S21

The Greatest
for small workpieces.

Key data

The S21 is a cylindrical grinding machine for small workpieces in individual, small batch and mass production.
It has a distance between centres of 400 mm and a centre height of 125 mm.
It can machine workpieces with a maximum weight of 30 kg.

STUDER

Fritz Studer AG

The name STUDER stands for more than 100 years of experience in the development and production of precision cylindrical grinding machines. «The Art of Grinding.» is our passion, highest precision is our aim and top Swiss quality is our benchmark.

Our product line includes both standard machines, as well as complex system solutions in high-precision cylindrical grinding for machining small and medium-sized workpieces. In addition we offer software, system integration and a wide range of services. As well as receiving a complete tailormade solution the customer also benefits from our 100 years of know-how in relation to the grinding process.

Our customers include companies from the machine tool industry, automotive engineering, tool and die makers, the aerospace industry, pneumatics/hydraulics, electronics/electrical engineering, medical technology, the watch industry and job order production. They value maximum precision, safety, productivity and longevity. 24 000 manufactured and delivered systems make us the market leader and are clear evidence of our technological leadership in universal, external, internal and noncircular grinding. Around 800 employees, including 75 apprentices, make it their goal every day to ensure that «The Art of Grinding.» will continue to be closely linked to the name STUDER in the future.

S21

If you want to get big results with small workpieces, you can rely on the S21. As a versatile universal cylindrical grinding machine the S21 is suitable for grinding small, high-precision workpieces e.g. for aviation, precision mechanics, hydraulics or pneumatics. Thanks to the high-resolution B-axis of 0.0001 deg you can grind cylindrical and conical parts in a single clamping, saving changeover time.

Characteristics

Dimensions

- Distance between centres 400 mm (15.7")
- Centre height 125 mm (4.9")
- Grinding wheel diameter 400 mm (16")

Hardware

- Turret wheelhead with the option of:
  - manual swivel 2.5 deg
  - automatic swivel 1 deg
  - high-resolution B axis 0.0001 deg
- Frequency-controlled motor-driven grinding spindles for external and internal grinding
- C axis for the workhead enabling form and thread grinding
- Full enclosure with two sliding doors
- Granitan® S103 mineral-casting machine base

Software

- Extremely easy programming with StuderPictogramming
- StuderGRIND programming software for producing grinding and dressing programs on a PC
- Reduced setup and resetting times with STUDER Quick-Set
- Standardized interfaces for loader and peripheral devices

The Greatest for small workpieces.
The versatile universal cylindrical grinding machine is designed for grinding small workpieces in customized as well as small and large-batch production. It is produced in series, is expandable and can be adapted precisely to the demands made on it: this flexibility guarantees an optimal price/performance ratio. The solid Granitan® S103 machine base forms the basis for a cylindrical grinding machine that is equipped with high quality components, thus guaranteeing maximum precision, performance and reliability over many years.

The full enclosure allows the use of emulsion or oil as a cooling lubricant, and its two large sliding doors make the machine room easily accessible and convenient for setting up. Handling devices that ensure automated production around the clock can be connected via the defined loader interface.

The practical STUDER grinding software with its proven StuderPictogramming allows even less experienced users to quickly optimize the potential of this machine. The StuderGRIND software is also available; this enables efficient programming of special applications, such as form and thread grinding. The systematic development, production, assembly and testing of STUDER products are carried out in a process-oriented manner and in strict compliance with the VDA 6.4 and ISO 9001 directives.

Granitan® S103 mineral-casting machine base

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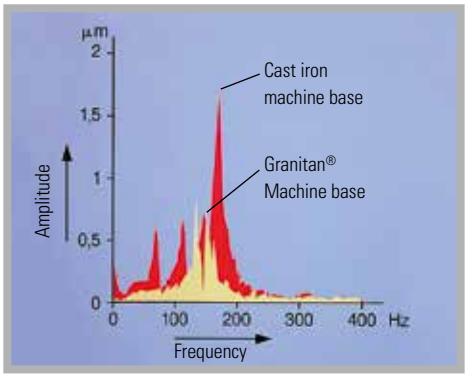

- Vibration-damping
- Thermal stability
- Non-wearing

The material structure developed by STUDER and which has proved its superb efficiency over many years is produced in the company's own plant using the most modern industrial techniques.

