ACU-RITE SOLUTIONS

Own the Cut

Power, precision and CNC confidence—built for machinists who don’t settle.

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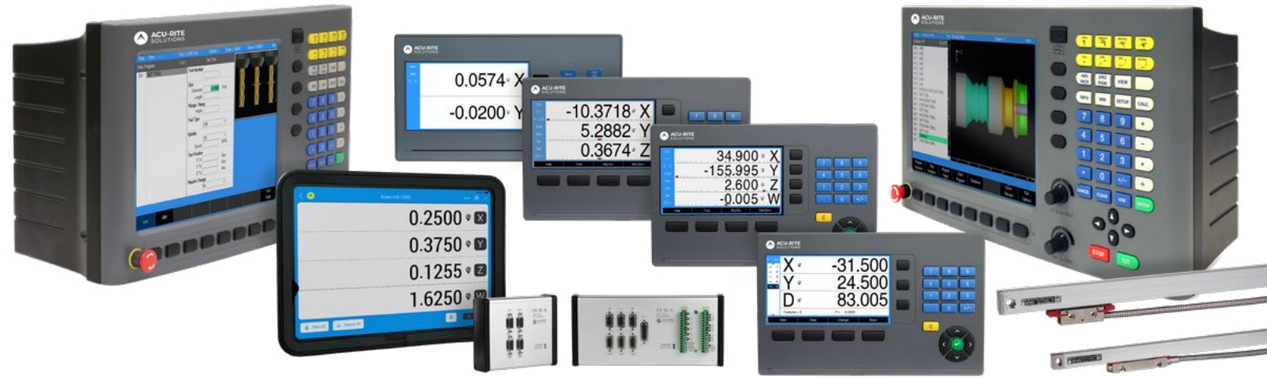


No guesswork. Just results.

For more than six decades, ACU-RITE SOLUTIONS has helped machinists, educators, and manufacturers unlock new levels of precision and productivity. As part of the HEIDENHAIN Family of Brands, ACU-RITE SOLUTIONS combines German engineering excellence with American manufacturing to deliver user-friendly technologies that raise the standard for manual machining.

Every day in shops across North America, our CNC controls, digital readouts (DROs), and precision encoders turn ideas into finished parts with accuracy you can measure and performance you can feel. Built for machinists who value simplicity and reliability, these systems provide the accuracy of advanced automation—without the complexity of high-end CNC systems.

Our Approach to Empowering Machinists

At ACU-RITE SOLUTIONS, innovation isn't about replacing the machinist—it's about amplifying human skill through smarter technology. We design every control, DRO, and encoder with one goal: to make precision more accessible to anyone operating a manual machine.

Backed by HEIDENHAIN Innovation

As a proud member of the HEIDENHAIN Family of Brands, we benefit from a continuous exchange of technology, research, and expertise that spans the global motion-control industry. This collaboration allows us to deliver solutions that bring world-class performance to shops of every size—built, supported, and serviced right here in the USA.

Versatility for Every Machining Environment

Our products support a wide range of operations—from entry-level to experienced machinists, across milling, turning, grinding, and boring applications, and compatible with more than 100 machine makes and models. Whether in a trade school, job shop, or R&D lab, ACU-RITE SOLUTIONS scales to your goals.

Precision Meets Practicality

ACU-RITE SOLUTIONS products are designed for the realities of the shop floor:

- Superior positioning accuracy for tighter tolerances
- Reduced scrap and setup time for higher profitability
- Intuitive design that minimizes training and speeds operation
- Industry-leading durability for maximum uptime and machine longevity

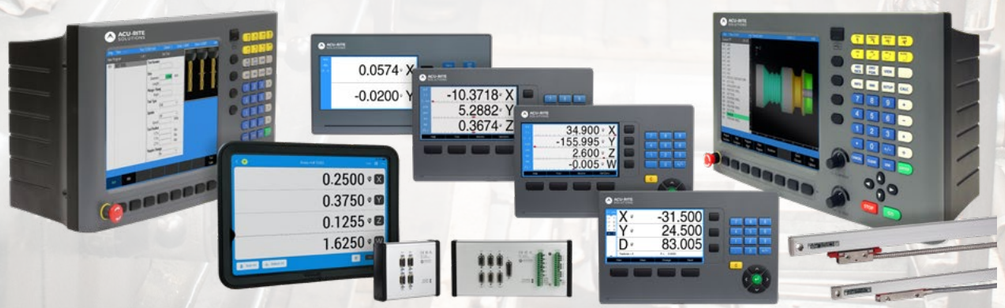
Made for Makers

Our customers include educators inspiring the next generation, professionals pushing production goals, and enthusiasts perfecting personal projects. For all of them, ACU-RITE SOLUTIONS represents a trusted partner—a system they can rely on for performance, consistency, and support.

A Legacy of Partnership

For over 60 years, ACU-RITE SOLUTIONS has stood beside machinists as more than a technology supplier. We're a partner in precision—committed to continuous improvement, seamless integration, and exceptional service. Backed by HEIDENHAIN, we continue to pioneer technologies that redefine what's possible in manual machining, helping you turn big ideas into reality. ■

4 benefits of choosing ACU-RITE SOLUTIONS control & DRO systems



For over 60 years, ACU-RITE SOLUTIONS has developed the most trusted CNC control and digital readout (DRO) systems in the machine tool marketplace. Whether setting up a new machine tool or retrofitting an old one, an ACU-RITE SOLUTIONS control or DRO paired with an encoder forms an economical and effective system for precision machining.

Over one million ACU-RITE SOLUTIONS glass scales are in use today. So, why do so many machining professionals, hobbyists, and educators choose ACU-RITE SOLUTIONS? Keep reading to discover the top benefits of using our precision machining technologies.

What do ACU-RITE SOLUTIONS technologies achieve?

ACU-RITE SOLUTIONS control and DRO systems automate manual machining. Our advanced technologies enable more accurate positioning and higher productivity while saving time and cost. The result is greater machine tool profitability.

Nearly every manual machining application can achieve next-level accuracy with ACU-RITE SOLUTIONS. Our products support professionals seeking higher production, educators inspiring the next generation, and hobbyists pursuing their passions.

ACU-RITE SOLUTIONS Controls

ACU-RITE SOLUTIONS develops entry-level controls that improve machining capabilities and accuracy in applications requiring manual and automated operation. They have broad automation features, user-friendly conversational and G-code programming, and full 3D contouring.

- MILLPWR^{G2} CNC Milling Control: Use it on knee and bed mills with up to three axes as a DRO, a programmable CNC control, or both.
- TURNPWR CNC Turning Control: Program manual and automated operations on turning machine tools with up to two axes plus spindle.

ACU-RITE SOLUTIONS DROs

ACU-RITE SOLUTIONS DROs continuously display the true location of machine axes, eliminating the need for manual

calculations. This real-time positioning feedback reduces errors significantly, improving machining accuracy. They feature pre-programmed common cycles, plus specific functions for milling and turning.

- DRO100: The most cost-effective, entry-level DRO with essential display technology.
- DRO203: Our most popular DRO, offering versatility and reliability for various machine tool applications.
- DRO203Q: Our most popular DRO, enhanced with Quadra-Chek for efficient graphic inspection and metrology applications.
- DRO300: The most complete DRO, featuring advanced programming capabilities and support for up to six axes.
- droPWR: A cutting-edge solution for transforming an iPad® into a powerful ACU-RITE SOLUTIONS DRO.

ACU-RITE SOLUTIONS encoders

ACU-RITE SOLUTIONS controls and DROs are even more effective when paired with an ACU-RITE SOLUTIONS encoder. Our linear and inductive encoders provide repeatable, high-accuracy feedback in almost any machining application and environment.

ACU-RITE SOLUTIONS linear encoders integrate advanced optical technology that resists size, shape, and density changes due to temperature variations. As a result, they eliminate errors caused by machine wear and backlash.

- SENC 50 linear encoder: Highly compact dimensions maximize accuracy in tight and restricted spaces.
- SENC 150 linear encoder: Advanced precision technology enhances accuracy in diverse applications.
- LMF 9310 linear encoder: Resists virtually all contaminants while providing high-accuracy feedback for large machine tool applications.

What are the benefits of using ACU-RITE SOLUTIONS technologies?

ACU-RITE SOLUTIONS products have an exceptional reputation because they improve the quality, efficiency, and profitability of manual machine tools. Our control and DRO systems integrate cutting-edge technology developed by HEIDENHAIN to machine superior workpieces. They are built to last in tough machining environments and intuitive for machinists of all skill levels to operate. They also come with dedicated customer support.

Benefit #1: Superior quality

ACU-RITE SOLUTIONS controls and DRO systems machine superior workpieces because they are powered by the continuous innovation of HEIDENHAIN.

Founded in 1889 in Berlin, HEIDENHAIN has a century-long tradition of pioneering measurement, control, and drive system technology. ACU-RITE SOLUTIONS applies motion control innovations out of HEIDENHAIN labs in Germany to design and build its products locally, keeping its "Made in America" tradition alive.

Our joint legacy of technical ingenuity promises the most advanced precision technologies available. That is why ACU-RITE SOLUTIONS products reliably enhance machining quality and efficiency, creating better workpieces with tighter tolerances and less scrap.

Introduced in 2022, the ACU-RITE SOLUTIONS droPWR is a recent example of our ongoing product development. The dro**PWR** is a first-of-its-kind Bluetooth-enabled DRO that transforms the iPad® into a cable-free ACU-RITE SOLUTIONS DRO. When used with the IBT400 or IBT400+ encoder, dro**PWR** allows seamless switching between milling, turning, and grinding tasks, making it ideal for shop classes, production environments, and small shops.

Benefit #2: Durability

Investing in a durable control or DRO system maximizes manual machine tool profitability. Reliable equipment reduces downtime, repairs, and material waste, increasing production capacity and long-term cost savings.

When it comes to durability, ACU-RITE SOLUTIONS technologies stand out. Since day one, our products have been designed and built in the USA, ensuring the quality to withstand even the harshest machine shop environments. Our controls, DROs, and encoders are crafted in an ISO-certified facility, have rugged hardware, and carry an IP rating. Exceptional protection against dust, debris, and liquids means our systems can handle the demands of regular use for years.

"These DROs have proven to be of high quality and very reliable," said Nick Sjoberg, Graduate Assistant at Southern Illinois University College of Engineering. "Even though we have ACU-RITE SOLUTIONS DROs in the shop that are older than me, they work just as well as the new ones (minus all the fancy new features)."

Benefit #3: Ease of use

Advanced precision technology should be easy to use. That is why our control and DRO systems are intuitively designed for machinists of all skill levels. They boost efficiency through improved accuracy and time savings on setup and operation.

ACU-RITE SOLUTIONS control and DRO systems simplify manual machining operations through numerous features:

- **Custom Bracket Kits:** Retrofitting a manual machine is easy with our custom bracket kits, which are compatible with over 100 machine makes and models.
- **Installation Guides:** Our step-by-step installation guides walk the machinist through the process, making setup quick and straightforward.
- **User-Friendly Interface:** The user-friendly, intuitive interface features context-sensitive graphical guidance and conversational dialog.
- **Large, Clear LCD Displays:** Large displays automatically adjust to ambient light, ensuring clear visibility in any environment. They also feature dynamic zoom, which enlarges position values to the maximum size for improved legibility during adjustments.
- **Multi-Language Support:** ACU-RITE SOLUTIONS controls and DROs are intuitively designed in 15+ languages.

