

# S121/S131/S141

The experts in internal and radius grinding.



## Key data

The S121/S131/S141 are radius internal cylindrical grinding machines in a class of their own. With the ability to choose from different fit-out standards and sizes, the right machine can be configured for any application. The maximum swing diameter is 400 mm and the maximum workpiece weight is 100 kg.

GLOBAL  
TECHNOLOGY LEADER  
PERFECTION  
CUSTOMER FOCUS  
EFFICIENCY  
SAFETY  
SOPHISTICATED PROCESSES  
PRECISION

# The Art of Grinding.

TECHNOLOGY LEADER  
EFFICIENCY  
PERFECTION  
CUSTOMER FOCUS  
PRECISION  
GLOBAL  
SOPHISTICATED PROCESSES  
SAFETY

## Fritz Studer AG

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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 tailor-made 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, automotive, tool and die, aerospace, pneumatics/hydraulics, electronics/electrical engineering, medical, job shops and the watch industry. 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.

# S121/S131/ S141

Differing in size and complexity, but essentially the same: The experts in high-precision internal cylindrical grinding of radii, spheres, balls, cones and diameters. The incomparable STUDER precision is based on the Granitan<sup>®</sup> machine bed and StuderGuide<sup>®</sup> guideway system. During the development of the machine the highest attention was given to the ergonomics, be it in connection with grinding, the machine set-up or with the maintenance of the machine.

# S121

## Dimension

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- Swing diameter over table 300 mm
- Maximum workpiece weight 100 kg

## Hardware

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- Granitan® S103
- StuderGuide® guide system with linear drive
- Fully automatic B-axis with direct drive with a swiveling range of -20 to +91 deg
- Spindle turret with two grinding spindles or one fixed spindle or two spindles in parallel
- C-axis for the workhead enabling form and thread grinding
- Full enclosure with two sliding doors



## Software

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- Simple to use and program thanks to HMI StuderSim
- StuderSIM programming and simulation software for the creation and simulation of grinding and dressing programs on the machine control or on an external PC
- Standardized interfaces for loader and peripheral devices

The S121 radius internal cylindrical grinding machine has an exceptional price/performance ratio and is the ideal machine for internal, face and external grinding of chuck components. It has a host of sophisticated technical features such as the revolutionary StuderGuide® guideway system, high-precision axis drives with linear motors, a fully automatic B-axis with direct drive, etc.

The S121 is especially suitable for grinding complex workpieces from very hard materials such as tungsten carbide, ceramic and sapphire as well as for general grinding tasks. Optimal stability and rigidity enable diameters, cones and transitional radii (ground using the pendulum method through interpolation of the B and X/Z axes) to be ground to a polished surface quality. The machines are ideal for the manufacture of dies, especially in the packaging industry, where tungsten carbide and ceramic are primarily processed. Hydraulic components such as axial pump pistons, guide plates and housings made of hardened steel, cast iron and copper can also be produced. Other fields are the production of complex workpieces with several tapers greater than 20 to 90 deg in a single clamping, where the main applications are in the watch and medical industries with extra-hard materials such as industrial ceramic, sapphire and tungsten carbide, as well as the manufacture of human implants for shoulders, knees and hips from ceramic and titanium.

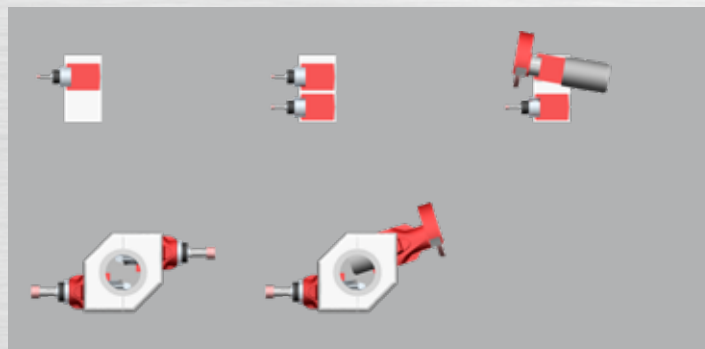
Precision is the result of perfect interaction between a large number of different factors. The basis is the Granitan® S103 machine base with its excellent dampening and thermal behavior. The modules are ideally suited to each other and produced with the customary STUDER precision. The large distance between the guideways and the very rigidly constructed slides form the basis for the precision and productivity of this machine. All components involved in defining precision are temperature-stabilized.

