Control systems for engraving and milling systems

Technical applications become all the more powerful, the more extensively and precisely their development is oriented to the user's requirements. For the machine manufacturer, it is therefore important to find a control systems partner that is intensively involved in the end customer's world. By the same token , for the control systems supplier innovation is particularly fostered if the supplier can develop new, application-oriented control system strategies with a cooperation partner from the field of machine construction. For ECKELMANN, PASO Präzisionsmaschinenbau GmbH is such a partner. For use in new engraving and milling machine, proven ECKELMANN CNC technology was expanded by application-specific function in close cooperation with the engineers at PASO GmbH.

PASO Präzisionsmaschinenbau GmbH, once Profigrav, in Herzberg am Harz, manufactures precision milling and engravng systems. The product palette ranges from compact engraving machines for sign and stamp production through universally applicable milling systems for rational tool and mould construction to the high-tech range of powerful high-speed milling machines.

Innovative machine and CNC technology for first-rate milling quality

For flexible use when engraving and milling spatial geometries with maximum demands on machining quality, PASO is now launching the new PS700-RTCP machine series on the market. The model with three linear and two swivel axes achieves a positioning accuracy of +/- 2µm with an axis resolution of 0.12µm or 0,5µ°, and offers an operating range of 700mm x 650mm x 350mm. In the present case, spindle output amounts to 3.4 kW at a maximum of 40,000 rpm. The speed of the linear axes ranges up to 20 m/min. What is more important for a high machining speed with maximum production quality, though, is optimum coordination of the drive and control systems.

The ECKELMANN E•CNC20 used operates with an interpolation cycle of 0.5 ms and features the corresponding processor and storage capacity to be able to guarantee absolutely uniform and fast machining, even in the event of complicated three-dimensional contours. Specially programmed five-axis transformation (see right-hand side) ensures highly dynamic distortion-free milling and engraving.

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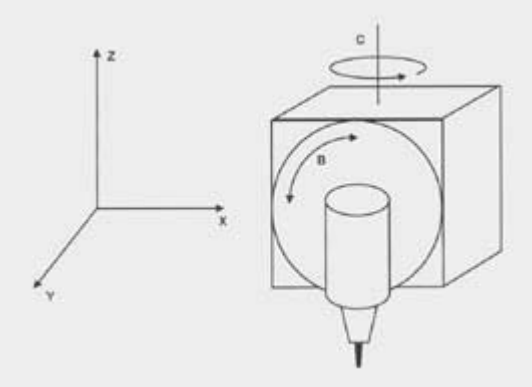
Automatic clamping compensation operates by means of a mechanical 3D probe which communicates with the control system by means of an infrared transmitter. The machine consists of a solid gantry design and features gauge pressure ventilation, which protects the guidance system from soiling. The reduced-quantity spray unit ensures optimum cooling of the workpiece.

Five-axis transformation for distortion-free milling



Precise distortion-free milling of spatial contours is only possible if the tool axis is placed approximately vertically on the workpiece surface. This means that, in the event of curved surfaces, the tool must be moved by a swivel motion about two rotation axes to arrive at the normal position with respect to the machining surface. Typical applications for these cutting conditions are profiling of curved tyre covers or engraving curves metal surfaces, for example. For a given path of the tool tip, the five-axis transformation programmed by ECKELMANN results in an automatic compensating motion of the linear axes if corresponding motion of the rotation axes is necessary to correct the normal position. Thus, with a swivel angle of +/- 90° about the B axis and +/- 180° about the C axis, the tool can be positioned at any time at the optimum angle for cutting. The NC program simultaneously supports automatic tool length offsetting. This innovative transformation process is also known by the name of Rotating Tool Center Point (RTCP).

In conjunction with the high interpolation frequency of the CNC20, thanks to this process the PS700-RTCP achieves a constantly high machining rate, even when it comes to curved workpiece surfaces. If required, ECKELMANN also offers the axis transformation described for the simultaneous control of six axes.

Precision from development to commissioning

The high-grade realisation of all mechanical and electrical components and well thought-out coordinate of the machine and control hardware and software guarantee the above-average precision of the PS700-RTCP, even at high machining rates. To ensure that this quality benefits the final customer to the full, PASO GmbH places great value on conscientious acceptance testing of its machines. Thus, among other things the guidance systems are measured in all planes by means of an autocollimator system and are adjusted to a flatness accuracy of <5µm. From cooperative development to commissioning, PASO and ECKELMANN stand for an effective and application-oriented engineering service to the end customer's technical and economic benefit.

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