Unit V

LADDER,PLC AND CASCADE

Ladder diagram

- **Ladder logic** has evolved into a **programming language** that represents a program by a graphical diagram based on the circuit diagrams of **relay logic** hardware.

- In the ladder diagram each rungs show how a field is turned on and also interacts with next field devices.
- Since PLCs use logic ladder diagrams, the conversion from existing electrical relay logic to programmed logic is easy to accomplish.
- The devices are connected in series or parallel to produce the desired logical result.
- Ladder logic is used to develop software for programmable logic controllers (PLCs) used in industrial control applications.

Ladder diagram physical output

- —( )— A **regular coil, energized** whenever its rung is closed.
- —(\)— A "not" coil, energized whenever its rung is open.
- —[ ]— A regular contact, closed whenever its corresponding coil or an input which **controls it is energized.**
- —[\]— A "not" contact, closed whenever its corresponding coil or an input which **controls it is not energized**

Ladder logic

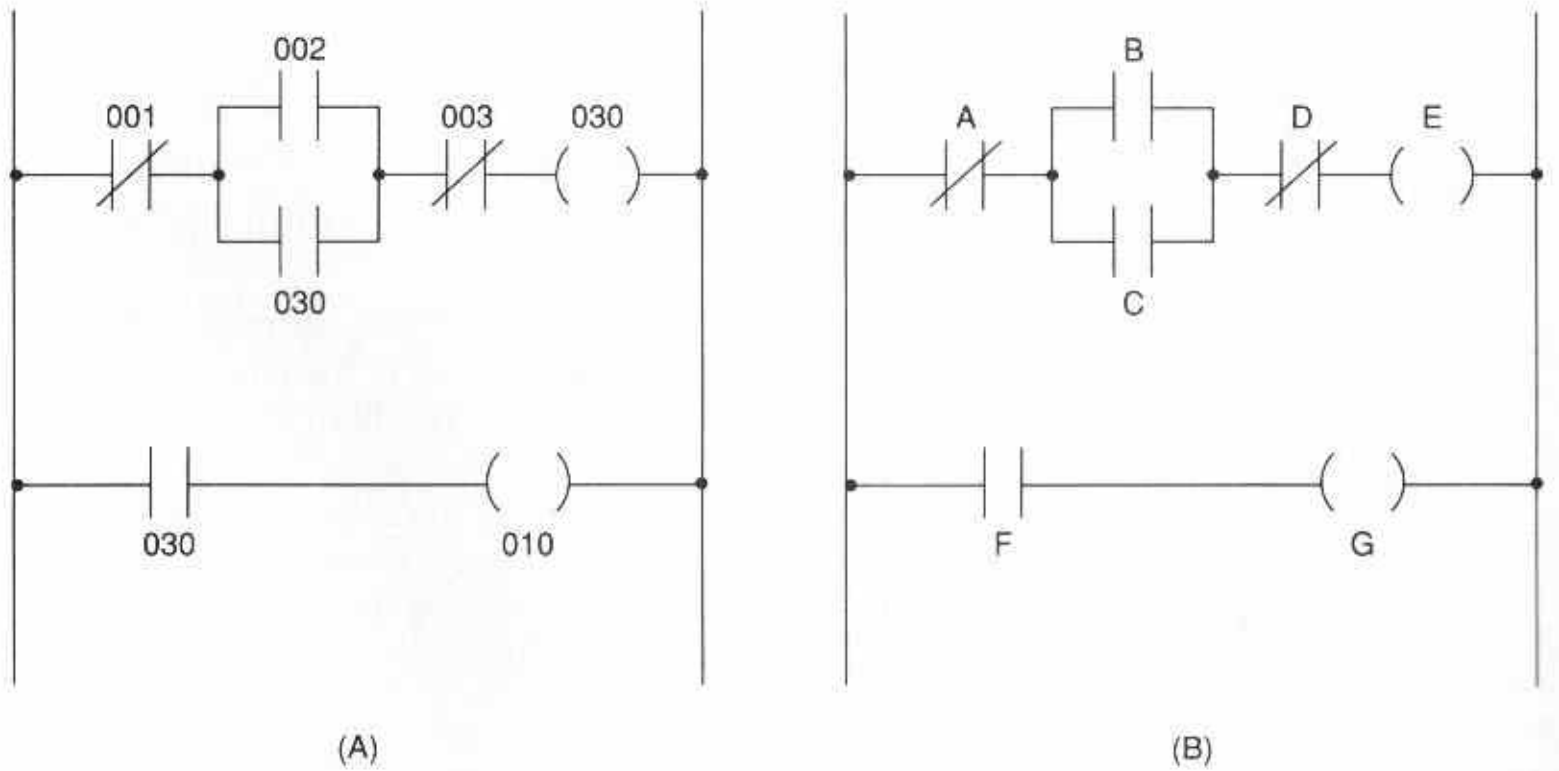


Figure 13-36. PLC ladder logic diagrams.

