

Swiss-Style Machines Simplified

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By **Kip Hanson**
Contributing Editor,
SME Media

For shops that produce smaller components—say anything under 1.5" (38.1 mm) or so in diameter—there's no shortage of reasons to invest in Swiss-style CNC lathes. Reasons include:

- Dual spindles and independent tool slides make it possible to perform several machining operations simultaneously.
- Compact work zones mean cutting tools don't have to travel far to the workpiece, while fast rapid traverse rates get them there faster.
- High spindle speeds eliminate the cutting speed restrictions of larger lathes, improving tool life and part quality.
- Dozens of cutting tools and extensive milling capabilities reduce the need for secondary operations and make lights-out machining easier.

Add to this list advanced capabilities like laser machining, thread whirling, oscillation cutting, and the option to switch between fixed and sliding headstocks, and it's clear that these efficient, capable machine tools can complete most parts in less time than all but the less-flexible, far more expensive alternatives—rotary transfer equipment and multi-spindle screw machines.

Facing the Challenges

There is a catch. With these awesome capabilities comes complexity. Each of the slides, spindles, and cutting tools just mentioned must be

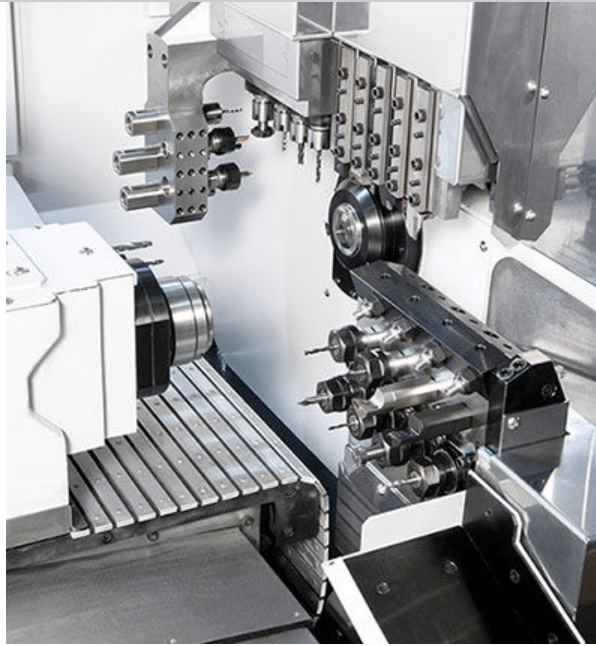
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special G-codes. To avoid damaging the workpiece and machine, there must be perfect alignment of the main and sub-spindle during part transfer. The compact work zone that helps give Swiss machining its short cycle times can make tool changes a bit troublesome, with operators using tiny wrenches to turn tiny screws while reaching past, around, and under other cutting tools. Worse, all those tools in tight quarters tend to catch long, stringy chips, which, if left unattended, can spell disaster.



Absolute Machine Tools' eight-axis Nexturn PYII series has a second Y axis, up to eight sub-spindle tools, and a maximum of 27 tools in total. Additional tooling options allow more live tools to be used on both the main and sub spindles for complex and intricate part geometries. (Provided by **Absolute Machine Tools**)

The good news is that Swiss-style machine tool builders recognize these challenges, and ever since the invention of the sliding headstock lathe in 1872 have been working to make their wares easier to operate. One of these is **Absolute Machine Tools Inc.**, Lorain, Ohio, where Greg Knight, vice president of sales for production turning products, suggests that ease of use begins with a capable CAM system.

“Aside from our Nexturn line of CNC Swiss lathes, we offer a broad line of milling, turning, and EDM equipment, and wanted a programming system that works well with all of them,” he said. “After extensive evaluation, our applications department recommended we go with ESPRIT [developed by DP Technology]. It provides the graphical collision detection needed to avoid crashing an expensive machine tool, and because we work very closely with them on post-processor development, our customers can be assured they’ll get quality G-code. And, like I said, it’s quite easy to use, especially for novice programmers.”

Training for Success



Absolute Applications Engineer Scott Petrisko stresses the importance of operator training. “There’s definitely room for improvement out there,” he said. “Too many shops limp by, relying on their machinists’ ability to read the machine manual and pick things up on their own. If they were to spend some time and money on regular training, they could get so much more out of their machine tools. It pays for itself very quickly.”

Petrisko suggested that a more complex Swiss-style lathe, one with plenty of available tool stations and generous spindle capacity, is in many situations a better choice than one that just meets the minimum requirements for a part or family of parts. Having additional stations means there’s a greater likelihood that whatever cutting tool is needed for any given job will be resident in the machine, reducing changeover time, just as a larger spindle opens the door to additional work.

