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**CNC Multi-Spindle  
Automatics**

Series **PC**





**W**ith the multi-spindle automatics of the PC series Schütte provides its users with a highly efficient production tool that manufactures complex turned parts of the highest quality at the right price.

**T**he exceptional flexibility of the machine ensures that the production of small and medium sized component batches enjoys the same advantages the multi-spindle auto offers mass production. The range of functions provided by the PC goes



far beyond turning. In many cases it allows complete-machining of the workpiece, including a variety of threading and milling operations, polygon turning and off-centre drilling. The same applies to the rear of the workpiece.

**T**he ongoing development objectives of Schütte are to increase flexibility and operator comfort and to improve workpiece quality. For this very reason the PC series of machines combines tried and tested design features with new, innovative manufacturing and control system technology:

- The machine base and spindle housing are made of a cast mineral compound with impeccable credentials in system damping and thermostability. The outstanding vibration damping properties are the basis for improved surface finishes and extended tool life.
- The high-precision spindle drum is locked with a hydraulically operated, three-part Hirth coupling. The positive locking mechanism ensures great stability and repeat-accuracy positioning, both crucial preconditions for the manufacture of precision components.
- The hydraulic drive units are overload-protected to cope with crash situations. Their outstanding vibration damping properties



*The very sturdy hydraulic endworking slide drive with linear measuring system and control valve*

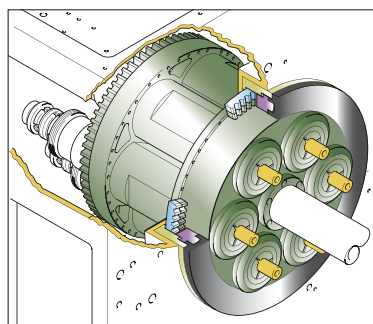
help to maintain the integrity of the control loop during dynamic operations. The force-density created by the compact machine design provides a further advantage.



*Drive housing with hydraulic endworking slide drives*

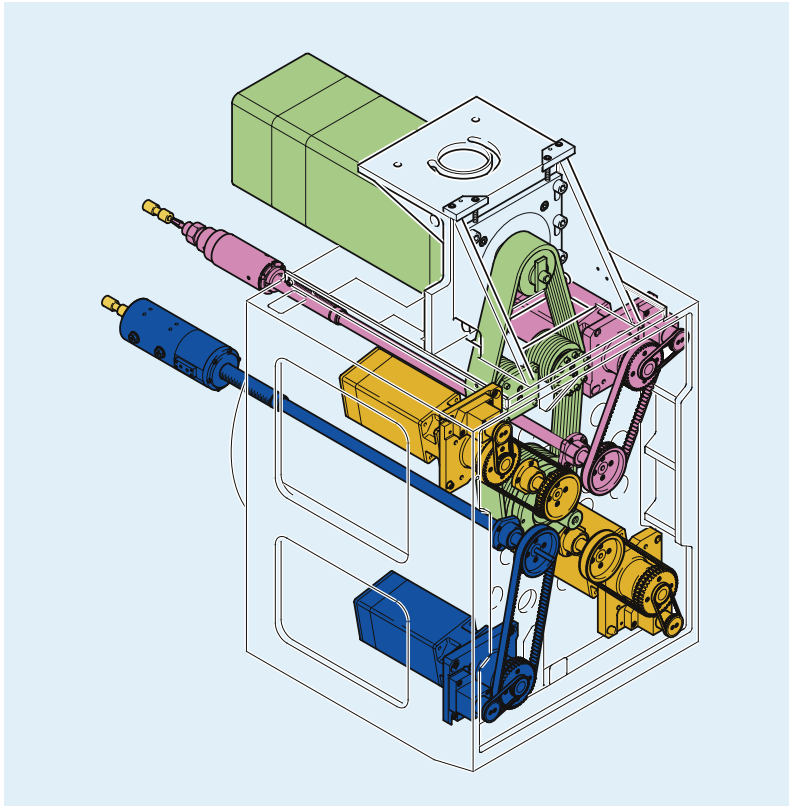


*Spindle housing with drum and guide tube, cross slide support brackets and some of the slideways*



*Spindle drum with Hirth coupling, locked in the spindle housing*

- All spindle, feed and indexing drives are digitally controlled – a factor that guarantees high-quality control and benefits the contour integrity during copy turning, the surface finish of polygon turned flats and the quality of chased threads.
- Endworking and cross slides are equipped with direct position feedback systems of 0.1  $\mu\text{m}$  resolution that ensure the accurate positioning of all slides – an important design feature when diameters of the highest precision are machined.
- A hydraulic oil cooler ensures that the temperature of the feed drives is well balanced and temperature growth is reduced. A correspondingly dimensioned heat exchanger for the coolant ensures that a uniform temperature is maintained throughout the tooling zone.
- The ergonomically designed control interface – adapted to suit Schütte multi-spindle autos – offers maximum programmer and operator comfort. Both machine and external workstation can be used for tool management operations, predefined program runs and automatic cycle time calculations.



