SPEEDIO
U500Xd1

Universal Compact Machining Center

Machine Tools Sales Department,
Machinery Business Division,
Brother Industries, Ltd.

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SPEEDIO U series
Introduction of U500Xd1

1. Description of SPEEDIO
2. Outline and Advantages
3. Performance and Features
4. Machining demonstration

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Cutting Out the Waste

Times are changing. Are you ready?

You need a machine that's fast and compact.

With the ability to make any cut.

In this world, only the strong survive.

Make it better with SPEEDIO.

SPEEDIO

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SPEEDIO

SPEEDIO is a brand of No. 30 machine for customers who demand high productivity, which has high machining ability while having compactness and speed not found in No. 40, and is eco-friendly

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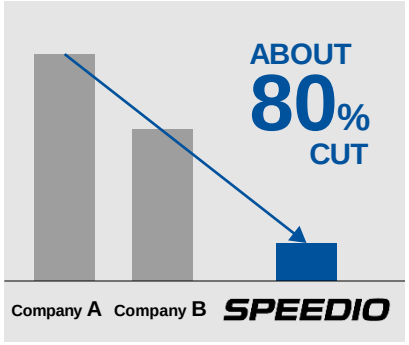
Exceptional Environmental Performance

SPEEDIO for the Environment

Looking to Achieve Carbon Neutrality

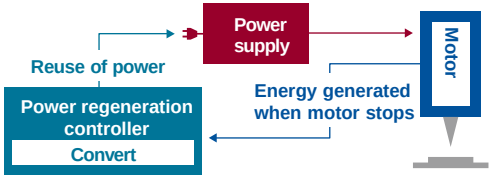
While retaining the #30 spindle, and based on Brother's original technology, the SPEEDIO strives for industry-leading environmental performance, in addition to overwhelming high productivity, machining capabilities, and usability.

When machining is performed by replacing a general #40 machining center with the SPEEDIO

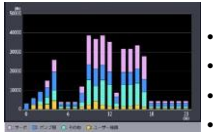


Power-Saving Functions

Power Regeneration system



Power consumption application



- LED work light
- Coolant automatically turns OFF
- Standby mode
- Machine light automatically turns OFF
- Display automatically turns OFF
- High efficiency pump, etc.

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U SPEEDIO

U500Xd1

Universal
Compact Machining Center

S Compact Machining Center
S300 Xd1
S500 Xd1
S700 Xd1

W Wide Stroke Compact Machining Center
W1000 Xd2

M Compact Multitask Machine
M200 Xd1
M300 Xd1

R Compact Machining Center Equipped with Pallet Changer
R450 Xd1
R650 Xd1

F High Rigidity Compact Machining Center
F600X1

H Horizontal Compact Machining Center
H550 Xd1

Special Options
T-200Ad/ **BV7-870A**d
T-200A

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2. U500Xd1 Outline and Advantages

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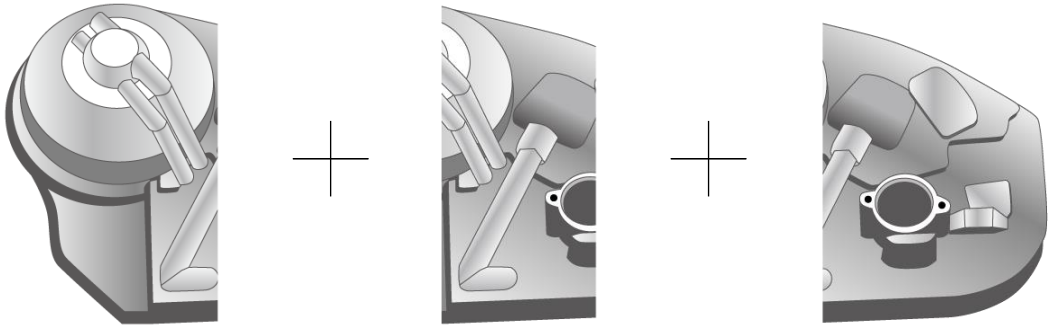
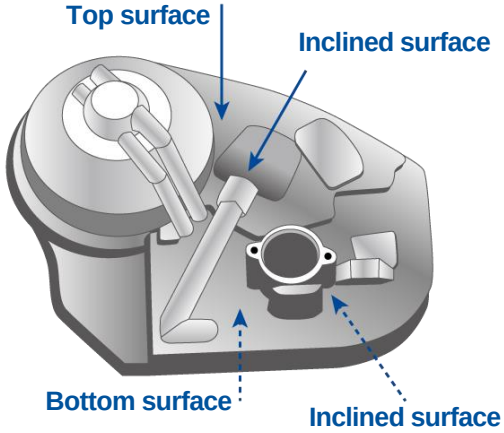
Market environment changes

In response to a shift to EVs in the automobile industry, materials for parts has changed from iron to aluminum die cast and integration of functions has progressed.

- **Parts have become larger.**
- **Medium- to large-size aluminum workpieces that require multi-face machining have increased.**





Presently, development of EV parts is in its early days. Therefore, designs change frequently, and the life span of products becomes shorter accordingly.

→ To respond to “frequent process changes” and “fluctuation in production volume,” and to achieve “stable accuracy of multi-face machining”

Needs for process integration have increased.

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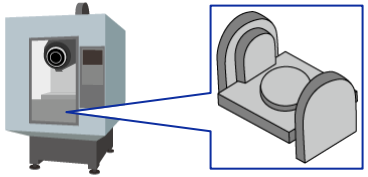
Selection currently available

#30 machines offer sufficient machining capability, however,

- To perform multi-face machining, **fixture area is insufficient.**
- To mount a large tilting rotary table, **max. loading weight is insufficient.**

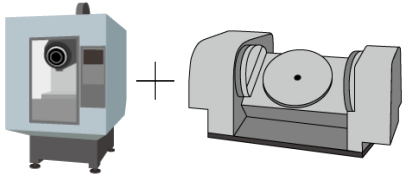
#30 machine with built-in 5 axes



Competitors' #30 machine with built-in 5 axes
Fixture rea:
Approx. Φ350 mm

Insufficient jig area

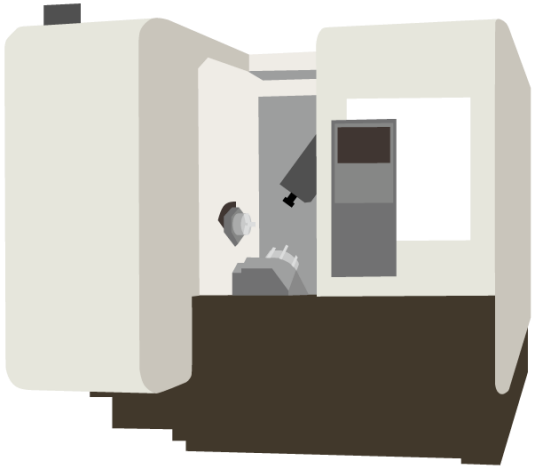
#30 machine + Tilting rotary table



Tilting rotary table
Fixture area **Φ500 mm**
Weight **approx. 1200 kg**

Insufficient max. loading weight

Users are obliged to select expensive #40 machines.



