

Programmable Logic Controller ME 314 - Lecture 1

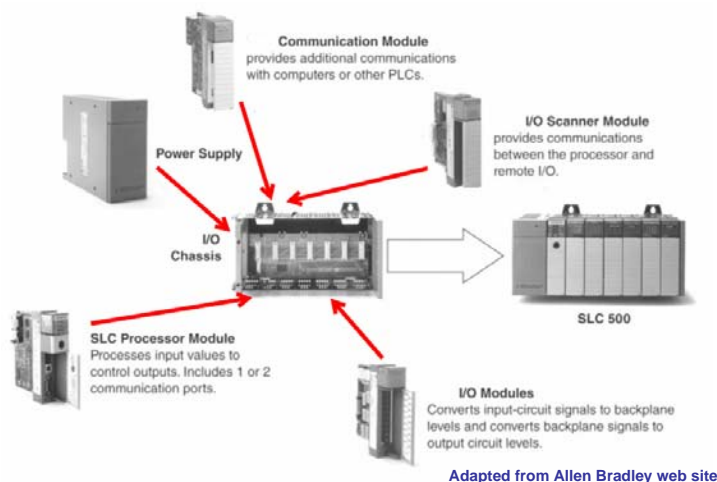
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Topics for PLC

- What is a Programmable Logic Controller (PLC)?
- How to program PLCs?
 - Ladder diagrams
- How to design the program?
 - State transition diagrams

What is a PLC?



- A special **computer** for logic controls

Definition of a PLC (Programmable Controller, PC)

ANSI/NEMA IA 2.1-1994 (R2002) paragraph 2.50:

A **digitally** operating **electronic** system, designed for use in an industrial environment, which uses a **programmable memory** for the internal storage of user-oriented instructions for implementing specific functions such as **logic, sequencing, timing, counting and arithmetic**, to control, through **digital or analog inputs and outputs**, various types of machines or processes. Both the PC and its associated peripherals are designed so that they can be easily integrated into an industrial control system and easily used in all their intended functions.

GM Criteria for PLCs - 1968

- Easy to program
- Easy to maintain
- Highly reliable in an industrial environment
- Expandable
- Cost competitive
- Compact
- Communicate
- Accept 120 VAC input signals
- Operate 120 VAC devices
- Over 4k memory

Signals in PLCs

- **Inputs**: describe the status of the process to the controller (external)
- **States**: discrete modes the controller can be in (internal)
 - **State transitions**: functions of the current state and the inputs
- **Outputs**: actions initiated by the controller based on the current state (external)

Logic Inputs {1,0}

SW1 (switch 1)
PB7 (push button 7)
START (start push button)
STOP (stop push button)
E-STOP (emergency stop button)
LS2 (limit switch 2)
etc.

Logic States {1,0}

Motor running
Press descending
Waiting for start
Waiting for n seconds
etc.

Logic Outputs {1,0}

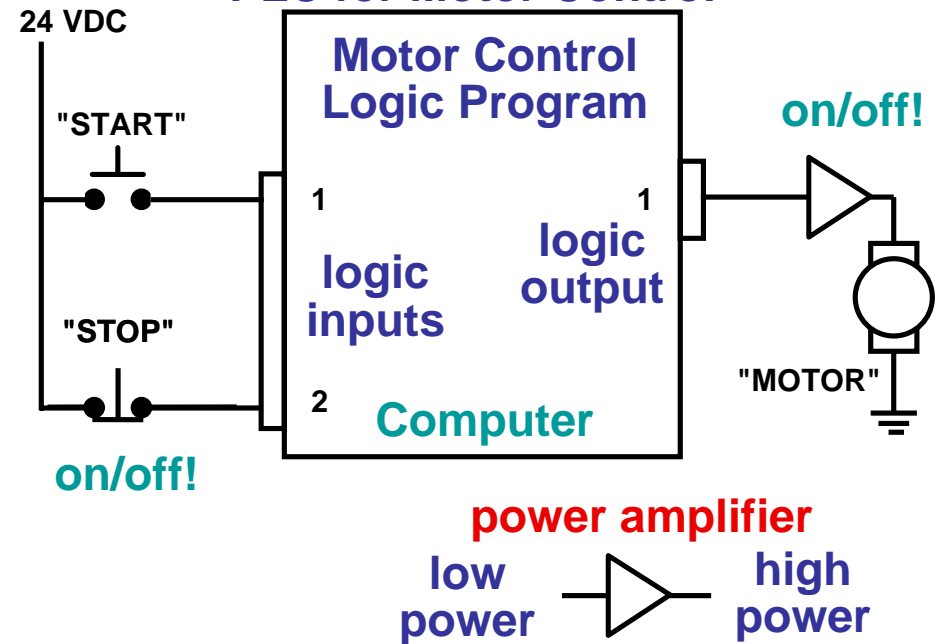
LAMP
MOTOR
VALVE
PUMP
etc.