*The variable tool drive allows for tool spindles to be driven at a speed different from that of the work spindle. If required, the drive shaft can be stopped.*



*Auxiliary drive units for the speed-controlled direct drive in selected spindle positions.*

**T**he demands made on multi-spindle automatics are manifold: the complete-machining of workpieces requires the integration of a variety of manufacturing processes and the machining of difficult, high-tensile materials calls for a flexible machining technology. But more than anything else, there are the persistent demands for maximum productivity and precision.

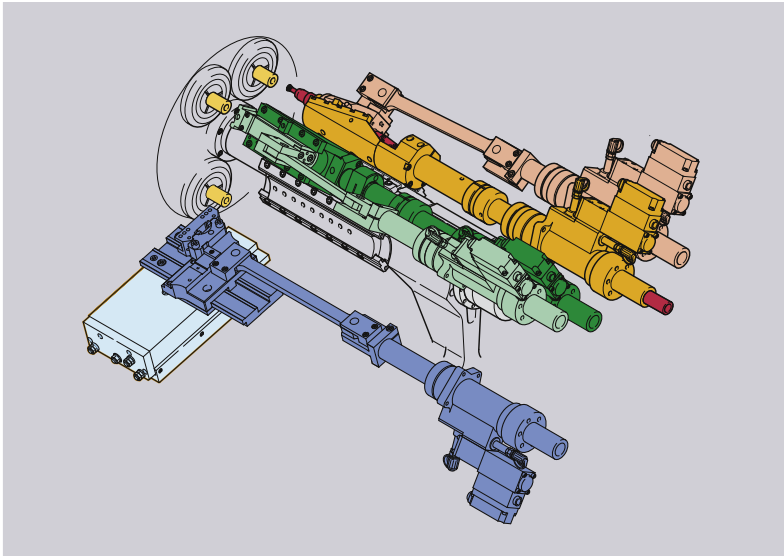
**S**chütte has met the wide ranging demands that are made on the modern production engineering environment, with a flexible, modular machine design.

### Drives

**A** powerful central drive provides every spindle with sufficient power to carry out heavy, time-optimal roughing operations using the plunge-cutting or the plunge-and-longturning method. Even large bores requiring tremendous feed forces and high torque rates present no problem for the powerful spindle and feed drives.

**I**f the spindle has to be stopped in a certain position, or where C-axis operations are required, Schütte provides auxiliary drives that allow speed-controlled spindle operations. This also helps to optimise machining technologies and cycle times, for instance through the selection of constant cutting speeds for face turning operations. Auxiliary speed units can be mounted in every spindle position.

**T**he tool spindle drives consist of play-free, speed-controlled, belt-driven motors, which - complemented by the high quality of work spindle and feed drive controls - allow operations like rigid tapping to be carried out. As a cost-effective alternative, the tool drives can also be controlled via central shaft and change gears.



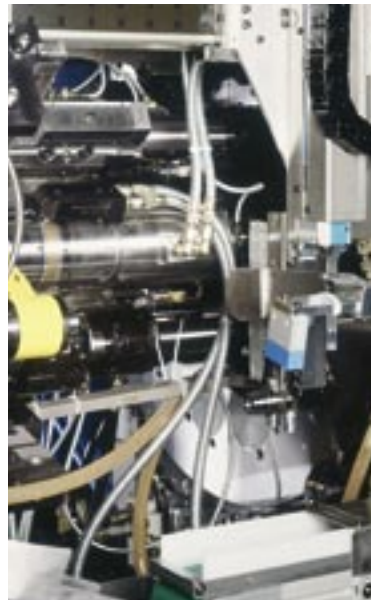
*Compound slides can be mounted on all endworking and cross slides and permit the machining of internal and external contours with simple standard tools.*

*A workhandling system removes the workpieces undamaged.*

## Compound slides

**C**ompound slides can be mounted on all endworking and cross slides. Typical applications include contour turning and thread chasing operations. Any number of rotation-symmetric contours - such as tapers, spherical shapes, undercuts and transition radii - can be machined internally or externally. The contour elements are freely programmable, machined with standard tools and of high contour integrity and precision.

**C**ompound slides are also used in conjunction with driven tools, for instance for polygon turning opera-



tions (in steel) that employ the long-turning method, as well as for milling and off-centre drilling operations. The use of compound slides also brings greater ease to the positioning of frequently changing cutting tools and attachments, as it can be done by the machine control.

## Auxiliary equipment

**T**he PC series offers a wide range of auxiliary attachments with which the machine can be equipped to suit particular requirements. This includes:

- pick-off spindles with precision chucks
- drilling spindles, endworking, with HSK standard adapter and (on request) a coolant supply of max. 100 bar, for deep-hole drilling operations, etc.
- a cross drilling attachment with (on request) angular swivel head
- a polygon turning attachment with variable speed drive
- a milling attachment for slot milling operations, using side-and-face milling cutters
- a tried and tested toolholder system for preset changeover WS400
- a workpiece handling system, for the safe removal of the finished components

**T**he flexibility in combining drive units, auxiliary equipment and tooling systems ensures that every machine can be configured to suit a particular, customer-specific production requirement. Building on the selective, cost-effective original investment, the scope of the machine can, at a later date, be extended with a retrofit to suit changes in production requirements.

