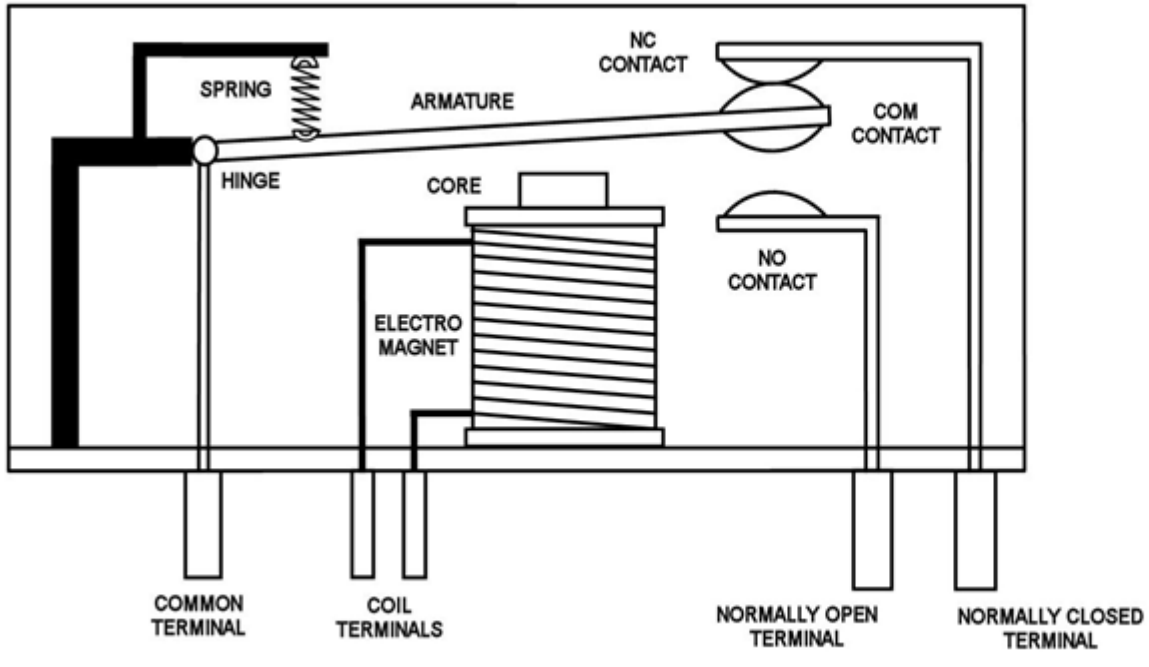
PLC

PROGRAMMABLE LOGIC CONTROLLER

Introduction to PLC

What is Relay ?

- Electromechanical switch



This is a drawing of a de-energized relay When no current is flowing in the electromagnet coil the armature is pulled up by the spring and its COM contact connects to the NC contact.

