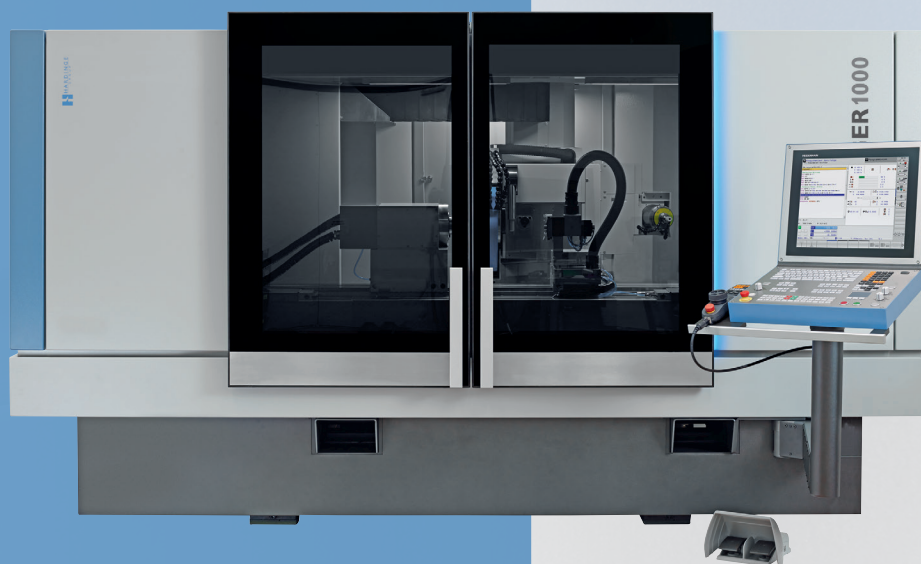


KELLENBERGER 1000

Cylindrical Grinding Systems



800-843-8801
WWW.HARDINGE.COM

 **HARDINGE**

INNOVATIVE GRINDING SYSTEM

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 I000 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-axis 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

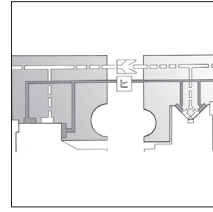
The machine table has been considerably extended so it allows unmatched, optimal positioning of the grinding wheel and a larger travel distance, but also many machining options and application-specific configurations.

FUNCTIONAL MACHINE CASING

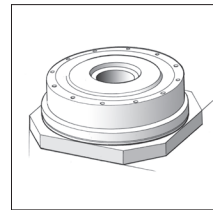
The increased sheet metal thickness means even more process reliability, allowing larger internal grinding wheel diameter of up to 125mm. With their large viewing windows, the generously-sized doors allow optimum control over the work process and make it easier to access the work space. The genuine glass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

EASY COMMISSIONING

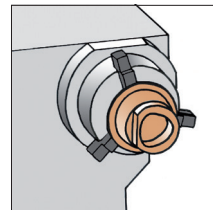
The integrated transportation concept (hook machine) shortens commissioning times considerably.



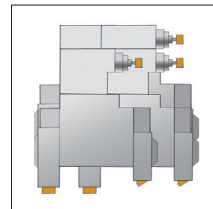
- Hydrostatics
- X and Z guideways
 - no stick-slip, no wear
 - good damping
 - ultra-fine correction options



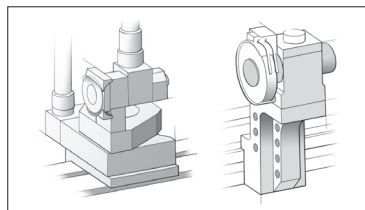
- Hydrostatic B-axis
- full-fledged NC axis
 - pre-tensioned hydrostatic guideway
 - Direct drive



- 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



FUNCTIONAL DESIGN WITH HIGHLY PRECISE TECHNOLOGY

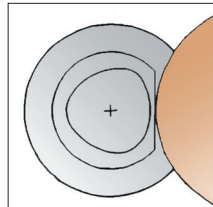
- Control system
- Heidenhain GRINDplus 640
 - FANUC 31i



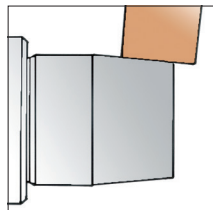
- Software
- KEL-MMI
 - KEL-SOFT



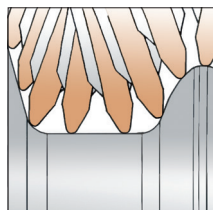
- X/C interpolation
- non-circular workpieces
 - Thread grinding
 - Jig grinding
 - Groove grinding



- X/Z interpolation
- Taper grinding
 - Profile grinding
 - dressing



- X/Z/B interpolation
- Contour B+
 - Profile grinding with controlled grinding wheel



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.

