# S31

The Versatile
for big tasks.


## Key data

The S31 is a cylindrical grinding machine for medium-sized workpieces in individual, small batch and mass production.
It has distances between centres of 650/1000 mm and a centre height of 175 mm.
It can machine workpieces with a maximum weight of 80/120 kg.

STUDER
KÖRBER SOLUTIONS


## 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. 22 000 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.

# S31

If versatility is your concern, then the S31 is the ideal machine for you. It is designed for producing medium-sized workpieces in individual, small batch and mass production. Its Granitan® S103 mineral casting machine bed largely equalizes temporary temperature fluctuations. The swiveling wheelhead allows you to externally, internally and face grind workpieces in a single clamping – with a high-resolution B-axis of 0.0001 deg.

# Characteristics

## Dimensions

- Distance between centres 650 / 1 000 mm (25.6" / 39.4")
- Centre height 175 mm (6.9")
- Grinding wheel diameter 500 mm (20")

## 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 compact CNC universal cylindrical grinding machine for medium-sized workpieces with external and internal grinding in a single clamping.**

The versatile universal cylindrical grinding machine is designed for grinding medium-sized 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 pictogramming 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

1

- Vibration-damping
- Thermal stability
- Non-wearing

The material structure developed by STUDER, 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 cushioning behavior 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. This provides high stability throughout the day.
- 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 guideways offer the highest possible accuracy through the entire speed range with high load capacity and cushioning levels. Thanks to the robust and maintenance-free design, these excellent guideway characteristics are more or less completely retained.

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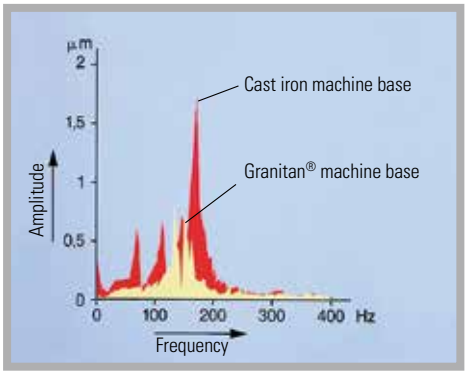


1 Machine bed with longitudinal and cross guideways
2 Guideways with patented surface structure
3 Vibration behavior of gray cast iron and Granitan® S103

# Longitudinal and cross slides

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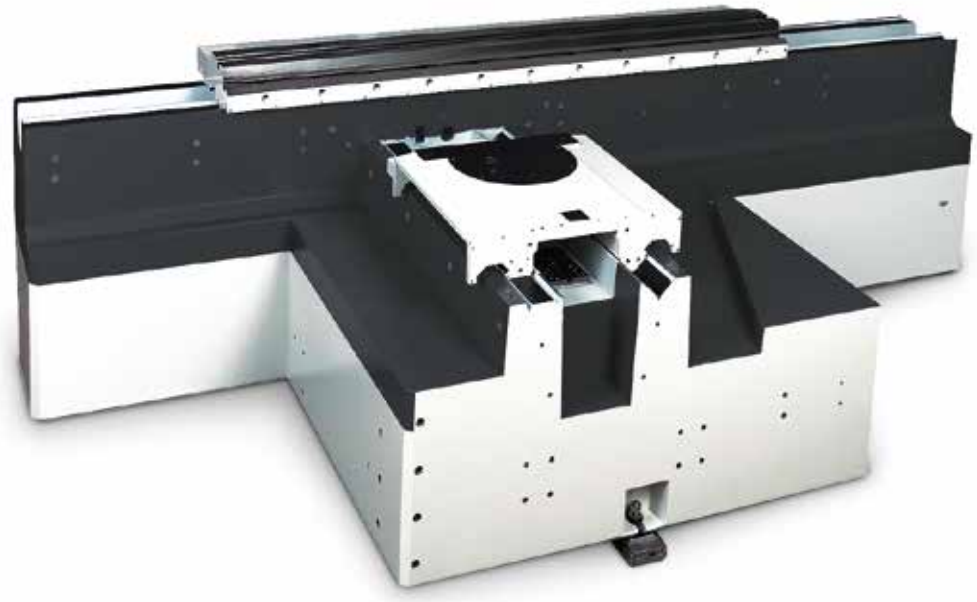

