

**Almamoun University collage**

**Power electrical Engineering**

**المسيطرات الرقمية والمعالج الدقيق**

**Third year Class**

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**Lecture 2**

## **Characteristics of a PLC System**

**There are seven distinct characteristics in a PLC system, these are:**

- 1. It is field programmable by the user. This characteristic allows the user to write and change programs in the field without rewiring or sending the unit back to the manufacturer for this purpose.**
- 2. It contains preprogrammed functions. PLCs contain at least logic, timing, counting, and memory functions that the user can access through some type of control-oriented programming language.**
- 3. It scans memory and inputs and outputs (I/O) in a deterministic manner. This critical feature allows the control engineer to determine precisely how the machine or process will respond to the program.**
- 4. It provides error checking and diagnostics. A PLC will periodically run internal tests of its memory, processor, and I/O systems to ensure that what it is doing to the machine or process is what it was programmed to do.**
- 5. It can be monitored. A PLC will provide some form of monitoring capability, either through indicating lights that show the status of inputs and outputs, or by an external device that can display program execution status.**
- 6. It is packaged appropriately. PLCs are designed to withstand the temperature, humidity, vibration, and noise found in most factory environments.**
- 7. It has general-purpose suitability. Generally a PLC is not designed for a specific application, but it can handle a wide variety of control tasks effectively.**

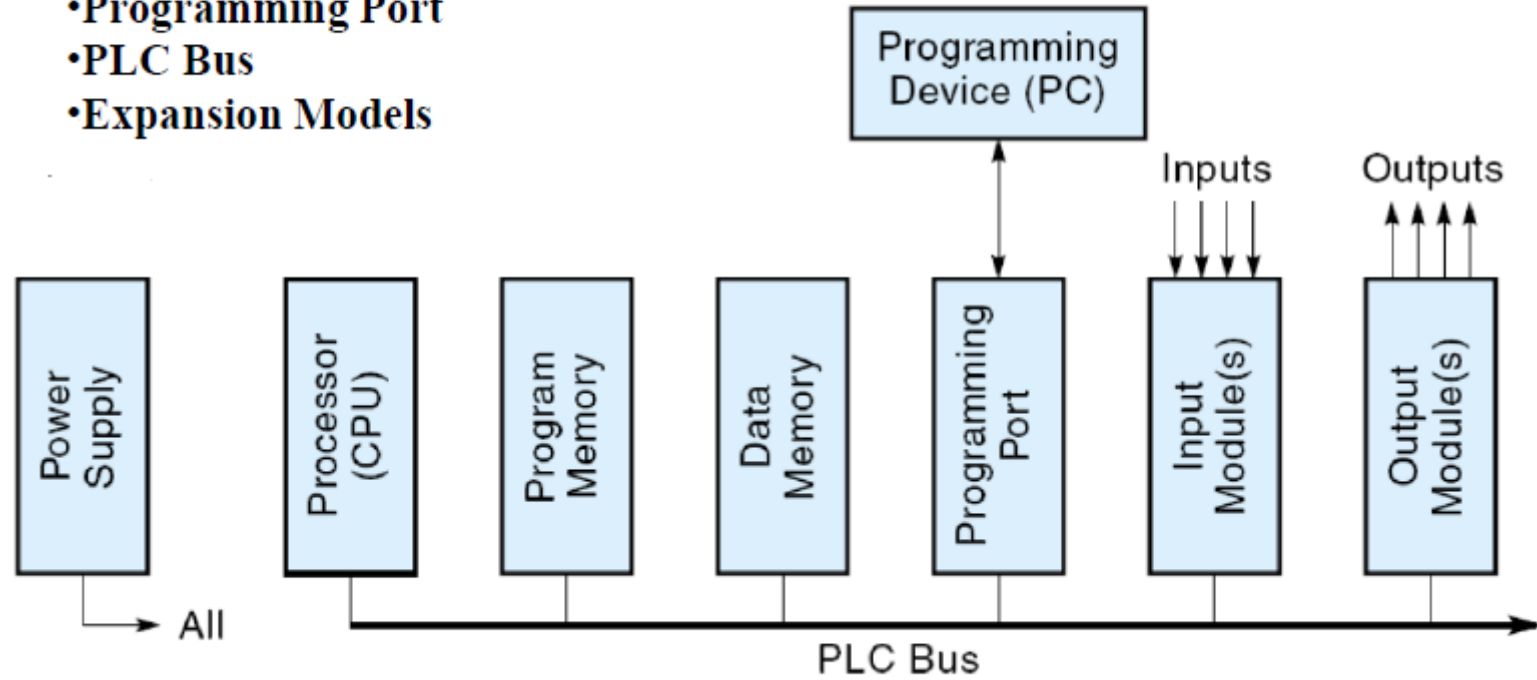
## Types of PLC Construction:

- **Compact PLC**
  - it covers units with up to 128 I/O's and memories up to 2 Kbytes.
  - Capable of providing simple to advance levels or machine controls
- **Modular PLC**
  - The most sophisticated units of the PLC family. They have up to 8192 I/O and memories up to 750 Kbytes.
  - Can control individual production processes or entire plant.



