



**SKY**

**Product Presentation**

- [Advantages and Applications](#)
- [Main Features and Options](#)



## ADVANTAGES AND APPLICATIONS



## Advantages and Applications

### Better performances

#### Higher Precision & Backlash Recovery

**Absolute linear glass scales\*** up to 4000 mm stroke, with no need of regulation: **less temperature deviations** compared to the steel version (stroke > 4000 mm).

**Monolithic structure** to guarantee **high precision and stability** overtime, with thickness dimension of 12 mm including internal ribs and thermal stabilization.

**Axis and spindle thermal compensation probes.\***

**Vibration monitoring system** with different configurations in order to preserve machine and spindle performances.

#### Higher Rigidity

**Precision ball screws** diameter 63 mm with controlled preload.

**Preloaded runner blocks** - long version assembled on **rails** dimension 45.

**Compact and rigid fork head** with torque motors and hydraulic locking system on the rotary axes.

#### Higher Speed and Dynamic

**Fast exchange arm** to avoid dust or chips in the tool holders.

**Increased tool change speed** up to 8 " \*

**Feed rate self-adapting control** during milling process. \*

#### Safe & Clean Environment

**Cooling system with filters and chip conveyor** for aluminium high volume milling.

**Chiller unit for coolant** to stabilize the temperature of the liquid during the milling process for moulding applications.\*

**Chip reader system** for automatic recognition and information on the tool life cycle. \*

**Tool changer with up to 200 positions**, managed by a robot on the side of the machine.

**Dedicated cameras** set on the spindle housing to **verify the working cycle and monitor unattended machining** .\*

\* Optional

## Enhanced precision

EXAMPLE: SKY 2617

AXIS	TYPE	STROKE	POSITIONING PRECISION	REPEATABILITY
X	Linear	2600 mm	0,019 mm ( $\leq 0,008/m$ )	0,008 mm
Y	Linear	1700 mm	0,016 mm ( $\leq 0,008/m$ )	0,006 mm
Z	Linear	1300 mm	0,011 mm ( $\leq 0,007/m$ )	0,006 mm
C	Rotary	+/- 360°	20 arcsec	10 arcsec
A	Rotary	+135°/-110°	20 arcsec	10arcsec

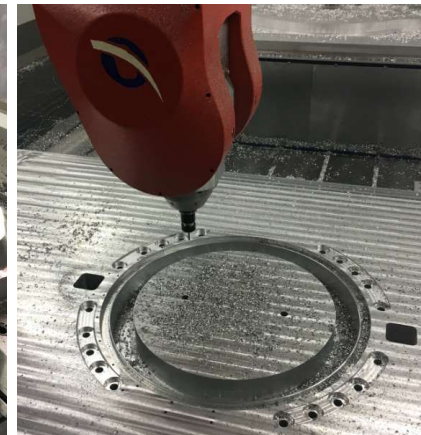
## THE IDEAL SOLUTION FOR MACHINING PATTERNS AND MOULDS, ESPECIALLY IN ALUMINIUM.

Materials: aluminium and light alloys; tempered steel and stainless steel; composite materials (resins, carbon fiber, kevlar, fiberglass, honeycomb); resins.

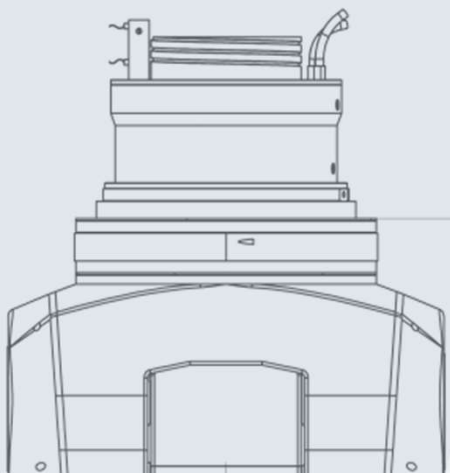
Application sectors:



AUTOMOTIVE | AEROSPACE | RAILWAY | MILITARY | PATTERNS & MOULDS | MEASURING & CONTROL CALIBERS



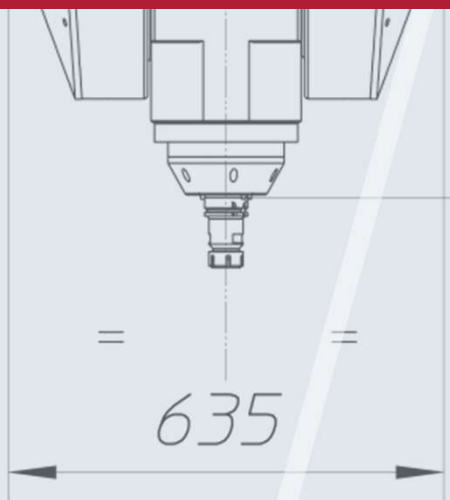
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## MAIN FEATURES AND OPTIONS



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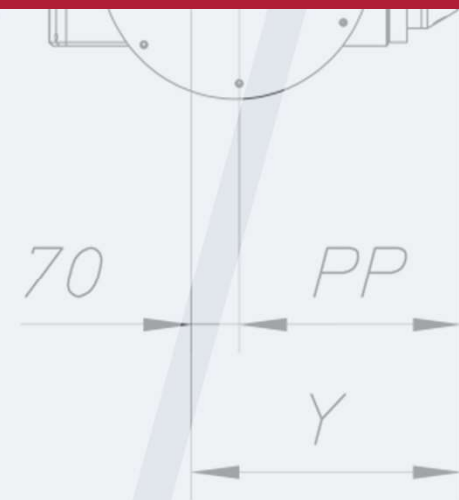
635



X

70

PP



70

PP

Y

### Description

The SKY Series offers **higher rigidity and accuracy on the tool bit**, drastically reducing vibrations and assuring **high finishing quality**.

Machining centers with screw handling, equipped with linear scales, **ideal for the automotive and aerospace sectors, and more generally for the production of moulds and dies in aluminium or steel, as well as components in composite materials**. This series is designed to offer a **unique combination of performances: reduced machining times, flexibility, high quality surface finish, rigidity and durability**.