For the tools that do need to be changed—and there are always a few with every setup—Petrisko is a big fan of quick-change tooling, suggesting that these systems help maximize machine uptime. John Kollenbroich, head of product management for **Horn USA Inc.**, Franklin, Tenn., agrees. He noted that quick-change helps reduce setup times, and speeds in-process tool replacement as well, which can be a leading contributor to machine downtime. In addition, it makes offline tool presetting a possibility, further increasing productivity and reducing the chance of operator error during tool touch-off.

Tooling Up

“We’ve partnered with W&F Werkzeugtechnik out of Germany, and they offer a quick-change tooling system for both rotary and square shank toolholders,” he said. “It’s activated with a single screw in the side of the holder that gets tightened down to a specific torque of four Newton-meters, and seats like an HSK-style holder does, with dual face and taper contact. There’s also an alignment pin in the square shank tools that assures perfect centerline.”

For a more comprehensive tooling approach, Kollenbroich said the company offers the WF Micro Linear Gang Plate, which works with the W&F Micro stick tools just described or a shop’s existing square shank tooling. Chris Foschaar, application and sales engineer for Horn, explained that the modular attachment replaces a Swiss-style machine’s



Offline measurement of cutting tools does not require any special equipment, as shown in this example using a presetting block from National Machine Products. (Provided by Tsugami/REM Sales)

This eliminates the need for individual plastic or copper coolant lines that are easily snagged by passing chips, he said, or that the machine operator inadvertently knocks out of position when changing a cutting tool, possibly with catastrophic results.

“The main advantage of the plate is

interchangeability. It allows an operator to

index or change tools quickly and accurately, a task that can be difficult on most Swiss machines due to the close quarters. Between that and the fact that you don’t have to worry about the coolant lines, it’s a big time saver.”

Derek Briggs, Swiss product manager for **Tsugami/Rem Sales LLC**, Windsor, Conn., seconded the need for quick-change tooling and integrated high-pressure coolant. He pointed to the GWS-Tooling system from German manufacturer Goeltenbodt as a preferred solution for Tsugami and other brands of CNC Swiss-style lathes. “One of its biggest benefits is the ability to use standard, off-the-shelf toolholders,” he said. “You loosen one screw, pop out a cartridge containing the stick tool, and either change the insert on the bench or install a preloaded cartridge. And since there’s a presetter that comes with the system, there’s no need to ever touch off in the machine, saving more time.”

Admittedly, these systems are a pricey option—depending on the manufacturer, the machine tool, and the number of tooling stations needed, a shop might expect to spend \$50,000 or more to tool up each of its lathes. And yet, given the continuing shortage of skilled machine operators along with every shop’s desire to achieve high OEE (overall equipment effectiveness) levels, such investments are easily justified.

All Aboard

style machines. He said it's very simple to use, supports all but very complex machining operations, and provides machine-specific simulation and code generation. It also generates the tool offsets, further simplifying setup. And while Abile might not be as powerful as ESPRIT or other commercially available CAD/CAM systems, it is perhaps "a good starting point" for shops with less sophisticated machining needs. "It's especially great for new users, as it helps them gain confidence while they learn how to program."

Gonzalo Serrano has a similar suggestion. An applications engineer at **Index Corp.**, Noblesville, Ind., he said the company's WinFlexIPS and WinFlexIPSPPlus programming and simulation software is designed specifically for the Traub line of Swiss-style lathes. The first of these comes standard on all machines, while the "plus" version can be installed on a PC or laptop and supports higher-level machining functions like engraving, 3D simulation, and complex milling cycles.

Both simulate using the post-processed G-code, and both make it easy to apply the correct cutter compensation values, or insert the "synch" codes needed to perform turning or milling on up to four axes simultaneously. "This last part—synchronization—is something that a lot of lathe machinists struggle with, at least until they find out how easy it actually is," said Index Proposals Engineer Randy Carlisle. "That's why training is so important, and why shops should invest in equipment from a distributor that offers excellent applications support. Doing so can have a dramatic effect on both the productivity and profitability of these very capable machine tools."



The Index iX Center automated cell is intended for lights-out manufacturing, and utilizes a pallet system for material management and a FANUC robot to pass parts to a Renishaw gauge or CMM. (Provided by Index)

And although it might seem to have nothing to do with making Swiss operation any easier, Industry 4.0-type functionality goes a long way towards achieving the two goals just mentioned. According to Serrano,

provides helpful information for the machine operator, such as programming tips and maintenance reminders.