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



MEASURING SYSTEM

HYDROSTATIC B-AXIS

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

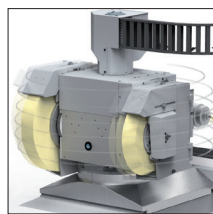
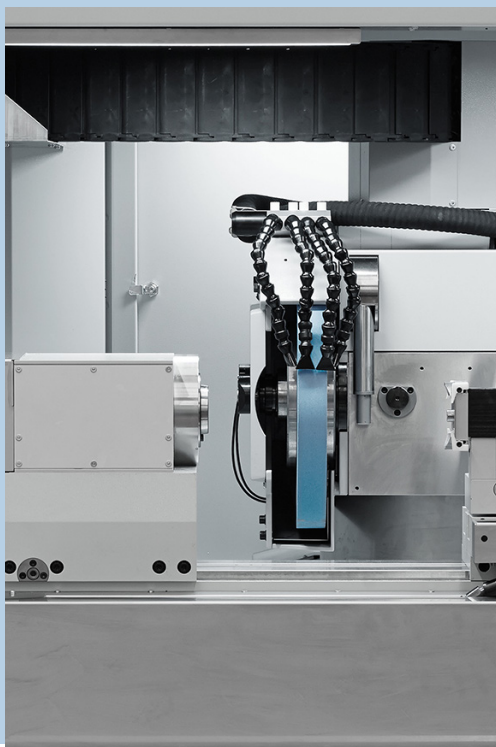
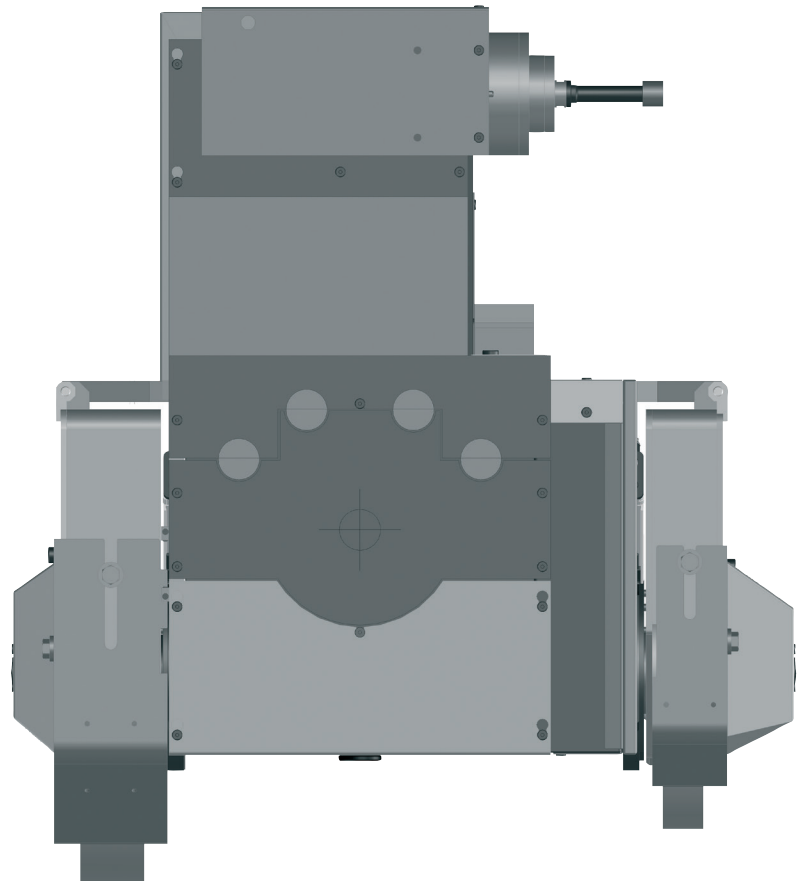
The pre-tensioned hydrostatic is the basis for higher accuracy and better surface quality. Steps of $0,0001^\circ$ can be traveled with ease.

KEL-SET

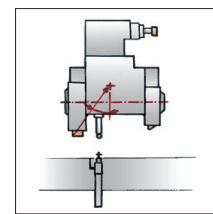
Automatic grinding wheel measuring system. Movements to the measuring ball and to the grinding wheels occur automatically, with their position information being stored in the control system. When swiveling the wheelhead into any angle, the positions of the grinding wheel edges are automatically taken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

ADVANTAGES FOR THE USER

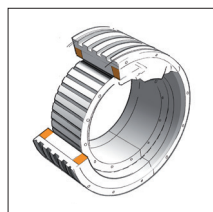
- Programming takes place with the actual dimensions according to the work drawings and independently of the swivel angle of the wheelhead
- no need for renewed calibration of the swiveled grinding wheel
- simple and fast acquisition of the grinding wheel data when retooling the machine
- integrated tool management for external, face- and internal grinding



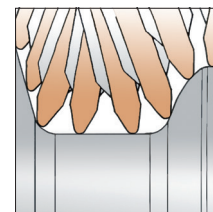
- Hydrostatic B-axis
- pre-tensioned hydrostatic guide
 - wear-free direct drive
 - one second 180° swiveling



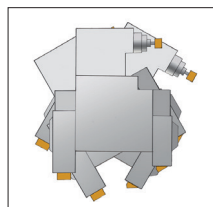
- KEL-SET
- Patented automatic grinding wheel measuring system



- Direct drive system
- water-cooled high-torque motor guarantees high level of torque
 - no referencing rotary encoder



- Contour B+
- Machining possible in unclamped state
 - short cycle times
 - new machining methods
 - high flexibility



- Clamping
- and B-axis position without any deformation
 - large dimensions guarantee high clamping moment

WORKHEAD, C-AXIS & TAILSTOCK

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.

