

a91nx

Horizontal Machining Center



Atsugi and Fuji Katsuyama works are certified for ISO14001 and ISO9001.

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M521Ea 2402 (V-T)



a91nx

800 × 800 mm pallet
machine pursued for
reliability and productivity



Spindle

Only takes 2.7 seconds to reach maximum speed —
10000 min⁻¹ standard spindle

Speed range : 20 - 10000 min⁻¹
Spindle interface : BT50 (7/24 taper #50), HSK-A100^{*1}
Output characteristics : 55/37 kW (25%ED / continuous rating)
Torque characteristics : 721/305 N·m (10%ED / continuous rating)
Start-up time : 2.7 sec (10000 min⁻¹)



15000 min⁻¹ high power spindle^{*1}

Speed range : 20 - 15000 min⁻¹
Spindle interface : HSK-A100
Output characteristics : 75 kW (25%ED)
: 40 kW (continuous rating)
Torque characteristics : 512 N·m (10%ED)
: 430 N·m (25%ED)
: 220 N·m (continuous rating)
Start-up time : 2.7 sec (15000 min⁻¹)

◎ Heavy-duty cutting capability^{*2,*3}

Tool used : 50 mm diameter face mill
Material : Aluminum alloy (A7050)
Spindle speed : 15000 min⁻¹
Feed rate : 12000 mm/min
Axial depth of cutting : 4 mm
Radial depth of cutting : 50 mm

Metal removal rate 2400 cm³/min

8000 min⁻¹ high torque spindle^{*1}

Speed range : 20 - 8000 min⁻¹
Spindle interface : BT50 (7/24 taper #50)
: HSK-A100^{*1}
Output characteristics : 75 kW (25%ED)
: 37 kW (continuous rating)
Torque characteristics : 1199 N·m (10%ED)
: 552 N·m (continuous rating)
Start-up time : 2.8 sec (8000 min⁻¹)

◎ Heavy-duty cutting capability^{*3}

Tool used : 160 mm diameter face mill
Material : Ductile cast iron (FCD450)
Machining position : Table top 1250 mm

Axial depth of cutting 11 mm

Radial depth of cutting : 128 mm

Metal removal rate 1819 cm³/min

^{*1} Optional specification

^{*2} Actual value of continuous rating: 40 kW

^{*3} Actual results in the environment in our factory

Mechanical structure

Ball screws

The large-diameter ball screws are double supported and pre-tensioned to maximize rigidity and therefore linear positioning capability. The ball screws and bearing brackets are core-cooled and temperature is synchronize with the bed temperature to maximize the dynamic accuracy of the machine.

