HEIDENHAIN

Mastering Motion

Unlocking the Full Potential of Modern Machine Tools

Contents

Why machine tools matter now more than ever

From smartphones to satellites, nearly every modern product owes its existence to the machine tools that helped build its components. And while machine tools have always been vital, the expectations placed on them today are evolving rapidly. Manufacturers are under pressure to produce tighter tolerances, shorter lead times, and smarter operations—all while dealing with labor shortages and the rising complexity of parts.

At HEIDENHAIN, we live at the intersection of this challenge. We don't just deliver parts like encoders and controls—we help machine tool builders, integrators, and operators unlock a new level of control over their processes. Our solutions don't just make motion possible—they make precision achievable, automation seamless, and efficiency repeatable.

What follows is a look at how HEIDENHAIN technologies help machine shops meet the moment—from motion control and intelligent CNCs to retrofitting strategies and educational support. Whether you're building the next generation of 5-axis machining centers or breathing new life into a legacy lathe, we're here to help you master motion. ■

When to retrofit a machine and how to choose the right control

With just about any **CNC control**, you can be certain you'll be able to take code from a CAD CAM system and start machining with the push of just a few buttons. But what makes one control better than another? They're not "one size fits all."

Retrofitting a machine tool with a CNC control can revive an outmoded capital investment into an active revenue source. A prime example is what's happening with the return of manufacturing to the U.S. A lot of the work being reshored includes large parts, because they are getting more and more expensive to bring from overseas. The problem is, the multimillion dollar machines, with dozens of meters of traverse, are 20 years old and replacement is both expensive and very disruptive to business.

Retrofitting has proven a smart alternative because it brings the machine back to life at a fraction of the cost of a new machine and much faster than several-month lead time. While prime candidates for retrofitting, these large machines are not the only ones suited for retrofitting.

When retrofitting machines is a good idea

- There's a need or opportunity to add new capabilities, cut different parts and/or enter a new market.
- There's a network of machines, but not all machines have controls that can connect.
- If a company purchases a 5-axis machine in order to be able to cut parts in fewer setups and reduce labor costs.
- In order to counter a competitor who has added a new machine. New machines and controls can outperform previous generations of machines and controls by 50 or 100 percent depending on the application.
- When machining 3D surfaces, as in big mold applications or forming dies, and the machine cannot hold tolerances anymore.
- If you have different size cavities within the same part. In other words, a cavity on one end of the part machined on Monday isn't the same size as the same cavity on other end of the part machined on Friday.

What makes a good CNC control

Ultimately, a quality CNC control empowers the operator to do more at the machine. It allows more flexibility to diagnose and address issues right at the CNC without reposting a program from a CAM system to machine a good part. The right control chosen with the right objectives in mind have a huge impact on productivity.

An engaging interface that's attractive to young talent

All the industry sectors are trying to find new talent and younger generations of

> "Retrofitting has proven a smart alternative because it brings the machine back to life at a fraction of the cost of a new machine and much faster than several-month lead time."

people to fulfill the roles of those who will go on into retirement in a few years. Engaging, modern looking, empowering controls will play a big role in both hiring and workforce development. Young workers are used to working with technology and will have more of a desire to use it in their occupation.

Flexibility and versatility

Controls also contribute significantly to the all-important flexibility. Flexibility is something that's becoming more and more of a requirement to stay competitive. The ability to adjust on the fly and program even 3-plus-2 parts right on the CNC can be a distinct competitive advantage, as opposed to waiting to go through the whole process of CAM reprogramming for simple parts.

Computing power or speed

Especially in 5-axis applications, you are dealing with a lot of data points. Imagine machining a football, every cutting tool edge has to reach that football is an XYZ, maybe even a C position. Millions of points need to be controlled very, very accurately, making it more important that your control can handle the data fast enough; we're talking millisecond processing times.

The control actually needs to know what's coming next. If a control is lagging behind, you will see it on the part, a little scratch there or a little dimple there. The cutting tool will stand there turning before it moves on to the next location.

If you want to manipulate 3D models, and zoom in and out of specific pockets, you need a powerful control. These also use the same responsive touchscreens of the tablets and smartphones we've become so comfortable with.

A fully synchronized motion system

At HEIDENHAIN, we rarely put our CNC control on the machine with motors , scales, rotary or linear encoders from anyone but HEIDENHAIN. When somebody buys a CNC control from HEIDENHAIN with the entire motion system, they're guaranteeing that everything works in sync. That's unique to HEIDENHAIN, because not all control suppliers also make encoders, scales and motors. Syncing all the mechanics makes motion faster, more responsive and accurate.

This allows for high performance and features like Adaptive Feed Control where spindle load, speeds and feed are calculated together; if there's not enough material and things could be moving faster, the machine adjusts how it moves over the area without any intervention from the operator .

If you're looking to learn more about CNC machining and controls, or to see how a new control can impact your machinery and boost your bottom line, contact us today. ■

Machine tool automation

What it is and why it's needed

From the first punch card-driven CNC controls that debuted decades ago to the newest closed-loop boring tools on the market today, automation has touched nearly every aspect of the machining industry. And machine tool automation is only growing more common as technology becomes cheaper and more easily integrated into machine tools. But what is it? What are its benefits, its challenges? Read on to learn more.

What is machine tool automation?

Machine tool automation uses the latest developments in hardware, software and controls to perform machining tasks with less, or no, human intervention. This takes multiple forms. For example, when you program a cut into a CNC control using CAD or CAM, the machining of that part is fully automated. Or, a machine tool could use automated tool loading, which switches out workpieces without any operator intervention.

This automation can be partial (also known as "open-loop"), where an operator still monitors feedback and makes adjustments manually, or total ("closed-loop"), wherein the machine tool itself makes adjustments as it operates. In both cases, the tool leverages software and hardware in order to simplify and speed up operations.

Why machine tool automation is needed

There are many reasons why a shop would consider automating its machine tools. Machinists are facing skyrocketing demand for parts, sometimes on short timetables. Parts may require extremely complex geometries, fine details or other factors that would be very time-consuming without automation. And those parts will only grow more complex as technology grows more advanced—consider what's under the hood of a sedan from 1995 versus one from 2023.

Along with all this, while employment numbers have bounced back significantly in the wake of baby boomers leaving the workforce, shops of all sizes still deal with worker shortages. Operators need to maintain or increase their productivity, despite having fewer people in the shop. Add all this together and you have an industry ripe for automation.

4 benefits of machine tool automation

The advantages of automation are many and vary by operation, but here are some of its biggest benefits:

Productivity

The more aspects of your shop you automate, the more time operators have each shift. They focus on more fulfilling, higher-level work—and won't get dragged down by labor challenges when there are fewer people on the floor. Depending on how automated a shop is, it may even be able to run outside of working hours. The end result: more parts machined per day, happier workers, higher productivity and better ROI.

Safety

Automated solutions are perfect for dangerous, dull and dirty tasks—the fewer of those tasks humans have to perform during operation, the fewer opportunities there are for someone to get hurt. Even something as simple as better ergonomics lowers the risk of repetitive-motion injuries, protecting workers—and maintaining productivity.

Quality assurance

Even the most skilled machinists make mistakes. We're only human, after all. And the tighter the tolerances, the more complex the part or the larger the production run, the more damaging each error becomes.

When you program a design into a CNC control, you can rest assured the machine will make the same cuts or bores every time. Increasingly sensitive real-time monitoring also ensures that if variance does occur, either the operator or the tool itself can adjust to compensate in the moment, rather than after the part is fully machined. Repeatability remains high, waste remains low.

Predictive maintenance

Performance monitoring doesn't just spot and correct errors. It can also call out when a tool's components start to wear and identify exactly where in the machining process the performance is degrading. Components that might have otherwise gone unnoticed and even done damage to the tool are spotted; operators can, as a result, swap out components or tools before equipment failure. Productivity loss is minimal, tool life is extended and ROI reflects it.

Potential challenges for adopting machine tool automation

Machine tool automation presents mostly benefits—but it can create some challenges, as well.

Initial investment

For starters, there's the initial investment. Automated machine tools can be more expensive—sometimes significantly so—than their less-advanced counterparts. Hesitation is an understandable reaction, especially if owners want to standardize their equipment across the entire floor. But it's important to remember that these machines offer quicker ROI—and, thanks to boosts in productivity, they add more value over time.

Skills gap

Standardization may also exacerbate the skills gap—that is, the gap between the skills your operators need and the ones they currently have. Even a single new tool with features unfamiliar to operators can cause confusion or slow down production as workers get used to the tool. If a shop doesn't standardize, workers will have to remember multiple different ways of operation depending on which tool they happen to be using. That's a recipe for inefficiency. By contrast, the more standardized your shop floor becomes, the more productive it gets (and the easier it is to train employees). Once your most experienced operators

get comfortable with new machines, ROI will skyrocket. Plus, younger generations of workers are excited about the possibilities offered by automation; with the right training and onboarding, shops will see boosted recruitment.

Tech support

Finally, the more digital and online your machine tools are, the more tech support and cybersecurity you'll need. You may need to establish an entirely new role or partnership dedicated to machine maintenance (at least until operators are completely with the equipment). Plus, as soon as your tools are connected to the internet (or even simply to each other via Bluetooth), they're vulnerable to bad actors and could be subject to data protection regulations (such as the California Consumer Privacy Act). Machinists will have to adjust to calling tech support or considering cybersecurity implications as they work. Fortunately, it's not difficult to train for these challenges. The end result is a truly modern workforce: confident with new machines, able to deftly navigate tech support issues and knowledgeable about best security practices.

These challenges are real—but they're all surmountable. With careful planning, strategic investment and open conversations with staff, your shop can adopt automated machine tools with minimal fuss and maximum ROI.

Industries embracing machine tool automation

The big question here is not "which industries are embracing machine tool automation," it's "which industries are not embracing it?" The benefits we've discussed apply to virtually every manufacturing sector, and companies are embracing automation accordingly.

Here are just a few of the industries adopting automation in their everyday operations:

- Automotive
- Aerospace
- Electronics
- Medical devices
- Energy
- Consumer goods
- Space technology
- Metal fabrication

What the future of machine tool automation holds

Automation in machine tooling advances by leaps and bounds every year. Some features once thought to be science fiction are already in use—and others are well on their way. Advances in machine vision will soon make tools even better at monitoring performance. Widespread adoption of 3D printing may lead to easier prototyping and faster iteration of new designs.

And things are getting more advanced from there. We're already seeing the industry embrace digital twin technology, which models a machine's operation using a programming station. These twins replicate a machine's behavior, cutting parameters and functions for review—exactly replicating how a real tool would run. This saves the shop floor time they'd otherwise spend on setup, simulation and debugging. It also increases reliability and productivity.

Now consider augmented reality, which is already taking off in manufacturing as a training and diagnostic tool. Touchscreen displays with real-time information are pretty convenient, but imagine if you could monitor the tool's performance with a 3D view of each component overlaid on the actual tool itself. Special glasses and headsets, which are constantly evolving, make such applications possible.

There's also artificial intelligence and machine learning. Real-time optimization and predictive maintenance are already occurring, but as machines get smarter their solutions become more effective. They can anticipate repairs farther out. And their human operators can work with this information to machine the best parts possible.

So, what does the future hold? In a word: everything. Automation has a way of transforming every industry it touches—making things easier for operators, letting them do more things at once and in general enabling success once thought impossible. Now it's our turn! ■

Tool monitoring

How it enhances efficiency, precision and TCO

In the competitive world of modern manufacturing, efficiency and precision are not just goals; they are necessities. Every second counts, and every tool must perform flawlessly to maintain the high standards expected in today's market.

One of the critical strategies to achieve these standards is through effective tool monitoring. By predicting and preventing tool failures, manufacturers can significantly reduce downtime, enhance product quality and ultimately lower the total cost of ownership (TCO).

What is Tool Monitoring

Tool monitoring refers to the process of continuously observing and analyzing the performance and condition of tools used in machining operations. It aims to predict and prevent tool failure, ensuring optimal tool usage and minimizing disruptions. By using advanced sensors and systems, tool monitoring can detect anomalies in tool behavior and trigger necessary actions to mitigate potential issues.

How Does Tool Monitoring Work

Tool monitoring systems use a variety of sensors and technologies to track tool conditions in real-time. These systems measure parameters such as vibration, force, spindle temperature, and other operational metrics to identify signs of wear or potential breakdowns.

By continuously analyzing this data, tool monitoring systems can provide insights that help improve overall production efficiency and precision. They enable manufacturers to make informed decisions about tool maintenance, replacement and process adjustments, enhancing productivity and product quality.