- The excellent dampening proprieties of the machine base ensures outstanding surface quality of the ground workpieces. The service life of the grinding wheel is also increased, leading to reduced downtimes.
- Temporary temperature fluctuations are extensively compensated for by the favorable thermal behavior of Granitan®, resulting in high dimensional accuracy at all times.
- The V and flat guideways for the longitudinal and cross slides are moulded directly into the machine base and are provided with a non-abrasive Granitan® S200 slideway coating.

The patented knobbed structure of the guideways largely eliminates the slip-stick effect or floating of the slides observed on conventional guideways. The guideways offer the highest-possible accuracy through the entire speed range with high load capacity and dampening levels. Thanks to the robust and maintenance-free design, these excellent guideway characteristics are more or less completely retained.

1 Machine bed with longitudinal and cross guideways
2 Guideways with patented surface structure
3 Vibration behavior of gray cast iron and Granitan® S103

Longitudinal and cross slides

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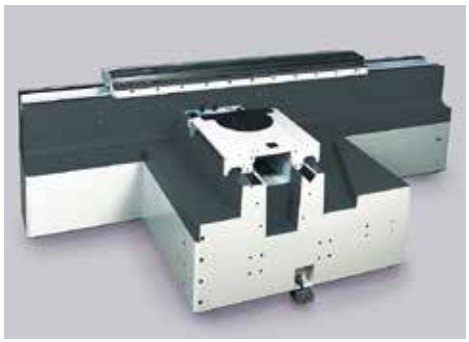

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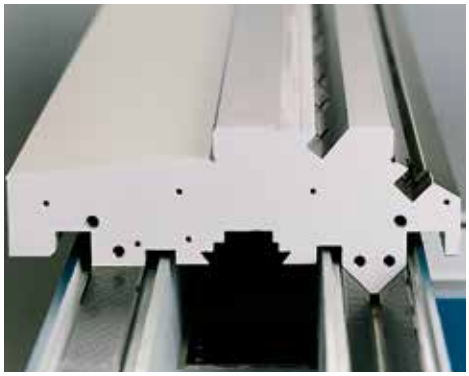

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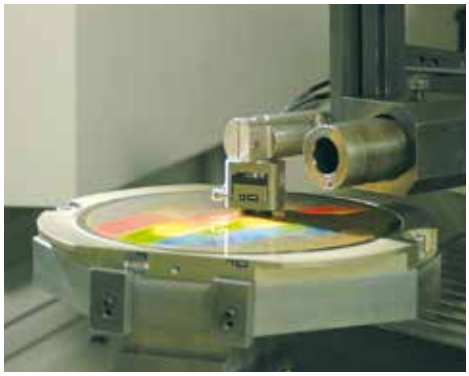

- Auxiliary scale for setup and resetting
- Effective covering of the guideways

The longitudinal and cross slides are manufactured from high-quality gray cast iron and have highly precise, ground V and flat guideways, with the distance between the guideways optimally suited to the machine's overall rigidity. The slides rest completely on the guideways of the machine bed through the entire speed range. This provides the cornerstone for the excellent inherant grinding straightness of 0.002 mm (0.000,08") over 400 mm (15.7") measured length. The slides are advanced by 40 mm (1.6") diameter circulating ball screws connected to a three-phase servomotor via torsion-resistant, bellow-type couplings. These axes achieve high process speeds, on the one hand, while on the other hand the short auxiliary times also guarantee maximum precision with in-feed movements of 0.0001 mm (0.000,004"). These axes can be equipped with rotative or linear measuring systems, depending on requirements.

The top of the longitudinal slide has a surface that is ground over its entire length and acts as a support for the workhead, the tailstock, as well as accessories and devices. A setup scale, recessed in the table, makes it easy to set up and reset the position of workhead, tailstock and ancillary equipment. An additional T-slot with ground surface enables optimal utilization of dressing devices.