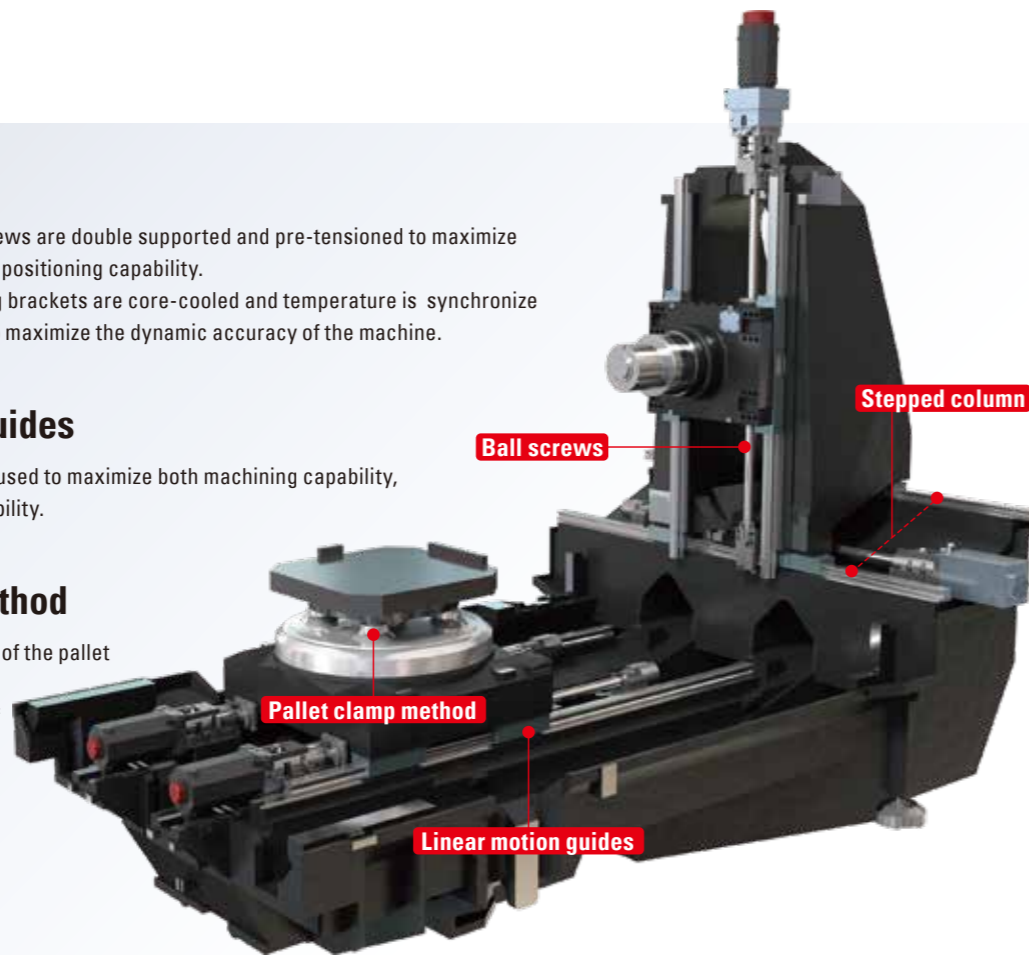
Linear motion guides

Oversized roller guides are used to maximize both machining capability, as well as, component reliability.

Pallet clamp method

Highly accurate positioning of the pallet with 4 tapered cones.

The clamping mechanism of each taper cone provides balanced support for high cutting capacity.



Stepped column

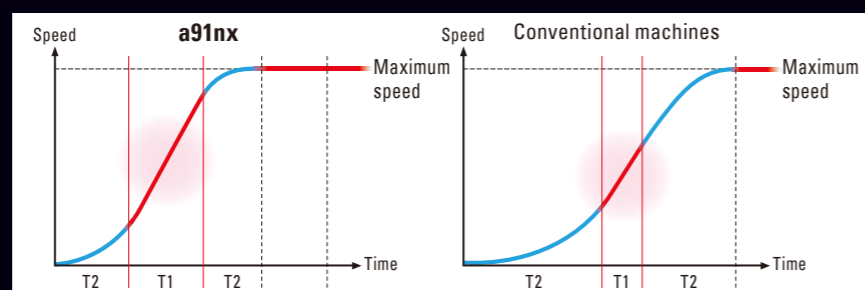
A long-standing Makino design.

The slant design elements maximize the combined system rigidity while also enduring X axis movement accuracy and speed.

This stepped design supports the machine to move at high speed and high acceleration mode by reducing the weight of column without compromising rigidity of the machine in Z-axis direction.

Acceleration and deceleration

The use of a slanted column reduces the weight of the moving body, which allows for minimization of the critical acceleration/deceleration "jerk" zones.