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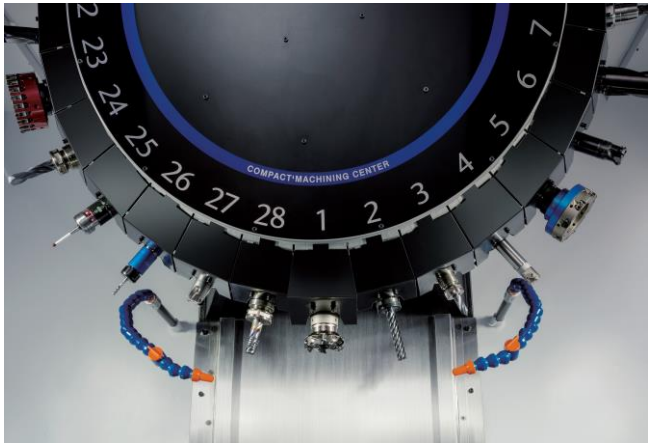
New structure that enables process integration

SPEEDIO U500Xd1 Universal Compact Machining Center

SPEEDIO Built-in large tilting rotary table

28-tool high-speed turret magazine



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Product Concept

Universal
Compact
Machining Center
SPEEDIO

U500 Xd1

		U500 Xd1	**U500**Xd1-5AX
Travels	X / Y / Z	500 mm / 400 mm / 300 mm	
	A (tilt axis) / C (rotary axis)	150 ° (-30°~+120°) / 360 °	
Simultaneously controlled axes (Interpolation)		Linear: 4 axes (X, Y, Z, 1 additional axis) Circular: 2 axes	Linear: 5 axes (X, Y, Z, A, C) Circular: 2 axes
Max. loading capacity		100kg	
Max. spindle speed		10,000 min^{-1} / 16,000 min^{-1} (Optional) (High-torque spec. and 27,000 min^{-1} spec. not available)	
Tool storage capacity (pcs.)		14 / 21 (Optional) / **28** (optional)	
Spindle options		BT dual contact spindle Coolant Through Spindle (CTS) Max. 3 MPa / Max. **7 MPa** *	

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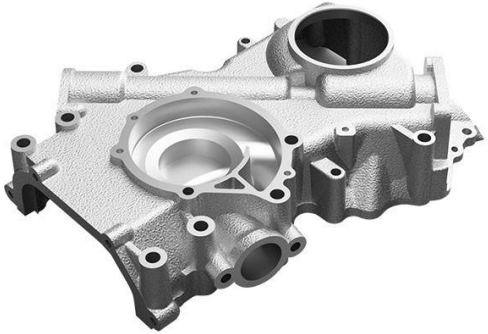
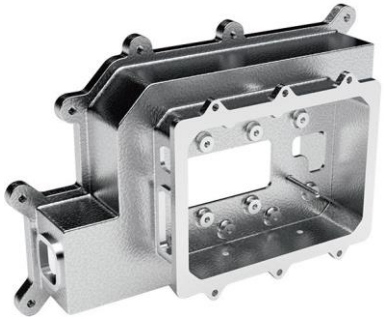
* Only piping is provided when 7 MPa is selected.

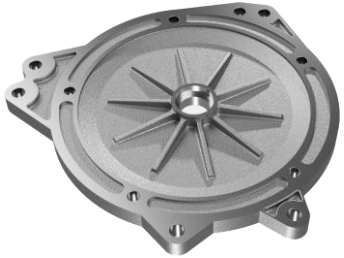
Product Concept: Target Workpieces

Multi-face machining of mainly die cast parts, using large tilting rotary table

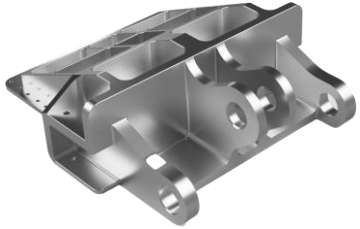
Automobile







Aircraft



Medical

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Product Features

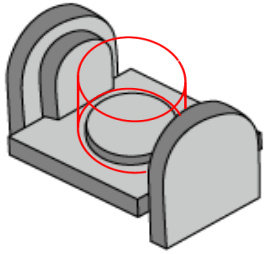
Ample fixture area

As parts are becoming larger, the fixture area of #30 multi-face machining machines is not sufficient.

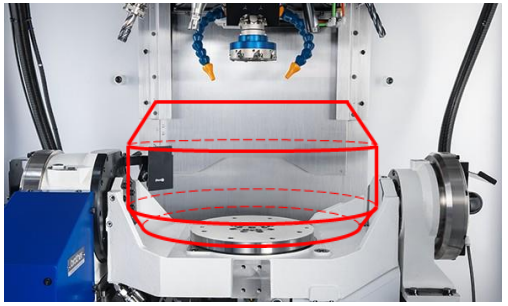
▼

**The U500Xd1 provides ample fixture area of ø500 mm.
Large workpieces can be mounted.**

Normal #30 multi-face machining center
Fixture area: Approx. ø350 mm



U500Xd1
Fixture area: ø500 x 270



28-tool magazine available

As parts are becoming complex,
the number of tools set is often insufficient.

▼

A space-saving 28-tool magazine is available.

Same machine width as when a 14- or 21-tool magazine is mounted

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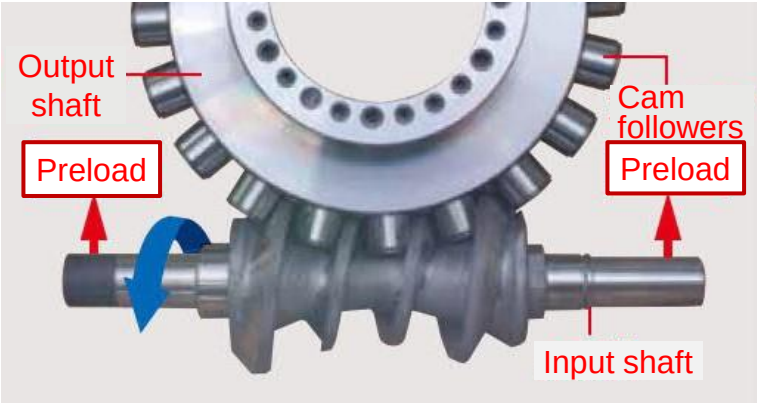
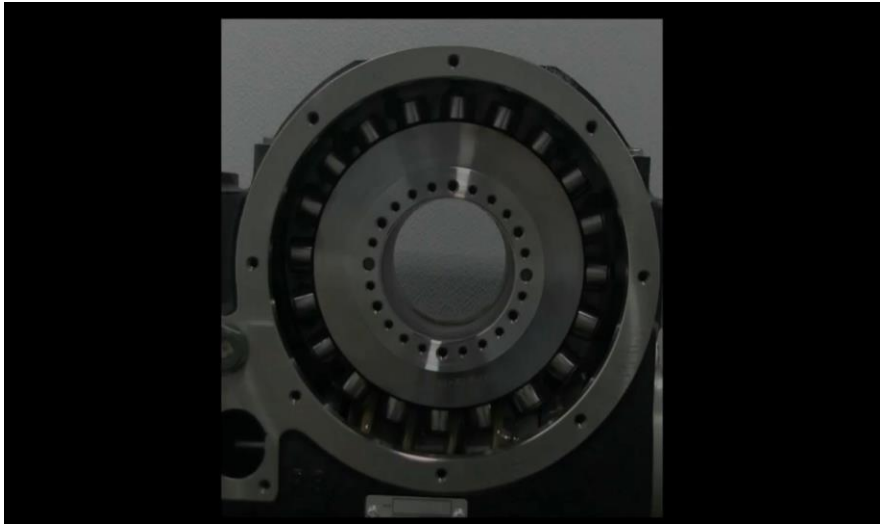
Roller gear cam used for A and C axes

