Programmable Logic Controllers (PLC)

Introduction Of PLC

- PLC stand for “Programmable Logic Controller”.
- It is a hardware device & it is a microprocessor based control system.
- PLC is a general purpose computer modified specifically to perform control task .
- It is used for industrial automation.
- These controllers can automate a specific process, machine function, or even an entire production line.
- PLC is developed for an electronic replacement for hard wired relay logic system for machine control.

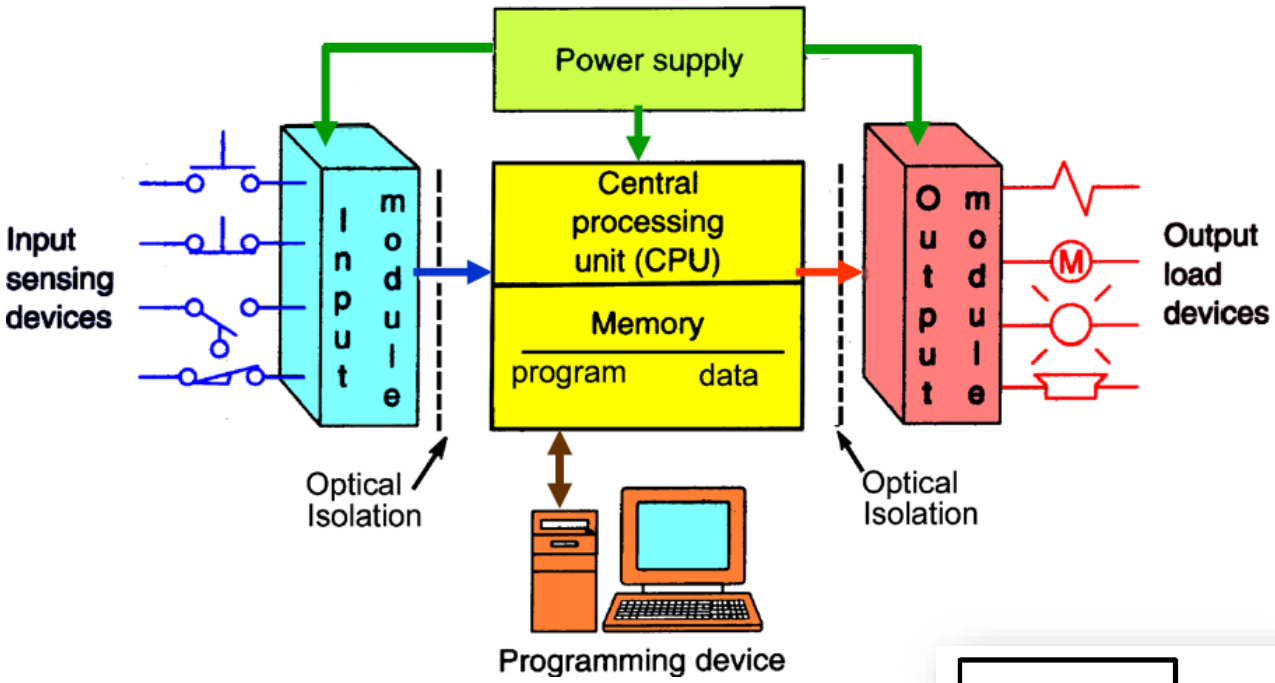
- They are designed for industrial use to control many automated process in industry's.
- PLCs were invented by Dick Morley in **1968**
- The term PLC is the register trademark by Allen-Bradley Company.
- Since then PLC has revolutionized the industrial and manufacturing sectors. There is a wide range of PLC functions like timing, counting, calculating, comparing, and processing various analog signals etc.