WORKHEAD

- Roundness and dimensional accuracy due to pre-tensioned high-precision antifriction bearings
- Roundness of the workpiece $dR < 0.4 \mu\text{m}$ ($< 0.016 \mu\text{inch}$) on chucked work
- Versatile in use
- fine adjustment for cylinder correction for chuck work
- ISO 702-I spindle nose

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.

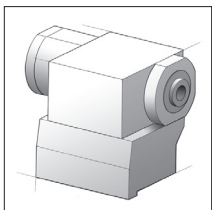
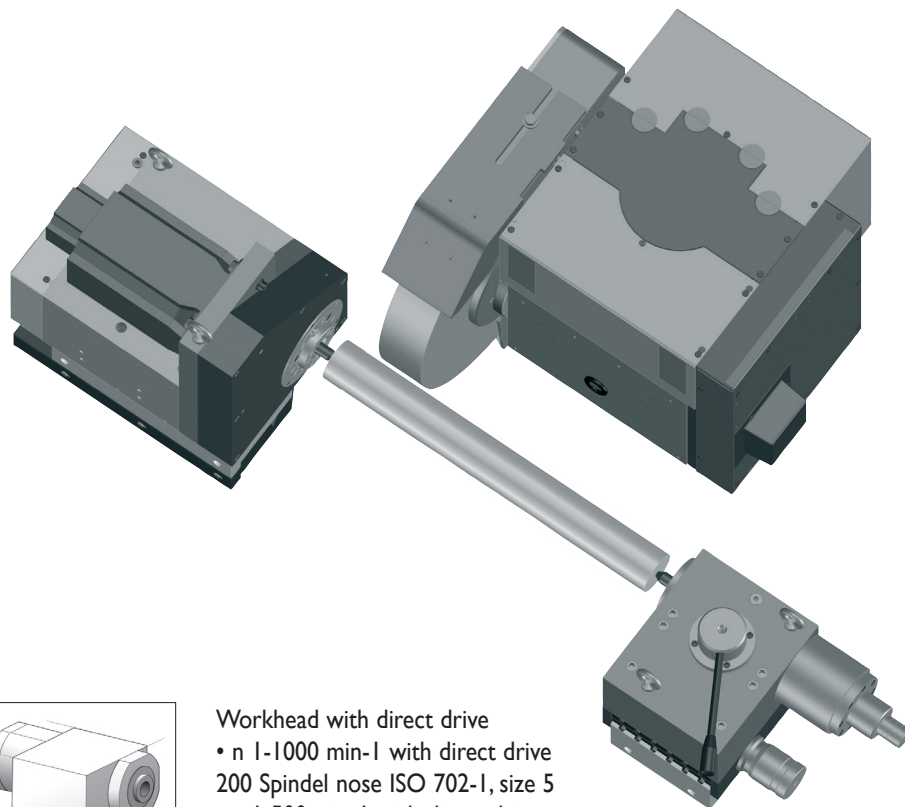
TAILSTOCK

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

- rigidity allowing 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

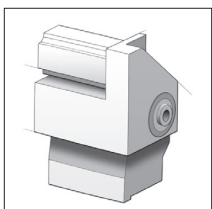
OPTIONS

- hydraulic or pneumatic sleeve retraction
- automated cylinder correction
- enlarged travel, 80 mm (3.14 inch)
- reinforced design



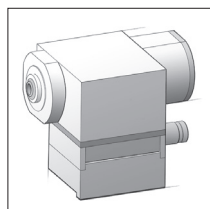
Workhead with direct drive

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



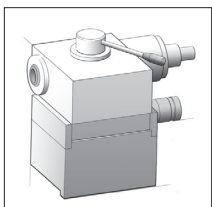
Workhead

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



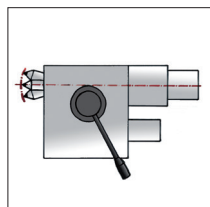
Synchronized tailstock

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



Tailstock

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



Micro-adjustment

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

MODULAR WHEELHEAD VARIANTS

UNIVERSAL WHEELHEADS

- Motor output 10 kW (13.6hp)
- 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