SKY					
Axis	X	Y	Z	C	A
Stroke	2,6/3,6 m	1,7/2,2/3 m	1,3 m	+/- 360°	+135° / -110°
Speed	50 m/min		30 m/min	60 rpm	60 rpm
Spindle	From 30 kW up to 42 kW at 24.000 rpm max.				
CNC	Siemens, Heidenhain, Fanuc				
Tool change	From 18 to 200 positions				
Linear accuracy	≤ 0,008 mm/m for linear axes				
Rotary accuracy	+/- 10 arc sec for rotary axes				
Measurement system	Heidenhain absolute linear glass scales, 5 micron resolution				



## Main Features and Options

### Structure

SKY machines are **simultaneous 5 axes CNC High Speed Gantry Machining Centres** featuring a monolithic structure with suspended bridge sliding on the two extremities, and made of extra-thick, welded and heat-treated steel.



## Main Features and Options

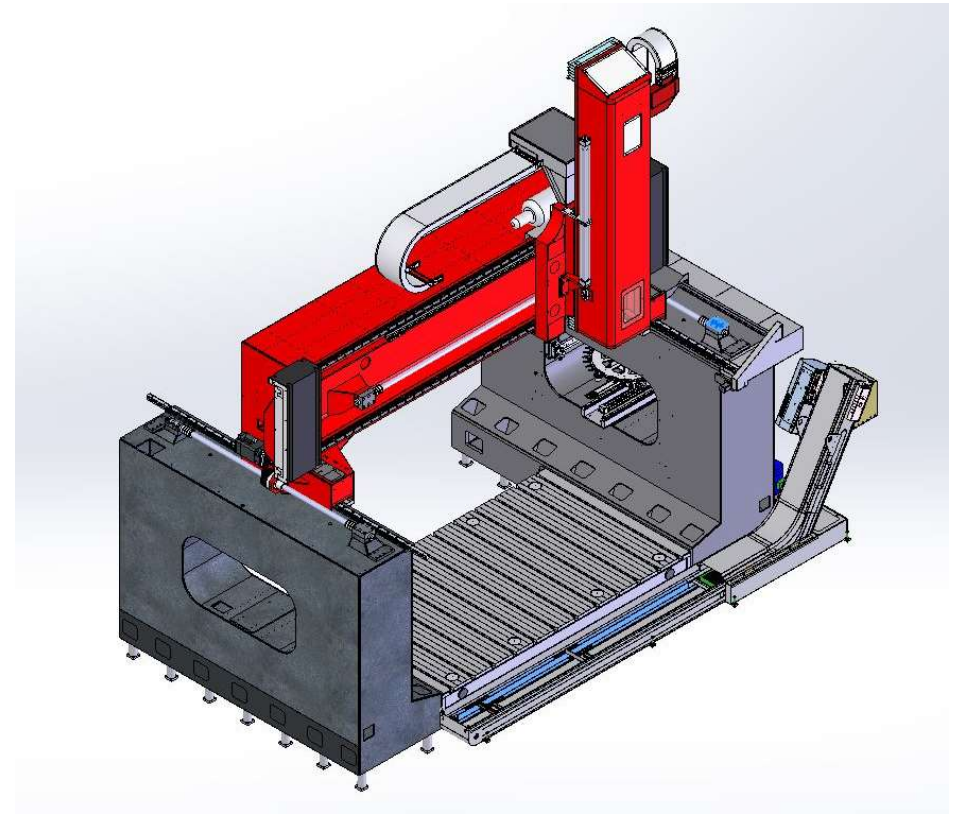
### Structure

The longitudinal movement (Y axis) is made by a **weight-optimized and structurally rigid portal**.

For **highly dynamic performance and precision**, the transversal movement (X axis) is made by the carriage running on the bridge, on which is mounted a vertical ram (Z axis) with high bending strength for large ranges.

The Z axis is provided **with balancing and stop devices preventing the machine from damages in case of voltage drop**.

The **fourth axis (C)** rotates the unit around the vertical Z-axis and the **fifth axis (A)** tilt the spindle in the vertical plane. The **rotary axes are equipped with special gearbox to eliminate the backlash**.

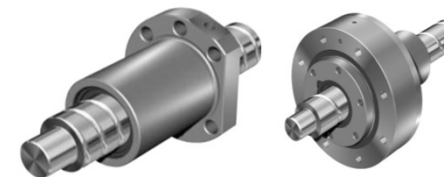


## Handling and axes

### RECIRCULATING BALL SCREWS

The movement is driven by ball screws (diameter 63 mm, pitch 40 m); the position is controlled by Heidenhain linear scales with 5 micron accuracy.

Axis	Type	Dimension	Pitch	Thrust	Feed rate	Acceleration	Recirculating screws supplier	Kinematics	Lubrication
X	Ball	Ø 63	40 mm	27.000 N	50 m/min	3 m/sec. <sup>2</sup>	Bosch-Rexroth	Pre-loaded nut	Automatic
Y	Ball	Ø 63	40 mm	27.000 N	50 m/min	3 m/sec. <sup>2</sup>	Bosch-Rexroth	Pre-loaded nut	Automatic
Z	Ball	Ø 50	20 mm	10.000 N	30 m/min	3 m/sec. <sup>2</sup>	Bosch-Rexroth	Pre-loaded nut	Automatic

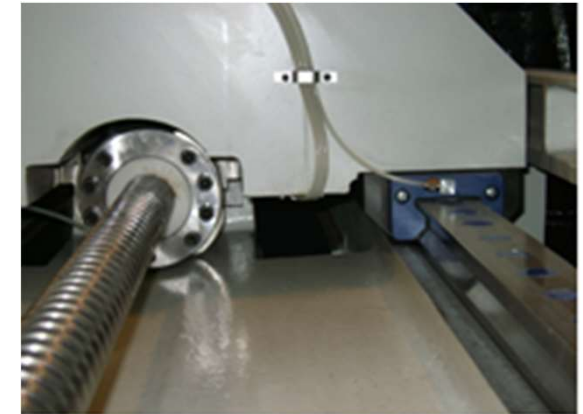


## Main Features and Options

### Handling and axes

Axis	Diam./Pitch	Thrust	Feed rate	Acceleration
X	63/40 mm	27.000 N	50 m/min	3 m/sec. <sup>2</sup>
Y	63/40 mm	27.000 N	50 m/min	3 m/sec. <sup>2</sup>
Z	50/20 mm	10.000 N	30 m/min	3 m/sec. <sup>2</sup>