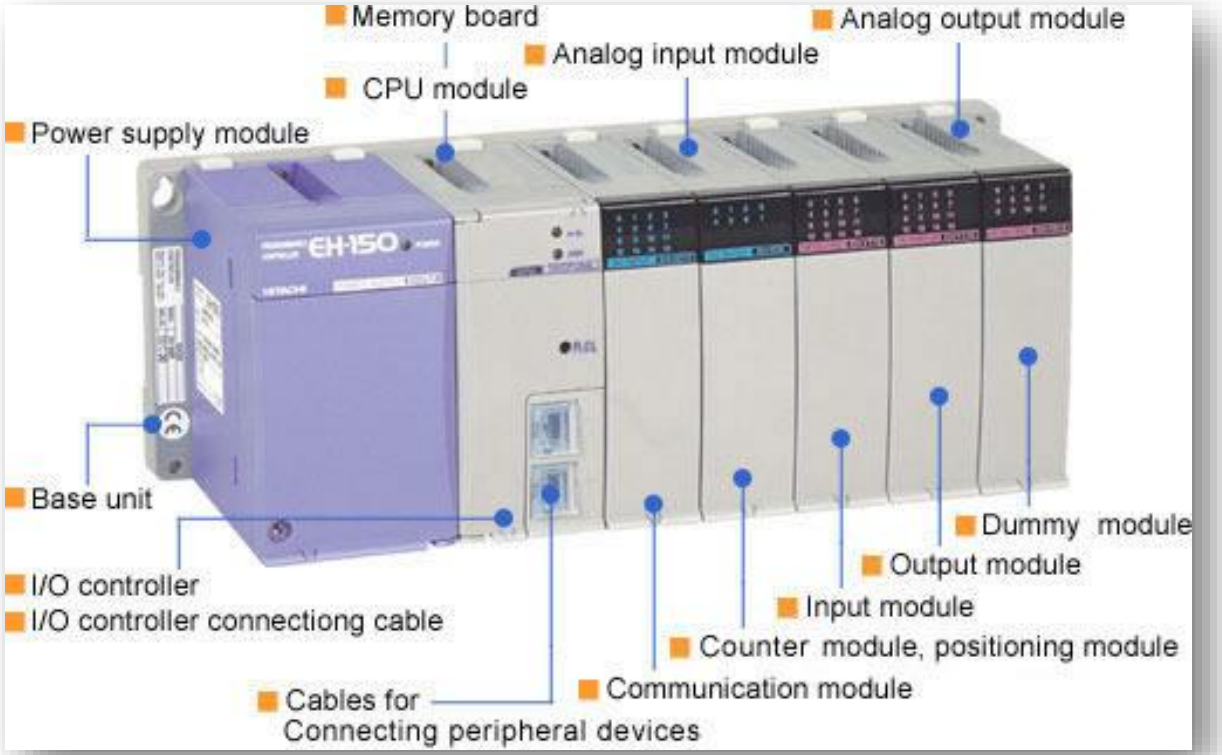
- Developed to offer the same functionality as the existing relay logic systems
- Programmable, reusable and reliable
  - Could withstand a harsh industrial environment
  - They had no hard drive, they had battery backup
  - Could start in seconds
  - Used Ladder Logic for programming

