

Race to the Finish:

KOEPFER UPS THE ANTE ON HIGH-SPEED HOBGING

Just eight or 10 years ago, most machines required around 20 seconds to machine armature shafts, but the Koepfer 160 has achieved this in eight seconds for a number of years. Koepfer has managed to cut machining time even further—to six seconds—with an optional workpiece loading capability, which will be offered as a modification to the machine's long-bed version. An extra two seconds per armature shaft goes a long way in terms of the millions of them produced every year.

"The K 160 is designed as a fully automatic machine and is setting new standards, which is partially due to its ingenious loading concept," says Armin



The integral gantry loader with rotating twin-gripper allows for shortest loading and unloading times.



The Koepfer 160 gear hobbing machine is well-suited to manufacture steering pinions with an eight-axis control system and high speeds on both the work and cutter spindles.

Wacker, VP of sales and marketing for Koepfer GmbH in Germany.

"Our K 160 already gives us the fastest manufacturing time for shafts in the world," Wacker says. "The new concept, in which the workpieces are literally 'shot' through the spindle, almost completely eliminates idle/changeover times. It allows us to reduce the machining time for a shaft by yet another two seconds. In other words, we have made the leap from eight to six seconds."

The preexisting model has been redesigned to offer increased workpiece length, and the material handling system now allows much heavier parts. The new concept also includes a new shifting hob head with a maximum hob shift of 160 mm. Programming is now simpler with a full color touch panel, 1 MB of memory and a BWO control that includes conversational dialogue. The BWO is a CNC control commercially available in Germany, and it offers some unique, technical electronic capabilities not readily available on some other controls. New software includes dialogue programming facility, which is an operator friendly, interactive programming for the CNC control.

"What that means is the operator simply answers a series of questions, presented in the computer format with supporting graphics," explains Dennis Gimpert, president of Koepfer America. "And by answering those questions there will be sufficient information for the CNC control to write a traditional CNC program automatically. That is fairly typical today in contemporary controls. When it started 25 years ago or so, this wasn't available on CNC controls and the operator would have to write a block program—it's almost like machine language, so he would have to have a level of expertise to do that. But today, an operator, if he can read a blueprint, can 'program the machine' and the machine writes the program for



The K160 manufactures steering pinions by soft pre-hobbing and hard finish-hobbing (skiving) of the gearing.

him, the true executable program.”

The combined software and drive technology upgrades allow for a degree of precision that previously was only possible with grinding. This makes the K 160 appropriate for machining components with special safety requirements, such as those used in the aerospace industry. The K 160 has a work spindle speed of 1,000 rpm and a maximum cutting spindle speed of 5,000 rpm, which can be increased to 12,000 rpm. Wacker explains the benefits of the increased speed.

“On the one hand, we are not maxing out any of our machines, as we not only want to, but must, ensure they always suit the prevailing customer requirements. On the other hand, tooling manufacturers have—over the last few years—made enormous strides with, for example, coating processes. The much greater wear resistance of today’s tool alloys allows us to increase spindle speeds and cutting speeds. 5,000 rpm is already pretty fast, but we have to be able to increase that when necessary.”

With the standard work spindle speed, users can create armature shafts with four teeth using a 24 mm hob at a cutting speed of 300 m/min. The maximum workpiece length for the standard version of the K 160 is 300 mm, and it has a maximum hobbing length of 200 mm. The long-bed version of the K 160, which is available with the new modifications, has a maximum hobbing length of 480 mm and a maximum workpiece length of 600 mm.

Various Koepfer automation systems are available. They include the integrated gantry loader with flexible workpiece magazines, chain loader and conveyor belt storage section. Another system features a rotating twin-gripper, which provides the shortest loading and unloading times. A high-capacity redistributing storage system is an option that enables the machine to be run a number of hours and is quick to

reset; this accommodates both gears and shaft- or pinion-type components.

