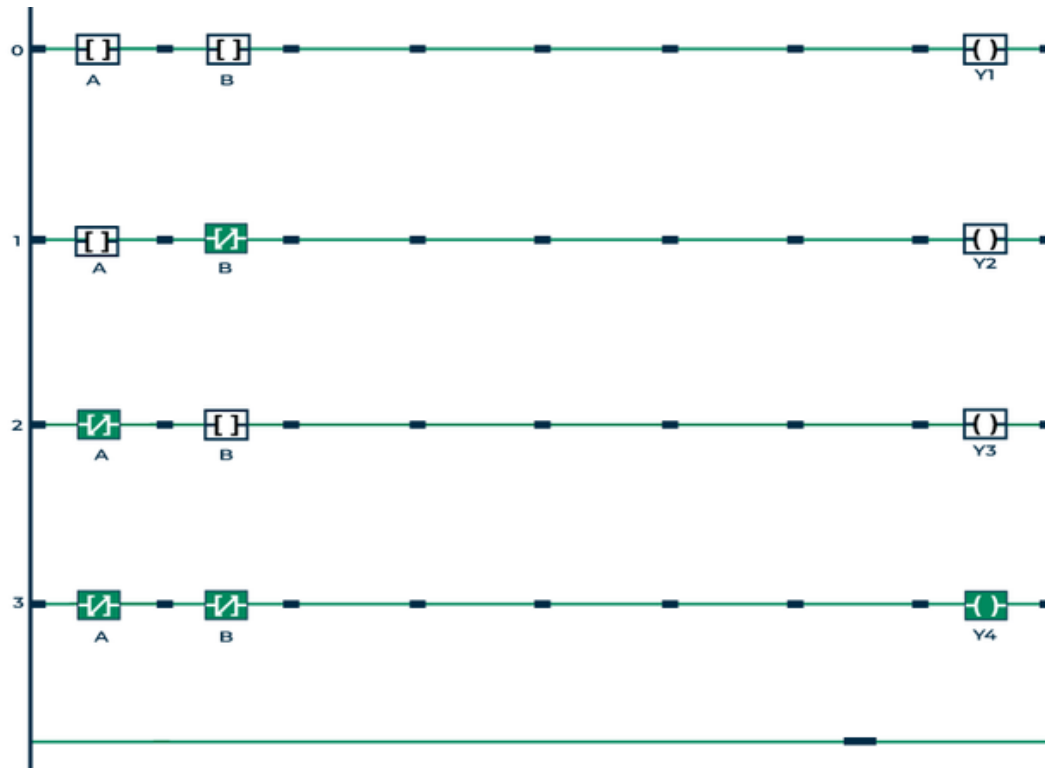
Falling/trailing pulse execute state change from HIGH to LOW or ON to OFF

Ladder logic example programming

Ladder logic example programming

■ AND logic diagram

NO switches are representing input 0, means no current is passing, and NC switch are representing input 1, which means current passing through the circuit

