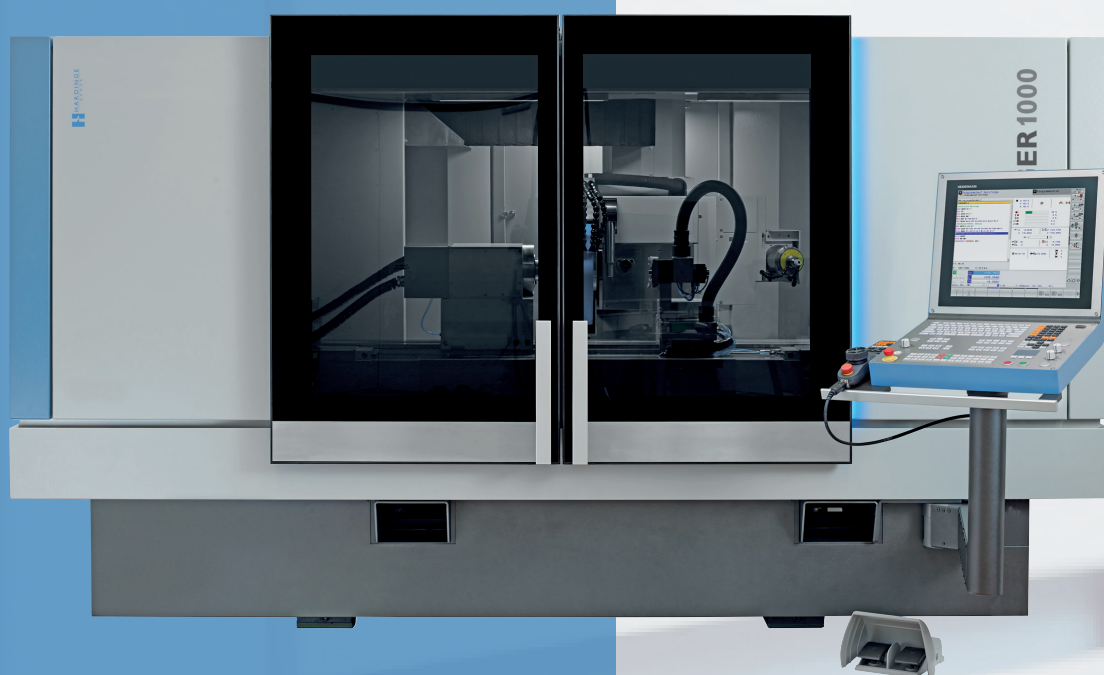


KELLENBERGER 1000

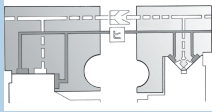
Cylindrical Grinding Systems for
the most Demanding Applications



KELLENBERGER
WWW.HARDINGE.COM

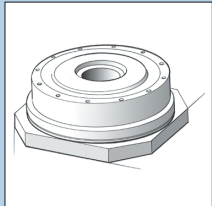


THE INNOVATIVE GRINDING SYSTEM



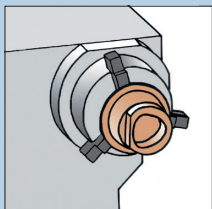
HYDROSTATICS

- X and Z guideways
- No stick-slip, no wear
- Good damping
- Ultra-fine correction options



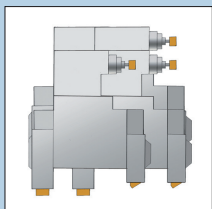
HYDROSTATIC B-AXIS

- Full-fledged NC axis
- Pre-tensioned hydrostatic guideway
- Direct drive



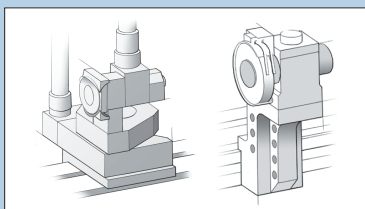
C-AXIS

- For non-circular workpieces
- For threads
- High-precision spindle bearing
- Direct drive
- High flexibility



PLATFORM CONCEPT FOR MORE THAN 30 DIFFERENT WHEELHEADS

- Universal wheelheads
- Diagonal wheelheads
- Tandem wheelheads
- Various mounting positions



DRESSING SYSTEMS

- Independent interface at table
- Pivotable unit for chucked work
- Rigid diamonds
- Form and profile dressers



PRECISION WITH HYDROSTATICS

Hydrostatic guideways and a strict separation of the machine base from the assemblies, generating heat or vibration, provide superb precision and productivity.

The excellent static and dynamic rigidity of the machine base permits a three-point set-up. The Kellenberger 1000 therefore has no particular requirements on the building's foundations. The hydrostatic guides for the longitudinal slide movement (Z-axis) and for wheelslide infeed (X-axis) provide the basis for the machine's extreme accuracy. X- and Z-axes movements are practically frictionless at all speeds. There is no stick slip; even the smallest increments of $0.1 \mu\text{m}$ can be traveled without a problem, so that the machine features measuring-machine accuracy.

LARGE WORK SPACE — UNIQUE TABLE CONCEPT

The machine table has been considerably extended so it allows unmatched, optimal positioning of the grinding wheel and a larger travel distance, but also many machining options and application-specific configurations.

FUNCTIONAL MACHINE CASING

The increased sheet metal thickness means even more process reliability, allowing larger internal grinding wheel diameter of up to 125 mm. With their large viewing windows, the generously-sized doors allow optimum control over the work process and make it easier to access the work space. The genuine glass laminated safety panes require very little maintenance.