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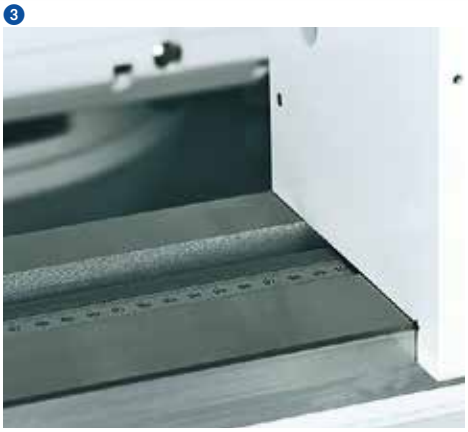

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- Auxiliary scale for setup and resetting
- Effective covering of the guideways

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 travel range. This provides the cornerstone for the excellent inherant grinding straightness of 0.0025 mm (0.000,10") over 650 mm (25.6") measured length. The slides are advanced by 40 mm (1.57") 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 Grid measurement
3 Setup scale
4 T-slot and clamping surface for mounting dressing tool holders etc.

# Turret wheelhead

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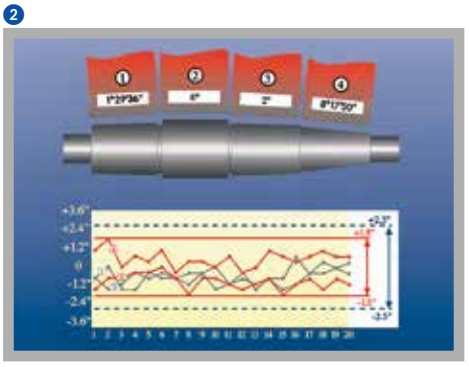

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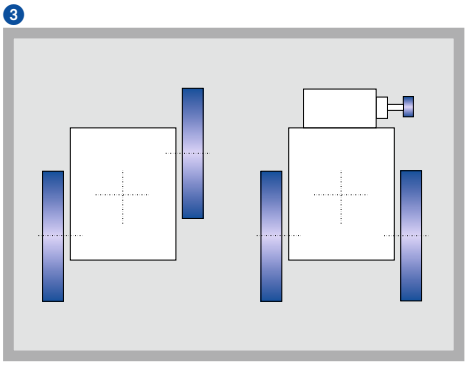

4

- 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 500 mm (20") and a width of 63 (80 F5) mm (2.5" / 3.15") are fitted to the shaft ends. Efficient high-frequency spindles with an external diameter of 120 mm (4.72") 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.

1 Universal wheelhead
2 Evaluation of B-axis repetition accuracy
3 Possible configurations of the wheelhead
4 Internal grinding spindle

# Tailstock

- Taper corrections
- Barrel flooding

The generously dimensioned barrel, designed for the use of Morse 3/4 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. The machine is also equipped with an optional synchronous tailstock for direct driving of workpieces between centres.

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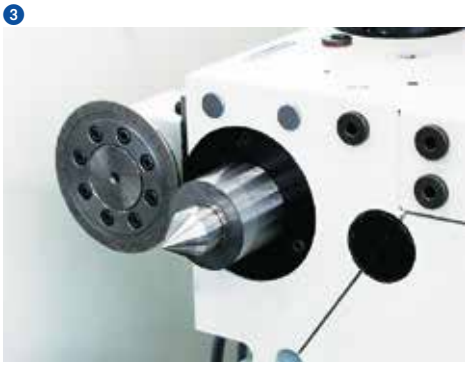

4

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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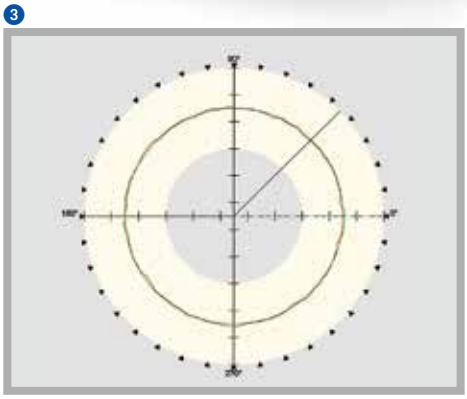

