

# Hydraulics & Pneumatics

## Chapter 4: Programmable Logic Controller (PLC Programming)

by

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# Lesson Outcome

- By the end of this lecture, student should be able to:
  - Identify the symbols in PLC ladder diagram and it's function.
  - Explain basic process of writing ladder diagram.

# Content

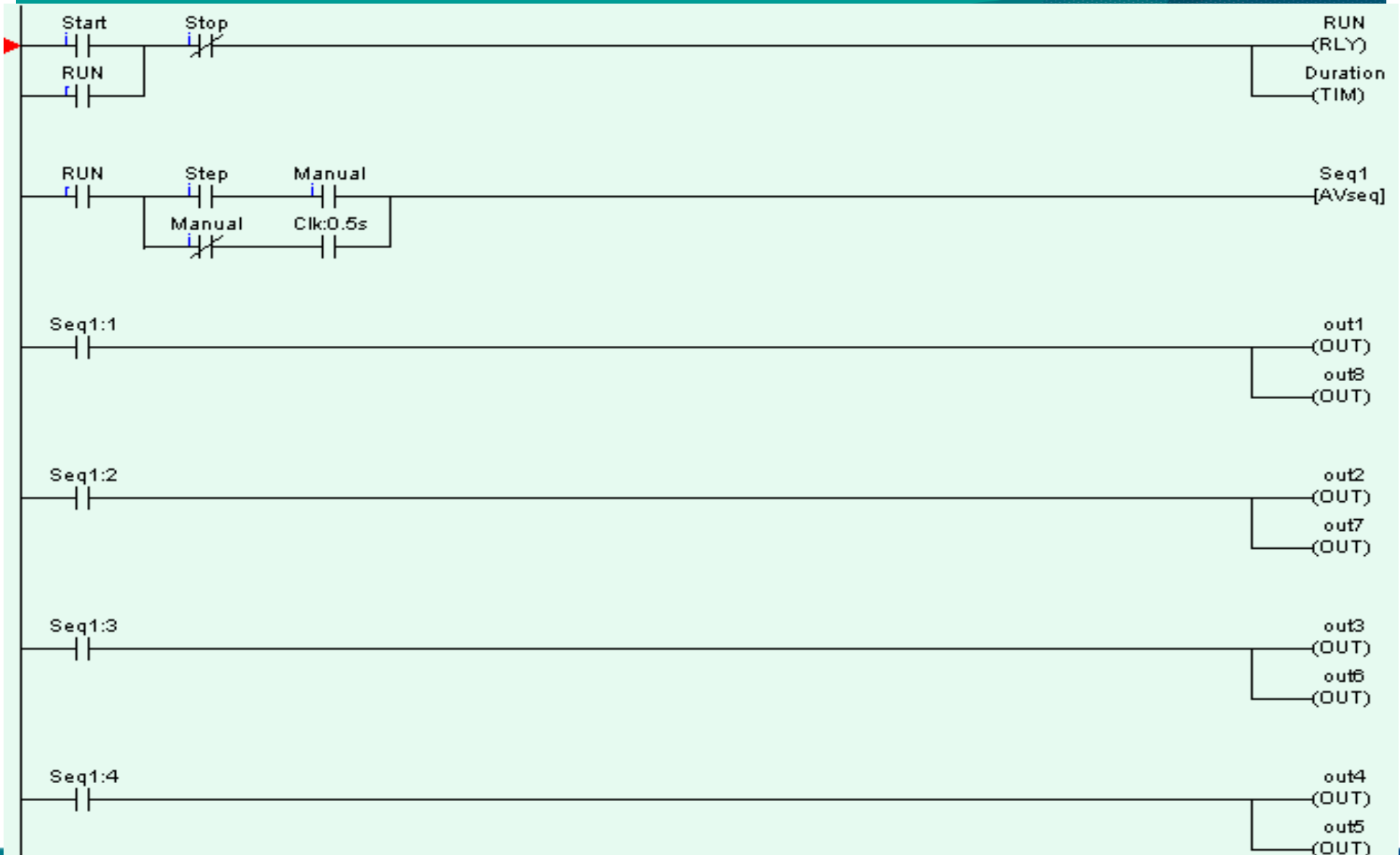
- Symbols in PLC Ladder Diagram
- Fundamental of Ladder Diagram
- Ladder Diagram for Multiple Actuators