Introduction to PLC

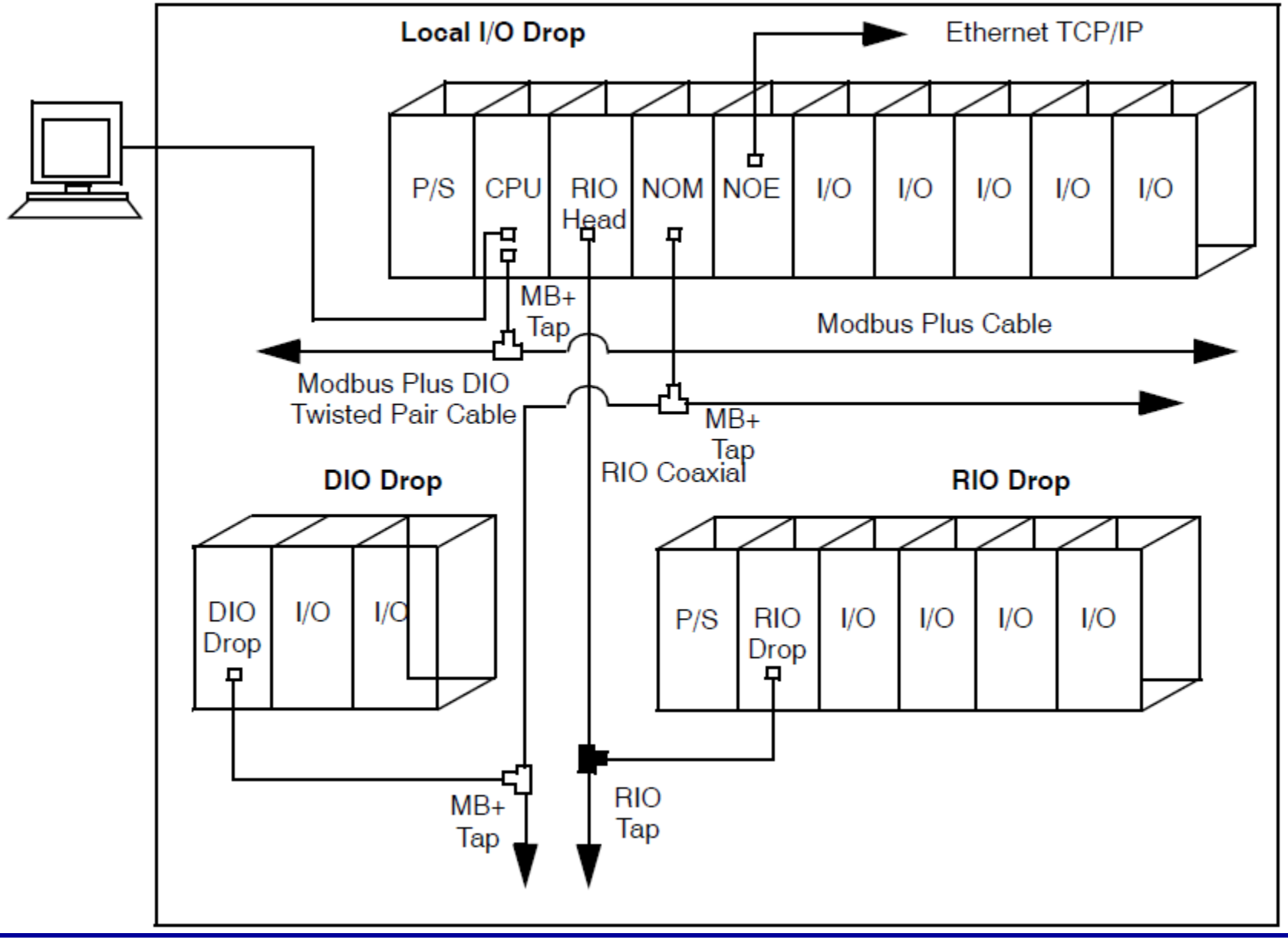
Manufacturers

- Siemens (Top Manufacturer ~ 30% of the Market)
- Allen-Bradley
- Mitsubishi
- Others: Omron, Toshiba, HIMA, GE-Fanuc

Advantages

- Diverse range of Inputs/Outputs
- Protection from Electrical noise
- Protection from Vibration
- Diverse range of temperatures
- Input/Output Fast Scan Rates

Block Diagram of Modicon PLC (Schneider Electric



Sensors and Actuators

- Example of Sensors
  - Temperature
  - Flow
  - Pressure
  - Level
  - Limit switch
  - On-off switch
  - Pushbutton
  - Fire/Gas/Smoke
- Example of Actuators
  - Motors
  - Valves
  - Lamps/LEDs
  - Alarms
  - Pumps