4

- 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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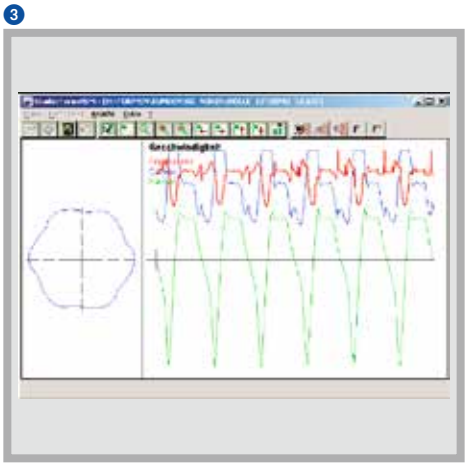

Complete machining also entails form and thread grinding operations to an ever increasing extent. These processes are made possible by the position and speed-controlled C-axis. The standard C-axis with measuring system on the drive motor is suitable for thread grinding. A direct measuring system is mounted 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 S31 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

1

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

The S31 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.

2

1 Machine control
2 Manual control unit

# StuderWIN

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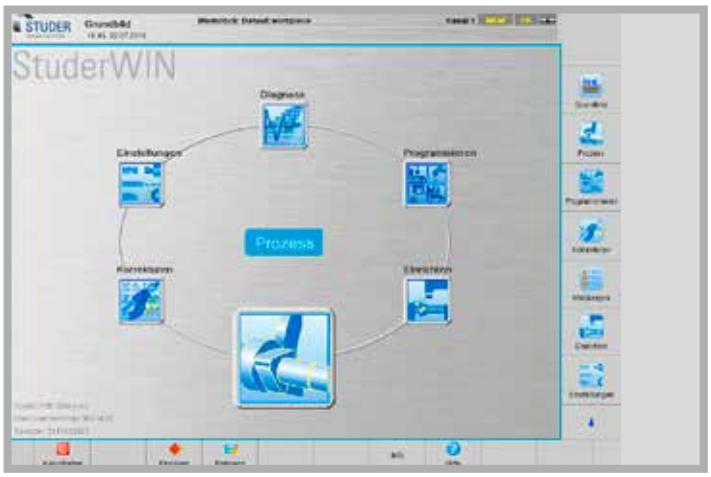


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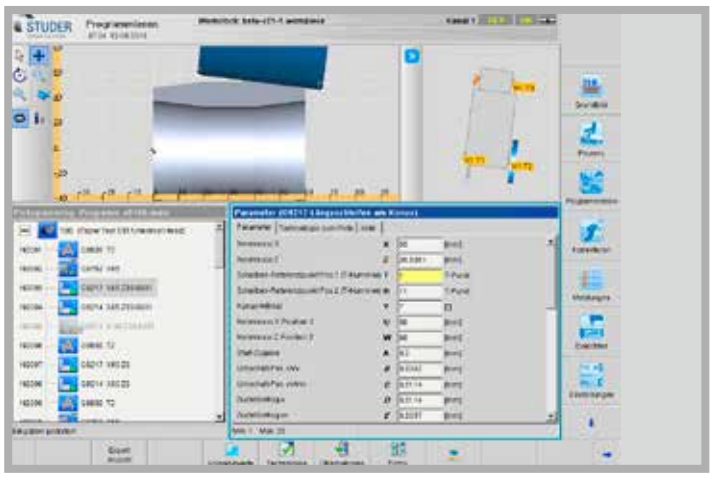

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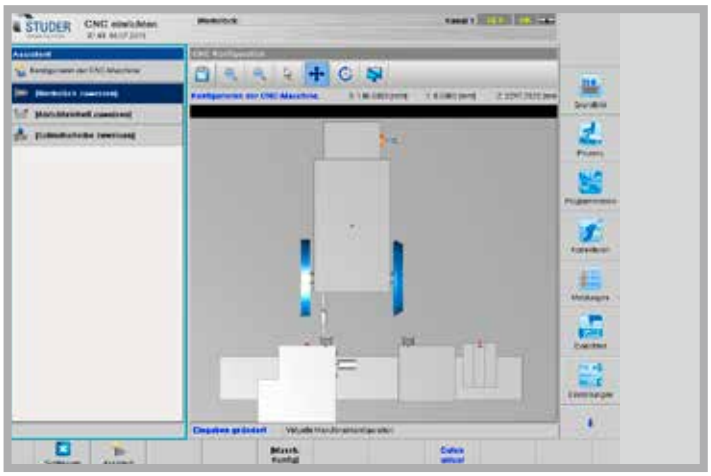


- Latest software technology
- Pictogramming

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 S31 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:

- Pictogramming: The operator strings the individual grinding cycles together – the control generates the ISO code.
- 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.