# Fundamentals of Programming

## ⊠ Ladder Logic

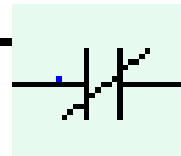
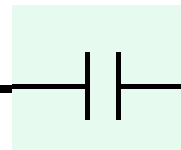
- Symbolic representation of electrical circuit
- Symbols in ladder logic is divided into **contacts (input)** and **coils (output)**

# Ladder Logic (example)

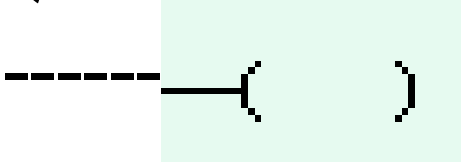


# Contacts

- ⊠ Most input to PLC are either on (true) or off (false)
- ⊠ Input – sensors and switches
- ⊠ Common symbols
  - Normally open
  - Normally closed

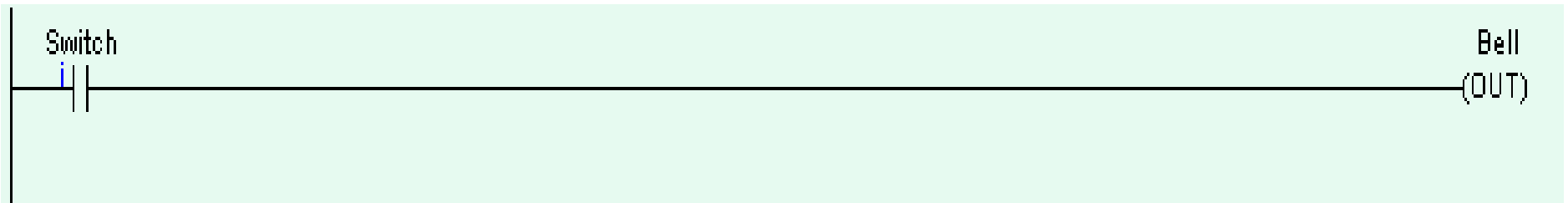


# Coils

- ⊠ Coils are output symbols
- ⊠ Real output device – motor, light, pump, counter, timer, relay
- ⊠ PLC examine contact (input) in ladder and turn the coil (output) on or off
- ⊠ Coil symbol 

# Ladder Diagram Design

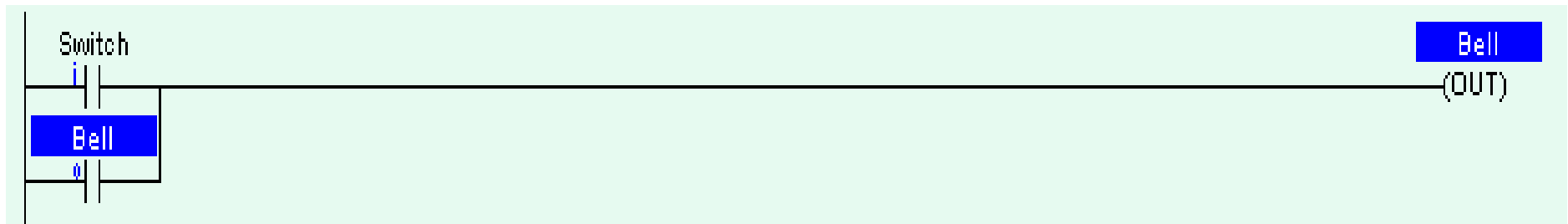
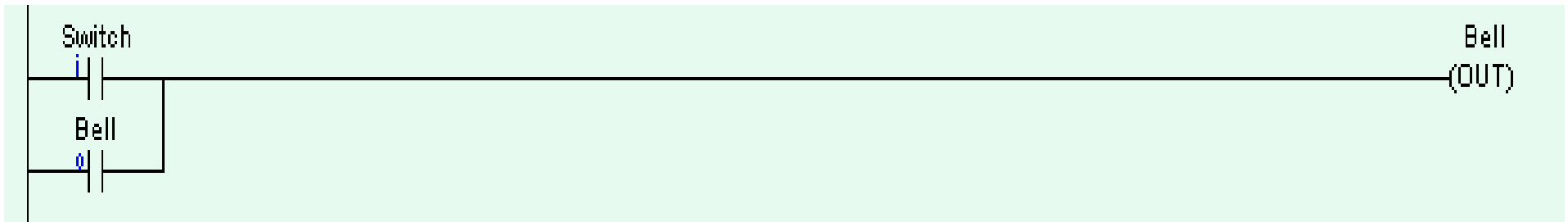
- ⊠ Problem: Draw a ladder diagram for a bell circuit. When a switch is **pressed**, the bell will ring