Choosing an ACU-RITE SOLUTIONS control or DRO system ensures every machinist can operate it easily and efficiently.

"Students can quickly go to the control for the first time, understand how the control works, what it's supposed to do, and they can very quickly pick up and write a simple program," said Garret Parker, Department Head of Computer-Integrated Machining at Randolph Community College.

Benefit #4: Dedicated support

Exceptional products deserve exceptional support. We help customers leverage the full capabilities of ACU-RITE SOLUTIONS technologies to maximize machine tool profitability. Customers can receive products promptly, access convenient local support, and tap into next-level precision machining solutions from the HEIDENHAIN Family of Brands.

Reliable Product availability

Our commitment to American manufacturing promises quality as well as reliability. Because our products are designed and built in the USA, product availability and shipping are reliable. In North America, fast-track shipping is an option. ACU-RITE SOLUTIONS customers get the technologies they need promptly, maximizing uptime.

Convenient local support

Customers can access product support from wherever they purchase their ACU-RITE SOLUTIONS product, ensuring convenient assistance in their local time zone.

In North America, HEIDENHAIN technical support representatives are available by phone Monday through Friday. Our vast network of factory-certified distribution partners also supports ACU-RITE SOLUTIONS products in North America.

A robust library of online support resources is available 24/7, including product manuals, tips, and instructions.

HEIDENHAIN Solutions

As part of the HEIDENHAIN Family of Brands, ACU-RITE SOLUTIONS has the scale and resources to deliver every customer the most suitable precision technology for their application needs. ACU-RITE SOLUTIONS products naturally lead users to next-level HEIDENHAIN solutions as needed.

How fast will you see ROI with ACU-RITE SOLUTIONS?

ACU-RITE SOLUTIONS control and DRO systems continue to be the preferred choice among machining professionals. They gain superior machining capabilities, long-term durability, intuitive design, and dedicated support—all intended to boost manual machine tool profitability.

ACU-RITE SOLUTIONS customers see a return on their investment in as little as 30 days. Try our ROI Calculator to estimate how quickly you could see a return on yours. ■

What is the lifespan of a DRO system?

If you're in the market for a digital readout (DRO) system, understanding its longevity will maximize the return on your investment. A durable DRO will reduce downtime and repair and replacement costs while providing long-term accuracy.

Keep reading to learn how long a DRO and the connected encoder can last and the factors influencing lifespan.

What influences DRO system lifespan?

DRO systems improve machining quality and efficiency by displaying the exact positioning of every axis on a manual machine tool. Their lifespan depends on several factors, including the component materials and when and where they operate. A DRO system will be most reliable when properly designed, installed, and maintained for your specific machining application.

Materials

The materials used for the encoder and the DRO display unit significantly influence longevity. They determine how well the components withstand wear, environmental conditions, and mechanical stress. Materials designed to support both precision and durability will ensure the long-term functionality of DRO components.

For example, an encoder with a stainless steel scale can be highly durable but less accurate than a glass scale. Glass scales are precise. They can withstand harsh environments with protective housing and durable seals.

Choosing a DRO system with the right combination of materials will help you meet the demands of your operating environment while achieving long-lasting performance.

Usage frequency

The frequency of operation is another factor in DRO system lifespan. Systems with subpar design, materials, or construction are more susceptible to the effects of heavy or inconsistent use.

Continuous use, such as in high-volume manufacturing, increases the movement of components. This can create thermal stress and component fatigue, which gradually degrade the system.

On the other hand, intermittent use can cause components to become stiff, potentially reducing DRO encoder lifespan through friction, abrasion, and overheating.

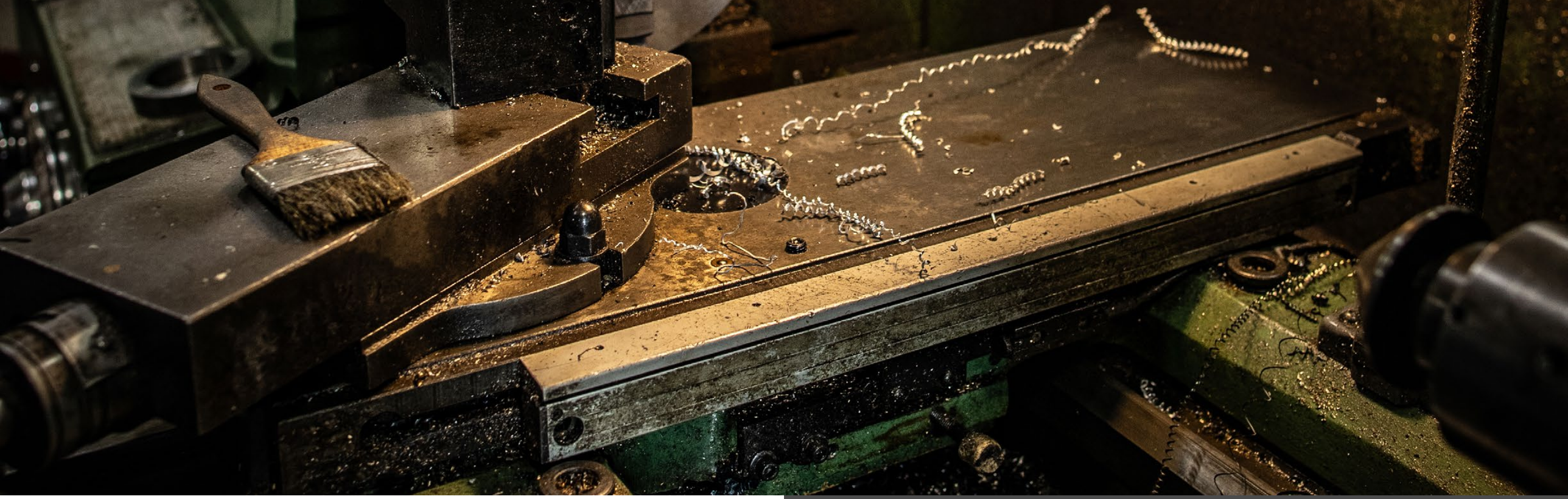
The most durable DRO systems stand up to the demands of all machining applications, from year-round use to one-off operation.

Operating environment

Longevity also depends on the environment in which a DRO system operates. Machining environments can expose DROs to conditions such as:

- Excessive heat or cold
- Excess moisture
- Dust and particles
- High vibration

These conditions can cause components to degrade, become misaligned, or



short-circuit, reducing system accuracy and lifespan over time.

When you choose a DRO system designed for your operating environment, you will protect its longevity.

How long do DRO systems last?

DRO lifespan depends on many factors, including the materials and design, usage frequency, and operating environment. On average, DRO systems last approximately 10 years. However, a more durable option like ACU-RITE SOLUTIONS can perform optimally for decades.

Machinists choose ACU-RITE SOLUTIONS because our technologies have a strong reputation for long-term reliability. Our DRO systems are designed and built in the United States with high-quality materials and components, withstanding heavy wear and use in even the most demanding machining environments.

ACU-RITE SOLUTIONS DRO system on a mill for 28+ years

In the video (right), an ACU-RITE SOLUTIONS DRO runs on a standard knee mill. The linear encoder is mounted on the back of the table for the X-axis and on the knee of the machine for the Y-axis. It has operated in this position for more than 28 years.

ACU-RITE SOLUTIONS DRO system on a lathe for 15+ years

The video on page 13 shows an ACU-RITE SOLUTIONS DRO on a lathe, where it has operated for over 15 years. Despite the harsh conditions of the shop, the DRO continues to display the true location of both axes.

How to extend DRO system lifespan?

No matter which DRO system you choose, there are steps you can take to ensure it operates for as long as possible. To minimize the risks of wear and malfunction, make sure to install, operate, and maintain your DRO system according to the manufacturer's instructions.

Installation

Your DRO and the connected encoder should be correctly installed and mounted by qualified personnel as defined by the system manufacturer.

Proper installation supports longevity through:

- Accurate alignment and stabilization that prevent mechanical stress.
- Protection from environmental conditions.
- Stable power connections that prevent system malfunctions and short circuits.

Operation

Following the operating instructions will keep your system performing at its best by preventing malfunctions and damage.

ACU-RITE SOLUTIONS Product Longevity: Mill

ACU-RITE SOLUTIONS 00:32

Make sure to:

- Never open the housing.
- Never engage or disengage any connecting elements while the unit is under power.
- Only assign pins or wires that are used.
- Remove dust protection caps only when connecting measuring devices or peripherals.

Most importantly, don't operate a defective system, which can severely damage it; replace components immediately.

Cleaning

The most durable DRO systems don't necessarily need regular cleaning. However, cleaning can enhance DRO encoder longevity by reducing contamination, wear, and tear while preserving accuracy.

Avoid improper cleaning, which can damage the system, by following these general dos and don'ts:

Do...	Don't...
Use a cloth dampened with water and a mild detergent for cleaning exterior surfaces.	Use abrasive or aggressive cleaners, strong detergents or solvents.
Use a lint-free cloth and commercially available glass cleaner to clean the screen.	Use sharp-edged objects to remove persistent contamination.

Maintenance

High-quality DRO systems are essentially maintenance-free. Yet, conducting an annual maintenance check can help prevent avoidable downtime.

Here are a few maintenance checks you can perform each year:

- Check that all labels and symbols on the product are legible. Contact an authorized service agency for any corrective action.
- Inspect electrical connections for damage and functionality and replace any defective cables.
- Check power cables for faulty insulation and weak points and replace them according to the manufacturer's specifications.

Storage

You may need to repackage and store your DRO in the case of a facility move or temporary decommissioning. You should follow the proper steps to prevent damage when it's not in operation.

Best practices for storing a DRO system include:

- Using packaging as close as possible to the original.
- Protecting it from impact and vibration during transit and from the ingress of dust or humidity.
- Placing all included accessories in the original packaging.
- Storing it according to the manufacturer's specified ambient conditions.
- Inspecting it for damage after transport or longer storage times.

Maximize your machine tool profitability with a durable DRO system

Investing in a durable DRO system will maximize the profitability of your manual machine tools. You will improve production capacity and cost savings through reduced downtime, repairs, and material waste.

ACU-RITE SOLUTIONS DRO systems are backed by the continuous innovation of HEIDENHAIN, equipping machining professionals, hobbyists, and educators with the most advanced precision technologies available.

With an ACU-RITE SOLUTIONS DRO, you will:

- Create high-quality machined workpieces with less scrap and tighter tolerances.
- Save time and cost through intuitive installation and operation.
- Achieve repeatable accuracy with machine tools both new and old.

Since day one, we've designed and built our DROs in the United States to ensure superior quality. We craft them in an ISO facility with rugged materials, housings, and seals that protect against exposure to environmental elements. Plus, built-in error correction helps prevent unnecessary wear. ACU-RITE SOLUTIONS DROs can function optimally for decades in applications from simple to complex and the harshest environments.

When you purchase an ACU-RITE SOLUTIONS DRO from an authorized channel partner, you will receive local end-to-end support for its lifetime. Every channel partner is factory-certified to purchase, install, and service all ACU-RITE SOLUTIONS products, helping you maximize the lifespan of your DRO.