LAMP = 1 sets lamp on
LAMP = 0 sets lamp off

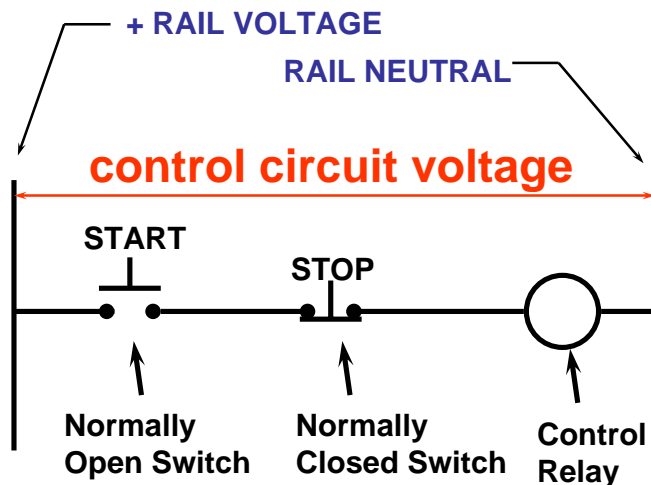
outputs are set by
the state of the
control system

SOLa (solenoid a)
M1 (motor relay 1)
M2 (motor relay 2)
etc.