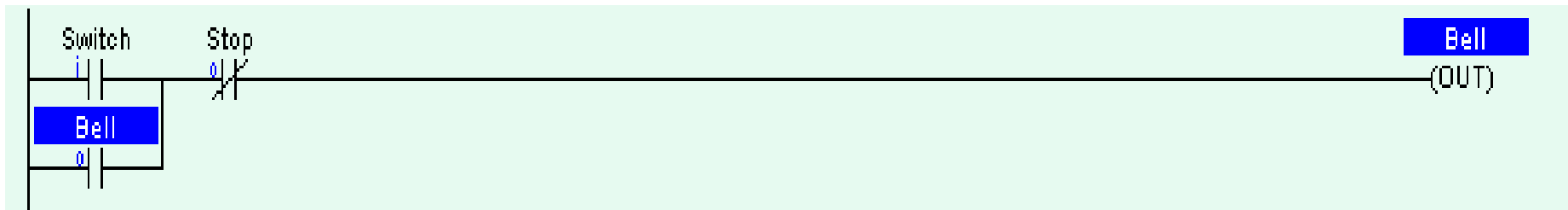
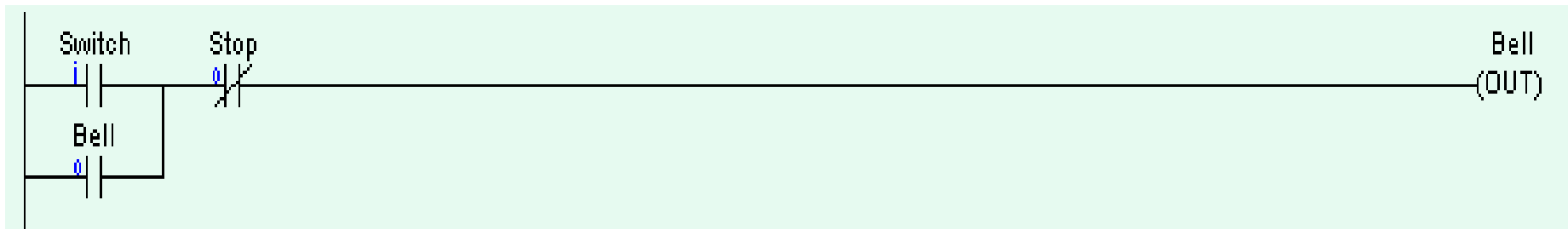
# Ladder Diagram Design

- Modify the diagram, so that when the switch is pressed once and released, the bell is ringing **continuously**