1 Machine base with longitudinal and cross slides
2 Setup scale
3 T-slot and clamping surface for mounting dressing tool holders etc.
4 Grid measurement

Turret wheelhead

1

- Complete machining
- Motor spindles
- High cutting speed of 50 m/s

The swiveling wheelhead enables the external, internal and form grinding of workpieces in a single clamping. The wheelhead is equipped with a water-cooled, maintenance-free motor-spindle mounted on roller bearings, with infinitely variable speed control. External grinding wheels with a diameter of 400 mm (15.7") and a width of 40 (50 F5) mm (1.5"/2") are fitted to the shaft ends. Efficient high-frequency spindles with an external diameter of 120 mm (4.7") are used for internal grinding.

Depending on the customer's requirement, the turret wheelhead is available with a manual (2.5 deg) or automatic (1 deg) swivel (Hirth coupling). STUDER's unique fine-adjustment concept enables the automatic setting of intermediate angles with a resolution of 0.0001 deg, a system that proves its worth on a daily basis in the large-scale production processes of well-known automobile industry suppliers. Side doors fitted to the machine enclosure and auxiliary tools make changing the grinding wheel easy. The strength of this machine is especially evident when producing small batches or in complete machining operations: The setup and retooling costs can be reduced by between 50 % and 90 % compared with conventional systems.

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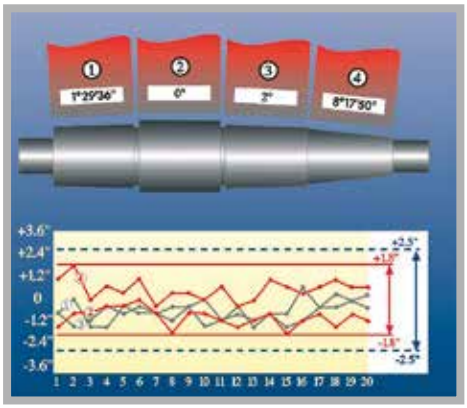

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1 Turret wheelhead
2 Evaluation of B-axis repetition accuracy
3 Internal grinding spindle

Tailstock

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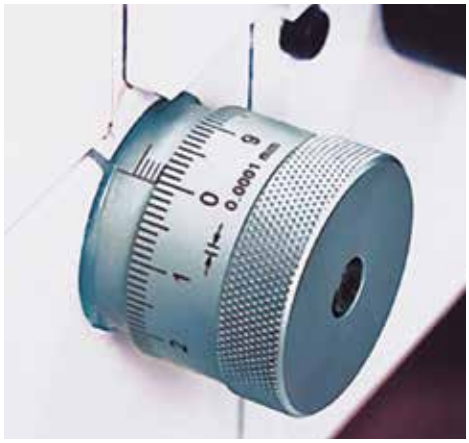

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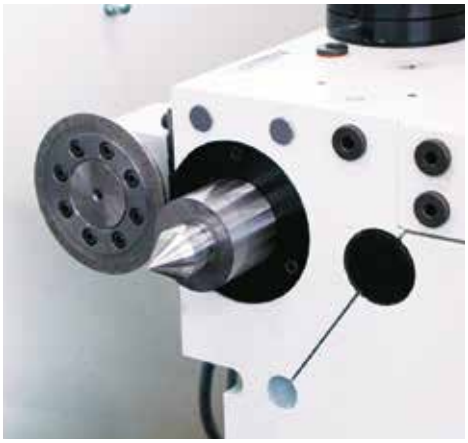

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- Taper corrections
- Barrel flooding

The generously dimensioned barrel, designed for the use of Morse 3 taper centres, glides in the tailstock housing. The centre pressure can be adjusted with the delicate precision required for grinding high-precision workpieces. The tailstock can be equipped with a hydraulically actuated barrel retraction for workpiece changeover The fine adjustment enables taper corrections in the range below 1 µm when grinding between centres. A pneumatic lifting process facilitates movement during setup and resetting.

In order to guarantee optimum thermal stability, the tailstock is flooded with cooling lubricant, as are the barrel and the diamond holder.