FUNCTIONAL DESIGN WITH HIGHLY PRECISE TECHNOLOGY



COMPACT AND MAINTENANCE-FRIENDLY

Elements such as the power supply, electrical cabinet, and a central connection point for lubricating coolant, water cooling system, and compressed air were all integrated into the casing. Service and maintenance doors for unimpeded access to machine components are integrated into the back.

OPTIMIZED ENERGY MANAGEMENT

Performance-optimized central cooling system. Automated procedures for switching on and off. Energy-efficient low-pressure hydrostatics.

EASY COMMISSIONING

The integrated transportation concept (hook machine) shortens commissioning times considerably.

MACHINE RE-COOLING SYSTEM

- Comprehensive cooling system with needs-based design (wheelhead & grinding spindles, direct drive, hydrostatics, electric cabinet)
- Increased flow rates at lower system pressure
- Active cooling principle for optimal temperature stability
- Minimized thermal drift, so smaller deviations on workpiece
- Hydrostatic oil cooled to ambient temperature
- Automatic tracking of surroundings, water cooler: Sensor in bed measures reference temperature of regulator

OPTIONS

- Increased coolant pressure up to 10 bar
- Interface for fire extinguisher system
- Automatic door drive
- Replacement aid for grinding wheels and tailstock

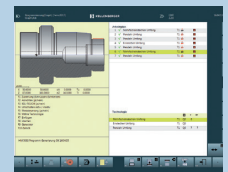
CONTROL SYSTEM

- Heidenhain GRINDplus 640
- Fanuc 31i - B
- 19" Touch Screen



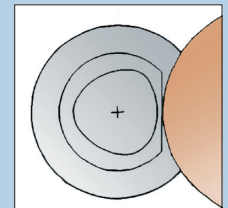
SOFTWARE

- RED Solution
- BLACK CAM Solution



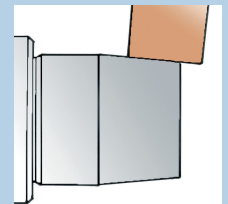
X/C INTERPOLATION

- Non-circular workpieces
- Thread grinding
- Jig grinding
- Groove grinding



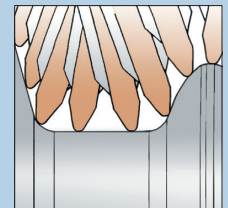
X/Z INTERPOLATION

- Taper grinding
- Profile grinding
- Dressing

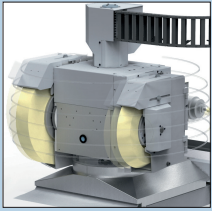


X/Z/B INTERPOLATION

- Contour B+
- Profile grinding with controlled grinding wheel

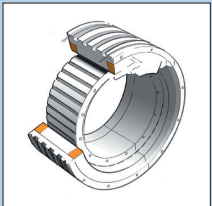


B-AXIS AND AUTOMATIC GRINDING WHEEL MEASURING SYSTEM



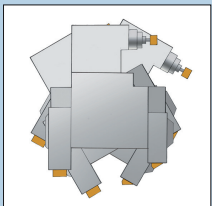
HYDROSTATIC B-AXIS

- Pre-tensioned hydrostatic guide
- The direct drive is wear-free
- 180° swiveling in one second



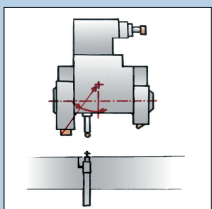
DIRECT DRIVE SYSTEM

- The water-cooled high-torque motor guarantees a high level of torque
- The rotary encoder is integrated in the absolute measuring system of the machine and requires no referencing



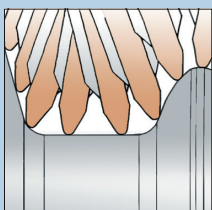
CLAMPING

- The B-axis can be clamped in any position without any deformation
- The large dimensions of the clamps guarantee high clamping moment



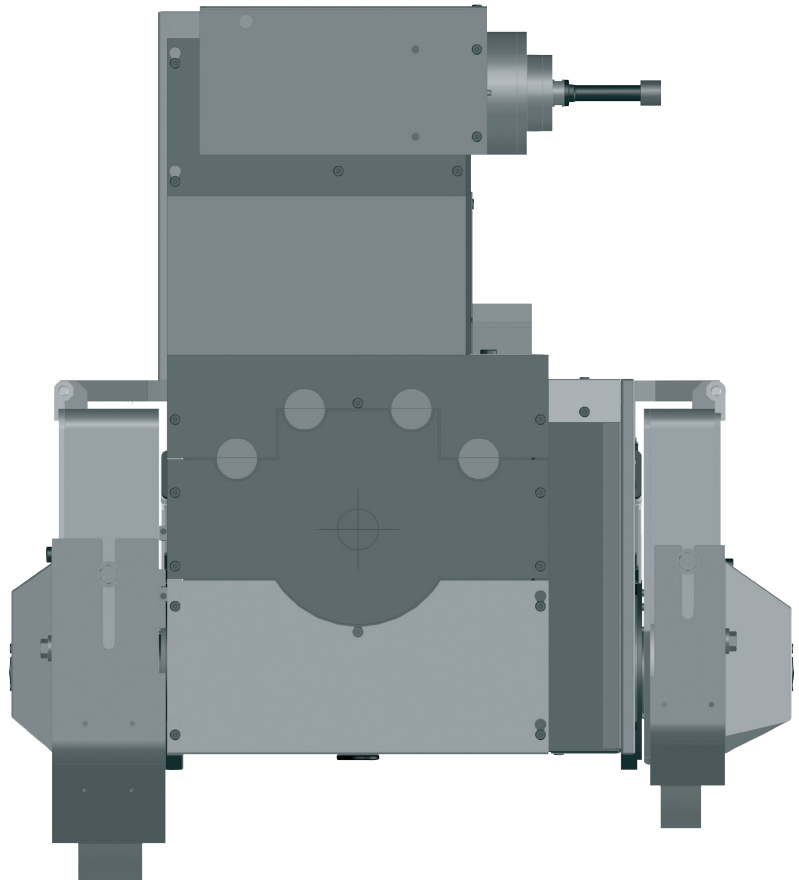
KEL-SET

- Automatic grinding wheel measuring system
- EU patent No. EP 0542 674 B1
- US patent No. 5.335.454



CONTOUR B+

- Machining also possible in un-clamped state
- Short cycle times
- New machining methods
- High flexibility



HYDROSTATIC B-AXIS

Full-fledged NC-axis with pre-tensioned hydrostatic guideway and direct drive.