## Advantages

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- It can be configured for any imaginable internal grinding task
- High flexibility
- Compact with excellent accessibility to the inside of the machine from three or four sides (for maintenance and service)
- Short set-up and changeover times thanks to well thought-through set-up philosophy

The S121 radius internal cylindrical grinding machine uses the StuderSIM operating system, which creates a stable programming environment and contributes to efficient use of the machine. With StuderSIM, workpieces – derived from a drawing – can be completely defined and all necessary geometric data for the grinding cycles can be generated. The grinding process can be checked and visualized by means of simulation on a PC or on the machine.



# S131/S141

## Dimension

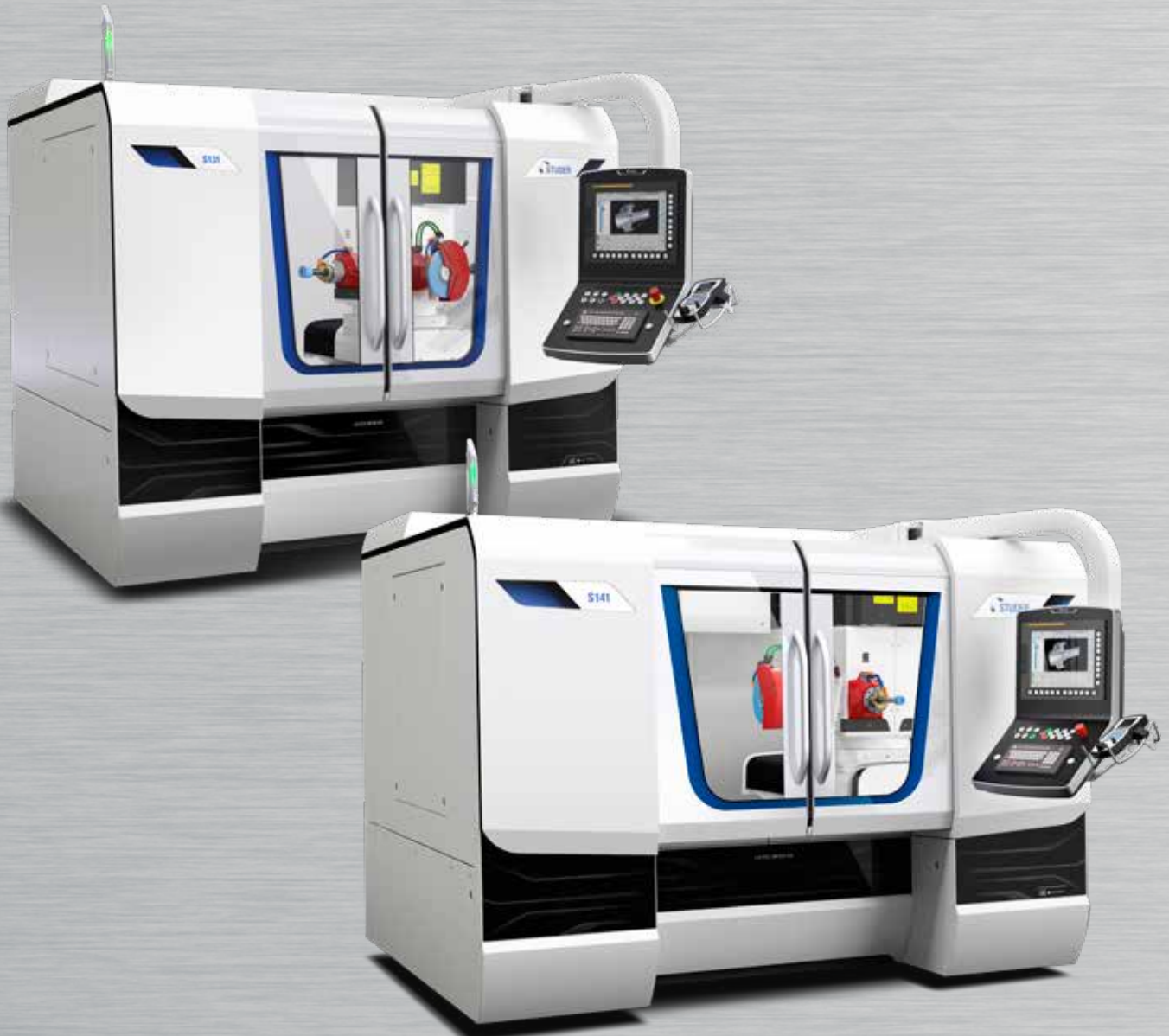
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- Swing diameter over table  
S131: dia. 300 mm  
S141: dia. 400 mm
- Maximum workpiece weight 100 kg