# Basic Elements of a PLC

- Power Supply
- Processor (CPU)
- Memories
- Input/output modules
- Programming Port
- PLC Bus
- Expansion Models



# Power Supply

The basic function of the power supply is to convert the field power into a form more suitable for Use electronic devices that comprise the PLC

In large PLC systems, this power supply does not normally supply power to the field devices.

In small and micro PLC systems, the power supply is also used to power field devices.



## Power Supply Features and Specifications

•It is typically non-redundant. Hence a failure of the PLC power supply can cause the entire control system to fail.

•It will typically contain high-voltage components. Hence an isolation failure can create the potential for serious injury or fire.

Useful guidelines when considering the power supply of a PLC include the following:

1. The power supply should be packaged properly so that the heat generated by the power supply can be removed in order to prevent overheating. This will increase reliability. If the power supply cabinet is hot to the touch at room temperature in an office environment, it will be hotter still when locked in a control panel or located on the factory floor. Care, of course, must always be taken to avoid touching any exposed power terminals.
2. The power supply should be tested by a certification agency, such as Underwriters Laboratories (UL) or the Canadian Standards Association (CSA). These agencies perform temperature testing and electrical isolation testing on power supply components. A UL or CSA mark on the PLC power supply will indicate that the power supply was tested to comply with some basic minimum standards.
3. The power supply should meet at least one reputable standard for noise immunity. Two of these standards are NEMA ICS 2-230 (a showering arc noise test) and IEEE Std. 472 (a high-voltage impulse test). Some noise testing may also be performed by certification agencies, such as UL and CSA. The power supply should also be capable of withstanding line-voltage variations such as dropouts, brownouts, and surges, which are common to industrial facilities.

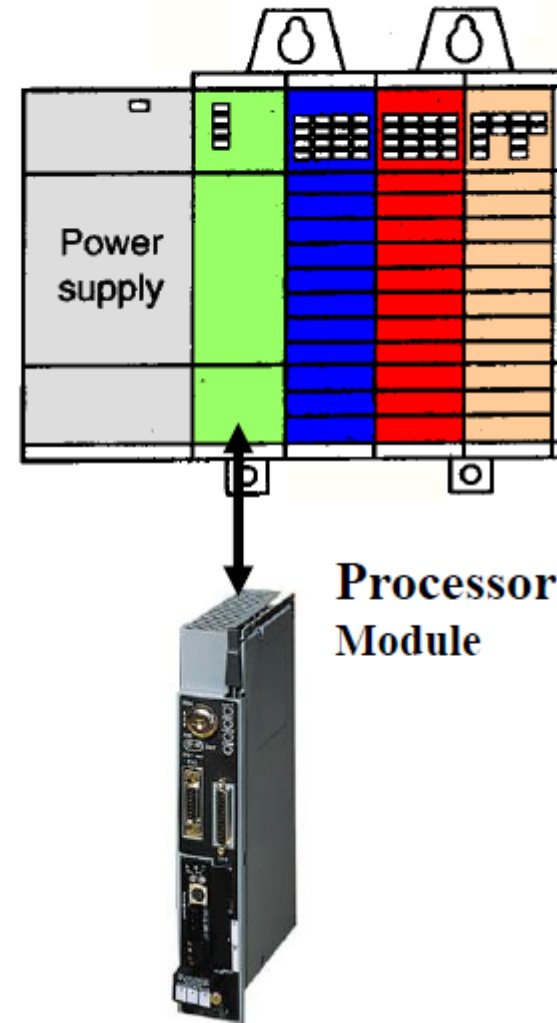


# Processor Module

This module is the prime essence of a PLC system

It consists of a microprocessor which is sometimes specially designed for the purpose of being implemented in a PLC system design for implementing the logic, and controlling the communications among the modules.