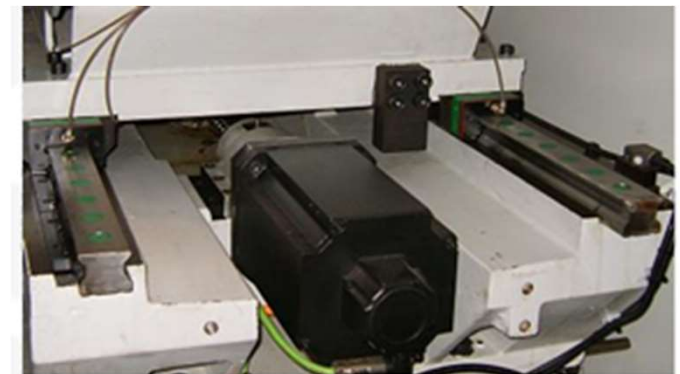
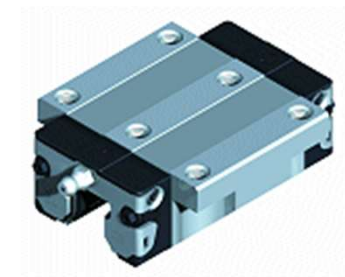
Axis	Recirculating screws supplier	Kinematics
X	Bosch-Rexroth	Pre-loaded nut
Y	Bosch-Rexroth	Pre-loaded nut
Z	Bosch-Rexroth	Pre-loaded nut



## Handling and axes

### RECIRCULATING SLIDING BLOCKS ROLLER TYPE

Axis	Type	Dimension	Blocks	Lubrication
X	Roller	RA 45	6	Automatic
Y	Roller	RA 45	8	Automatic
Z	Roller	RA 45	6	Automatic

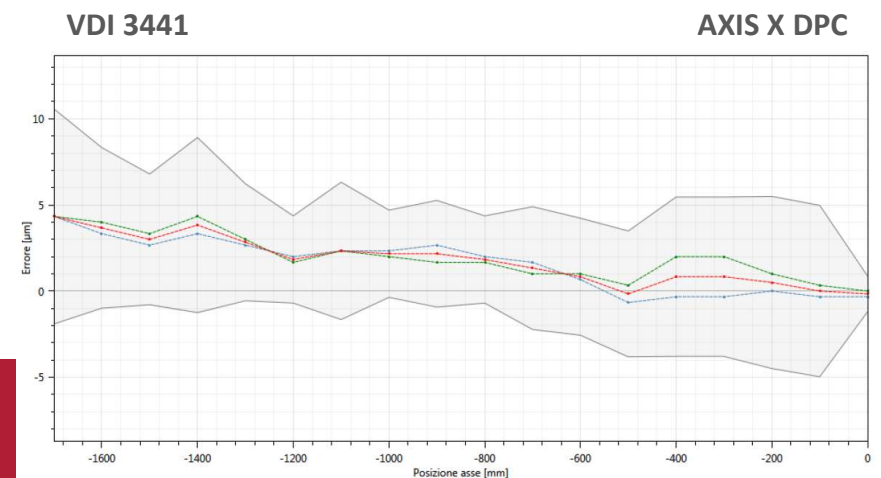


## Handling and axes

### VDI-DGQ 3441

Specified machine accuracy can be achieved at a constant environmental temperature of 20°C (+/-2°C).

Even in the absence of linear scales, accuracy can be optimized by creating a calibration table with axis position detection by means of an interferometer. The calibration table is stored in the CNC memory. The CNC uses this data to automatically compensate the positions of the axes. The laser interferometric system issues a positioning accuracy certificate based on the VDI-DGQ 3441.



### ADVANTAGES

- **Guaranteed performances in terms of precision and repeatability of the machine as well as complete calibration of the linear and rotative axes at the initial levels (of the installation), thanks to the scheduled, preventive maintenance.**
- **It is possible to create different tables of compensation that can be activated directly from the NC, in case of non-air-conditioned environments with temperature variations upon season changes. \***

### Accuracy (10 axis strokes test):

Positioning accuracy	P = 16 µm
Repeatability	PS= 6 µm

\* Optional



### Working table

#### ALUMINIUM VACUUM TABLE

Specifically designed for aluminium plate machining, this aluminium table is provided with a grid matrix with grooves for vacuum-evacuation through rubber seals. It is also equipped with a metal insert hole matrix for mechanical clamping/vacuum passage.

#### ADVANTAGES

- **Clamping area adjustable** according to the size and position of the piece.
- **Clamping area delimited by the arrangement of the gasket in the channels of the table:** it is possible to clamp the piece directly on the table or combine it with a expendable surface.
- **Mechanical clamping** is possible using vacuum screws and clamps.





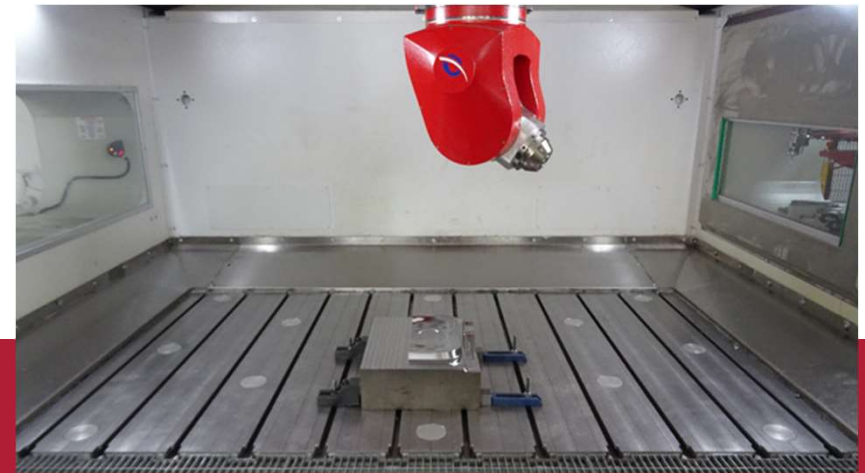
## Main Features and Options

### Working table

#### STEEL TABLE WITH T-SLOTS

The working table consists of a steel table with **T-slots for piece fixing**: 250 mm interaxis with **loading capacity of 400 kg/m<sup>2</sup>**.