The pre-tensioned hydrostatic is the basis for higher accuracy and better surface quality. Steps of 0,0001° can be traveled with ease.

KEL-SET

Automatic grinding wheel measuring system. Movements to the measuring ball and to the grinding wheels occur automatically, with their position information being stored in the control system. When swiveling the wheelhead into any angle, the positions of the grinding wheel edges are automatically taken into account.

ADVANTAGES FOR THE USER

- Programming takes place with the actual dimensions according to the work drawings and independently of the swivel angle of the wheelhead

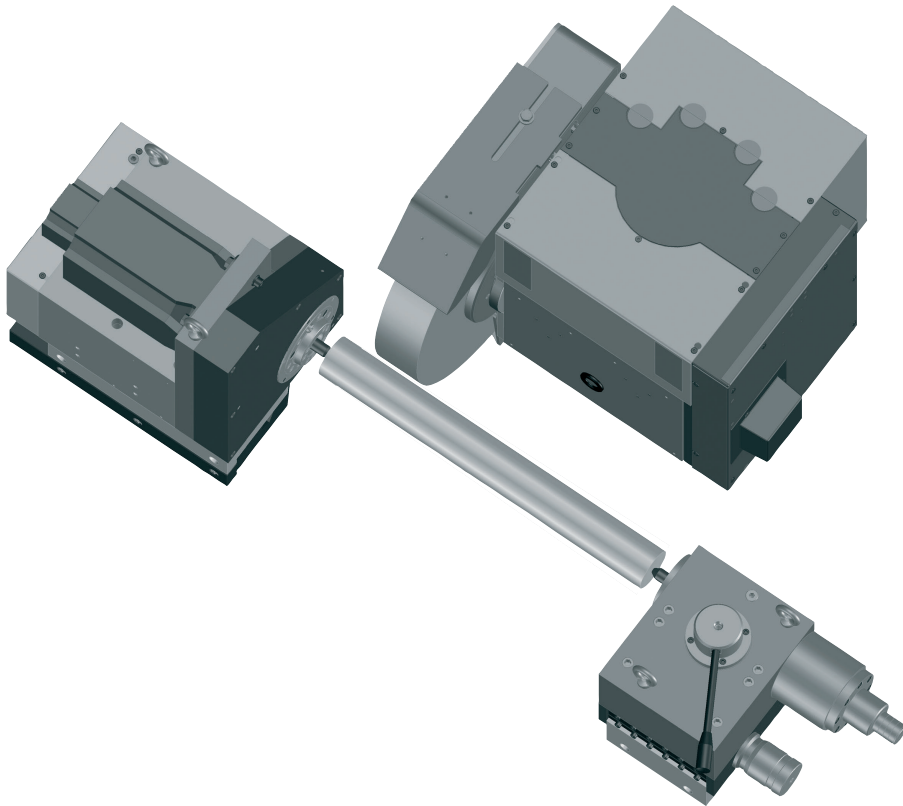
- No need for renewed calibration of the swiveled grinding wheel
- Simple and fast acquisition of the grinding wheel data when retooling the machine
- Integrated tool management for external, face and internal grinding

WORKHEAD

Robust and rigid design on a solid base. Strong motor. Infinitely variable spindle speed. Airlock seals prevent ingress of dirt or water as well as the formation of condensation.

- Excellent roundness and dimensional accuracy thanks to pre-tensioned high-precision antifriction bearings
- Roundness of the workpiece dR < 0.4 µm (< 0.016 µinch) on chucked work
- Versatile in use
- Comes standard with fine adjustment for cylinder correction for chuck work
- ISO 702-1 spindle nose

WORKHEAD, C-AXIS AND TAILSTOCK



OPTIONS

- Roundness of the workpiece $dR < 0.2 \mu\text{m}$ ($< 0.008 \mu\text{inch}$) on chucked work
- Positioned spindle stop

C-AXIS

The option of interpolating the X- and C-axes makes it possible to use the cylindrical grinding machine also for unround shapes such as polygons, free contours and eccentric forms. The rotary encoder with a resolution of 0.0001° is installed directly on the workhead spindle. The non-circular movement is superimposed on the grinding movements so that the grinding machine can use all the grinding cycles on unround grinding too, including the handwheel release for the X-axis.

TAILSTOCK

The tailstock features a large and heavy design. The nitride-coated sleeve runs in sturdy ball-bush bearings.