Are you ready to unlock next-level accuracy and efficiency in your manual machining? Contact an ACU-RITE SOLUTIONS channel partner to find the right DRO for your application. ■

ACU-RITE SOLUTIONS Product Longevity: Lathe

ACU-RITE SOLUTIONS 00:25

Entry to advanced

A machinist's career growth via ACU-RITE SOLUTIONS

Education and training are essential and unending in the world of manufacturing. Whether just beginning training or being a seasoned machinist, it's crucial to keep skills up-to-date and to adapt to advancing manufacturing technologies.

With the right training and tools, manufacturers can unlock the ability to run more advanced machines and achieve greater success in their field. The ACU-RITE SOLUTIONS product catalog allows learners to grow into and layer on more advanced features as they master the basics.

Richard Brown, Machine Tool Instructor at Horry-Georgetown Technical College, shared his perspective on progressive product training at the college:

"The program actually takes you from the foundational skills all the way through completion of programming CNC…. Here we feel like you need the foundational skills so that if something goes wrong with the program, you know how to adjust it. ACU-RITE SOLUTIONS is good to teach on because it gives the student, right in their face, what's happening as they're moving the dials. Once they get that, you no longer see them watching the dials. You see them just watching the screen and they know exactly where it's at when they're cutting the parts."

You can support a machinist's career path, from entry-level to advanced, by pairing the trainee with various products in the ACU-RITE SOLUTIONS catalog. Let's step through the sample progressive product training below.

Entry-level: Manual input systems

One of the first steps in manufacturing education is gaining experience with manual machine tools. This entry-level exposure allows individuals to learn the fundamentals of machining, including tool selection, work holding, and toolpath creation.

For trainees newer to manufacturing, ACU-RITE SOLUTIONS offers a range of entry-level manual input systems that are ideal for shop classes, production environments, and small shops. The DRO100, DRO203, DRO300, and droPWR are digital readout systems that allow users to quickly and accurately measure workpiece dimensions. The TURNPWR and MILLPWR^{G2} systems are CNC retrofit packages that can be added to existing manual machine tools to enable CNC capabilities. By mastering these manual input systems first, trainees will establish a foundational understanding of basic machine functions.

Garret Parker, Department Head of Computer-Integrated Machining at Randolph Community College, shared his experience using ACU-RITE SOLUTIONS controls in his classroom:

"The ACU-RITE SOLUTIONS control is a perfect match for students. The layout of the control is very user-friendly. The students can quickly go to the control for the first time, understand how the control works, what it's supposed to do, and they can very quickly pick up and write a simple program to be able to produce a part."

Intermediate: Interactive conversational programming for three-axis machining

As you gain experience with manual machine tools, you unlock your ability to run more advanced machines.

Beyond the basics, the MILL**PWR**^{G2} and TURN**PWR** are excellent systems for intermediate users who want to upgrade their milling or turning machine. With interactive conversational programming, MILL**PWR**^{G2} and TURN**PWR** allow users to easily create toolpaths without needing advanced programming skills. These systems are also compatible with the Bridge Adapter, which allows for a seamless transition to HEIDENHAIN controls.

Advanced: Complex tool paths and automated processes

Simply put, more technology typically translates to more training.

For advanced machinists, HEIDENHAIN controls are the future of manufacturing technology, offering an outstanding user experience and putting new possibilities at their fingertips. These CNC controls are intuitive, task-focused, and customizable. ACU-RITE SOLUTIONS and HEIDENHAIN offer a range of systems that allow users to upgrade their manual machine tools to enable CNC capabilities.

Next steps for educators

If you are an educator, we invite you to tour the ACU-RITE SOLUTIONS Technology Education Center located in Schaumburg, IL. Our product experts can guide you through the progressive product training technologies to equip your training center.

We also encourage you to take advantage of our School Discount Program, offering deep discounts on select controls and DROs to schools with precision metalworking and vocational programs.

Today, ACU-RITE SOLUTIONS has partnerships with many educational facilities throughout the United States. Brandon Hasdeldon, Associate Vice President of Academic Affairs/Dean of Horry-Georgetown, shared:

"Our partnership with ACU-RITE SOLUTIONS developed as we got into building these advanced manufacturing centers. ACU-RITE SOLUTIONS is an industry standard. The liability, the longevity, the accuracy of the systems are definitely there."

Next steps for trainees

If you are interested in training on any of the products or topics showcased above, the ACU-RITE SOLUTIONS Technology Education Center offers in-person and virtual training programs yearlong. You can view the current Training Calendar here, and sign-up for upcoming classes here.

To submit any additional questions regarding ACU-RITE SOLUTIONS progressive product training or School Discount Program, you can contact HCTraining@heidenhain.com. ■

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!"

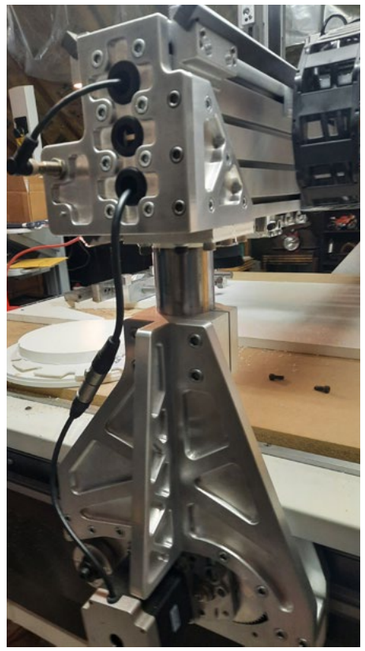
ACU-RITE SOLUTIONS controls support The Toro Company

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." ■

Precision meets passion

How HEIDENHAIN and ACU-RITE SOLUTIONS power 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 MILLPWR^{G2} 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. ■

Why are ACU-RITE SOLUTIONS products compatible with so many manual machine tools?

ACU-RITE SOLUTIONS creates precision CNC control and digital readout (DRO) systems compatible with an extensive range of machine tools. Whether you are looking to buy a new machine tool or already have one, integrating ACU-RITE SOLUTIONS technologies is a cost-effective way to improve its accuracy and efficiency.

Custom bracket kits for 100+ machine makes and models

ACU-RITE SOLUTIONS CNC control and DRO systems are for milling, turning, grinding, boring, EDM, and large machine tool applications. We offer custom bracket kits for different mounting positions on over 100 specific machine tool makes and models.

"Our custom bracket kits simplify installation because they eliminate the need for bracket modification," said John Parker, product manager at HEIDENHAIN CORPORATION. "They set ACU-RITE SOLUTIONS apart from other brands, which either don't provide brackets or offer brackets that must be modified to fit the machine."

Custom bracket kits from ACU-RITE SOLUTIONS come with a step-by-step installation guide to maximize machine tool uptime. This means you can seamlessly integrate ACU-RITE SOLUTIONS CNC control and DRO systems into new or existing machines:

- **New installations:** Choose the machine tool that meets your service, support, and cost requirements and then integrate ACU-RITE SOLUTIONS to maximize its accuracy.
- **Retrofits:** Add ACU-RITE SOLUTIONS to improve machining performance without investing in entirely new machinery, extending equipment lifespan.

The CNC control and DRO systems are designed to be compatible no matter which machine tool you choose, providing superior positioning accuracy that improves machining quality and efficiency. This level of compatibility allows machinists to enhance the performance of various machine tools across diverse applications.

For example, the American Precision Museum installed a MILL**PWR**^{G2} CNC control on its 1960s Bridgeport mill. The retrofit allows the museum to demonstrate the Bridgeport mill's original capabilities and advanced precision and efficiency when using the MILL**PWR**^{G2}.

Affixing a DRO to the machine tool correctly is critical for achieving optimal functionality and accuracy. Our custom mounting bracket kits simplify the installation.

You can choose from six DRO mounting bracket kits for various mounting positions:

- Tilt-swivel
- Short arm
- Long arm
- U-bracket with T-joint
- Single-position stand
- Frame panel mount

Linear encoder mounting bracket options

Our custom mounting bracket kits also maximize the accuracy of ACU-RITE SOLUTIONS linear encoders—without having to modify standard bracketing or form your own.

DRO mounting bracket options

Scale mounting bracket kits are available for these types of machine tools and dozens of brands, both past and present:

- **Mills:** Knee, bed, quill, crossfeed, and longitudinal
- **Lathes:** Crossfeed and longitudinal
- **Grinders:** Cross feed and down feed

Linear encoders for nearly every machining environment

Over 1,000,000 precision glass scales from ACU-RITE SOLUTIONS are in use today. That is because pairing our CNC control and DRO systems with an ACU-RITE SOLUTIONS linear encoder boosts the performance of nearly every manual machine tool.

Our durable linear encoders provide repeatable, high-accuracy feedback in industrial facilities and job shops to home workshops and schools. The Southern Illinois University College of Engineering uses ACU-RITE SOLUTIONS DROs and linear encoders to help students prepare manufacturing and design projects. One DRO system is on a Bridgeport mill in the college machine shop, where dozens of students use it almost daily.

ACU-RITE SOLUTIONS linear encoders are the most reliable on the market. They are designed, manufactured, and tested to withstand even the harshest machine shops—for years on end. In addition to flexible mounting features, they feature armored cable, a rugged scale case, and an IP rating of 53 when installed per instructions.

The precision glass scale integrates advanced optical technology developed by HEIDENHAIN, which resists size, shape, and density changes regardless of temperature and humidity variations. The result is improved machining quality, fewer errors, and less scrap and downtime.

From tight and restricted spaces to large machine tool applications, ACU-RITE SOLUTIONS linear encoders are compatible with diverse machining environments:

- **SENC 50 linear encoder:** Highly compact dimensions for tight and restricted spaces with travel lengths of 1-20".
- **SENC 150 linear encoder:** A compact yet robust design for almost any application (including EDMs, grinders, lathes, mills, and inspection equipment), with travel lengths of 2-120".
- **LMF 9310 linear encoder:** Virtually impervious to contaminants, a multi-section linear encoder with travel lengths of 127-773" for large machine tool applications.

Comprehensive product support

Integrating ACU-RITE SOLUTIONS CNC control and DRO systems is easy, especially when you tap into our comprehensive product support resources. You can access our vast network of channel partners and HEIDENHAIN technical support representatives for guidance during product installation, troubleshooting, and operation. We will help you maximize your equipment's accuracy, functionality, and lifespan.

- **Immediate support:** Contact our Technical Support Call Center at (847) 490-1191 from 7 a.m. to 5 p.m. CT, or email us at acu-ritesolutions@heidenhain.com. (Visit our support page to view the phone numbers for Canada and Mexico.)
- **Training classes:** Attend in-person or live online training classes and learn how to operate your new ACU-RITE SOLUTIONS product.
- **On-demand resources:** Visit the support section of our website to view product tips and instructions, documentation, registration forms, and software updates. This is where you will find the installation guides for our custom bracket kits.

"We know ACU-RITE SOLUTIONS DROs are easy-to-use and reliable products. We found the DRO quite easy to retrofit onto the machine and were thrilled that the mounting brackets and all were included in the kit."