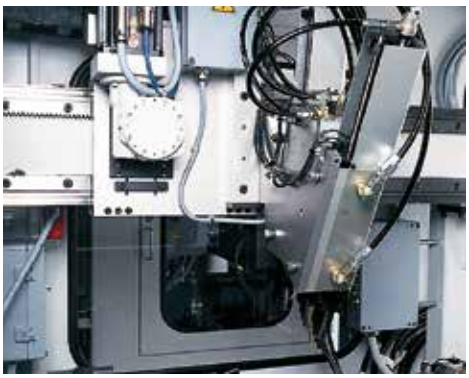
1


- Automated production processes
- Integrated quality control
- Standardized loading interfaces

Loading systems are available for the STUDER S31, which can be precisely adapted to the machine application and the machining processes thanks to their modular design. The corresponding peripherals ensure seamless integration into the respective production process. The handling systems used 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 match grinding. Coolant, pneumatic and hydraulic components are mounted at the back of the machine and are freely visible. A visual check can be carried out with a single glance.

2



3

1 STUDER «*easyLoad*»
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 | 650 / 1 000 mm (25.6" / 39.4") |
| Centre height | 175 mm (6.9") |
| Max. workpiece weight between centres | 80 / 120 kg (176 / 264 lbs) |

## Cross slide: X axis

| | |
|---|---|
| Max. travel | 280 mm (11") |
| 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

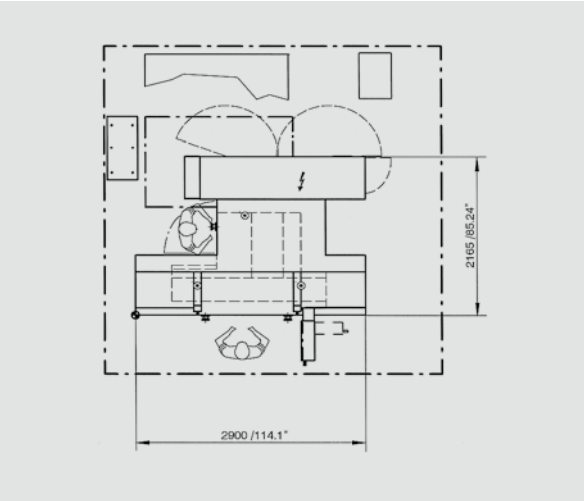
| | |
|---|---|
| Max. travel | 800 / 1 150 mm (31.5" / 45.3") |
| Speed | 0,001 – 20 000 mm / min (0.000,04 – 787 ipm) |
| Resolution | |
| Rotational measuring system | 0,0001 mm (0.000,004") |
| Option: linear measuring system | 0,0001 mm (0.000,004") |
| Distance between guideways | 200 mm (7.9") |

## Wheelhead

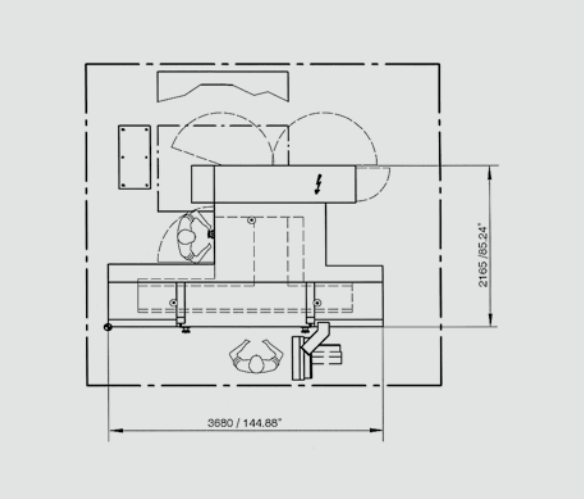
| | |
|---|---|
| Swivel range | -15 to + 195 deg |
| Manual swivelling axis | 2,5 deg Hirth |
| Automatic swivelling axis | 1 deg Hirth |
| Fine adjustment | 0,0001 deg |
| Fitting taper | dia. 73 mm (2.87") |
| Drive power | 7,5 kW (10 hp) |
| Grinding wheel left, dia. x width x bore | 500 x 63 (80F5) x 203 mm<br>20 x 2.5" (3.15"F5) x 8" |
| Grinding wheel left, dia. x width x bore | 500 x 63 (80F5) x 203 mm<br>20 x 2.5" (3.15"F5) x 8" |
| 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 |