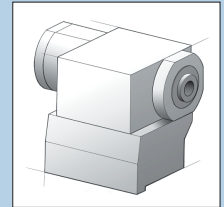
- Excellent rigidity makes it possible to achieve high rates of infeed even with heavy workpieces
- Sensitive sleeve pressure adjustment
- Micro-corrector for quick and easy cylinder corrections
- Pneumatic relief for tailstock movement

OPTIONS

- Hydraulic or pneumatic sleeve retraction
- Automated cylinder correction
- Enlarged travel, 80 mm (3.14 inch)
- Reinforced design

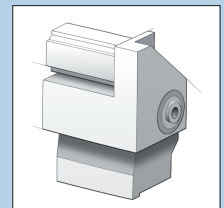
WORKHEAD WITH DIRECT DRIVE

- n 1-1000 min-1 with direct drive 200 Spindel nose ISO 702-I, size 5
- n 1-500 min-1 with direct drive 300 Spindel nose ISO 702-I, size 8



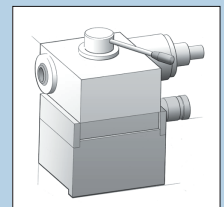
WORKHEAD

- Standard, n 1-1000 min-1
- Spindel nose ISO 702-I, size 5
- As desired, with fixed or rotating center



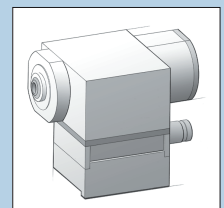
TAILSTOCK

- Morse taper 4
- Retraction of sleeve 50 mm (1.96 inch)



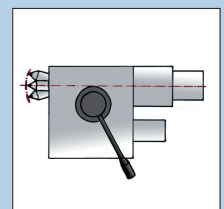
SYNCHRONIZED TAILSTOCK

- With integrated sleeve
- Morse taper 4
- Retraction of sleeve 50 mm (1.96 inch)

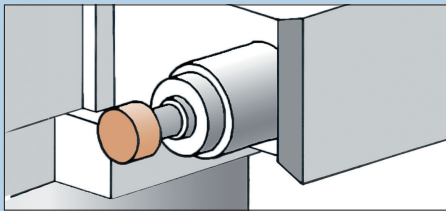
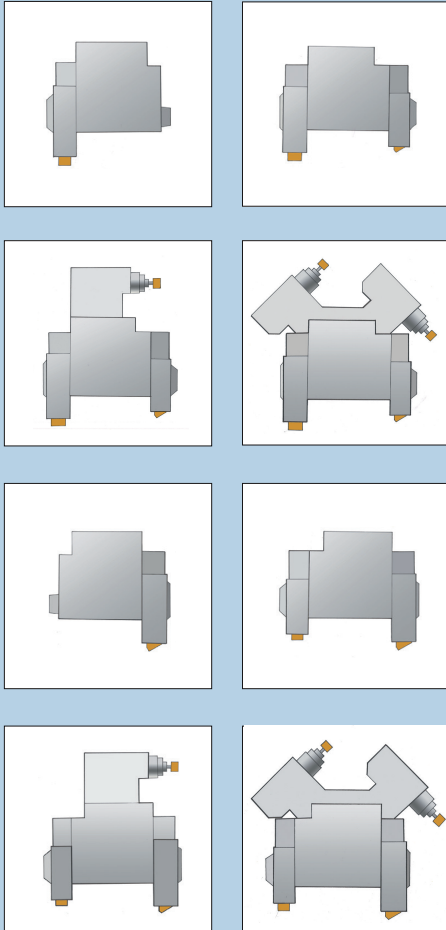


MICRO-ADJUSTMENT

- Adjustment range $\pm 150 \mu\text{m}$
- Optionally with automatic cylinder correction

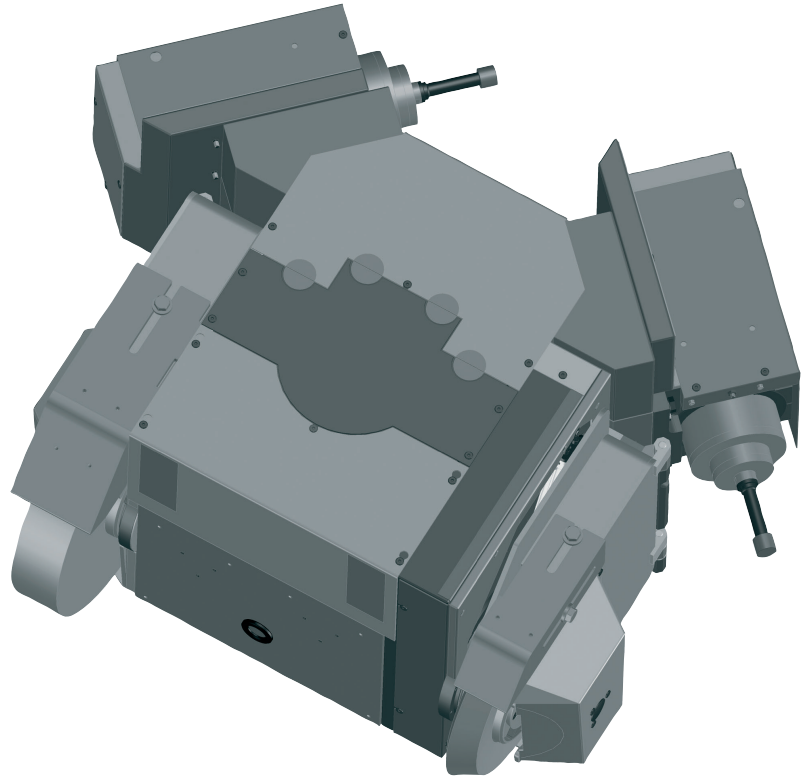


MODULAR WHEELHEAD VARIANTS



INTERNAL GRINDING ATTACHMENT

- High-frequency internal grinding spindle



UNIVERSAL WHEELHEADS

- Motor output 10 kW (13.6 hp)
- Water-cooled precision-balanced drive motor
- Infinitely variable drive of OD and ID grinding spindles
- Hydrodynamic multi-surface spindle bearings
- Grinding wheel dimensions
Ø 500 x 80 mm (20 x 3.15 inch)
- High-frequency ID grinding spindles