Industry 4.0 and remote monitoring systems also serve to alert management if there's a problem, Carlisle noted. "They allow you to see real-time production figures, like how many parts were machined during a specified time period, and whether there were any rejects. Obviously, you need a measuring system to capture that data, which is something we offer with our Index iXCenter automated cell. It uses a FANUC robot to pass parts to a Renishaw gauge or CMM, for example, that can measure certain dimensions and then make offsets to the relevant cutting tools as necessary."

Check it Out

Brian Such, executive vice president at **Marubeni Citizen-Cincom Inc.**, Allendale, N.J., lists a slew of time-saving features such as in-line probing on new machines from his company. Also, grammar check quickly proofreads machine programs for syntax errors, reducing validation time. Cutting tools used on two or more machine "channels" can be controlled using the same offset. The "free axis control system" makes it easy to relabel the X-axis as the Y-axis, for example, and is used to increase machining precision in some applications.

Perhaps most valuable to setup people is the on-machine program check function, which transfers the traditional feed rate and rapid overrides to the manual pulse handle and allows operators to instantly slow all axes down to a snail's pace or ramp back up to full speed. This avoids the white knuckle "riding the e-stop" approach with which so many CNC machinists are familiar. And if an error is found or collision is about to occur, it's possible to pause program execution, make a live edit, and pick up where you left off.

Such went on to point out the ease with which an operator can synchronize the main and sub-spindle, a task that has long been challenging on some machines. "Anyone with a milling-capable Swiss machine will at some point find themselves trying to pass a non-round, irregularly-shaped part to the sub-spindle. On a Citizen, you just wheel the sub over to the main, rotate the spindle by hand until it's aligned, close the collet on the workpiece, and push a button called 'phase set'



This Cincom machine is equipped with the latest NC model to drastically reduce the startup and screen switching time compared to conventional machines with advanced functions. (Provided by Marubeni Citizen-Cincom)

to pass the part on the fly at any rpm.”

As for the probing mentioned earlier, the company is set to release this feature on its L-series machines. “We introduced an ATC (automatic tool changer) on some of our machines last year, and some of our customers

began asking for a faster, more automated way of setting tools than with a presetter,” Such said. “So we will soon have a probing system available that has a probe in the ATC and one next to the sub-spindle, which shops can use to touch off tools during the setup process as well as measuring parts while machining. It’s pretty cool.”

The Fix is In

Star CNC Machine Tool Corp., Roslyn Heights, N.Y., is another machine builder with an extensive lineup of Swiss-style lathes and proprietary technology. Yet it’s the company’s new fixed headstock machine that has National Sales Manager Ed Garber most excited. That’s because the SK51—a mill-turn lathe with twin-turrets, twin-spindles, and 51-mm bar capacity—boasts FANUC’s iHMI (intelligent human machine interface) control, which Garber suggests changes the playing field in terms of operator usability.

“The turrets on the SK51 have identical X, Y, and Z travels and can each carry up to 32 tools, so there’s a lot going on here,” he said. “Because of this, we needed a control with excellent simulation capabilities, one that can display the tools, milling attachments, and workpiece in 3D and identify any potential interference before the operator pushes cycle start.”

As with the other machine suppliers interviewed for this article, Star wanted a control that’s powerful yet easy to use. The iHMI meets both requirements, with cycle time estimation capabilities, graphical tool libraries, maintenance reminders, and machine troubleshooting functions, including visibility to servo and spindle operating values. “We’ve also

other features that help shorten both setup and cycle times,” said Garber.

He agreed with his peers that quick-change tooling systems are a vital piece of any machine tool optimization strategy,

Swiss or otherwise, and

mentioned Exsys Automation and its DECOFLEX system as a top contender. And like others, Garber noted as well the increasing role that Industry 4.0 is playing for manufacturers of all stripes, machine shops among them. For Star and other brands of CNC equipment that use FANUC controls, that means the SMOOSS-i, short for Star Monitoring & Operator Support System.