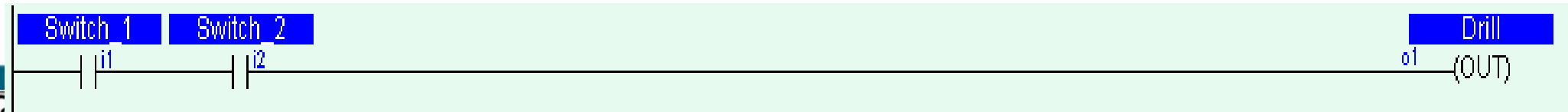
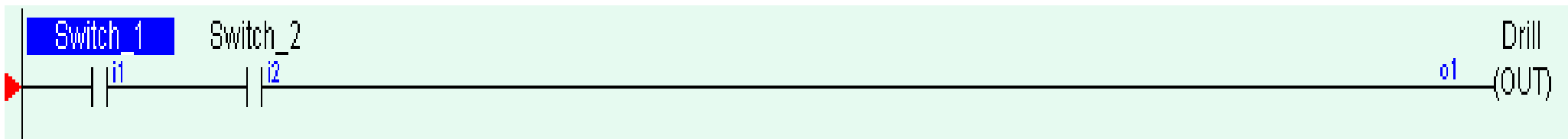
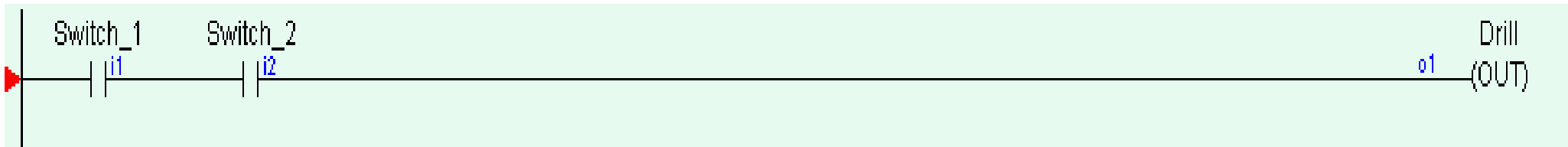
# Ladder Diagram Design

- Add another button to **stop** bell ringing



# Exercise!

- A drill press machine only works if there is a part present and the operator has one hand on each start switches (2 start switches)



# PLC programming

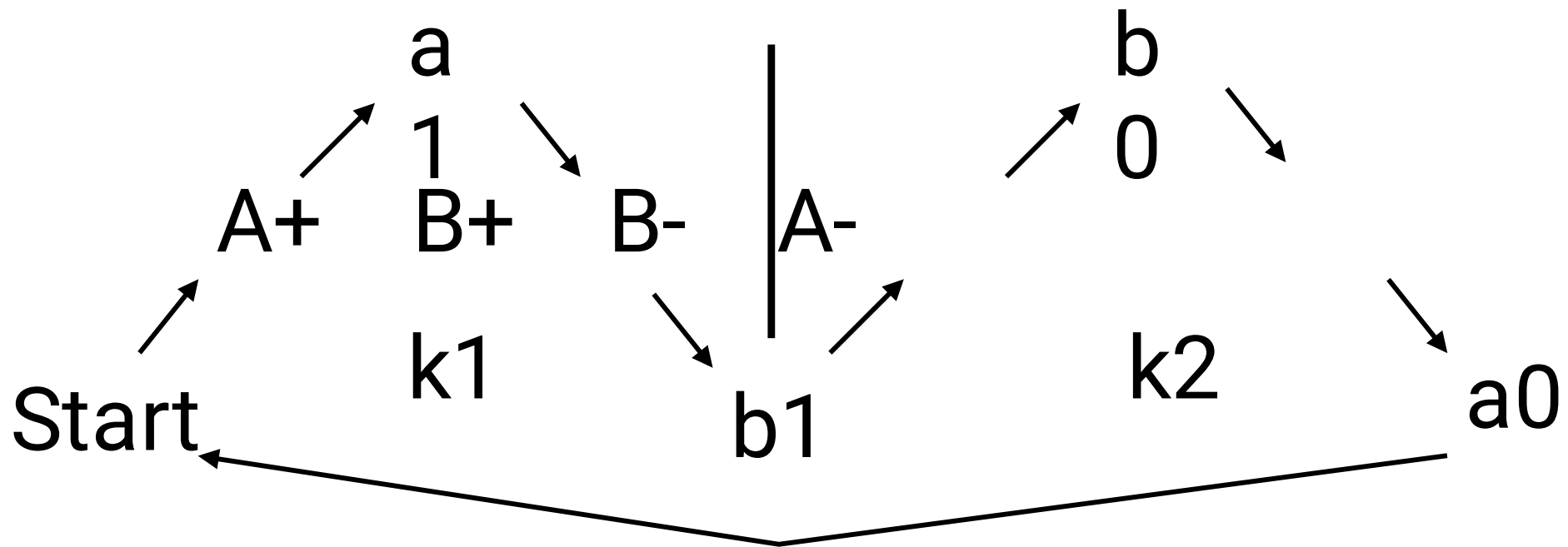
- Example: Design a PLC ladder diagram for pneumatic system with the following sequence:

A+ B+ B- A-

Using a single solenoid valve

# General Steps

1. Identify sequence of movement
2. Group the sequence : **1 group contains 1 relay**
3. Identify limit switch status



## 4. Identify relation

### Group 1

$k1 \rightarrow \text{start.a0}$

$A \rightarrow k1$

$B+ \rightarrow k1.a1$

### Group 2

$k2 \rightarrow k1.b1$

$B- \rightarrow k2$

$A- \rightarrow k2.b0$

Turn of  $k2$

k1 → start.a0

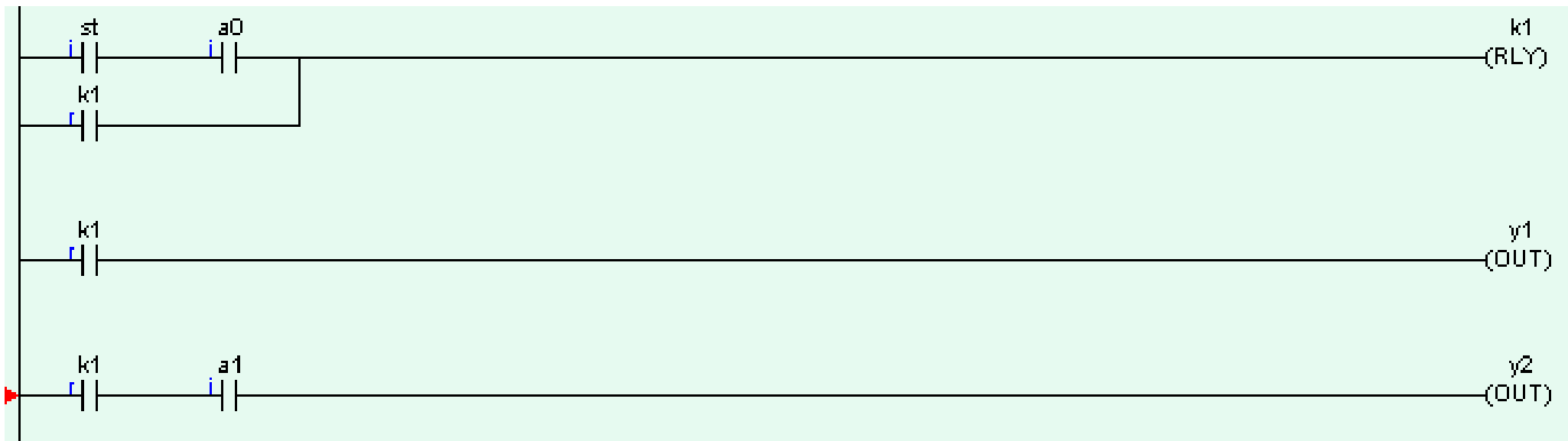