Rich Pekelney
Trustee and Volunteer
San Francisco Maritime National Historical Park Association

Channel Partner support

Our channel partners have significant experience in manufacturing and machine automation, so they are prepared to meet the demands of diverse machining applications. They are exceptionally knowledgeable about ACU-RITE SOLUTIONS products, and many have partnered with us for decades.

ACU-RITE SOLUTIONS channel partners provide in-person support for the lifetime of our technologies. Each is factory-certified and authorized to purchase, install, and service all of our products. We have dozens of channel partners across North America, and you can use our channel partner locator map to find one near you.

HEIDENHAIN support

You can also get help with ACU-RITE SOLUTIONS products from HEIDENHAIN technical support representatives based in North America:

Unlock next-level precision with ACU-RITE SOLUTIONS CNC control & DRO systems

ACU-RITE SOLUTIONS' precision CNC control and DRO systems integrate seamlessly with manual machine tools new and old. Their superior compatibility allows machining professionals, hobbyists, and educators to tailor machine tools to their specific needs and expand their capabilities. No matter what machine tool you use or the machining environment you work in, choosing an ACU-RITE SOLUTIONS CNC control or DRO system will improve your accuracy, efficiency, and quality.

Contact a channel partner today and explore ACU-RITE SOLUTIONS for your application. ■

How machine tool errors occur

It is common knowledge that all machine tools — new and old — contain some error in the accuracy of moving components when compared to a standard that is known to be true. This area of concern is important enough for you to learn more about these errors and why they occur.

In every machining operation, there is always some degree of error or inaccuracy due to at least one of the following machine tool deficiencies:

1. Gravity causes deflections in the machine tool structure, particularly when a heavy workpiece is placed on a machine with overhanging table or ways. A result of these deflections is called Abbe error. (The following paragraphs provide further explanation.)
2. The fit between mating surfaces is loose, because of manufacturing tolerances, subsequent wear or improper gib adjustment.
3. The ways are not scraped straight or are not aligned perfectly at assembly.
4. Driving and cutting forces cause deflections, since no material is totally rigid.
5. Temperature variations can distort machine geometry.

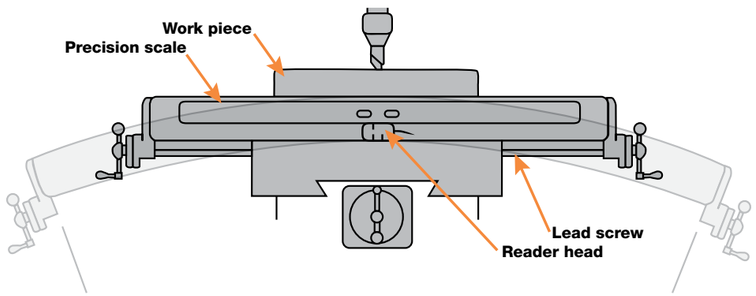
In addition, machine tables and ways can be forced out of alignment if you use the locks improperly. Tables that are not completely locked in position will shift from the forces of machining and eventually wear.

Abbe error (also called machine geometry or transfer error) is a progressive fault occurring mainly in machine tool tables or beds. It occurs in other moving parts also, but we'll limit our discussion here to mill tables. Gibs and table ways can wear due to an increase in pressure at the edge of the machine way, on both the knee and center of the table. This causes increased wear at these points as the center of gravity of the table moves with an increasing overhang.

The shift of weight is gradual as the table moves from the center; therefore, the wear is also gradual. The result is the formation of an arc shape along the table and knee, concave to the ways. Pressure of the gib against the way causes the gib to wear. Often when a short travel is used, retightening the gib causes localized wear of the way.

The scale attached to the table measures its horizontal motion with respect to the fixed reading head. A worn table, however, follows the curvature of the arc, resulting in an error in the movement of the workpiece relative to the cutter. In the case of the milling machine, the workpiece is moving too far.

ACU-RITE SOLUTIONS readout systems include automatic linear error calculation and stored error compensation factors in all systems as a standard feature. Both linear and non-linear error compensation can be entered into the readout. Error compensation corrections of up to ±99999 ppm (parts per million) can be entered. ■



Tools & Resources

ROI Calculator

How fast will your shop see ROI after your ACU-RITE SOLUTIONS purchase?

ACU-RITE SOLUTIONS products are not only a breeze to operate, but they also produce faster set-ups, shorter run times and a major boost in productivity. Using our custom calculator, you can see just how quickly your company will start seeing ROI from your ACU-RITE SOLUTIONS purchase.

Check it out now!

FAQ

Browse answers to common questions about operating and maintaining ACU-RITE SOLUTIONS CNC controls, digital readouts, encoders, and accessories.

Check it out now!

Tips & Instructions

Get the most from your ACU-RITE SOLUTIONS product! Browse insights and instructions for setting up and operating ACU-RITE SOLUTIONS CNC controls, digital readouts, encoders, and accessories.

Check it out now!

Powering Precision with ACU-RITE SOLUTIONS

YouTube

ACU-RITE SOLUTIONS 00:50

10 reasons
a CNC retrofit is good for your knee or bed mill

If you have any knee and bed mills sitting idle, taking up space in your shop, you're not alone. It's difficult to figure out what to do with a heavy manual machine or a run-down, outmoded CNC center. But "dealing with" idled machines doesn't always mean having to get someone to take it or finding a way to get rid of it. Just because an old control is missing an impossible-to-find piece of hardware, or a machine is "just too difficult to do anything more with" doesn't mean it can't be a bigger revenue center.

There's a strong chance you can get more value out of that good iron. The structures that underly machine tools haven't changed much and stay sound long after the electronics of the original readout or control. Computer numerical controls (CNCs), on the other hand, have evolved dramatically since a lot the older machinery on today's shop floors was built. That's where we find the way to more life, more performance and more return from machines once thought scrap.

Controls have come to a point where manual knee and CNC-ready bed mills that were once thought too old and too new to justify a retrofit are more productive fits than ever. You can get almost all the advantages of a proprietary system, direct from the maker of your specific machine, and then some, without the extra cost. Here are 10 reasons to consider retrofitting knee or bed mill CNC controls:

1. Return on investment

First and foremost, extra machining capacity is acquired for significantly less than the cost of buying a new machine. In other words, you'll definitely see return on investment with a retrofit before you will with a full machine replacement. Don't let that good iron go to waste. Not to mention, a new machine requires significant downtime upfront for installation, reorganization of workflows, training, etc. Depending on the scale, retrofits often pay for themselves in the six months to two years.

2. User friendliness

It starts with large, color, high resolution screens that make life so much easier on operators. Modern CNC interfaces can also replicate existing CNC interface features and enhance them with improved graphics and custom screens, as on-screen graphics help smoothly guide users with conversational text. Programs can also be shown graphically, 2D or 3D, with edit capabilities right at the machine.

Seamless integration with hardware, like USB and CAD software make 3D work, transfer of data and offline programming simple. Controls' PC-based interface is intuitive to modern operators, making them easy for training and developing teams, troubleshoot and/or prevent errors.

3. Reduced unplanned downtime

Modern CNCs have a much higher MTBF (mean time between failures) than older ones. Advanced system screens can provide clear graphics for faults and show solutions to resolve them. Plus, at this point, technicians know how to debug and troubleshoot modern CNCs faster than older controllers.

4. Storage capacity

Where legacy controls or DROs may not have even had storage, today's CNCs have all kinds of virtual space for programs, tools and measurements. The latest MILL-PWR^{G2}, for example, has 2.5 GB of internal storage. Still not enough? No problem. USB and standard ethernet connections make memory effectively unlimited.

For some perspective, the original MILLPWR had 512 MB of storage.

5. Full-speed machining

Advanced contouring can cause older machines to slow down. That's often because the CNC can only process and execute simultaneous movements so quickly. (There's unused power in the machine.) Not only is this slower, but it can leave gouge or dwell marks on the part where a cutter lagged behind. That's not an issue when the MILL**PWR^{G2}**, for example, has a processor 1.4 GHz.

6. Interconnectivity and actionable data

CNCs have historically been isolated. Not anymore. Reconnecting a machine to a network with tooling or programming information can open up all kinds of possibilities. PC network protocols like Ethernet are so much faster than the previous serial communication, NC programs and data can be delivered to the control from a remote server in a fraction of the time. What's more, some controls can send diagnostic data out, a huge advantage for maintenance planning and sourcing.

7. Error reduction

Modern controls allow for 3D modeling and simulations of parts directly at the machine. DXF files can be imported directly from a CAD file and saved. Users can simulate and find out if their part will be collision-free or not before pressing "start". Controls also can have canned coding for common tool paths, processes and offsets that eliminate the need for typing in detailed sequences. Modern controls will even estimate how much machine time a part will take, giving operators the chance to adjust paths before it's too late.

8. Easy installation and service

Every machine is a little different, wiring, dimensions, power sources etc. This certainly adds some challenges to fitting the right control. However, control makers, especially ACU-RITE SOLUTIONS, are eliminating a lot of the difficulties with custom engineered retrofit kits. We offer custom engineered kits for simple bolt-on installation for dozens of different machine brands. A retrofit kit, for example, can be built to include:

- Remote stop/go switch
- Ball screws
- Servo drives and motors
- Motor mounting castings and hardware
- Handwheels
- Precision linear encoders
- Console and encoder mounting hardware
- Machine-specific bracketry
- Recovery drive

What's more, you can often upgrade and maintain the control inexpensively, with less vendor involvement, just like you would to an office PC. More proprietary or customized controls do not offer this flexibility.

9. Full G-code imports

CNC controls can make a very limited 3-axis machine into one that can handle advanced, multi-directional milling. The ability to import G-code unlocks all kinds of powerful functions and features. For one, spindle control that automatically adjusts spindle speed and/or direction on machines with an electronic variable speed spindle. Some controls have a "look ahead" feature that can detect sudden movements in the program and adjust. With code imported, controls also have built-in error compensation for linear and bidirectional non-linear movements.

10. Warranty coverage

Retrofit controls are often backed by strong warranty coverage. With our MILL-**PWR^{G2}**, receive a comprehensive two-year warranty that's supported by a nationwide network of factory trained and certified distributors.

To learn more about what's possible with a modern CNC retrofit, explore what our MILL**PWR^{G2}** control for manual knee and CNC-ready bed mills is capable of. Turn your idling machinery into value centers again. ■

Key considerations when selecting a digital readout system

Older manual machines were built to last; "good bones" as they say. But as technology improves and the bar gets higher, manual machines may need a digital retrofit to be fully usable. That's where digital readouts (DROs) come in; in conjunction with digital controls, they can essentially turn machines from manual to CNC with easy-to-use, digital functionality.

Not only do DROs allow shops and training facilities to get more life from their manual machines, but they can improve productivity and raise the quality of the machined workpiece.

How DROs work

Put simply, a DRO is a communication device between the operator and the machine tool. The DRO displays the machine table's direction, distance and location. The readout/interface itself pairs with feedback devices installed directly on the motion axes to provide positional feedback; operators can then see the position of the tool/workpiece on the DRO screen.

