
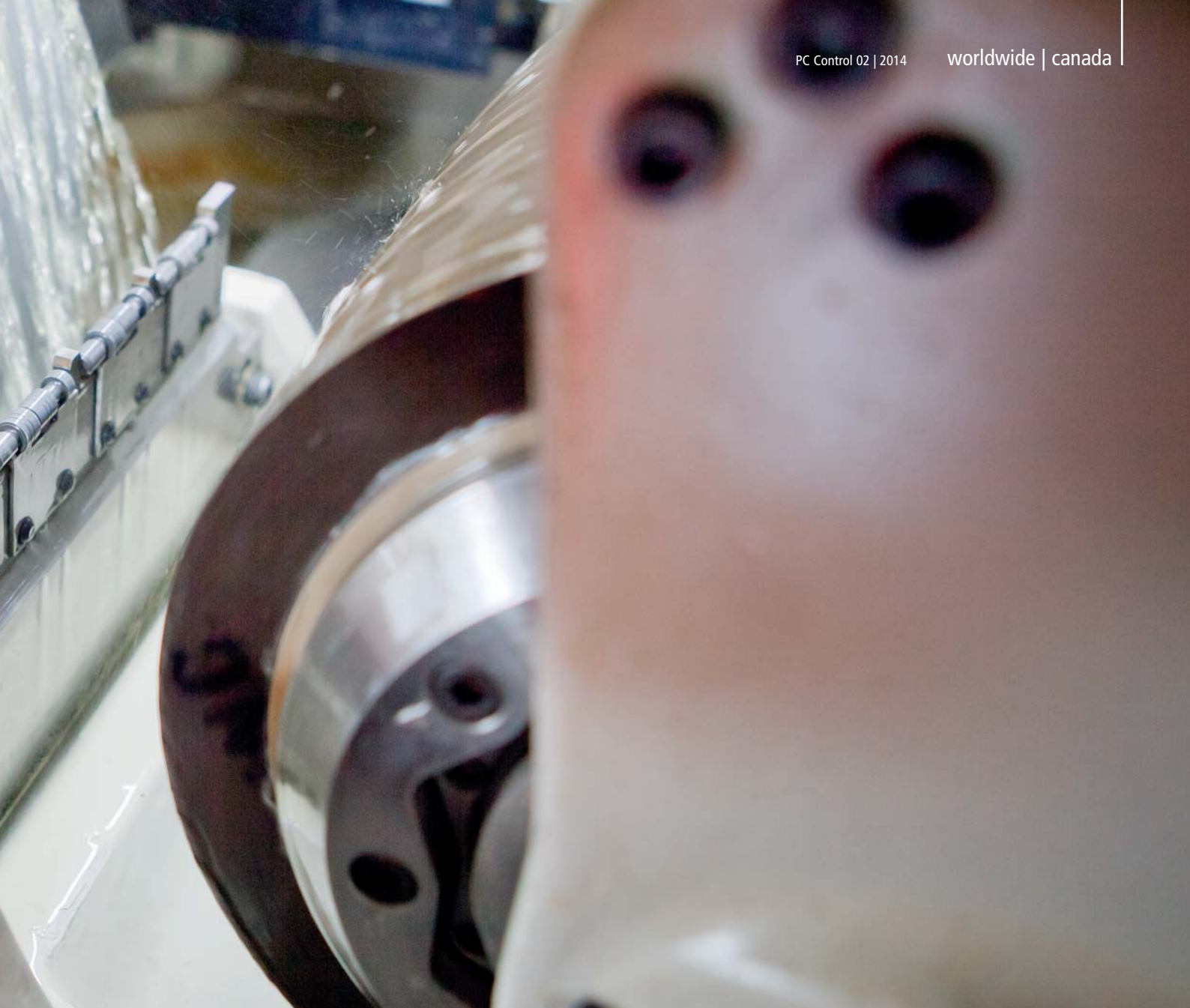


Improved gauging makes it easier for Echo Hill to correct the grinding patterns during production based on closed-loop control, which enables automatic modifications right down to the micron level or even below. The machine runs successfully with up to four parts simultaneously, without a decrease in efficiency.