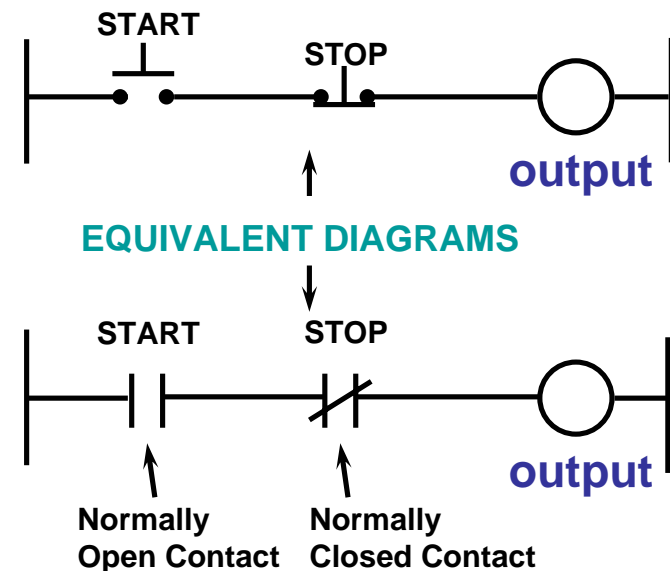
PLC for Motor Control

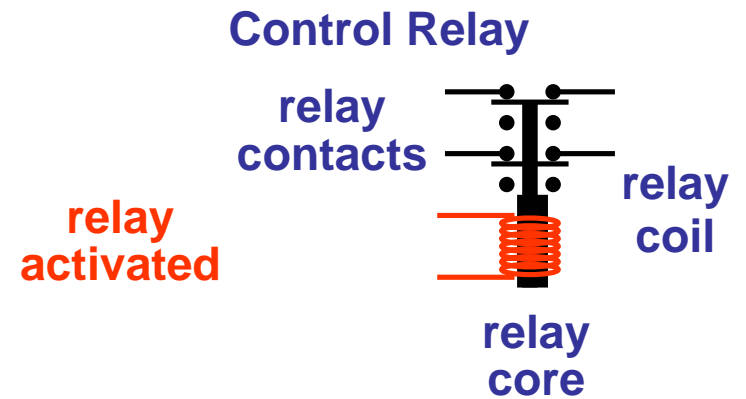
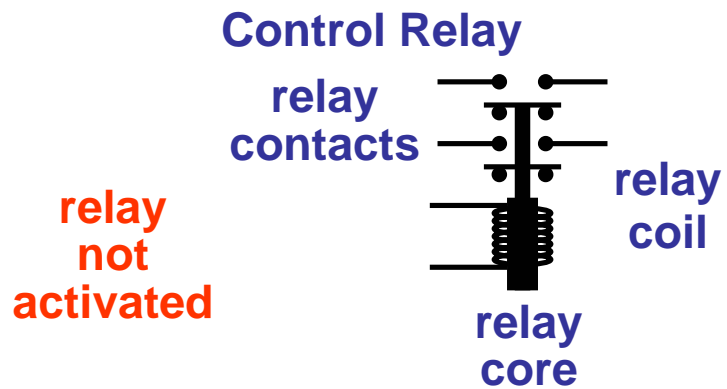
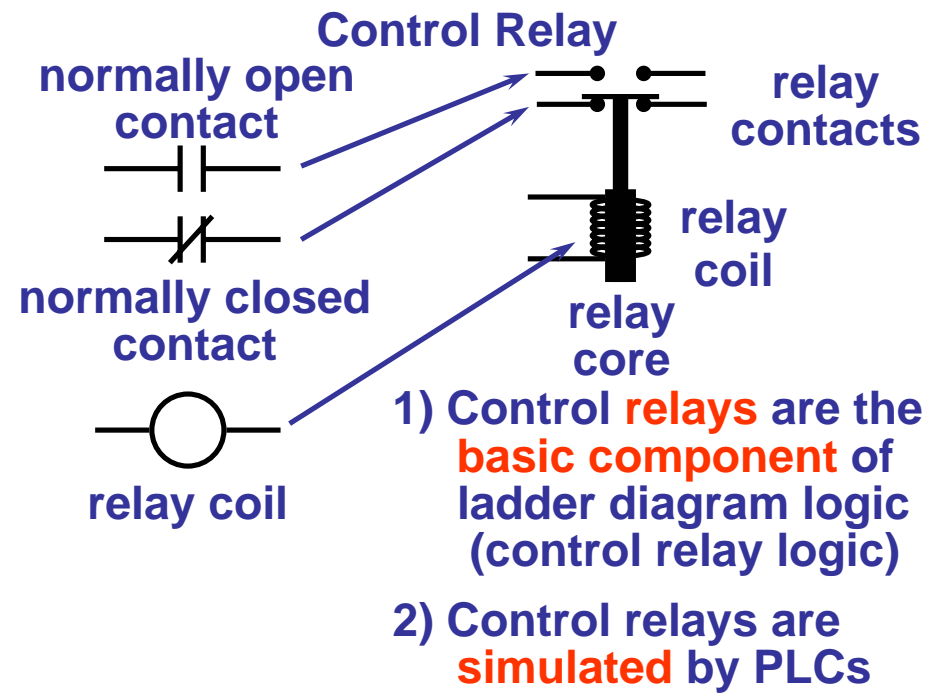
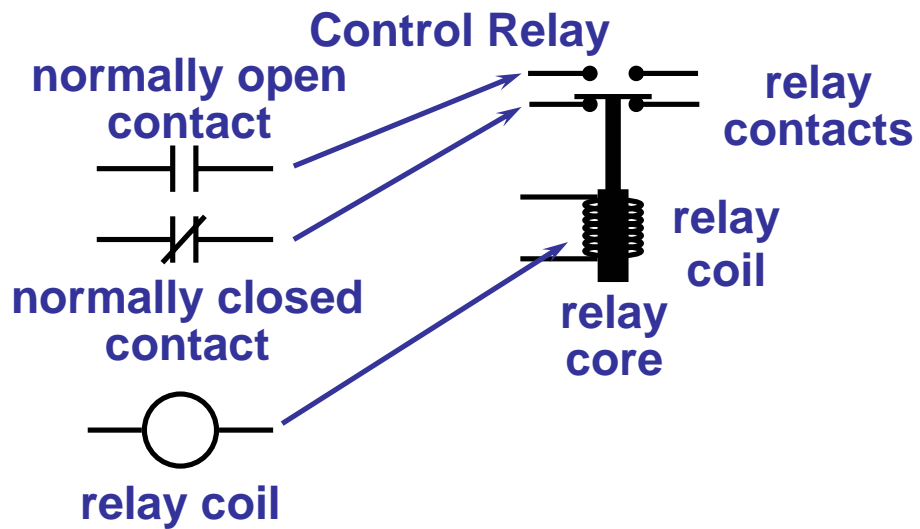