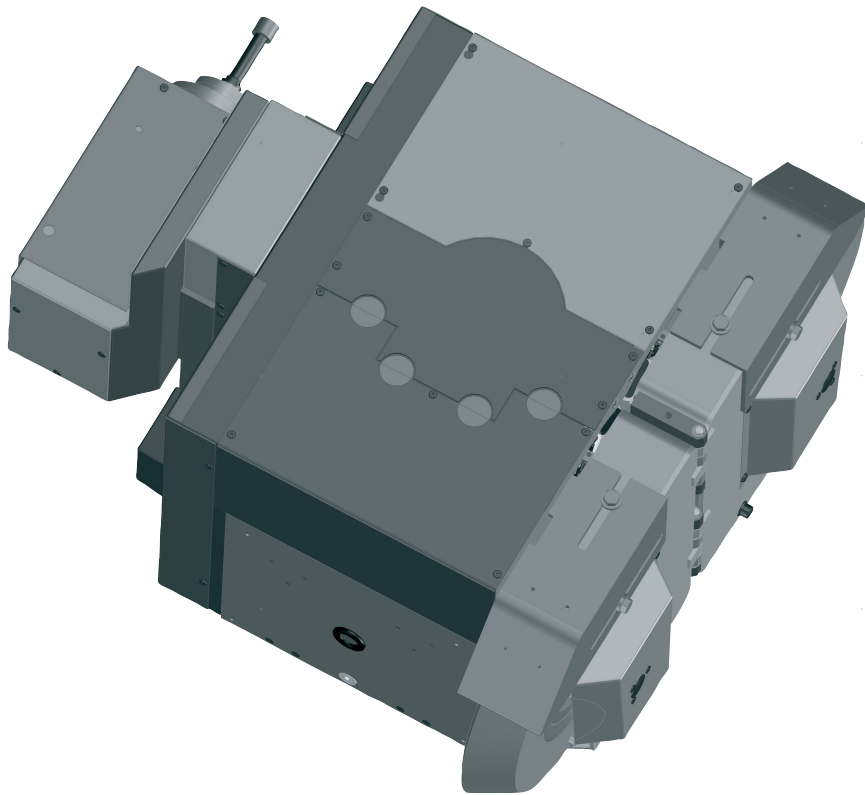
The universal wheelhead covers various user needs. In addition to external, face- and internal grinding, the use of two internal grinding spindles or the option of thread grinding or unround grinding are now increasingly in demand. Grinding in one setting allows shorter processing times and improves the quality of the workpieces considerably.

The new modular system makes it possible to supply the universal wheelhead to customer specifications, from a simple wheelhead with one tool to a configuration with up to four tools; see examples.

DIAGONAL WHEELHEADS

- Motor output 2x 10 kW (13.6 hp)
- Water-cooled precision-balanced drive motors
- Infinitely variable drive of OD and ID grinding spindles
- Hydrodynamic multi-surface spindle bearings
- Grinding wheel dimensions
2x Ø 500 x 80 mm (20 x 3.15 inch)
- High-frequency ID grinding spindles
- Min. 2 OD grinding wheels
- Max. 2 OD grinding wheels and 2 HF ID grinding spindles

The diagonal wheelheads provide the option of rough and finish grinding in one setting. The additional use of HF ID grinding spindles also allows universal OD, face- and ID grinding.



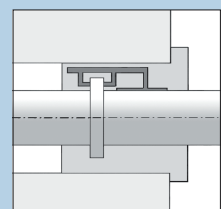
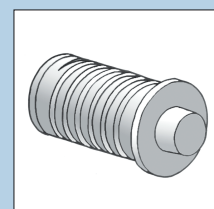
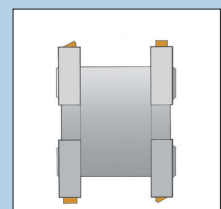
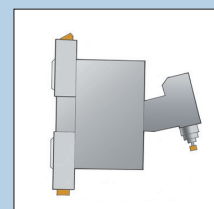
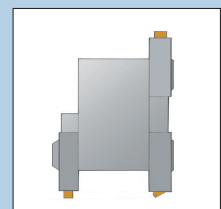
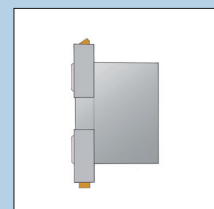
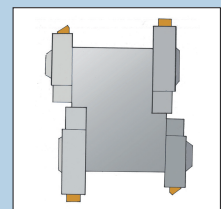
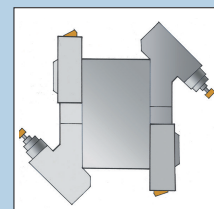
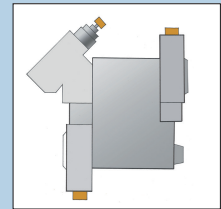
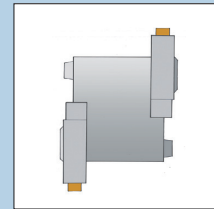
TANDEM-TYPE WHEELHEADS

- Motor output 2x 10 kW (13.6 hp)
- Water-cooled precision-balanced drive motors
- Infinitely variable drive of OD and ID grinding spindles
- Hydrodynamic multi-surface spindle bearings
- Grinding wheel dimensions
2x Ø 500 x 80 mm (20 x 2.5 inch)
- High-frequency ID grinding spindles
- Min. 2 OD grinding wheels
- Max. 4 OD grinding wheels or
2–3 OD grinding wheels and 1 HF
ID grinding spindle

The tandem-type wheelheads are designed for the possibility of carrying out straight and angular infeed operations in the same setting. With an additional HF internal grinding spindle it is possible to also process internal grinding work. The ideal equipment for these wheelheads can be determined by the nature of the workpieces to be ground.