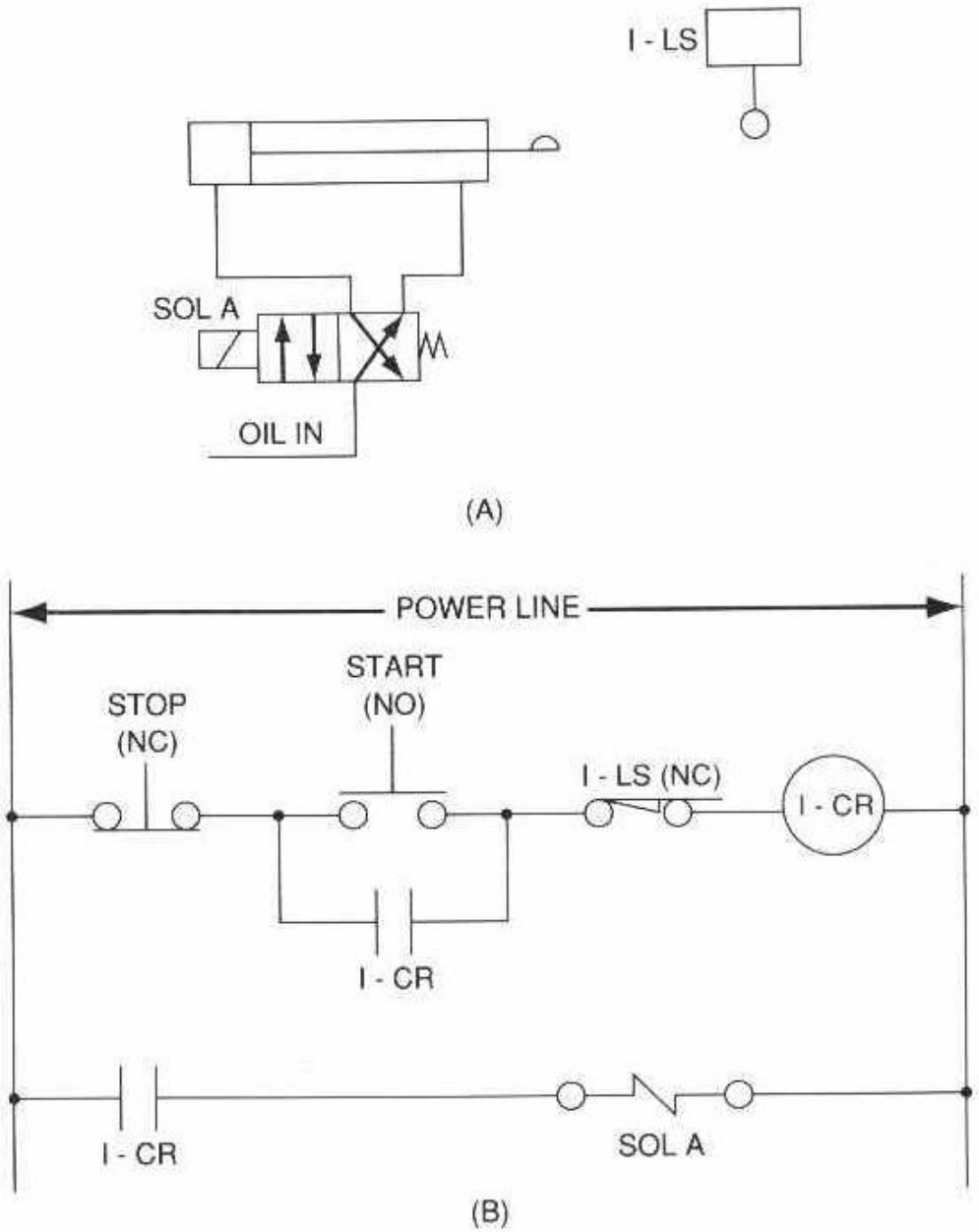


Figure 13-34. Control of a hydraulic cylinder using a single limit switch.

