Drive & Control
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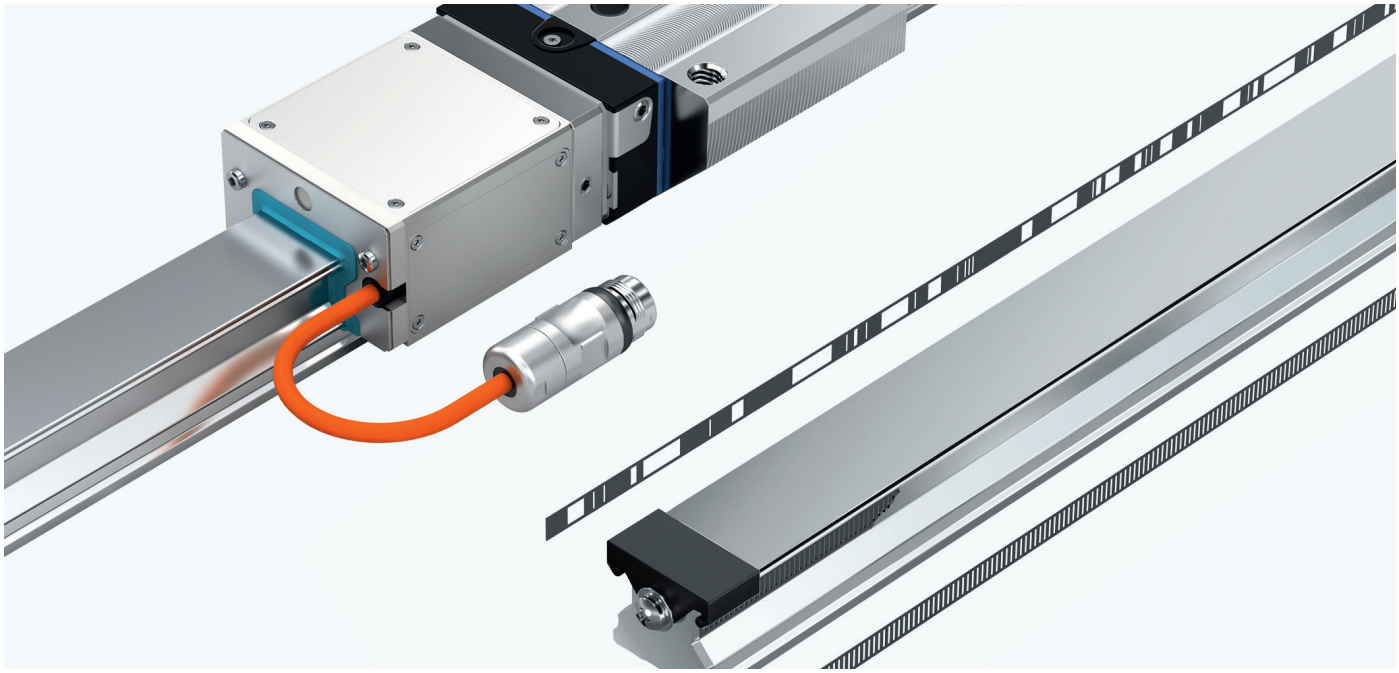
Technical Article