Programming Methods

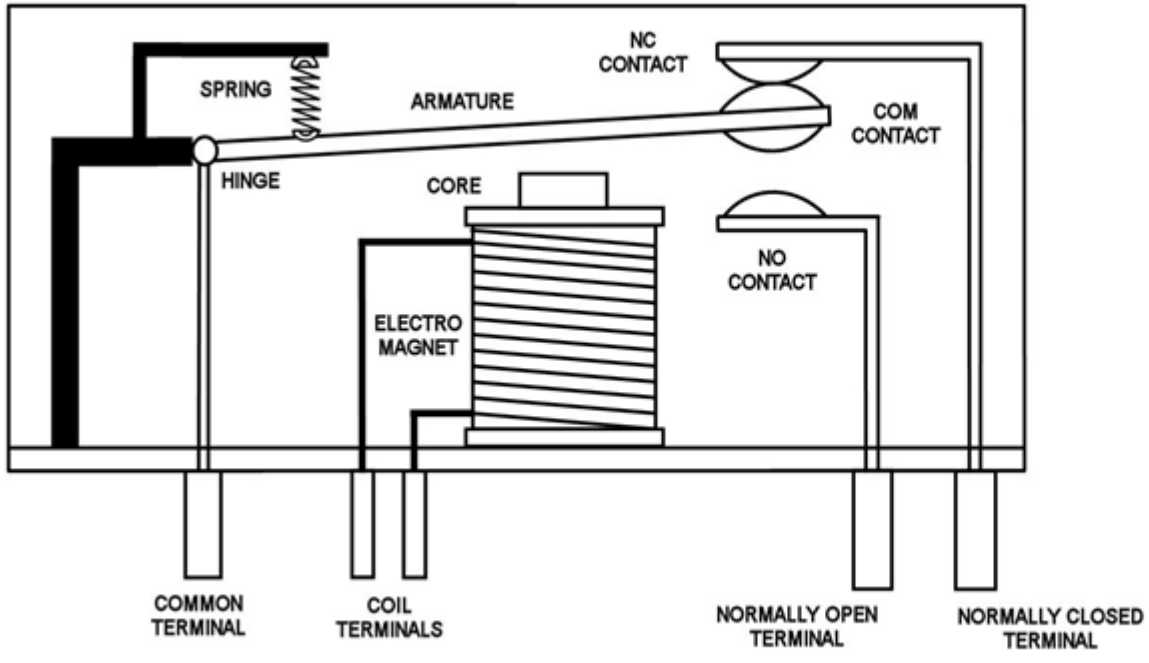
- Ladder Logic (most famous/widely used)
- Function Blocks (new trend)
- Other: Sequential Function Charts, Structured Text