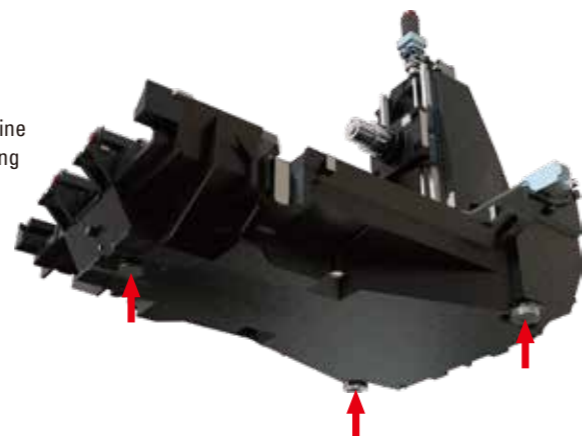


3-point support

Maximizes foundation requirements, expedites machine installation and keeps machine in alignment eliminating periodic re-leveling requirements.

[Advantages of 3-point support]

- A machine is hard to be affected by aged deterioration of foundation.
- Periodic level maintenance is not required.
- Reduction of foundation cost.

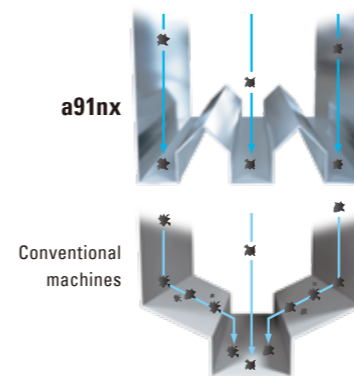


Chip evacuation

Advanced chip management



Chip disposal is improved by the new design. Close-to-vertical walls and three channel trough guide the chips directly out of the machine chamber. Chip accumulation and the need of coolant for chip evacuation are extremely reduced.



Coolant

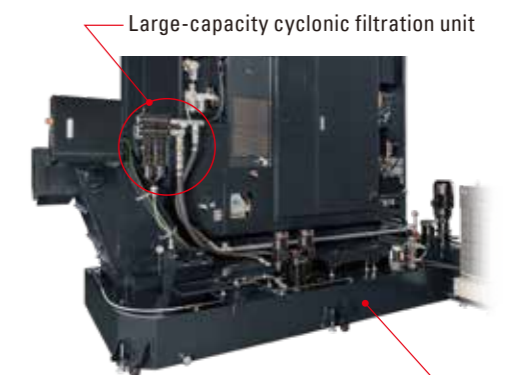
For horizontal surfaces such as spindle or the area around the table, various coolant types are provided as standard:

- Base coolant
- Nozzle coolant
- Shower coolant
- Through spindle coolant
- Table washing coolant (optional equipment)

Clean tank stirring

The coolant tank is equipped with a drum filter, but sludge smaller than the filtration accuracy of the filter enters the clean tank, accumulates and finally causing problems at the pump.

The a91nx prevents sludge accumulating in the clean tank. The standard stirring function inside the clean tank circulates the coolant by water stream. The agitated sludge is separated from the coolant by a large-capacity cyclonic filter and discharged out of the machine.



Clean tank conveyor*



Video

A conveyor can be attached to the clean tank. The scraper runs on the bottom of the tank to ensure that sediment is discharged.

*Optional specification

Operability



Accessibility

Easily access the machine chamber.
Tool wear and machining result can be checked without any obstacle.