HF ID GRINDING SPINDLES

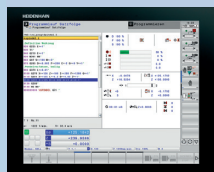
- MFM 1224-42
- MFM 1242-60
- Frequency converter up to 3000 Hz



WATER-COOLED PRECISION-BALANCED DRIVE MOTORS

HYDRODYNAMIC MULTI-SURFACE SPINDLE BEARINGS

HEIDENHAIN CONTROL SYSTEM GRINDPLUS 640



MONITOR

- 19" TFT Multitouch
- Expanded process data display

GREEN SOLUTION

- Dialogue guided set-up and programming
- G-Code based
- Toll Management

ADVANTAGE

- Safe set-up and programming
- Defined G-Codes
- Multiple tool reference points

BENEFITS

- Ideal for high complex workpieces
- Unlimited combination of G-Codes
- Complete machining with ease

RED SOLUTION

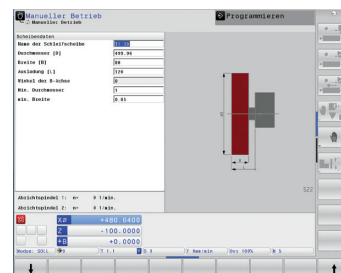
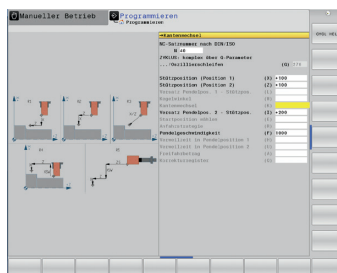
- GRAPHIC Guide with integrated technology processor

ADVANTAGE

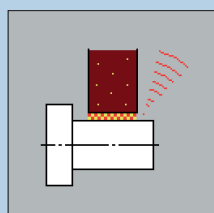
- Interactive
- Visualized part programming
- Quick set-up and results

BENEFITS

- Set-up of simple parts at minimized time
- No G-Code needed
- Less downtime

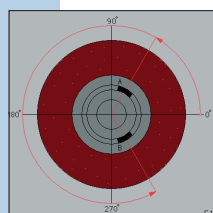


ACOUSTIC EMISSION



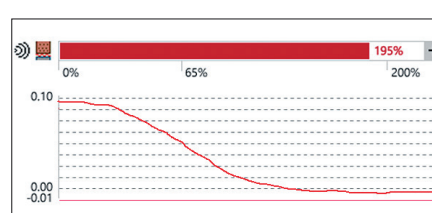
- GAP control with up to 6 sensors
- Operation and display integrated in the control system

BALANCING



- Semi-automatic or automatic balancing of the grinding wheels
- Operation and display integrated in the control system

IN-PROCESS GAUGE SYSTEM



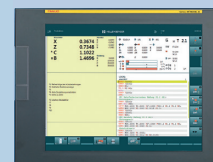
- Up to 4 gauge heads
- Interrupted diameters
- Non-interrupted diameters
- Passive longitudinal positioning

FANUC CONTROL SYSTEM 31i



MONITOR

- 19" TFT Touch
- Expanded process data display



RED SOLUTION

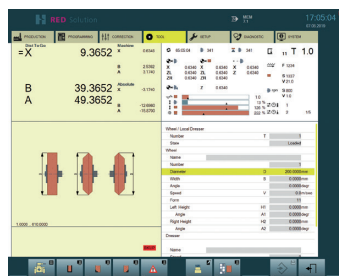
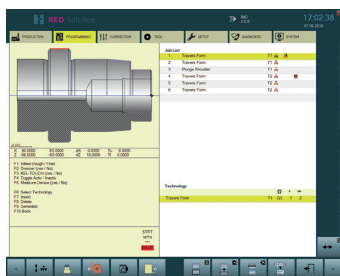
- ICON Guide
- GRAPHIC Guide with integrated technology processor

ADVANTAGE

- Unlimited G-Code programming
- Interactive
- Visualized part programming
- Quick set-up and results

BENEFITS

- Complex parts at minimized cycle time
- No G-Code needed
- Less downtime



BLACK CAM SOLUTION NON-ROUND, PROFILE; AND THREAD

- Full project management
- Simplified creation of Out of round and profile contours
- Integrated technology processor
- Simple CAD system features
- Create contours and profiles or import DXF and step-files
- Error Analysis and Simulation

ADVANTAGE

- No separate CAD system necessary
- Creation of complex contours and profiles no more challenging

- Grinding process technology available at a click

BENEFITS

- Complex parts at minimized cycle time
- Use of the machine as its maximum performance
- Minimized risk of machine or process errors