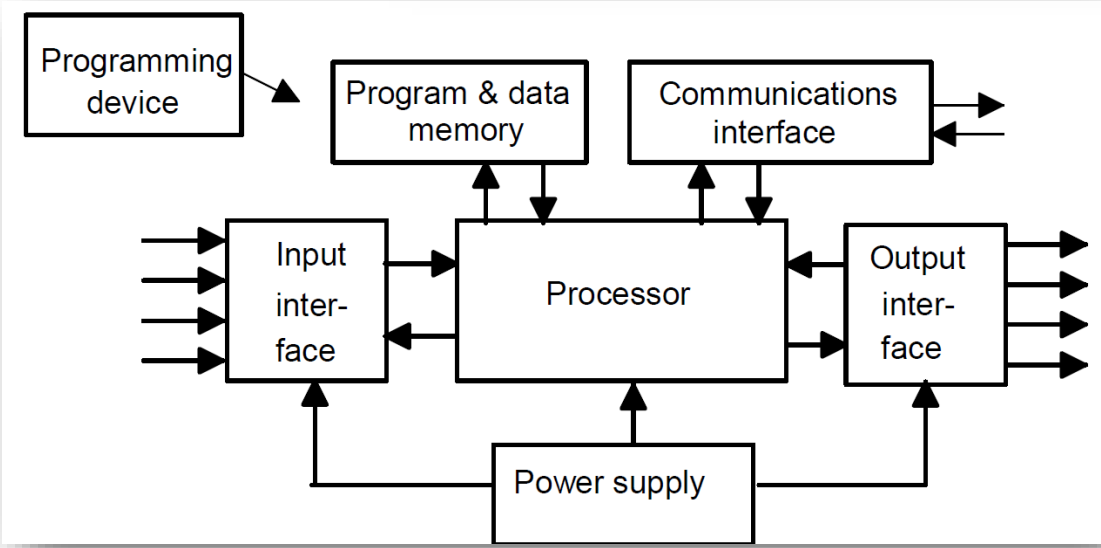
Advantages of PLC Control Systems

- Flexible
- Faster response time
- Less and simpler wiring
- Solid-state - no moving parts
- Modular design - easy to repair and expand
- Handles much more complicated systems
- Sophisticated instruction sets available
- Allows for diagnostics “easy to troubleshoot”
- Less expensive

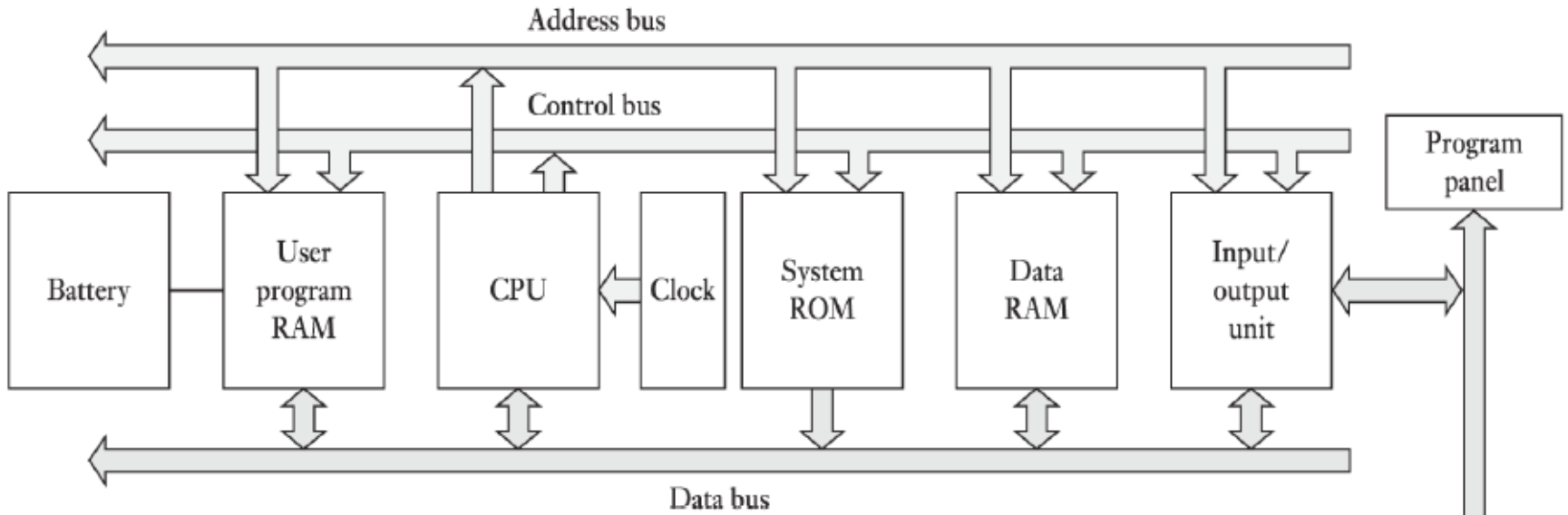
PLC System


Power supply
Central processing unit (CPU)
Memory
program
data
Input module
Output module
Input sensing devices
Output load devices
Optical Isolation
Optical Isolation
Programming device


Memory board
Analog output module
Analog input module
CPU module
Power supply module
Base unit
I/O controller
I/O controller connectiong cable
Cables for Connecting peripheral devices
Communication module
Counter module, positioning module
Input module
Output module
Dummy module


Programming device
Program & data memory
Communications interface
Input inter-face
Processor
Output inter-face
Power supply