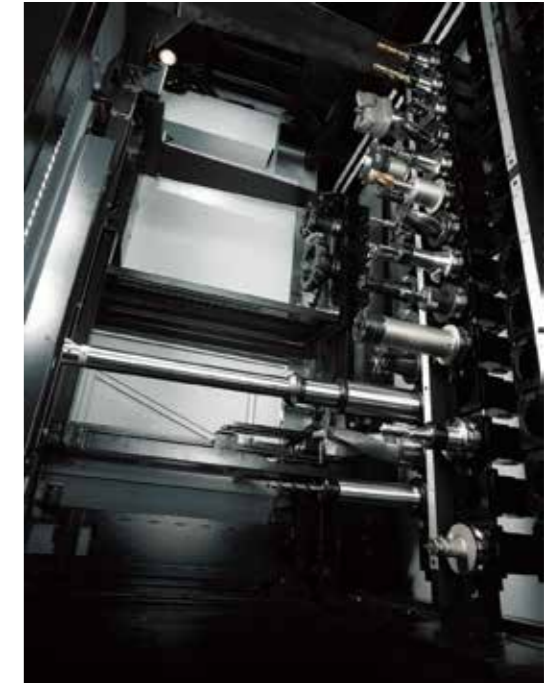
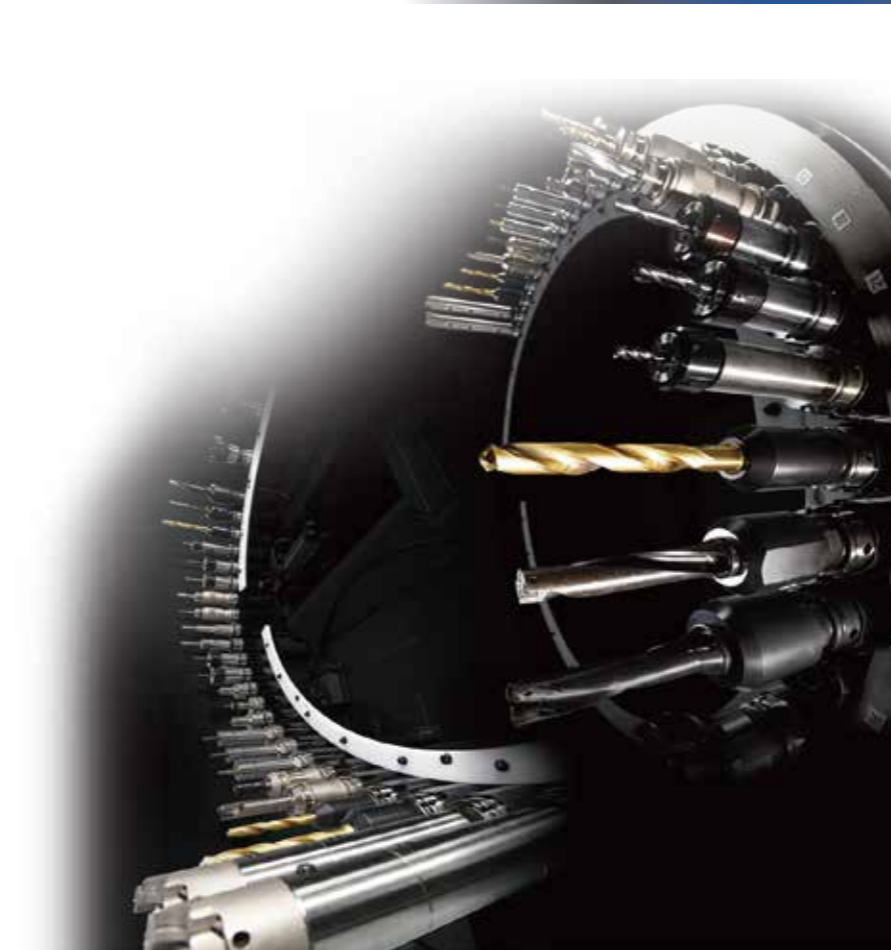
Pallet loading station (PLS)

Wide opening doors allow carrying the workpieces and fixtures by crane.

Steps are installed so that setting up the workpiece by entering the pallet changer is possible.



Automatic tool changer



Tool magazine (ring type)

The servo-type ATC shutter and cam-type ATC mechanism provides very fast tool changes.
Spindle nose cleaning air flow for cleaning the taper hole to reduce chip entrapment during tool change.