**Achieves backlash-free operation and high rigidity.
As there is very little abrasion, adjustment is not necessary.**





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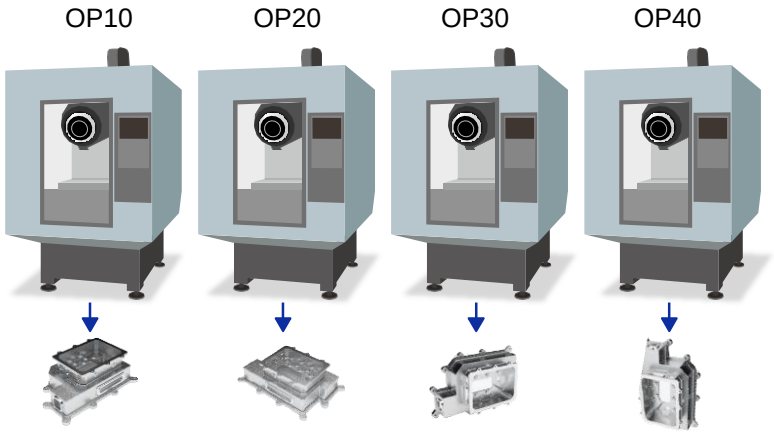
Process division and process integration (ex. inverter case machining)

Process division: 4 machines



- Although cycle time is shorter, machining time balance adjustment is required.
- Required process design time is longer.

Process integration: 2 machines x 2 cells

- **Although cycle time is longer, machining time balance adjustment is easier.**
- **Process design time can be shortened.**
- **Can easily respond to short product life span.**
- **Can easily secure multi-face machining accuracy.**

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3. Performance and Features

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① Tool magazine

Available with 28-tool magazine option

(Selected from 14-, 21-, or 28-tool magazine)

② Spindle

Coolant Through Spindle withstand 7 MPa (optional)

③ Machining capability

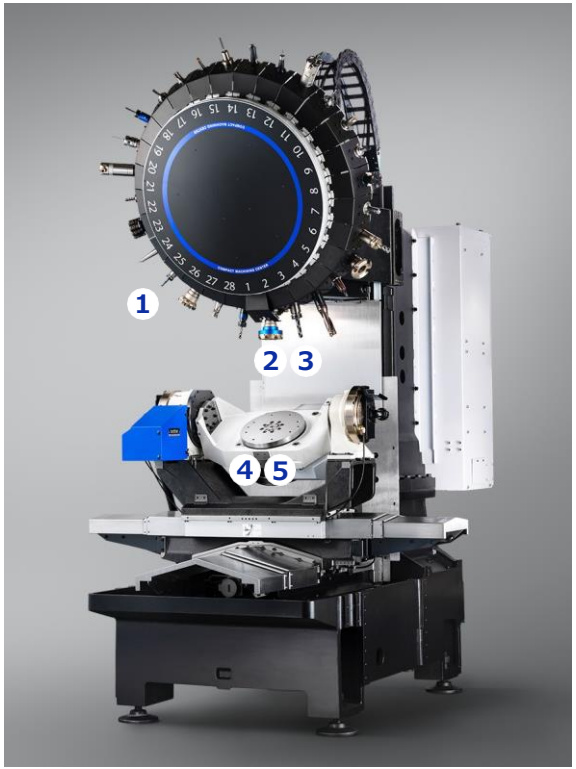
Increase in max. tool weight 4 kg *1

④ Table

Table loading capacity 100 kg

⑤ Equipped with large tilting rotary table using roller gear cam

*1: Parameter setting needs to be changed.



⑥ Simultaneous 5-axis control

(according to selected specifications)

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Extensive Machine Performance

Pursuit of High Productivity

Advanced New D00 Control

Untiring Improvement of Reliability

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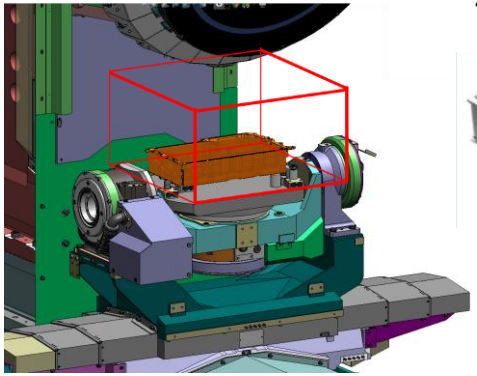
Tilting rotary table is incorporated to secure ample fixture area

Travel area



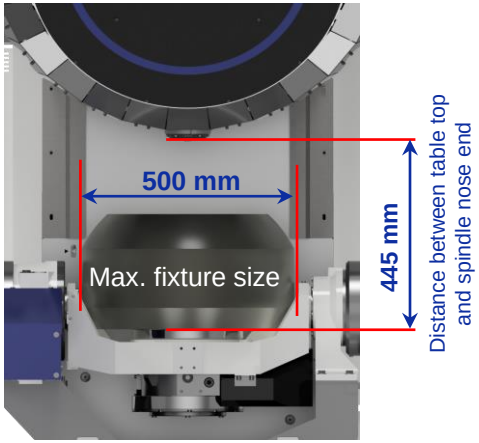
Workpiece size
400×230×90 mm

Travel area

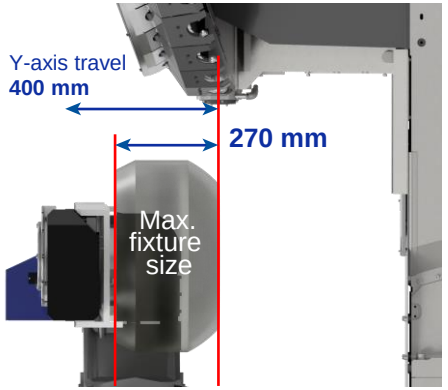
Fixture mounting area	ø500 mm × 270 mm
Travels	X 500 mm × Y 400 mm × Z 300 mm
Max. loading weight	100 kg

Jig mounting area

A-axis at 0 deg.