## Hardware

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- StuderGuide® guide system with linear drive
- Fully automatic B-axis with direct drive with a swiveling range of -60 to +91 deg
- Spindle turret with up to four grinding spindles
- C-axis for the workhead enabling form and thread grinding
- Full enclosure with two sliding doors
- Granitan® S103



## Software

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- Simple to use and program thanks to HMI StuderSim
- StuderSIM programming and simulation software for the creation and simulation of grinding and dressing programs on the machine control or on an external PC
- Standardized interfaces for loader and peripheral devices

The S131/S141 are radius internal cylindrical grinding machines of the latest generation. They have a host of sophisticated technical features such as the revolutionary StuderGuide® guideway system, high-precision axis drives with linear motors, a fully automatic B-axis with direct drive, etc.

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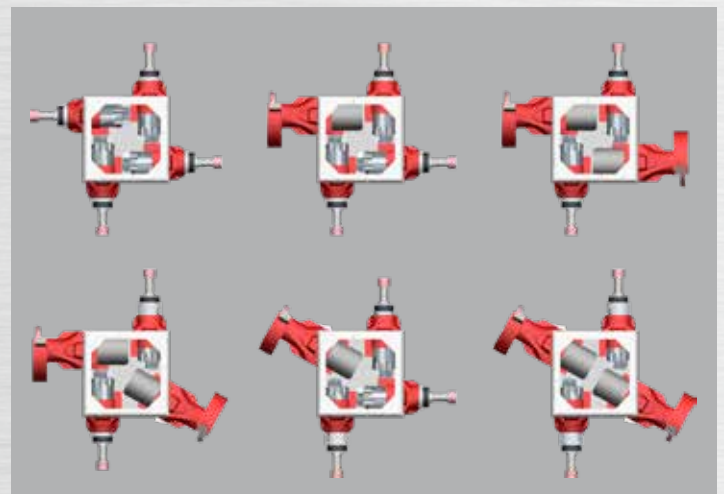
Precision is the result of perfect interaction between a large number of different factors. The basis is the Granitan® S103 machine bed with its excellent dampening and thermal behavior. The modules are ideally suited to each other and produced with the customary STUDER precision. The large distance between the guideways and the very rigidly constructed slides form the basis for the precision and productivity of this machine. All components involved in defining precision are temperature-stabilized.