Tool storage capacity **60 tools**
Maximum tool diameter **115 mm** (with adjacent tools)
356 mm (without adjacent tools)
Maximum tool length **900 mm**
Maximum tool mass **30 kg** (limited)

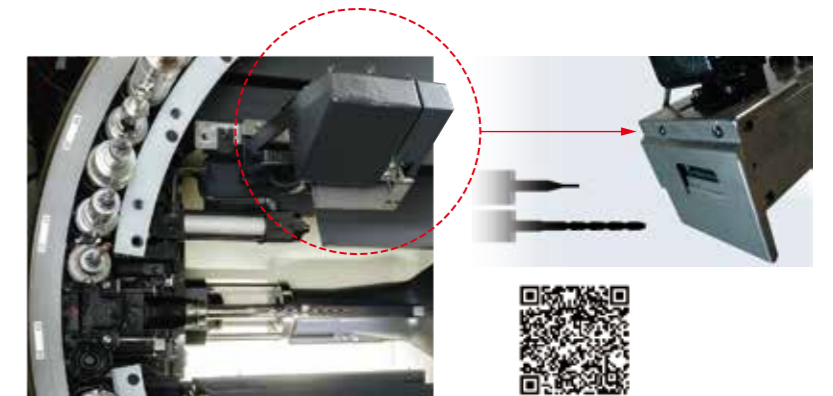
Large capacity matrix magazine*

Tool storage capacity **185, 297 tools**
Maximum tool diameter **102 mm** (with adjacent tools)
356 mm (without adjacent tools)
Maximum tool length **900 mm**
Maximum tool mass **35 kg** (limited)

*Optional specification

Broken tool sensor *Vision B.T.S.*

A tool damage detection device using a CCD camera is installed as standard equipment.
The BTS detects breakages by taking photos of the tools before and after machining.
Since Vision B.T.S. is in the ATC magazine, you can check the tool without affecting the cycle time.
The detection time is much shorter than the conventional contact type and the system is more reliable. Due to the non-contact measuring, you don't need to fear tool breakages.
The System reduces cycle time and improves productivity.



Website

Reducing cutting time —

Optimize machine operation according to machining conditions. Even when the machine is operated at high speed and high acceleration, the machined surface quality and shape accuracy are maintained and the machining efficiency is improved.

5 processing modes to improve performance or quality.

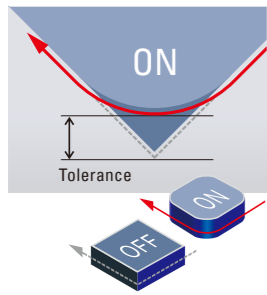
| | | | | |
|--|--------------------------------------|-----------------------------------|---|---|
| Ultra High Performance Mode M256 | High Performance Mode M251 | High Accuracy Mode M250 | Ultra High Accuracy Mode M252 | Super High Accuracy Mode M254 |
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Standard mode

Advanced control technology

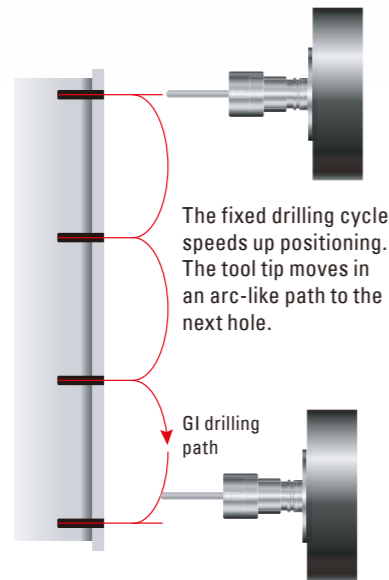
GI milling

The degree of tolerance at the corner section of the tool path can be adjusted. This allows the movement around the corner section to be smoothed out by reducing the deceleration range of the feed rate.