Common types of digital readout (DRO) systems

DROs can be used for a fairly wide range of machining applications:

- Milling (vertical boring mills, universal horizontal/vertical mills)
- Turning (horizontal lathes, vertical lathes)
- Surface grinders
- Optical comparators
- EDM machines

Common types of DROs range from entry-level DROs that provide measurement for a single-axis machine all the way up to advanced DROs with programming function capabilities and measurement of up to six axes. New technology is even making it possible to turn an ordinary iPad into a digital readout with a single app.

Factors to consider when purchasing a DRO

At the most basic level, all DROs enable the same thing: feedback to the operator about the position of the machine and workpiece to enable more accurate and productive machining. But choosing the right DRO for your specific needs involves a few key factors.

Application/machine type

First and foremost, your DRO selection will depend on your machining application and type of machine, because different DROs support different machining operations and different numbers of axes. This simple DRO selector tool can help you make your selection based on machining application and number of axes. For those looking for one DRO for multiple machine types and applications, the new droPWR turns any iPad into a digital readout. It allows users to dynamically switch between milling, turning and grinding, with multiple configurations on one tablet.

Added features/capabilities

In addition to basic considerations like type of machine and number of axes, you'll also want to consider how much functionality you need. For example, different models of DROs might accommodate the same applications and axes number, but have different capabilities in terms of storing tool offsets and multi-step programs; enabling machining of more complex shapes; and delivering presetting capabilities. Some advanced models allow users to measure, create, construct and export 2D feature types, including point, skew, line, distance, circle and angle. Get a quick comparison of several of these models here.

Feedback systems

If the digital readout console is the face of your DRO system, the feedback systems are the brains. These feedback systems generally come in three types: glass, inductive and magnetic. The choice you make will depend on a few factors. For example:

- Glass scales, which read changes in light to make measurements, are extremely accurate and precise.
- Inductive encoders detect changes in capacitance reactance and translate them into motion measurements. However, they usually require more mounting space and aren't highly accurate.
- Finally, magnetic encoders scan alternating magnetic poles as the machine moves and detect changes in magnetic flux fields. They're slightly more accurate than inductive encoders, with smaller footprints, but can be susceptible to extreme temperatures.

Ease of use

Ease of use can be a big factor for a typical DRO user—either those training operators to use new technology; those bringing on less experienced operators; or instructors teaching students to use machinery for the first time. Like most technologies, ease of use typically correlates with the sophistication of the technology. More entry-level DROs have fewer bells and whistles, but a lower learning curve for simple machining tasks. More feature-filled DROs offer greater benefits for more complex applications, but may require a bit more training/education. In general, however, today's leading DRO manufacturers are committed to making DRO systems that are both intuitive and robust.

Budget

As with ease of use, your needs will influence the amount you should plan to spend on a DRO system: the more demanding the application, the higher potential cost. And, as with most things in life, you usually get what you pay for. One thing to keep in mind when justifying your investment is the cost of swapping out a manual machine entirely—versus the cost of retrofitting it with a high-quality DRO system.

Factors to consider to choose the best DRO brand

Once you've narrowed down your needs for a DRO, you may find yourself comparing similar models from different brands. How can you know which is the right choice? Use this list to determine how different manufacturers measure up.

Brand reputation and track record

In a day and age when you can buy tooling (and yes, DROs!) on Amazon, it pays to do some research on the brand and provider to ensure the manufacturer has a proven track record of product quality and support. For almost 60 years, ACU-RITE SOLUTIONS DROs have been made in America, in an ISO facility. Perhaps most importantly, ACU-RITE SOLUTIONS is a member of the HEIDENHAIN Family of Brands; HEIDENHAIN is a known world leader in precision feedback and motion control—one of the most crucial success factors for a DRO system. The manufacturer you choose should have case studies and customer testimonials to back up product and support claims.

Quality, accuracy and durability

As mentioned, a DRO is only as good as the feedback system that drives it. This precision feedback function has been ACU-RITE SOLUTIONS parent company HEIDENHAIN's bread and butter for 130 years (you read that right!). Whether you need a system that will endure the harshest industrial conditions or will deliver the utmost in accuracy (or a little of both), HEIDENHAIN and ACU-RITE SOLUTIONS have a wide range of options to choose from. When it comes to the DRO console itself, you'll want to make sure the IP rating and overall construction stands up to your shop conditions (moisture, temperature, contaminants, vibration, etc.).

Installation

Before you choose a DRO brand, you'll need to have a handle on installation requirements. Some systems are off the shelf, and will require manual adjustments on the user's end to make hardware fit and work properly (adjusting scale mounting brackets, for example). ACU-RITE SOLUTIONS is the only manufacturer to offer custom mounting kits suited to your specific machine model (with over 100 different machine make and model options)—to make installation much faster and eliminate human error.

Versatile offering

Your DRO brand of choice should have a DRO option that fits your needs perfectly—from the feedback system and console to the installation kit. This will ensure not only that the system works exactly as it should, but also that you won't have any hiccups when it comes to installation. ACU-RITE SOLUTIONS offers a wide range of DRO system options, plus custom mounting kits for more than 100 machine makes and models for foolproof retrofitting.

Service, support and warranty

Last but certainly not least, does your DRO brand offer solid service and support? If they aren't in the United States or if DROs are not a main focus for them, the answer may be "no." America-based ACU-RITE SOLUTIONS provides easily accessible support by phone, appointment or online. What's more, every ACU-RITE SOLUTIONS DRO has sophisticated help functions built in. With the press of a button, users can access help and step-by-step installation/retrofit instructions. Finally, all ACU-RITE SOLUTIONS products come with a two-year warranty.

Even armed with all this information, it helps to talk to an expert when making a decision on which DRO is best for your operations. Call 1-847-490-1191 or contact the ACU-RITE SOLUTIONS pros online for a free consultation and quote. ■

8 tips for getting started with digital readouts

A digital readout (DRO) can bring a lot to a machine shop. Just to name two of the biggest perks, they make life easier on operators and boost the efficiency of a variety of machine tools. DROs are popular upgrades for knee mills, vertical boring mills, horizontal/vertical mills, horizontal/vertical lathes, surface grinders and EDMs. To help get you started on the right foot, we've collected some of our top tips for selecting, installing and using DROs.

1. Turn to video for help

YouTube and Vimeo offer a wealth of knowledge on different readouts, scales and machines. You'll find troubleshooting and quick how-tos. Don't forget about your supplier as a resource, either. We offer a variety of instructional videos for our DROs on everything from updating software to reversing direction.

2. Accuracy, repeatability, and resolution

Knowing the subtle distinction between accuracy, repeatability and resolution will help ensure you get a DRO that can perform the tasks you need. Put simply, accuracy is how close a measurement is to the true value, repeatability is how well a system repeats an outcome and resolution is the smallest increment a system can display.

3. Incremental vs. absolute positioning

Most new DROs offer the option, or different modes, to choose between incremental and absolute positioning. Then again, you may not need one or the other. Incremental (point-to-point) positioning is done from a displayed preset dimension to zero, or from zero to the dimension, then the display is reset to zero. Absolute positioning provides a unique location or reading at all times. Another perk of absolute positioning is that it allows rapid recovery of position once power has been restored to the system after shutdown or accidental loss of power.

4. Measure carefully

A common error when selecting scales to pair with a DRO is measuring the machine's travels wrong. Remember, table size and travel are not the same. Travel lengths should account for things like the dovetail, knee, stops and any extra clearance needed for the reader head to avoid collisions. Always measure hard stop to hard stop.

5. Have tools handy

Keep in mind, that mounting equipment can be generic. You may need to modify them to fit your machine—face them off, square them up or even make your own. Have tools like a hammer, drill, screwdriver or Allen wrenches gathered for DRO installation.

The easiest way to install a DRO on a machine tool is not to modify bracketry yourselves, but to use custom mounting brackets. We offer kits with custom brackets for nearly every machine in the marketplace, saving significant installation time and hassle.

6. Align carefully

Do everything you can to avoid chips entering the scale or readout housings. Consider facing any openings or seals away from the cutting area, sources of chips, oil or spray.

7. Don't forget about cords

Each machine is a little different, so pay close attention to where cords can attach or gather. Note any table locks, oil sources, switches or power sources can impact access or movement.

8. Use readouts for inspection too

The most popular digital readout in the machine tool marketplace now has Quadra-Chek onboard. Designed for use with optical comparators and measuring microscopes, "The Q" can efficiently measure 2-D features and export that data over a USB-C connection.

You're well on your way to making your machine/s and team more efficient. If you're looking for a little more guidance on which ACU-RITE SOLUTIONS DRO might be right for your operation, be sure to use our quick online DRO Selector Tool. ■

Tools & Resources

Documentation

Learn to operate and maintain your ACU-RITE SOLUTIONS product. Review flyers, manuals, and REACH compliance information about our CNC controls, digital readouts, encoders, and accessories.

Check it out now!

Training

Learn how to operate your new ACU-RITE SOLUTIONS product. Register to attend an in-person or online training event hosted by HEIDENHAIN technical support representatives.

Check it out now!

Work with an Expert

Do you want a reliable local partner for the lifetime of your ACU-RITE SOLUTIONS product? If so, tap into the expertise of our channel partners. Each is factory-certified and authorized to purchase, install, and service all ACU-RITE SOLUTIONS products, providing comprehensive in-person support.

Check it out now!

HEIDENHAIN Corporate Group - Family of Brands

YouTube
ACU-RITE SOLUTIONS 01:37

Why choose an ACU-RITE SOLUTIONS DRO system?

A digital readout (DRO) provides a simplified method of measuring and machining for operators while optimizing the accuracy and profitability of the piece of equipment. Understanding the very latest DRO options can help you enhance traditional machining operations and then some.

Newer DRO platforms make it easier to accurately machine complex shapes that, at one time, were next to impossible on manual machines. DROs are also effective efficiency boosters in more applications than ever before–now they can even go mobile.

How does a DRO system work?

A DRO system consists of a readout display unit and linear encoder feedback for all axes, depending on the machine tool and the length of travel. The readout continuously displays the actual location of all connected axes. With a simple keypad and software-specific functions, the operator can perform many different operations.

Linear encoders mounted on the machine contain a measurement standard and a movable scanning device or reader head. The linear encoder is installed along the full travel of the machine's axes and the reader moves along the full length of each; electronics read the position, interpret the information and send it to the digital readout to display the precise machine movement.

Features and benefits of ACU-RITE SOLUTIONS DRO systems

Fundamentally, ACU-RITE SOLUTIONS DROs make manually operated machines more profitable, improve productivity and raise the quality of the machined workpiece. Together with the linear scales from ACU-RITE SOLUTIONS, these DROs form an economic and effective package solution for initial setup, retrofitting machine tools and more.

If you're curious how quickly one or more DROs will pay for themselves, our ROI calculator makes the math easy, using your own shop's numbers.

In a manual machine application, complicated shapes and patterns can be machined, but it can be a tedious and error-prone process. If a machinist wants to manually move to a location several inches or mm away, he would have to start with a known location and very carefully count the number of turns made with the hand crank handle, then stop at the correct division on the machine dial. The machine operator must be careful to keep count of how many times they crank the handle and not misinterpret the starting point. Most manual machines use standard lead screws that are not very accurate and oftentimes account for backlash present in the machine tool. When approaching the starting point of the machining operation, it is always good to approach from the same direction to eliminate the possibility of manual machine tool backlash.