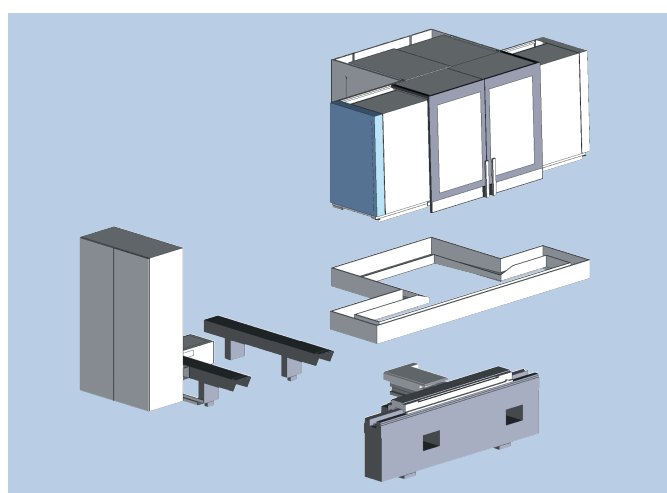
SECURITY INTERFACE / REMOTE DIAGNOSTICS



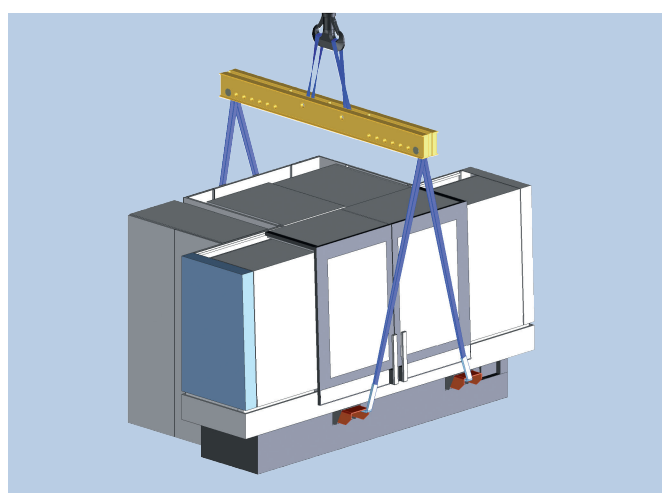
- Security Interface / Remote Diagnostics
- Highest IT Standard
- Industry 4.0 ready
- Reduced down- and waiting time
- Cost reduction at Service and Maintenance
- Preventive Maintenance

TECHNICAL DATA

Main Specifications			Metric	Imperial
Distance Between Centres	mm	inch	1000 / 1600	40 / 63
Grinding Length	mm	inch	1000 / 1500	40 / 59
Centre Height	mm	inch	200 / 250 / 300	7.87 / 9.84 / 11.81
Weight of Workpiece Between Centres	kg	lbs	150 / 200 / 300	330 / 441 / 660
Load on Chucked Work	Nm	lbft	160 / 320 / 750	118 / 236 / 553
Mains Voltage Required			3 x 400V / 50Hz / 3 x 460V / 60Hz	3 x 400 / 50 Hz / 3 x 460V / 60Hz
Power Consumption Depending on Equipment	A	A	35-80	35-80
Space Required / Length x Width	mm	inch	3600 x 2050 / 4600 x 2050	141.73x80.70 / 181.10x80.70
Longitudinal Slides Z-Axis				
Travel	mm	inch	1170 / 1670	46.06 / 65.74
Rapid Traverse Speed	m/min	ipm	20	787
Resolution	um	uinch	0.1	0.004
Wheelslides X-Axis				
Travel	mm	inch	365	14.37
Rapid Traverse Speed	m/min	ipm	10	393
Resolution	um	uinch	0.00001	0.0000004
B-Axis				
Resolution			0.0001	0.0001
Swiveling Range			max. 240	max. 240
Wheelhead General				
Drive Motor Water-Cooled	kW	hp	10	13.4
Peripheral Grinding Wheel Speed	m/s	ft/min	45 m/s standard / up to 63 m/s optional	
Wheelhead Universal				
Grinding Wheel Dimensions, Lefthanded Side	mm	inch	400 / 500	16 / 20
Grinding Wheel Dimensions, Righthanded Side	mm	inch	300 / 400 / 500	12 / 16 / 20
Wheelhand Tandem-Type				
Grinding Wheel Dimensions, Lefthanded Side	mm	inch	400 / 500	16 / 20
Grinding Wheel Dimensions, Righthanded Side	mm	inch	400 / 500	16 / 20
Wheelhand Diagonal				
Grinding Wheel Dimensions, Lefthanded Side	mm	inch	400 / 500	16 / 20
Grinding Wheel Dimensions, Righthanded Side	mm	inch	400 / 500	16 / 20



SEPARATE INFRASTRUCTURE



EASY TRANSPORT

Internal Grinding Attachment

Bore for Spindles Up to	mm	inch	120	4.72
HF Spindles MFM	kW	hp	10 / 15	13.4 / 20.1
Rotational Speed 1224 / 42	min-l	rpm	42,000	42,000
Rotational Speed 1242 / 60	min-l	rpm	60,000	60,000

Workhead Standard/Direction Drive

Rotational Spindle Speed	min-l	rpm	1-1000 / 1-1000 / 1-500	1-1000 / 1-1000 / 1-500
Internal Taper			MT5 / MT5 / MT6	MT5 / MT5 / MT6
Short Taper Holder, Outside			ISO 702-1 : Size 5 / Size 5 / Size 8	ISO 702-1 : Size 5 / Size 5 / Size 8
Micro-Adjustment	sec	sec	+/- 60	+/- 60

Tailstock

Internal Taper			MT4	MT4
Retraction of Sleeve	mm	inch	50 optional 80	1.96 optional 3.15
Micro-Adjustment	um	uinch	+/- 150	+/- 6