Key Benefits of Tool Monitoring

Reduced Downtime

The primary benefit of tool monitoring is the significant reduction in downtime. By detecting tool wear or breakage early, operators can take preventive actions before a complete failure occurs, thus minimizing production interruptions and maintaining production schedules.

Increased Productivity

Tool monitoring helps in identifying and replacing worn or broken tools quickly, preventing unplanned work stoppages. This leads to an overall boost in productivity, as machines spend more time operating efficiently and less time in maintenance or rework.

Improved Safety

Early detection of tool breakage reduces

the risk of accidents and injuries. By preventing damaged tools from continuing to operate, tool monitoring systems help maintain a safer working environment.

Cost Savings

Reducing downtime and preventing damage to workpieces and equipment directly translates to cost savings. Tool monitoring systems help avoid the high costs associated with unplanned downtime, scrap parts and extensive repairs.

Enhanced Quality

Monitoring tools in real time ensures that any deviations in tool performance are detected and addressed promptly. This leads to higher quality and consistency in the final products, as defects and rework are minimized.

Predictive Maintenance

Tool monitoring supports predictive maintenance by using data analytics to predict when a tool will need replacement. This approach allows for optimal tool usage and scheduling of maintenance activities, reducing waste and ensuring that tools are replaced only when necessary.

Types of Tool Monitoring Systems

Tool monitoring systems come in various types, each designed to address specific challenges in manufacturing. Understanding these different systems reveals their unique features and benefits.

Tool Breakage System

Tool breakage is a common challenge in machining operations. The right tool breakage detection system can help detect and deal with breakages immediately, minimizing disruptions. Modern systems are more affordable and advanced, making them accessible for the average shop.

The TD 110 is a high-performance tool breakage detection system that uses inductive, non-contact sensors. It can detect breakages at rapid traverse speeds and is capable of inspecting HSS and carbide microtools down to 0.4mm in diameter. The compact and robust housing of the TD 110 ensures durability and ease of integration into existing workflows. It reduces scrap, prevents secondary damage, and lowers TCO by eliminating the need for compressed air and requiring minimal maintenance.

Vision System for Tool Inspection (VT 121)

The VT 121 is a vision system designed for comprehensive tool inspection beyond tool life. It optimizes cutting parameters, NC programs and monitors tool breakage. The system features a rugged and compact design with an IP68 protection rating and protective lenses. It allows for tool inspection directly on the control, saving time and enabling automated inspections during machining. The VT 121 provides panoramic and close-up images of tools, facilitating detailed analysis and optimization.

Laser-Based Systems

Laser-based tool monitoring systems use light to detect changes in tool conditions. These systems are highly sensitive and ideal for high-speed operations where physical contact is not feasible. However, they can be expensive and cannot measure wear on the tool's critical cutting edge.

Infrared Sensors

Infrared sensors monitor temperature spikes in tools and materials. They are useful for detecting thermal anomalies that indicate tool wear or impending failure. These systems are non-contact and provide real-time data but may require calibration and maintenance to remain effective.

Machine Vision Systems

Machine vision systems use cameras and image processing software to analyze tool performance. These systems can provide detailed visual data on tool conditions but may be complex to integrate and require significant processing power.

Considerations for Selecting the Right Tool Monitoring System

Choosing the appropriate tool monitoring system involves evaluating several critical factors to ensure it meets your operational needs. Carefully weighing these elements can guide you to the best decision for your specific requirements.

Cost

When selecting a tool monitoring system, consider the initial investment and long-term cost savings. Systems that reduce downtime, improve quality and extend tool life can offer significant cost benefits over time.

User Training

Ensure operators are adequately trained to use and interpret data from the tool monitoring system. Training can maximize the effectiveness of the system and ensure that potential issues are promptly addressed.

Integration and Compatibility

Choose a tool monitoring system that is compatible with your existing equipment and workflows. Systems that can be easily retrofitted or integrated with minimal disruption will be more effective and cost-efficient.

Tool monitoring is a vital strategy for enhancing efficiency, precision and reducing the total cost of ownership in machining operations. By understanding the various types of tool monitoring systems and considering key factors such as cost, user training and compatibility, manufacturers can select the right system for their needs. HEIDENHAIN offers advanced solutions like the TD 110, VT 121 and VT 122, which provide reliable, cost-effective and high-performance tool monitoring capabilities.

For more information on how HEIDENHAIN tool monitoring systems can benefit your operations, contact us today and ask about the TD 110, VT 121 and VT 122 products. ■

Milton Willis has an impressive track record of over 32 years in the machine tool industry and 26 years with HEIDENHAIN CORPORATION. He has established himself as a technical service expert with a deep understanding of mechanical and electrical machine tools for CNCs. Whether it's providing technical support or training, Milton is committed to delivering the highest level of service to his clients.

Inside the HEIDENHAIN Family of Brands

Technologies that power precision

From encoders to motors, HEIDENHAIN's reach in the machine tool industry extends far beyond the TNC control. Through a family of specialized brands, HEIDENHAIN delivers advanced motion technologies that support every stage of the machining process — whether you're building the next high-performance CNC or retrofitting a legacy mill for modern work.

The following pages highlight key members of the HEIDENHAIN family of brands whose products are engineered specifically for machine tool applications. These brands offer motion feedback, direct-drive power, encoder technology, and system-level performance trusted by builders, retrofitters, and manufacturers worldwide. Each one plays a unique role in helping today's machines cut faster, measure more accurately, and operate more reliably.

Inductive Precision for Harsh Machine Tool Environments

AMO specializes in the development and production of linear and angular measuring systems based on the proprietary AMOSIN® inductive sensing method — a technology that blends the precision of optical encoders with the durability of magnetic systems. Designed specifically for harsh industrial environments, AMO encoders offer robust, high-resolution motion control feedback that thrives in machine tool applications.

Whether it's a large-format CNC, a long-travel manual machine, or a retrofit project bringing legacy equipment back online, AMO encoders deliver reliable, dynamic positioning. Their flexible, modular design allows seamless integration — even in challenging conditions filled with coolant, chips, and vibration. AMOSIN® technology opens the door to custom solutions as well, supporting unique machine tool designs across metalworking, aerospace, medical, and semiconductor manufacturing.

As part of the HEIDENHAIN family of brands, AMO represents a versatile, rugged, and future-focused approach to encoder technology — built for the realities of today's machining environments.

AMO speed sensor optimizes main spindle

The WMK 3010S rotational speed sensor from AMO provides users of milling and turning machines a better option for operation of their main spindle. Besides providing speed data, the WMK 3010S also supports the capturing of operating status data of that spindle thus optimizing many costs related to the operation of the machine.

Available in North America through parent company HEIDENHAIN, this AMO speed sensor includes a USB interface which allows the operating status of the spindle to output to the machine control. This enables the user to record rotational speed, operating time, temperature and more. Put these factors together, and overall performance and uptime expectations are optimized.

The rugged, inductive, incremental scanning head on the WMK 3010S is available with a 1Vpp interface. It has a minimalist modular design, allowing this IP67-rated product to be installed in existing customer designs without significant modifications. It is available in the common industry line count increments and can be operated up to a max of 50,000 rpm.

Many useful features are offered in the WMK 3010S including:

- Inductive Scanning
- IP67 protection
- Max speed of 50,000 rpm
- Integrated acquisition of operational data
- Offline output of data via USB
- Low Cost ■

ETEL

High-Performance Motion for Advanced Machine Tools

When machine tool builders require the highest levels of speed, control, and responsiveness, they turn to ETEL. As a global leader in direct-drive technology, ETEL provides a wide range of high-performance motors and motion platforms designed to push modern CNC systems to their limits.

ETEL offers one of the most extensive portfolios in the industry, including over 170 torque motor models and more than 40 linear motor types. These motors are engineered for zero backlash, ultra-low cogging, and exceptional dynamic response—making them ideal for applications where precision and speed must coexist. From multi-axis machining centers to hybrid and additive platforms, ETEL's technology helps machine tool OEMs and end users achieve faster cycle times, smoother motion, and higher accuracy.

With its deep expertise in motion system integration and its commitment to tailored engineering solutions, ETEL empowers manufacturers to build the next generation of high-performance machine tools.

The visionary and pioneer

Nicolas Wavre, a visionary in the field of technology and innovation, has left a lasting mark on the industry by developing ETEL from a start-up into an international company.

The origin of a passion for technology, innovation, and development

Nicolas Wavre's passion for technology began at an early age. "My father built his first car with his brother at the age of 16 in 1916, at a time when only doctors and notaries in Neuchâtel owned cars," he recalls. "He was an engineer and a visionary, passionate about mechanics, and that way of being influenced me." This early exposure to technical innovation laid the foundation for Nicolas Wavre's later career.

Early career and the founding of ETEL

After graduating from EPFL in 1969, he embarked on a doctoral thesis focused on the study of electromagnetic fields in linear induction motors under the supervision of Prof. Marcel Jufer. In June 1974, he, along with Prof. Jufer and other partners and professors, founded ETEL S.A. in St-Sulpice (VD). The early years were extremely challenging but also very formative. "We didn't have a product catalog, but we knew we could do anything," he explains with a smile. With Professor Jufer, who was a virtuoso in electromagnetic calculation, they offered truly innovative solutions based on the principle of direct drive. "At the same time, I was able to build a very good team of young engineers at ETEL, which was a wonderful human experience. Together, we built a true industrial production tool thanks to everyone's commitment and motivation."

ETEL's developments

In the 1980s, ETEL developed rotary and linear motors for the European space sector (ESA) and applications for NASA. "We have motors literally everywhere in space," Nicolas Wavre notes with a smile. Starting from 1988 onwards, ETEL's production took off, and the company gained an international reputation by producing the first torque and linear motors applied to the medical and industrial markets. For machine tools, direct drive caused a quantum leap in machining precision. Simultaneously, linear motors achieved positioning accuracies in the nanometer range, contributing to the rapid development of the semiconductor industry. These technological breakthroughs made ETEL indispensable in the sector.

A life dedicated to innovation

Even after retiring from ETEL in 2004, Nicolas Wavre remains connected to the sector. "I advise many start-ups because the problems often remain the same as before: human, financial, strategic challenges, etc.," he explains. "My experience can often help." He emphasizes the importance of an adequate strategy and qualified human resources. Today, at 78 years, Nicolas Wavre is still active on boards of directors and remains a valuable mentor for young companies.

Dr. Wavre's impressive career and unwavering commitment to innovation have made ETEL a leading company. His story is an inspiration and shows how passion and tenacity can lead to major technological advances. ■

Precision in motion

5 common CNC problems solved with HEIDENHAIN innovation

With shorter lead times, tighter tolerances, and machines expected to do more with less oversight, shops that rely on CNC technology face a moving target. Productivity and precision often clash—especially as parts get more complex and skilled labor becomes harder to find. While many of these challenges aren't new, the technology to solve them is advancing rapidly.

From improving part accuracy and speeding up setup to preventing costly downtime, HEIDENHAIN and its family of brands—including ACU-RITE SOLUTIONS, ETEL, and RSF—deliver practical solutions to the everyday hurdles that shops face. Here are five common machining problems—and how HEIDENHAIN's innovative technologies solve them without adding complexity for operators or programmers.

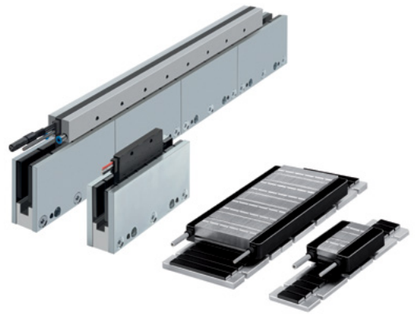
Preventing precision drift over time

Even subtle shifts caused by thermal expansion, backlash, or wear can gradually throw off your positioning—especially during long runs. Most systems rely on rotary encoders mounted to the motor, but this approach doesn't capture what's happening at the axis itself.

HEIDENHAIN solves this with a closed-loop feedback system that places linear and angle encoders directly at the point of motion. It gives the control system a real-time view of actual machine position, allowing instant correction and consistent precision—even in demanding environments.

The RSF exposed linear and modular angle encoders reinforce this approach. With non-contact feedback, zero friction, and high resolution, they're ideal for clean environments and applications requiring smooth, accurate motion. Paired with HEIDENHAIN controls, RSF encoders eliminate guesswork, lag, and overshoot.