A-axis at 90 deg.



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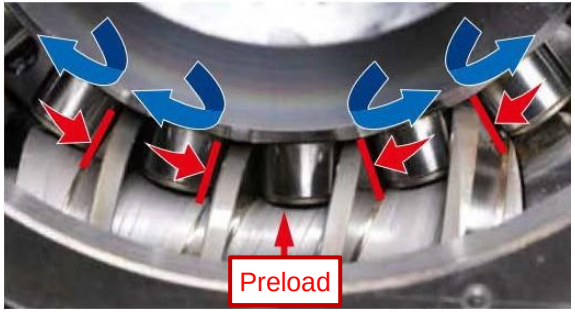
Using roller gear cam ensures high accuracy and long service life

The “cam” and “special cam follower” constantly make line contact from left and right to ensure backlash-free operation.
This enables highly accurate positioning, **leading to improvement of machining accuracy.**

The “cam” and “special cam follower” are rolling bearings.
There is little wear even after long periods of operation.



High inertia mode enables handling of heavy fixtures

In general, complex fixtures such as hydraulic clamping systems are heavy and have high inertia.
Since a high inertia mode is prepared, there is no need to spend design man-hours on fixture weight reduction (lower inertia).

	Allowable inertia (kg·m2)	High inertia mode Allowable inertia (kg·m2)
Around A-axis	**1.5**	←
Around C-axis	**1.8**	**2.6**

※High inertia mode requires setting of machine parameters, with a maximum C-axis speed of 60 min-1.

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Simultaneous 5-axis control
(U500Xd1-5AX spec.)

Wants to produce products where continuous surface quality is required, such as medical equipment.

Wants to reduce machining time and improve quality by creating a simple program.

▼

Simultaneous 5-axis control plus tool center point control enables quality improvement and reduction of machining time.

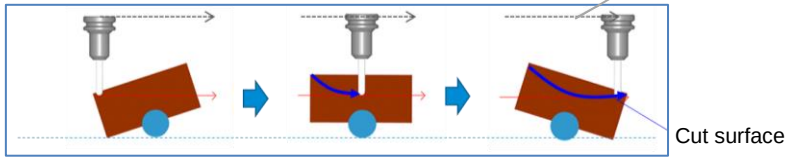
The following functions are standard on the M200Xd1-5AX:

- Simultaneous 5-axis control
- Tool center point control (look-ahead 1,000 blocks)
- Memory capacity (3 Gbytes)
- Submicron command
- Feature coordinates setting

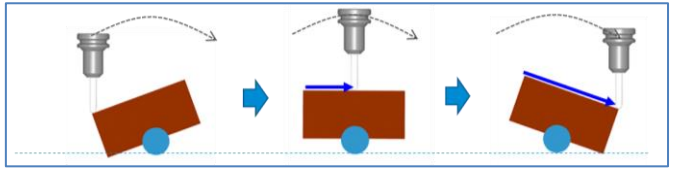
Effects of tool center point (TCP) control

As this function controls the tool so that the tool tip moves along the specified path even when the direction of the tool changes, minute division is not necessary when creating an NC program.
In addition, as the travel speed of the control point can be kept constant, the surface quality improves.

Without TCP control (simple 5-axis interpolation)



With TCP control



Excerpted from Ai Solutions HP
http://www.ai-sols.co.jp/5axis/5ax_topic/

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28-tool magazine has been available to enhance process integrated machining

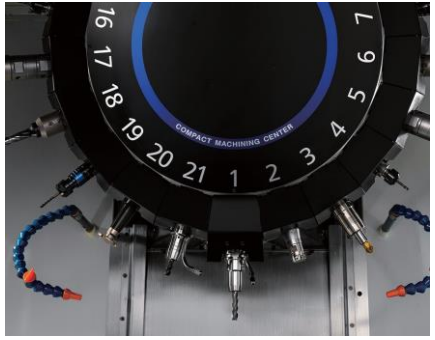
In addition to the 14-tool magazine, 21- and 28-tool magazines are optionally available.

The 28-tool magazine satisfies the tool capacity required for process integration.

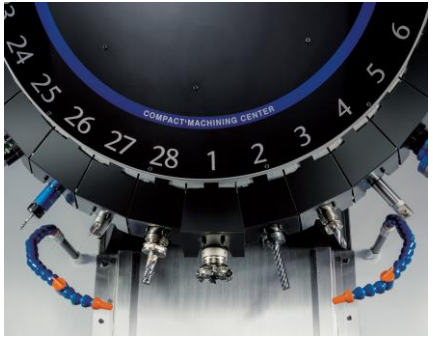
Max. tool length: 250 mm Max tool weight: 4 kg

14-tool magazine

21-tool magazine



28-tool magazine



* When the tool weight exceeds the standard spec. of 3 kg, there are some restrictions on ATC magazine loading capacity or speed adjustment is required.

Suitable spindle can be selected for machining details

Spindle speed: 10,000 min^{-1} / 16,000 min^{-1} (optional) Spindle taper: BT / BT dual contact (optional)

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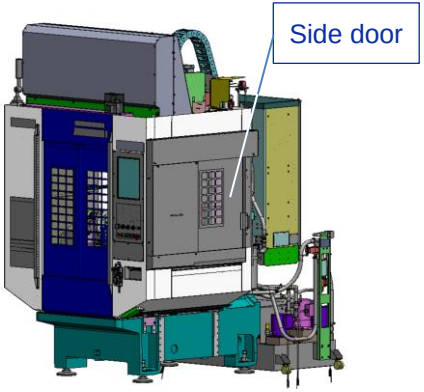
Coolant Through Spindle (CTS) 3.0 MPa / 7.0 MPa

- Using high-pressure CTS piping (optional) or 3 MPa CTS improves machining efficiency.

Using side door improves visibility.

- Side door (OP) improves visibility even when machining with tilted A-axis.