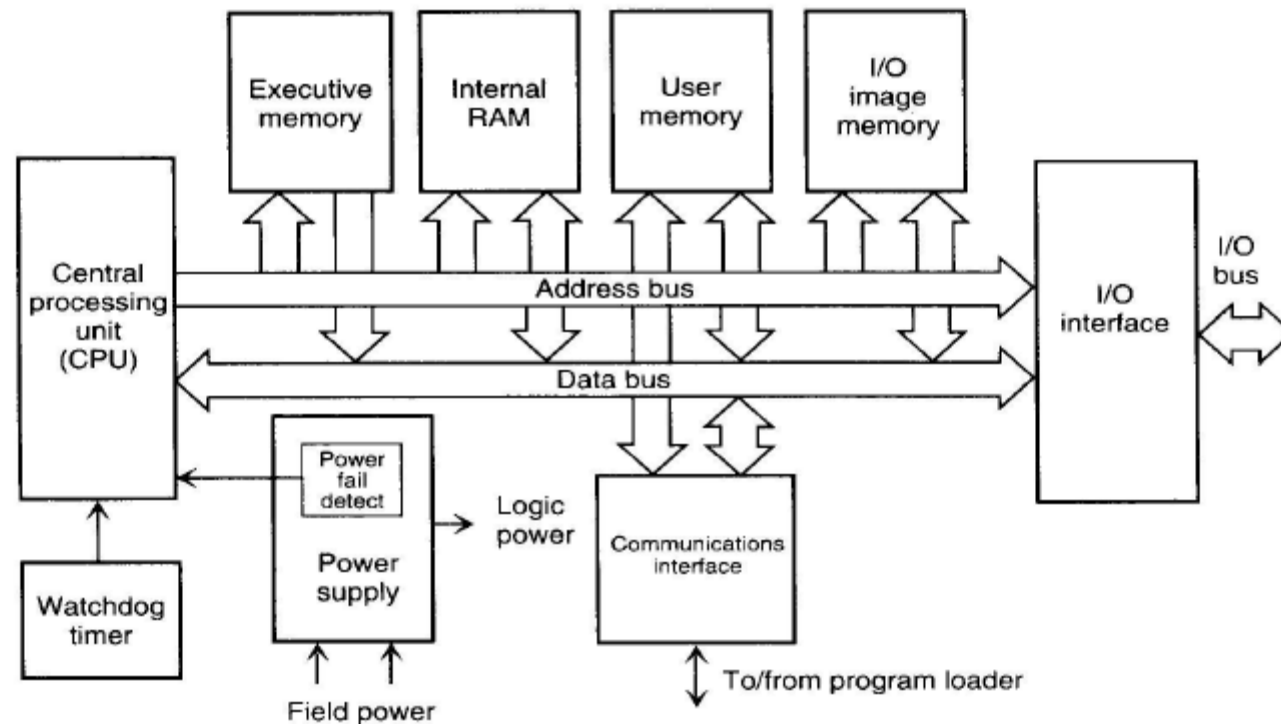
The processor module accepts input data from various sensing devices via Input modules, executes the stored user program, and sends appropriate output commands to control devices via output modules.



## Processor Module Details

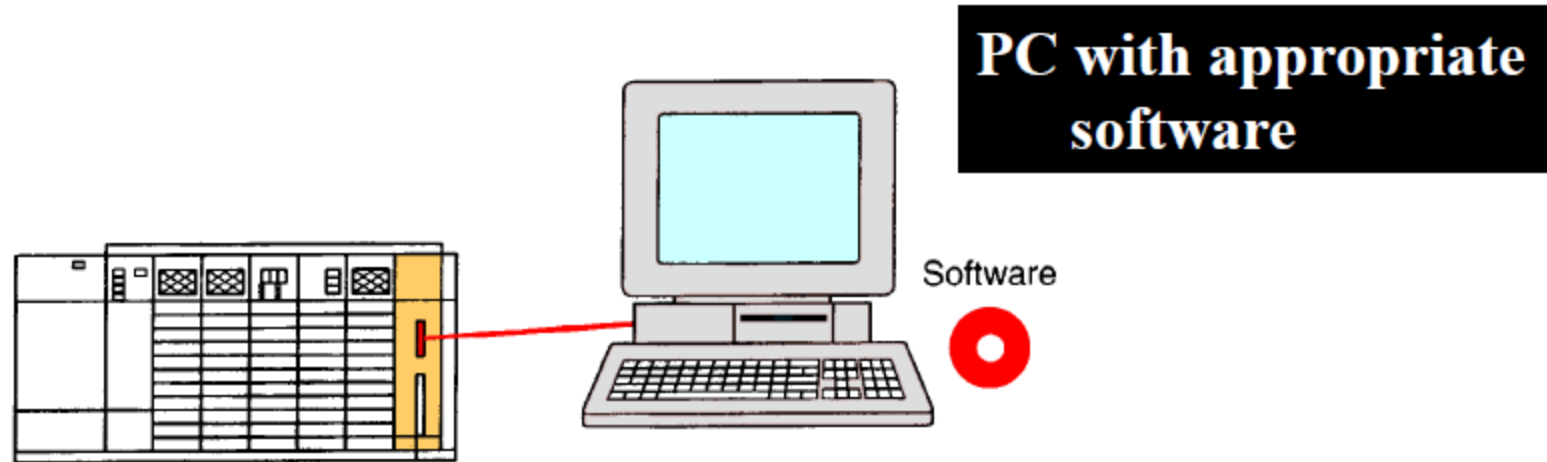
A detailed block diagram of the processor section of a PLC is shown in Figure below.