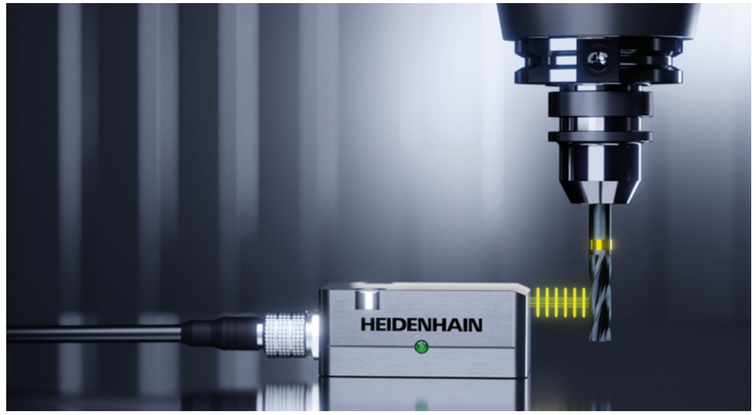
Rotary motion also benefits. The ETEL direct-drive torque motors remove mechanical play while working with high-resolution encoders to ensure ultra-smooth, controlled motion across all speed ranges. Combined with HEIDENHAIN and RSF technologies, shops get tight control over every axis—linear or rotary—without sacrificing performance.



Simplifying setup and reducing changeover time

For short runs or frequent part changes, setup time is often the hidden bottleneck. Aligning stock, setting tools, and adjusting offsets can eat into production. HEIDENHAIN combats this with touch probes and automated setup routines that integrate directly with TNC controls. These visual, step-by-step sequences walk operators through the process, automatically calculating offsets and reducing the chance of human error.

ACU-RITE SOLUTIONS also plays a significant role here. Its user-friendly CNC controls for mills and lathes are built for everyday machinists—whether it's a small shop or a student learning the ropes. The interface is easy to navigate without giving up the functionality needed for serious work. Paired with HEIDENHAIN's advanced systems, this makes precision accessible at every skill level.



Catching tool breakage before it costs you

Tool failure doesn't always make a dramatic entrance. A fractured cutter can silently destroy a part—or worse, damage your spindle—if not detected in time. That's where the HEIDENHAIN TD 110 tool breakage detector comes in. Using inductive, non-contact sensing, it monitors for broken tools in real time—without ever touching them. It's ideal for high-speed machining or delicate tooling.

When paired with the TNC7 control, the system instantly alerts operators the

moment breakage occurs. It helps avoid rework, unplanned downtime, or machine damage—especially during unattended shifts or critical parts runs.

Empowering operators with smarter interfaces

The best CNC controls don't just manage machines—they empower the people who run them. As shops bring in new talent or cross-train existing staff, usability matters more than ever. HEIDENHAIN's TNC7 is designed for this shift. With intuitive multi-touch controls, customizable layouts, and adaptive on-screen guidance, the TNC7 reduces onboarding time and operator errors.

A standout feature is on-screen contour drawing. Operators can sketch a part right on the control, and the system automatically generates the machining code. It eliminates the need for external CAM software for many everyday tasks and helps teams ramp up faster with less training.

Boosting speed without sacrificing surface quality

High feed rates often come at the cost of finish quality—but HEIDENHAIN makes it possible to have both.

With features like Cycle 32, TOLERANCE, 3D-ToolComp, and ADP (Advanced Dynamic Prediction), toolpaths are constantly optimized in real time. These functions minimize vibration, refine transitions, and smooth motion—even at high speeds.

ADP is especially powerful, adjusting for inconsistent NC code to ensure consistent motion through complex geometries. That means faster production without risking part rejection due to poor finish or dimensional errors.

Smarter technology. Smoother results.

Solving machine tool challenges isn't always about buying bigger equipment—it's about making your current systems work smarter. With intelligent controls, precision feedback, and user-friendly interfaces, HEIDENHAIN and its brands help you do more with what you already have.

By combining proven hardware, modern usability, and a collaborative technology ecosystem across RSF, ETEL, and ACURITE SOLUTIONS, HEIDENHAIN offers a complete framework for smarter, more reliable machining—from setup to finish.

To see how these innovations can support your goals, visit our website. ■

Waltz Brothers reaches new heights with TNC7 and 5-axis machining

Waltz Brothers, Inc. has been in business since 1939. Started by three brothers as a grinding house, it has evolved and expanded with every new Waltz generation. Today, both brothers and sisters run the facility and have solidified it as a go-to source for high-quality, close-tolerance parts used by some of the most renowned Aerospace companies in the world.

Their full-service manufacturing capabilities span everything from "print to perfection," as the team says. That includes engineering, CNC turning, CNC machining and abrasive processing services.

One thing that has remained constant over the decades is a never-ending commitment to stay constantly moving and make the best parts for their customers. And Waltz knows the key to quality parts is quality machines and talent.

THE SITUATION: Navigating complex parts and a skills gap

Waltz Brothers has manufactured parts for various industries and leading brands like Caterpillar and Hewlett-Packard. Over the last few years, aerospace has been the primary focus. The shop averages about a few hundred parts a month with consistent repeatability.

However, some challenges come with working in such a demanding industry, starting with the complexity of the parts themselves. That complexity is only increasing, while at the same time, the margin for error is getting smaller and smaller. In the past, machinists may have gotten by with little blemishes. However, clients today want perfect parts every time—and they want them fast. When you're making 50 parts, that can take up to seven months to make, and those little blemishes can equal a hefty fee even to ask if they're acceptable.

At the same time as mounting pressures to perform, Waltz is also navigating labor challenges like the rest of the industry. "The parts are getting tougher. The people aren't going through the trades anymore," says James Waltz, Shop Manager at Waltz Brothers.

Waltz is finding the opportunities to push forward amidst the challenges, though. With new talent and a new job to manufacture highly complex impellers, he knew it was time to invest in 5-axis technology, finally.

THE SOLUTION: Harnessing 5-axis control

The jump to 5-axis machining was something Waltz had been considering for a while, especially as he looked to standardize equipment on the shop floor. A requirement was that any new additions must be versatile and perform at the highest level to ensure top-quality parts.

In January, Waltz Brothers added the HERMLE C 250 machining center with the HEIDENHAIN TNC7 control. Jake Schnitzler, manufacturing engineer at Waltz, immediately went to work learning the ins and outs of the new control system. That included a new programming language unique to HEIDENHAIN.

After getting past the initial learning curve, Schnitzler was astounded by how intuitive the HEIDENHAIN control was to set up. Another feature he found exciting was the collision monitoring and 3D machining simulation, which provides a perfect visualization of the machined part and work envelope. This simulation helps the team pinpoint any issues early to avoid those little yet costly blemishes — or worse a machine collision.

"For the complex parts that we do, the TNC7 just makes it easier to do it in ways that I haven't really seen on other controls — or anything close," says Schnitzler.

Defining the tool is vital to a proper simulation — something the Waltz team was unfamiliar with before the TNC7. Essentially, the team inputs all the tool definitions, saves them to a file and stores all the tools externally from the machine. Then, they can return to that job later, import the file and be ready to go.

"What seemed like a burden at first turned into a blessing. We're basically able to plug and play with an automatic setup. We've never really been able to do that before," Schnitzler adds.

One of the biggest concerns was whether the next person could pick up using the TNC7 as quickly as Schnitzler. However, after a month and a half, they had trained another teammate, Adela. While she had never run a machine before training, Adela is now on her third setup. Something that could have taken engineers years to master in the past took Adela just months. This speaks volumes to her aptitude and the ease and intuitive nature of the control.

THE IMPACT: Unlocking efficiency and confidence

Not only has Waltz Brothers seamlessly onboarded to the TNC7 software, but they are already seeing results. In fact, after just seven months with the 5-axis technology, Waltz has been so impressed with the performance that he already ordered a second machine with the TNC7.

They are seeing faster parts and cycle times. With the TNC7, they can put a part on in the morning and run it with confidence, knowing it'll be good when they return at the end of the day. No more scrapping parts, chasing sizes and needing to make constant adjustments.

"Let's say every operation was 10 minutes. Before, we did a part every 40 minutes, and now it's 30 minutes. I'm saving 10 minutes a part, which is great. But the bigger thing is that the machine is running for 30 instead of 10 minutes – and now people have more time to do more things," says Waltz.

The ability to hand off or run jobs and step away confidently has also freed employees to do more. The team can now run eight machines versus two or three. This not only leads to speed and saving but also allows for more experience and training.

"We're trying to take a lot of headaches out of the shop. That was one of the main reasons for getting the HERMLE with the TNC7. It just makes our operators' lives a lot easier and our quality guys happier. It's all those things," Waltz adds.

Regarding the complexity of the parts, Waltz Brothers also has complete confidence in the precision and reliable processes of the TNC7. It's making the complex and the difficult easier, and that makes all the difference when it comes to achieving their goal of being one of the top manufacturing companies in the world.

To continue paving their way forward, Waltz Brothers is also working closely with the HEIDENHAIN team in Schaumburg to ensure they are fully utilizing all aspects of the TNC7 on their HERMLE machine — and soon to be machines. From additional training to insights and learnings, the Waltz Bros are reaching new levels of precision, performance and efficiency. ■

Waltz Brothers Incorporated, based in Wheeling, Illinois, is a third-generation, family-owned precision manufacturing company with a rich history dating back to its founding in 1939. Specializing in high-quality, close-tolerance parts, the company has established itself as a key player in aviation, aerospace, automotive, military, medical, and hydraulic equipment industries.

What's happening in the machine tool market?

We recently sat down with Gisbert Ledvon, our Vice President of TNC, to talk about the important things happening in the machine tool market right now. From control advancements and connectivity to emerging technologies, we cover it all in this discussion. Find out from an insider where things are heading and which opportunities may help your situation.

Q Who are you working with on a daily basis? Who's your customer?

Gisbert Ledvon: I primarily work with two types of customers. One would be an OEM customer and they can be from various countries around the world. We help them to do two things: to apply the latest motion technology to their equipment and train their application engineers on the new features and functions HEIDENHAIN offers on motion control and on CNC systems. We demonstrate how the latest HEIDENHAIN features on their machine tool can outperform competitors.

The other group of customers would be end users…the people who buy the equipment and make stuff you and I use on a daily basis. From a HEIDENHAIN perspective, if customers are investing in more-advanced machining applications (controls), we want to make sure that they can utilize that equipment as efficiently and as quickly as possible. We want to make that learning curve as short as possible.

Q What are OEMs looking for? What do they come and look to you for? What are they asking for?

GL: The mechanics of machine tools are, more or less, the same for many of the builders out there. Construction materials (e.g. cast iron, polymer granite or welded design) can differentiate some, but to really stand out in a competitive machine tool market, OEMs are turning to motion control. They're looking for ways to make sure that the machine they've designed is moving as fast, as accurate and as dynamic as possible.

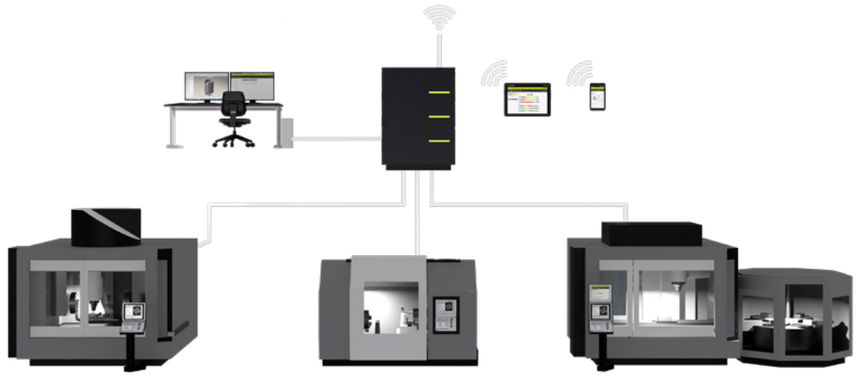
Our OEM customers ultimately come to us because HEIDENHAIN really can offer a complete motion solution; they can get a full package to optimize their machine design to its full potential. Other CNC builders might be able to provide the control, but they cannot provide the other components: the linear scales, rotary encoders, drives motors, CNC control and touch probes for tools and workpieces.

Q What is the end user most commonly coming to you asking for? What are they coming to you looking for?

GL: A lot of times we're working with end users who are stepping up from a relatively simple controller to one that's much more powerful, with more features and capabilities. Our job is to take the fear or hesitancy out of the operators and programmers, to make sure that they have an easy transition and eventually reach the fullest potential of what they can do with the control, especially when it comes to 5-axis machining.

Also, we want to get the next generation of operators in front of these machines as much as possible. We work to make sure that the next generation of operators can embrace a powerful control. The next generation of operators doesn't just want to push buttons. That's over. The younger generation wants to be a part of the process. They want to take the responsibility to do something right. They want to make a part on their own and our solution is really a perfect setup for that.

They can do it all with a HEIDENHAIN control; it's very unique compared to other controls where you rely 80, 90, 100 percent on getting a perfect CAD program to run a program on your machine. We're empowering that new generation of operators to take responsibility.