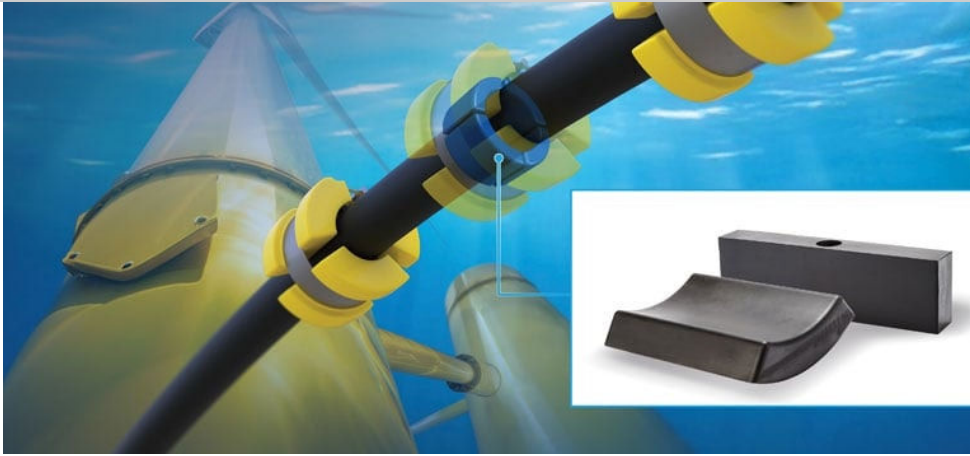
“A customer puts this on their server, connects the machine tools to the network and has instant, real-time access to machine status, part counts, tool life values, scheduling information, and so on,” Garber said. “It will send e-mail notifications if there’s a problem and can be used to back up machine parameters and SRAM data. We find that it’s a great tool for management to keep a proactive eye on things, but for those manufacturers who display production information on a big screen TV out on the shop floor, it serves to get the machine operators and programmers more involved. Because everyone has access to the same data, they now take greater ownership and responsibility for the metrics shown there.”



The SK-51 type A CNC Swiss automatic lathe from Star comes with FANUC's iHMI control, offering ease of use and advanced graphics. (Provided by Star)

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By Ed Sinkora



SMART MANUFACTURING

Using Data to Deliver Results

CoroPlus Silent Tools Plus dashboard is shown here on a tablet.
(Provided by Sandvik Coromant.)

By Kip Hanson

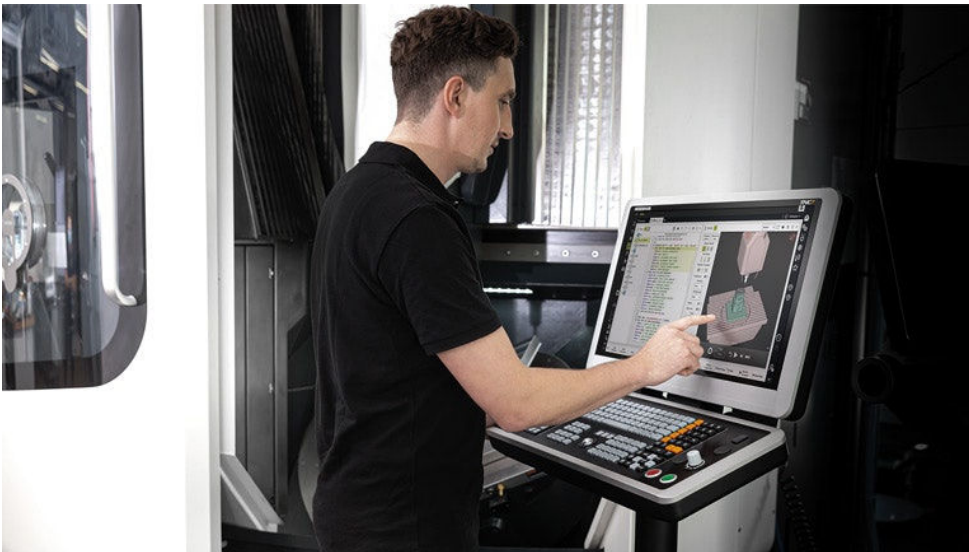


TOOLING & WORKHOLDING

Machine Tools for Toolmakers

Shown here: OPS Ingersoll's Eagle V5C, a "high-speed, ultra-rigid 5-axis vertical machining center (VMC) with enhanced cooling controls." (Provided by MC Machinery.)

By Kip Hanson



PRODUCT DESIGN & ENGINEERING

Machine Learning for Machine Tools

Heidenhain's Integrated Process Monitoring learns the speeds, feeds and torques experienced by each axis throughout a cut in producing a good part, and then tracks and displays any deviations for analysis and adjustments thereafter. (Provided by Heidenhain.)

By Ed Sinkora



SMART MANUFACTURING

Collaborating with Robots

Between “Blade Runner,” “Terminator,” “The Matrix” and other blockbuster movies, Hollywood has painted a frightening picture—one in which intelligent machines attempt to destroy humanity.

By Kip Hanson



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