A   $\rightarrow$  k1

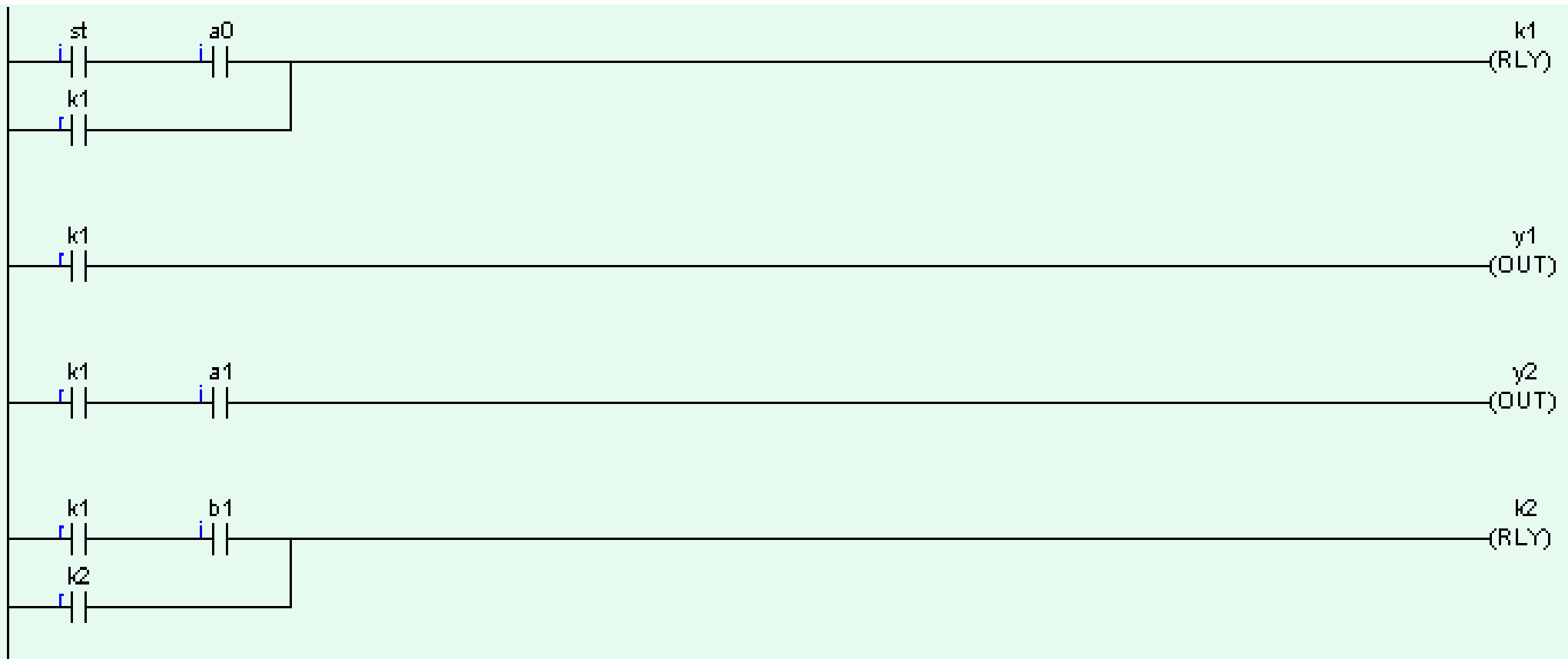




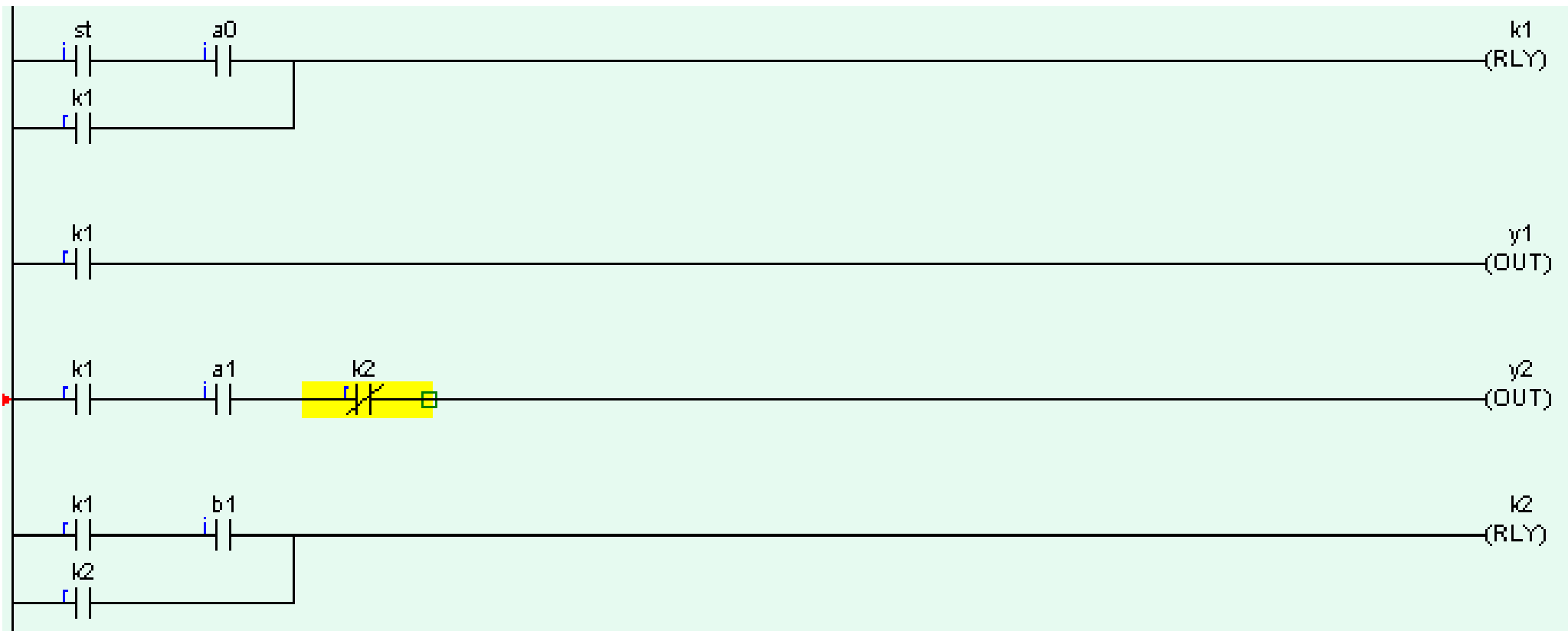
B+ → k1.a1



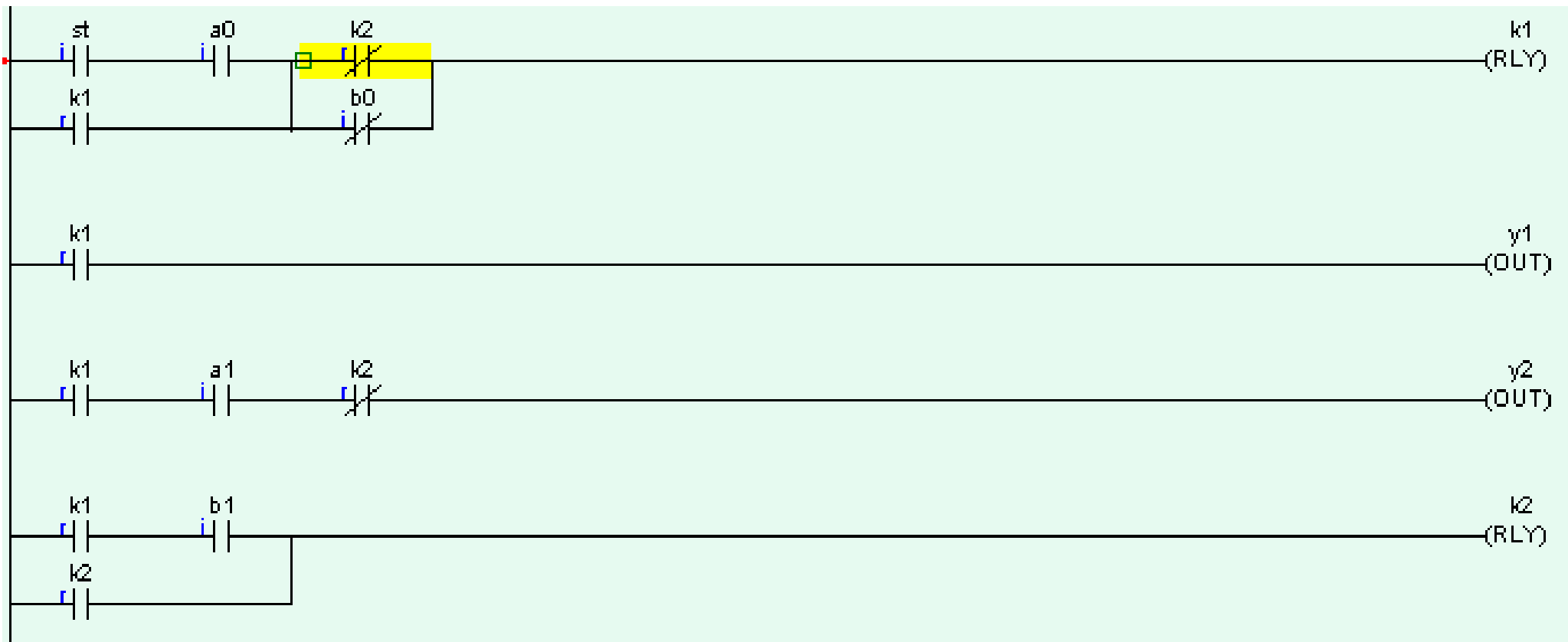
k2 → k1.b1



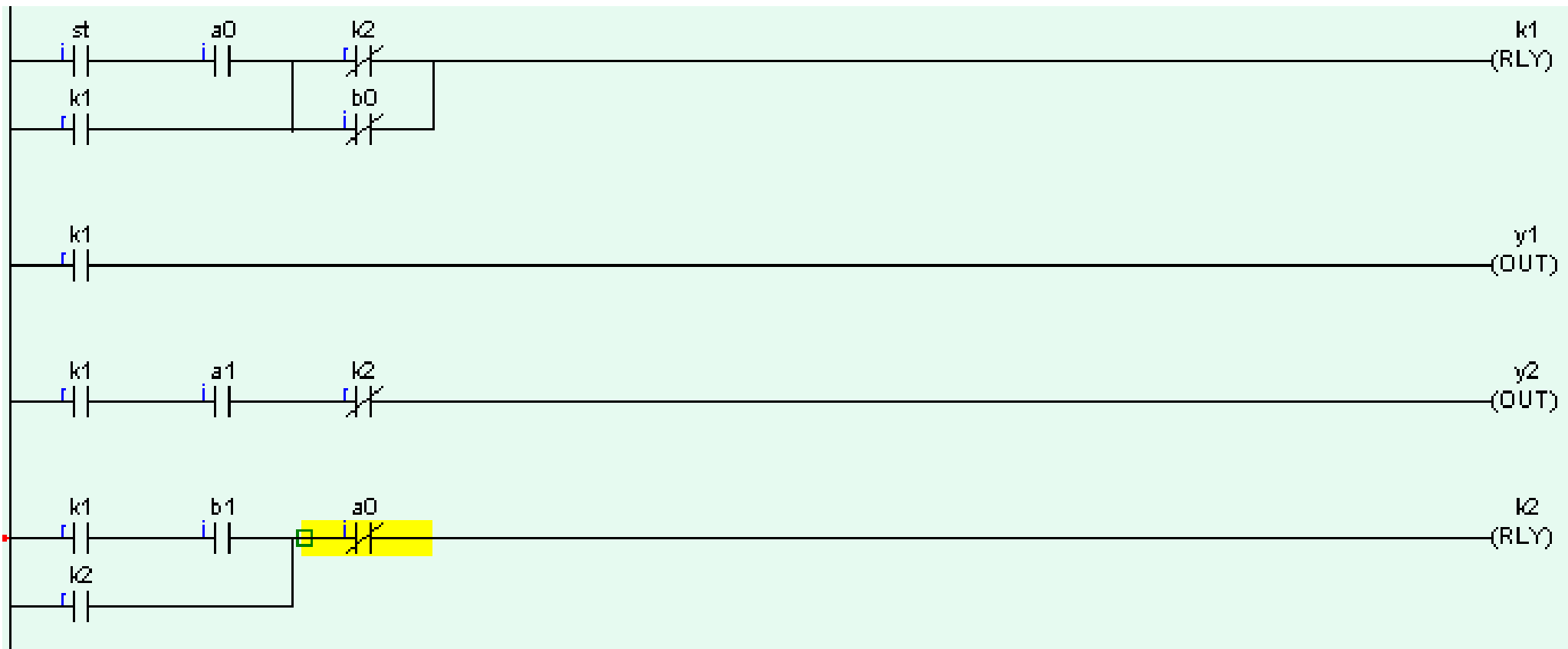
# B- → k2



A- → k2.b0



# Don't forget to OFF k2



# Summary

- In this lesson, we have learn
  - The basic symbols and function in PLC ladder diagram.
  - How to design a ladder diagram for pneumatic application