How do HEIDENHAIN products help integrate machine tools into concepts like Smart Manufacturing or Industry 4.0?

GL: You have to have reliable processes to even think about these concepts. Motion control and CNC can fundamentally help with reliability. When you're connecting machines, you want to have flexibility to put this part on that machine. Or, if you have to change the schedule, you might need to change the parts beyond that, on a different machine. The more consistent motion control you have on multiple machine tools, the better off you're going to be.

Controls like ours are very capable of networking. That means they have the flexibility to take something from the network—a program, tool and setup data needed to cut a particular part or to speed up the process. At the same time, the control system has to be able to provide data to an ERP system or any other monitoring system. You want to make sure that your control is able to give you predictive maintenance information. The next step is to consolidate all that data into a data stream or a monitoring system for reference and improvement.

Does artificial intelligence have a role in machine tools?

GL: We did this already. We didn't call it A.I., but if you think about what we can do on the motion control side now, we can predict certain ways the machine is going to behave. For example, our AFC feature, Adaptive Feed Control.

If we're machining a part and all of a sudden the thickness of the part changes, the machine will sense the chip load or the load on the spindle and feed that information back to the control. The control will recognize the situation and slow things down to avoid breaking the tool. Even though the programmer forgot to tell the machine, the control is smart enough now to look at the situation and make a real-time decision.

With the new TNC7, you can even machine an entire part to collect all the data—the movements, the spindle loads, speeds and feeds—on a particular part. That data is stored in the control and when the next part is cut, the machine will monitor all my motion and color code where things deviated from the original perfect part.

What are State-Monitor and Plant Monitor?

GL: There are a lot of monitoring solutions out there. And people maybe say, what does HEIDENHAIN know about software? Similar to the controls, we made this a plug-and-play solution. It's something you can use without having a business degree, quickly analyze the stats, and see what's going on with the machines. It's more visibility to bottlenecks and improved productivity and don't even have to have a HEIDENHAIN control in your shop.

If you have multiple plants across the country, across the world, now with Plant Monitor we can connect multiple State Monitor locations and organize all that in a very condensed overview. Somebody in the headquarters can make very quick decisions to move parts around, depending on where maybe logistic issues are. Plant Monitor gives you that flexibility to look at that type of macro information very quickly.

Could you explain the concept of a digital twin?

GL: The digital twin has been out for a few years now. They usually help verify the tool path and that there aren't any types of collisions using CAD data to create the toolpath. The digital twin will also help the programmer determine how to maximize the machine's work envelope without interfering with any component mounted on the work table or within the work envelope.

We have a little bit different approach. We work with the machine tool builder, and we ask for all the information, as far as what components he's using, how big the machine is and what the dynamics are. We basically build a digital twin in the control based exactly on the specific machine tool.

That gives us an advantage because now we know how that machine tool actually behaves based on the mass, the size, the motor, the encoder technology. So, when we do a prediction of how long it's going to take to cut this particular part, we have a much better understanding, and we can do a much more accurate calculation.

Should users standardize the machine tool or the control?

GL: People standardize on processes. They'll buy the same machinery and equipment so that the same processes can be followed consistently. The problem with that is if you standardize on a brand in the machine tool world, you're going to be very quickly limited to what you can do. What if the machine brand isn't offered in 5-axis or a size that's big enough or small enough or fast enough for new or different work?

Instead of standardizing on a brand of a machine tool, you should rather standardize on a control system on the CNC. It gives you a lot of flexibility to move your operators around. Operators can achieve X result no matter the machine if they are trained on a standardized control. A big new order can be managed expertly, no matter the machine, thanks to consistent controls.

Standardize the whole motion system and it takes performance to a totally different level. Don't put your time into standardizing the machine tool, standardize what's driving the machine tool to the way that works best for you.

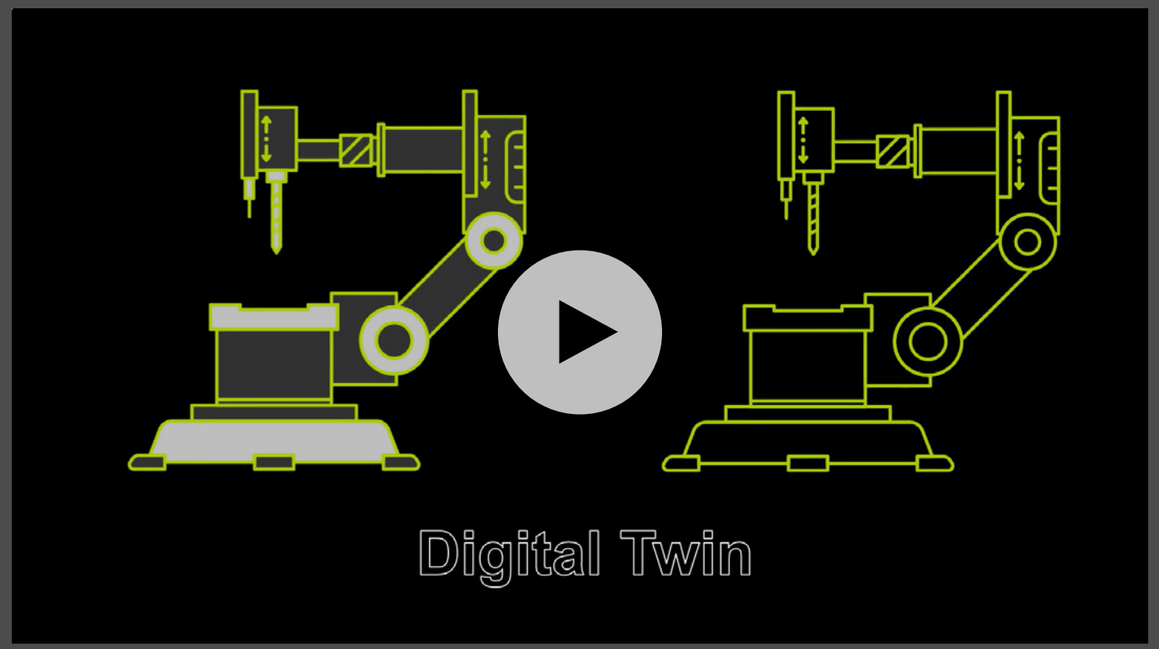
What has you excited about the machine tool industry right now? What are you looking forward to?

GL: I'm still excited about the fact that more and more people are still discovering what can be done with machine tools. Industries will still, all of a sudden, realize something new that can be done with machine tools. And it's often something no one would have ever imagined 10 or 20 years ago. Who would imagine that somebody would machine a bone plate for a knee or face? Who would have thought we'd machine crowns out of metal for teeth replacement? Our phones are all machined surfaces…nobody would have thought that 20 years ago when everything was made of plastic.

I'm excited about finding more things that can be machined and should be machined. Additive machining is one of those. It's going to be much more relevant coming down the road and I think there's an opportunity for machine tool builders in the post-processing of additive parts. The 5-axis machining technology will thrive here, even more than just in the traditional metal cutting market segments like aerospace, mold and die, medical, etc. To be able to take a part out of that additive machine, get it over to a milling machine and get it finished accurately and quickly will be invaluable.

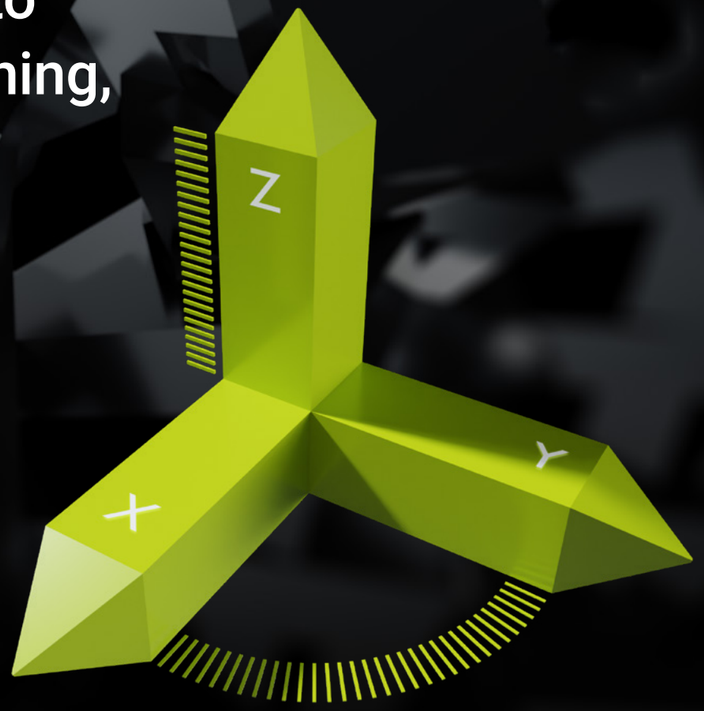
Conclusion

From CNC controls to individual motion control components, HEIDENHAIN has the know-how, hardware and software to make machine tools more precise, powerful and reliable. Whether you're a machine tool builder or end user, we can help make your machines more efficient. ■



Unlock CNC success with the TNC Club

Your Direct Line to Expert Help, Training, and Community



Whether you're programming your first machine or optimizing complex workflows, having the right support makes all the difference. The TNC Club connects you directly with HEIDENHAIN experts, advanced training, and a network of professionals who understand the real challenges of using TNC controls.

What you'll gain

- Personalized support from seasoned NC specialists
- Access to exclusive training, live sessions, and workshops
- A fast-track to expert troubleshooting and insights
- Opportunities to influence future HEIDENHAIN products with your feedback
- A community of peers solving real-world CNC problems

Built for your success

From boosting your skills to keeping your machines running at peak performance, the TNC Club gives you practical tools that drive results—plus the connections that keep you ahead of the curve.

Two ways to get involved

✅ **Essential Access – Always Free**

- Direct access to knowledgeable support
- Resources tailored to your registered machines
- Timely updates and insights

⭐ **Premium experience – for advanced users**

- Full access to in-depth training via HIT software
- Customized education with HEIDENHAIN trainers (on-site or remote)
- Invitations to all exclusive events, webinars, and advanced content
- $1,300 for the first year, $1,100 annually after

You can upgrade or adjust anytime—it's all about what works best for you.

Let's make great machines run even better

Wherever you are on your CNC journey, the TNC Club is here to help you grow. Visit us in Schaumburg, IL, or bring our expertise directly to your shop floor. You'll find the training, support, and people who can elevate your work—starting today.

Connect. Learn. Thrive. ■

Register for the TNC Club!

Unlock your machining potential with training programs

At HEIDENHAIN CORPORATION, we understand the critical role that precise and efficient control systems play in the success of modern machining. That's why we're committed to providing comprehensive training opportunities that enhance the skills of end users and support personnel, ultimately reducing the total cost of ownership of your machinery.

Whether you're based near our Schaumburg, IL facility or close to our new CONNECT Manufacturing Innovation Hub in Fremont, CA, our training courses are designed to elevate your expertise and operational efficiency.

HEIDENHAIN training offerings are meticulously structured to cater to various levels of expertise and operational needs—from basic operations to advanced programming and maintenance. Our programs begin with foundational courses that introduce participants to the basics of machine controls and CNC operation. As learners progress, they encounter more complex subjects such as 5-axis machining, complex workpiece measurement, and advanced programming languages like Klartext.

For beginners, courses such as setting up TNC controls provide a solid grounding and participants can then build on this knowledge with advanced offerings, such as Klartext and Q-parameter programming for the TNC. For those on the path to becoming shop floor experts, our expert-level courses explore specialized techniques like tilted machining and 3D workpiece measurement with touch probes.

Our instructors are celebrated for their engaging and clear teaching styles. As noted by a recent participant from an in-house training, "Their [HEIDENHAIN] ability to break down complex concepts into manageable pieces made the learning process both efficient and enjoyable. This hands-on approach not only ensures that concepts are easily understood but also allows ample opportunity for practical application." Participants leave our courses not just with knowledge but with the confidence to apply what they have learned to real-world challenges!

Training for the next generation: ACU-RITE SOLUTIONS

In addition to our core HEIDENHAIN training, we are proud to offer educational programs through ACU-RITE SOLUTIONS, a HEIDENHAIN brand dedicated to making high-precision technology more accessible—especially in educational and hands-on learning environments.

For more than 40 years, ACU-RITE SOLUTIONS digital readouts and CNC controls have been the preferred choice of instructors across the country, known for their simplicity, accuracy, and reliability. These solutions are ideal for turning new or used manual mills, lathes, grinders, and EDM machines into high-functioning tools for classroom or shop instruction—preparing students for careers in precision metalworking and motion control.

