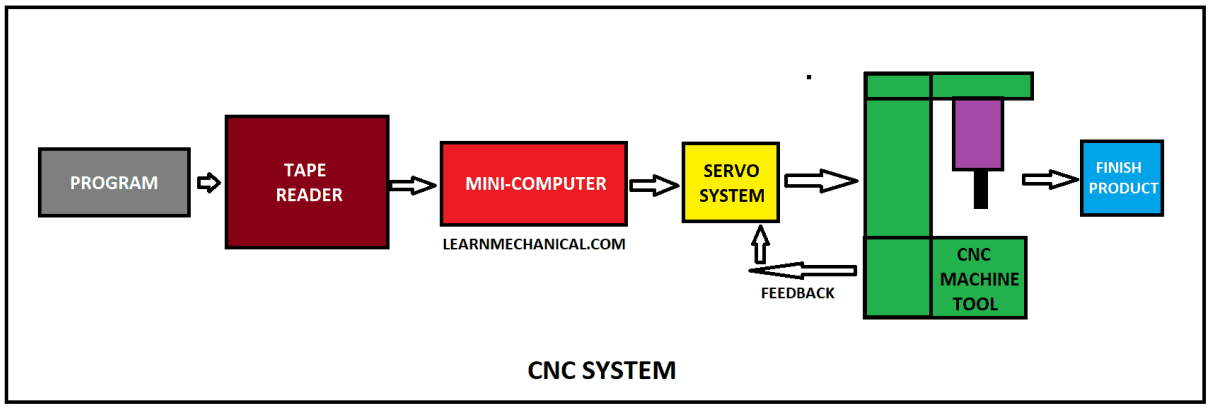
CNC MACHINES

CNC: Computer Numerical Control – A computer and CAM software are used to automate, control, and observe the motions of a machine using digital data. The machine might be a robot, router, lathe, grinder, welder, sheet metal stamping machine, laser or waterjet cutter, or any number of other devices. The computer is often an on-board specialized controller for bigger industrial machinery. However, the computer can be an external PC for machines that are more suited to hobbies or with certain retrofits. In order to move and control the machine axes and carry out the preprogrammed movements, the CNC controller collaborates with a number of motors and drive components. The advanced feedback system that continuously analyzes and modifies the cutter's speed and position is often present on industrial equipment.



CAM: Computer-Aided Machining or Manufacturing – This is the process of using different software programs to generate toolpaths and NC code for a CNC-operated machine based on data from 3D computer models (CAD). The combination of the two is frequently referred to as CAD/CAM.

Parts of CNC Machine

- **The Input Device**
- **Machine Control Unit**
- **Machine Tools**
- **The Drive System**
- **Feedback Mechanism**
- **Display Unit**
- **Bed**
- **Headstock**
- **The Tailstock**
- **Tailstock Quill**
- **Pedal or a Footswitch**
- **Chuck**
- **The Control Panel**

The primary components of a CNC machine are represented by the following:

The Input Device

These are the tools used to enter part-programming data into a CNC machine. Three types of input devices are often used: magnetic tape readers, punch tape readers, and computers connected via RS-232-C.

Machine Control Unit

The CNC machine's brain is here. The MCU completes all of the CNC machine's controlling operations. It completes and decodes the provided instructions and reads them among the many jobs. The coded instruction is decoded by it. This axis employs interpolation (linear, spherical, and helical) to create motion commands.

It supplies the amplifier circuit driving the spindle mechanism with the axis speed order. For each driving axis, it gets feedback signals indicating position and speed. It supports auxiliary control features like tool change, coolant, or spindle on/off.

Machine Tools

To manage position and speed, a CNC machine tool is always equipped with a sliding table and a spindle. The X, Y, and Z axes of the machine are used to operate the tables, while the Z-axis is used to control the spindle.

The Drive System

The ball drive motors, lead screws, and amplifier circuit make up the CNC machine's driving system. The MCU provides the amplifier circuit with the signals (i.e., position and speed) from each axis.

The drive motors are then turned on by amplifying the control signals. And to position the machine table, actuated drive motors turn the ball lead screw.

Feedback Mechanism

Transducers, which serve as sensors in the system, are used. Another name for it is a measuring system. It is made up of position and motion transducers that constantly track the location and movement of the cutting tool.

The MCU receives signals from these transducers and creates control signals to rectify position and motion faults by comparing reference signals to response signals and comparing response signals to reference signals.

Display Unit

Programs, instructions, and other essential information about the CNC machine are shown on a monitor.

Bed

On CNC machines, these components carry the whole machine's weight, necessitating mounting all other parts. Due to the fact that the tool turret in CNC lathe machines travels over them, the bed component is built of harder materials like cast iron.

Headstock

Due to the fact that the workpieces are secured to the headstock, it is one of the key parts of CNC lathe machines. The primary axle of the CNC lathe is driven by motors.

The Tailstock

When a CNC machine is used to conduct tasks like noodling, threading, and turning, this lathe gives the workpiece more grip. On the workpiece's end surfaces, support is offered.

Tailstock Quill

Thanks to the tailstock quill, the workpieces are more evenly distributed between the headstock and the tailstock.

Pedal or a Footswitch

The tailstock quill is transferred to the forward and reversed positions, for example, as the pedal is utilized to open and shut the chuck while attempting to grip the component.

Chuck

Because the chuck is positioned on the main axle, the tool has room to fix.

The Control Panel

Control panels are one of the key components of CNC machines that are utilized to set or feed programs for the operation to be carried out on the workpieces. It is sometimes referred to as the CNC machine's brain.

Various parts of a CNC machine (Reference: **mechanicaljungle.com**)

Flexible Manufacturing System

A flexible manufacturing system (FMS) is a manufacturing system in which there is some amount of febibility that allows the system to react in case of changes, whether predicted or unpredicted. Flexibility in manufacturing means the ability to deal with slightly or greatly mixed parts, to allow variation in parts assembly and variations in process sequence, change the production volume and change the design of certain product being manufactured.

This flexibility is generally considered to fall into two categories, which both contain numerous subcategories.The first category, machine flexibility, covers the system's abilitychanged to produce

new product types, and ability to change the order of operations executed on a part. The second category is called routing flexibility, which consists of the abil y to use multiple machines to perform the same operation on a part, as well as the system's ability to absorb large-scale changes, such as in volume, capacity, or capability.

Most FMS consist of three main systems. The vo.k machines which are often automated CNC machines are connected by a material handling system to optimize parts flow and the central control computer which controls materia movements and machine flow.

The main advantages of an FMS is its high flexibility in managing manufacturing resources like time and effort in order twanufacture a new product. The best application of an FMS is found in the production of small sets of products like those from a mass production.

▪What is FMS ?

- A flexible manufacturing system is a automated machine cell, consisting of a group of processing workstations, interconnected with automated material handling and storage system.