The table is equipped with a special V-shaped processing, which avoids the gluing of the piece to the table due to the vacuum during machining with coolant.



#### ADVANTAGES

- **The most rigid and precise solution:** the table is mechanically connected to the monolithic structure of the machine and allows to have a single machine/piece body, granting stability and machining precision.
- Particularly suitable for mechanically clamping equipment and pieces to the table.

### Working table

#### TABLE WITH T-SLOTS AND ZERO POINT

The T-slot table could be customized with embedded zero point connection, pneumatic or hydraulic, according to the clamping force required.

The zero point distance can be agree with the jig size. The operator can also open or close the zero point using a dedicated M function, that will guarantee the positioning.

#### ADVANTAGES

- The zero point system is the fastest way to change jigs: the pieces or equipment can be positioned within the working area with a repeatability  $<0,01\text{mm}$ , without changing alignment/positioning and using customized reference pins.



### Head and Electrospindle

#### SINGLE SHOULDER HEAD

This simultaneous 5-axis machining head **enables tool inclination and orientation in any 3D direction**. It is equipped with servomotors with gearboxes and direct measurement system to grant **high dynamism and accuracy performances**.

It is also provided with a pneumatic / oil-dynamic axis locking system for the rotating axes which allows a **higher machining rigidity**.

#### ADVANTAGES

- **Compact design to decrease collision issues:** the spindle can be very close to the part, without using very long tool holders.
- **Particularly suitable for working in small and indoor spaces.**



### Head and Electrospindle

#### 22kW SINGLE SHOULDER HEAD

- Axis C +/-270°
- Axis A +/-120°
- Rotary axes accuracy: 30 arc/sec
- Repeatability: 12 arc/sec
- Pneumatic rotary axes brakes
- C axis clamping force: **1.100 Nm**
- A axis clamping force: **1.100 Nm**

#### *Equipped with:*

##### **ELECTROSPINDLE 22 kW**

- |   |                                  |
|---|----------------------------------|
| - Power: <b>22kW</b> (S1)                     | - Liquid cooled spindle          |
| - Max. rotation speed: <b>20.000 rpm</b>      | - Permanent grease lubrication   |
| - Max. torque: <b>28 Nm</b> at 7.500 rpm (S1) | - Automatic tool change          |
| - Tool taper: <b>HSK A63</b>                  | - Rotary joint tool lubrication* |

#### 42kW SINGLE SHOULDER HEAD

- Axis C +/-270°
- Axis A +/-100°
- Rotary axes accuracy: 20 arc/sec
- Repeatability: 10 arc/sec
- Oil-dynamic rotary axes brakes
- C axis clamping force: **3.000 Nm**
- A axis clamping force: **2.000 Nm**

#### *Equipped with:*

##### **ELECTROSPINDLE 42 kW**

- |   |   |
|---|---|
| - Power: <b>42kW</b> (S1)   | - Liquid cooled spindle                     |
| - Max rotation speed: <b>24.000 rpm (18.000 rpm grease lubrication)</b> | - DLS (oil) or permanent grease lubrication |
| - Max. torque: <b>67 Nm</b> at 6.000 rpm (S1)                           | - Automatic tool change                     |
| - Tool taper: <b>HSK A63</b>  | - Rotary joint tool lubrication*            |

\* Optional

## Main Features and Options

### Head and Electrospindle

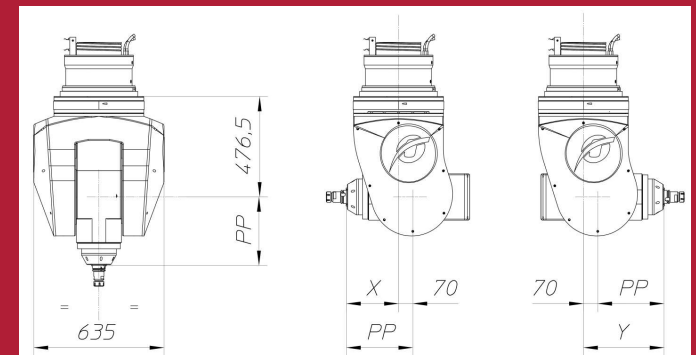
#### FORK HEAD TORQUE

This fork head is made of spheroidal cast iron and is equipped with hydraulic brakes on the rotary axes A and C. C axis movement is managed by a torque motor, while the A axis is activated by double motor with torque multiplier and backlash resetting.



#### ADVANTAGES

- Suggested for **increasing the component finishing quality** during the **simultaneous machining of linear axes interpolated with rotary axes A and C.**
- Designed to reach undercuts processing up to **45°**, allowing the **machining of the piece in the lower part.**
- Thanks to its symmetry, **better stability and rigidity**, it is particularly suitable for aluminium machining and ideal for the automotive, aeronautical and mechanical sectors.



### Head and Electrospindle

#### FORK HEAD TORQUE

- Axis C +/-360°
- Axis A +135° -110°
- Rotary axes accuracy: 20 arc/sec
- Repeatability: 10 arc/sec
- Oil-dynamic rotary axes brakes
- C axis clamping force: **2.000 Nm**
- A axis clamping force: **2.000 Nm**

#### Equipped with:

##### **30 kW ELECTROSPINDLE (IBAG)**

- Power: **30kW** (S1)
- Max. rotation speed: **24.000 rpm**
- Max. torque: **29 Nm** at 10.000 rpm (S1)
- Tool taper: **HSK A63**
- Liquid cooled spindle
- Permanent grease lubrication
- Automatic tool change
- Rotary joint tool lubrication\*

#### or:

##### **42 kW ELECTROSPINDLE (IBAG/FISCHER)**

- Power: **42kW** (S1)
- Max. rotation speed: **24.000 rpm**
- Max. torque.: **67 Nm** at 6.000 rpm (S1)
- Tool taper : **HSK A63**
- Liquid cooled spindle
- DLS (oil) or permanent grease lubrication
- Automatic tool change
- Rotary joint tool lubrication\*

\* Optional

### Tool changer

#### 18/24/30-POSITION AUTOMATIC TOOL CHANGER

The tool changer is integrated on the right/left side of the machine structure and **it consists of a carousel featuring HSK F63, HSK A63 toolholder collets.**

The carousel is driven by a gearbox and brushless motor with a maximum rotation of 180°/s to guarantee a faster movement for tool changing, a pneumatic cylinder move the carousel inside the working area during tool changes operations.