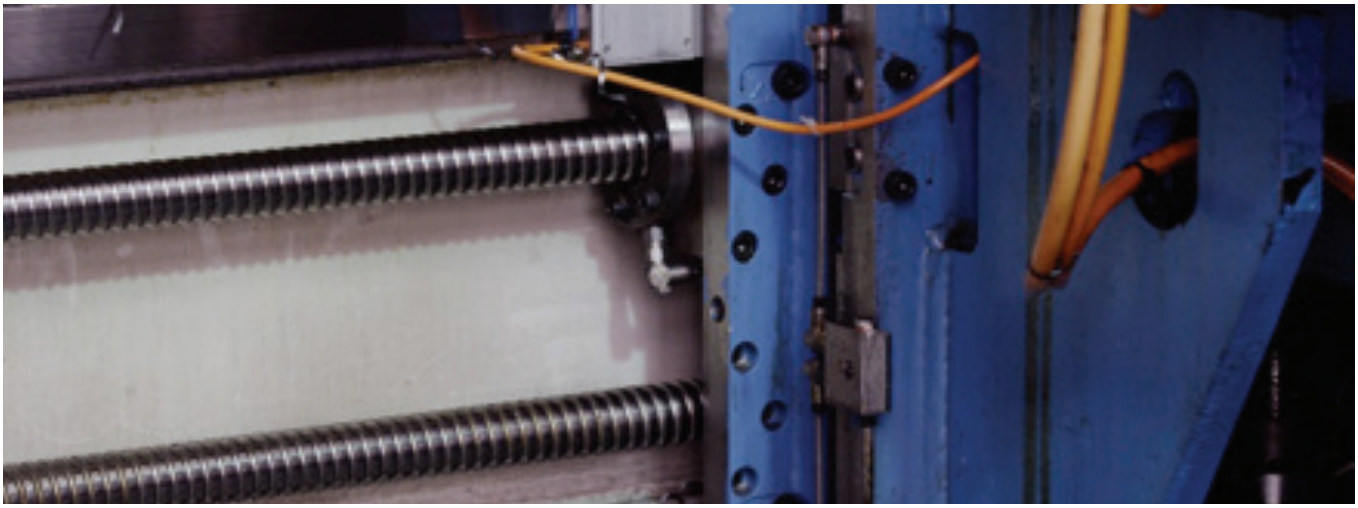
Integrated Measuring Systems (IMS) save costs over the entire machine service life



Replacing glass scales saves on costs at Bosch Rexroth plant in Schweinfurt. IMS-A Absolute Measuring System with absolute and incremental encoded scales.

In virtually every metal machining sector and application, accuracy requirements are increasing constantly. This also increases the degree of accuracy required of linear motion technology and measuring systems. To meet this challenge, Bosch Rexroth has been using its maintenance-free IMS measuring system in all new and upgraded machine tools at its plant in Schweinfurt for more than two years. In terms of maintenance costs and machine uptime, IMS has saved tens of thousands of euros in costs during the first two years compared to the glass scales that were previously in use. Machine manufacturers benefit from IMS, too. With its compact design and easy integration, IMS not only decreases system and assembly costs for machine OEMs; it also allows them to offer enhanced machine performance to their customers.

At its Schweinfurt plant, Bosch Rexroth manufactures high-precision profiled rails, runner blocks, ball screw drives, other linear motion components and entire linear motion systems. The accuracy demanded here is high. Only by meeting minimum tolerances in production has Rexroth been able, for many years, to ensure the interchangeability that allows users to combine any type of profiled rail and runner block that are the same size. In the highest accuracy class, UP, the accepted height and parallelism tolerances over 1,000 mm



IMS-A Integrated Measuring System complete assembly lowers lifetime costs through minimized maintenance.

for the profiled rails are both just three micrometers.

This reproducible quality in mass production requires highly precise machine tools with measuring systems that are just as accurate. Until 2014, Bosch Rexroth relied exclusively on optical position sensors for its metal-cutting manufacturing equipment, such as for its profilers, surface grinders and drills. While these sensors achieved the necessary height accuracy, they were very expensive over long distances, generated regular maintenance costs and, in some cases, caused unplanned machine downtime.

Wear-free and with a repeat accuracy of +/- 0.25 µm

That all changed with the IMS integrated measuring system, which comes in incremental (IMS-I) and absolute (IMS-A) versions integrated into the linear guides. The integrated measuring system detects the absolute position of the axis down to +/- 3 µm/m. The IMS is resistant to vibration, shock and magnetic interference. Since the IMS uses induction measurement, it is wear- and maintenance-free. Thanks to the total integration of sensor technology and onboard electronics in the ball and roller runner blocks, design engineers can avoid external measuring systems and sealing air systems, saving both cost and installation space.

Even in work areas with metalworking fluids, dust, shavings and other contaminants, the IMS does not require elaborate, energy-intensive, high-maintenance air sealing systems thanks to its IP67 protection rating. Even electrical and magnetic interference do not affect performance. Position resolution is up to 25 nm. This extremely high resolution creates the conditions for excellent control loop dynamics and, with it, short cycle times. System accuracy is equal to that of glass scales. This means a repeatability of +/- 0.25 µm is possible.