This section consists of four major elements: (1) power supply, (2) memory, (3) central processing unit (CPU), and (4) I/O interface.





# Programming Device



The computer monitor is used to display the logic on the screen.

The personal computer communicates with the PLC processor via a serial or parallel data communications link.

A personal computer (PC) is the most commonly used programming device.

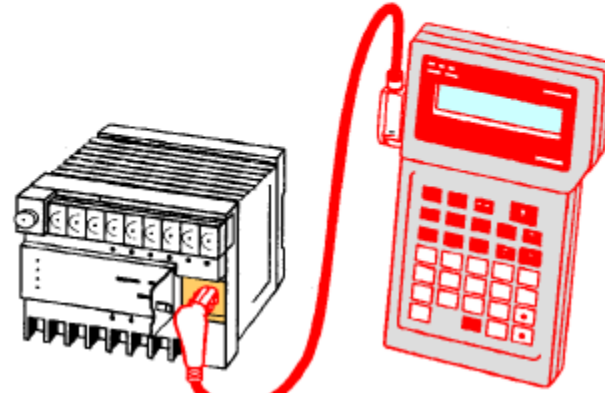
The software allows users to create, edit, document, store and troubleshoot programs.

If the programming unit is not in use, it may be unplugged

and removed. Removing the programming unit will not affect the operation of the user program.

# Programming Device

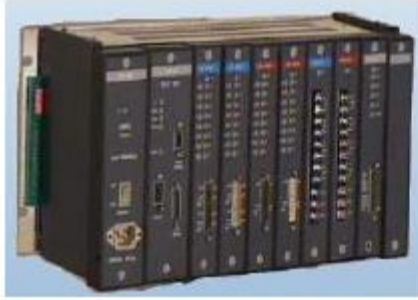
## Hand-held unit with display



- They are compact, inexpensive, and easy to use, but are not able to display as much logic on screen as a computer monitor.
- Hand-held programming devices are sometimes used to program small PLCs.

Hand-held units are often used on the factory floor for troubleshooting, modifying programs, and transferring programs to multiple machines.

## PLCs Versus Personal Computers



Same basic architecture



### PLC

- operates in the industrial environment
- is programmed in relay ladder logic
- has no keyboard, CD drive, monitor, or disk drive
- has communications ports, and terminals for input and output devices

### PC

- capable of executing several programs simultaneously, in any order
- some manufacturers have software and interface cards available so that a PC can do the work of a PLC

# PLC Size Classification

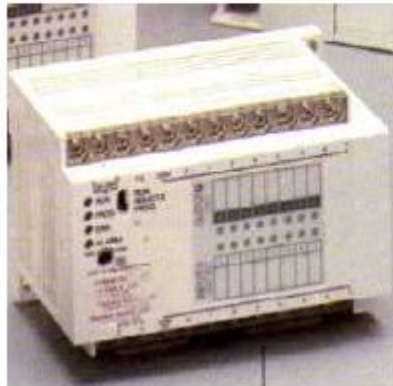
## Criteria

- number of inputs and outputs (I/O count)
- cost
- physical size



Allen-Bradley PLC-5 Family  
- handles several thousand I/O points

Allen-Bradley SLC-500 Family  
- handles up to 960 I/O points



Micro PLC  
- handles up to 32 I/O points



Nano PLC  
- smallest sized PLC  
- handles up to 16 I/O points

## Areas of Application

- Manufacturing / Machining
- Food / Beverage
- Metals
- Power
- Mining
- Petrochemical / Chemical