Recent additions like the droPWR iOS app (which transforms an iPad® into a full-featured digital readout) and the Bridge Adapter Kit (which helps bridge the gap between ACU-RITE SOLUTIONS and HEIDENHAIN controls) underscore our commitment to innovation in education.

ACU-RITE SOLUTIONS supports virtual and in-person training sessions, both at your site and at our Schaumburg, IL headquarters. And because we believe so strongly in the value of STEM education, we offer special pricing and training incentives for technical schools nationwide.

When you train with ACU-RITE SOLUTIONS, you're not just learning technology—you're helping shape the next generation of skilled manufacturing professionals.

A future of collaboration and innovation

Looking forward, HEIDENHAIN CORPORATION is excited about the continued expansion of our training programs, especially with the opportunities our new CONNECT Manufacturing Innovation Hub in Fremont, CA will offer. As we enhance our educational offerings, we invite more machinists and technicians to join us in advancing their skills.

If you're seeking to master the operation, maintenance, and optimization of HEIDENHAIN controls and systems, look no further. Our training courses are specifically designed to help you achieve mastery over your equipment, reducing downtime and costs while enhancing output and precision.

We invite you to enroll in our upcoming virtual or in-person sessions and start transforming your machining operations. Choose HEIDENHAIN for your motion control needs and join the ranks of skilled professionals who are driving the future of manufacturing!

For more information and to register for a course, visit our website to contact our training department directly. Elevate your skills, reduce your costs, and push the boundaries of what's possible with your machinery. With HEIDENHAIN, you're not just operating machines; you're mastering them.

Choose HEIDENHAIN, where precision meets possibility. ■

2025 precision machining trends

Ongoing advancements in precision machining are reshaping manufacturing processes. Manufacturers that embrace these technologies can rapidly accelerate their machining efficiency and capability. In 2025, we expect to see five key trends fueling adoption and investment in precision machining technology. ACU-RITE SOLUTIONS is at the forefront, driving innovation to support the future of manufacturing.

Trend #1: Bluetooth® integration

Bluetooth® adoption in manufacturing is on the rise. Analysts at ABI Research anticipate that global annual shipments of Bluetooth®-enabled industrial devices will grow six-fold between 2022 and 2028. According to ABI Research, Bluetooth® technology is increasingly essential in industrial digitization because of its energy efficiency and low cost.

Bluetooth® technology enables greater accuracy and efficiency in machining by transferring real-time measurements and data between machine tools and mobile devices. For example, the ACU-RITE SOLUTIONS droPWR iOS app integrates Bluetooth® technology and an IBT interface box to turn an iPad® into a digital readout.

With the first-of-its-kind dro**PWR** application, an iPad® can do everything an ACU-RITE SOLUTIONS digital readout can do except without cables between the tablet and machine tool. It can connect to multiple machine configurations in one tablet, including for milling, turning, and grinding machines with up to six axes.

Since droPWR launched in 2022, downloads have increased annually, signaling greater adoption of Bluetooth®-enabled devices in machining workflows. The dro**PWR** iOS app exemplifies how Bluetooth® powers more precise, flexible, and efficient machining.

Trend #2: Reshoring

Reshoring became a strategic priority for many manufacturers amid the COVID-19 pandemic, which caused remarkable disruptions in the global supply chain. The recent announcement of potential shifts in U.S. trade policy has manufacturers bracing for more supply chain shifts.

In 2025, manufacturers who purchase from suppliers outside the U.S. may have to pay more for the materials and technologies that fuel their production. Those that prioritize domestic suppliers will be in good company. According to recent research by Bain & Company, 81% of CEOs and COOs reported plans to bring their company's supply chains closer to home, an increase of 18% since 2022.

Manufacturers can reduce supply chain risks by purchasing digital readouts and CNC controls from domestic suppliers, such as ACU-RITE SOLUTIONS. We are proud to have designed, built, and supported our technologies from America since day one.

Sourcing precision machining technologies domestically in 2025 can help manufacturers control costs and secure faster lead times, support, and service. Reshoring will unlock greater operational efficiency for many.

Trend #3: Sustainability

U.S. environmental regulations are becoming stricter, which will make sustainability a business goal for many manufacturers in 2025. Some imminent regulations include rules by the Securities and Exchange Commission (SEC) requiring public companies to report on their environmental impact and more rigorous state requirements for emissions and renewable energy.

We can expect to see companies upping their investment in sustainability efforts to address these new regulations. Only 1% of the 300 public and private companies surveyed in early 2024 by Morgan Stanley said that sustainability is not significant to long-term corporate strategy.

Among manufacturers, there are other reasons behind the growing investment in sustainability:

- Aligning with corporate values
- Creating a cleaner and healthier environment
- Improving company reputation

Automation will continue to be an effective strategy for reducing the environmental impact of manufacturing. For example, precision machining technologies reduce material waste caused by errors and defects through greater accuracy and consistency. Less time spent on rework can lower energy consumption.

Precision machining contributes to a more efficient manufacturing environment, making it a critical enabler of sustainable manufacturing practices.

Trend #4: Precision machining technologies in schools

In early 2024, a Manufacturing Institute and Deloitte report revealed that the U.S. manufacturing industry could require 3.8 million jobs to be filled in the next 10 years. Fortunately, enrollment in related education programs is rising. As a result, we could see colleges, universities, and trade schools invest in and upgrade their precision machining technologies to support real-world learning.

Here are a few indicators of the resurgence in manufacturing-related education:

- **Engineering Enrollment:** In the 2023-24 school year, undergraduate enrollment in engineering majors at four-year institutions increased by 6.1%, marking the first increase in five years.
- **Skilled Trade School Enrollment:** Enrollment in skilled trade schools was declining at 4.2% CAGR before the COVID-19 pandemic but grew at 1.2% CAGR from 2020 to 2023.
- **Manufacturing Degrees:** The number of associate's degrees conferred between 2011-12 and 2021-22 rose by about 11% in the manufacturing, construction, repair, and transportation fields.

Precision machining technologies help educators prepare students for practical manufacturing, engineering, and machining challenges. Students at the Southern Illinois University College of Engineering use ACU-RITE SOLUTIONS digital readouts to design and produce parts. Horry-Georgetown Technical College teaches students foundational to advanced machining skills with ACU-RITE SOLUTIONS technologies in its machine tool lab.

Institutions that invest in cutting-edge precision machining technologies equip students with the skills and experience to thrive in the ever-evolving manufacturing industry.

Trend #5: Improved user experience (UX)

The UX of digital readout and CNC control systems has significantly improved thanks to ongoing technological advancement. In 2025 and beyond, we can expect further innovation to support the current and future manufacturing workforce.

Half of all U.S. manufacturing workers are age 44 and over. This median age indicates that much of the workforce is nearing retirement while fewer younger workers are entering the field. UX improvements will make precision machining technologies more user-friendly for machinists of all experience levels while attracting the next generation of workers.

We think these UX features, which improve the speed and accuracy of machining operations, will eventually become standard:

Intuitive Interfaces: User interfaces (UI) will become more intuitive with simplified workflows, customizable settings, and

touchscreen displays, allowing machinists to adapt to new technologies quickly.

Ergonomics: Precision machining technologies will be designed with adjustable screens, ergonomic keyboards, and other features to minimize operator strain.

ACU-RITE SOLUTIONS has long been at the forefront of UX advancements because our technologies are designed for machinists from entry-level to experienced. Backed by the continuous innovation of HEIDENHAIN, we are dedicated to continually advancing ease of use and accuracy. Our digital readouts and CNC controls feature graphical and text-based displays, touchscreens, customizable display layouts, automatic error detection, ergonomic keyboards, and more.

In 2025, we are excited to continue leading the endless pursuit of greater machining accuracy and efficiency.

Stay current on precision machining with ACU-RITE SOLUTIONS

Understanding precision machining trends is essential for machinists, manufacturers, and educators alike. From Bluetooth® integration and reshoring efforts to sustainability initiatives, education growth, and enhanced UX, 2025 offers opportunities to better prepare for the future of manufacturing.

Sign up for our monthly enewsletter to stay informed about precision machining and the latest news and product developments from ACU-RITE SOLUTIONS. ■

Powering Precision with ACU-RITE SOLUTIONS

YouTube

ACU-RITE SOLUTIONS 00:50

Made for Machinists, by Machinists

Not everyone on the shop floor is a programmer — and with ACU-RITE SOLUTIONS, they don't have to be.

Designed with the operator in mind, Acu-Rite's Solutions digital readouts and controls deliver precision and productivity. From faster setups to smarter navigation, we're here to make machining intuitive.

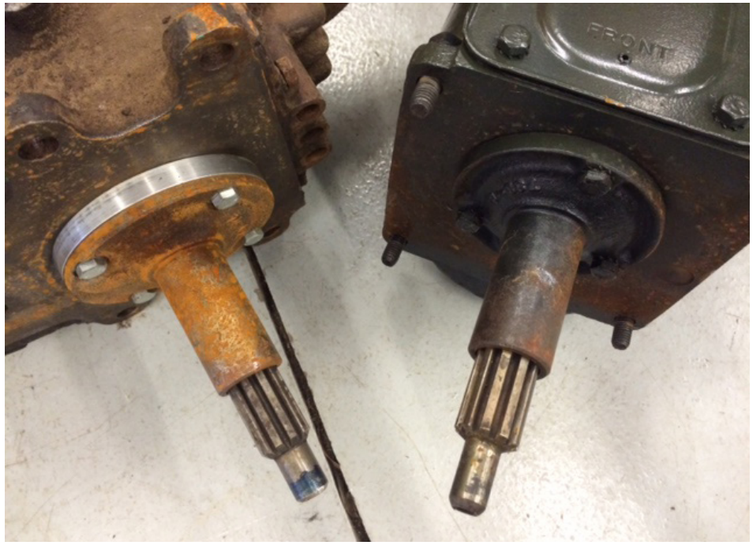
Explore Our New Website

Same Quality Products, New Brand Name

ACU-RITE SOLUTIONS
Powering Precision

Hobbyists create custom auto parts using ACU-RITE SOLUTIONS' MILLPWR^{G2}

A couple of hobbyists in southwest Florida with a 2-axis Bridgeport and MILL**PWR**^{G2} use that system to build custom one-off parts for street rods and hotrods. Hobbyist Len Milheim is a master tool-and-die maker from Michigan, and Bill Hutchison is a retired high-tech industry exec. They have teamed up over the last couple of years in Sarasota, FL, to make some really cool custom hot rod parts.



Project 1: Transmission adapter

Hutchison is currently rebuilding a 1949 Studebaker ¾ ton pickup truck and was unhappy with the 3-speed column shift transmission, but wanted originality. So he found a 1949 Studebaker 4-speed out of a larger truck, and Milheim designed and cut this aluminum adapter to mate it to the original engine block.

Pictured above is the original 3 speed on the right. The shiny ring on the 4-speed on the left is the collar that adapted the 4-speed input shaft to the clutch and pressure plate. These two units allowed the old 4-speed to bolt right up.

Project 2: 1948 International KB6 Dash

Hutchison has a 1948 International car hauler sitting on a late model Freightliner chassis. A lot of fabrication was required for this combo. According to Hutchison, this solid aluminum dash bezel was machined from a billet and matches the dash contours and houses all the rocker switches. He noted the engraving under each switch, stating that was also done with the G2, as was the engraving on the steering column horn button sitting on a custom base to mate the handmade leather covered steering wheel to the steering column.

Project 3: Custom rear axle knuckles

A more ambitious current project under way involves the machining of one-off custom rear axle knuckles to adapt a 1955 Corvette independent rear suspension assembly to a 1996 ½ ton pickup truck. Hutchison says "I have built hot rods for years but I am a blacksmith compared to Len the "jeweler".

Len is making it possible to produce exceptional one-of-a-kind components for my projects that I never thought affordable before, but I was wrong. The tools in ACU-RITE SOLUTIONS MILL**PWR**^{G2} turn us loose to build anything we can imagine." ■

Precision meets passion

How HEIDENHAIN powers custom automotive builds

For those who live to build, restore, and race, there's an unspoken truth that echoes through every machine shop and garage: precision is performance.

Whether you're rebuilding a big-block V8, fabricating a one-off turbo setup, or machining parts for a car destined for the track, precision makes the difference. Not just in how a part fits—but in how it performs under pressure, how long it lasts, and how confidently you can move on to the next step. That's why more and more builders—especially those focused on hot rods, racing platforms, and vintage restorations—are integrating HEIDENHAIN technology into their workflow.

Best known for its role in industries like aerospace, electronics, and medical manufacturing, HEIDENHAIN brings that same elite level of performance to the custom automotive world. And while its name might be more familiar in R&D labs or high-production shops, what's exciting is how accessible this precision has become for race teams, fabricators, and small-batch part makers.