## Advantages

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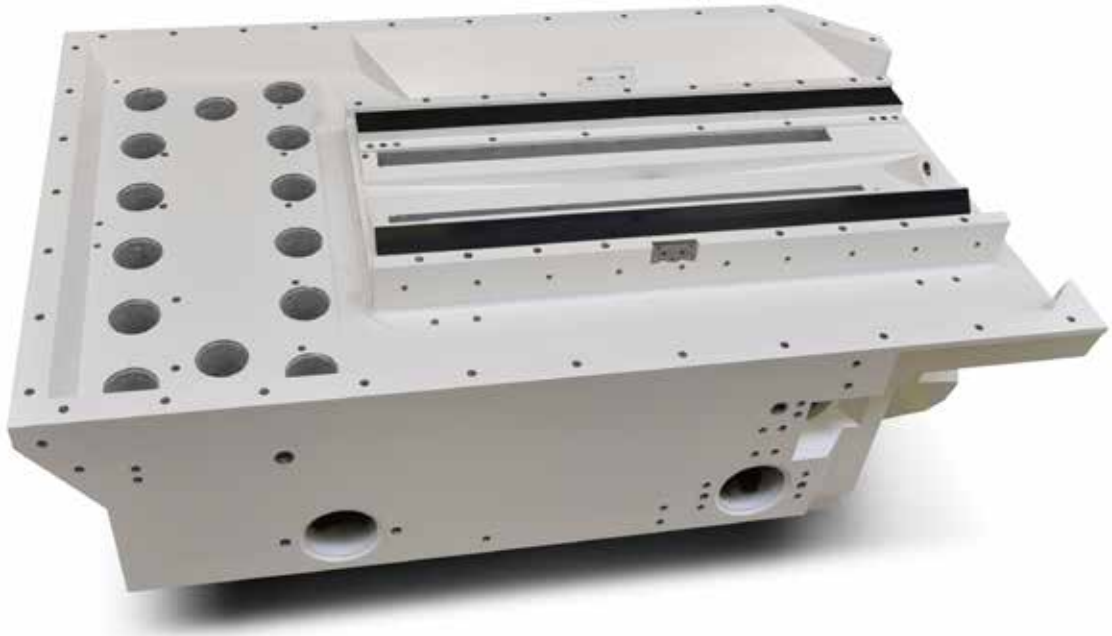
- It can be configured for any imaginable internal grinding task
- High flexibility
- Compact with excellent accessibility to the inside of the machine from three or four sides (for maintenance and service)
- Short set-up and changeover times thanks to well thought-through set-up philosophy

The S131/S141 radius internal cylindrical grinding machines use the StuderSIM operating system, which creates a stable programming environment and contributes to efficient use of the machine. With StuderSIM, workpieces – derived from a drawing – can be completely defined and all necessary geometric data for the grinding cycles can be generated. The grinding process can be checked and visualized by means of simulation on a PC or on the machine.



# Granitan® S103 mineral casting machine bed

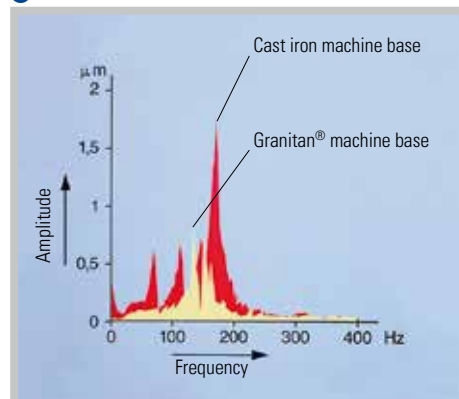
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- Vibration damping
- Thermally stable
- Non-wearing

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 vibration dampening 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 by the favorable thermal behavior of Granitan®. This provides high stability throughout the day. The StuderGuide® guide system for the longitudinal slide is formed directly in the machine bed and coated with Granitan® S200 wear-resistant guideway surfacing material. 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 remain the same during the lifecycle.

