

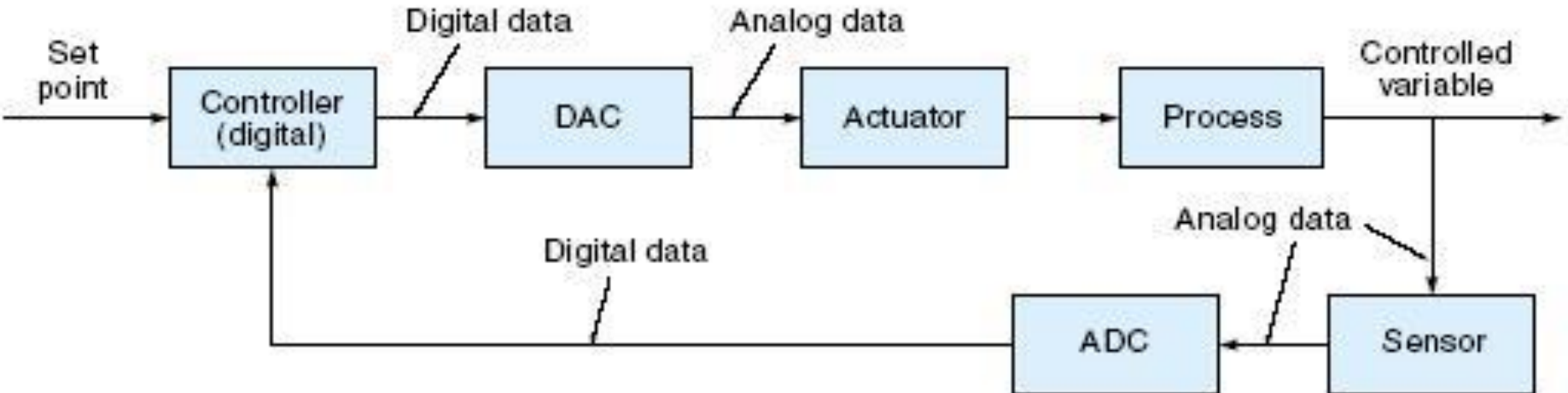
EIPC (NEE-403)