Workpieces can be loaded diagonally with a metering hopper that features multiple feeder rails. Another option is an auxiliary tool that can be used for deburring operations, as a vibration dampener, a holder for the sensor that enables the automatic timing of workpieces with hardened gear teeth or for special purpose applications such as live deburring tools. For milling single- and multiple-start worms, an optional worm milling attachment can be fitted to the standard hob head.

“Blowing our own horn is not part of our strategy, but in the K 160, we have the world’s fastest shaft hobbing machine,” Wacker says. “And with the new concept, we shall improve on it even more.”

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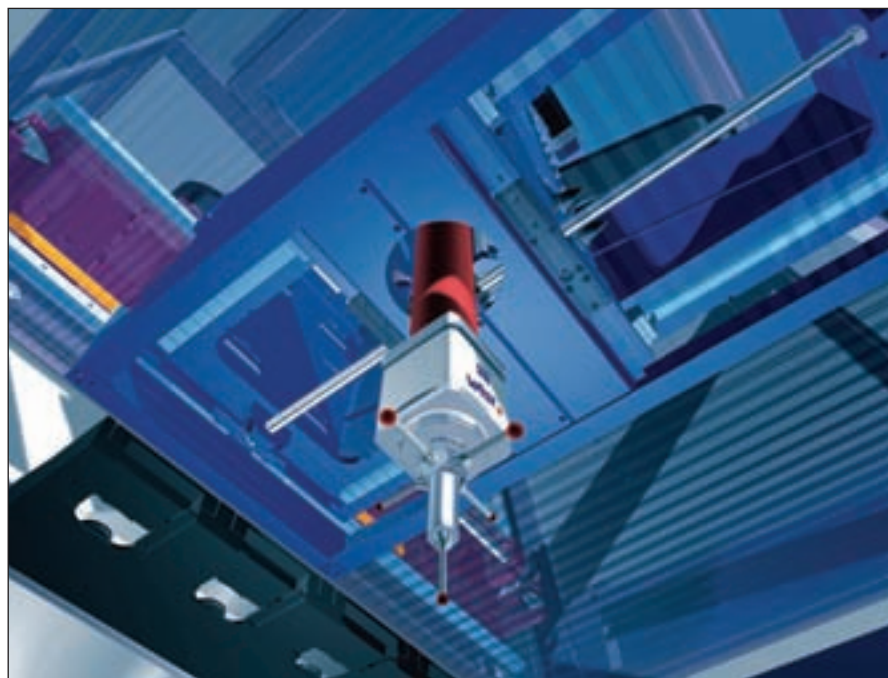


Gage Max Measuring Technology

A GOOD FIT FOR LINDE

Linde Material Handling (LMH), a global manufacturer of forklifts and industrial equipment, originally measured gears with dedicated gear measuring machines. In order to measure the whole gearbox housing on the CMM as well as the gears on the gear checker, the company had to use two machines. Recently, LMH began using its GageMax CMM from Carl Zeiss for measuring gears. With GageMax, the company found a flexible production measuring center that was able to evaluate both parts.

"We have had dedicated measuring machines and therefore are able to compare the capabilities of each machine," says Katja Bleifuss, department of quality assurance at LMH. "With GageMax and *GEAR*



Digital view into GageMax encapsulated 3D Box and VAST XT sensor (courtesy Carl Zeiss).

PRO software, we are able to perform geometry and gear measurements directly in the production area."

With the addition of the *GEAR PRO* software package, CMMs can be used not only for geometrical parts but also for gears, which makes it a more versatile tool for the customer.