1 Tailstock
2 Fine adjustment for taper corrections
3 Dressing spindle for rotative dressing
4 Dressing tool holder on separate guide

Workhead

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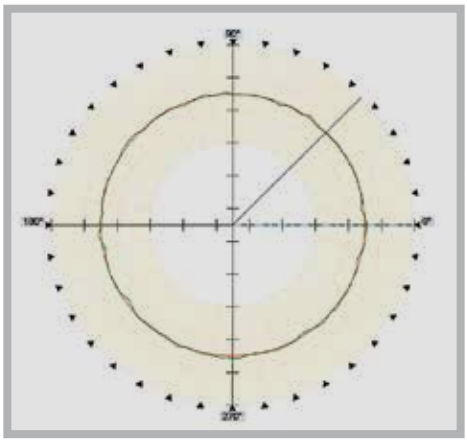

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- Pneumatic lifting
- Low-maintenance
- High roundness accuracy

The versatile universal workhead enables both live spindle grinding and grinding between centres. The machine can also be fitted with a specially designed chuck workhead for chuck applications. The workheads are equipped with roller bearings, are low-maintenance and have an excellent roundness accuracy of under 0.0004 mm (0.000,016"), which can be optionally improved to under 0.0002 mm (0.000,008") during live spindle operations. The fine adjustment allows for taper corrections in the 1 µm range during live spindle operations. Like the tailstock, the workhead is also equipped with a pneumatic lifting device to facilitate movement during setup and resetting.

1 Universal workhead
2 Fine adjustment for taper corrections
3 Roundness during live spindle grinding operations
4 Large selection of clamping devices

C-axis for form and thread grinding

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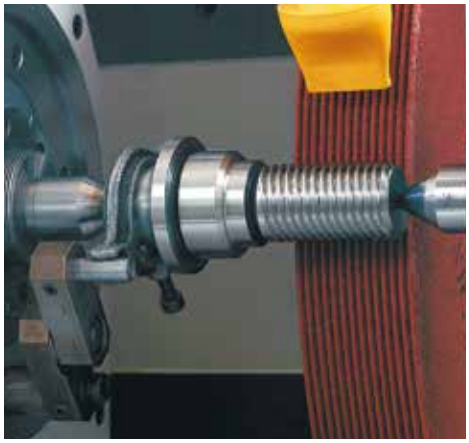

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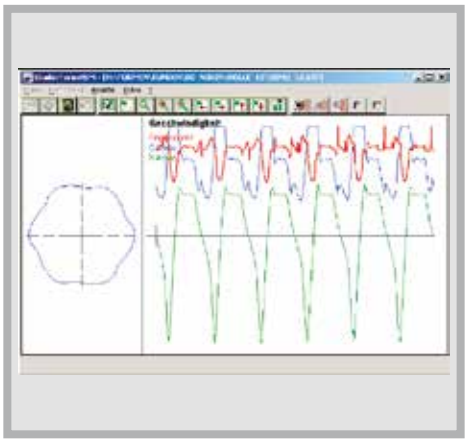

Complete machining also entails form and thread grinding operations to an ever increasing extent. These processes are made possible by the position and speed-controlled C-axis. The standard C-axis with measuring system on the drive motor is suitable for thread grinding. A direct measuring system is mounted on the workhead spindle for maximum form accuracy (high-precision C-axis). Acceleration and grinding forces are absorbed without difficulty through the high dynamic rigidity of the axis drives.

Form and thread grinding
The STUDER S21 enables axis-parallel grinding of conventional to high accuracy threads. Polygons, eccentrics, control cams, cams etc. can be manufactured cost-effectively and in the highest precision with High Speed Machining (HSM).

1 Form and die grinding
2 External and internal thread grinding
3 Contact ratios during form grinding

Control system and operation

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- PCU manual control unit
- EMC-tested control cabinet
- Ergonomically arranged controls

The S21 is equipped with a 31*i*-A series Fanuc control with integrated PC. The 15" touch screen facilitates intuitive operation and programming of the machine.
The electrical cabinet is positioned behind the machine. The power and control compartments are spatially separated. The layout of the elements complies with the relevant safety norms and is EMC-tested.

All controls are clearly and ergonomically arranged. An important role is played by the manual control unit, which facilitates setup close to the grinding process.
A special function – the Sensitron electronic contact detection device – reduces downtimes to a minimum.

