YASDA

Higher accuracy produces greater profitability

YASDA MICRO CENTER

YMC 650

Linear Motor Drive

New technologies for micro high speed machining
targeting sub-micron accuracy
Reliable spindle and construction to avoid thermal distortion

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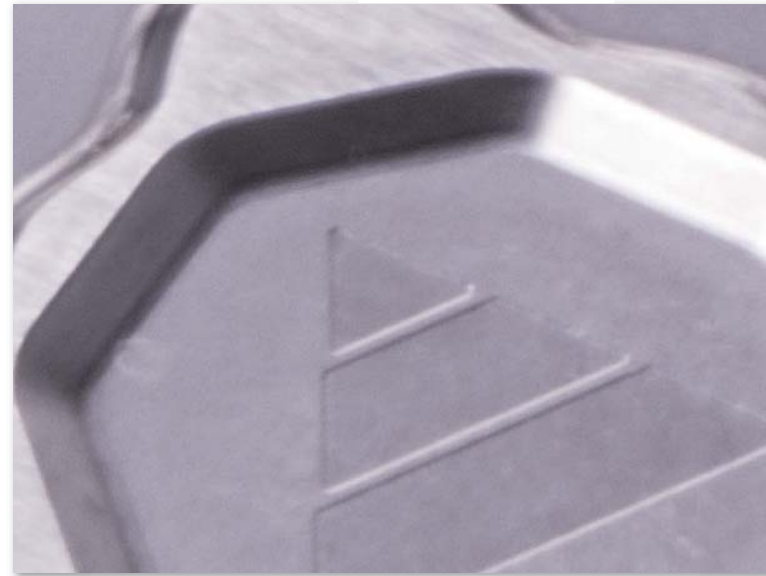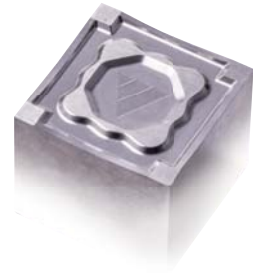
YMC 650   E
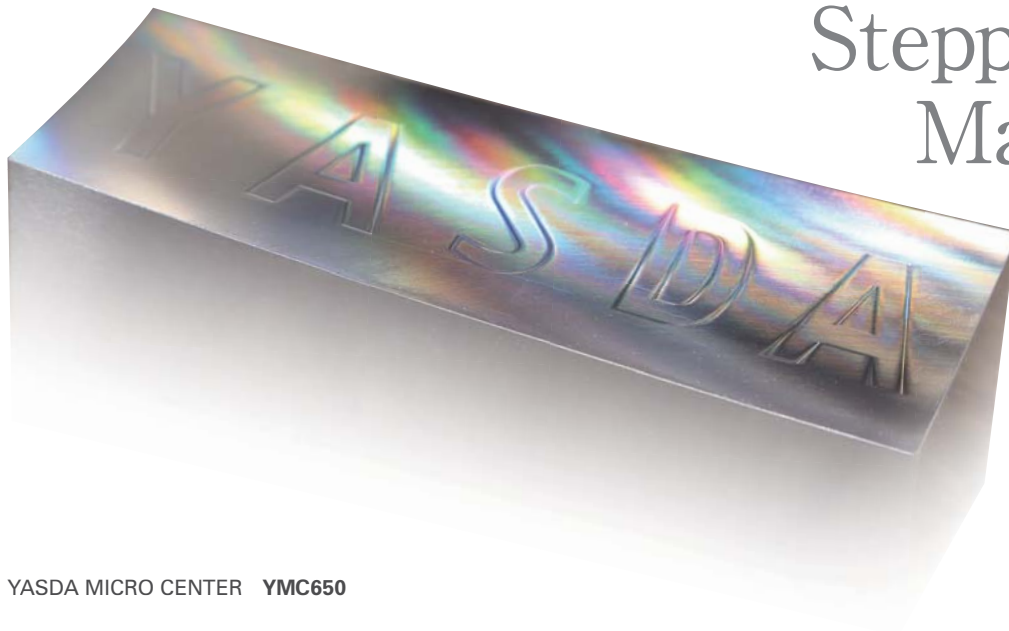
Dimples
Mirror Finish
STAVAX(52HRC)

Indexable Tool
CARBIDE(93HRA)

Stepped level Machining
Mirror Finish
STAVAX(52HRC)

YMC650

Renewed human machine interface (HMI) and OpeNe Version2.0 software connect human and machine, adaptable to a wide range of micro and high precision machining.

New human machine interface (HMI) and upgraded OpeNe Version2.0 software connect human and machine, adaptable to a wide range of micro and high precision machining.