"GageMax brings this technology from the measuring lab to the factory floor and adds a big time benefit to the

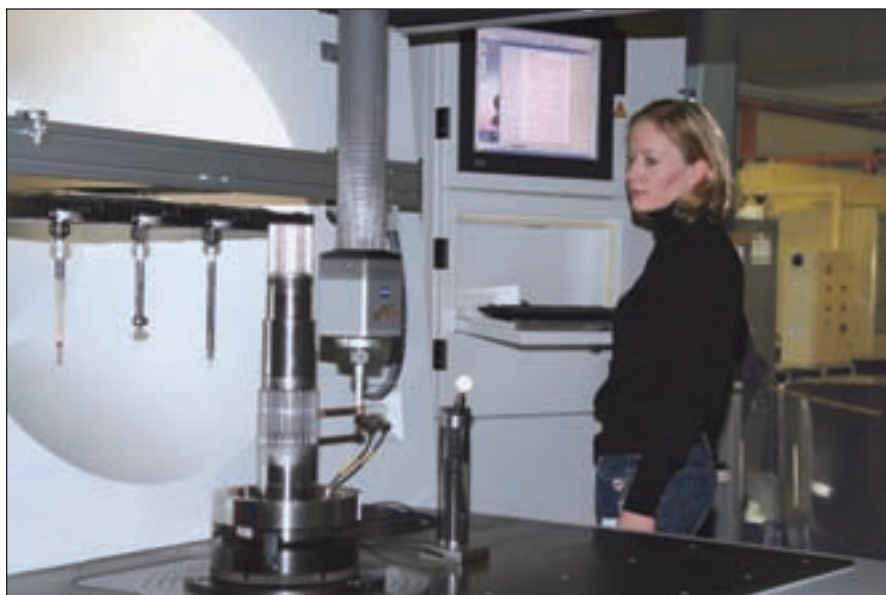
production control process. Now our customer has a tool for getting reliable measuring results for both geometrical parts and all kinds of gears directly in his production line and at ambient temperature—a real shortcut in the control cycle," says Roman Gross, Application Technology, Carl Zeiss.

The *GEAR PRO* software package in combination with GageMax can work under nearly any environmental conditions you might find in modern production, according to Gross.

"This measuring technology is not influenced by environmental factors, such as dirt, heat, cold, vibrations, etc. It is more flexible than dedicated gear measuring equipment in regards to set-up, alignment and size of the workpieces," Bleifuss says.

"GageMax can measure the whole range of parts that is normally checked in the quality lab directly in the production environment. Together with *GEAR PRO* software and eventually an integrated rotary table, it becomes a flexible inline gauging device for all gearbox manufactures," Gross says.

At LMH, the production runs in three shifts; therefore measuring equipment



Katja Bleifuss measures a drive shaft on the shop floor with GageMax (courtesy Carl Zeiss).

must work around the clock. This places special requirements on CMMs and software. Production demands that disruptions are carefully documented. These documents show that the measuring equipment is reliable and has not caused any failures in production.

Quality management is vital at LMH, where measurement results are stored on a centralized server. Employees are responsible for the global quality assurance of the gears and each individual knows the various requirements.

"The user interface can be set up—with images, drawings, etc.—to allow inexperienced users to easily start the measuring programs that have been created offline using CAD models by quality personnel," Bleifuss says.

Gross says that customers in aerospace, automotive and wind energy are all acting globally and want to run the same production process whether they're in North America, Europe, India, China or wherever else the parts are manufactured.

"They want the same quality controls, so they expect the same service and reaction time all over the world. These requirements cannot be fulfilled by a small, regionally organized company,"

Gross says.

LMH has been quite pleased since turning to Carl Zeiss for its gear measuring technology.

"The hardware and software from Carl Zeiss is very flexible, and the company offers customer-specific

solutions. Accuracy and speed of the machines is comparable to our dedicated gear measuring machines. If there are any suggestions or ideas, we communicate these to Carl Zeiss right away," Bleifuss says.