Precision CNC controls for custom components

Driving this shift are HEIDENHAIN industry-leading TNC controls—especially the TNC7 and TNC 640. Trusted in high-end machining environments, these controls are ideal for intricate parts like custom cylinder heads, billet manifolds, and precision transmission housings.

Built for complexity and speed, these systems feature:

- Adaptive feed rate control
- Intelligent toolpath optimization
- Fluid 5-axis motion and machine kinematics

For shops using advanced mills or machining centers, that means confidently tackling steep walls, deep pockets, and tight curves with repeatable, high-tolerance results. Especially in short-run or mixed-part environments, consistency is a competitive advantage — and HEIDENHAIN delivers.

Feedback systems that drive accuracy

Behind every high-quality part is motion control you can count on. The HEIDENHAIN LC series linear encoders provide position feedback at the nanometer scale, ensuring high-tolerance machining for critical components like camshafts, crankshafts, and injectors.

Rotary applications benefit from RCN and ECI/EQI encoders, built to withstand speed, heat, and vibration. Whether you're running an engine dyno, tuning on a test bench, or building a one-off race part, HEIDENHAIN encoders give you precise, reliable data where it matters most.

Touch probing that keeps work on track

In custom fabrication, setups change constantly—and errors can derail a build. That's why in-process probing is essential. HEIDENHAIN TS 460 touch probe system verifies part location, orientation, and critical features directly on the machine. No need for external metrology between cuts. This real-time feedback helps teams:

- Minimize waste
- Maintain tight tolerances
- Stay agile and efficient in the shop

For high-mix, low-volume work—like custom brackets or one-off housings—this saves time and protects quality.

Bringing legacy equipment into the modern era

Legacy machines still have a place in today's shop. Through ACU-RITE SOLUTIONS, HEIDENHAIN helps bridge the gap between classic tools and modern precision.

With products like digital readouts (DROs) and the MILLPWRG2 CNC control system, older mills and lathes gain new capabilities—without giving up their reliability or feel.

Real builders. Real results.

In Sarasota, Florida, retired high-tech executive Bill Hutchison and master tool-and-die maker Len Milheim are proving what's possible. Working out of a garage shop, they're using a 2-axis Bridgeport equipped with an ACU-RITE MILL**PWR**^{G2} to craft custom components for hot rods and classic trucks.

Their projects include:

- A machined adapter to fit a 1949 Studebaker 4-speed to its original engine block
- A billet aluminum dash bezel for a 1948 International KB6 car hauler
- A custom-machined steering column horn button
- Custom rear axle knuckles to adapt a 1996 Corvette IRS to a 1955 pickup

Parts like these are too complex—and often too expensive—to outsource. By machining in-house, they're not only saving money, they're building better.

"I've built hot rods for years, but I'm a blacksmith compared to Len the jeweler,"

says Hutchison. "Len is making it possible to create one-of-a-kind components I never thought I could afford. The tools in ACU-RITE's MILL**PWR**^{G2} turn us loose to build anything we can imagine."

Precision that powers every great build

HEIDENHAIN isn't a flashy brand stamped on a finished part—but its influence is everywhere: In the tight fit of a piston. The perfect symmetry of an intake runner. The flawless finish of a machined surface that performs under pressure.

For builders who obsess over every measurement, and racers who push every part to the limit, HEIDENHAIN delivers the tools to create without compromise.

Build Bold. Machine with Confidence.

Ready to take your builds further?

Explore HEIDENHAIN and ACU-RITE SOLUTIONS and see how precision engineering can power your next project. ■

Hidden value of sealed encoders in reducing ownership expenses

In the rapidly evolving industrial landscape, manufacturers face the dual challenge of boosting operational efficiency and managing overhead costs. Key to addressing these challenges is the strategic selection of components such as encoders, which significantly influence both productivity and maintenance expenses.

This article explores the considerable benefits of the HEIDENHAIN LC and RCN series encoders, emphasizing how their advanced technologies not only enhance performance but also substantially reduce the total cost of ownership (TCO). Understanding TCO—a calculation that includes not just the purchase price of an asset but also the cumulative costs of operation throughout its lifecycle—is crucial for businesses aiming to make informed decisions that optimize long-term value.

Common challenges that impact overall cost of ownership

Understanding TCO—a calculation that includes not just the purchase price of an asset but also the cumulative costs of operation throughout its lifecycle—is crucial for businesses aiming to make informed decisions that optimize long-term value. Part of that equation is examining environmental and reliability challenges impacting encoder performance and maintenance needs. Let's look at the most common challenges faced in industrial environments.

Environmental factors

Industrial environments are notorious for their harsh conditions, which can dramatically impair the functionality and longevity of mechanical components. Coolant, moisture and machine way oil are common culprits that degrade traditional encoders. These elements infiltrate the interior of the encoder, and eventually cause the machine to fail.

Traditional encoders, without this type of optimized scanning, may require frequent maintenance or outright replacement, each of which incurs considerable costs.

In contrast, HEIDENHAIN encoders are equipped with advanced scanning and robust sealing technologies designed to protect against these environmental aggressors.This not only ensures uninterrupted and reliable operation but also extends the lifespan of the encoders significantly. As a result, businesses can avoid the regular expense of replacing or repairing fewer durable units, thereby reducing the total cost of ownership and improving equipment uptime.

Relationship between performance and reliability

The reliability of performance in the machine tool industry is fundamentally linked to the accuracy and consistency of its components. Encoders, which arecritical in measuring and controlling precise movements and positions, must deliver exact measurements to ensure machines operate efficiently. Any deviation or error in encoder readings can lead to operational inefficiencies and potential downtime for repairs. These inefficiencies often result in costly interruptions to production and increased maintenance expenses.

HEIDENHAIN encoders are designed with a focus on delivering consistent, accurate measurements that support efficient machine operations. The steadfast reliability of HEIDENHAIN encoders means that machines can operate for longer periods under optimal conditions with reduced risk of breakdowns. This reliability is critical for maintaining productivity as well as extending the operational time of the machinery itself, further impacting the total cost of ownership positively.

By addressing these common challenges with superior technology and design, HEIDENHAIN encoders play a pivotal role in helping businesses manage and reduce their total cost of ownership. This is achieved through enhanced durability, reliability and precision, which are essential for maintaining continuous and efficient industrial operations.

How these encoders drive down system costs and enhance reliability

By addressing these common challenges with superior technology and design, HEIDENHAIN encoders play a pivotal role in helping businesses manage and reduce their total cost of ownership. This is achieved through enhanced durability, reliability and precision, which are essential for maintaining continuous and efficient industrial operations.

Let's explore further how choosing the right encoder solutions can effectively address operational challenges, resulting in substantial cost savings and enhanced system reliability.

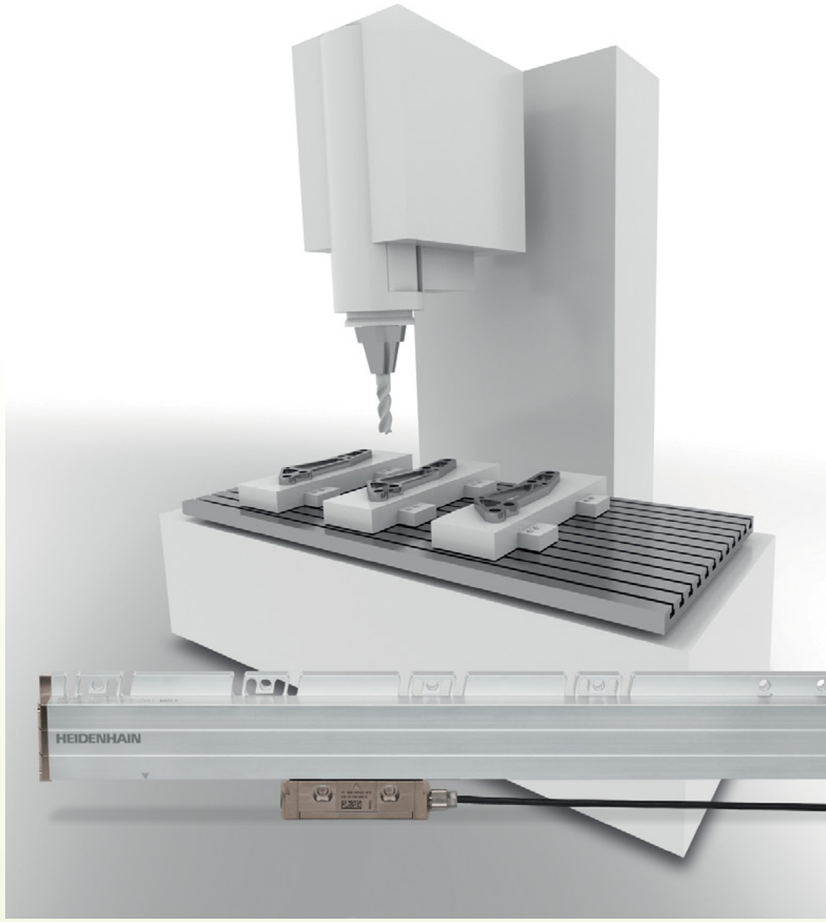
No extra filter system

In environments prone to contamination, traditional encoders often require additional filtration systems to protect against pollutants like dirt, oil mist and grease. These systems add to the initial setup cost and demand ongoing maintenance and replacement of filters, significantly increasing operational expenses.

The HEIDENHAIN LC 6 and RCN 1 series encoders are innovatively designed to function optimally without the need for these auxiliary filtration systems. By leveraging advanced scanning technologies and housing technologies, these encoders prevent contaminants from affecting the internal components and operation of the encoder, thereby maintaining accuracy and functionality. This capability allows businesses to avoid the financial burden associated with purchasing and maintaining additional filtration equipment. The simplification of system design that results from eliminating these extra components also reduces potential points of failure, enhancing system reliability and reducing downtime and associated costs.

Easy installation

One of the more subtle yet notable costs associated with implementing new technology in industrial settings is related to installation. Complex installation processes can lead to extended downtime, higher labor costs and the potential for installation errors, which can further increase expenses due to delays or damage.



HEIDENHAIN encoders, particularly those in the LC 100, 200 and 400 series, are renowned for their ease of installation. These encoders feature versatile designs that easily adapt to existing systems with minimal modifications required. The user-friendly nature of these devices reduces the time and technical expertise needed to install them, thereby decreasing the costs related to installation labor. Additionally, quicker and simpler installation means machinery can return to production sooner, minimizing downtime and maximizing productivity.

Less sealing air

Traditional encoders often rely on a continuous supply of sealing air to prevent contamination from compromising their operational integrity. This requirement entails not only the installation of air supply equipment but also ongoing energy costs to maintain air pressure and flow. Over time, these costs accumulate, adding a substantial amount to the operational expenses of running industrial machinery.

In most applications, HEIDENHAIN encoders are designed to operate efficiently without the necessity of sealing air. This design innovation eliminates the need for associated air supply systems, thereby saving on both the installation and energy costs involved in maintaining such systems. This reduction in energy consumption not only lowers operational costs but also aligns with sustainability goals by reducing the carbon footprint of manufacturing operations. By diminish-

ing reliance on sealing air, HEIDENHAIN encoders contribute to a more cost-effective and environmentally friendly production environment.

In some, the right sealed and angle encoders, such as those offered by HEIDENHAIN, address common industrial challenges by enhancing system design, simplifying installation and reducing the need for additional equipment and resources. These improvements drastically reduce system costs, not only through direct savings but also by minimizing potential downtime and enhancing overall system reliability and efficiency.