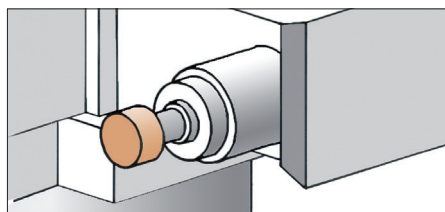
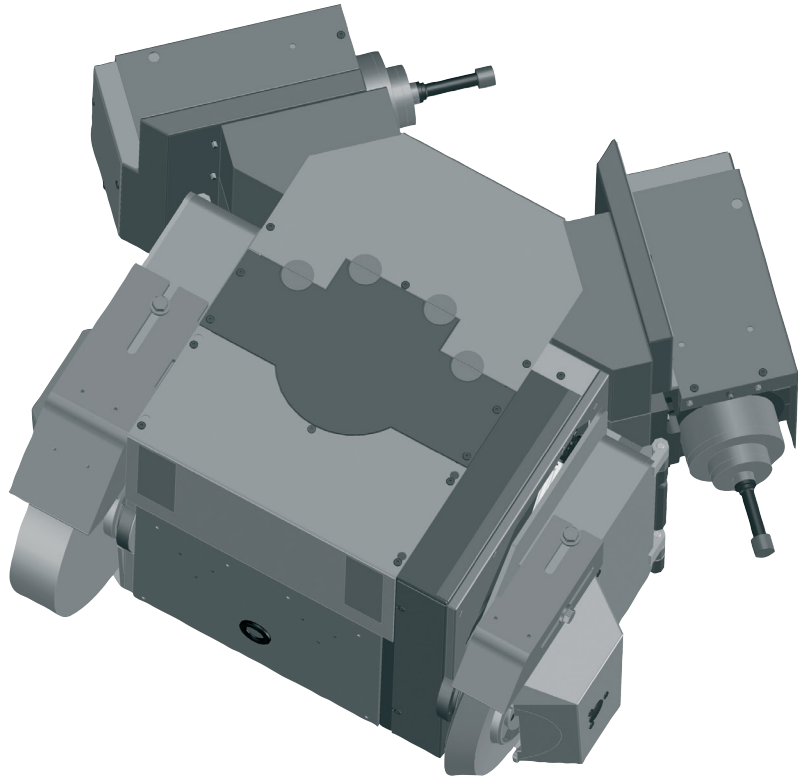
The universal wheelhead covers various user needs. In addition to external, face- and internal grinding, the use of two internal grinding spindles or the option of thread grinding or unround grinding are now increasingly in demand. Grinding in one setting allows shorter processing times and improves 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 10kW (13.6hp)
- 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

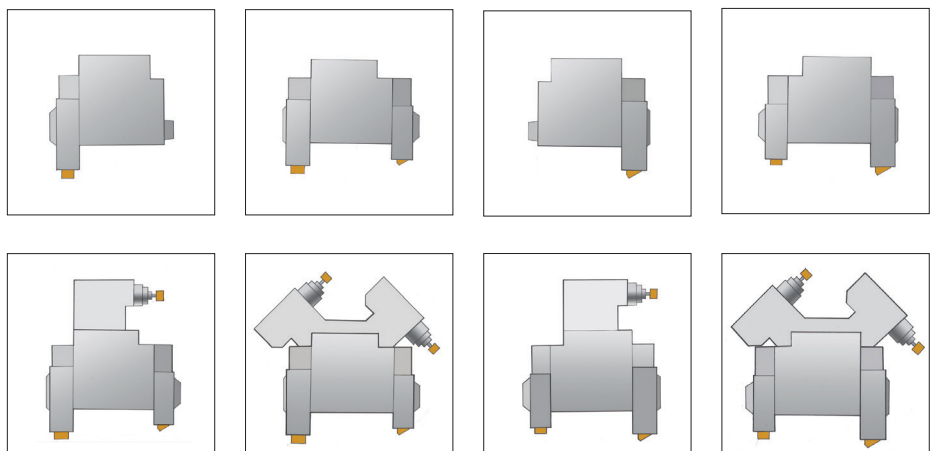
The diagonal wheelheads provide the option of rough and finish grinding in one setting. The additional use of HF ID grinding spindles also allows universal OD, face and ID grinding.