Architecture of a PLC



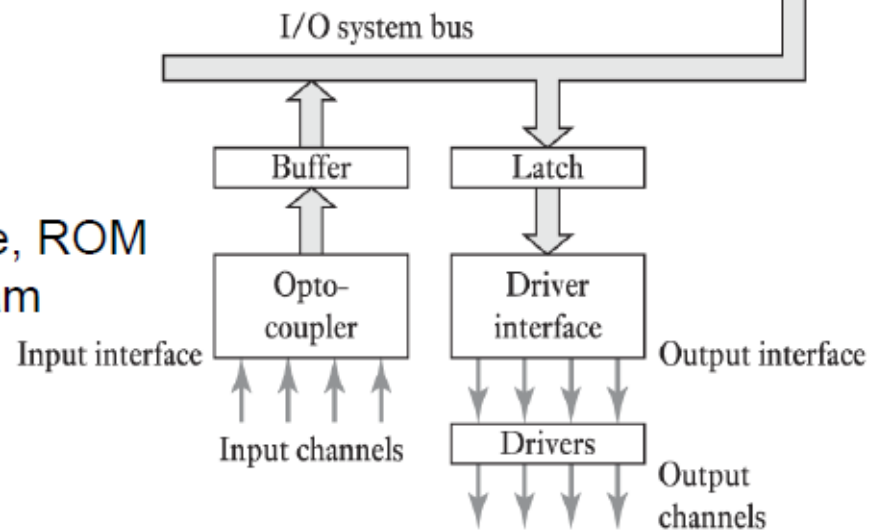
It consist essentially of:

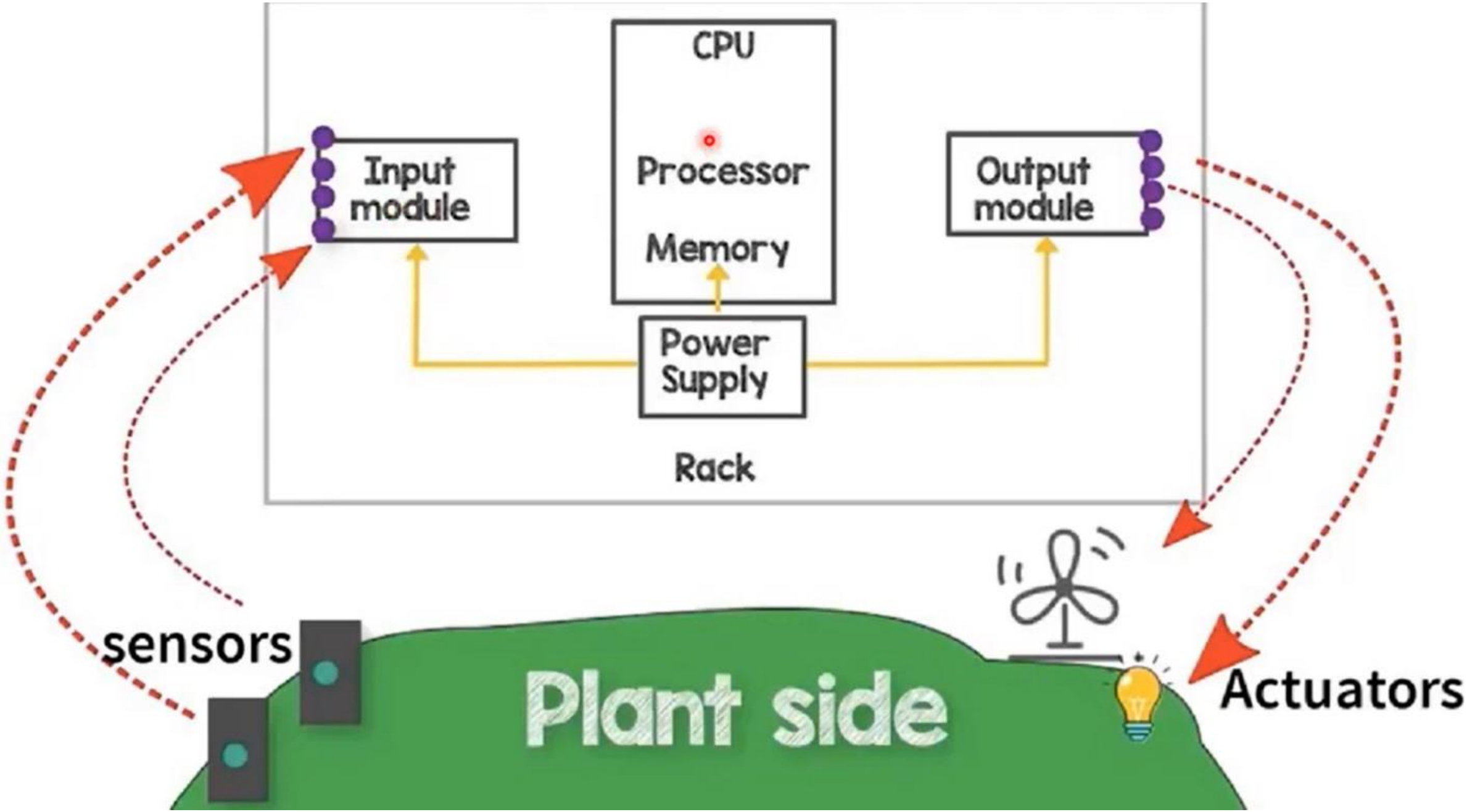
Central processing unit: control all processes with frequency 1-8 M Hz