YASDA Micro Center YMC650 is a cutting edge high-end machine which allows a wide range of high accuracy and surface quality machining. It inherits the features of YASDA's bestselling machine YMC430 and at the same time, has expanded strokes. To deliver highly accurate and long hour machining, all necessary elements such as the linear drive on all axes and measures against thermal displacement are implemented on a highly rigid machine body.
In addition, upgraded YASDA OpeNe software provides intuitive control, self-diagnosis and analysis in a simple format.
YMC650 will open a new field of micro and high precision machining.

A new-generation high-end machine moving forward with the times

Symmetrical frame design offers high rigidity

Outstanding performance raising high-precision micromachining to the next stage with improved usability

High rigidity based on four-direction symmetrical H-shaped column and stability based on low center of gravity structure
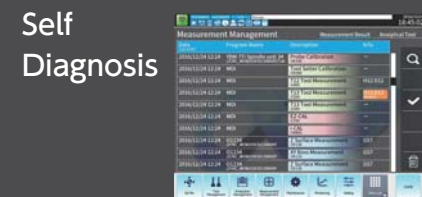
OpeNe
Version 2.0

A newly-designed HMI (Human Machine Interface) provides not only improved visibility, but the adoption of a touch panel realizes intuitive operational feel comparable to a smartphone with data selection, etc., reducing the burden on the operator.

Super rigid machine structure

High rigidity is necessary even for a machine specializing in micro machining. This super rigid machine structure allows high servo gain and highly responsive control of the machine by increasing resonant frequency.
The super rigid machine frame is composed of a rigid box shaped column and bed which are thoroughly analyzed by FEM and firmly assembled on carefully hand scraped mating faces.

Edge Computing

OpeNe Version 2.0 integrates correction information, measurement information, axis specific information, etc., during operation. Appropriate sharing of this information by operators, administrators and higher-order equipment allows on-site interoperability to be improved.
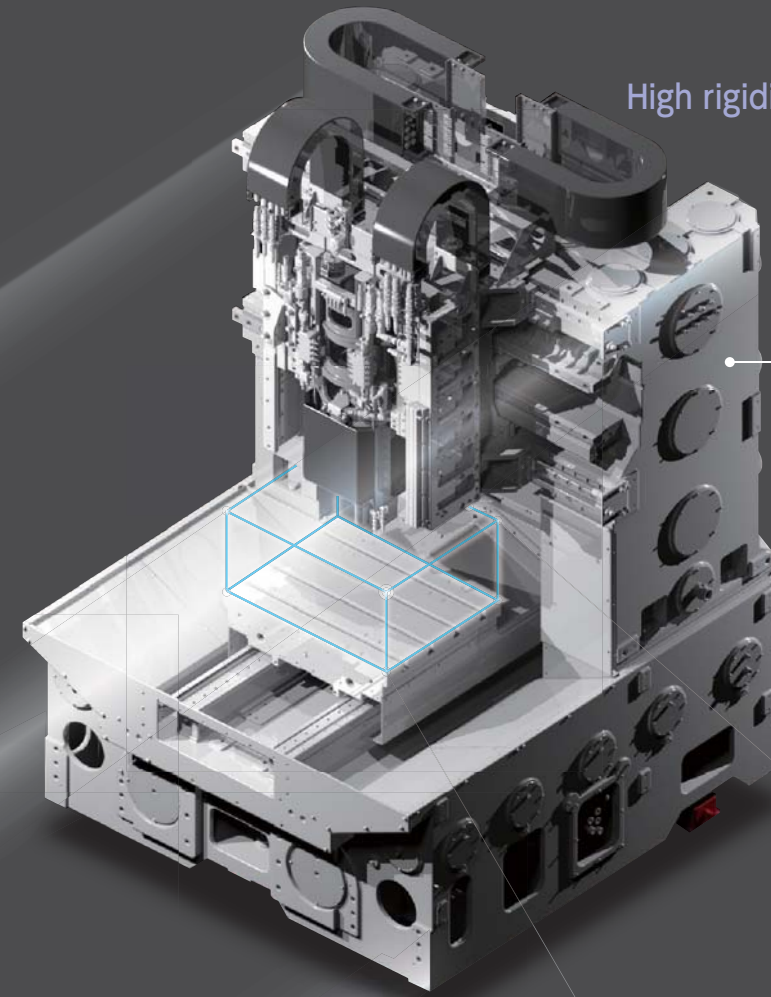
Self Diagnosis

Further advanced self-diagnosis function closely monitors any change in running status and axis information. This function generates cautions and warnings based on efficient and appropriate diagnosis results using YASDA's original monitoring algorithm, not by relying on add-on equipment.

Supporting the need for larger workpieces in micromachining

Inheriting the higher micromachining capabilities already achieved with the YMC430 while enlarging the working area.