Maximum precision and efficiency for grinding applications

To solve age-old problems in precision grinding technology, Echo Hill turns machinery upside down





The production of precision parts – in the past the domain of highly specialized craftsmen – is largely handled by machines these days. Centerless grinding is a special technique for precision grinding of cylindrical machine components, in which the workpiece is not fixed, but turns between a fast-rotating grinding wheel and a slower rotating, smaller regulating wheel. This technique is used for the production of precision parts for the automotive, aviation or aerospace industries, for example. Meeting the requirements of minimum tolerances right down to the micron range, short production runs and automated production of lot size one requires powerful, customizable automation technology.



A remote "Economy" Control Panel from the CP690x series is used for machine visualization.





The Canadian company, Echo Hill Automation, based in Beamsville, Ontario, specializes in the production of machines for centerless grinding. Other grinding machines that are currently available in the market can generally only process one part at a time. In many cases, different grinding profiles still have to be set manually. In the past, another issue with centerless grinding was parts gauging.

Echo Hill has invested a great deal of effort in research and development, with the aim to optimize the grinding process. "Most of our customers deal with a wide range of different parts, i.e. production runs tend to be short, with frequent product changeovers. Another factor is that the dimensional tolerances for processed parts have become smaller and smaller over the years," said Harry Schellenberg, President of Echo Hill Automation. "In order to enable high-precision, efficient production with small production runs and different dimensions, we had to redesign our machines."

Echo Hill turns the machine concept on its head

In many cases the grinding heads for this kind of machine can weigh more than 1000 lbs (500 kg), so that the mechanical components that are used for moving machine components are subject to high wear and tear. What's more, the grinding process is notorious for generating debris, which means that even high-precision grinding machines have trouble meeting the tight tolerances.

Echo Hill's "Tactic 8" machine is an innovative solution for these challenges. In this machine with an 8-inch grinding wheel, the movable components are turned on their head, so to speak, i.e. the linear motors are mounted at the top of the machine, so that the parts no longer have to be fed under the grinding wheels but can be processed from above. The magnetic force of the linear motors counteracts the weight of the slide bars, neutralizing the weight of the rotating roller slide mechanism, with the result that wear is minimized and the service life of the machine is increased significantly.

Scientific Automation integrates robotics and measurement technology into the control platform

"In addition to mechanical improvements, the Tactic 8 was equipped with the integrated PC- and EtherCAT-based control platform from Beckhoff. This has increased the overall efficiency of the machine," said Harry Schellenberg. "Originally, we started talking to Beckhoff because we were looking for a robot control system. In the past we used separate controllers for the machine, the robot and the gauging system, which made communication complex. With Scientific Automation we now have a platform that bundles robotics, measurement technology and machine automation on a single PC, software platform and network, which gives us clear competitive advantages."

Echo Hill uses a high-performance C6515 Industrial PCs (IPCs), equipped with a second generation Intel® Core™ i3 processor and TwinCAT automation software. A remote "Economy" Control Panel from the CP690x series is used for machine visualization. "The fact that the HMI software runs on the same PC as our automation software is a significant improvement," said Dan Schellenberg, Vice President and control expert at Echo Hill Automation. "Before we switched to PC-based control as our standard, we used a hardware PLC and a separate PC for the HMI."

"The big advantage of the PC-based control platform is that TwinCAT NC I integrates the whole robot coordination and handling of the three axes in a single controller and software," said Dan Schellenberg. "Since the PC runs G-Code for complex movements, it is quite easy to modify programs when the parameters change. In addition, it is possible to use different programming languages, ranging from standard to highly specialized languages, depending on what is best for a particular task. For regularly recurring motion control elements, TwinCAT offers function blocks, which save a lot of programming time."

The TwinCAT XML Server software supplement can be used to read and write parts parameters in a standard format. "This is particularly helpful bearing in mind that some of Echo Hill's applications have up to 4,000 parts parameters, which change continuously during production," said Dan Schellenberg. "It makes parameter transfer between machines much more flexible."

Echo Hill implemented full parts testing across the whole grinding process with the aim of achieving maximum precision. High-precision measured data acquisition enables the machining patterns to be controlled during the production, which makes it possible to implement automatic changes right down to the micron level or even below: the measuring system can control all workpieces with a tolerance of up to 6 μm . The Tactic 8 can process up to four parts simultaneously, without loss of precision. Dan Schellenberg is enthusiastic: "Within a few minutes our customers can grind four parts at the same time, with everything straight as a die – that's the pinnacle of grinding art."