Memory: Buffers as temporary storage, ROM for system data & RAM for user program

Input/output interface:

System buses




CPU
Processor
Memory
Input module
Output module
Power Supply
Rack
sensors
Plant side
Actuators

Comparison of PLC & PC

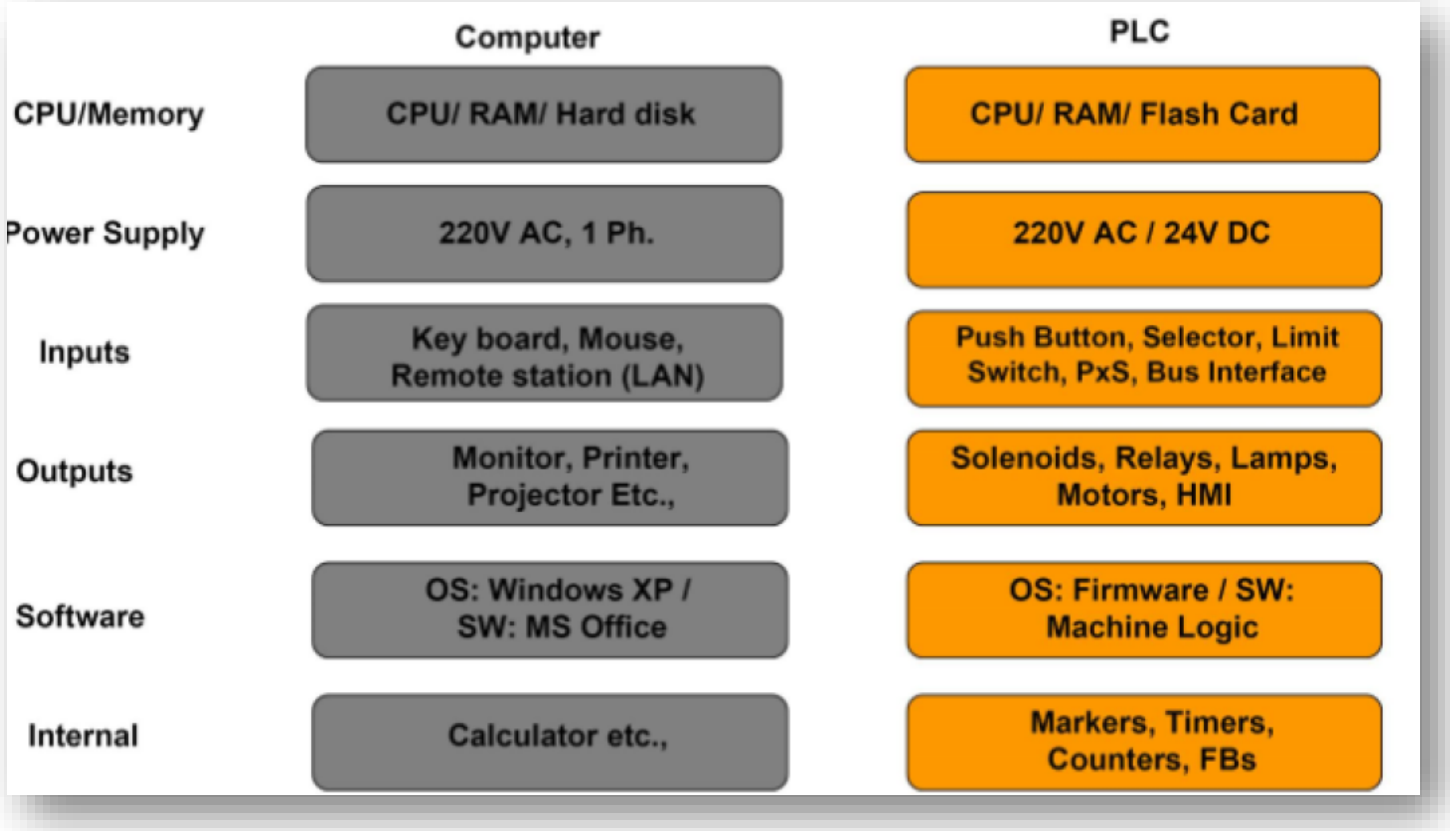
• PLCs are similar to computers, but computers are optimized for calculation and display tasks