Video

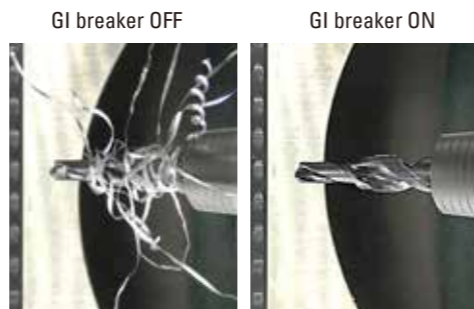
GI drilling



Video

GI breaker (Optional Equipment)

This function breaking up long cutting chips produced during hole machining. Suppresses the occurrence of wrapping on the tool and abrasion marks on the workpiece. Continuous cutting is possible without interruption such as by inverting the feed axis. Productivity improves by eliminating trouble-shooting operations and reducing machining time rather than the pecking cycles.



Website

Reduction of non-cutting times —

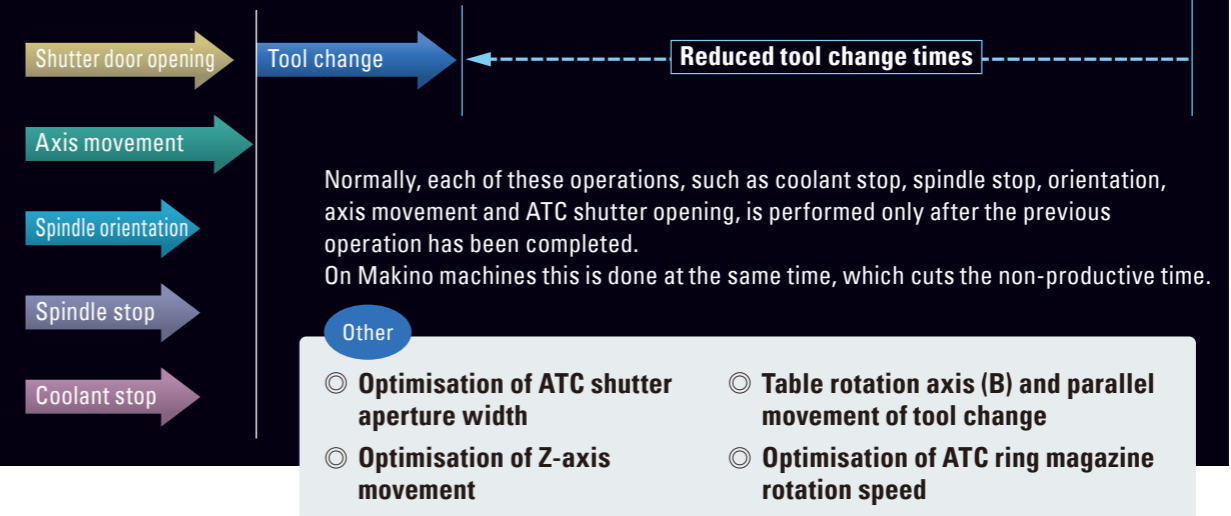
In the world of parts machining where the same process is repeated many times a day, the accumulation of small times such as tool change time and positioning time makes a big difference.

[General machines] Next operation is performed after the previous operation is completed



Save time working in parallel

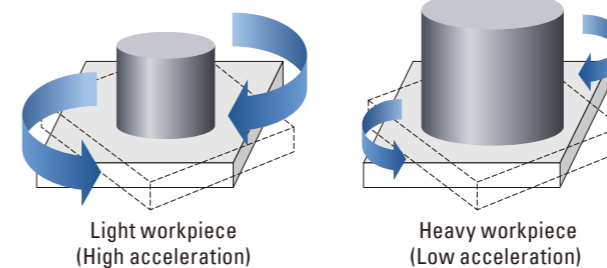
[Makino's system] All operations are performed simultaneously



Positioning time reduced

Inertia Active Control

The pallet inertia is measured automatically and the optimal acceleration / deceleration of the B-axis/Z-axis is carried out. Faster movement when loading light workpiece reduces positioning time.