Tool dimensions: 110 mm diameter in the adjacent position, 300 mm length and 5 kg weight.

#### ADVANTAGES

- Thanks to the tool changer location outside the working area, **tools can be replaced manually through a safe side access.**
- **Greater safety:** each station is controlled by a **photocell that checks the presence of the tool holder, avoiding collisions caused by operator errors.**



## Main Features and Options

### Tool changer

#### TOOL CHANGER WITH ROBOT SOLUTION UP TO 200-POSITIONS

The ring or chain **tool changer with 200-positions** is managed by a robot on the right/left side of the machine. The robot arm is equipped with a clamping system which pre-loads the next tool automatically, **in order to decrease the tool change cycle time.**

Tool taper: HSK A63.

200 positions: maximum diameter is 130 mm in adjacent position, maximum length is 300 mm and weight is 10 kg.



#### ADVANTAGES

- **Greater safety and cleanliness:** tool changer installed outside of the working area with external protections.
- **Efficiency and safety:** it is possible to change the tools from the racks outside the machine while it is working.
- **Flexibility:** it is possible to manage very large tools such as angular heads and saw blades.





## Main Features and Options

### Protection system

#### PERIMETER ENCLOSURE WITH MANUAL FRONT DOOR

The perimeter enclosure is equipped with **wide windows for visual inspection** of the working area and is made up of **sound absorbing panels to reduce noise while ensuring a clean environment** inside the working area.

Doors are equipped with **safety and locking devices** to allow **access to the working area only if the machine is stopped**.

#### ADVANTAGES

- **Checking the milling operation in safety condition** – it's also possible to go inside the working area with the machine in hold modality.



### Protection system

#### TOTAL ENCLOSURE

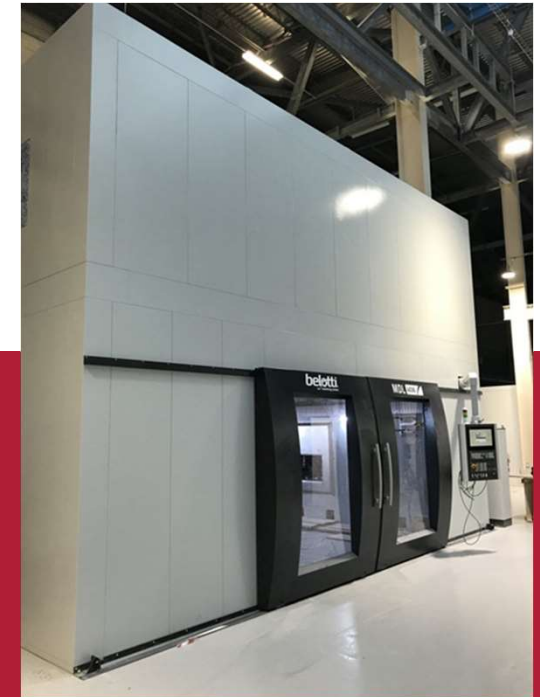
The total enclosure is designed to guarantee compliance to the current European noise rules for machining centers.

**Structure with sound proof panels are both made of galvanized and painted steel sheet. The doors to the loading/unloading area are manual and slide outside the fixed front wall of the enclosure. They also move on ball screws linear guides to make the opening and closing soundless while providing excellent vision into the machine.**

Doors are equipped with **safety and locking devices** to allow **access to the working area only if the machine is stopped.**

#### ADVANTAGES

- **Soundproof cabin: noise lower than 80 dba.**



### Protection system

#### TOTAL ENCLOSURE WITH OPEN ROOF

This enclosure, totally compliant to the current European noise rules for machining centers, is equipped with **automatic upper doors for loading of parts by means of an overhead crane**. Even the manual lower doors have a wide opening to enable loading of pieces according to the strokes.

#### ADVANTAGES

- **Cleanliness and soundproof cabin: guaranteed hermetic solution from dust and noise lower than 80 dba.**
- **Maximum usability:** the motorized upper doors can open completely the working area, allowing the access of pieces from above with an overhead crane as well as from the front of the machine.



### Protection system

#### MOTORIZED UPPER ROLLING SHUTTER

The motorized rolling shutter limits the **escape of chips from the working area** and **makes the opening and closing operations easy and quick**, allowing loading by means of an overhead crane.

The special translucent fabric guarantees **ample light in the working area**, already artificially illuminated.



#### ADVANTAGES

- **Cleanliness and safety:** the rolling shutter closes completely the top of the machine, containing chips inside the working area during 5-axis operations.
- **Flexibility:** the motorized bellows can open completely the working area, allowing the access of pieces or equipment that must be loaded from above with an overhead crane, reducing time drastically.



### Dust suction system

**HIGH PRESSURE SUCTION SYSTEM for 5-axis head with electronic control** for the removal of dust and shavings in the milling area. Also available in ATEX version.



#### MOTORIZED SUCTION HOOD

The extension of the electronic hood adapts automatically according to the length of the tool and the machining depth of the piece. Max. stroke: 140 mm.

#### ADVANTAGES

- Efficient suction guaranteed thanks to the possibility of locating the high pressure flow rate in contact with the piece and electronically adjusting the position of the hood during cutting operations.
- Possibility to control the hood as an axis, from the cutting program.
- **Particularly suitable for dusty materials and for the composite profiling of composite, to avoid collisions or damage to the parts.**



## Main Features and Options

### Dust suction system

#### GROUND OR SIDE SUCTION SYSTEM FOR HIGH REMOVAL VOLUMES

**10.000 – 12.000 – 18.000 – 24.000 m<sup>3</sup> capacity** depending on the volume of the machine, with static and dynamic dust extraction ports.