With an ACU-RITE SOLUTIONS digital readout on a manual machine tool, the user can eliminate machine tool backlash as the readout will display the exact machine tool position for each axis consistently regardless of approach direction.

ACU-RITE SOLUTIONS readouts also provide common machine functions such as Tool Radius Compensation, HOLE PATTERNS, INCLINE line and ARC

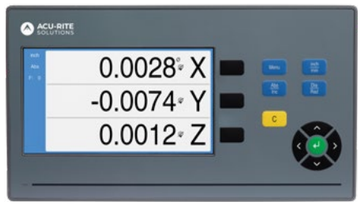
MILLING, Point-to-Point line milling, Tapper calculations for turning operations, and Radius Diameter calculations to name a few. Other features and benefits include:

- Since day one, nearly 60 years ago, ACU-RITE SOLUTIONS DROs have been made in America, in an ISO facility. This ensures that ACU-RITE SOLUTIONS support is available easily by phone, appointment and/or online in local time zones.
- ACU-RITE SOLUTIONS is a member of, and backed by, the HEIDENHAIN Family of Brands, a world leader in precision feedback and motion control.
- Each ACU-RITE SOLUTIONS DRO is designed for tough machine shop environments, with rugged hardware and IP-rated seals.
- Once activated, the Dynamic Zoom feature maximally enlarges the value for the axis currently being moved. The operator immediately sees which axis is currently moving and can easily read the numerical value from a greater distance. Watch Dynamic Zoom in action.
- The Axis Highlight feature makes the axis in use appear in a darker, bold font for clearer review.
- Multiple Language Support offers over 15 languages standard on each DRO.
- Sophisticated Help functions are built right into every DRO. With the press of a key, the user is taken directly to the User Manual or step-by-step installation/retrofit instruction
- When paired with an ACU-RITE SOLUTIONS scale, Position-TRAC recalls the last data after a power loss. Also, users retrofitting a DRO to their machine themselves appreciate the Installation Guide. See how Position-TRAC works.
- All of today's ACU-RITE SOLUTIONS DROs feature a standard 7-inch, color, flat-panel display that shows the actual axis position clearly

ACU-RITE SOLUTIONS DRO product overview

The product line includes everything from entry-level DROs providing measurement for a single-axis machine all the way up to advanced DROs with programming function capabilities and measurement of up to six axes. The technology has even been adapted into new options for those ready for the next step up to entry-level CNC products for both milling and turning (with MILLPWRG2 and TURNPWR controls).

DROs have commonly been used for milling (on standard and universal horizontal/vertical boring mills and jig bores), turning on lathes and surface grinders, but they are also effective on machines with an unusually high number of axes or inspection machines such as on optical comparators. Let's run through the full DRO lineup.



DRO100

The DRO100 is a simple readout for one, two or three axes, with sturdy housing and a splash-proof membrane keyboard. The DRO100 displays position values, status information and additional useful data. The most important functions are available quickly and directly via function keys. If the DRO100 is connected to a lathe, the user can simply switch from radius to diameter display.

Besides being commonly found on milling, turning and grinding applications, this DRO is also sometimes found paired with height gages/scales in inspection rooms. This might be as part of an inspection table system for checking part tolerance offering the user a much larger readout option for example.

DRO203

A versatile digital readout for up to three axes, the DRO203 digital readout is designed as a sturdy, upright unit with a splash-proof, full-travel keypad for use in a workshop. Its conversational dialog guidance and distance-to-go display facilitate positioning tasks and special functions for producing hole patterns (linear patterns and circular patterns). For turning, the user can easily switch between the radius and diameter display when the position display is configured for such. On lathes with a separate top slide, the sum display feature on the 3-axis version of the DRO200 series allows for the display of the saddle and top slides together or separately.

DRO203Q

Affectionately referred to as "The Q", this model is perfect for use with optical comparators and measuring microscopes. With the help of a graphic evaluation screen and intuitive interface, you can measure and export 2-D data quickly over a USB-C serial connection. The Q makes it possible to measure, create and construct the following feature types: point, skew, line, distance, circle and angle.

DRO300

A programmable digital readout for multiple axes, the ACU-RITE SOLUTIONS DRO300 supports all operations with intuitive interactive menus on a large color display. A separate I/O unit provides switching input/outputs for simple tasks in automation. The DRO300 allows for storage of up to eight programs, each with up to 250 working steps. Equipped with the same functions as the DRO203, the DRO300 also offers a connection for the KT 130 edge finder. This allows the user to define presets and datums with speed and precision. The DRO300 also offers programmability for small-batch production on conventional machine tools with up to four axes.

With the simple addition of the IB2X box, the DRO300 can measure up to six axes. This makes it highly effective for large machine tools. Plus, the use of an IOB610 box offers the ability to switch inputs/outputs; the user can look at the spindle speed of a milling machine or constant surface speed in a turning application.

droPWR

This breakthrough technology allows users to effectively transform their tablet into a DRO. Using Bluetooth® technology, the tablet connects to the DRO system, combining an intuitive user experience with touch screen convention. Dynamic switching between applications (milling, grinding and turning), multiple user configurations and machine-to-machine switching on a single tablet makes operators and machines hyper-efficient.

How to choose the right ACU-RITE SOLUTIONS readout

While ACU-RITE SOLUTIONS DROs are versatile, you have choices, capabilities, features and options that can best match your equipment and work. The first thing to think about is the application: grinding, turning, milling, sinker EDM, inspection, etc. How many axes does the machine have? Will the DRO support one type of work or a variety? Will you need to machine more complex shapes, and save offsets or programs?

Equipped with answers to questions like these, you'll be able to quickly identify the best ACU-RITE SOLUTIONS DRO for you. For some extra help, give our DRO Selector Tool a try.

Compatible machine brands for retrofitting

ACU-RITE SOLUTIONS DROs are exceptionally equipped for retrofitting. We're the only readout manufacturer that offers bracket kits for specific machines and brands. This includes more than 100 different machine makes and models, from manual mills to lathes. No measuring or drilling, everything lines up flush and fast. Put simply, ACU-RITE SOLUTIONS makes hardware installation easier than any other DRO brand.

If you're looking for some more advice on where to start or how to retrofit, contact us. ■

Absolute vs. incremental positioning on a DRO

Absolute and incremental positioning are used interchangeably when discussing the position values of the DRO. Both absolute and incremental position methods give the operator greater flexibility when machining a part.

Absolute coordinates are defined as each position on the work piece is unique. Using Figure 1, the absolute coordinates for position 1 are X = 20 mm, Y= 10 mm and Z = 15 mm.

With **incremental** coordinates, the last point traveled to becomes the new reference point on which the operator bases his next move. In Figure 2, the operator wants to move from position 2 to position 3. The operator would input the following values to move to position 3 incrementally.

XI = 10 mm

YI = 5 mm

ZI = 20 mm

Incremental coordinate positioning is very useful tool when the operator doesn't want to do addition or subtraction to figure out the absolute coordinates. Figure 3 shows how the operator can put in XI = 30 and YI = 30 instead of doing the addition to find out what the absolute coordinate of position 2 is when moving from position 1.

Also, incremental coordinates are used with bolt-hole patterns so the operator doesn't have to know the exact coordinates of each bolt hole but rather move until each axis display is zero before drilling a hole.

In conclusion, each coordinate system has its benefits and it is truly up to the operator to take advantage of the benefits of each coordinate measurement system. ■

Figure 1

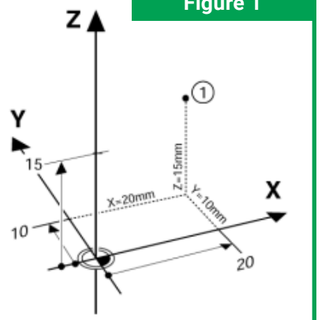


Figure 2

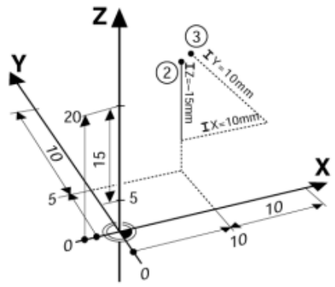


Figure 3

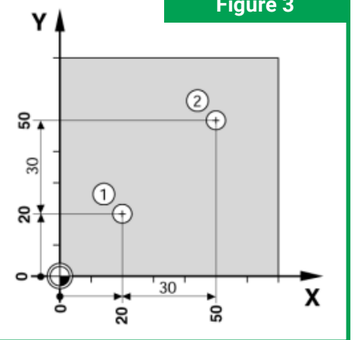
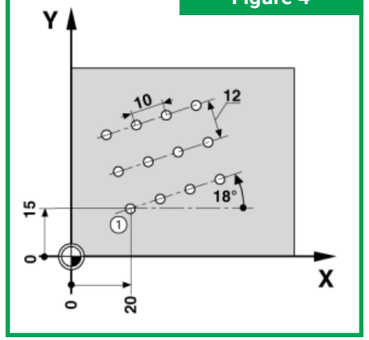


Figure 4



Useful digital readout terminology everyone should know

Each specialty or area of the metalworking world has its own terminology. One term you'll hear often in machining is "DRO."

A Digital Readout (DRO) is an electronic display system used with manual machine tools like mills, lathes, and grinders. It shows the precise position of the cutting tool or workpiece along one or more machine axes, usually X, Y, and Z. By eliminating the guesswork of handwheel readings, DROs make machining faster, easier, and more accurate, especially when tight tolerances matter.

Sometimes, words can even mean something a little different depending on the context. For example, we know what "precision" means, but in the realm of digital readouts (DROs), "precision" may be defined as the closeness, or tolerance, of agreement among repeated measurements of the same characteristic, by the same method, under the same condition.

Let's look at a few more terms from the DRO world that are good to know in the context of machine tools and readouts.

Reference mark

This is a pattern on the glass scale that is sensed by the reader head and is used for the Position-Trac™ feature or to quickly reset the readout system to zero.

Repeatability

Repeatability is the ability of the scale to return to an identified position within the specified tolerance. A repeatable scale is one that begins at zero on both an indicator and readout system; the table or tool is moved away from zero on both the indicator and readout system; when the table or tool is returned, both the indicator and readout system should again read zero. If this operation can be performed numerous times within a specified tolerance, the readout system and machine are judged to be repeatable.

Scale assembly

ACU-RITE SOLUTIONS scale assemblies consist of a glass scale enclosed in aluminum housing with sealed, die-cast metal end caps. To enhance glass scale durability, it is further protected from the environment by a recessed highly chemical-resistant, interlocking lip seal.

Reader head

Part of the DRO system's encoder is a photo-electric device that converts the line pattern on the glass scale to a digital signal. The signal is the input the readout uses to display tool/workpiece position.

Zero reference

This is the point selected on or near the workpiece from which positioning is started, or in some cases, referenced for the entire machining operation. Zero reset is automatic or manual zeroing of the measurement (or count) displayed on the DRO. (Another term for reset.)

Quadrature

A sine or square wave signal whose phase differs by 90° with respect to a base signal, the quadrature signal is necessary for bi-directional counting.

Offset

This refers to the radius or diameter of a round cutting tool by which a dimension is modified in order not to over-cut or undercut the required dimension.

Metrology

Metrology is the science and technology of precision measurements, often for the purposes of quality control. Tools like the ACU-RITE SOLUTIONS Edge Finder and touch probes are often used for in-machine inspection.