Y-axis
X-axis
Z-axis
420
300
280
250
YMC430
YMC650
600
500
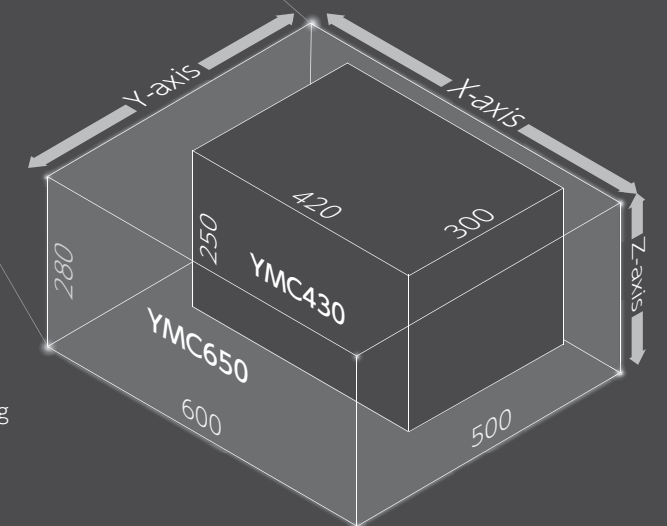
Machine specification

Travel (X/Y/Z)	600/500/280mm
Table working surface	700x550mm
Table loading capacity	200kg
Rapid traverse rate	20,000mm/min

Cutting feed rate	12,000mm/min
Drive system	All axes controlled by linear motor drives.
Least input increment	$0.01\mu m$
Scale feedback of all axes	$0.001\mu m$

Advanced thermal distortion stabilizing measures cultivated from experience and technology

YMC650's thermal distortion stabilizing system for sustaining stable high-precision machining

Cooling of the Z-axis linear motor

Cooling of the X-axis linear motor

Cooling of the column

Cooling of the spindle head

Cooling of the Y-axis linear motor

Cooling of the bed
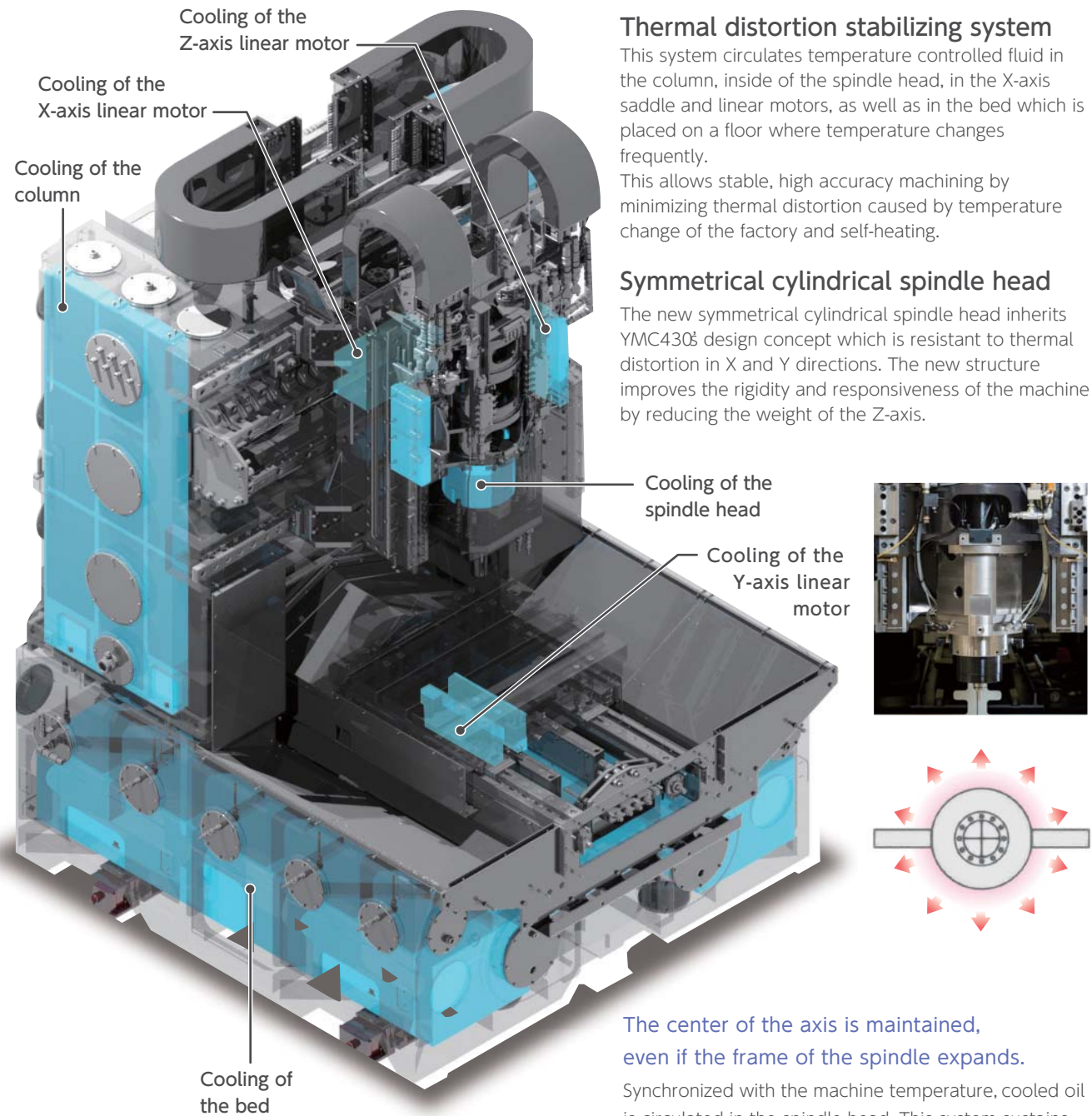
Thermal distortion stabilizing system