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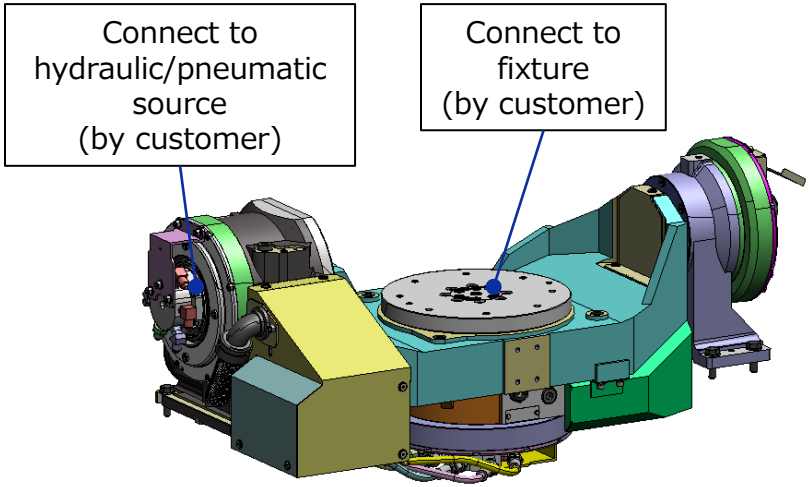
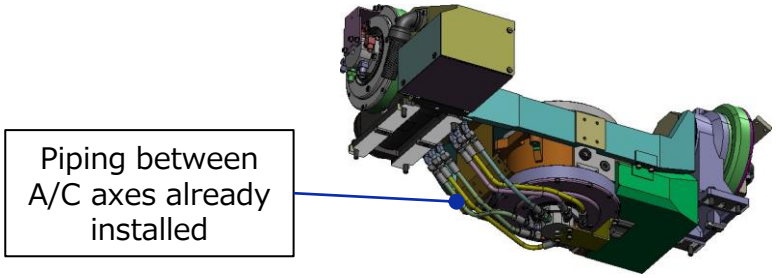
Using rotary joint for A/C axes makes fixture design easier

- As it includes piping between A/C axes, available by only connecting both sides.





	Rotary joint (optional)
Hydraulic or pneumatic	6 ports
Withstand pressure	Hydraulic: 7 MPa Pneumatic :1 MPa
RJ(A) ⇔ RJ(C)	Hydraulic hose

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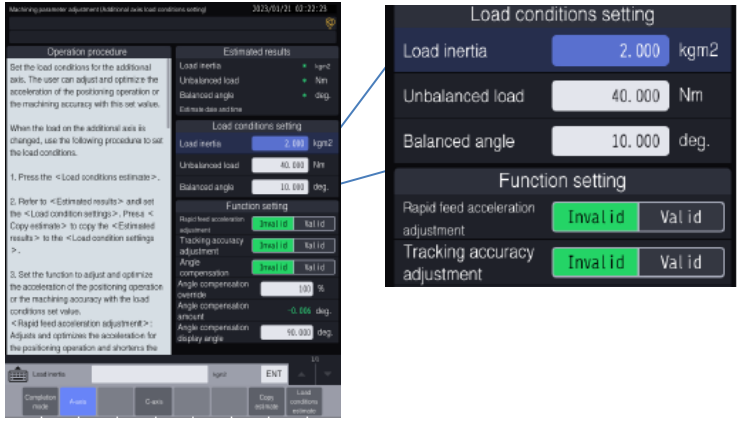
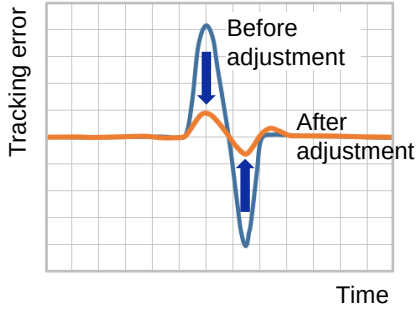
Optimizing parameters by “Additional axis load setting”

The support app estimates the inertia, unbalanced load, etc. based on the rapid feed torque and speed.



Improvement of A/C-axes tracking

The A/C-axes cutting feed is automatically adjusted based on the estimated inertia to reduce the tracking errors on the A/C-axes, achieving stable three-dimensional machining accuracy.



Making A/C-axes faster by estimating A/C-axes inertia and unbalanced load

Correcting A-axis angle error

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Extensive
Machine Performance

Pursuit of
High Productivity

Advanced
New D00 Control

Untiring Improvement
of Reliability

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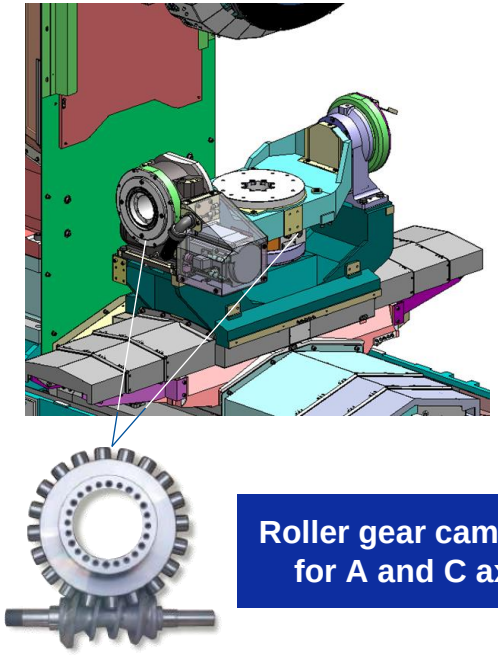
Roller gear cam used to ensure high productivity

Roller gear cam suitable for high-speed rotation is used for A and C axes to ensure high productivity.



Roller gear cam used for A and C axes

Indexing feed rate

	Indexing feed rate(min^{-1})	High inertia mode Indexing feed rate(min^{-1})
A-axis	**50**	←
C-axis	**75**	60

Positioning time

	90 deg.	180 deg.
A-axis	**0.9 s**	–
C-axis	**1.2 s**	**1.4 s**

*at standard inertia mode, including clamping time

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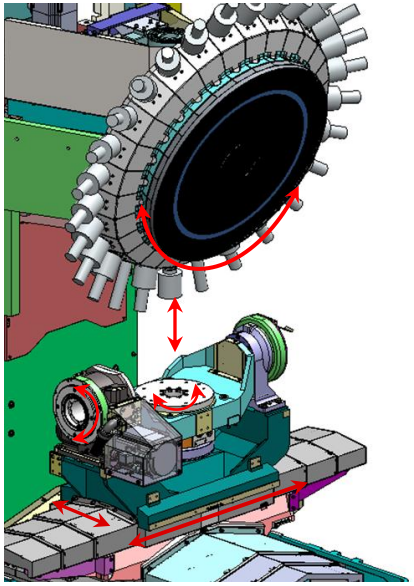
Non-cutting time has been reduced to achieve high productivity

“Non-stop ATC” has been achieved by reducing wasted time, such as in tool change time, shifting from cutting to non-cutting motion, and positioning time.

	14 / 21 tools	28 tools
Tool To Tool	**0.6 s**	0.7 s
Chip To Chip	**1.2 s**	1.3 s

Wasted time at ATC has been further reduced by simultaneous operation of axes, including A and C axes.



Simultaneous operation

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Extensive
Machine Performance

Pursuit of
High Productivity

Advanced
New D00 Control

Untiring Improvement
of Reliability

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CNC-D00: Easier User Operation with New User Interface

Global Standard User Interface

Received “iF DESIGN AWARD 2021" one of the top 3 design awards in the world.