Other

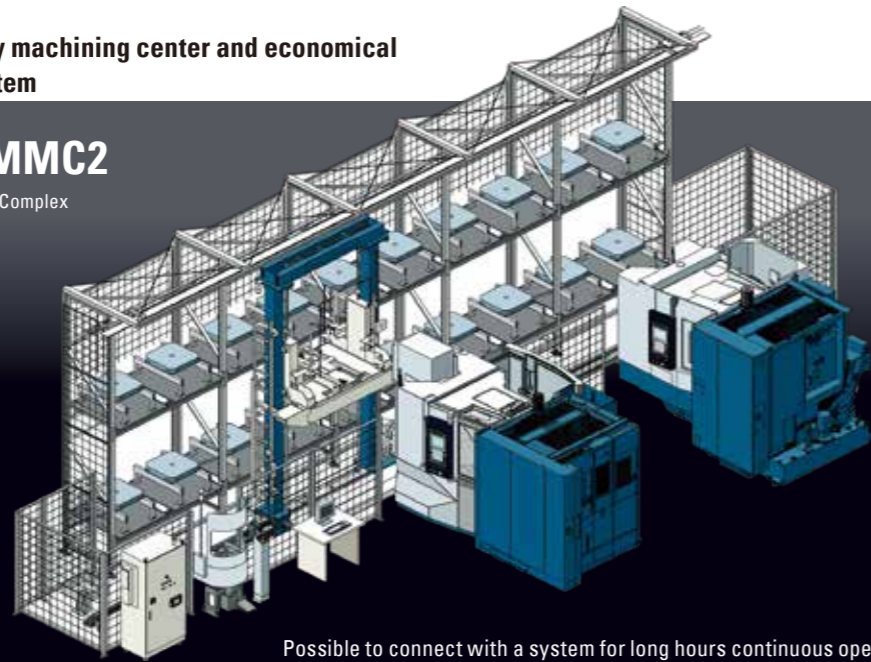
- Agile spindle**
Reach maximum speed in just 2.7 seconds
- High acceleration**
Fastest start-up to maximum speed while suppressing vibration
- Simultaneous operation**
Linear axis movement (X and Y, Z) and table rotation axis (B)

Automation

High efficiency machining center and economical unmanned system

MODULE MMC2

MAKINO Machining Complex



Possible to connect with a system for long hours continuous operation. Assets (pallets, etc.) of existing facilities can be converted.

Avoiding an unexpected machine down

MH+max

Spindle diagnosis

Constant monitoring of the status of the spindle. Minimize the unplanned downtime.



Coolant monitoring

Coolant flow and temperature are monitored. Predicts the occurrence of temperature-related processing faults.

Oil pressure monitoring

Hydraulic pressure and temperature sensing. Real-time detection of oil deterioration.

Monitor and grow the machine

ProNetConneX 2.0

- Watch over the machine anytime, anywhere
- Receive machine health checkups with automatic
- Constantly keep the machine equipped with the latest software



Up time visualization



Machine software updates



Email notification

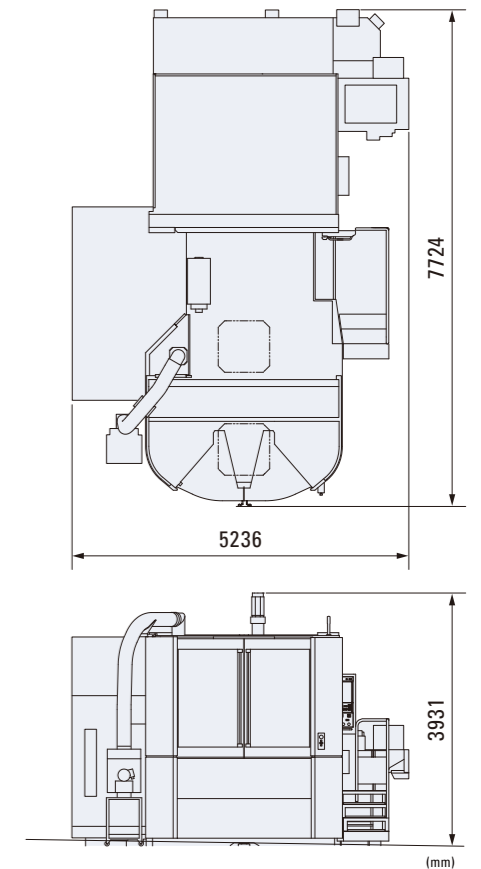


Periodic report distribution

Specifications (standard)