2





# StuderGuide® in the longitudinal and transverse axis

1



2



- High geometrical traversing accuracy
- Effective covering of the guideways

The StuderGuide® guide system for the X and Z axis is coated with Granitan® S200 wear-resistant guideway surfacing material and offers the highest possible accuracy through the entire speed range with high load capacity and cushioning levels. StuderGuide® extends the benefits of hydrostatic systems and guideways with a patented surface structure. A big advantage of StuderGuide® in comparison with hydrostatic guides is the cushioning component in the direction of

motion. The slides are powered by linear motors with direct measuring systems with a resolution of 10 nanometers. The maximum travel speed is 20 m/min for both axes. This provides the basis for high-precision and efficient grinding with the shortest possible auxiliary times. The combination of StuderGuide®, linear motors and direct measuring systems guarantee the highest possible interpolation accuracies.

# Grinding spindle turret



- Large selection of grinding spindles
- External grinding wheel changed in just a few movements

The spindle turret of the S131/S141 with integrated swivel axis enables the use of up to four grinding spindles (including a maximum of two external grinding spindles) and a universally usable measuring probe. The swivel axis has a direct drive which enables very quick and precise positioning. The high-resolution direct measuring system guarantees a positioning range of  $<1^\circ$ . This allows complete machining of workpieces in the

same clamping – with minimal auxiliary times and highest precision.

The spindle turret of the S121 swivels hydraulically through 180 deg to a stop. It can be equipped with two grinding spindles (including one external grinding spindle). The S121 can also be equipped with one or two fixed spindles in a linear arrangement.

# Workhead



The high-precision workhead is equipped with special bearings and guarantees the highest roundness accuracy. The A4/MT5 spindle nose complies with the DIN/ISO 702-1 standard. The airlift simplifies adjustment when setting up or resetting the workhead. A high-precision C axis, with direct measuring system on the workhead spindle, is available for form and thread grinding.

- High roundness accuracy
- Low-maintenance
- Air lift

# B-axis



The automatic B-axis with a swiveling range of -60 to +91 deg has a direct drive, which enables very quick and precise positioning. This enables extremely precise grinding with interpolation of the B-axis to machine radii. The high-resolution direct measuring system guarantees a positioning range of the high-precision B-axis <math>< 1''</math>.

The B-axis is completely sealed off and requires no maintenance.

① Workhead with ring sensor on the spindle nose

② B-axis with direct drive

# Dressing



- Configurable according to client's requirements
- Rotating or stationary dressing tools can be used



An easy-cutting grinding wheel is essential for cost-effective and high-quality grinding. Studer offers a large selection of dressing units, to allow an optimal and flexible adaption of the dressing process to the specific material, dressing tool and workpiece properties.

In addition to fixed dressing units, dressing spindles can be mounted for rotary dressing tools. The latter are especially suitable for dressing ceramic bonded CBN grinding wheels. In combination with the acoustic touch sensor technology, a precisely defined, minimal amount can be dressed using the Touch-Dressing-CBN method.

# Sensor technology/ Measuring probe



STUDER attaches great importance to optimized grinding processes. The sensor system plays a big role, particularly in internal grinding. Three main objectives are targeted:

- Air-gap elimination to reduce cycle time
- Process monitoring during grinding and dressing
- Simple acquisition of grinding wheel and workpiece

With small bore diameters it is particularly difficult to obtain an analyzable signal. STUDER achieves the best result with a ring sensor, comprising a revolving transmitter ring and a fixed receiver ring. The signal transmission between the rings occurs contactlessly.

The measuring probe is used for the following operations:

- Measuring the ZB distance
- Length positioning
- Measuring uninterrupted internal and external diameters
- Compensation of wear and tear to wheels when using non-dressable grinding wheels
- Optimized grinding cycles
- Measuring lengths
- Process control

- Air-gap elimination
- Set-up assistance
- Process reliability
- Process optimization