Programming Devices

- Hand held Programmers
- PCs Off-line Programming
- Dedicated Programmers

Introduction to Ladder Logic

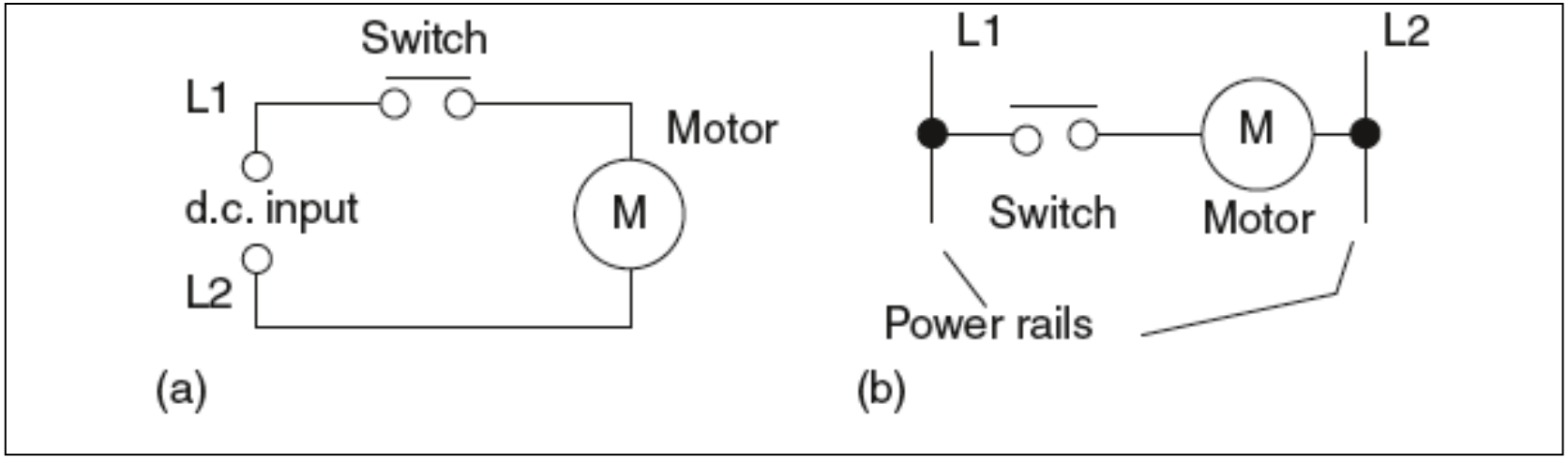
- Basic Building Block: **Relay**

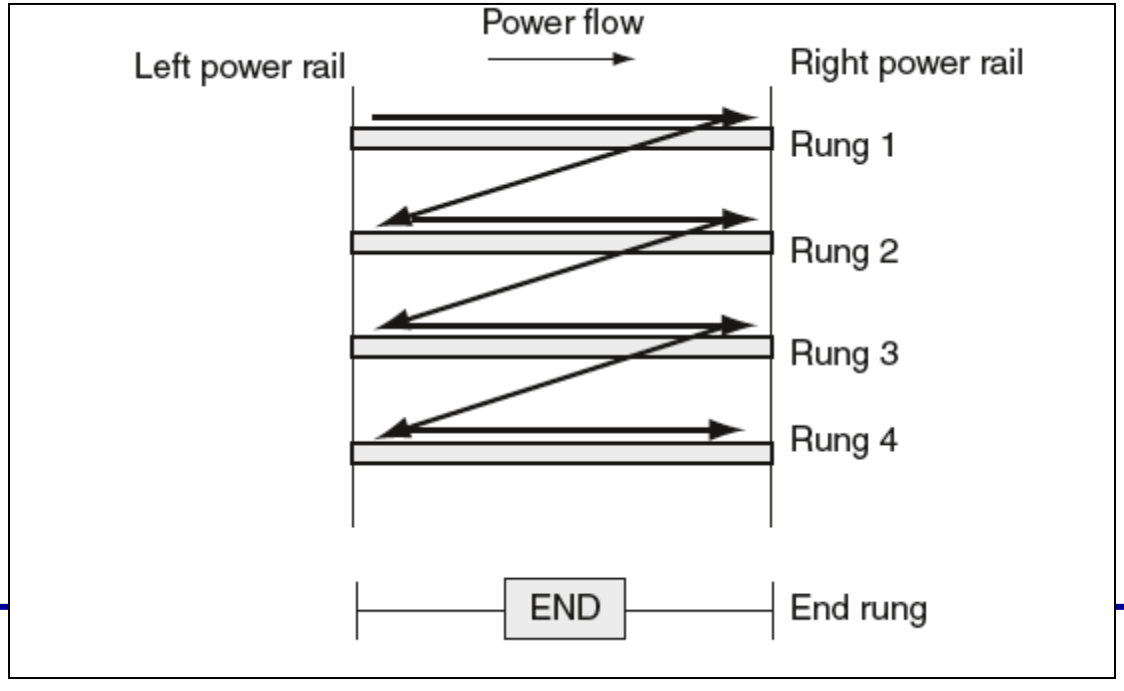


This is a drawing of a de-energized relay When no current is flowing in the electromagnet coil the armature is pulled up by the spring and its COM contact connects to the NC contact.