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1 Machine control
2 Manual control unit

StuderWIN

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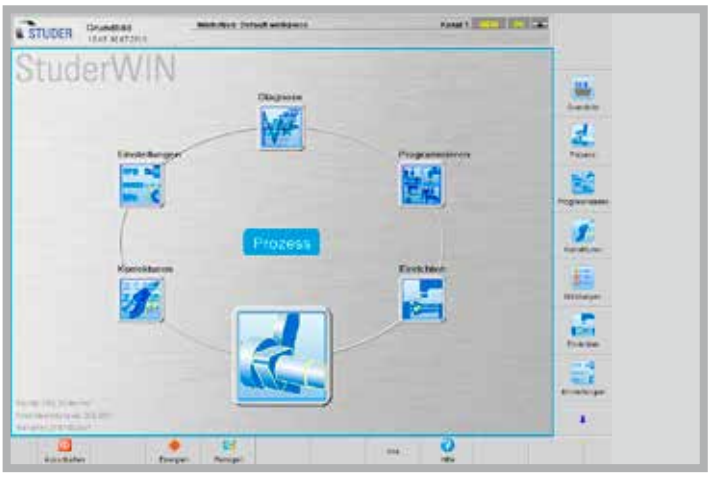

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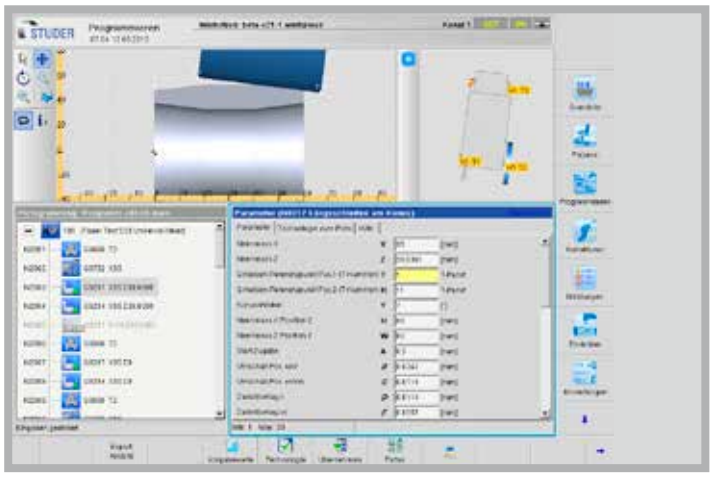

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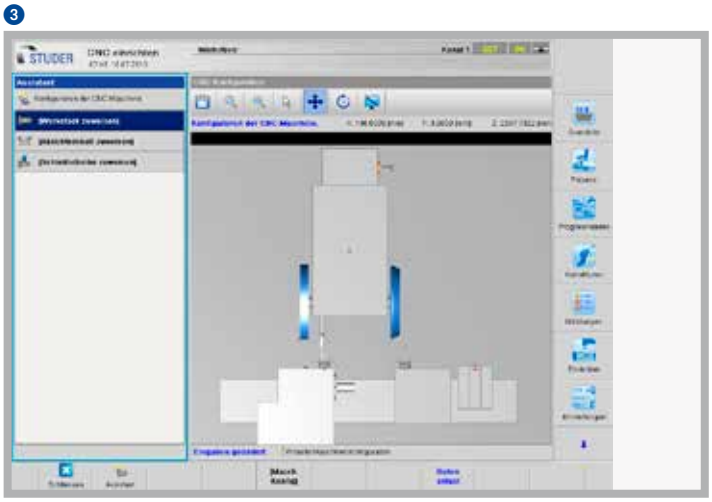

- Latest software technology
- StuderPictogramming

The user interface StuderWIN creates a stable programming environment and contributes to efficient use of the machine. The possibility of fully integrating the in-process gauging and sensor technology for process control as well as contact detection and automatic balancing systems in the operator interface enables standardized programming of the different systems. The software of an optional loading system is also integrated. The drive elements are optimally matched to the control system.