# Control system and operation

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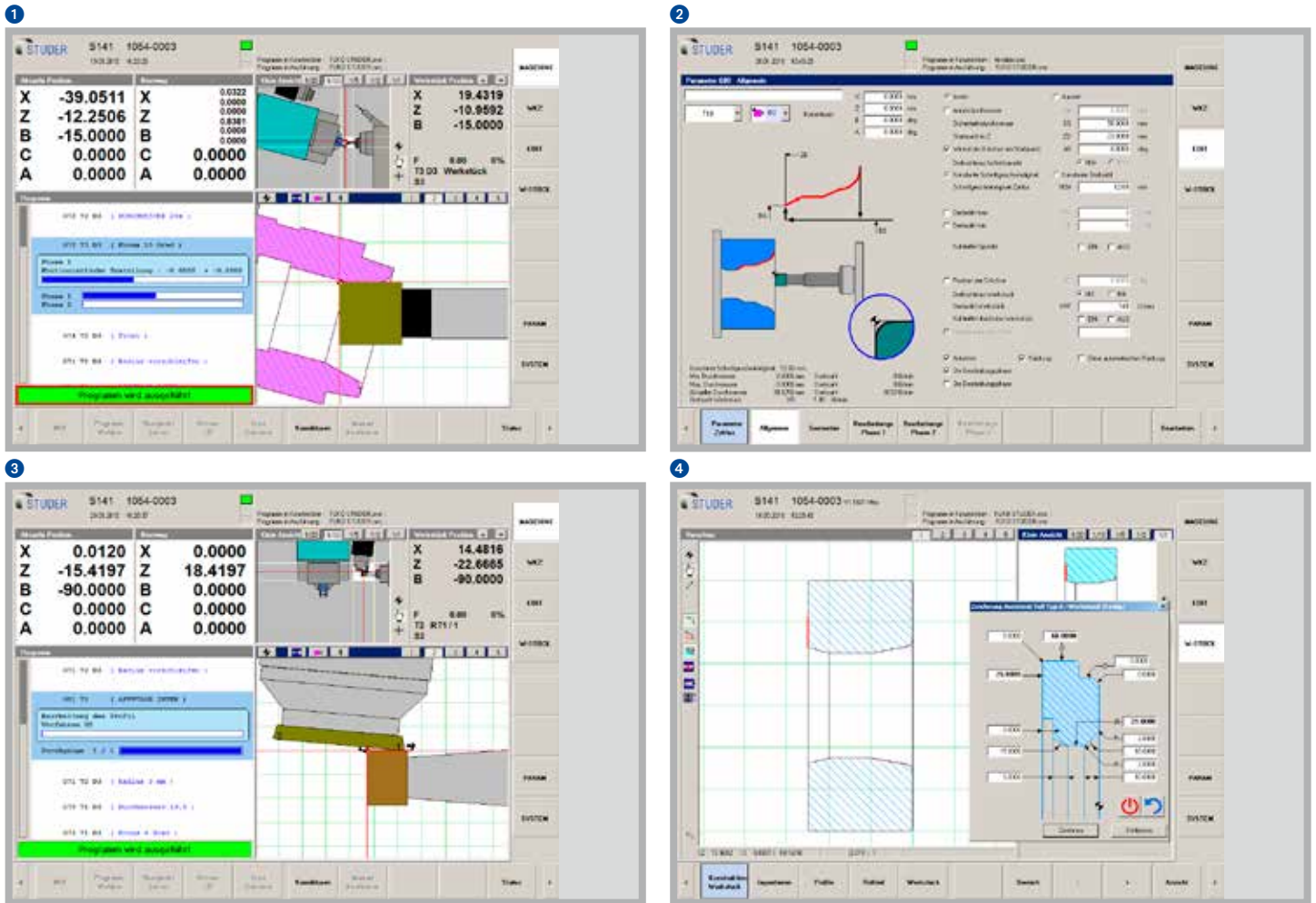
- PCU manual control unit
- EMC-tested control cabinet
- Ergonomically arranged operating elements

The Fanuc 31*i*-B series control system has an integrated PC. The 15" touch screen facilitates intuitive operation and programming of the machine. All operating elements 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



# StuderSIM



The machine control is equipped with the StuderSIM operating system. This operating system, specially developed for internal grinding applications, enables the programming of all basic cycles for grinding, dressing and process-supporting measurement. The basic cycles such as surface grinding, bore grinding, cone grinding, thread grinding, dressing and measurement are defined in the Parameter Input window.