### The control system

**T**he many uses to which a multi-spindle automatic with 40 or more CNC axes can be put makes considerable demands on the control system, especially if one does not want to limit operation and programming to the specialist.

**N**ew ground has been broken in the following areas:

- The control platform is a fast, powerful industrial PC that contains all the hardware components required to cope with such a multitude of functions. It is supported by an operator-friendly flat screen console of ergonomic design.
- The PC can be expanded to form a decentralised system. This expansion is made considerably easier by the Profibus that serves the communication with axes, sensory equipment and actuator technology.
- It is all made possible by the use of an operating system (Windows 2000, XP) that combines CNC and PLC as its basic software and runs it on a single system. Project planning and diagnostics tools for PLC or axis service and, of course, the tele-service, are already part of the standard equipment.



- Based on the Microsoft operating system, Schütte has created a technology and user interface that brings to the fore the typical features of a multi-spindle automatic: camshaft, trip dog controller and special canned cycles.

*The multi-spindle autos of the PC series are operated via a flat screen console that can be swung to either side of the machine, thus providing the operator at all times with access to all the operating elements at the best suitable location.*

- 1 Menu "Machine Parameters": This is where all data for spindle positions and slides is entered.



- 2 And it goes on. The menu "Spindle Position Configuration" serves to select and program spindle drives and slides.



This is followed by the decision, spindle position by spindle position and slide by slide, as to which type of programming to use:

- 3 Schütte cam programming: predefined cam types – only a very few parameters to be entered –



- 4 or NC-ISO programming with program forms to be completed.



## Operation and programming

The user-friendly operator interface "SICS 2000" is organised around operating modes and operating areas. Connected processes are combined in relevant menus.

Programming and optimisation follows the technological process and are easily selected and carried out spindle position by spindle position. The generation of machining programs is made easier with the access to a number of canned cycles (similar to the former use of cams), including visualisation of the motion sequence and the query of input parameters. As an alternative, the programmer may also use the typical DIN-ISO programming language or a combination of both to generate his machining programs. Selection of the various types of tools and their incorporation into the NC program is just as easy. As soon as the whole of the machining process has been defined, the cycle time can be computed and the motion sequence graphically displayed.

This software is also available as a stand-alone version, to be used as a programming tool on an external PC workstation.

Machine type	A 36 PC	S 36 PC	S 51 PC
Max. bar capacity			
standard, round ..... mm	36	36	51
square ..... mm	25	25	36
hexagon ..... mm	30	30	44
Max. bar length ..... m	4	4	4,2
Swing diameter ..... mm	358,2	300	340
Bar feed-in ..... mm	115	115	140
Endworking slides			
Endworking slide travel (position) ..... mm	145 (I...VI, VIII)	145 (I...V)	175 (I...V)
Endworking slide travel (position) ..... mm	250 <sup>2)</sup> (VII)	250 (VI)	280 (VI)
Max. endworking slide speed ..... m/min	25	25	25
Measuring system resolution of endworking slide ..... µm	0,1	0,1	0,1
Max. feed force endworking slide ..... N	4500	4500	8000
Diameter of concave cut-out on endworking slide ..... mm	112	112	112
Slide travel for rear side machining ..... mm	130	130	130
Auxiliary endworking slide drives			
Number of auxiliary endworking slide drives .....	14	10	10
Traverse of auxiliary endworking slide drives ..... mm	145	145	175
Max. speed of auxiliary endworking slide drives ..... m/min	25	25	25
Measuring system resolution of auxiliary endworking slide drives ..... µm	0,1	0,1	0,1
Max. feed force of auxiliary endworking slide drives ..... N	4500	4500	8000
Cross slides			
Cross slide travel (position) ..... mm	80 (I, II)	90 (I...V)	100 (I...V)
Cross slide travel (position) ..... mm	70 (III...VIII)	70 (VI)	70 (VI)
Centre height cross slide ..... mm	60 (I...VIII)	60 (I...V)	60 (I...V)
.....	-	35 (VI)	35 (VI)
Max. feed force cross slide ..... m/min	20	20	20
Measuring system resolution cross slide ..... µm	0,1	0,1	0,1
Max. feed force cross slide ..... N	4500	4500	6000
Spindle speed (infinitely variable) ..... min <sup>-1</sup>	560...4000	560...4000	335...3000
Idle time, standard ..... sec	1,2	1	1,5
Power rating drive motor ..... kW	28	28	28
Nominal pressure in HP circuit ..... bar	100	100	100
Dimensions			
Length ..... mm	5830	5780	5900
Width ..... mm	1900	1576	1766
Height ..... mm	2580	2400	2550
Weight of machine ..... approx. kg	8500	7500	9300
Weight of auxiliary units <sup>1)</sup> ..... approx. kg	2500	2200	2700

<sup>1)</sup> switchgear cabinet, hydraulic pack, bar guide, swarf removal system and coolant plant  
<sup>2)</sup> alternatively also in positions III, IV and VIII

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