"Some of our other customers—
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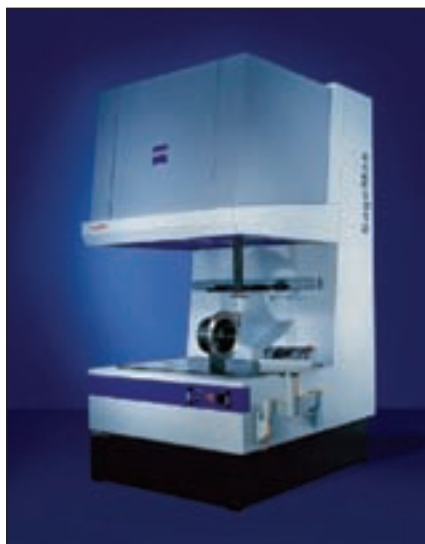
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GageMax offers lower life cycle costs and higher productivity, according to the manufacturer (courtesy Carl Zeiss).



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NEWS

Magna, ZF, Delphi, VW and Ferrari—like this concept as it allows measurement of both housings and gears on one machine directly on the factory floor without losing time for transport to the measuring lab,” Gross says.

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James Engineering

DEVELOPS REPEATABLE DEBURRING SETUP WITH MAX SYSTEM

In 2007, James Engineering focused on two major problems facing the deburring industry. The first involved parts that required more than four operations in a given cycle. The second involved the elimination of part scrap due to non-repeatable setups.

“In the past, the only solution available at the time was to use multiple machines to achieve the desired



The MAX System from James Engineering offers Bi-Plane Tooling Technology (courtesy James Engineering).

throughput,” says James Richards, CEO of James Engineering. “The obvious issue with this is the excessive cost of purchasing, manning and running additional machines along with the tedious process of reconfiguring the tooling.”

While the issue of non-repeatable setups may not seem as obvious, many shops have labor practices that allow operators to leverage the significant investment it makes in training its operators on specialized equipment. As operators either switch jobs or leave a company, they take their machine setup expertise with them, exponentially increasing the chance of parts being scrapped on a regular basis.

“Scrapping of the parts can be a major expense in the wind energy, aerospace, marine and construction industries, where large industrial parts are the norm,” Richards says.

The obvious answer to the problem was to step up to a full CNC control system.

“CNCs offer precise and repeatable paths and positions. Problem is, the

existing machines require significant training and can be cost prohibitive," Richards says.

From the perspective of a tool builder who is required to engineer deburr machines with both a high level of functionality and at a reasonable price, employing a straight CNC just wasn't the answer.

"After exploring many different options, I gathered five veteran programmers together and expressed my vision for a new operating architecture," Richards says, "one that acts like a CNC control that was simple, intuitive, didn't require significant training to operate, could process multiple parts under multiple conditions and would virtually eliminate the hassle of repeat setups."

Following eight months of designing and testing, the result of the exercise is a new machine called the MAX System. The standard MAX System can service up to 23 different parts, each part can have up to 125 operations and there can be one to four tools working concurrently doing sequential operations on a single part during the cycle.

According to Richards, a customer would open the front door, insert the part and press the start button. Once the cycle is over, the part could be removed and replaced with a different part. This is precisely what James Engineering has done with the MAX System, without the cost of a full CNC controller.

"For the end user that utilizes repeatable parts processing, the MAX System would arrive with all of the parts setup preset into the machine," Richards says. "The end user would only need a new setup if they added a new part to the machine, which takes approximately 10 to 20 minutes depending on the number of operations required. Like a CNC, memory is stored forever, virtually eliminating the issues of part scrap and trained operator dependency."

The MAX System's new tool

layout provides two advantages—a larger work envelope with a smaller machine footprint, and the bulk of the tool axes has been removed from the harsh environment. James Engineering has named this Bi-Plane Tooling technology. This technology

is a proprietary, patented, gantry-type system using modular components.

The MAX System is capable of utilizing all four basic types of tooling including grinding media, rotary files, mill cutters and brushing media abrasives. It also has automatic wear

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compensation for each head that it uses. The working pressure applied to the appropriate tool head is also controlled.