Also available in ATEX version.



#### GRIDS

The machining center is equipped with dust extraction grids positioned on the front side of the machine, allowing good dust extraction during milling operations.



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## Main Features and Options

### Cooling liquid system

#### COOLING LIQUID SYSTEM WITH CHIP CONVEYOR, LIQUID COLLECTION TANK WITH MECHANICAL PAPER FILTER AND HIGH / LOW PRESSURE PUMPS

##### Chip conveyor

- Watertight body with 250 l lubro-coolant liquid collection tank
- Belt with 400 mm centre distance and 3,5 m/’ feed
- Chip conveyor opening dimensions: mm 3100 x 250
- Booster/transfer pump with 180 l/min capacity
- Safety microswitch for rotation control with protection cover
- Dredging service lift with 60° inclination and chips exit at 1 m height

##### Coolant collection tank

- Paper filter with 220 l/min at 35µm filtering fabric
- Level adjustment for filtering fabric automatic feed
- Microswitch to signal roll end
- Control panel and filter control
- Dirty liquid conveyor
- Electrowelded steel sheet tank for collection of filtered emulsion, equipped with pump housings with the following dimensions: mm. 1.600 x 800 x H 700 – Net capacity 800 l
- Sheet steel tank for mud and used filtering fabric collection, with the following dimensions: mm. 800 x 200 x h 515 mm

##### Liquid coolant chiller\*



\* Optional

### Cooling liquid system

#### LOW PRESSURE COOLING

Usually required when it is necessary to remove the scraps from the part and the machine table. The cooling liquid comes out from the nozzles mounted on the head. Electro-pump for delivery of low-pressure lubro-coolant (with different capacity and bar pressure, depending on the Serie) to the nozzles mounted on the spindle.

#### HIGH PRESSURE COOLING

Usually required when drilling with drilled bits and when milling with inserts. The cooling liquid comes out from the machine electrospindle. Electro-pump for delivery of high-pressure lubro-coolant with 30 l/min capacity and 40 bar pressure, equipped with no. 2 cartridge filters for liquid filtration at 10  $\mu$ m absolute.

In option, a rotary joint suitable for feeding the lubro-coolant through the tool at a 40 bar pressure and a 30.000 rpm rotation, or for spray-mist operation.





### Cooling liquid system for composite materials

Specific cooling liquid system with filtering capacity 3/5  $\mu\text{m}$ .

#### ADVANTAGES

- **Increased cutting tool life: up to 3 times** comparing to the MQL system.
- **Completely clean milling zone - no chips and small scraps** – thanks to the coolant pressure and flow during milling operations.
- **Ideal for very high precision machining:**
  - no melting of the material on the cutting edges thanks to the high pressure with dedicated cutting tools for internal coolant, **avoiding breakage or damage to the surface;**
  - control of the coolant temperature **avoiding thermal distortion of the part during milling process.**



### Options

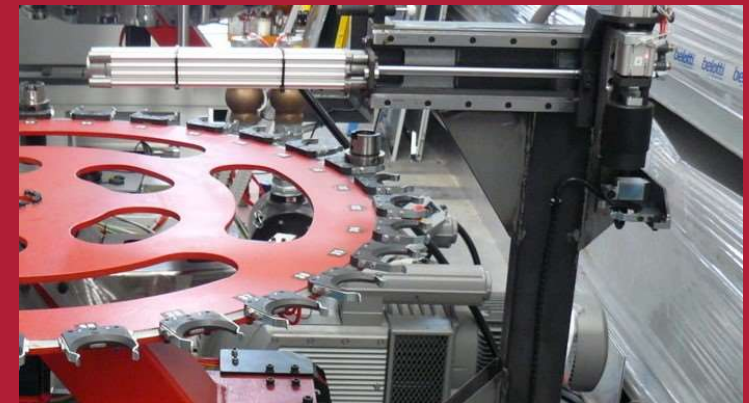
#### CHIP READER\*

**Automatic reading and writing system of all tool parameters**, which are written with a pre-setting external to the machining center. The CNC can automatically write the residual life in the chip when unloading the tool from the magazine.



#### ADVANTAGES

- **All information and parameters written automatically outside the machine**, during the tool holder loading operations.
- **Greater safety**: the recording of all data in the NC and the detection of the tool position allow to **minimize errors from operator**.



\* Optional

### Options

#### MQL – MINIMAL QUANTITY LEVEL

The MQL system, in the presence of a rotating joint, is used to **generate aerosols for internal and external lubrication**. This system refills itself automatically out of a separate tank and can be determined via parameter settings from the CNC-control regarding the requirements of the cutting operation.

#### ROTARY JOINT

The spindle can be equipped with a rotary joint to allow **the passage of the lubricant-coolant or air through the tool**. **The lubrication is carried out directly on the cutting edge, even in the presence of a suction hood.**

#### ADVANTAGES

- During the milling of aluminium, chip gluing is avoided, vibrations are reduced and the tool temperature is kept low.
- **Higher surface finishing quality.**
- **Increased tool life.**
- **Increased productivity:** higher working speed during aluminium milling.



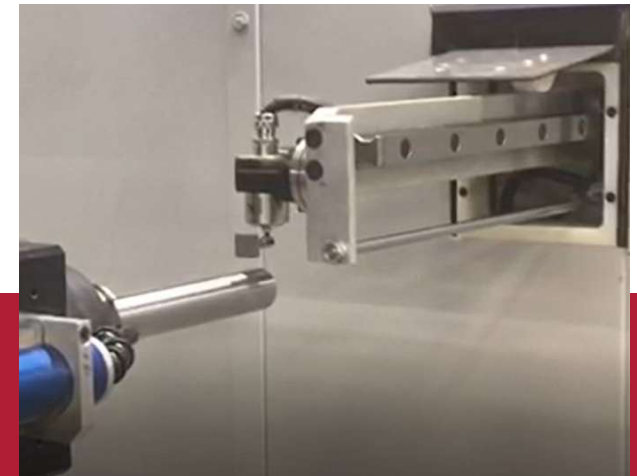
### Options

#### SDS (Self Diagnostic System) MEASURING SYSTEM FOR ROTARY AXES AND TOOLS

This system allows to control the rotary axes alignment and the tool length measurement through a M function pre-installed in the NC.

