



Machining

## What You Need to Know About Multiaxis CNC Machining

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### What You Need to Know

Shop owners must decide which CNC machine configurations are the most appropriate to their needs, and then figure out many other operational factors.

The leaders of the pack in many milling departments are 5-axis CNC machines.

Don't forget to update and upgrade your CAM software and take advantage of simulations to help the learning curve.

When deciding whether multiaxis tools are right for the job, shop chiefs first need to understand what's changed from more conventional machining tools and then what factors to consider.

Selecting a computer numerical control lathe or machining center was once a simple task: What travel is needed and how many RPMs? But fast forward to today's staggering array of CNC machine tools and tooling options, which leaves many potential buyers scratching their heads over what's needed now and wishing for a crystal ball to predict what will be needed tomorrow.

Welcome to the world of modern multitaskers, turn-mill lathes and 5-axis machining centers. Shop owners and management must decide which of many CNC machine configurations is most appropriate for their needs. They also must figure out how to tool it, who's most qualified to operate the equipment, whether and how to automate, and what parts are best machined on these new multiaxis tools.

### The CNC Equipment Evolution

What's changed, and why does it matter?

#### CNC Equipment Phase 1: The Turn-Mill

Not long after the first CNC lathe hit the production floor, some clever machine tool engineer had the bright idea to replace the tailstock with an opposing spindle. Suddenly shops could turn both ends of a

workpiece in a single operation.

Not long after that, someone decided to stick a few rotating tool holders in the turret and give the lathe an indexing spindle, providing basic milling and drilling capabilities.

Of course, the next logical step was to equip those machines with C-axis spindles and Y-axis slides, allowing shop floors to often skip the milling department altogether. While they were at it, many lathe builders added another turret or two, so machining time could be balanced between the left and right spindles.

## CNC Equipment Phase 2: Enter Multitasking Machines

It wasn't until builders began equipping their wares with B-axis machining, center-style spindles and tool changers that the term "multitasking machine" started gaining widespread use. This is somewhat ironic considering CNC lathes have had multitasking capabilities for decades.

The line between the two is fuzzy, but multitasking generally denotes a machine with a true milling spindle and tool changer, while machines with conventional turrets—no matter how complex—are simply known as turn-mills.

Making things fuzzier is the fact that some machine builders add grinding, hobbing or additive manufacturing capabilities to their various machine models—increasing the ability to produce parts in a single operation.

## CNC Equipment Phase 3: 5-Axis Milling

Not to be outdone, the tried and true 3-axis machining center received a makeover as well. Taking their cue from rotary table and trunnion-style programmable indexers, 5-axis machining centers let shops machine five sides of a workpiece in a single clamping (known as 3+2 machining).

Carrying that concept a bit further, 5-axis machining simultaneously makes for easy production of turbine blades, orthopedic implants and similar free-form shapes. This capability is quickly making these machines the leaders of the pack in many milling departments.



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## Can CNC Super Machines Deliver ROI?

Making the move to new equipment is generally daunting given the upfront investment and the training preparation required. Is it really worth it?

Ask around and you'll find very few shops regret the move to multitasking, turn-mill or 5-axis machining. Here's why: They can machine parts in fewer operations because these machines' geometric accuracy is better than that of traditional multioperation machines.

There are also fewer fixtures to build and less work-in-process. Plus, turnaround times typically run days rather than weeks. Because super machines typically have more tooling stations, it's likely that changeover times will be shorter (assuming adequate programming, simulation and tool setup).

Added all together, the shop floor teams have far greater flexibility and the business has a better bottom line.

## Factors to Consider Before Buying A Multiaxis Machine

With knowledge of the newest CNC machining tools, what are some of the things to consider before buying a super machine, and what prep needs to happen before new equipment arrives?

### Step 1: Tool Up with the Right CNC Equipment

Let's face it: Many shops buy nowhere near enough tooling for their new machines, relying instead on whatever vises, square-shank holders or CAT-40 tapers are already on-site. That's a bad idea, especially with a super machine.

For starters, there's a good chance the tooling interface will be different than that of current equipment. Capto, VDI and HSK are common—do you know how these **modular tools** work, and are there enough of them to fully tool dozens (perhaps hundreds) of tool positions?

You also want the most rigid grip possible to take advantage of a new machine's greater metal-removal abilities. Take a hard look at **shrink-fit** or hydraulic tool holding for no-slip interfaces. And give some thought to an offline presetter. There's nothing worse than having an expensive piece of equipment sitting idle while searching for tools or touching them off on the machine.

The same can be said for workholding. Lathes should be equipped with high-quality, quick-change chucks or collet systems (one for each side). And don't even think about putting a 6-inch machinist's vise on a new 5-axis machining center. It needs a high-profile vise offering unrestricted access to all sides of the workpiece. And here again, consider a quick-change, ball-lock or zero-point mounting system and vise jaws that are equally speedy.

**Don't skimp on tools, software or the training and simulation needed to realize the full potential of multiaxis machining.**

## Step 2: Evaluate CAM Software Capabilities

What about your computer-aided manufacturing software? If a shop is full of 2-axis lathes and 3-axis mills, chances are the CAM software is not up to snuff. It might be time for an upgrade—or a new system entirely.

Be sure to schedule training now so users are not fumbling on day one. If a full-system replacement is planned, grab a handful of CAD files and start kicking some tires. Evaluate how quickly the CAM provider can program the multiaxis parts. Make absolutely sure a bulletproof post processor is available for the new machine.

One last thing: Also consider investing in some toolpath simulation software because multiaxis machines are more complex than more conventional lathes and mills. Simulation is a good way to evaluate plans before machining and to identify potential pitfalls before they become shop floor problems.

### Key Takeaways

- Multiaxis machining can be complicated to adjust and require an upfront investment, but the benefits outweigh the obstacles.
- Don't skimp on tools, software or the training and simulation needed to realize the full potential of multiaxis machining.

*If you've made the move to a CNC super machine, what one tip do you find yourself sharing again and again?*