This type of programming guarantees great flexibility and remains very user-friendly and workshop-oriented. Each cycle is equipped with a dynamic help system and guides the operator through the grinding data creation process. After programming, the process can be simulated and optimized. This ensures reliability, as well as guaranteeing short programming times and increased cost effectiveness.

# Customer Care

STUDER cylindrical grinding machines should fulfill 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



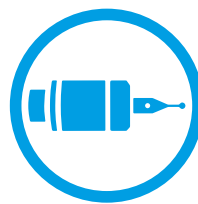
## Prevention

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

	S121	S131	S141
Swing diameter above table	300 mm (11.8")	300 mm (11.8")	400 mm (15.7")
Max. workpiece weight including clamping devices	100 kg (220 lbs)	100 kg (220 lbs)	100 kg (220 lbs)

## Cross slide (X-axis)

Max. travel	350 mm (13.8")	350 mm (13.8")	500 mm (19.7")
Speed	0.001–20 000 mm/min (0.000,04–787 ipm)	0.001–20 000 mm/min (0.000,04–787 ipm)	0.001–20 000 mm/min (0.000,04–787 ipm)
Resolution	0.00001 mm (0.000,000,4")	0.00001 mm (0.000,000,4")	0.00001 mm (0.000,000,4")
Distance between guideways	285 mm (11.2")	285 mm (11.2")	285 mm (11.2")

## Longitudinal slide (Z-axis)

Max. travel	400 mm (15.7")	400 mm (15.7")	500 mm (19.7")
Speed	0.001–20 000 mm/min (0.000,04–787 ipm)	0.001–20 000 mm/min (0.000,04–787 ipm)	0.001–20 000 mm/min (0.000,04–787 ipm)
Resolution	0.00001 mm (0.000,000,4")	0.00001 mm (0.000,000,4")	0.00001 mm (0.000,000,4")
Distance between guideways	350 mm (13.8")	350 mm (13.8")	450 mm (17.7")

## Grinding spindle turret

Spindle set-up	Turret	Turret	Turret
Max. number of spindles	2	4	4
Swiveling range	0 / 180 deg	-50 to +280 deg	-50 to +280 deg
Repetition accuracy	< 1"	< 1"	< 1"
Swiveling time for 180°	< 4 s	< 3 s	< 3 s
Resolution		0.00005 deg	0.00005 deg

### Internal grinding

Locating bore	dia. 100/120 mm (3.9"/4.7")	dia. 100/120 mm (3.9"/4.7")	dia. 100/120 mm (3.9"/4.7")
Speeds	24 000–120 000 rpm	24 000–120 000 rpm	24 000–120 000 rpm
Grinding mandrel length (swiveling on the turret)	max. 180 mm (7.1")	max. 180 mm (7.1")	max. 220 mm (8.7")

### External grinding

Peripheral speed	50 m/s (9840 sfpm)	50 m/s (9840 sfpm)	50 m/s (9840 sfpm)
Fitting taper	HSK-C50	HSK-C50	HSK-C50
Grinding wheel	dia. 250/50 x 25 mm (10"/2"/1")	dia. 250/50 x 25 mm (10"/2"/1")	dia. 250/50 x 25 mm (10"/2"/1")

### Options

Measuring probe	Yes	Yes	Yes
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## Swiveling table

Swiveling range	-20 to +91 deg	-60 to +91 deg	-60 to +91 deg
Repetition accuracy	< 1"	< 1"	< 1"
Resolution	0.00005 deg	0.00005 deg	0.00005 deg