Unit-4

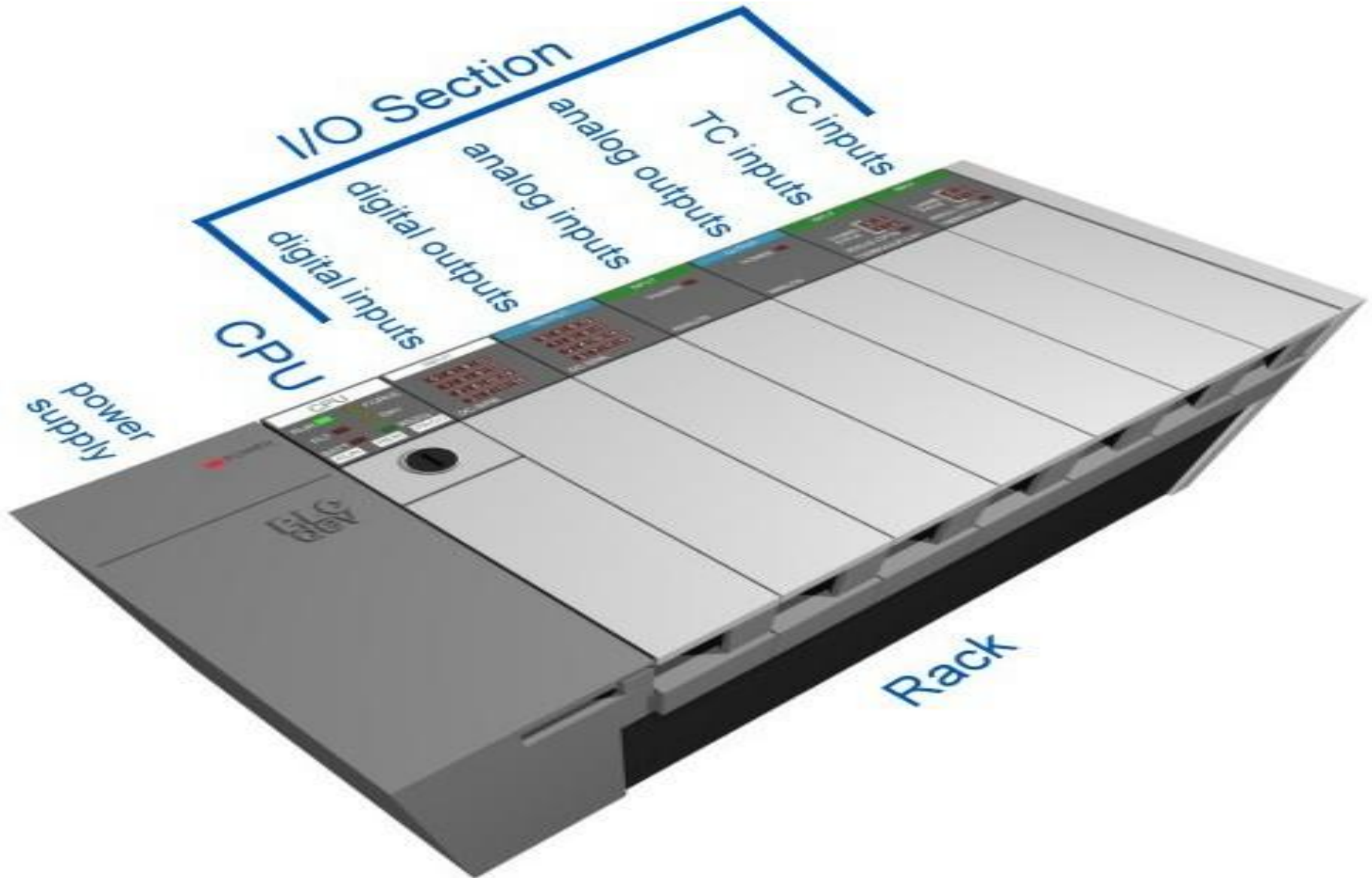
Process Control

Digital Control

- Digital devices such as **microcontrollers, Digital Signal Processors, programmable logic controllers or computer etc** is used as the controller. Here ADC & DAC are integrated to the System for proper conversions from analog to digital and vice-versa.



Programmable Logic Controllers



Programmable Logic Controllers

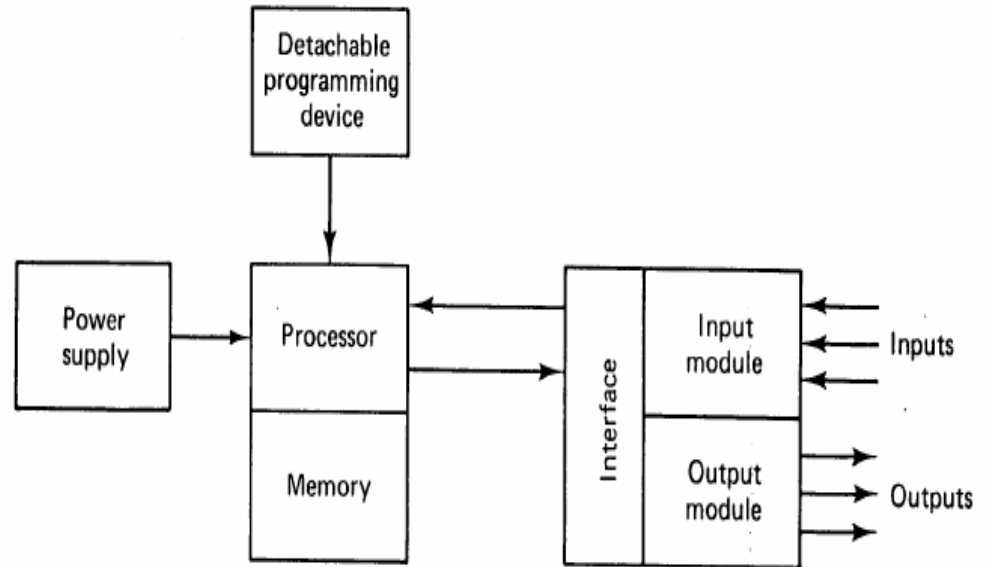
- *A digitally operating electronic apparatus which uses a programmable memory for the internal storage of instructions for implementing specific functions such as logic, sequencing, timing, counting, and arithmetic to control, through digital or analog input/output modules, various types of machines or process.*
- **Programmable logic controllers (PLC's) permit hardware control devices such as relays, timers, counters, and drum controllers (sequencers) to be replaced by programmable solid-state components and programmed instructions.**
- **PLC reads the status of the external input devices, e.g. keypad, sensor, switch and pulses, and execute by the microprocessor logic, sequential, timing, counting and arithmetic operations according the status of the input signals as well as the pre-written program stored in the PLC.**