How HEIDENHAIN encoders help you achieve your sost goals

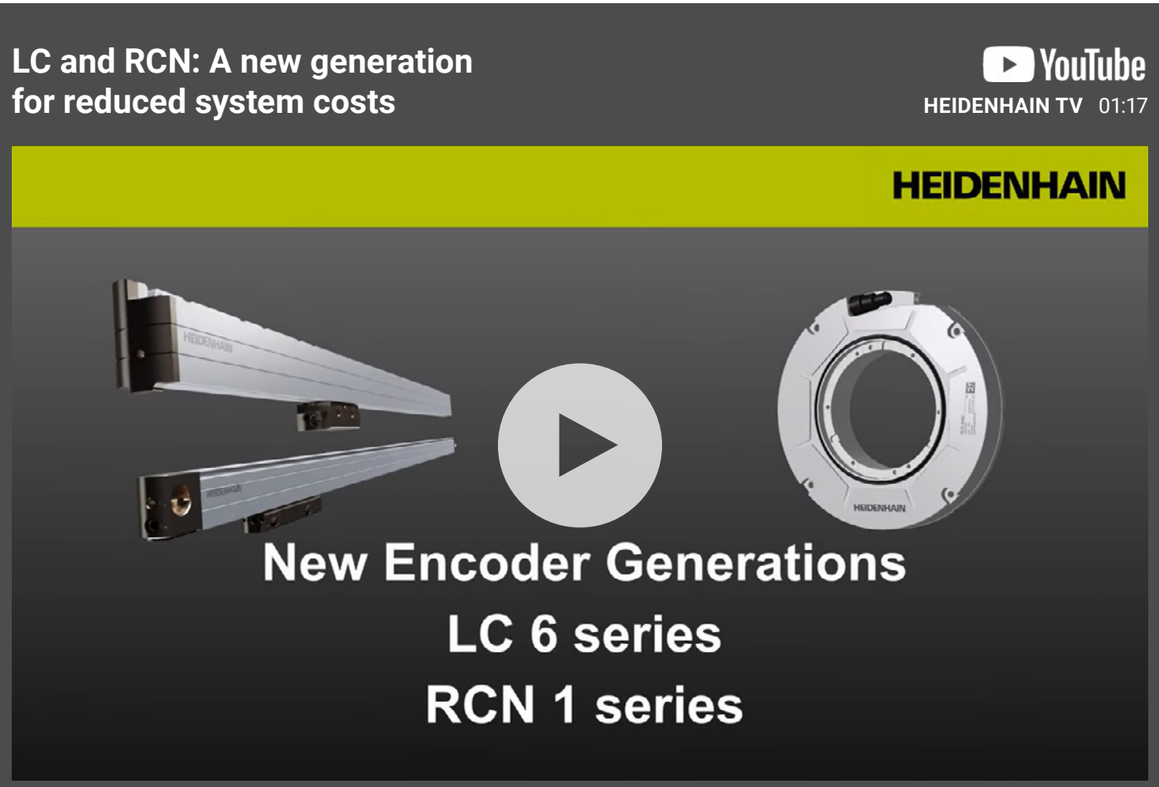
The design and technological advancements embedded in HEIDENHAIN encoders significantly lower the total cost of ownership. The RCN series, for example, supports high shaft speeds and integrates temperature sensors, optimizing machine productivity and reducing maintenance frequency. These encoders maintain precise performance even in adverse conditions, ensuring consistent operation without the need for regular maintenance or recalibration.

The LC 6 series encoders are particularly noted for their robustness and consistent accuracy, ensuring long-term reliability even in the most demanding machine tool environments. These features make the LC series a preferred choice for applications requiring high durability and minimal operational interference, thereby extending machine service life and reducing the frequency and costs associated with component replacement or system downtime.

Opting for HEIDENHAIN encoders is a strategic decision that enhances machine efficiency and cuts long-term operational costs considerably. By investing in these high-quality components, businesses can enjoy improved machine reliability, reduced downtime and lower maintenance costs—securing a competitive advantage in their industry.

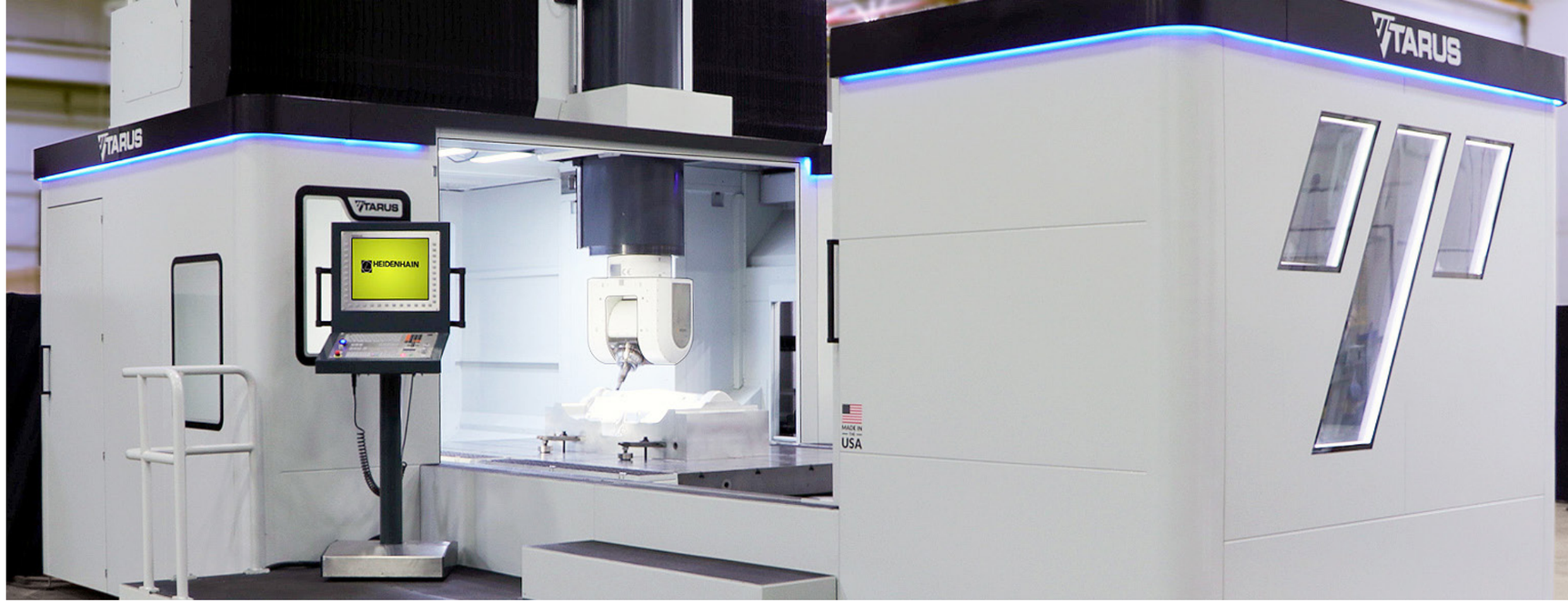
For a deeper understanding of how HEIDENHAIN encoders can optimize your operations and contribute to substantial cost savings, visit our contact us page. Our experts are ready to assist you in designing a customized solution that aligns with your specific operational needs and financial objectives, ensuring that you maximize your investment and achieve your business goals. ■

Milton Willis has an impressive track record of over 32 years in the machine tool industry and 26 years with HEIDENHAIN CORPORATION. He has established himself as a technical service expert with a deep understanding of mechanical and electrical machine tools for CNCs. Whether it's providing technical support or training, Milton is committed to delivering the highest level of service to his clients.



A great one-two punch

A rare American builder of large machine tools with ‘strong bones’ adds a superior control to bring new benefits to many.



With the need for high quality contour surface milling on the rise in manufacturing, one of the rare large machine tool builders based in the U.S. has now met that challenge and is making an impact in those industries that need it most. Welcome TARUS.

Established in the Detroit, MI, area in 1969 and already well known by those in the automotive, aerospace and mold & die manufacturing industries, TARUS has made new significant investments in innovations, spearheaded by now including the state-of-the-art HEIDENHAIN TNC 640 CNC control on many of its large equipment offerings.

“We are excited about the changes made here over the last couple of years that give our manufacturing customers the edge they need to compete in today’s global marketplace,” explained Doug Greig, TARUS Co-owner with brother Dave. “TARUS has always been known to have great build on its machines, many say ‘strong bones.’ And we’ve now upped the game with machine performance levels of increased speed and accuracy highlighted by 5-axis capabilities with the HEIDENHAIN TNC controls and linear and rotary encoders predominantly. We believe this is a great one-two punch!” added Dave Greig.

TARUS’ large and durable American-made bridge and gantry milling machines boast an average large work envelope ranging 7’ x 10’ up to 14’ by 60’ as examples. “We are one of the few U.S. machine tool manufacturers making machines of this size. We have hundreds of customers including many in automotive such as GM, Ford, FCA and Toyota, as well as those in aerospace and mold & die.

Changing the game

“We at TARUS have some great machines with great features, but when it comes down to it, the customer really only cares about how fast they can complete their job, what is the uptime on their machine and how does their end product look,” explained Brad Kleinow, Director of Service at TARUS. “The fast speed, strong reliability and superior surface quality that HEIDENHAIN brings to the TARUS machines has proven to be a game changer.”

“There is a night and day difference in part surface finish with the TNC 640 when compared to the older TARUS machines equipped with our previous TARUS CNC,” explained Doug Greig. “With our current TNC 640 equipped machines, it is so much smoother and cleaner.”

Doug added that TARUS is now predominantly using the TNC 640 on its large high performance machines because its cutting and performance went through a thorough testing process and performed even better than expected, as well as the fact that many in their main markets now require the HEIDENHAIN. “The TNC 640 control is our preferred choice for these applications because of the reliability and performance it provides as a result of pairing it with the highly reliable HEIDENHAIN motion control feedback encoders,” said Doug Greig. “We believe that this coupling allows us to be the best at serving our machining markets in the long run.”

Overall, the HEIDENHAIN TNC 640 control is particularly well suited for milling-turning, HSC and 5-axis machining on machines with up to 18 axes. It is a workshop-oriented, high-powered and user-friendly control featuring numerous functions. Some of those tor TARUS customers include:

Above: TARUS TBM5 Gantry equipped with TNC 640, HEIDENHAIN glass scales and ETEL torque motor/direct drive ballnuts

Left: TARUS’ Brad Kleinow

- 3-D Tool Compensation through surface normal vectors
- Tool Center Point Management (TCPM) that uses a handwheel to change the angle of the swivel head during program run without effecting the position of the tool point
- Tool Radius Compensation: normal to tool direction
- Tilting working plane transformation coordination
- Speed: 0.5ms block processing speed
- Kinematics Opt for automatic measurement and compensation of positions in rotating axes

“The combination of features on the TARUS machines promise to provide users with increased performance, faster speeds, more flexibility, reduced set ups and more uptime,” said Doug Greig emphasizing that all those benefit the bottom-line of manufacturers.

Innovations from day one

ETEL torque motor-equipped direct drive ball-nut assembly at TARUS

The innovative nature of TARUS began at its inception with Doug Greig Sr. in 1969 who invented and went door-to-door successfully selling an add-on electronic hydraulic servo control for EDM machines.

From there, he built his own EDM machines, gun-drilling machines and copy-milling machines.

In the mid-1970s, development then began on the TARUS CNC which was used for all new TARUS milling, gun-drilling and measuring machines until 2008 when TARUS started building machines with customer-specified CNCs. In 2017, TARUS decided to make a shift towards the HEIDENHAIN TNC 640, with the first machines delivered in 2018.

Also, TARUS has also been a long-time customer of ETEL, a supplier of linear and multi-pole torque motors owned by HEIDENHAIN. One of the signature innovations at TARUS is its development and use of ETEL torque motors in a direct drive ball nut assembly found in its PMT Bridge and TBM Gantry CNC machines.

These unique torque motor assemblies are used to drive each machine axis (X, Y and Z), and result in improved efficiency, less wind-up and increased overall axis stiffness/rigidity. And because this direct

drive assembly has no belts or extra pieces, it results in a more reliable machine since there are less parts to fail.

“Many of our machine users don’t even know much about these built-in innovations! They just know the machines are fast, dependable and accurate,” said Doug Greig.

Kleinow added: “Overall, we believe TARUS now does things better than any other large 5-axis machine manufacturers. Besides marrying the newest high-level CNC technology with strong dependable machines, TARUS also now provides a unique Quality Control service team that stays with each machine at development through installation and service (no distributors used). This is unusual.”

Outlook and opportunity

“We believe the changed philosophies and revamping done here at TARUS over the last few years is exactly what the manufacturing industry needs to excel in today’s marketplace,” said co-owner Dave Greig. “And we are proud to manufacture these large machine tools right here in America.

“We are also proud of our long history and the successful use of HEIDENHAIN encoders that were helpful during our transition to current improved 5-axis control technology,” said Dave Greig. Kleinow added: “In fact, in the near future we expect to be involved with retrofitting many of our current machines in the field with these latest generations of HEIDENHAIN controls, drives, motors and feedback.”

To support the overall increase of HEIDENHAIN controls in the field, staff at the HEIDENHAIN North American offices are at the ready. This includes providing on-site application training at the end user by arrangement or by attending any of a number of TNC training classes held via the TNC-CNC Academy at the HEIDENHAIN offices in Schaumburg, IL.

The Greigs also mentioned that besides the new pairing with the class-leading HEIDENHAIN TNC 640 for improved surface quality and speed, their TARUS machines also now feature new state-of-the-art cables, connectors and cable chains to improve reliability and simplify servicing. This, along with the culture shifts at the TARUS and new quality and ISO 9001 certification processes now in place, are meeting the changing needs of today’s manufacturers.