The system is assembled on a **telescopic arm**, protected by dust or chips.

All operations take place in mechanical contact.



#### ADVANTAGES

- **One single system for axis requalification, length control and tool breakage.**
- **Automatic control.**
- **Possibility to manually recall the cycle with an M code, keeping the tool protected from dust or chips.**

### Options

#### NON-CONTACT TOOL SETTING SYSTEM

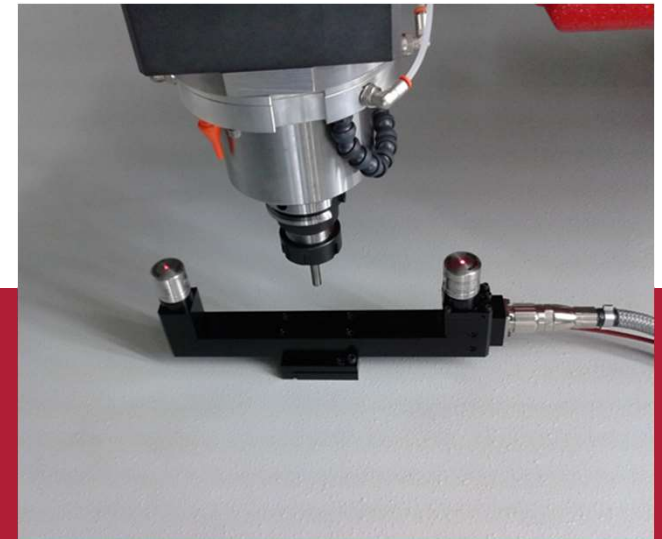
Useful for monitoring the tool status and for tool life management, this is a **flexible laser** system with ultra-compact laser tool setting transmitter and receiver units.

It can quickly perform operations of:

- length and diameter pre-setting
- contactless breakage detection and tool wear upon real conditions at the spindle working speed.

#### ADVANTAGES

- **Ideal for non-contact and very high precision diameter and tool length measurements:** the fixed positioning in the working area ensures a micrometric measurement of the rotating tools.
- Possible **connection to the automatic tool recognition system** for status control.



## Main Features and Options

### Options

#### HEIDENHAIN LINEAR SCALES

Direct incremental measuring system for all linear axes with graduated metal and pressurized line.

- up to 4 m in a single body with glass optical band
- from 4m up to 72m in modular body with steel optical band



Direct measuring system for all rotary axes



Linear axes thermal compensation system

LC 181 * S.Nr. 11132830D * Id.Nr. 341240-07	
<b>Hersteller-Prüfzertifikat</b> DIN EN ISO 9001:2015	<b>Manufacturer's Inspection Certificate</b> DIN EN ISO 9001:2015
Dieses Längermessgerät wurde unter den strengen HEIDENHAIN Qualitätsnormen hergestellt und geprüft. Die Positionabweichung liegt bei einer Bezugs-temperatur von 20 °C innerhalb der Genauigkeitsklasse ± 5,0 µm.	This linear encoder has been manufactured and inspected in accordance with the stringent quality standards of HEIDENHAIN. The position error at a reference temperature of 20 °C lies within the accuracy grade ± 5.0 µm.
<b>Kalibriernormale:</b> • Laser-Interferometer Kalibrierzeichen 3649 PTB 95 • Viskositätsprüfstand Kalibrierzeichen 108 PTB 95 • Barometer Kalibrierzeichen 3029 DKD-K-2301 99-06	<b>Calibration standards:</b> • Laser interferometer Cal. ref. 3649 PTB 95 • Viscosity point cell Cal. ref. 108 PTB 95 • Pressure gauge Cal. ref. 3029 DKD-K-2301 99-06
Relative Luftfeuchtigkeit: max. 50 %	Relative humidity: max. 50 %
<b>HEIDENHAIN</b> ROLAND HEIDENHAIN GmbH Rohrer Str. 18 D-91126 Weizheim	Produced/inspected by: PFEFFER / 23.11.2001
<b>Messprotokoll</b>	<b>Calibration chart</b>
Die Messwerte zeigen Mittelwerte der Positionen, abweichungen aus Vor- und Rückwärtsmessung.	The error curve shows mean values of the position errors from measurements in forward and backward direction.

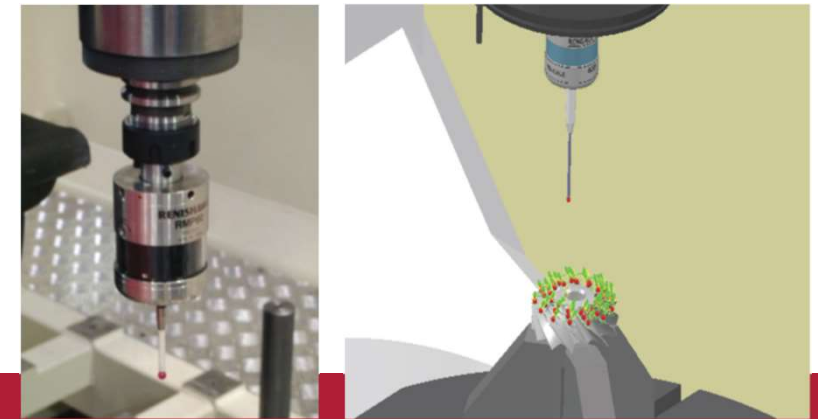
Original factory certificate

### Opzioni

#### 3D probing system with radio transmission

This system gets automatically the position of the piece and enables to auto-centre the cutting program taking into consideration possible piece deformations.

RPM 60 via radio mobile model is settled in the tool stock and is picked up automatically by the electrospindle without any manual operation.