Programmable Logic Controllers

- **The generated output signals are sent to output devices** as the switch of a relay, electromagnetic valve, motor drive, control of a machine etc.
- **To do so, a ladder program, consisting of a set of instructions representing the logic to be followed by the PLC, is developed, entered, and downloaded to the PLC.**
- The widely used **language in designing a PLC program is the ladder diagram**
- **It can also be programmed using assembly code, sequential function Chart, Functional Block Diagram etc.**
- **PLC is the workhorse of industrial Automation.**

Programmable Logic Controllers

- The basic components of the PLC are
 - Input module
 - Output module
 - Processor
 - Memory
 - Power supply
 - Programming device

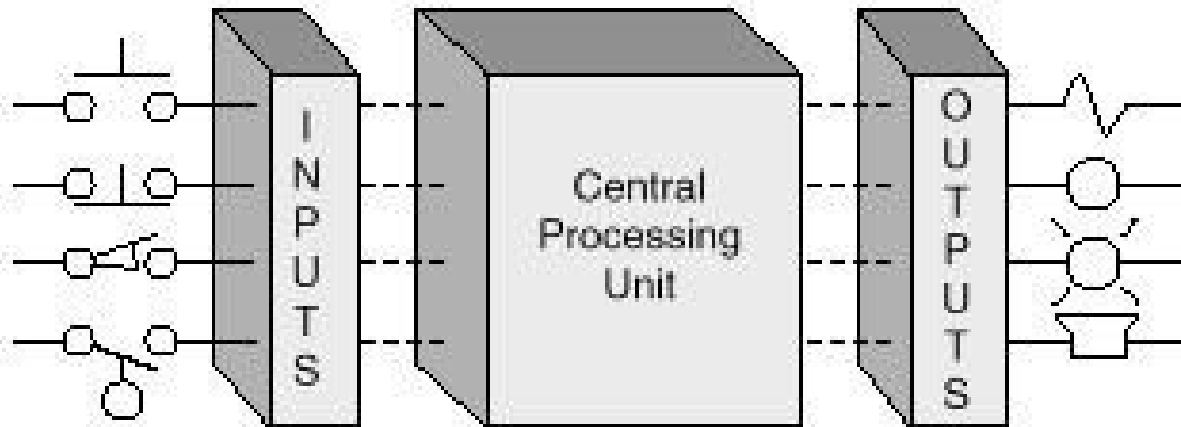


Programmable Logic Controllers

- **PLC memory**, (**Program memory**- storing the instructions for logical control operations & **Data memory**- stores status of switches, data from various I/O devices , past value of data etc.) which contains the program of logic, sequencing, and other input/output operations
- **The input module and output module:** are the connections to the **industrial process** that in to be controlled. The inputs to the controller are signals from **limit switches, pushbuttons, sensors, and other on/off devices**. Also, larger PLCs are capable of accepting signals from analog devices . The outputs from the controller are **on/off signals to operate motors, valves, and other devices required to actuate the process**.
- The processor is the **central processing unit (CPU)** of the programmable controller. **It executes the various logic and sequencing functions**.

Programmable Logic Controllers

- **A power supply** is specially used to **drive the PLC** .
- The PLC is programmed by means of a **programming device**. The programming device is usually detachable from the PLC cabinet so that it can be shared between different controllers. **It is used to build, test and edit the logical sequence that PLC will execute**