Introduction to Ladder Logic

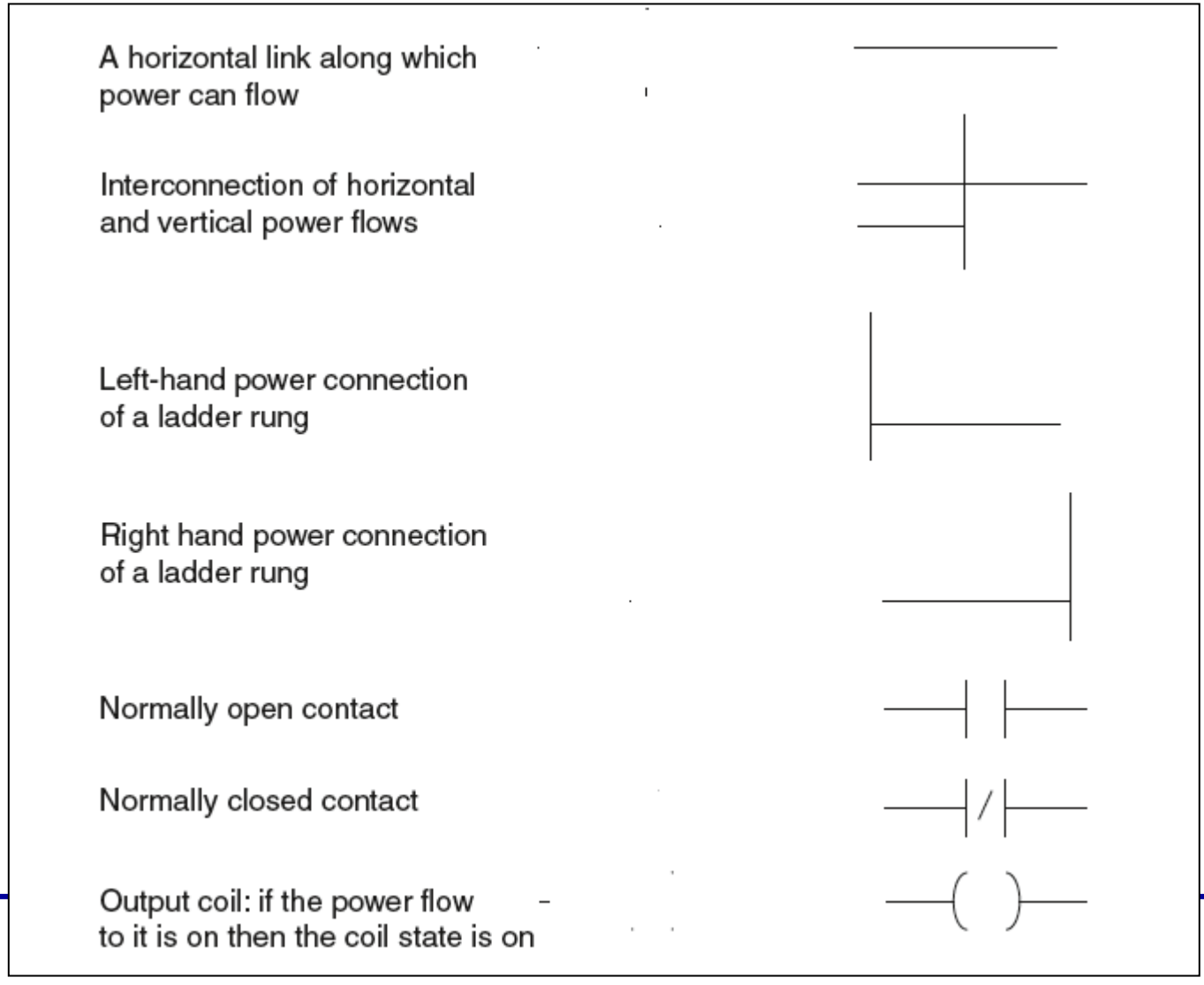
- Programming Symbols and Terminology





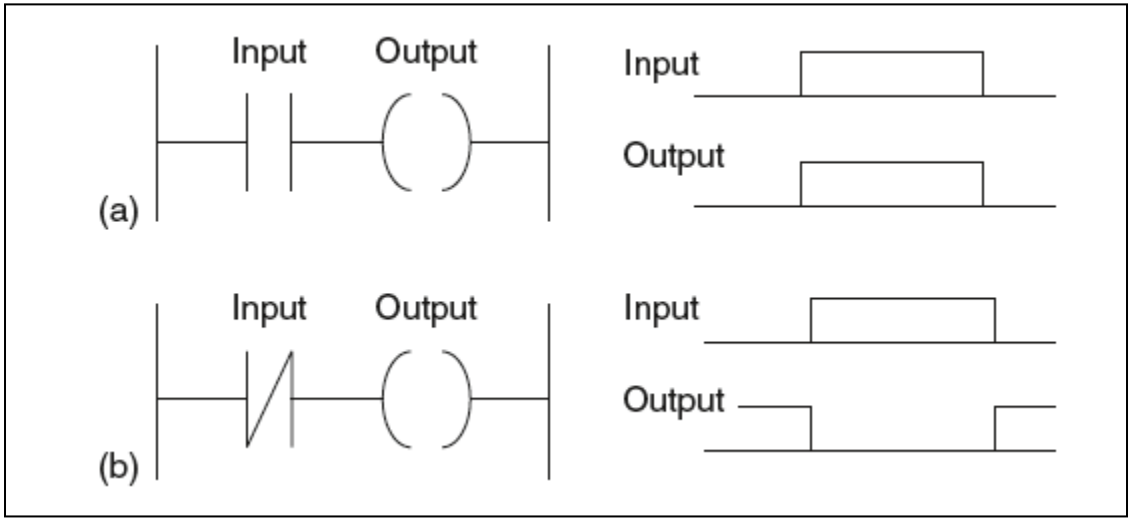
Introduction to Ladder Logic

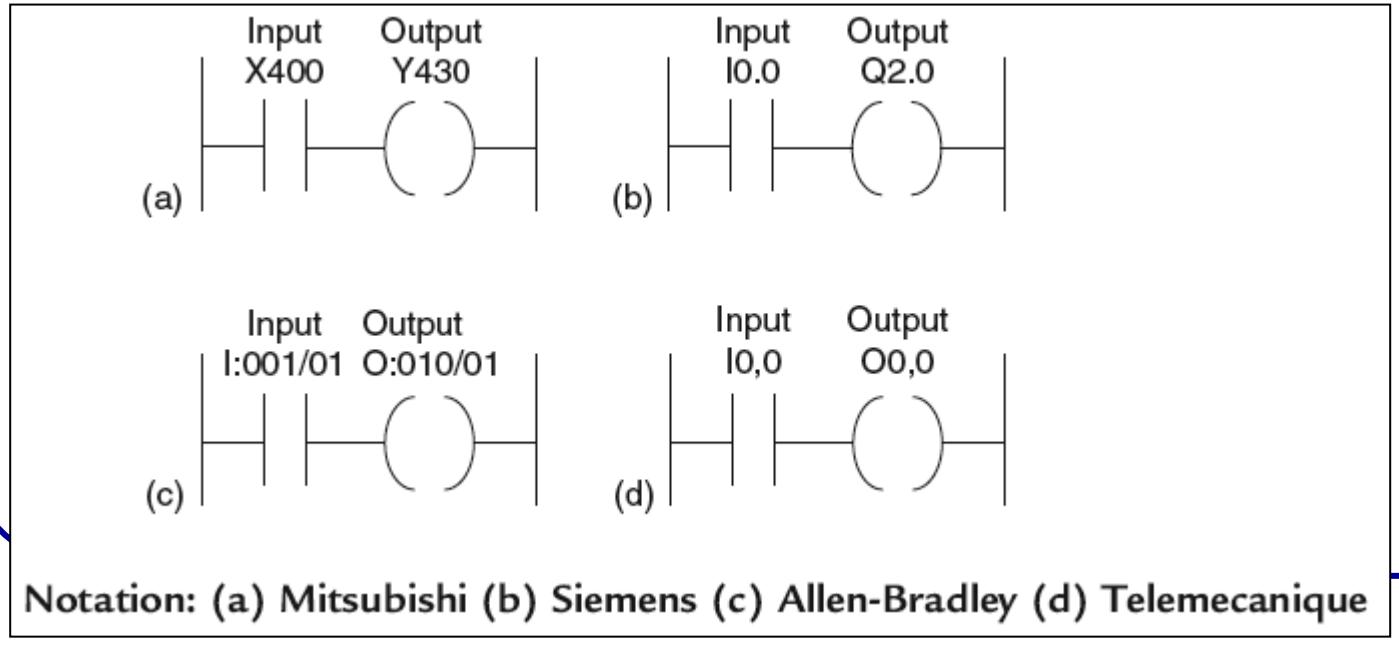
- International Electro-technical Commission Standard (IEC 1131-3)



Ladder Logic - Addressing

- Inputs and Outputs are all identified by their addresses (notation depend on manufacturer)