Incremental measurement

Incremental measurement is between two successive points on a workpiece, usually, with a DRO system, incremental (point-to-point) positioning is done from a displayed preset dimension to zero, or from zero to the dimension, then the display is reset to zero. The SENC 50, SENC 150 and LMF 9310 encoders from ACU-RITE SOLUTIONS all use incremental measurement.

Resolution

Resolution is the smallest unit of motion that a readout system is capable of measuring and displaying. ACU-RITE SOLUTIONS readout systems are accurate up to 0.00002" or 0.5 microns.

You can continue learning about readouts, encoders and their efficient application reaching out to our experts directly. ■

Empowering the next generation of precision machinists

ACU-RITE SOLUTIONS brings the best available machining technology to educators and students. Schools with precision metalworking and vocational programs can obtain deep discounts on our DROs and MILLPWR[G2] CNC control through our school discount program.

By adding ACU-RITE SOLUTIONS equipment to new or existing manual machines, educators can give students hands-on experience in:

- Turning and milling cycles (taper calculations, hole patterns, pockets, inclined milling)
- Probing and measurement with DROs
- Conversational CNC programming using the MILL**PWR**[G2]

The MILL**PWR**[G2] transforms a manual mill into a 2- or 3-axis CNC, while ACU-RITE SOLUTIONS linear encoders and DROs bring precise digital feedback to lathes, mills, grinders, CMMs, optical comparators, and more.

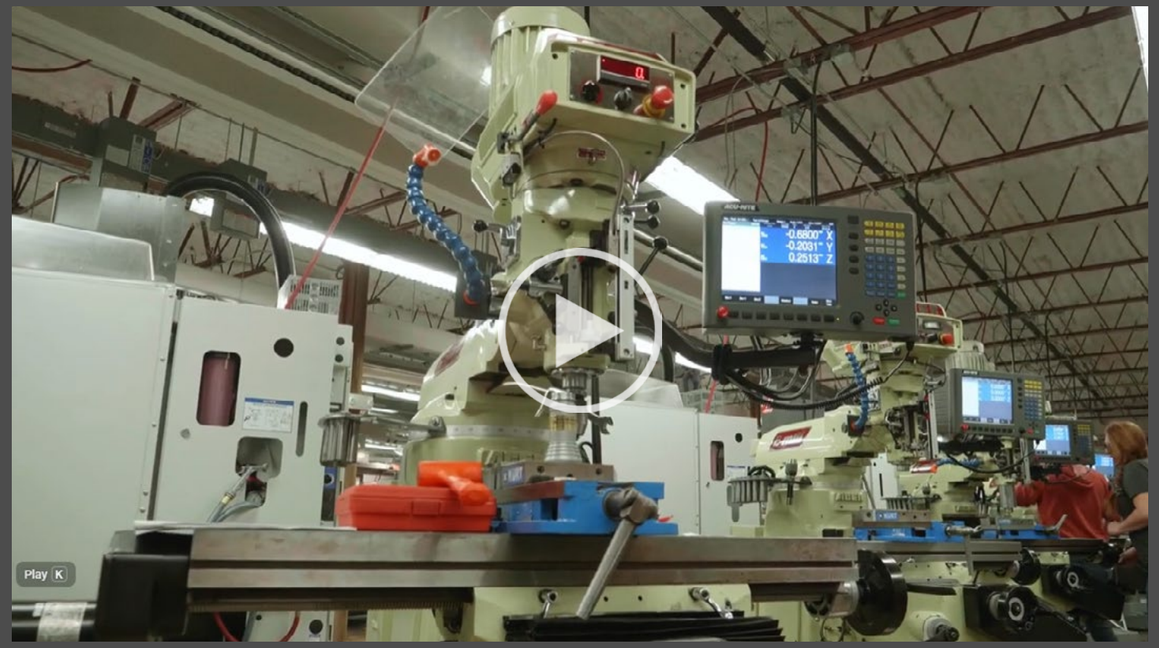
Schools can obtain the discount by purchasing from an ACU-RITE SOLUTIONS channel partner. A copy of the institution's P.O. must be presented at the time of order.

Available exclusively to educational institutions in North America. ■

ACU-RITE and Randolph Community College: Shaping the Future of American Manufacturing

YouTube

ACU-RITE SOLUTIONS 02:55



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 SOLUTIONS digital readouts and controls deliver precision and productivity. From faster setups to smarter navigation, we're here to make machining intuitive.

Check it out now!

Explore Our Website

Same Quality Products, New Brand Name

ACU-RITE SOLUTIONS
Powering Precision

MILLPWR^{G2} CNC control bridges past and future at American Precision Museum

Nearly two centuries ago, the Robbins & Lawrence Armory in central Vermont sparked the development of precision manufacturing and machine tools in America. Today, it's the home of the American Precision Museum (APM). Since 1966, APM has showcased American ingenuity by telling the manufacturing stories of yesterday, today, and the future.

The ACU-RITE SOLUTIONS MILLPWR^{G2} CNC control is vital to these efforts. Powered by the continuous innovation of HEIDENHAIN, the ACU-RITE SOLUTIONS control helps APM bridge the gap between traditional and modern machining methods. Together, we are engaging new audiences in the evolution of manufacturing—and inspiring the next generation of makers to continue the advancement.

The birthplace of modern manufacturing

APM stands as a testament to the dawn of precision manufacturing. It is a historic site located in Windsor, Vermont, that played a pivotal role in manufacturing interchangeable parts in the 1840s, a revolutionary concept at the time. To create the interchangeable parts, the site repurposed existing machinery and built new equipment powered by water in the nearby stream.

These innovations enhanced the efficiency and quality of manufacturing, giving way to new standards that became the American system of Manufacturing. The American system led to consumerism, making everyday objects such as bicycles and typewriters more affordable and accessible to the masses.

APM preserves this rich manufacturing heritage by showcasing traditional machinery and artifacts as well as modern machine tools. Its signature 4,000-square-foot exhibit, Shaping America, illustrates how mechanized production drove industrialization and developed modern consumer culture.

Interactive learning with the MILL**PWR**^{G2}

The ACU-RITE SOLUTIONS MILL**PWR**^{G2} CNC control is more than just an exhibit piece at APM. It's an educational tool demonstrating manufacturing machinery's evolution to nearly 6,000 annual visitors.

HEIDENHAIN CORPORATION donated the MILL**PWR**^{G2} to APM in 2023, and it was installed on a 1960s Bridgeport mill in the museum's Innovation Station. The MILL**PWR**^{G2} shows visitors in real time how CNC retrofit technology transforms manual machining methods.

"We learn so much from history, but some people won't be drawn to the historical side," said Jerry Rex, APM's Director of Corporate Development. "That's why we need modern technology to work with historical machinery. We need to show people how far we've come while encouraging them to help us reach the next level and bring us into the future of American manufacturing.

APM tailors demonstrations to the audience, which includes the public, students, and professionals from manufacturing companies. Generally, the goal is to show the Bridgeport mill's original capabilities

and its advanced precision and efficiency when retrofitted with the MILL**PWR**^{G2}. The museum also uses the MILL**PWR**^{G2} to create items visitors can purchase in the gift shop.

What makes the MILL**PWR**^{G2} the right fit for APM?

The MILL**PWR**^{G2} is an entry-level CNC retrofit system that improves machining accuracy and efficiency, increasing the profitability of manual knee and bed mills with up to three axes.

The MILL**PWR**^{G2} is ideal for applications requiring both manual and automated machining, like APM. Other factors make it an excellent fit for APM, too. It has robust control capabilities yet intuitive operation, versatile retrofitting capabilities, and American-made durability. It also comes with comprehensive training and support.

Powerful yet intuitive

The MILL**PWR**^{G2} allows APM to use it as a full-function DRO system, a programmable CNC control, or both. Yet its intuitive design makes operation easy.

"Even on an older piece of equipment, you can do some pretty powerful things very simply by using a control like the MILL**PWR**^{G2}," Rex said.

The MILL**PWR**^{G2} has simplified navigation, ergonomic keyboards, conversational programming, and essential and advanced functions. Any machine tool operator can quickly learn how to use it, from machining students to experienced machinists.

Retrofitting capabilities

When upgraded with the MILL**PWR**^{G2}, existing mills gain a longer lifespan and advanced capabilities without a significant investment.

"We try to show people that every application doesn't necessarily require a $200,000 or $500,000 machine. The ACU-RITE SOLUTIONS control on a Bridgeport can repeatably and accurately produce many parts that they need without taking a lot of floor space," Rex said.

The MILL**PWR**^{G2} is compatible with 100+ machine makes and models, turning just about any legacy knee mill into a powerhouse. Many customers who purchased the first-generation model are still using it decades later.

Made in the USA

Like all ACU-RITE SOLUTIONS technologies, the MILL**PWR**^{G2} has been designed and built in the USA since day one. So, its application on a Bridgeport mill, a staple in American manufacturing, makes it a particularly meaningful addition to the museum.

"We are the American Precision Museum, so being able to use an American-made and supported product on another American-made product is a real benefit," Rex said.

ACU-RITE SOLUTIONS products are crafted for lifetime durability. The MILL**PWR**^{G2} has rugged hardware and IP-rated seals, so it will stand up to even the harshest machine shop environments.

Dedicated training and support

ACU-RITE SOLUTIONS technologies are also supported in the USA for maximum reliability. Customers can access technical support by phone, appointment, or online in local time zones.

An ACU-RITE SOLUTIONS training specialist helped APM install and learn the MILL**PWR**^{G2}. They ensured the museum staff and volunteers understood exactly how to operate the CNC mill controller so APM could effectively integrate it into its mission.

Customers who purchase from an ACU-RITE SOLUTIONS distribution partner also receive local support. Our distributors are factory-certified and authorized to support all ACU-RITE SOLUTIONS products in North America, including purchasing, delivery, installation, training, and service.

Inspiring the next generation of manufacturers

MILL**PWR**^{G2} The high demand for manufacturing professionals is no secret. According to Manufacturing Institute and Deloitte research, 2.1 million manufacturing jobs are poised to go unfilled by 2030. There are plenty of job openings, but not enough people entering the profession to fill them.

APM is doing its part to address this gap through educational and career awareness programs. Its educational initiatives help spark interest in manufacturing careers by exposing students to the manufacturing technology and processes of the past, present, and future.

Each year, APM hosts field trips where students get to explore a variety of machining technologies. The MILL**PWR**^{G2} is central to these demonstrations.

"With the modern technology of the MILL**PWR**^{G2}, we have digital readout capability, the ability to run programs, and conversational control that makes machining more interesting to the younger generation who are potential engineers and makers. Sometimes you'll just see the sparkle in somebody's eye," Rex said.

APM also creates and distributes free STEM+M Kits (+M for Manufacturing) to fourth through sixth-grade students. They feature engaging challenges related to manufacturing, STEM, and design. Students may build a catapult, design tessellations, or construct a water wheel. Students can also explore APM in virtual tours.

Together, APM and HEIDENHAIN are providing education and inspiration to continue advancing manufacturing.