Motor Control Ladder Diagram

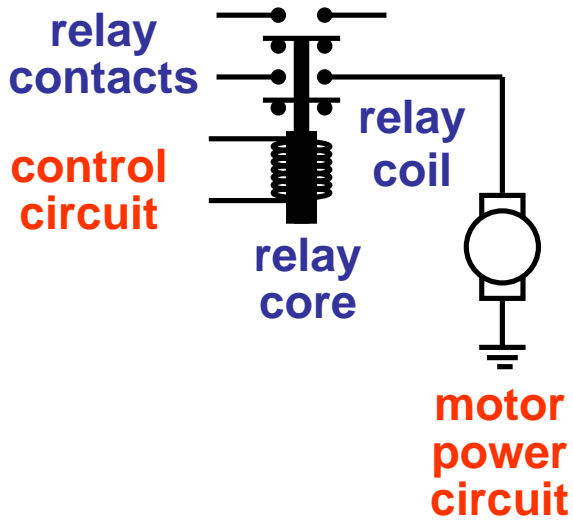


Motor Control Ladder Diagram

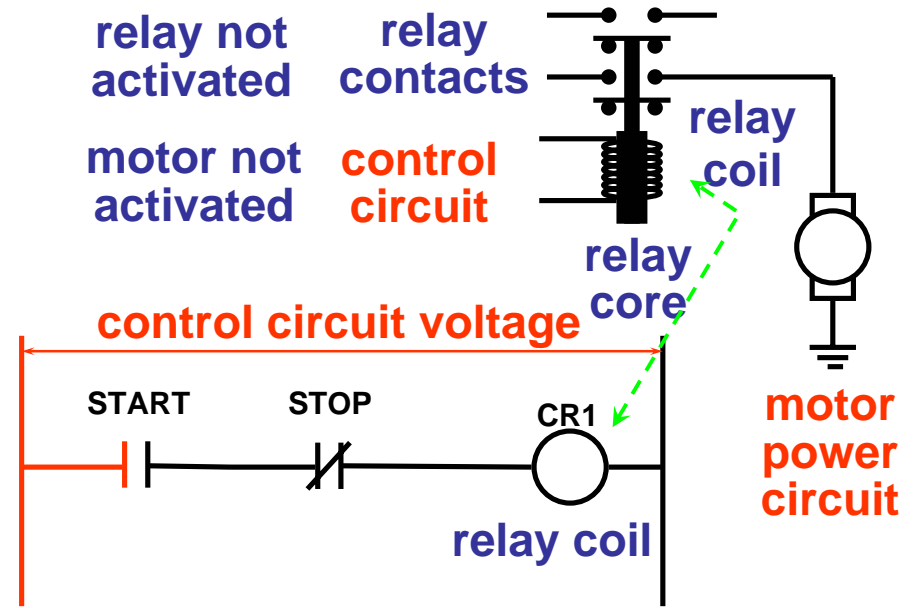




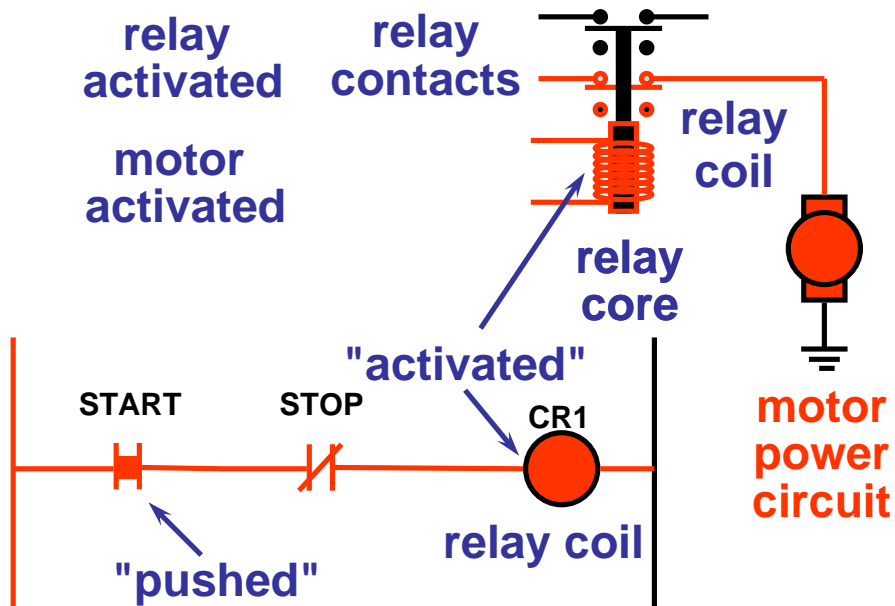
Motor Control Ladder Diagram



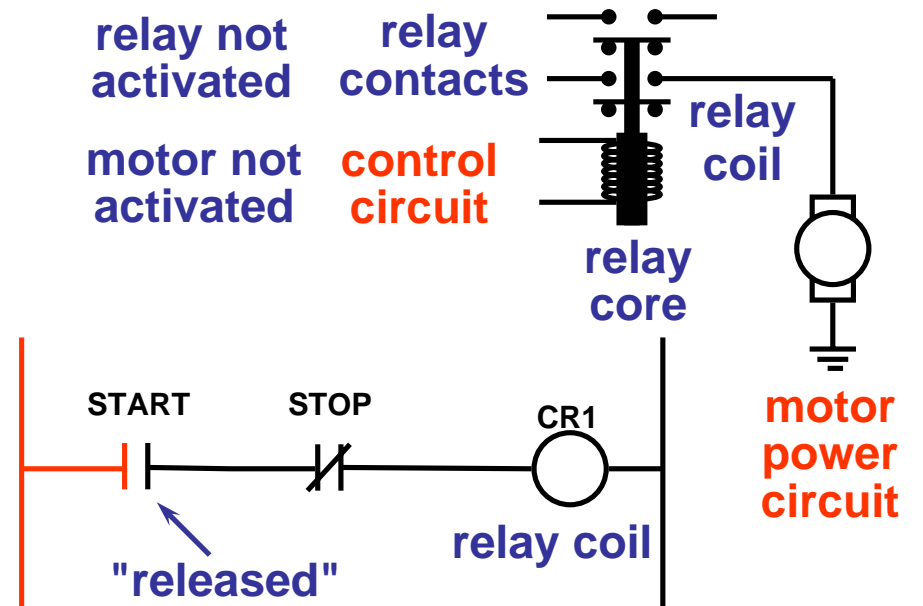