No more maintenance needed

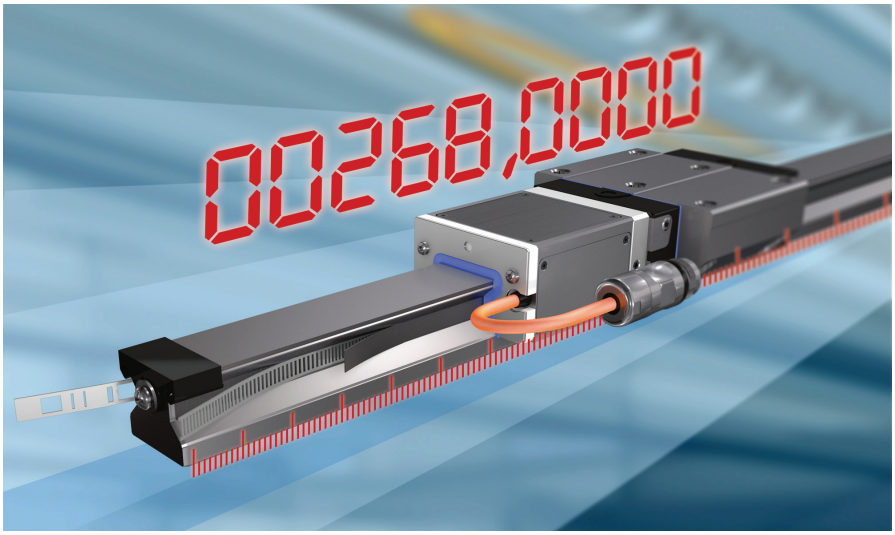
Since the precision is the same as that of an optical system, the crucial comparison comes from the actual costs of the IMS over the machine's service life. Bosch Rexroth in Schweinfurt records all operating and maintenance costs for all machines over their entire service life, then analyzes them systematically. The result of switching from optical measuring systems at the Schweinfurt plant back in March 2014 to the IMS is both clear and convincing. Introducing the integrated measuring systems factory-wide has saved the company tens of thousands of euros.

One reason for this is that regular maintenance is no longer necessary. For quality purposes, Bosch Rexroth had to test the measuring signal of all previous optical systems once per year. Such testing could only be conducted during breaks in production and was relatively involved, since each machine had up to four measuring systems.

Even encapsulated optical systems would still introduce contaminants. This is why Rexroth servicing crews would remove, clean and, if necessary, replace the glass scales every two years. This alone generated four-figure costs per measuring system.

Hours of downtime with glass scale systems

However, the highest costs associated with conventional systems are production downtime costs generated from having to replace damaged or worn glass scales. This unscheduled downtime tied machines up for hours. Aside from just physical removal and re-installation, the measuring system also had to be realigned and recalibrated. In highly dynamic applications, such as in laser-cutting systems, failure is not the only thing that can cause downtime. A contaminated measuring system is enough and production can resume only after a painstaking cleaning.



High measuring accuracy even under harsh metalworking conditions increases machining quality and surface quality.

Not one failure in two years

The experience Rexroth has gained over two years with the IMS speaks for itself. For one, Schweinfurt has not experienced a single instance of machine downtime that could be traced back to the integrated measuring systems – and no maintenance was required. Even if a failure were to occur, a repair would take an hour at most. Each component, i.e., rail, runner block with adapter plate, and scanner, can be replaced individually.

The interchangeable design offered by Rexroth ensures even less effort. All runner blocks of the same size fit onto all rails of the corresponding size without any restrictions. Replacement is as easy as pulling the scanner off and sliding a new one onto the rail. The IndraMotion MTX CNC controllers instantly detect the new measuring systems, and technicians do not have to align or configure anything. With DRIVE-CLiQ*, HIPERFACE**, FANUC*** and SSI interfaces for IMS-A, and 1Vss and TTL interfaces for IMS-I, the measuring systems integrate seamlessly into a wide range of automation systems.

Less operating costs without sealing air

In addition to substantially reducing maintenance costs, the integrated measuring systems also lower operating costs. The sealing air often required for encapsulated systems is no longer necessary. Aside from the energy costs, users also have to take into account how clean and oil-free sealing air has to be for highly sensitive glass scales. This, in turn, increases both processing and maintenance costs, since the necessary oil separators and particle filters have to be cleaned or replaced regularly.

For more information, go to:
www.boschrexroth.com/press and
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