Above: TARUS’ MM5 high-speed 5-axis CNC machine is for milling clay models of automobiles in design studios. The first TARUS machines equipped with TNC 640 were MM5 machines installed at Geely Design Studio in Gothenburg, Sweden. The large direct rotary tables are equipped with ETEL torque motors. A similarly equipped MM5 was installed at Navistar in Lisle, IL.

> “We are also proud of our long history and the successful use of HEIDENHAIN encoders that were helpful during our transition to current improved 5-axis control technology.”

“We are seeing much traction at TARUS starting now,” said Dave Greig. “We also have some new and exciting 5-axis products currently in development that we expect to launch within the next year or so. These products will be more game changers!”

Innovative TARUS machines

TARUS’ MM5 high-speed 5-axis CNC machine is for milling clay models of automobiles in design studios. The first TARUS machines equipped with TNC 640 were MM5 machines installed at Geely Design Studio in Gothenburg, Sweden. The large direct rotary tables are equipped with ETEL torque motors. A similarly equipped MM5 was recently installed at Navistar in Lisle, IL.

Besides large CNC milling machines, TARUS builds combination deep-hole drilling (gun-drilling) and milling machines for mold makers, as well as specialized multi-spindle deep-hole drilling machines. These deep-hole drilling machines are used in the nuclear industry for drilling critical steam generator tube sheets.

TARUS also builds machines for another niche resulting from its convenient location in Detroit, MI. In the 1980s, many local customers were using TARUS CMM and TARUS milling machines in their tooling and pattern/model operations. The Big 3 U.S. automakers and the local engineering companies approached TARUS to modify their existing TARUS machines to CNC mill and scan clay models for the design studios. This became very popular and now TARUS is one of the world leaders in CNC milling and scanning machinery for automobile design. ■

Below: ETEL torque motor-equipped direct drive ball-nut assembly at TARUS.

ACU-RITE SOLUTIONS

Pioneer Profiles

For the love of MILL**PWR**

Top right: Craig Guth at Toro's Product Development Lab.

Left and bottom right: Two of Guth's custom-made motorcycles

A longtime ACU-RITE SOLUTIONS user shares the life-changing benefits of the ACU-RITE SOLUTIONS control and his love for the brand.

Since 1996, Craig Guth has been using an ACU-RITE SOLUTIONS MILL**PWR** control in his home shop making custom motorcycle parts and more and is still using that same MILL**PWR** today! Not only that, but his love of machining secured him a full-time job in 2003 at The Toro Company headquarters in Bloomington, MN, where ACU-RITE SOLUTIONS controls are now used widely for prototyping.

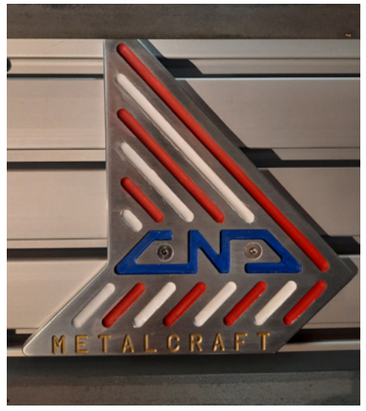
Melding his love of art with the benefits that machining provides, Guth has created many unique and useful things over the last 25 years. Originally teaching himself to use an ACU-RITE SOLUTIONS MILLPWR CNC on a mill still used in his home shop, Guth has become a go-to source for his unique inspirations of all kinds. A personal project head-turner are his fully custom-made motorcycles to name only one!

Then when Guth was hired as an employee at The Toro Company to support its Product Development Lab (PDL), his love for machining helped him as he supported various R&D projects. Toro is a well-known provider of outdoor equipment including turf and landscape, snow and ice management, specialty construction and more.

ACU-RITE SOLUTIONS control supports home-based business

It all began for Guth in 1994 when working for a local machine distributor where they evaluated various equipment and settled on obtaining multiple easy-to-use and conversational ACU-RITE SOLUTIONS MILL**PWR** controls for mills for sale. From there, Guth purchased his own and went to making molds for a local rubber company as well as custom motorcycle parts for sale and himself.

Guth's home-based business named CNC Metalcraft has produced many parts with truly unique designs since its inception. His fully custom motorcycles include specially designed parts using



Metal logo for Guth's home-based business

the MILL**PWR** that include those for the primary drivetrain (where clutch is housed and suspension parts), front end parts, triple trees and wheels. "I consider myself an artist and enjoy creating beautiful things," said Guth. "And I love working in the shop."

Another unusual project from Guth's past is the development of a unique computer box after being contracted by computer-manufacturer AMD to design and make one to look like aircraft landing gear. Using his shop MILL**PWR**, Guth developed this unique casing where it was showcased at a trade show exhibit and featured on the cover of a 2008 *Computer Power User* magazine (below).

One of Guth's most complex machining projects completed using his MILL**PWR** was the creation of his own large CNC wood router in 2015 that is now part of his home shop. It is 60" x 50" and consists of extremely complex and intricate patented machined parts. "The MILL**PWR** is so perfectly accurate that I can use a machine to make another machine!" said Guth. "I can whole heartedly say that the MILL**PWR** has changed my life. It really did."

Guth shared that one of his most-used features on the MILL**PWR** from his very start was the Geo-Calc which is an incorporated design program right in the control. "Back in the 90s, I didn't have access to Auto CAD or similar and the Geo-Calc helped me to design and create my parts right on the machine. I'd type in the lines and create right on the monitor, so the MILL**PWR** did everything from the design to controlling the actual build of it. I was really impressed with that."

Guth continued "Also I find the Teach Position feature especially useful where I can map out an existing part on the MILL**PWR** and design myself a copy. For example, I can take a motorcycle part, map it out on the machine and make a similar. I'm basically reverse engineering. It's fantastic!"

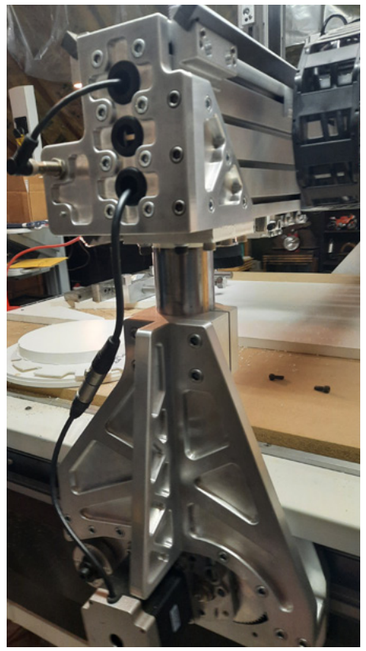
ACU-RITE SOLUTIONS controls support The Toro Company

When joining The Toro Company and its Product Development Lab in 2003, Guth explains that while he found the company's machining capabilities able to get most of the product prototyping jobs done, the tools were somewhat cumbersome and outdated. Seeking opportunities to further improve on its processes and technologies, Toro's PDL team now runs several ACU-RITE SOLUTIONS controls, mostly the new MILL**PWR**^{G2}s as well as a recently added ACU-RITE SOLUTIONS TURNPWR for lathes. Local distributor C&C Machine Tool in Blaine, MN, has and is continuing to provide and support Toro as needed. "We have done a lot of good work with Brent and Brian at C&C Machine," said Guth.

Customized fender and more

TURN**PWR** on lathe at Toro

Responsible for building product models, the team of 32 employees in the PDL are now more efficient and productive than ever. Besides machining, they also must deal with forming, welding, tube bending, assembling and painting. "The repeatability and part design of any of our machining is so much easier and faster now, and the MILL**PWR**s are an important part of that change," said Guth. "I am now in a position to help teach many of our newer staff how to use them, and they are finding the MILL**PWR**s easy to use as well. Besides harnessing their power doing quick circles, rectangles, lines, arcs and hole-making, our teams are using the Mirroring and Repeat options regularly."



Guth's creation: a 60" x 50" CNC wood router, consisting of extremely complex and intricate patented machined parts

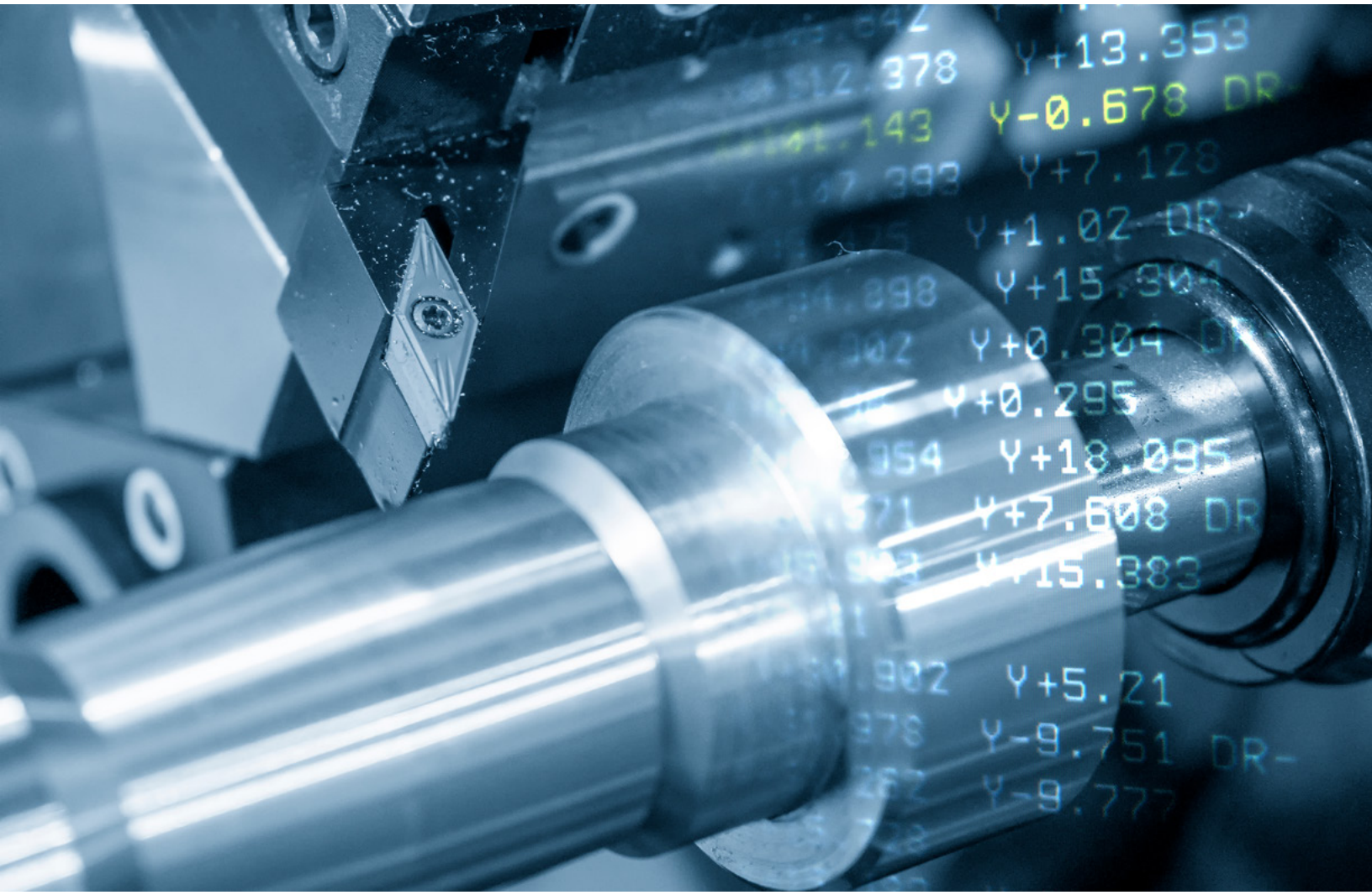
Guth added "Bringing these MILL**PWR**s into Toro has made it so we don't have to farm any machining projects out, as had to be done in past. This is both a time- and money-saver. And who wants to rely on outside sources nowadays."

Today

While Guth still is actively using his 1996 MILL**PWR** at his home shop, he does enjoy the next generation versions housed at Toro with the bigger and colorful screens. "I LOVE the newer screen and do hope to upgrade myself someday from my small black-and white monitor. You know, the way you program these newer machines really hasn't changed but the enhancements and added features make them better than ever," said Guth.

Toro's lathe featuring a TURNPWR control

"And while I've had to fix things on my home mill over the years, I've NEVER had a single problem with the ACU-RITE SOLUTIONS MILL**PWR** control even after all my thousands of hours of use. It just keeps working. The MILL**PWR** isn't just to make a part, but you can make a functional piece of art! It really did change my life! My next personal project on it is to make an elaborate e-bike out of aluminum with a space-age design. It's just great that this MILL**PWR** continues to help me bring my ideas to life." ■



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08/2025