Motor Control Ladder Diagram



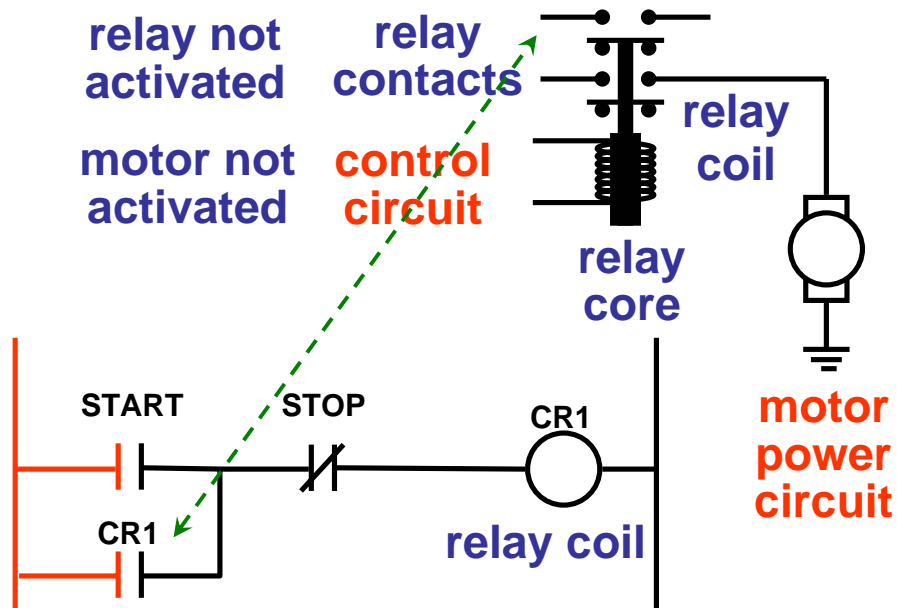
Motor Control Ladder Diagram



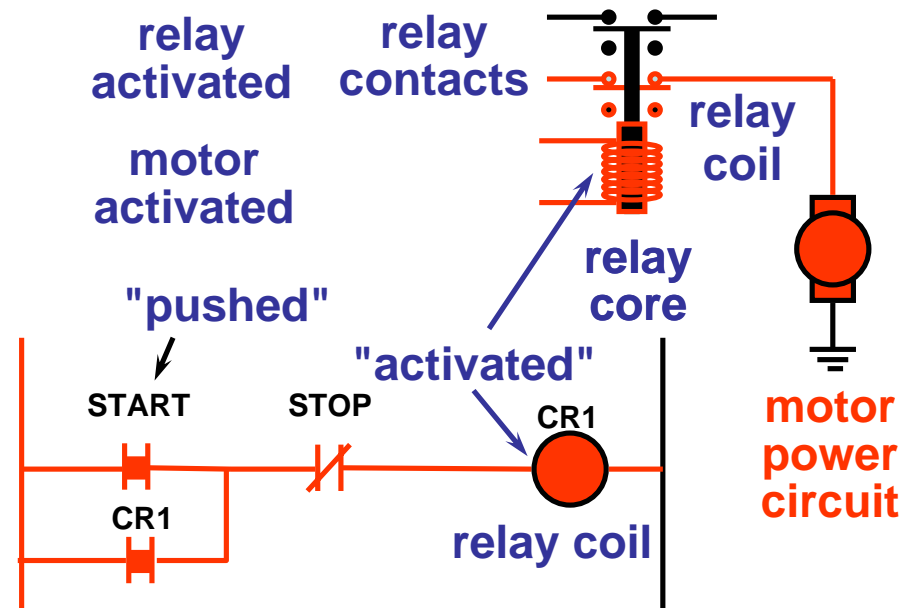
Motor Control Ladder Diagram



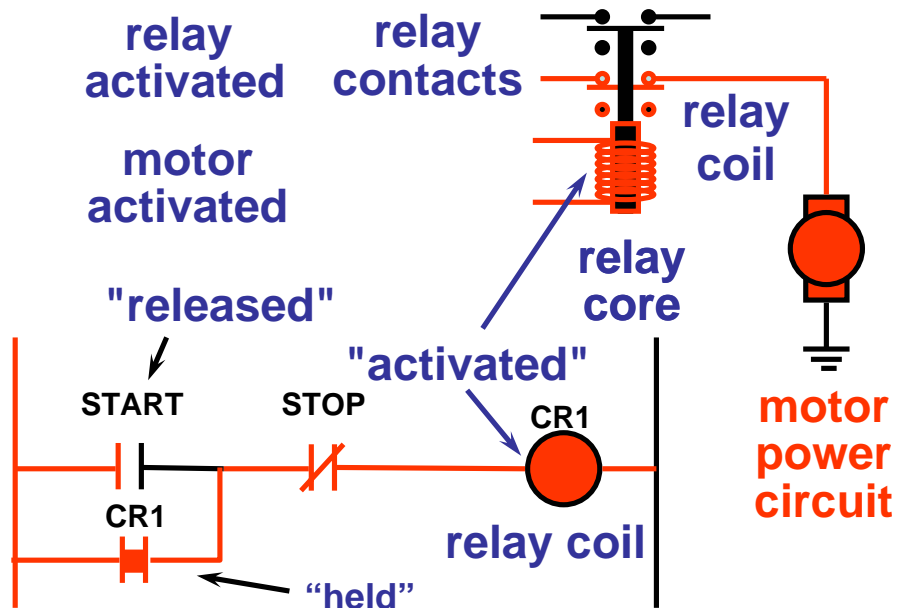