Our standardized touch panel is made for onsite work conditions

- **User operation like a smartphone**
- **Safe to use onsite**

Increased screen size
12.1-inch → 15-inch

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Consolidated Access on New Home Screen

Cycle time
Remaining time can also be displayed

Workpiece counter
Workpiece counters enabled in program are displayed

Tool life
5-tool display, starting from tool with shortest tool life

Support application keys

Home Screen

Program

Shortcut keys

Previous Screen
Touch panel can be changed to previous screen that user is accustomed to

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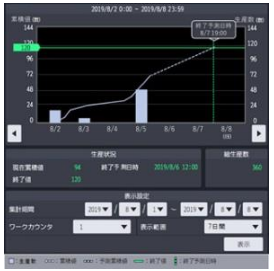
CNC-D00: Easier User Operation with New User Interface

Advanced User Interface

Equipped with new “Support Applications” to help the user with everyday tasks

More Visibility

Production performance



Operational performance

Power consumption

Task support

ATC tools

Recovery support / Check

Shorten cycle time settings

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Many New Convenient Functions Added

Tap override

Spindle and cutting **Override Enabled** during tapping operation

***Tap return recovery operation also enabled**

*Excluding end mill tapping (G177/178)

Cycle time log

Keeps the most recent **20 records** for cycle time

Cycle time log

Tool log

Tool log

After selecting a record from the cycle time log,

the **cutting time of each tool** in that program **can be displayed**

Additional functions

- Accessories
- Multi-skip
- Program restart from (automatically) saved position
- Measure time for specified part
- Load monitor and predict overload display
- Multiple block support in MDI operation
- External sub program call
- Added new ST/FBD languages to internal PLC

Accessories

Load monitor

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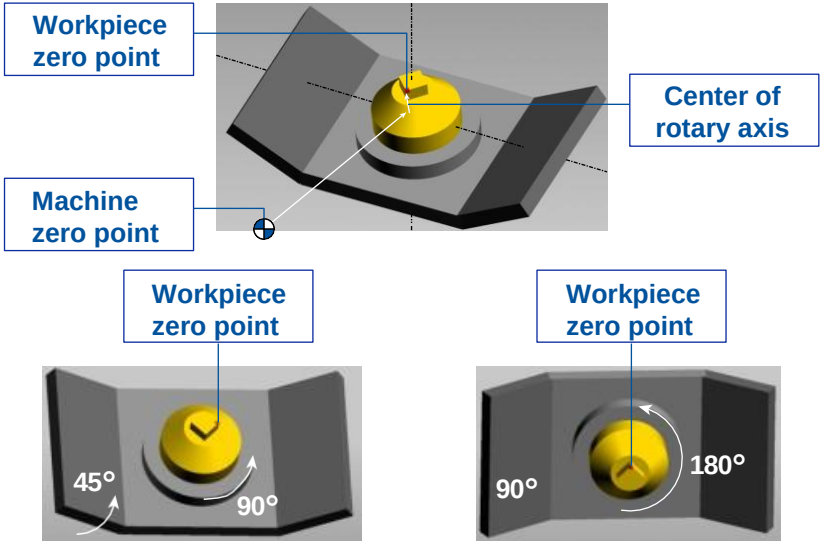
Equipped with functions effective for multi-face machining

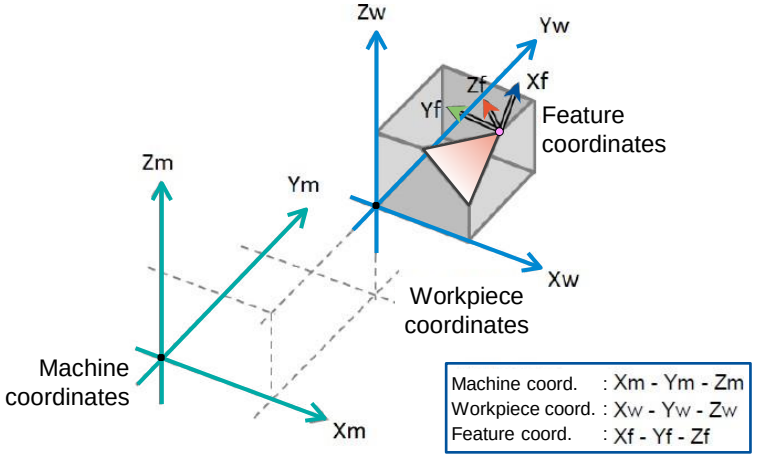
Rotary fixture offset G54.2 (optional)

Set the workpiece zero point on the rotary table.
This enables programming based on the workpiece zero point even when the rotary table is rotated.



Feature coordinates setting G68.2 (optional)

Set the angle of the inclined surface relative to the workpiece.
This enables programming with workpiece coordinates for the specified surface.



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Hardware Specifications Upgrade

- **Faster block processing speed**
  Block processing is 4 times faster
- **More look ahead blocks in high accuracy mode B**

  Standard 40 → **160**
  Option 200 → **1000**
- **Increased memory capacity, more workpiece zero point settings**

  ◎ Memory capacity

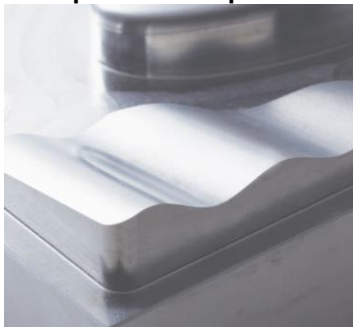
  Standard 100 MB → **500 MB**
  Option 500 MB → **3 GB**
  (Up to 4000 record files for both)

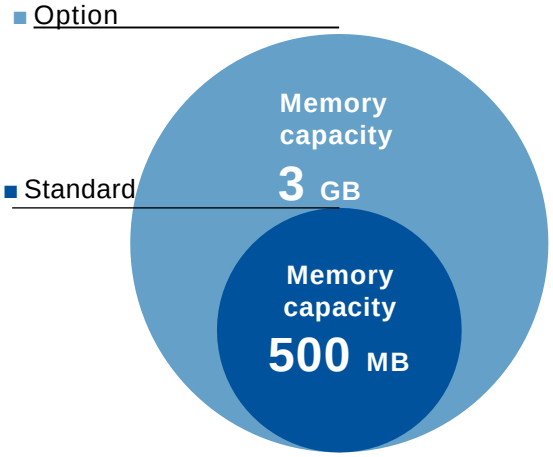
  ◎ Extended workpiece coordinate zero setting combinations

  48 → **300**
- **Doubled tool data capacity (NC only)**

  99 → **198**
  Tool life unit can be set to seconds

3D machining workpiece example





*Data comparison with CNC-C00

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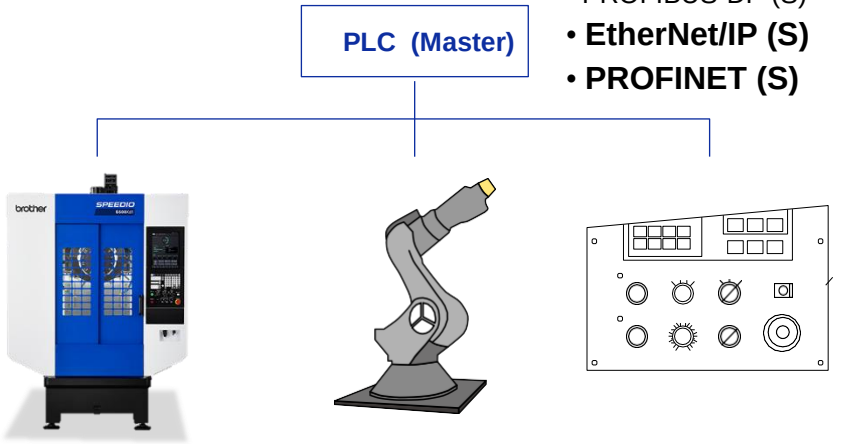
Added Compatible Standards

Added 2 types of industrial Ethernet:
Ethernet/IP and PROFINET to use on fieldbus networks, making the connection easier for users.