Programmable controller block diagram

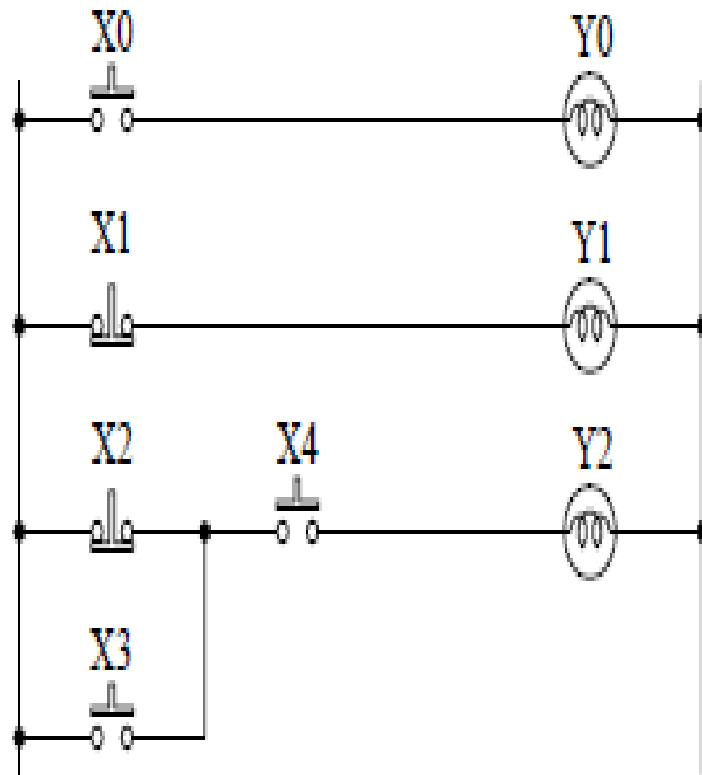
Programmable Logic Controllers

- During its operation, the CPU completes three processes:
- (1) it reads, or accepts, the input data from the field devices via the input interfaces,
- (2) it executes, or performs, the control program stored in the memory system, and
- (3) it writes, or updates, the output devices via the output interfaces. This process of sequentially reading the inputs, executing the program in memory, and updating the outputs is known as scanning.

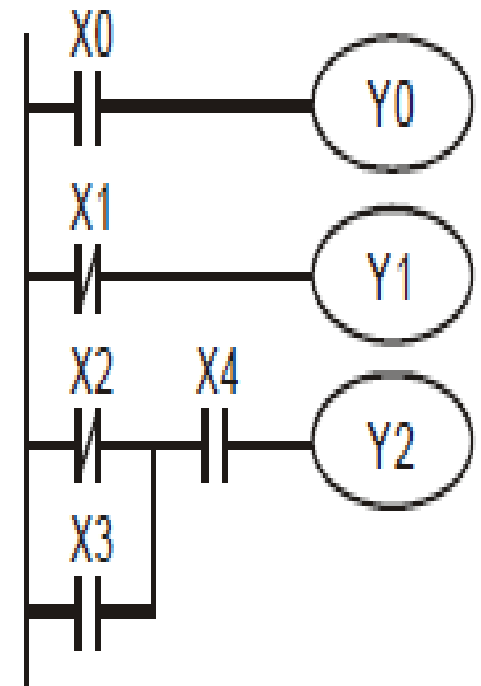
PLC

Examples of traditional ladder diagram and PLC ladder diagram for combination logic:

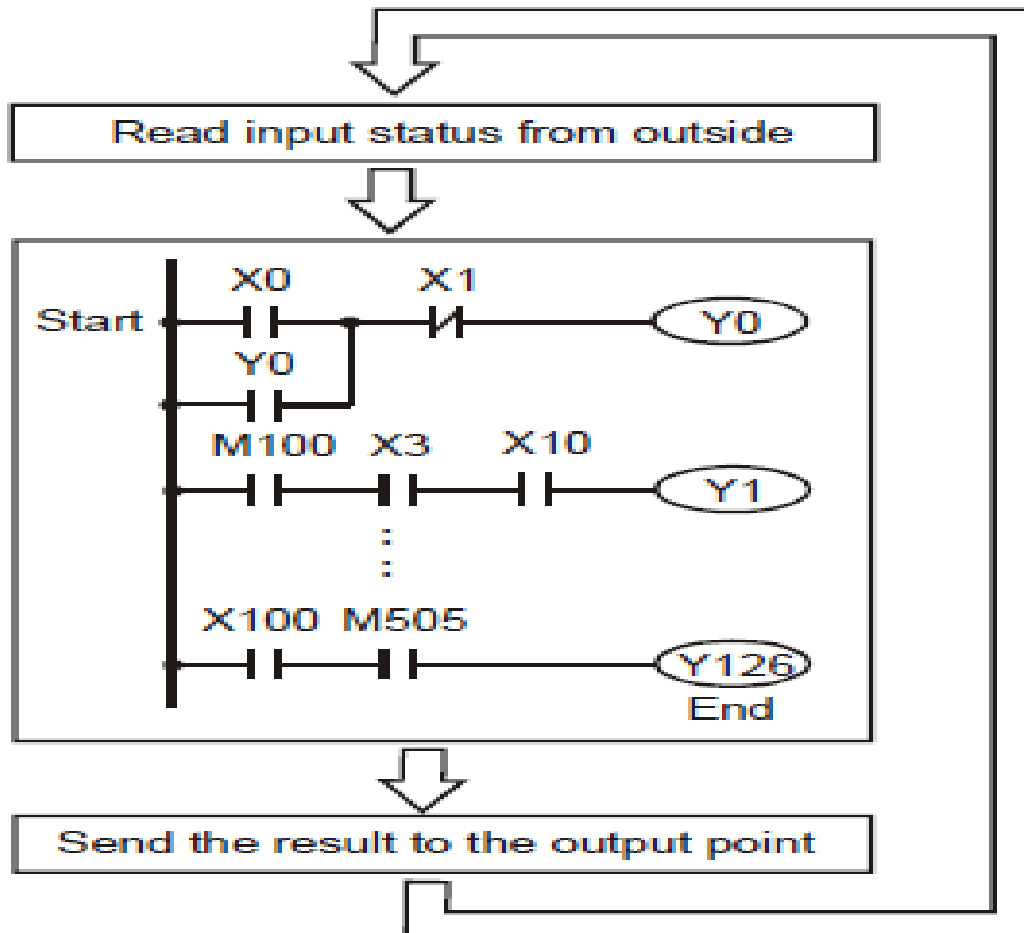
Traditional Ladder Diagram



PLC Ladder Diagram



PLC



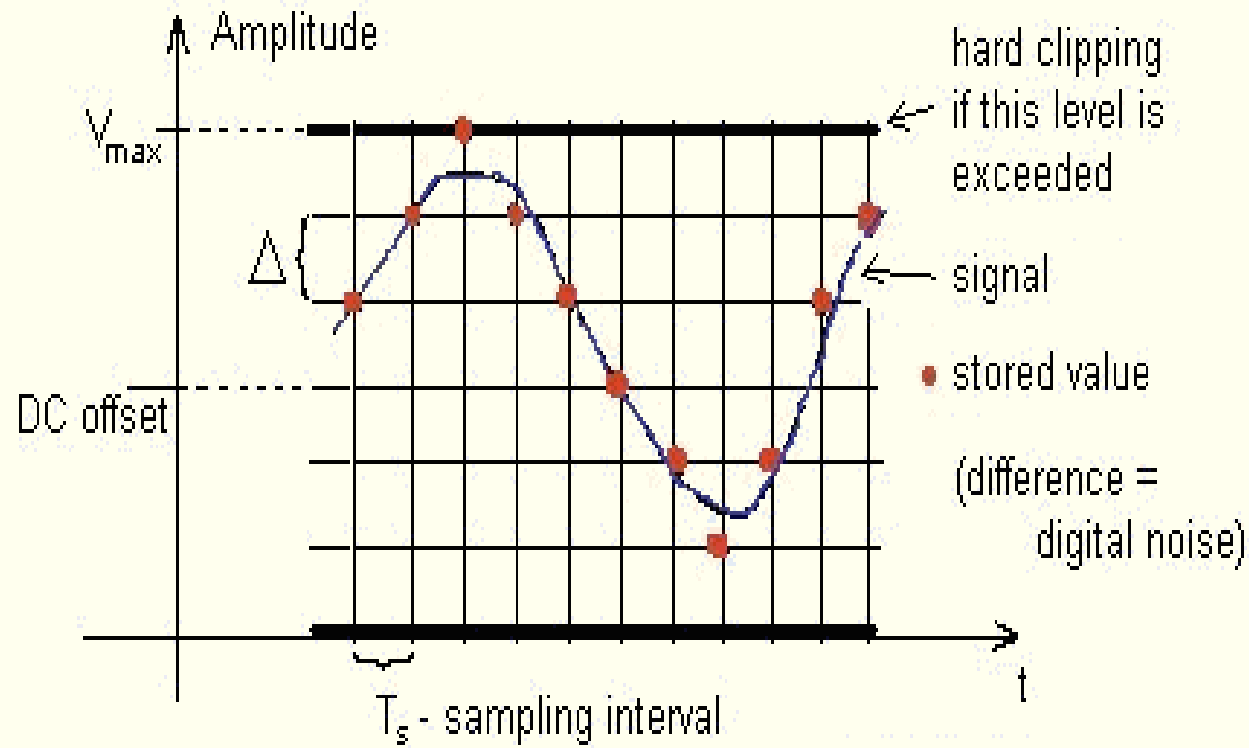
The output result is calculated based on the ladder diagram.