Motor Control Ladder Diagram



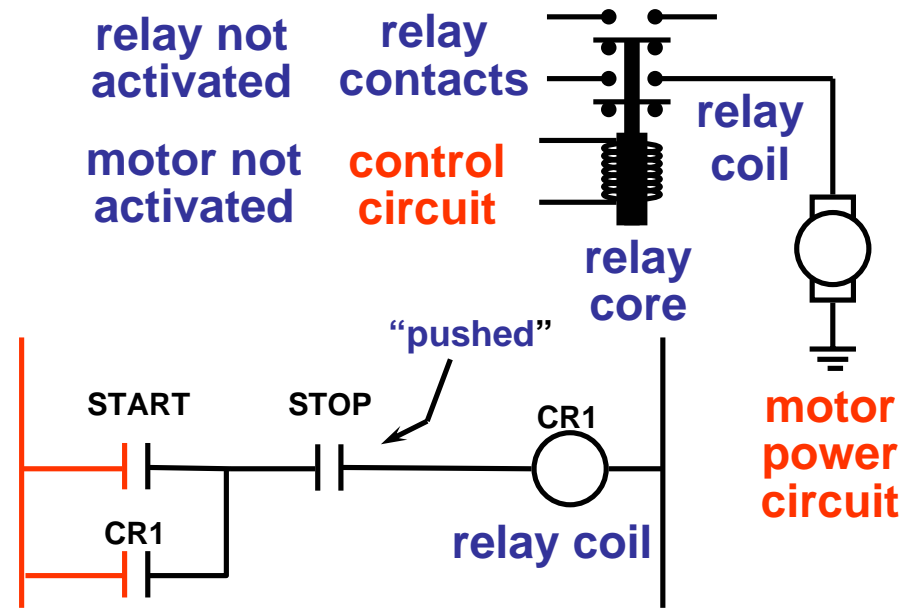
Motor Control Ladder Diagram



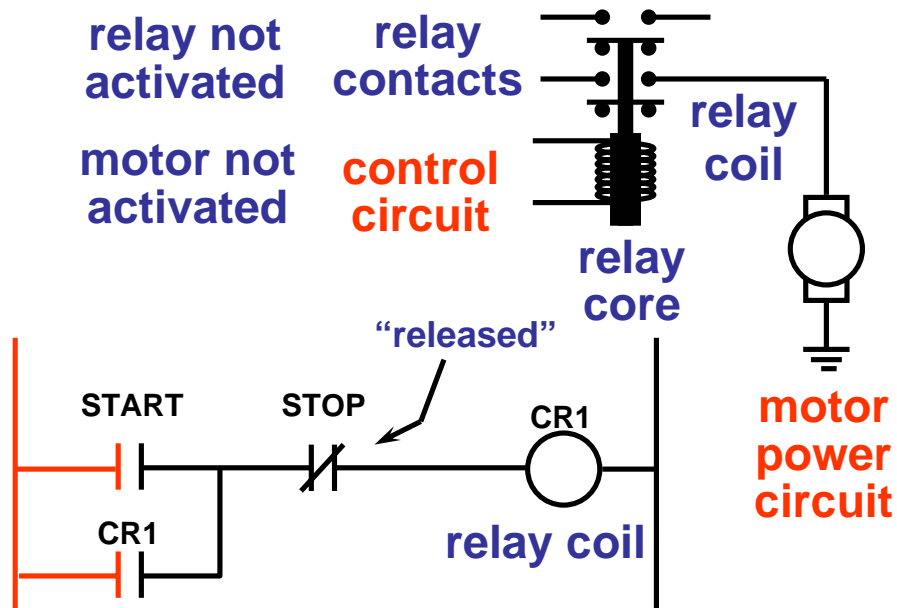
Motor Control Ladder Diagram



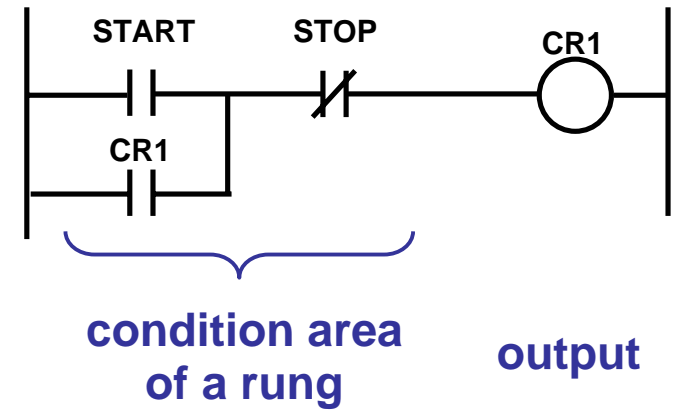
Motor Control Ladder Diagram