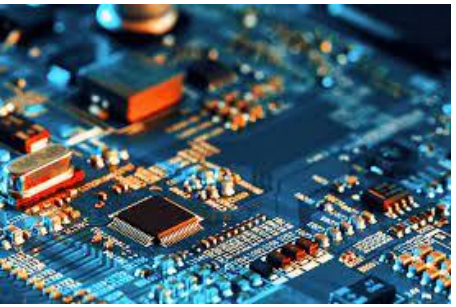
• PLCs are optimized for control tasks and the industrial environment.

• PLCs: – Are rugged and designed to withstand vibrations, temperature, humidity, and noise –

• Have interfacing for inputs and outputs, already inside the controller –

• Are easily programmed and have an easily understood programming language – Primarily concerned with logic and switching operations





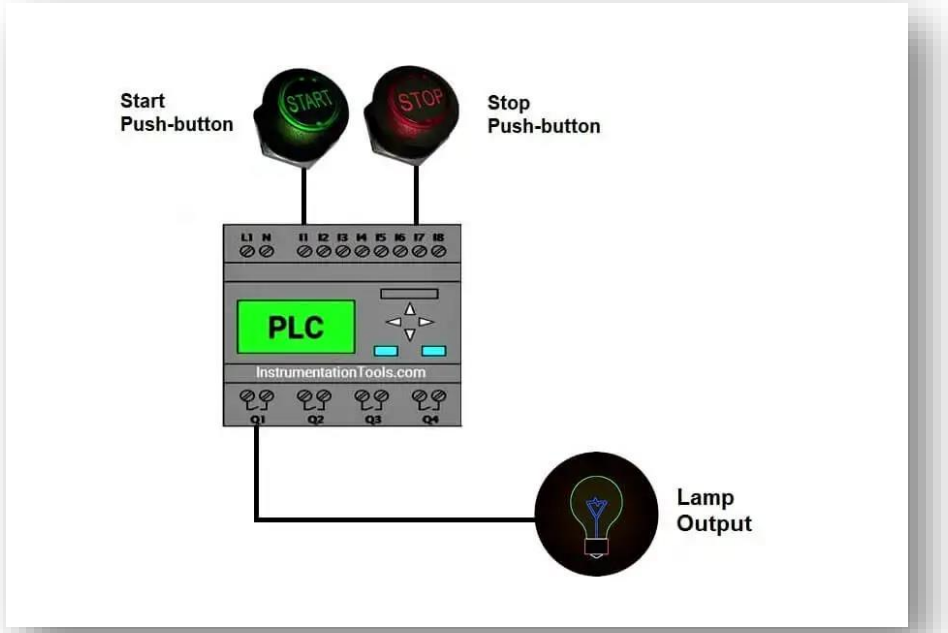
S.No	Microcontroller	PLC
1	Used for **any** type of application	It is a special microcontroller designed for **industrial** application
2	Microcontroller works with **electronic** devices. Ex: Transistor It will also work with relays	PLC works with **power** devices. Ex :relays,
3	It **doesn't** work as a **stand alone controller** but it came as a part of electronic circuit or device	PLC is a stand alone controlling device that can be programmed for any process.
4	**I/O ports in MC is less**	**I/O ports in PLC is more**
5	Microcontroller is a **chip**	PLC = **number** of chips