- CC-Link (M/S) *1
- Device Net (S)
- PROFIBUS-DP (S)
- **EtherNet/IP (S)**
- **PROFINET (S)**



SPEEDIO (w/ D00) Robot controller Sensors / Switches

Support also for OPC UA

Users can now connect directly to other companies' monitor software that is compatible with OPC UA.

*1 PLC (Master) is not necessary for CC-Link (Master).
*2 Only 1 type can be selected from all the options for the fieldbus network.

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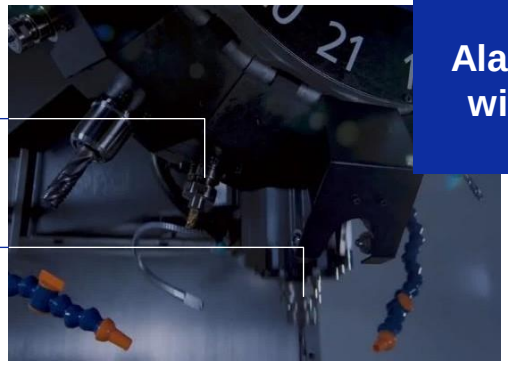
Support for Faulty Workpiece Detection & Machine Collision Avoidance

■ ATC monitoring function

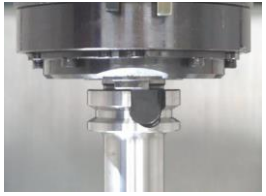
Detects problems due to attachment errors or in the event that a tool is forgotten.

Mis-attachment to machine

Tool holder missing



Alarm stop with ATC



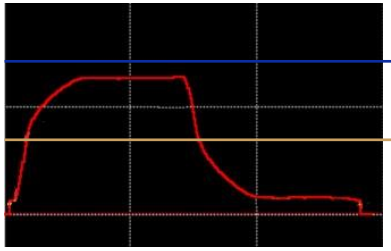
▶

Prevent outflow of defective workpieces

■ Machining load monitoring function

Detects increase in machining load.

Prevents outflow of defective workpiece caused by double machining.



Upper limit
Detects when exceeded

Lower limit
Detects when drops below

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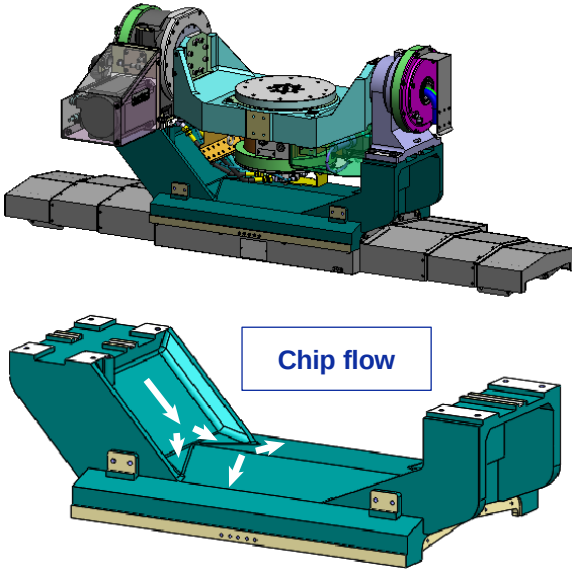
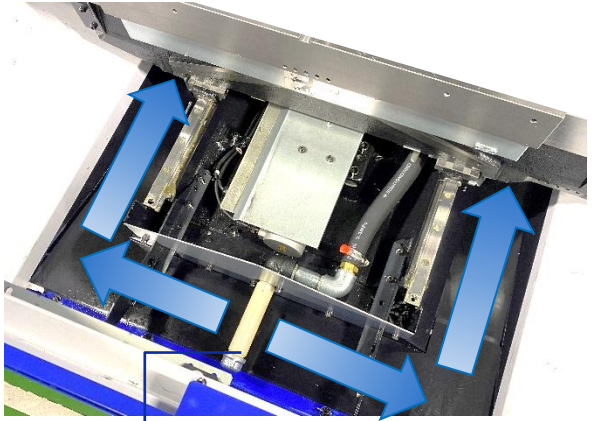
Improved chip evacuation

Entire surface of the base table has been inclined to improve chip evacuation performance.



The size of the shower piping under the Y-axis telescopic cover has been enlarged to increase the volume of coolant discharge.



Increased volume of coolant discharge by enlarging shower piping size

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Machine Specifications

Items			Details
Spindle	Taper		BT30 / BBT30 (optional)
	Spindle speed	min^{-1}	10,000 / 16,000 (optional)
	CTS piping		Withstand pressure 3.0 MPa / 7.0 MPa
Travels	X / Y / Z	mm	500 / 400 / 300
	A (tilt axis) / C (rotary axis)	deg.	150 (-30 to +120) / 360
Rapid feed rate	X / Y / Z	m/min^{-1}	50 / 50 / 56
	A / C	min^{-1}	50 / 75 (60 *1)
Table	Work area size	mm	Φ260
	Max. loading capacity	kg	100
ATC	Tool storage capacity	pcs.	14 / 21 (optional) / 28 (optional)
	Max. tool length	mm	250
	Max. tool weight	kg/tool	4.0 *2
NC unit	U500Xd1 / U500Xd1-5AX		CNC-D00 / CNC-D00v(DB)

*1: When using high inertia mode
*2: There are restrictions on spindle speed and total tool weight.