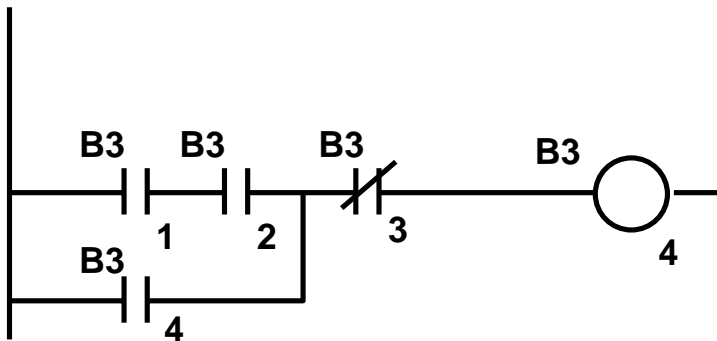
Motor Control Ladder Diagram



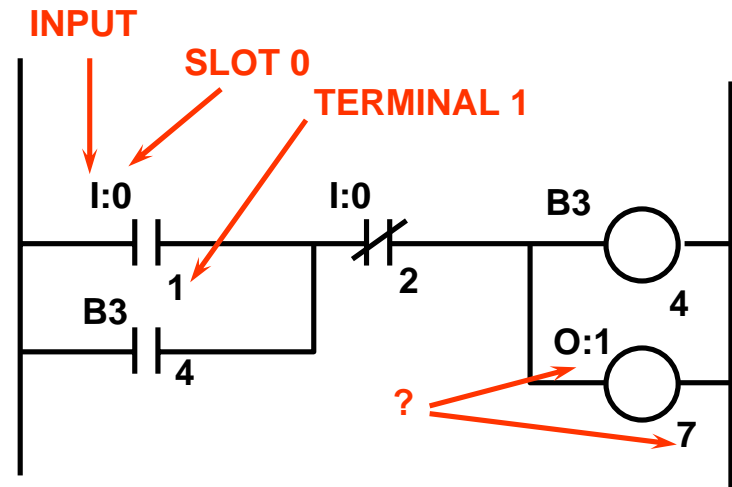
PLC Ladder Diagram



In a PLC all internal states, inputs and outputs are assigned to bits.



All external inputs and outputs are assigned to modules.



Programmable Logic Controller

ME 314 – Lecture 1

- Introduction to PLCs
- An example of using PLC in motor control
- Ladder diagrams for PLC programming
- State transition diagrams
- State transition diagrams to ladder diagrams