The sophisticated mechanical engineering concept of the S21 is completed by a grinding software program developed in-house by STUDER and which is continuously optimized in collaboration with users of the software. This software offers:

- StuderPictogramming: The operator strings the individual grinding cycles together – the control generates the ISO code.
- STUDER Quick-Set: The software for grinding wheel alignment reduces resetting times by up to 90 %.
- Microfunctions: Free programming of grinding and dressing process sequences for optimization of the grinding process.
- Integrated operating instructions assist safe machine operation.
- The software options for the grinding technology calculations, optimized dressing as well as the Contour-, Thread- and Formgrinding cycles increase the functionality of the machine.

1 StuderWIN
2 Workpiece programming
3 Assisted setup

Process-optimized complete solutions guarantee greater efficiency and reliability throughout.

1

- Automatic productionprocesses
- Integrated quality control
- Standard loader – interfaces

Several loading systems are available for the S21. From the cost-effective *easyLoad*, which is operated via the machine control, to the *easyLoad NC* with its own control unit, though to special solutions which can be precisely adapted to the machine application and machining processes, thanks to their modular design. The appropriate peripherals ensure seamless integration into the respective production process. The handling systems communicate with the machine via the standardized loader interface and enable even complex handling tasks to be solved. Comprehensive quality control is possible during the grinding process. This entails: in-process, post-process, recording, evaluation and correction. This type of quality assurance is crucial during grinding, but especially during match grinding.

2

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1 STUDER «*easyLoad NC*»
2 Work area with workpiece handling
3 Post-process measuring station

Customer Care

STUDER cylindrical grinding machines should fulfil the customer's requirements for as long as possible, work cost-effectively, function reliably and be available at all times. From «start up» through to «retrofit» – our Customer Care is there for you throughout the working life of your machine. 30 professional helplines and more than 60 service technicians are available in your area, wherever you are in the world.

- We will provide you with fast, uncomplicated support.
- We will help to increase your productivity.
- We work professionally, reliably and transparently.
- We will provide a professional solution to your problems.

Start up
Commissioning
Warranty extension

Qualification
Training
Production support

Prevention
Maintenance
Inspection

Service
Customer service
Customer consultation
HelpLine
Remote service

Material
Spare parts
Replacement parts
Accessories

Rebuild
Machine overhaul
Assembly overhaul

Retrofit
Modifications
Retrofits

Technical Data

Main dimensions

Distance between centres	400 mm (15.7")
Centre height	125 mm (4.9")
Max. workpiece weight between centres	30 kg (66 lbs)

Cross slide: X axis

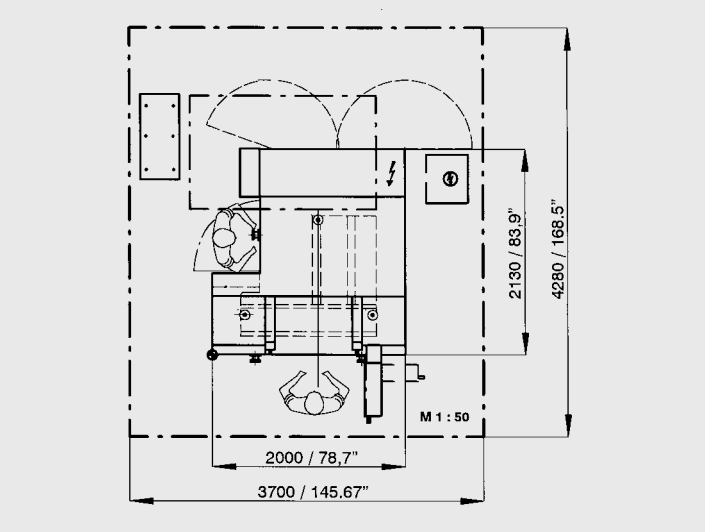
Max. travel	254 mm (10")
Speed	0,001 – 10 000 mm / min (0.000,04 – 394 ipm)
Resolution	
Rotational measuring system	0,0001 mm (0.000,004")
Option: linear measuring system	0,0001 mm (0.000,004")
Distance between guideways	280 mm (11")