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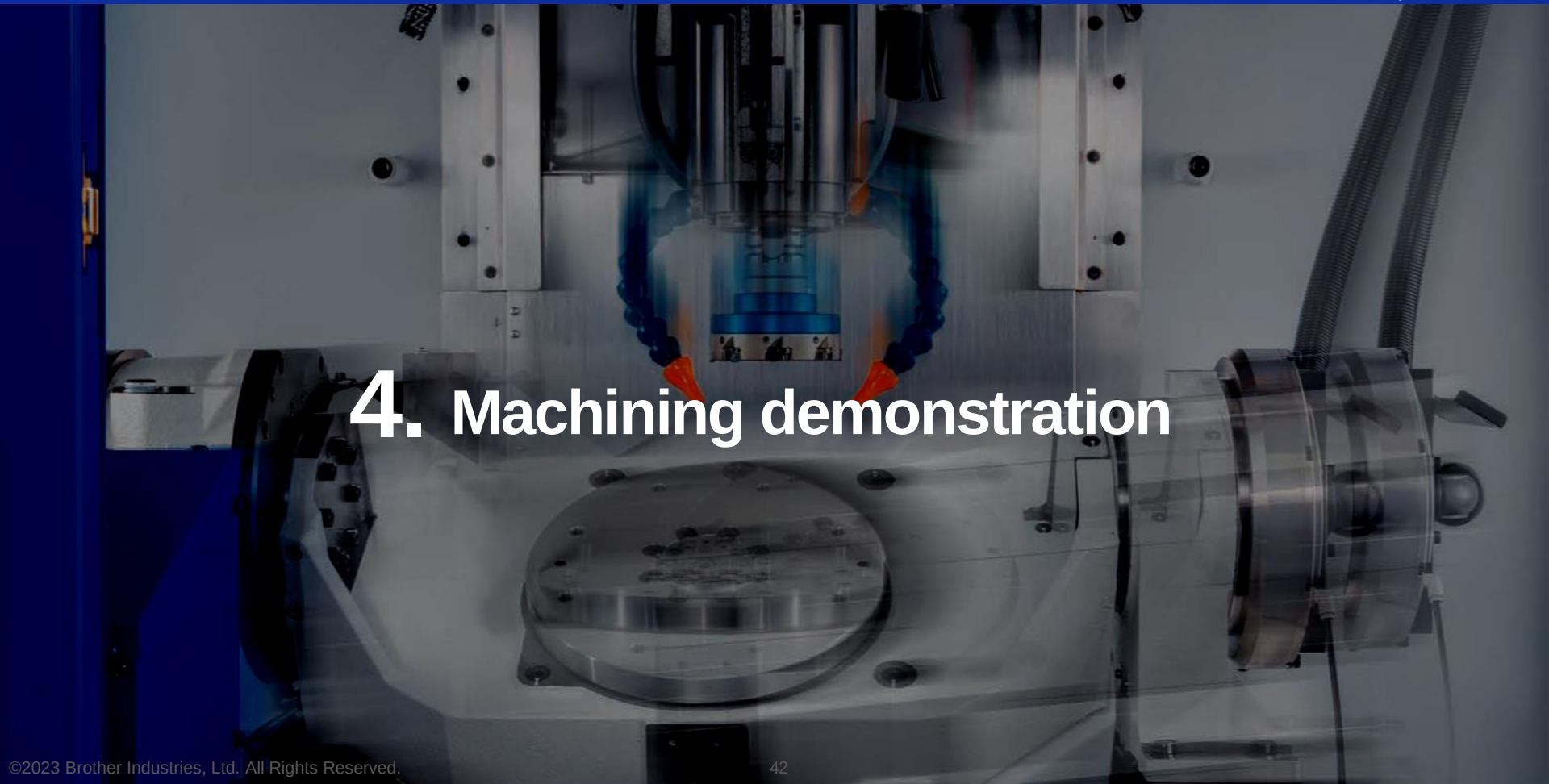

4. Machining demonstration

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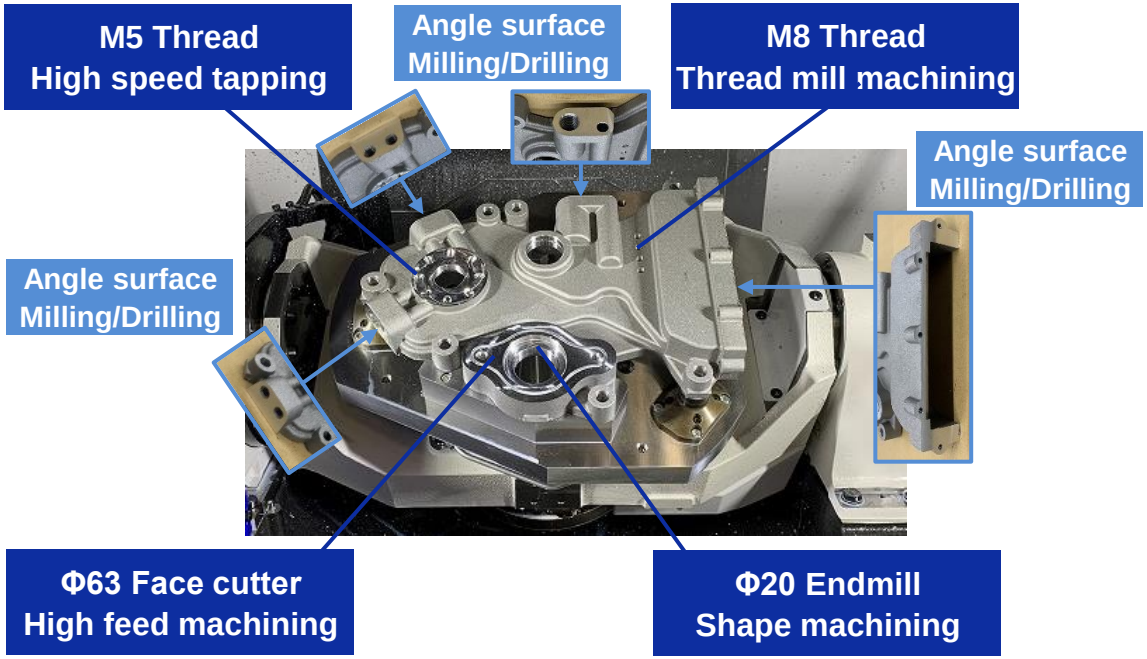
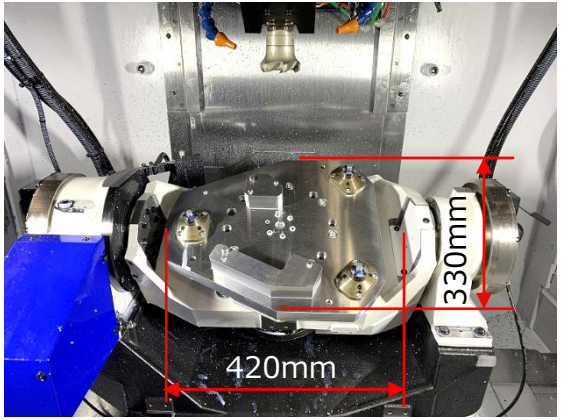
Process integration multi-face machining of automotive parts

Single-clamping multi-face machining using a built-in tilting rotary table





Hydraulic clamping system fixture

Workpiece	Timing chain cover
Workpiece material	Aluminum castings
Workpiece size	350x270x50mm
Fixture/workpiece weight	Approx. 60kg
Inertia around C-axis	0.99kg・m^2

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