EtherCAT Terminals for optimized temperature monitoring and vibration analysis

EtherCAT is used for machine networking. Different EtherCAT I/O terminals are used for data acquisition, temperature monitoring and vibration analysis on the grinding machines. Echo Hill uses the EL1262 XFC terminal with integrated over-sampling functionality, so that binary control signals from the process level can be picked up quickly and transferred to the controller. The base time of the terminals can be synchronized precisely with other EtherCAT devices via distributed clocks. In this way the temporal resolution of the digital input signal can be increased to n-times the bus cycle time. EtherCAT also transfers the length and diameter parameters to the connected vision system, which facilitates machine configuration during changeovers.

TwinSAFE ensures optimum safety

Safety over EtherCAT ensures comprehensive safety for the machine, operator and other personnel. Instead of using a separate cable set in conjunction with a special safety controller with its own software and network, TwinSAFE from Beckhoff integrates the safety technology in the standard I/O system – a simple and cost-effective solution.

Gauging a string of successes

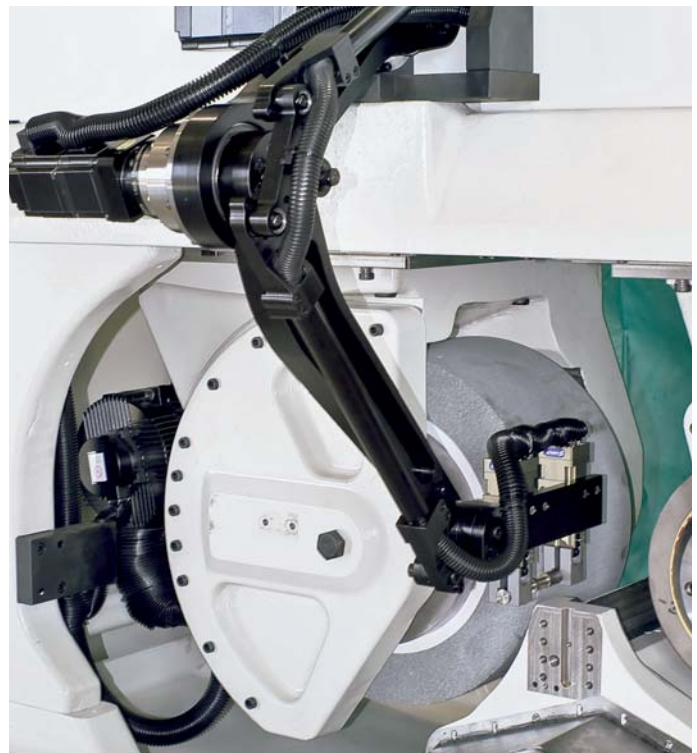
"The best selling point of the Tactic 8 is that it can process up to four parts simultaneously," said Harry Schellenberg. Another important aspect for our customers is the improved gauging technology. Now that we use EtherCAT we can execute up to 4,000 scans per second, far more than our previous limit of 1,000 scans," said the Echo Hill President.

Despite the fact that Echo Hill managed to optimize machine throughput by implementing the EtherCAT-based control platform, there was no cost increase. "Quite the opposite," said Dan Schellenberg, "Since the robot kinematics run on the central IPC, we were able to push down the total costs for the control system. In addition, we were able to significantly reduce the space requirements in the control cabinet, the footprint of the machine and the system complexity."

"Another competitive advantage is the shorter changeover time required of the machine," said the control expert. "Many of our customers produce workpieces for vehicle transmissions, often with very small lot sizes. This requires frequent changes of the machine parameters. With the Tactic 8 machine changeover times have been reduced by over 50 %."



Echo Hill controls the whole grinding cell, including three robots and the measuring system, via a C6515 Industrial PC and TwinCAT automation software.



With centerless grinding, the workpiece is not fixed, but turns between the fast rotating grinding wheel and the slower rotating, smaller regulating wheel. This technique is used for the production of precision parts for the automotive, aviation or aerospace industries, for example.

Further Information:

www.echohillautomation.com

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