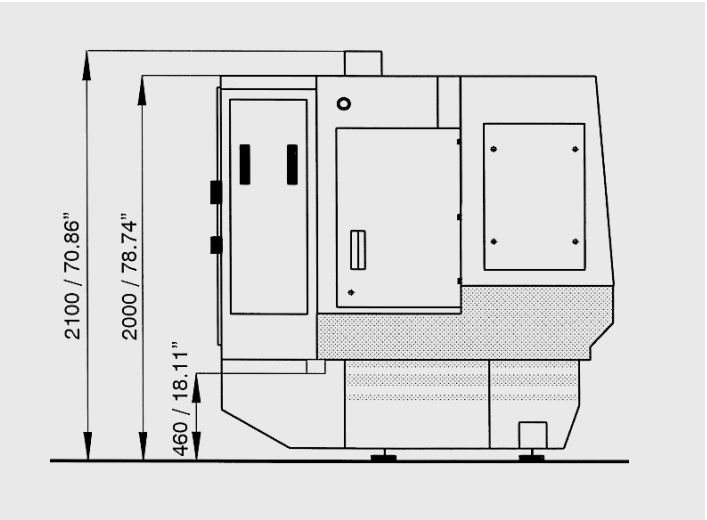
Longitudinal slide: Z axis

Max. travel	483 mm (19")
Speed	0,001 – 20 000 mm / min (0.000,04 – 787 ipm)
Resolution	
Rotational measuring system	0,0001 mm (0.000,004")
Option: linear measuring system	0,0001 mm (0.000,004")
Distance between guideways	200 mm (7.9")

Wheelhead

Swivel range	–15 to +195 deg
Manual swivelling axis	2,5 deg Hirth
Automatic swivelling axis	1 deg Hirth
Fine adjustment	0,0001 deg
Fitting taper	dia. 63 mm (2.48")
Drive power	5,5 kW (7.5 hp)
Grinding wheel left, dia. x width x bore	400 x 40 (50F5) x 127 mm (16" x 1.5" (2F5) x 5")
Grinding wheel right, dia. x width x bore	400 x 40 (50F5) x 127 mm (16" x 1.5" (2F5) x 5")
Circumferential speed	up to 50 m / s (9 840 sfpm)
Internal grinding device for high-frequency spindles	
Locating bore	dia. 120 mm (4.72")
Speeds	24 000 – 120 000 rpm





The information given is based on the technical levels of our machine at the time of this brochure going to print. We reserve the right to further develop our machines technically and make design modifications. This means that the dimensions, weights, colours, etc. of the machines supplied can differ. The diverse application possibilities of our machines depend on the technical equipment specifically requested by our customers. The equipment specifically agreed with the customer is therefore exclusively definitive for the equipping of the machines, and not any general data, information or illustrations.

Workheads

	For external grinding with fixed centre or live spindle grinding	For live spindle grinding, or external grinding with rotating centres
	Universal workhead	**Chuck workhead**
Speed range	1 – 1 500 rpm	1 – 1 500 rpm
Fitting taper	MT 4 / dia. 70 mm (2.75")	MT 4 / dia. 70 mm (2.75")
Spindle feedthrough	dia. 26 mm (1")	dia. 26 mm (1")
Drive power	3 kW (4 hp)	3 kW (4 hp)
Load during live grinding	70 Nm (52 ft lbs)	100 Nm (74 ft lbs)
Roundness accuracy during live grinding	0,0004 mm (0.000,016") option: 0,0002 mm (0.000,008")	0,0004 mm (0.000,016") option: 0,0002 mm (0.000,008")
C axis for form grinding		
– standard, indirect measuring system	0,0001 deg	0,0001 deg
– high precision, direct measuring system		0,0001 deg

Tailstock

Fitting taper	MT3
Travel of barrel	35 mm (1.37")
Diameter of barrel	50 mm (1.97")
Fine adjustment for cylindricality corrections	±40 µm (0.0016")

Control unit

Fanuc 31*i*-A

Guaranteed working precision

Straightness of the surface line	
Gauge length 400 mm (15.7")	0,002 mm (0.000,08")

Connected loads

Total connected load	20kVA
Air pressure	5,5 – 7 bar (80 – 102 psi)
Extraction capacity for cooling lubricant mist	
– emulsion	900 m^3 / h
– oil	500 – 1 000 m^3 / h
Total weight	4 300 kg (9 460 lbs)

STUDER

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Partner of the Engineering Industry Sustainability Initiative

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VDA6.4
certified

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