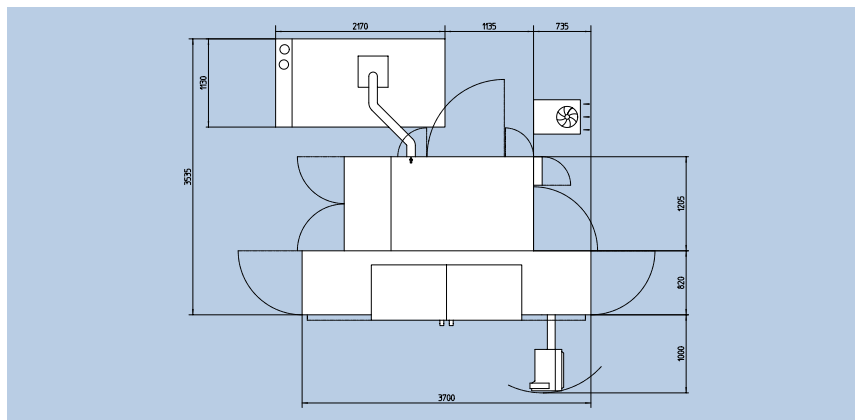
CNC Control System

Heidenhain	GRINDplus 6y40
Fanuc	Fanuc 3li

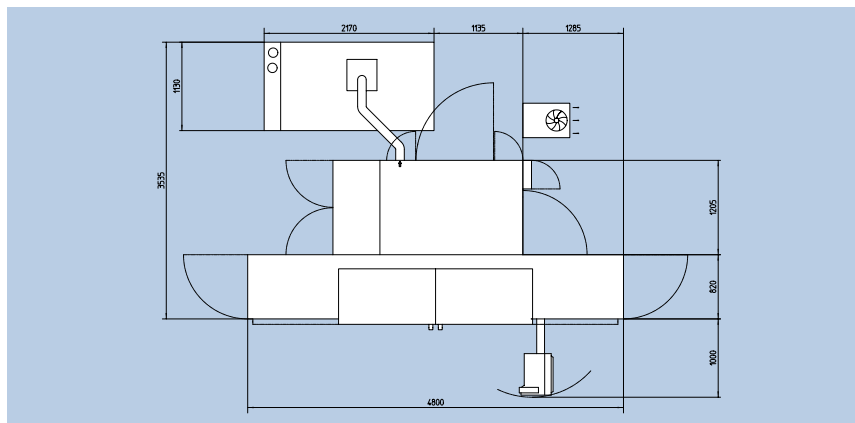
Measuring Systems

Gap Control	Acoustic emission
Balancing	Balancing

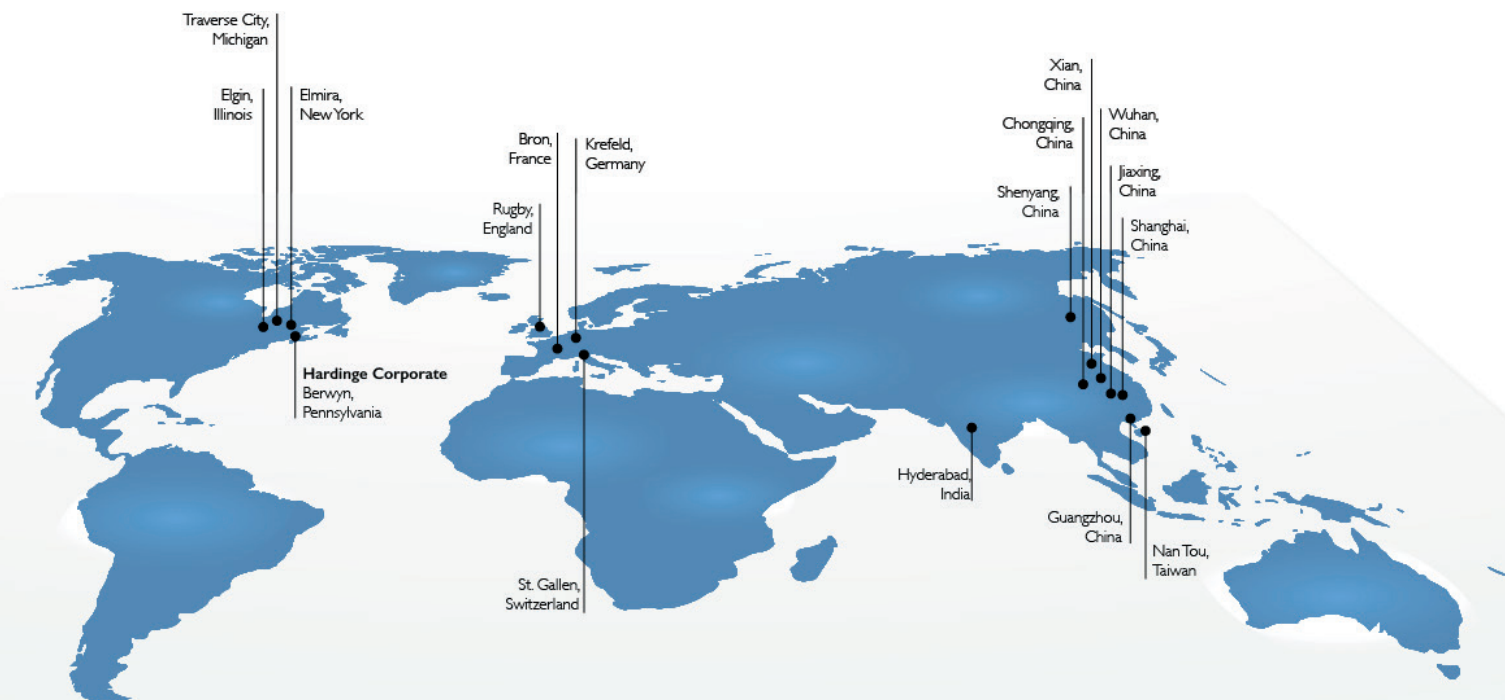
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SPACE-ASSIGNMENT PLAN 1000



SPACE-ASSIGNMENT PLAN 1600



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