Digital Recording

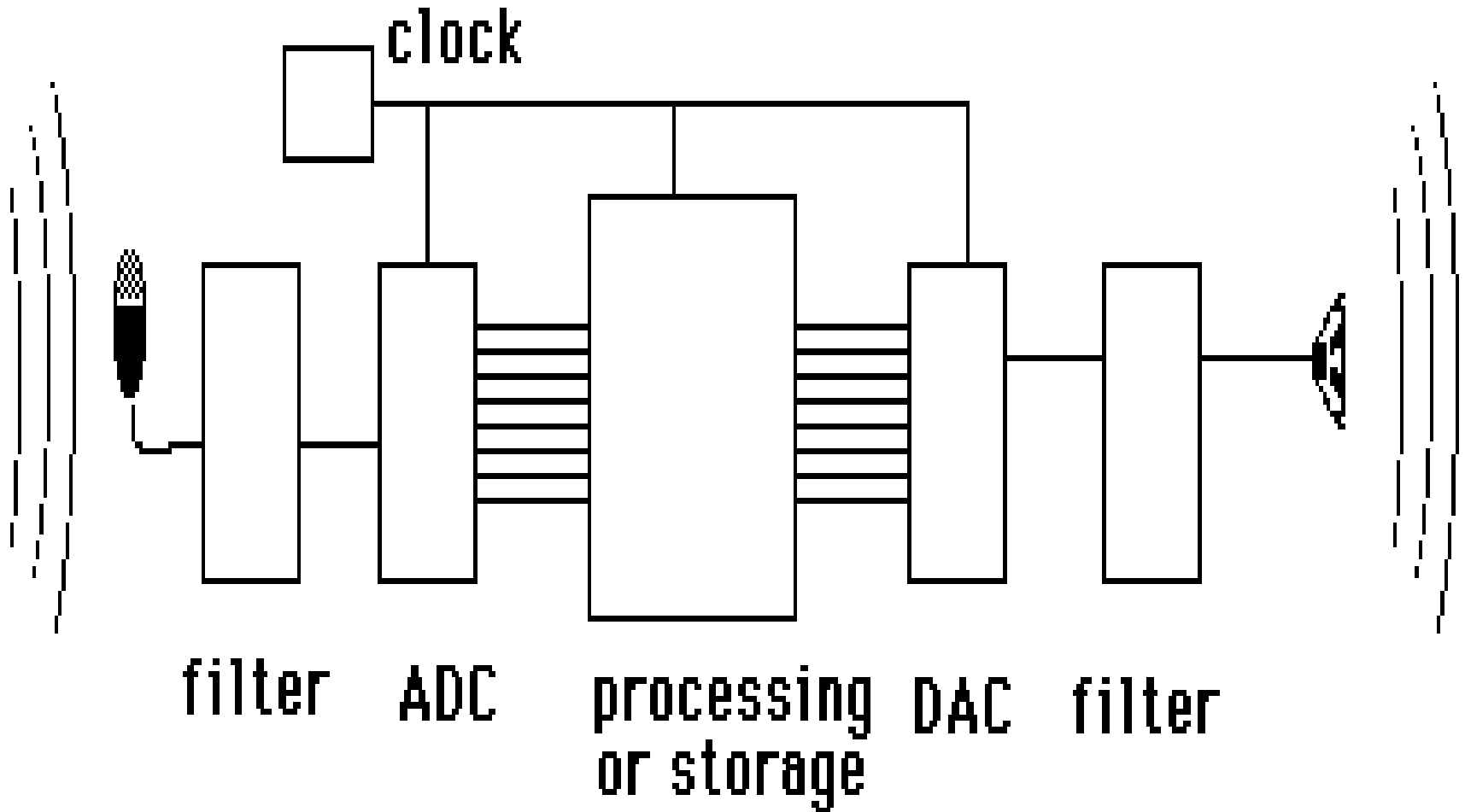
- **An analog signal is converted to digital** by an analog-to-digital converter, which measures the amplitude of an analog signal at regular intervals, which are specified by the sample rate, and then **stores these sampled & quantized numerical value in computer hardware such as compact disc or hard` disk.**
- **Digital recordings are very accurate**, the accuracy determined only by the quality of the D/A and A/D converters.
- For **optical disc recording technologies such as CDs or DVDs**, a laser is used to burn microscopic holes into the dye layer of the medium.
- **A weaker laser is used to read these signals.**
- This works because the **metallic substrate of the disc is reflective**, and **the unburned dye prevents reflection while the holes in the dye permit it, allowing digital data to be represented.**

Digital Recording

- During digital recording of the analog signal, analog to digital (A/D) conversion takes place from continuous time-amplitude coordinates to discrete time-amplitude coordinates



Digital Recording



Thank You