## Universal workhead

### Rpm range

- Standard	1 – 1 500 rpm
- High-precision	1 – 1 200 rpm
Holding fixture	A4 according to DIN / ISO 702-1/MT5
Bar capacity	dia. 35.5 mm (1.4")
Drive capacity	3 kW (4 hp)
Max. load for live grinding	300 Nm (224 ft lbs)
Max. workpiece weight including clamping devices	100 kg (220 lbs)
Roundness accuracy during live grinding	0.0004 mm (0.000,016")

### C-axis for form grinding

- Standard, indirect measuring system	0.0001 deg
- High-precision, direct measuring system	0.0001 deg

## Control unit

Fanuc 31i-B with integrated PC  
15" touch screen

## Connected loads

Total connected load	32 kVA
Air pressure	5.5 bar (80 psi)
Extraction capacity of extraction unit	1 200 – 1 800 m <sup>3</sup> /h

## Total weight

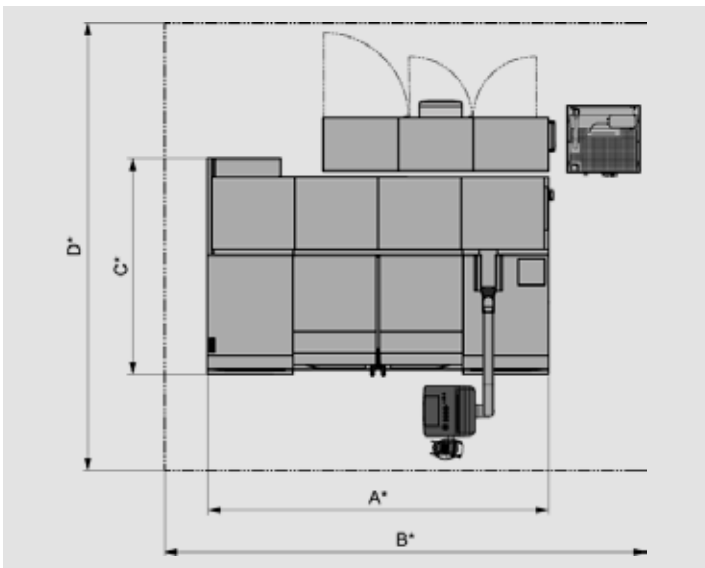
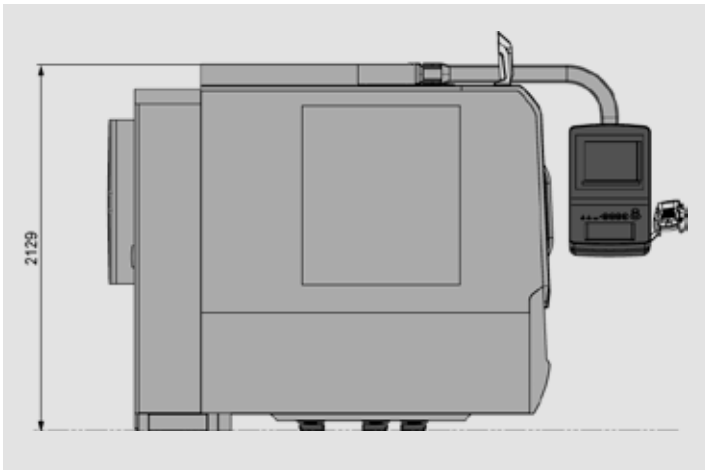
S121	5 050 kg (11 110 lbs)
S131	5 700 kg (12 540 lbs)
S141	7 400 kg (16 280 lbs)

The information given is based on the technical levels of our machines 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, colors, 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.

# Installation plans

	A*	B*	C*	D*
S121	2110 (83")	3890 (153")	1625 (64")	3770 (148")
S131	2270 (89")	4050 (160")	2030 (80")	4030 (159")
S141	2800 (110")	4580 (180")	2110 (83")	4280 (169")







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**ISO 9001**  
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