| | | |
|------------------------|--|---|
| Axis travels | X × Y × Z | 1400 × 1200 × 1350 mm |
| | B axis | 360 deg |
| | Distance from pallet top to spindle center | 100 - 1300 mm |
| | Distance from pallet center to spindle end | 100 - 1450 mm |
| Pallet | Size | 800 × 800 mm |
| | Maximum size (diameter × height) | 1450 × 1450 mm |
| | Maximum payload (evenly distributed) | 2000 kg |
| | Surface configuration | Tapped hole M16 × 24 holes (pitch 160 mm) |
| Spindle | Speed range | 20 - 10000 min ⁻¹ |
| | Interface | BT50 (7/24 taper #50) |
| | Motor power (25%ED / cont.) | 55 / 37 kW |
| | Torque (10%ED / cont.) | 721 / 305 N·m |
| Feedrate | Rapid traverse | 60000 mm/min |
| | Cutting feedrate | 1 - 50000 mm/min |
| Automatic tool changer | Tool shank | JIS B6339 50T |
| | Retention knob | JIS B6339 50P |
| | Tool storage capacity | 60 tools |
| | Maximum tool diameter (with adjacent tools/without adjacent tools) | 115 / 356 mm |
| Machine size | Maximum tool length | 900 mm |
| | Maximum tool weight (with limitation) | 30 kg |
| | Height | 3931 mm |
| Floor space | Width × Depth | 5236 × 7724 mm |
| | Width × Depth | 6980 × 11000 mm |

Layout / Front view



Standard specifications

- 10000 min⁻¹ spindle
- Spindle temperature controller
- 60 tools magazine
- Vision B.T.S. (Broken Tool Sensor)
- Tool cleaning air (tool change waiting position)
- Tool magazine door (with door lock)
- Rotary table (DD motor)
- Pallet clamp confirmation function
- Random program calling function
- Pallet changer
- Pallet changer safety guard (with door lock)
- Operator door lock (operation mode specification)
- Through spindle coolant and air (1.5 / 2.2 MPa: 50/60 Hz)
- Splash guard (with lighting)
- Signal light (3 layers)
- Nozzle coolant
- Base coolant
- Shower coolant
- Lift-up chip conveyor (right discharge)
- Coolant secondary filtration unit
- Interface for automatic extinguisher
- Spindle-table interference preventive function
- Linear interpolation type positioning
- GI control
- ECO mode functions
- MRDF (Machine Relocation Detect Function)

Optional specifications (●) / Optional equipment (★)

- 8000 min⁻¹ high torque spindle
- 15000 min⁻¹ high power spindle (HSK-A100 only)
- HSK-A100
- 185, 297 tools magazine
- Scale feedback (X, Y, Z 0.05 μm)
- Maximum payload 3000 kg specification
- Through spindle coolant and air (3 / 7 MPa) (with TSC secondary filtration unit)
- ★ Table washing coolant
- ★ Workpiece washing gun (Side of operator's door, PLS side, Side of operator's door & PLS side)
- ★ Coolant temperature controller
- ★ GI breaker
- Lift-up chip conveyor (right discharge, double layer)
- ★ Chip bucket (tiltable)
- ★ Mist collector
- ★ Automatic tool length measuring device
- ★ Automatic workpiece measuring device
- Portable manual plus generator with tool position display (with coordinate origin function)
- ★ Super GI.5 control
- Customer specified machine colour