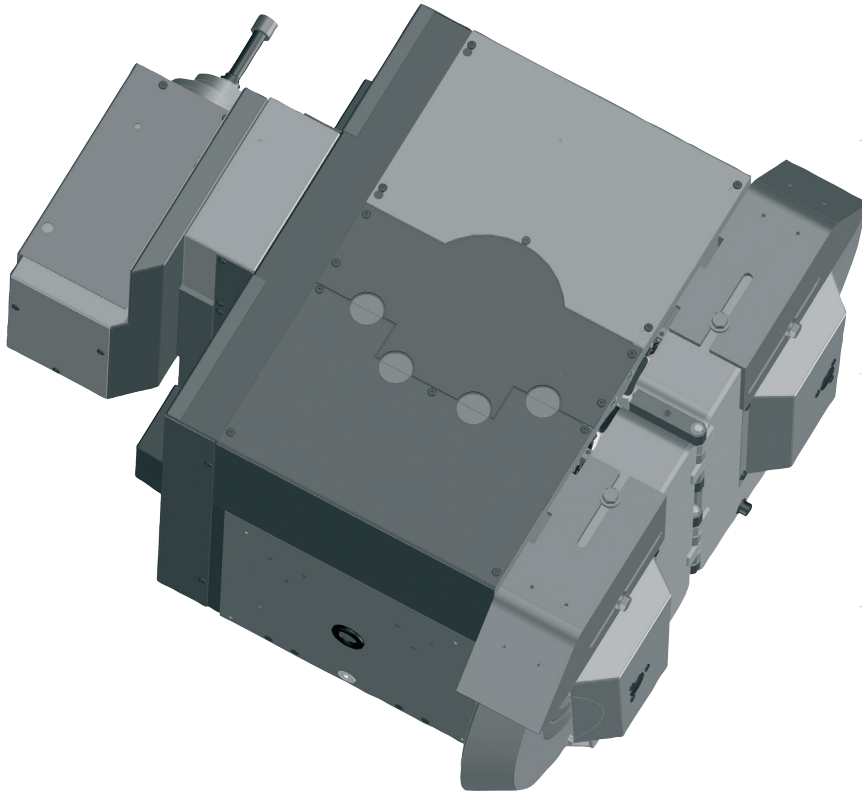
INTERNAL GRINDING ATTACHMENT

- high-frequency internal grinding spindle

UNIVERSAL WHEELHEADS

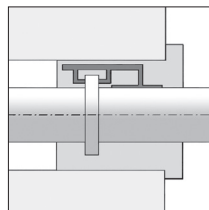
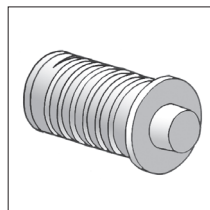


WORKHEAD, C-AXIS & TAILSTOCK



Water-cooled precision balanced drive motors

Hydrodynamic multi-surface spindle bearings



TANDEM-TYPE WHEELHEADS

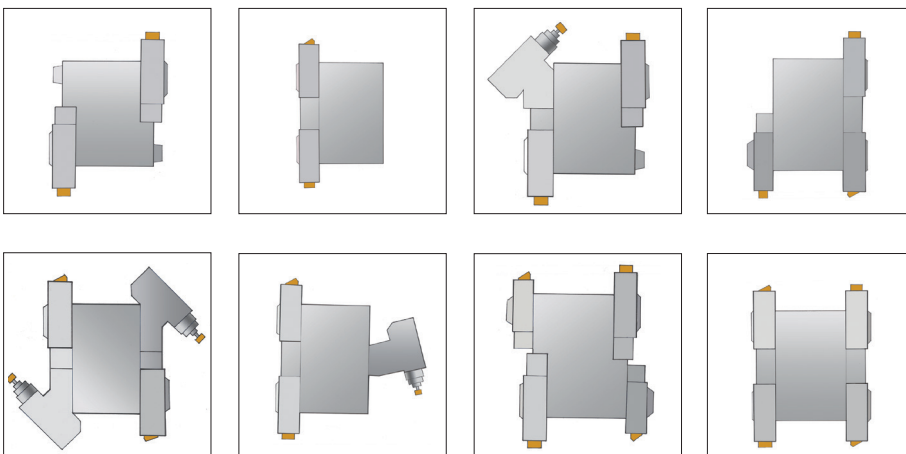
- Motor output 2x 10 kW (13.6hp)
- water-cooled precision-balanced drive motors
- infinitely variable drive of OD and ID grinding spindles
- hydrodynamic multi-surface spindle bearings
- Grinding wheel dimensions 2x $\varnothing 500 \times 63$ (20 x 2.5 inch)
- high-frequency ID grinding spindles
- min. 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.

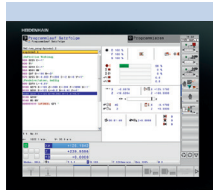
HF ID GRINDING SPINDLES

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

DIAGONAL/TANDEM-TYPE WHEELHEADS



CONTROL SYSTEM HEIDENHAIN GRINDPLUS 640



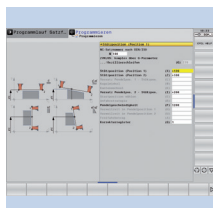
Monitor

- 19" TFT Multitouch
- expanded process data display



Keypad

- Mobile hand panel with handwheel/ emergency stop/ confirmation key



KEL-PROG

- dialog based ISO programming
- Cycle selection via Softkeys

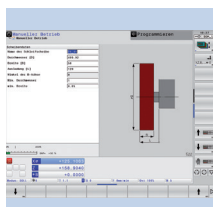


KEL-FORM

- Standard non-circular contour

KEL-GRAPH

- graphical programming
- Cylinders, cones, radii
- DXF import

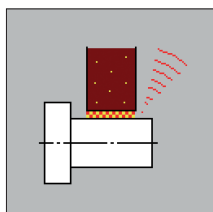


KEL-TOOL

- Tool administration
- local dressing devices
- Standard wheel definition

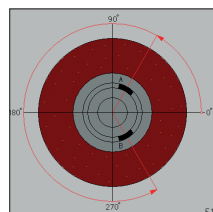


OPTIONS



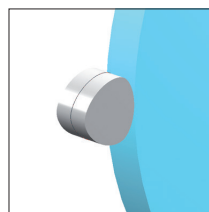
KEL-TOUCH

- GAP control with up to six sensors
- Operation/display integrated control system