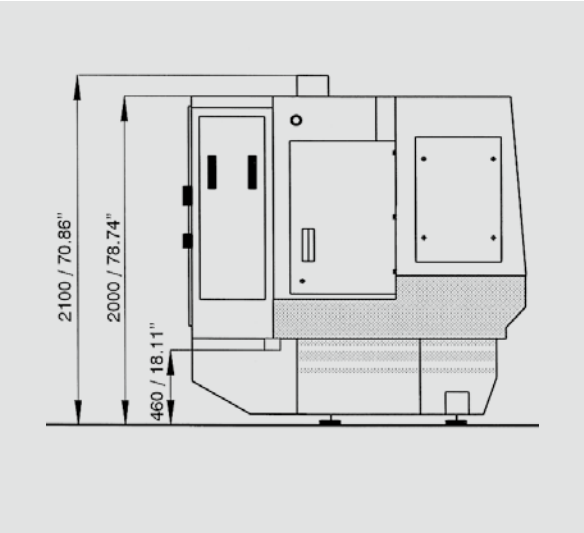
The information given is based on the technical levels of our machine at the time of this brochure going to print. We reserve the right to further develop our machines technically and make design modifications. This means that the dimensions, weights, colours, etc. of the machines supplied can differ. 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.

Distance between centres 650 mm (25.6")




Distance between centres 1 000 mm (39.4")



## Workheads

| | For external grinding with fixed centre or for live spindle grinding | |
|---|---|---|
| | Universal workhead MT 4 | Universal workhead ISO50 |
| Speed range | 1 – 1 500 rpm | 1 – 1 000 rpm |
| Fitting taper | MT 4 / dia. 70 mm (2.75") | ISO50 / dia. 110 mm (4.33") |
| Spindle feedthrough | dia. 26 mm (1") | dia. 50 mm (2") |
| Drive power | 3 kW (4 hp) | 4 kW (5.4 hp) |
| Load during live grinding | 70 Nm (52 ft lbs) | 180 Nm (134 ft lbs) |
| Roundness accuracy during live grinding | 0,0004 mm (0.000,016")<br>(option: 0,0002 mm / 0.000,008") | 0,0004 mm (0.000,016")<br>(option: 0,0002 mm / 0.000,008") |
| C axis for form grinding | | |
| – standard, indirect measuring system | 0,0001 deg | 0,0001 deg |

| | For live spindle or external grinding with co-rotating centre | |
|---|---|---|
| | Chuck workhead MT 4 | Chuck workhead ISO50 |
| Speed range | 1 – 1 500 rpm | 1 – 1 000 rpm |
| Fitting taper | MT 4 / dia. 70 mm (2.75") | ISO50 / dia. 110 mm (4.33") |
| Spindle feedthrough | dia. 26 mm (1") | dia. 50 mm (2") |
| Drive power | 3 kW (4 hp) | 4 kW (5.4 hp) |
| Load during live grinding | 100 Nm (74 ft lbs) | 250 Nm (186 ft lbs) |
| Roundness accuracy during live grinding | 0,0004 mm (option: 0,0002 mm) | 0,0004 mm |
| C axis for form grinding | | |
| – standard, indirect measuring system | 0,0001 deg | 0,0001 deg |
| – high precision, direct measuring system | 0,0001 deg | 0,0001 deg |

## Tailstock

| | |
|---|---|
| Fitting taper | MT3 / MT4 |
| 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 650 mm (25.6") | 0,0025 mm (0.000,10") |
| Gauge length 1 000 mm (39.4") | 0,0030 mm (0.000,12") |

## Connected loads

| | |
|---|---|
| Total connected load | 20 kVA |
| Air pressure | 5,5 – 7 bar (80 – 102 psi) |
| Extraction capacity for cooling lubricant mist | |
| – emulsion | 1 300 $m^3$ / h |
| – oil | 500 – 1 000 $m^3$ / h |

## Total weight

| | |
|---|---|
| Distance between centres 650 mm (25.6") | 5 200 kg (11 440 lbs) |
| Distance between centres 1 000 mm (39.4") | 6 000 kg (13 200 lbs) |

STUDER
KÖRBER SOLUTIONS

Fritz Studer AG
CH - 3602 Thun
Phone +41 33 439 11 11
Fax +41 33 439 11 12
info@studer.com
www.studer.com

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