

Classification of CNC Machine & System – What are the Types of CNC Machines | CNCLATHING

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CNC machining is a manufacturing process that programmed software to direct the motions, the **classification of CNC machine** indicates the types of the equipment and the works they can do. How many types of CNC machines are there? The following content will introduce each kind of CNC machine tool, you can find the difference between them.



Classification of CNC Machine - What are the Types of CNC Machines

CNC (Computer Numerical Control) Machine tool is an automatic machine tool equipped with a program control system, can achieve the purpose of complex, precision, small-batch and multiple **CNC machining parts** processing and production. There are many types of CNC machines, which can be classified into the following categories based on different methods.

1. Functions (Parts)

According to the functions or types of machined parts, CNC machines can be classified into five types: CNC milling machines, CNC lathes, CNC drilling machines, CNC plasma cutters, and CNC grinders.

- CNC milling machines: used to create shapes, slots, holes, notches, grooves, pockets, and specialty faces, and perform the machining process of manufacturing CNC milling parts, the rotary cutting tools on the mill to remove material from the stationary workpiece.
- CNC lathes: used to manufacture cylindrical objects, and perform the process of producing CNC turning parts, a cutting tool will shape the workpiece while the material block is turning rapidly on a spindle.
- CNC drilling machines: used to drill hole in the workpiece, the tool can locate the position for drilling quickly and accurately, sophisticated drilling machines can also perform reaming, counterboring, and tapping holes.
- CNC plasma cutters: a machine carries a plasma torch, which is for cutting metals, involves cutting through electrically conductive materials by an accelerated jet of hot plasma.
- CNC grinders: a machine uses a rotary wheel to abrade the material by grinding or grating it into the desired shape, it's easier to program than milling machines and lathes.

2. Motion type

Classification by motion, CNC machines can be divided into point to point systems and contouring systems.

- Point to point systems: the material and tool are placed at certain fixed relative positions at which they retaining until the cutter finishes the process and retracts, this type equipment including drilling, boring and tapping machines.
- Contouring systems: the machine tool cuts the material following a contour of a part, so it works in a continuous path, this type equipment including lathes, mills and routing machines.

3. Number of Axis

When classified by the number of axis, CNC machines can generally be divided into five groups: 2-axis machines, 2.5-axis machines, 3-axis machines, 4-axis machines and 5-axis machines.

- 2-axis CNC machines: a machines gives access to only two axis, like the lathe machines, the tool moves in 2 directions, like X and Z.

- 2.5-axis CNC machines: is also a 3-axis system but the movement is not in three-dimensional, the X and Y-axis moved to the position first and then the third axis starts to work, such as the drilling and tapping machines.
- 3-axis CNC machines: three axes (X, Y and Z) move simultaneously in three-dimensional, it's the most widely used and versatile machine that can achieve high accuracy and precision, can be used for automatic/interactive operation, milling slots, drilling holes, and cutting sharp edges.
- 4-axis CNC machines: the 3-axis machine with one more rotation on A-axis or B-axis, the common example is a vertical machine or horizontal machine. In the case of 4-axis machining, milling is performed on the additional axis, while the operation on the X, Y and Z is the same as the 3-axis system, and the rotation on the A or B axis is around the X-axis.
- 5-axis CNC machines: the 3-axis machine with extra rotation along two directions (Y and Z) on A-axis and B-axis, the rotations are respectively given by the bed and spindle movement (pivot point). 5-axis machines are advanced CNC machines and its multidimensional rotation and tool movement allows the creation of precise and intricate parts due to the improved access to undercuts and deep pockets, unparalleled finish and speed, often used for high-level applications, like aerospace parts, artificial bones, titanium pieces, oil and gas machine parts, military products and more.

4. Control loop

The classification of CNC machines according to the control loop can get the types: open loop system and closed loop system.

- Open-loop CNC machine refers to a system where the communication between the controller system and the motor is one way. The process for an open-loop system is simple, CNC software creates the information with necessary step and direction signals based on the user's purpose, the computer relays this information to the controller which then energizes the motor, and no feedback. Open-loop CNC machines use stepper motors.
- Closed-loop CNC machine has a feedback system to monitor the output of the motors, also able to correct errors in position, velocity, and acceleration. The feedback can be returned to the CNC controller or computer, and the former type is more common, the system with feedback fed into the signal generator or computer usually exists in high-end machines.

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