Sequential processing application

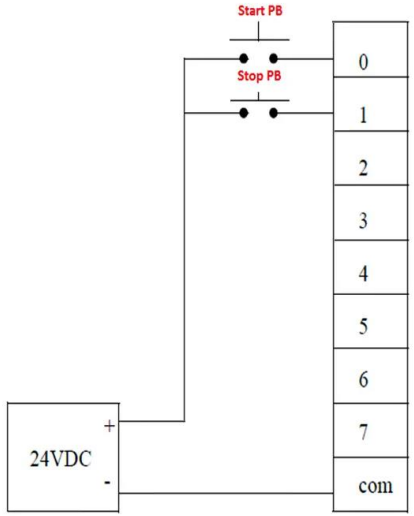
Parallel processing application

Principle of operation in PLC

PLC Working Process



PLC Input Module



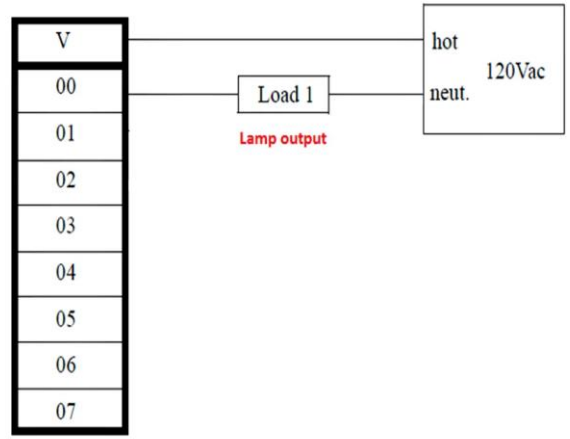
PLC Input Module

InstrumentationTools.com

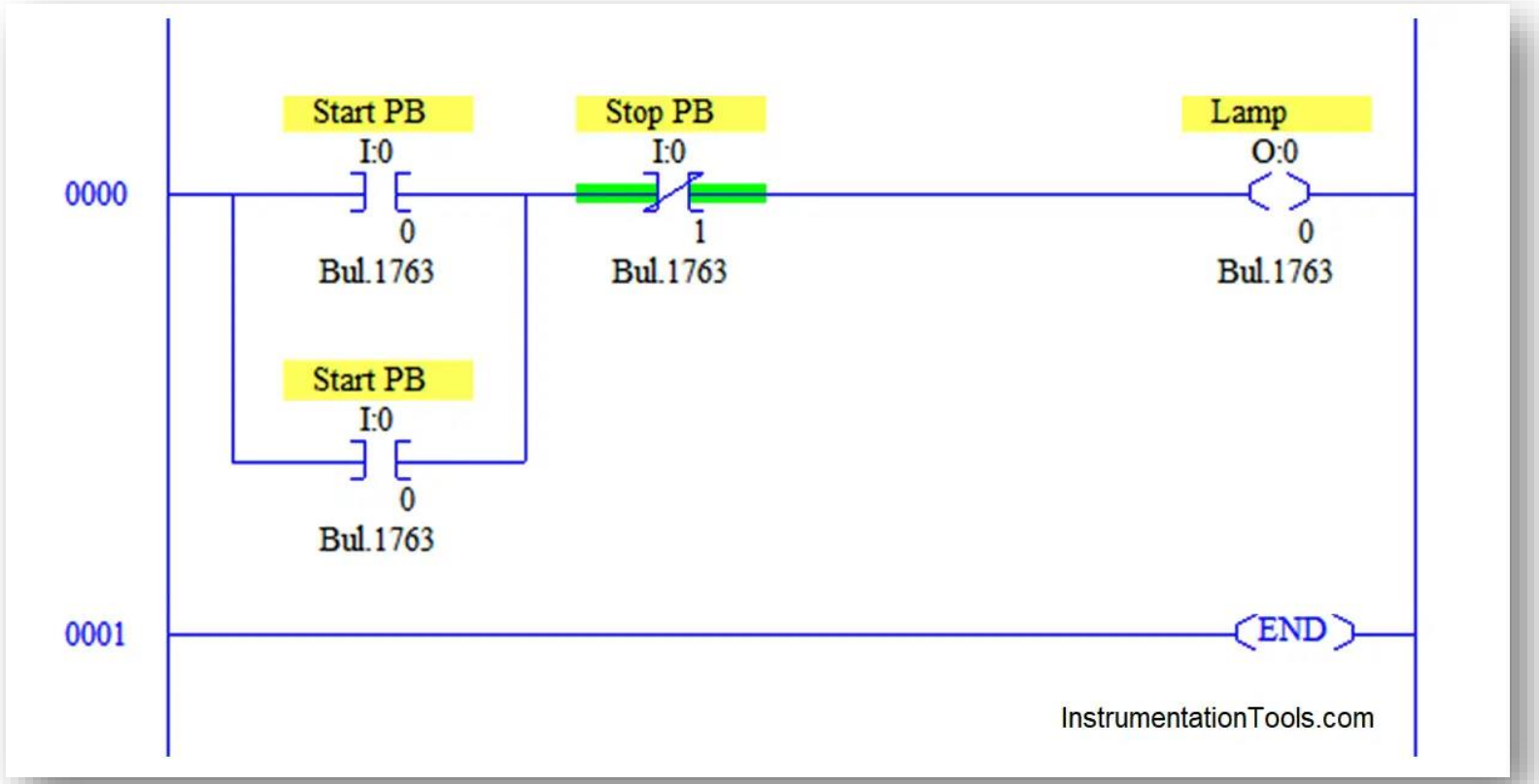
PLC Output Module

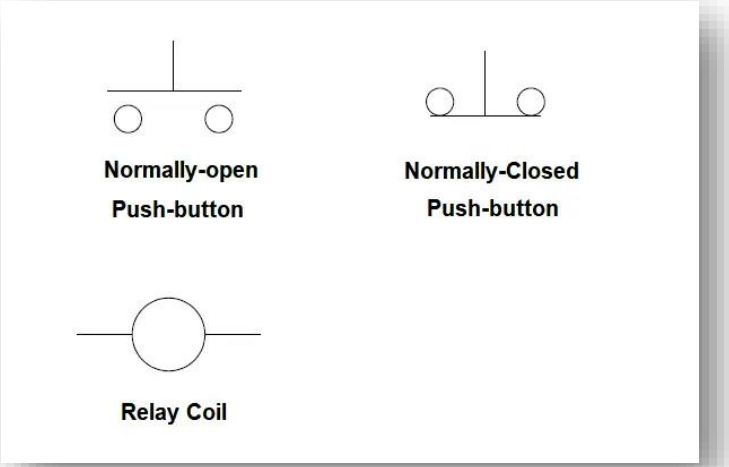
PLC Output Module

InstrumentationTools.com



PLC program for the above example in [Allen Bradley PLC Software]





Once the logic is done in PLC programming software, We have to download the program into the PLC controller using PPI (Point to Point Cable) or Ethernet Cable.

PLC Operation & CPU Scan Cycle

- The core of every PLC is a basic computer processor that gathers various inputs and evaluates them to achieve the desired output to control any process, machine etc.
- The inputs can be physical, digital or analog.
- As users can program the system in multiple ways to fit a certain scenario, PLCs within many applications across various industries, including conveyor system, oil & gas refineries, manufacturing lines and more.

- PLC takes microprocessor as the core and has many characteristics of microcomputer, but its working method is very different from microcomputer.
- Microcomputers generally work in a waiting mode.
- The PLC works by centralized input, centralized output and periodic cyclic scanning. The time used for each cyclic scan is called a scan cycle.

CPU Scan Cycle

One Scan Cycle

Input Read

Program Execution

Update Output

EOS

PLC System