KEL-BALANCE

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



KEL-SOFT OORG

- 3D software for creating non- circular grinding programs
- Algorithms for error detection and correction. Contour and grinding analysis
- Animation of non-circular motion and profile programmes

FANUC CONTROL SYSTEM 31i CONTROL SYSTEM



Monitor

- 19" TFT Multitouch
- expanded process data display



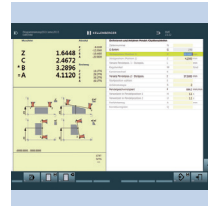
Keypad

- Mobile hand panel with handwheel/ emergency stop/ confirmation key



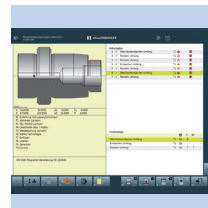
KEL-PROG

- dialog based ISO programming
- Cycle selection via Softkeys



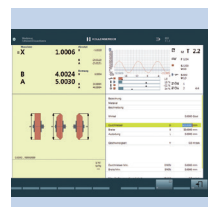
KEL-FORM

- Standard non-circular contour



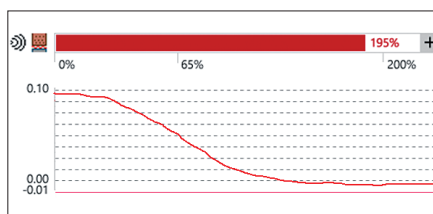
KEL-GRAPH

- graphic programming
- Cylinders, cones, radii
- DXF import
- Visualization of the grinding process



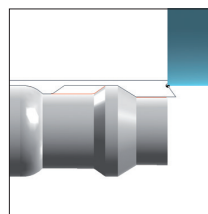
KEL-TOOL

- Tool administration
- local and global dressing devices
- Standard wheel definition with multiple reference points



In-process gauge system

- up to four gauge heads
- interrupted diameters
- non-interrupted diameters
- passive longitudinal positioning



KEL-SOFT Profil

- Contour-grinding or profile-dressing programmes
- CAD import, thread, clearing cycles