"HEIDENHAIN is committed to fostering the next generation of manufacturing professionals. We are proud to support the American Precision Museum for over a decade with U.S.-made and easy-to-use precision machining technologies," said Gisbert Ledvon, Vice President of Marketing at HEIDENHAIN CORPORATION.

ACU-RITE SOLUTIONS School Discount Program provides technologies at a discount to North American schools with precision metalworking and vocational programs.

> "We try to show people that every application doesn't necessarily require a $200,000 or $500,000 machine. The [MILL**PWR**^{G2}] control on a Bridgeport can repeatably and accurately produce many parts that they need without taking a lot of floor space."
>
> **Jerry Rex**
> Director of Corporate Development
> American Precision Museum

How to upgrade your manual mill with the MILL**PWR**^{G2}

The MILL**PWR**^{G2} supports educators inspiring the next generation, professionals seeking higher production, and hobbyists pursuing their passions.

Explore the advantages of machining with the MILL**PWR**^{G2} and contact us for more information. ■

ACU-RITE SOLUTIONS

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. ■

The HEIDENHAIN Family of Brands

YouTube

ACU-RITE SOLUTIONS 01:31

Precision in Your Hands

MILLPWR^{G2} halves setup time for custom glass fabricator

A family-owned glass fabricator in Ohio expanded its machining capabilities with the MILL**PWR^{G2}**, allowing it to handle a higher volume of work and more technically demanding jobs while significantly reducing programming and setup time.

Background

Delivering precision glass parts for demanding applications

Machined Glass Specialists (MGS) is a family-owned custom fabricator of high-performance glass materials like fused quartz, fused silica, and borosilicate. Since its founding in 1989, MGS has continually advanced its techniques, equipment, and efficiency to create precision glass parts affordably.

From its 15,000-square-foot facility in Ohio, MGS uses proprietary cutting, polishing, and inspection methods to craft one-of-a-kind glass components for industries ranging from semiconductors to medical. MGS parts are produced with the quality and reliability to perform in a

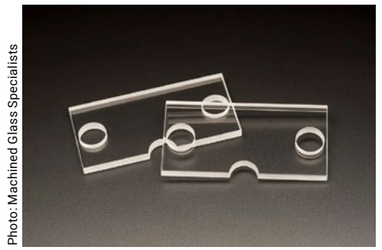


Photo: Machined Glass Specialists

variety of high-temperature, high-pressure applications.

Challenge

Why upgrade CNC controls when the old ones still work?

MGS wanted to keep pace with increasingly complex fabrication by modernizing its aging equipment—several milling and grinding machines and the legacy ACU-RITE SOLUTIONS MILLPWR CNC controls attached to them.

Their MILLPWRs were still performing well after nearly 20 years in service, eliminating human error that could cause costly material and tool waste and lost productivity. But MGS recognized that adopting more modern CNC technology would enhance their machining capabilities and efficiency.

"When it came time to buy new machines and upgrade our legacy MILLPWRs, choosing MILL**PWR^{G2}** systems was a no-brainer for us," said Jason Behm, Supervisor for Machined Glass Specialists, Inc.

Solution

Why was MILLPWR^{G2} the right fit for MGS's evolving machining needs?

After years of success using MILLPWR CNC systems, MGS purchased a used machine with a first-generation MILL**PWR^{G2}**. The team was quickly impressed by how it performed.

MGS needed a CNC control that could provide precision feedback in a dusty environment while adapting to frequent program changes. The MILLPWR^{G2} met these needs with a high-accuracy glass scale, durable construction, intuitive programming options, and comprehensive support.

The MILL**PWR^{G2}** is an entry-level CNC control for precision three-axis machining on knee and bed mills. It's designed for any job requiring manual and automated machining and can operate as a full-function digital readout system, a programmable CNC control, or both.

When it came time to purchase new mills and grinders, choosing the latest MILL**PWR^{G2}** CNC system was a "no-brainer," according to Jason Behm, supervisor. Behm worked with Ray Ayers at RLA Machine & Tool Sales, an authorized ACU-RITE SOLUTIONS channel partner, to purchase Kent mills and grinders with nine MILL**PWR^{G2}** systems.

"The MILL**PWR^{G2}** has been game-changing for our business, allowing us to take on more jobs and increasingly complex requirements," said Behm.

MGS requirements	MILLPWR^{G2} features
Accuracy: Gain the precision and speed to deliver on increasingly complex requests more effectively and efficiently.	▪ Durable linear encoders provide repeatable, high-accuracy feedback using advanced precision technology from HEIDENHAIN. ▪ Toolpath previews reduce the risk of programming mistakes, providing a listing and graphic with estimated machining time.
Flexibility: Adapt to varying program needs, which change almost every time MGS runs a job.	▪ Robust program storage accommodates repeat jobs, while manual mode allows ad hoc adjustments. ▪ Conversational and G-code programming make the MILL**PWR^{G2}** easy to use for machinists, from entry-level to experienced.
Durability: Stand up to the high volume of dust created by grinding and drilling glass materials.	▪ American-made design and construction for maximum reliability. ▪ Die-cast metal bezel and enclosure. ▪ IP ratings of 54 (front) and 40 (back).
Support: Gain reliable local support for the lifetime of the product.	▪ End-to-end in-person support (purchasing, installation, and service) provided by ACU-RITE SOLUTIONS' factory-certified and authorized channel partners nationwide. ▪ Live phone and email support from HEIDENHAIN representatives based in North America. ▪ On-demand support resources on the ACU-RITE SOLUTIONS website.

Results

How did the MILLPWR^{G2} upgrade help MGS say 'yes' to more jobs?

The MILL**PWR^{G2}** has transformed machining capabilities and efficiency for MGS, enabling it to complete more complex jobs efficiently.

One contributor is the DXF file import feature. Before implementing the MILL**PWR^{G2}**, MGS would turn down specific jobs because drawing programs point by point was so time-consuming. With the MILL**PWR^{G2}**, MGS can draw components in a CAD program, download the programs as DXF files, and import them into the MILL**PWR^{G2}**, saving time and scrap due to human error.

Behm estimates that the MILL**PWR^{G2}** has helped cut programming and setup time by at least half. In some cases, it has reduced setup time from five hours to just 10 minutes.

Today, MGS uses its nine MILL**PWR^{G2}** CNC systems to cut profiles, slots, pockets, and radii, often with tight tolerances and intricate geometry. For example, MGS recently fabricated a quartz nozzle measuring three-quarters of an inch in diameter by one-and-an-eighth inches long. The design involved drilling numerous holes, each with a diameter of 50 thousandths of an inch, at a 30-degree angle on the sides of the nozzle. The holes converged at the center of the part into another 50-thousandths hole. There were various steps at the ends of the part as well.

Upgrading to the MILL**PWR^{G2}** unlocked next-level efficiency for MGS, allowing it to continue producing superior workpieces while saving time and cost associated with setup, scrap, and other non-productive operations.

"If you're doing three-axis work, I think the MILL**PWR^{G2}** his just the way to go," said Behm.

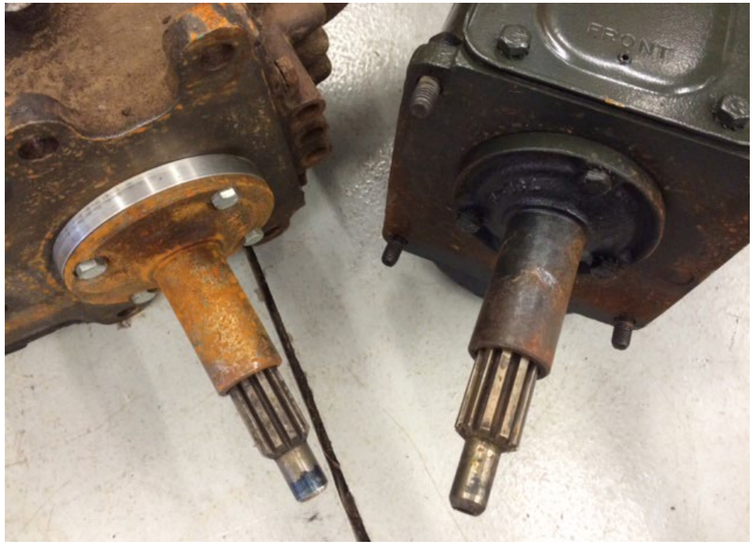
Are you ready for an affordable upgrade to your mill function and lifespan? Learn more about precision machining with the MILL**PWR^{G2}**. ■

"The MILL**PWR^{G2}** has been game-changing for our business, allowing us to take on more jobs and increasingly complex requirements."

Jason Behm
Supervisor
Machined Glass Specialists, Inc.

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 MILLPWR^{G2} turn us loose to build anything we can imagine." ■

TURN**PWR**

The shop-floor CNC game-changer

In today's competitive machining environment, efficiency and precision are everything. ACU-RITE SOLUTIONS TURN**PWR** control brings a new level of capability to the manual turning world-bridging traditional craftsmanship with modern CNC convenience.

Designed and built in the USA, TURNPWR is a workshop-oriented CNC control for lathes that helps machinists increase productivity while maintaining full control at every step. Ideal for both retrofit and new machine installations, it delivers the performance of CNC automation with the ease of conversational programming.

Smart, intuitive control

TURN**PWR** features a bright 12.1" high-resolution display and simple touch-screen interface that makes setup and operation effortless. Its graphical programming environment allows machinists to input part geometry and immediately see tool-path previews—no G-code experience required. For users who prefer traditional methods, TURN**PWR** also supports ISO (G-code) programming with editing functions built in.

Built for flexibility and speed

Perfect for hybrid shops, TURN**PWR** lets operators switch seamlessly between manual and automated operation, reducing setup time and scrap while boosting throughput. Its ability to import DXF files eliminates tedious hand-keying from prints, making it easier than ever to go from drawing to finished part.

Precision you can trust

TURN**PWR** operates as a closed-loop control system, using rotary encoders for precise positional feedback. When paired with high-resolution glass scales (1 µm / 0.00005"), it unlocks ACU-RITE SOLUTIONS' exclusive Position-Trac™ feature, which allows quick and accurate re-zeroing after power interruptions or machine shutdowns—keeping your work on track and minimizing downtime.

Practical for every shop

From small job shops to educational programs, TURN**PWR** is designed for anyone who values intuitive operation without sacrificing capability. Its conversational programming shortens the learning curve for new users while offering advanced options for experienced machinists.

A smart upgrade for turning

Whether retrofitting a legacy lathe or outfitting a new one, TURN**PWR** delivers a perfect balance of simplicity and sophistication. It's the ideal solution for shops that want CNC-level performance with hands-on control—helping machinists work faster, smarter, and more precisely than ever. ■

Key Features at a Glance

- 12.1" high-resolution color display
- Conversational and G-code programming
- DXF file import capability
- Closed-loop control with rotary encoder feedback
- Optional 1 µm glass scales and Position-Trac™ feature

Master Every Move

With ACU-RITE SOLUTIONS' TURN**PWR**, every cut is a calculated move.

Turn complex parts with CNC precision and the hands-on control machinists trust. TURN**PWR** gives you the advantage—faster setups, smarter programming, and accuracy that wins every time.

Check it out now!

Learn More About TURN**PWR**

Outthink. Outturn. Outperform.

ACU-RITE SOLUTIONS
Powering Precision

ACU-RITE SOLUTIONS

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