Programmable Logic Controllers (PLCs)

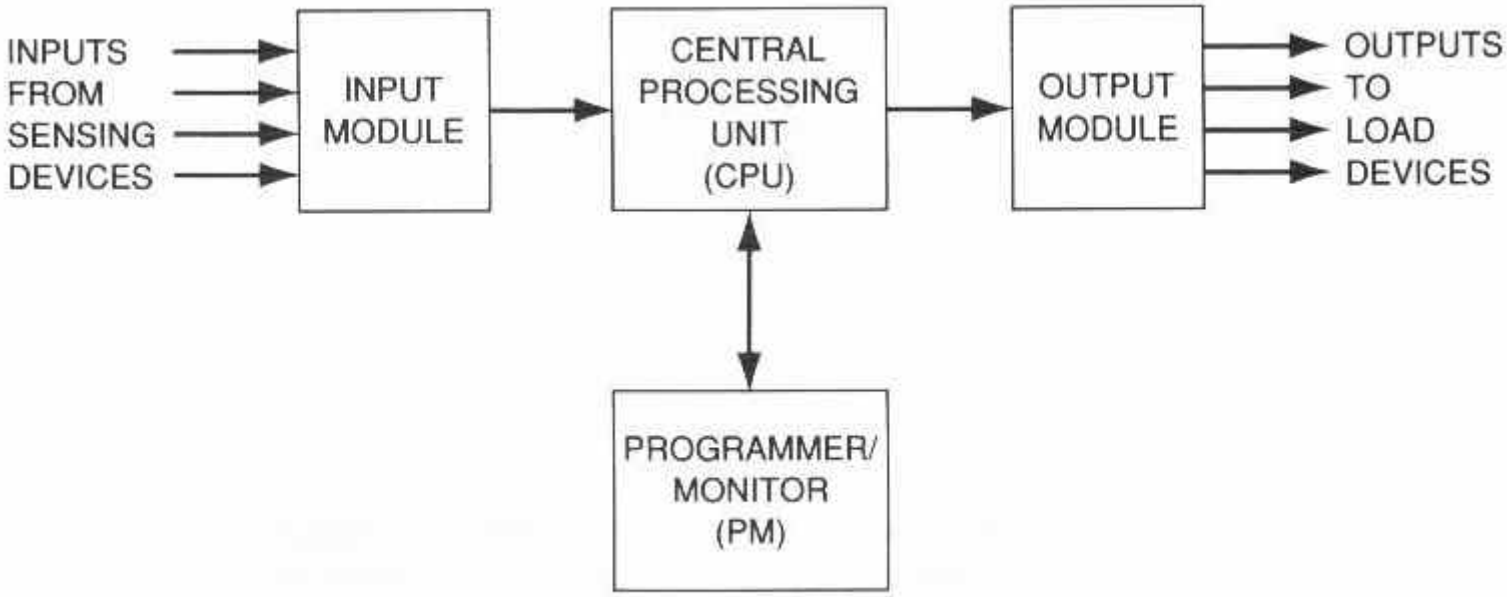


Figure 13-30. Block diagram of a PLC.

Logic function

- AND
- OR
- NOT

- A programmable logic controller (PLC) is a user-friendly electronic computer designed to perform logic functions such as AND, OR. and NOT for controlling the operation of industrial equipment and processes.
- PLCs, which are used in electromechanical relays consist of solid-slate digital logic elements for making logic decisions and providing corresponding outputs.
- Unlike general-purpose computers, a PLC is designed to operate in industrial environments where high ambient temperature and humidity levels may exist.

I/O connection diagram

- There are three sensing input devices to be connected to the input module and one output control/load device to be connected to the output module.
- The electrical relay is not included in the I/O connection diagram since its function is replaced by an internal PLC control relay.