Notation: (a) Mitsubishi (b) Siemens (c) Allen-Bradley (d) Telemecanique

Example – Automated Car Park Entrance

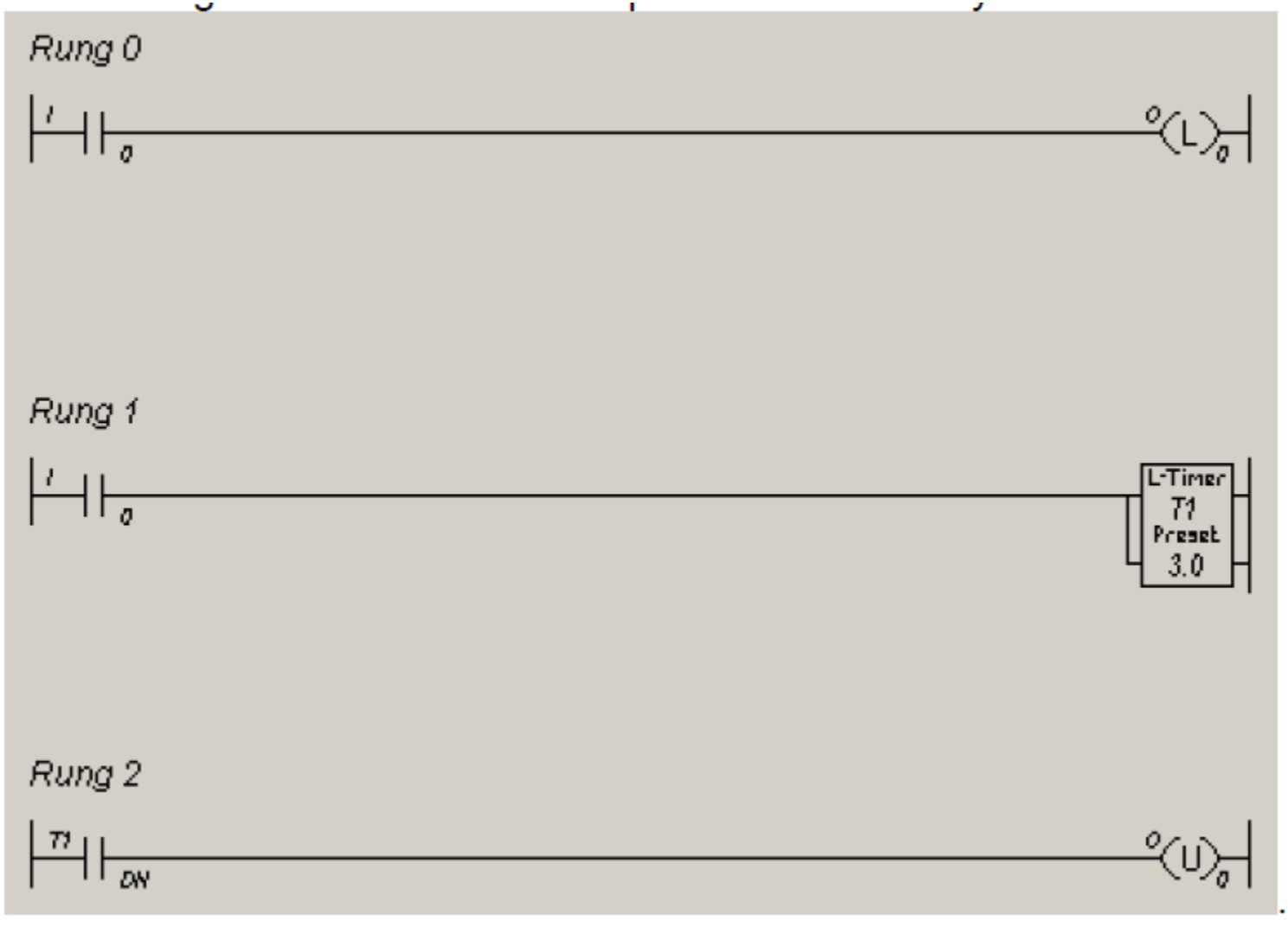
- Problem Statement
  - **Develop the Ladder Logic for an Automated Entry to a Car Parking using IR sensor for Car Detection and Motorized Barrier Beam.**
- Inputs / Outputs
  - How many sensors and actuators??

- LadSim Software:

Fully functional ladder logic design and PLC simulation software program by BYTRONIC that incorporates the functions used in PLC ladder programming. LADSIM uses the PC as a virtual PLC.

16 inputs/16 outputs/16 flags(Auxiliary Relays)/8 timers/ 8 counters/4 16-Shift Bit Registers.

Example – Automated Car Park Entrance



Automated Car Park Entrance

- Do not forget Resetting your timers !

Adding counters

- For example: 6 cars means car park full light is ON

PLC – Advanced Topics

- Safety
  - Fail-Safe
- Redundancy (Safety Integrity Level – SIL)
  - IEC Standard 61508/61511 (Application of Safety Instrumented Control Systems in the Process Industry)

Lab # 1 – Conveyor Belt

- It is required to design a Ladder Logic diagram to control the operation of a conveyor belt.
- There is a switch to start the system initially. The required operation is as follows: when the system is ON the conveyor belt starts moving with items loaded on it
- After 3 seconds the belt stops and the first item is inspected by a human inspector who stands before the belt and visually detects the passing items, the visual inspection takes about 5 seconds to detect if the item is good or not.
- After the 5 seconds the conveyor belt continues moving again. The time required for the next item to arrive before the inspector is 3 seconds. The inspector can reject items using a push button; after the item is rejected the conveyor belt continues moving directly without waiting the 5 seconds to pass.
- After the inspector rejects 3 items the system should stop.

QUESTIONS?

Note: Lab#1 Due Date is Sunday 9th October