"Roughly 90 percent of the deburring industry, even some job shops, do repeat parts manufacturing," Richards says. "In essence, the same group of

parts is processed the same way, over and over again. If this is your process, you want a simple machine to operate that requires virtually no training and minimal to no setup."

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"The Linear 100 is a solution to the demand for precision length measurement on the shop floor," says George Schuetz, director of precision gages at Mahr. "It is the ideal shop tool when the measuring

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requirements go beyond the capabilities of the typical comparative gage. With its fundamentally sound measuring principle and high accuracy readout, in the correct environment the Linear 100 can put sub-micron measurements directly into the hands of the precision machinist."

Features of the Linear 100 include an adjustable 76 x 76 mm (3 x 3 in) measuring table for modifying part position while measuring ODs, and a 4 to 40 oz adjustable measuring force stays constant over the measuring range. A 100 mm x 185 mm (4 x 7.3 in) worktable is responsible for accurate ID measurement. The measuring system is based on the ABBE principle, which determines whether the measuring arm and reference are in line to eliminate cosine errors.

Remastering is unnecessary while performing internal/external measurement and combined internal/external measurement. Measuring anvils are simple to interchange, so part measuring is more flexible. A solid cast body minimizes stresses and twisting error, and the Linear 100 has a digital display that allows users to select ID/OD results and preset values. An RS-232 interface helps transfer output data to PCs, and optional software enables users to move measured values to Windows programs like Excel.

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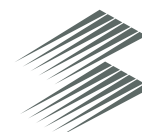
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manufacturing, where up to 95 percent of a solid block of material's weight is removed. They demonstrate twice the rate of removal of comparable carbide end mills, according to Emuge's press release.

"The Alu-Jet-Cut end mills were developed with one intention: to devour aluminum," says Stephen Jean, milling products manager at Emuge Corp. "By incorporating a series of specialized features into one tool, we can present



a tooling solution capable of doubling throughput as quickly and simply as the next tool-change."

The end mills are capable of cutting speeds greater than 3,000 surface feet per minute, and they resist vibrations due to a wear-resistant carbide substrate. A chip conveyor controls chip size and directional flow, which increases chip evacuation capacity and allows for stable operation with full radial engagement at one times diameter depth of cut. The result is 650 cubic inches per minute material removal rates.

Aluminum build-up along the cutting edges is reduced by a polishing process that achieves a higher quality surface. Combined with the shear velocity the tool operates at, the surface reduces the period of heat transfer from chip to tool by as much as 60 percent of other carbide end mills.

The Alu-Jet-Cut end mills come in a variety of corner radii, roughing and finishing designs. Roughing cutters are available with three flutes and finishing cutters with three and four flutes. They are suitable for minimum quantity lubrication.

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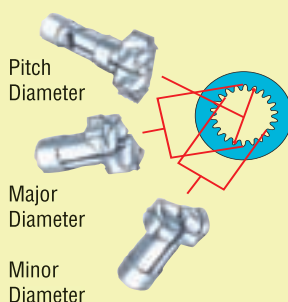
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The Pioneer Plus coordinate measuring machine from Sheffield Measurement, a subsidiary of Hexagon Metrology, features scalable options that include non-contact scanning capabilities and multiple sensor support. Powered by *PC-DMIS* software, the Pioneer Plus offers flexibility and accuracy for applications in aerospace, automotive, job shops and others.

A range of sensors are supported, and several types can be combined in a single system. One of the supported sensors is the ScanShark 4Vix line laser scanning probe, which collects data at 23,000 points per second and can quickly acquire data from geometrically complex parts. The scanner is lightweight and includes software filters for

ambient lighting situations and surface finishes from chrome to glossy black; spray-on coating is unnecessary.

Also supported is the CMM-V vision sensor, which measures large and small parts without contact. It can measure hole diameters, edge contours and miniature

features that a touch-trigger stylus can't define easily. The sensor operates as an extra supported probe inside the *PC-DMIS* software, so contact and vision features are programmed and inspected in one program.