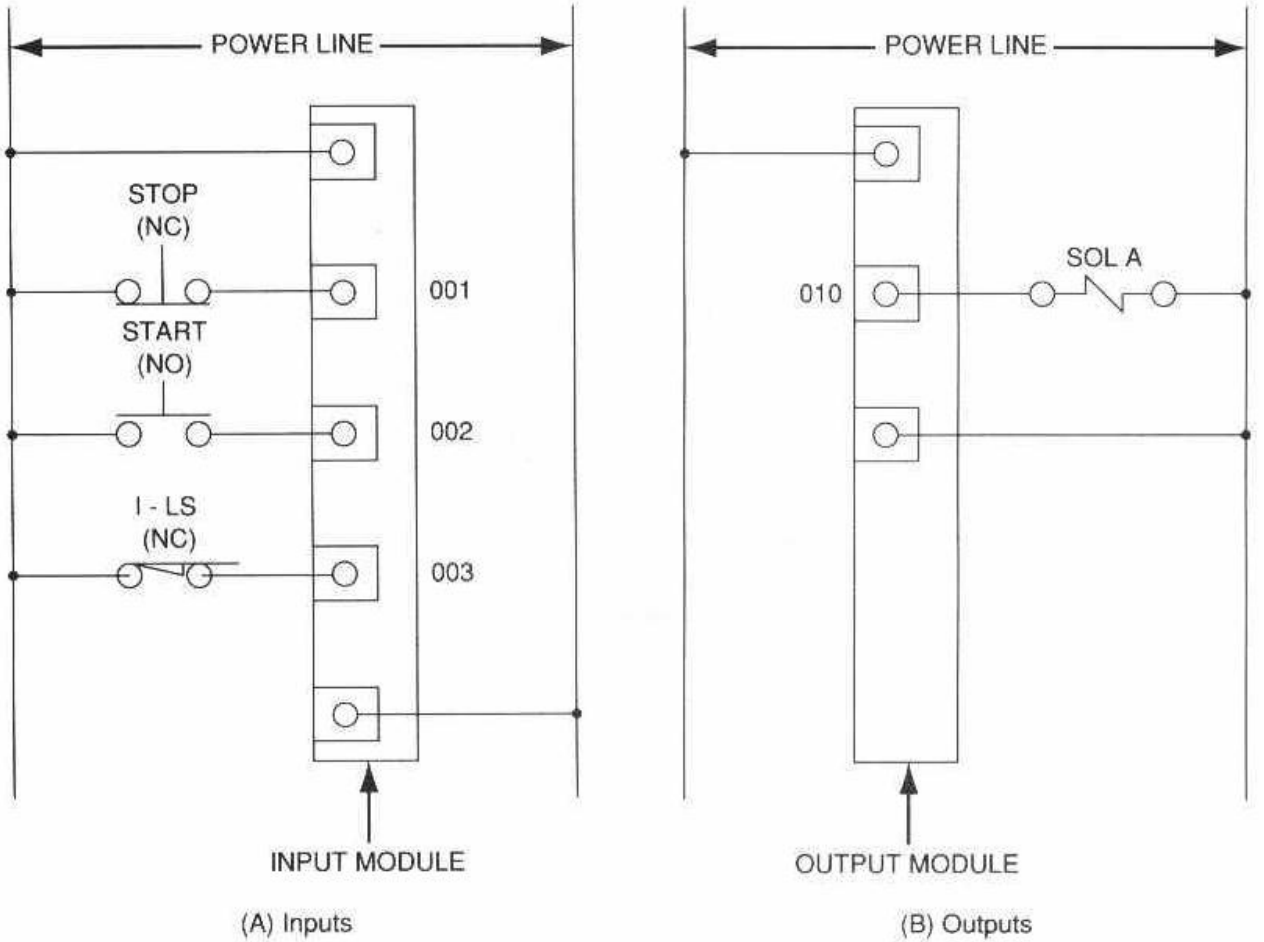


Figure 13-35. I/O connection diagram.

Advantages

PLCs provide the following advantages over electromechanical relay control systems:

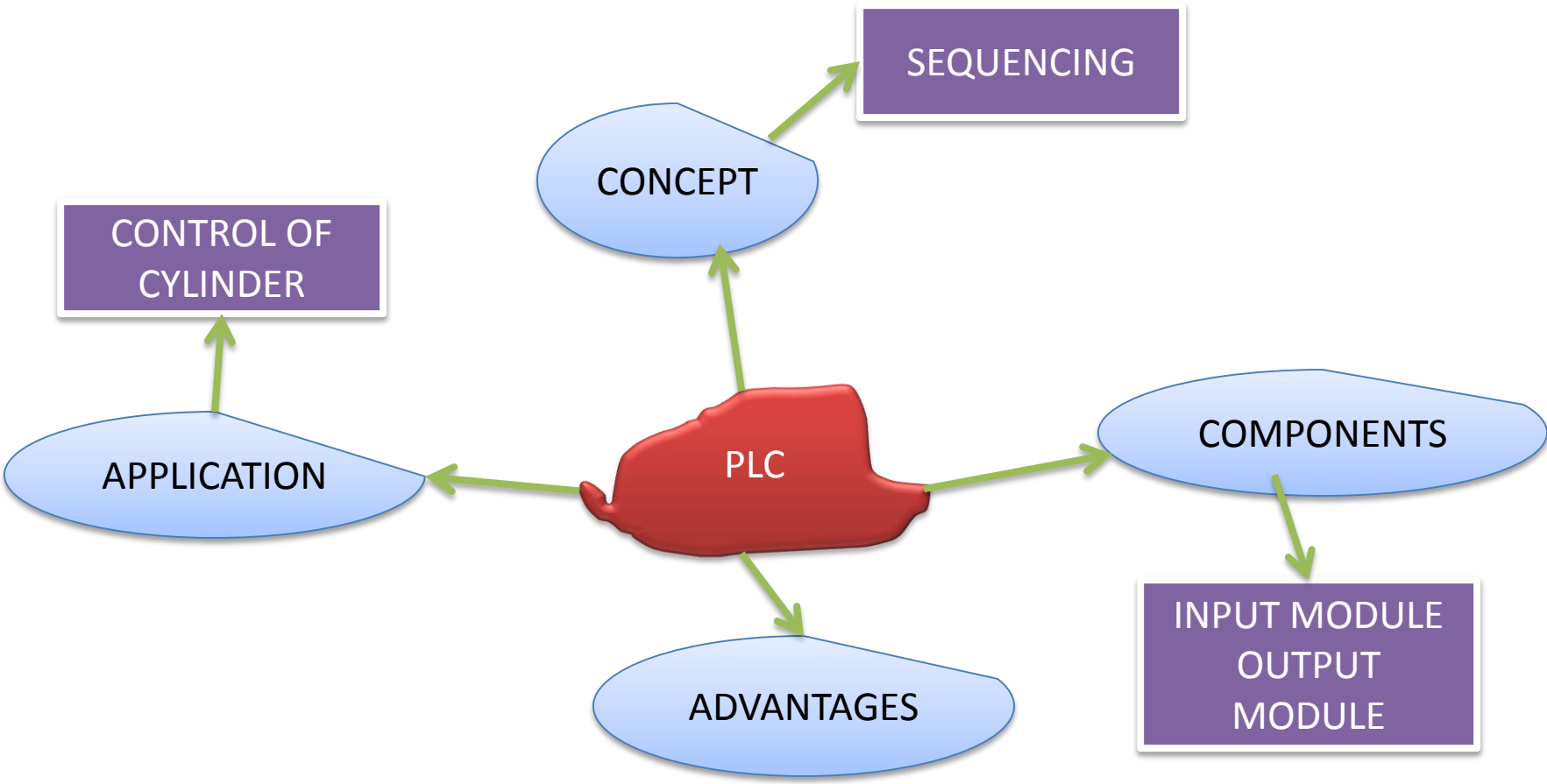
- They are more reliable and faster in operation.
- They are smaller in size and can be more readily expanded.
- They require less electrical power and are less expensive for the same number of control functions.

Practice

- Design a Sequential circuit for simple applications using cascade method.

Questions

1. What is PLC?
2. How does PLC differ from general purpose computers?
3. List the major units of PLC.
4. What is the function of CPU in PLC?
5. What is the purpose of I/O module in PLC?
6. Name the programming methods for programming the PLC.
7. What are the applications of PLC?


SEQUENCING
CONCEPT
CONTROL OF CYLINDER
APPLICATION
PLC
COMPONENTS
INPUT MODULE
OUTPUT MODULE
ADVANTAGES

Summary

- Logic circuits are also designed in fluid power system.
- It provides a means by which a logic circuit can be reduced to its simplest form.
- PLC is a device which is used to specialized circuit
- Major components
  - I/O Moule
  - Programming device

  - Program Monitor
  - Memory
- Used to create cylinder sequencing
- It avoids pressure trapped inside the components

Assessment

1. A “NAND” element needs:

A. one signal to block through flow. B. two signals to block through flow.

C. three signals to block flow.

2. A “NOR” element needs:

A. one signal to block through flow. B. two signals to block through flow.

C. three signals to block flow.

3. PLCs are _____ designed for use in the control of a wide variety of manufacturing machines and systems.

a) special-purpose industrial computers b) personal computers c) electromechanical systems d) All of the above

4)The _____ is moved toward the relay electromagnet when the relay is on.

a) Armature b) Coil c) NO contact d) NC contact

5)When a relay is NOT energized:

a) There is an electrical path through the NO contacts

b) There is an electrical path through the NC contacts

c) Neither the NO or the NC contacts have an electrical path

d) Both the NO and the NC contacts have an electrical path

Higher Order Question

- Actuation of a push button (S1) is to cause a lamp (H1) to be switchedon. The lamp is to be illuminated as long as the push button is actuated. Drawing up the circuit diagram and assembling the equipment Exercise definition

1. Declare of PLC program variables
2. Formulate of the PLC program in the various programming languages