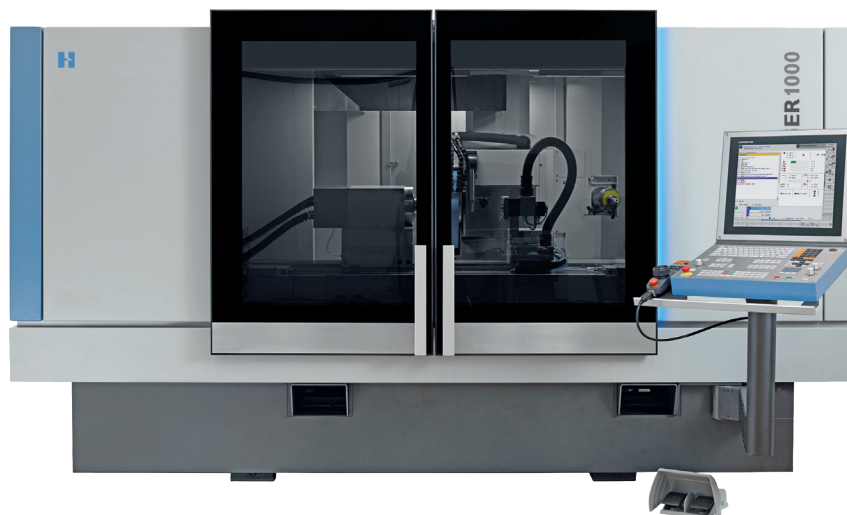
Remote diagnostics

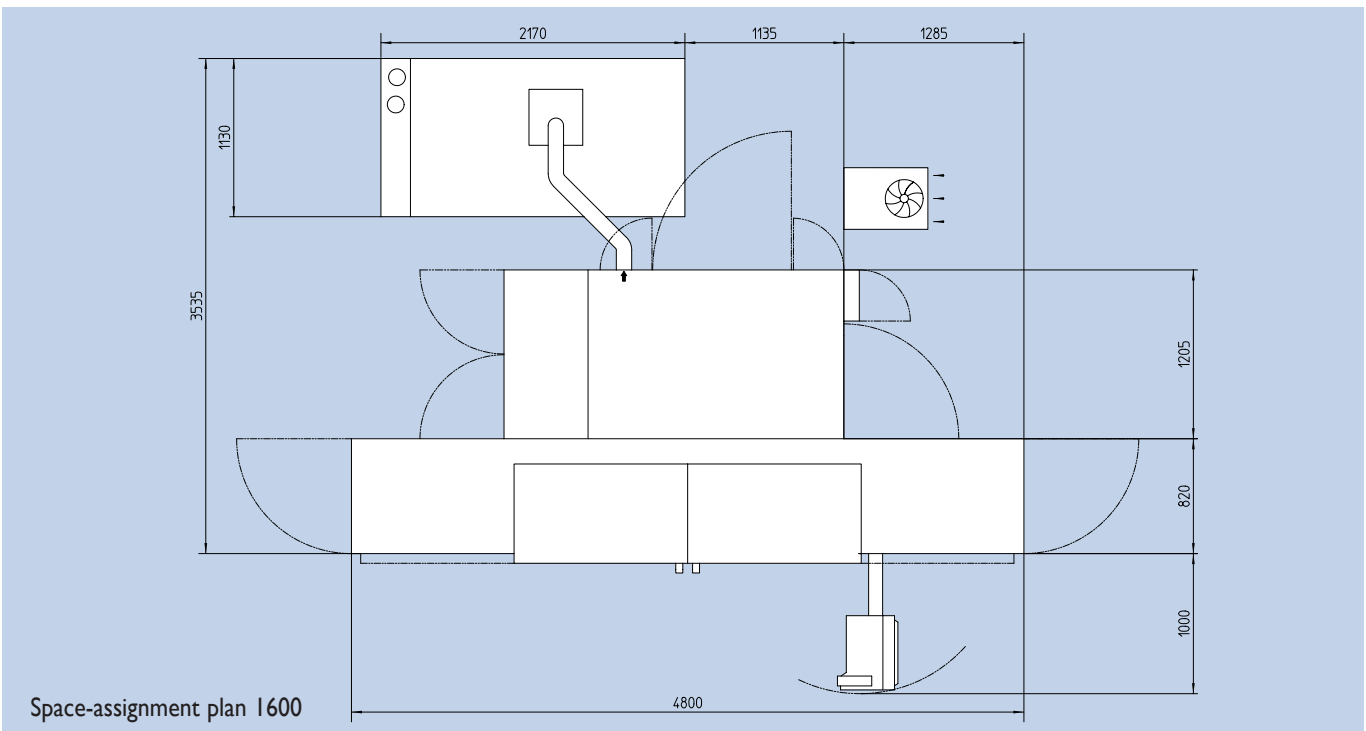
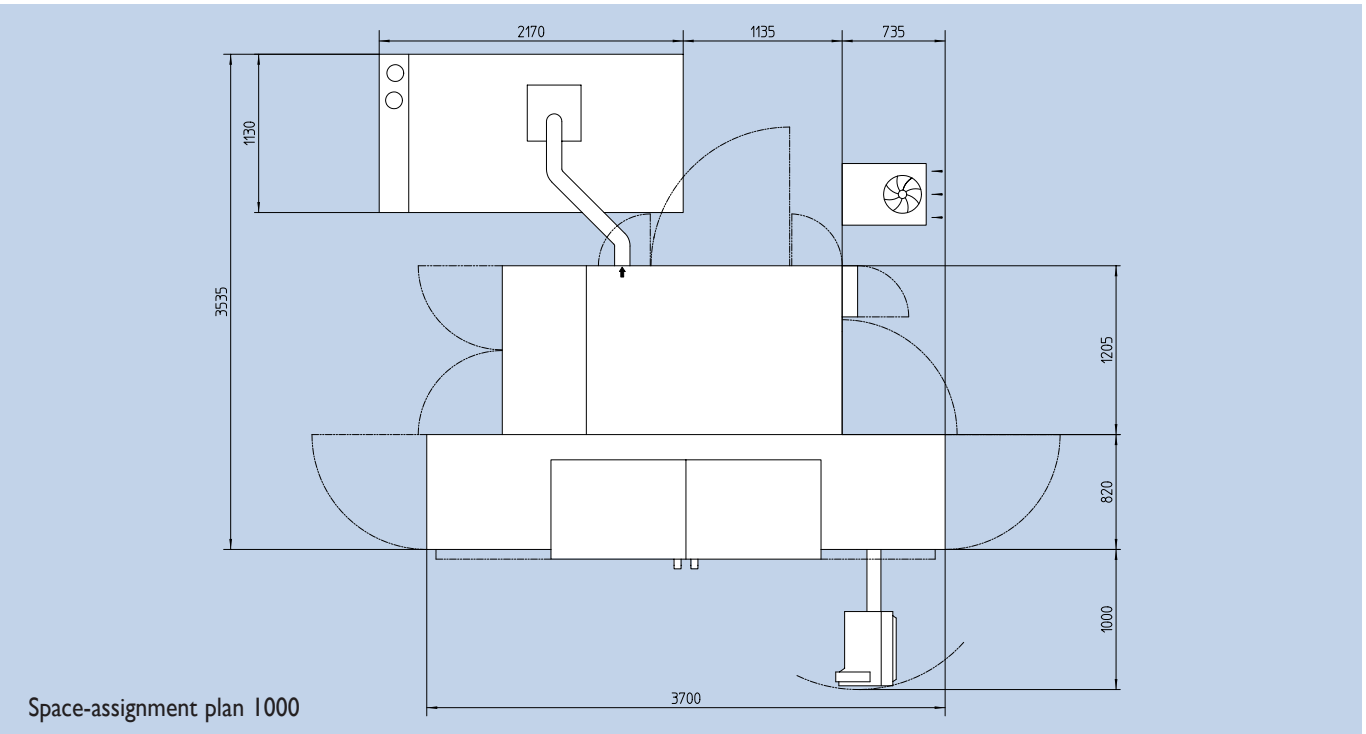
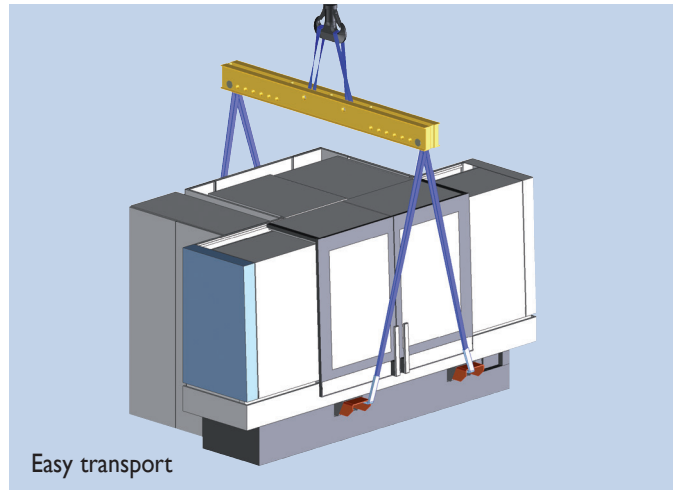
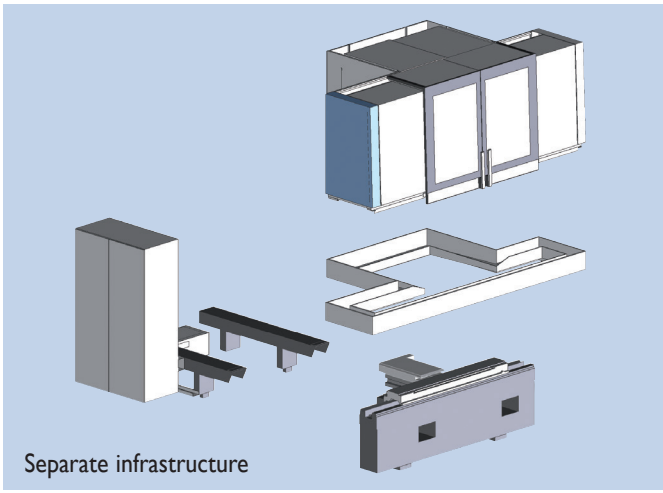
- Reduced standstill and maintenance times
- Reduction in costs for service and maintenance
- easy operation
- highest IT security standard