#### OPTIONAL Kinematics inspection system\*



\* Only with 5-axes head

### Options

#### VIBRATION MONITORING SYSTEM

**Miniaturized monitoring system particularly recommended in aerospace sector and aluminium milling applications, to preserve spindle and CNC machine performance.**

Using advanced monitoring modular techniques together with 8 different configurations, the device can **monitor every machine tool or product process in real time.**



#### ADVANTAGES

- **Increased production capability.**
- **Higher performance control** by planned maintenance to avoid drastic damage, minimize collision effect and **decrease time machine down time and repair costs.**
- **Reduction of the impact of damage by 25/30 times** thanks to the high reactivity of the machining center equipped with MONTRONIX: **10 milli/sec from collision detection to machine downtime; 500milli/sec time interval for the machining center motors overload stop.**
- **The system detects any tool imbalances, giving the alarm and avoiding damage to the electrospindle bearings.**



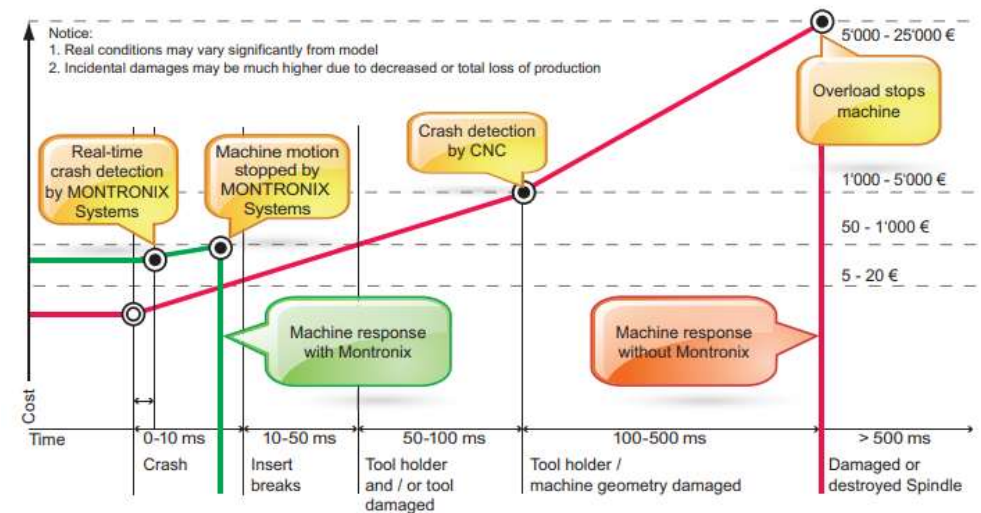
## Options

### MONTRONIX SOLUTIONS

- Reducing costs by avoiding machine shut downs
- Optimizing processing and station times
- Effectively generating and reading analytical data
- Protecting machines
- Protecting tools
- Protecting parts
- Assuring parts quality
- Securing the process chain for single and multi-part production
- Optimizing processes
- Assisting with preventive maintenance
- Extending tools and machine life

Productivity, Flexibility, Quality, Safety

■ COST - BENEFIT

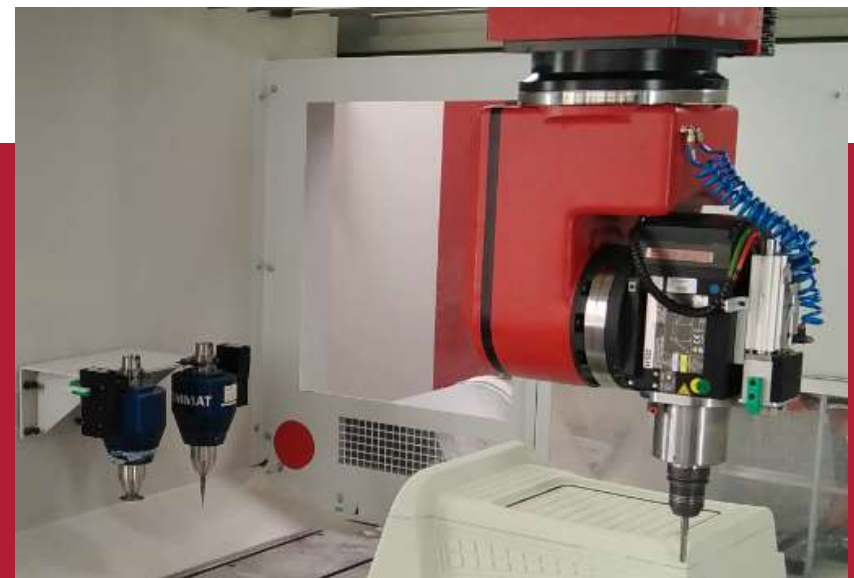
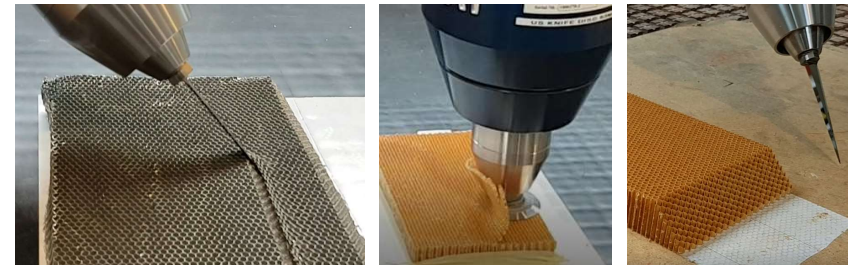


### Options

#### ULTRASONIC TECHNOLOGY

The ultrasonic cutting system allows to work special materials (honeycomb) using an **ultrasonic frequency up to 20 Kiloherztz**. The system is supplied with automatic tool changer and can be equipped with **two cutting systems**:

- **oscillating blade** of different lengths that is oriented according to the geometry, controlled by CNC and interpolated with the movement of all linear and rotary axes;
- **oscillating and rotating disc** both clockwise and anticlockwise, controlled by CNC.



#### ADVANTAGES

- **Particularly suitable for processing soft materials:** fabrics, phenolic honeycomb, aluminium honeycomb, rock wool, carpet etc.
- **Accuracy and cleanliness:** thanks to the high frequency of blade oscillation, the separation of the material does not produce dust and, in the case of honeycomb, does not produce cells crushing.



**THANK YOU**