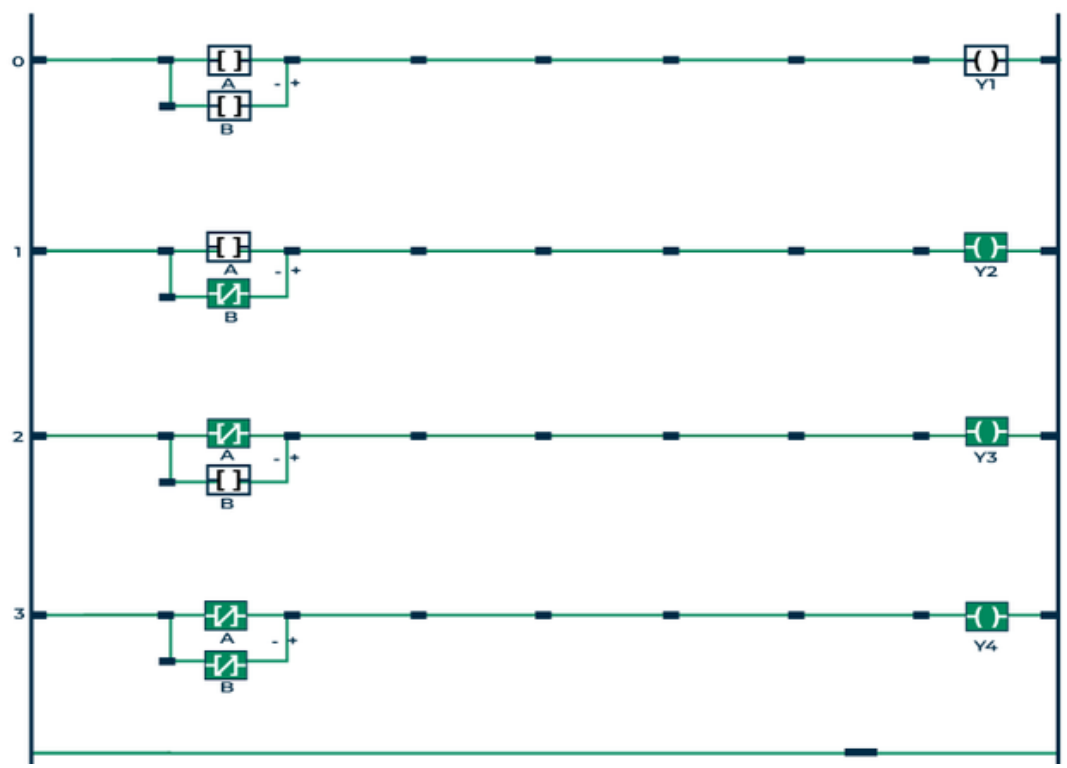


Input (A)	Input (B)	Output (Y = A.B)
0	0	0
0	1	0
1	0	0
1	1	1

Ladder logic example programming

■ OR logic diagram

NC switches(green) means current passing, which is denoted by 1, and NC switch(white) means no current passing, denoted by 0



Input (A)	Input (B)	Output (Y = A.B)
0	0	0
0	1	1
1	0	1
1	1	1

Advantages and Disadvantages

Advantages and disadvantages

■ Advantage

- A graphical diagram of electrical relay diagram, which makes it easy to understand.
- The visual representation of rungs reduces maintenance.
- LLD allow real time monitoring of the system status, which makes it more reliable.
- LLDs are modular and can be easily modified or expanded to accommodate changes in the control process.
- LLD is widely accepted as so many engineers and technicians are already familiar to this.

■ Disadvantage

- LLD can face problem in complex control system as the lack in sophistication of high level programming language.
- it is not suitable for time based operation or sequential problem.
- Proper documentation and version control can be challenging.
- It is not suitable for data processing task.

Ladder logic diagrams are read from left to right, just like reading a book. Each rung represents a specific control operation, with input conditions on the left and output actions on the right.

Instruction List

Instruction list

Basic Instructions

Instruction	Description	LX3V(1S)	LX3V (2N)	LX3VP	LX3VE
LD	Operation contact type NO (normally open)	i	i	i	i
LDI	Operation contact type NC (normally closed)	i	i	i	i
OUT	Final logical operation type coil drive	i	i	i	i
SET	Sets a bit device permanently ON	i	i	i	i
RST	Resets a bit device permanently OFF	i	i	i	i

Arithmetic and Logical Operations

Instruction	Description	LX3V (1S)	LX3V (2N)	LX3VP	LX3VE
ADD	Addition	i	i	i	i
SUB	Subtraction	i	i	i	i
MUL	Multiplication	i	i	i	i
DIV	Division	i	i	i	i
INC	Increment	i	i	i	i
DEC	Decrement	i	i	i	i
WAND	Word AND	i	i	i	i
WOR	Word OR	i	i	i	i
WXOR	Word exclusive OR	i	i	i	i
NEG	Negation	-	i	i	i

Inline Comparisons

Instruction	Description	LX3V (1S)	LX3V (2N)	LX3VP	LX3VE
LD=	Comparison of 16-bit data (==)	i	i	i	i
LD>	Comparison of 16-bit data (>)	i	i	i	i
LD<	Comparison of 16-bit data (<)	i	i	i	i
LD◇	Comparison of 16-bit data (◇)	i	i	i	i
LD<=	Comparison of 16-bit data (<=)	i	i	i	i
LD>=	Comparison of 16-bit data (>=)	i	i	i	i



Thank you