SPECIFICATIONS

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 / 50 Hz / 3 x 460V / 60 Hz	3 x 400V / 50 Hz / 3 x 460V / 60 Hz
Power consumption depending on equipment	A	A	35-80	35-80
Space required / length x width	mm	inch	3600 x 2050 / 4600 x 2050	141.73 x 80.70 / 181.10 x 80.70
Longitudinal slide: Z-axis				
Travel	mm	inch	1170 / 1670	46.06 / 65.74
Rapid traverse speed	m/min	ipm	20	787
Resolution	µm	µinch	0.1	0.004
Wheelslide: X-axis				
Travel	mm	inch	365	14.37
Rapid traverse speed	m/min	ipm	10	393
Resolution	µm	µinch	0.1	0.004
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	35 / 45 v-konstant	6890 / 8860
Wheelhead Universal				
Grinding wheel dimensions, lefthand side	mm	inch	400 / 500	16 / 20
Grinding wheel dimensions, righthand side	mm	inch	300 / 400 / 500	12 / 16 / 20
Wheelhead Tandem-type				
Grinding wheel dimensions, lefthand side	mm	inch	400 / 500	16 / 20
Grinding wheel dimensions, righthand side	mm	inch	400 / 500	16 / 20
Wheelhead Diagonal				
Grinding wheel dimensions, lefthand side	mm	inch	400 / 500	16 / 20
Grinding wheel dimensions, righthand side	mm	inch	400 / 500	16 / 20
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 / Direct drive 200 / Direct drive 300				
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	µm	µinch	+/- 150	+/- 6
CNC control system				
Heidenhain			GRINDplus 640	
Fanuc			Fanuc 31i	
Measuring systems				
Gap Control			KEL-TOUCH	
Balancing			KEL-BALANCE	

All specifications and designs are subject to alterations without notice







HARDINGE COMPANIES WORLDWIDE

Hardinge is a leading international provider of advanced metal-cutting solutions. We provide a full spectrum of highly reliable CNC turning, milling, and grinding machines as well as technologically advanced workholding accessories.

The diverse products we offer enable us to support a variety of market applications in industries including aerospace, agricultural, automotive, construction, consumer products, defense, energy, medical, technology, transportation and more.

We've developed a strong global presence with manufacturing operations in North America, Europe, and Asia. Hardinge applies its engineering and applications expertise to provide your company with the right machine tool solution and support every time.

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