The high-accuracy LSP-X1
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analog scanning probe head is the best fit for gear measuring, according to Bill Fetter, director of marketing and communications for Hexagon Metrology. It features all standard probing modes from single point probing and self-centering to continuous high-speed scanning for form and profile

measuring.

"The LSP-X1 sensor supports continuous touch analog scanning for three-dimensional gears, and the CMM-V could be used for geometry of gears that have a relatively loose specification and are mainly two-dimensional, such as plastic gears," Fetter says. "The

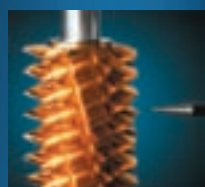
advantage of using a CMM-V would be you could quickly inspect a large quantity of small gears laid out on a table. The fact that you can combine both sensors on the same machine with the same software means you have a much more flexible system because you have a CMM that can inspect other things besides gears (think gearboxes), plus the ability to check gears. This capability can deliver a better return on investment than a single-purpose gear checking machine."

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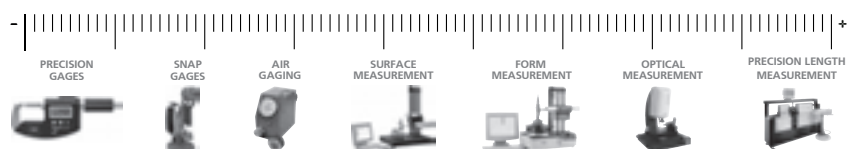
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diameter less than 1 mm.

The Mida Laser 75P uses an RS232 serial communication port for exchanging data during the measuring cycle to increase accuracy and repeatability results in harsh conditions, retrofit more simply without an M-code and to facilitate correct installation check and troubleshooting. This is in addition to the system's standard parallel I/O.



Uses of the Mida Laser 75P include tool identification, tool breakage detection, pre-setting of unknown tools, tool dynamic length and diameter measurement, tool wear compensation, tool cutting edge profile integrity verification and machine axis thermal drift compensation.

For more information:

Marposs Corp.
3300 Cross Creek Pkwy.
Auburn Hills, MI 48326
Phone: (248) 370-0404
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Honing Tools

LAST FIVE TIMES LONGER

The MMT superabrasive and diamond honing tools from Sunnen are factory-qualified to produce micron-level accuracy, and they are custom designed for fast metal removal and long

life. High-volume, precise honing is achieved with minimum burr condition. The MMT tools can be used for demanding parts, such as pinion gears, fuel injector barrels, piston pumps, cartridge valves and gun barrels.

The body and feed wedge of the tools

are precision machined from hardened tool steel. According to Sunnen, they typically last five times longer than conventional tools and reduce per-part cost by 30 percent. Accuracies of 0.0006 mm are achieved for diameter, roundness, straightness and taper. The

continued

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MMT metal-bond honing mandrels are available for bore sizes 4 to 65 mm (0.157–2.56 inches), and larger sizes are available for special orders.

The MMT tools are custom made for every application with a unique part number based on width, length,

expansion angle, number of stones and placement of stones. Options include one- to 12-stone versions for metal-bond diamond or CBN superabrasives. The honing stones are held in place by retention springs, and there is no need for truing because a factory verification



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allows the tools to produce parts right out of the box.

The MMT honing stones can be replaced under the Sunnen precision reload program or the field reload program. Precision reloads for high-tolerance honing are brought back to the factory, and the stones are fitted to the stone slots, cylindrically ground to specification and returned to customers. The field reloads are installed by customers as a drop-in replacement, so the assembly is designed to have clearance to the stone slot, and they are appropriate for honing applications with tolerances in the 0.008 mm (0.0003 inches) or greater range, such as pinion gears or connecting rods.

For more information:

Sunnen Products Company
7910 Manchester Avenue
St. Louis, MO 63143-2793
Phone: (314) 781-2100
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