This system circulates temperature controlled fluid in the column, inside of the spindle head, in the X-axis saddle and linear motors, as well as in the bed which is placed on a floor where temperature changes frequently.
This allows stable, high accuracy machining by minimizing thermal distortion caused by temperature change of the factory and self-heating.

Symmetrical cylindrical spindle head

The new symmetrical cylindrical spindle head inherits YMC430's design concept which is resistant to thermal distortion in X and Y directions. The new structure improves the rigidity and responsiveness of the machine by reducing the weight of the Z-axis.

The center of the axis is maintained, even if the frame of the spindle expands.

Synchronized with the machine temperature, cooled oil is circulated in the spindle head. This system sustains high precision machining over a long period.

Spindle that produces high accuracy and high quality

Irrespective of the tool type or rotation speed, YASDA's spindle accomplishes stable, high-precision machining for longer periods of time

High stability

YASDA's 40,000 min⁻¹ spindle, developed to achieve low vibration and high reliability, has been assembled with high accuracy to accomplish constant, high-precision machining for long periods of time.
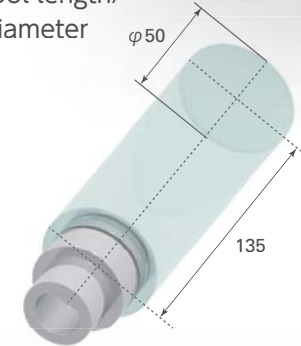
Spindle specification

Spindle speed range	200 ~ 40,000min⁻¹	Spindle drive motor	7.5kW (continuous)
Tool shank type	HSK-E32	Torque	1.8Nm (continuous)

Spindle power and torque diagram

— Spindle power   — Spindle torque
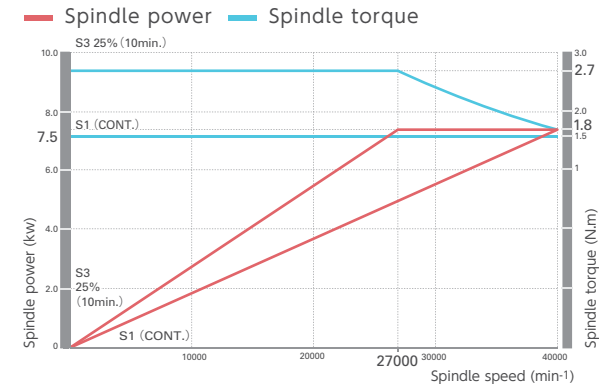
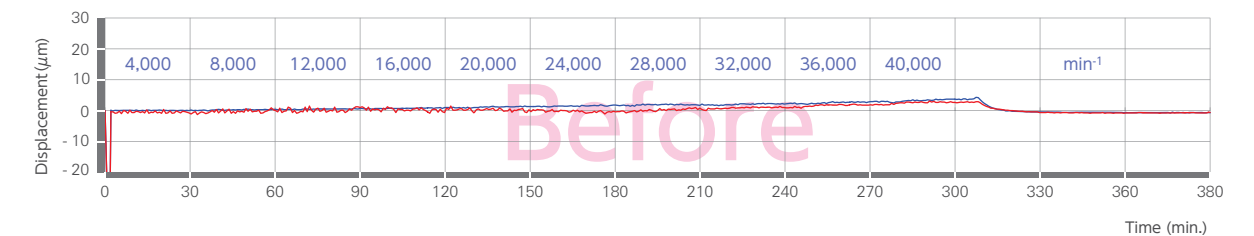Maximum tool length/diameter

φ50

135

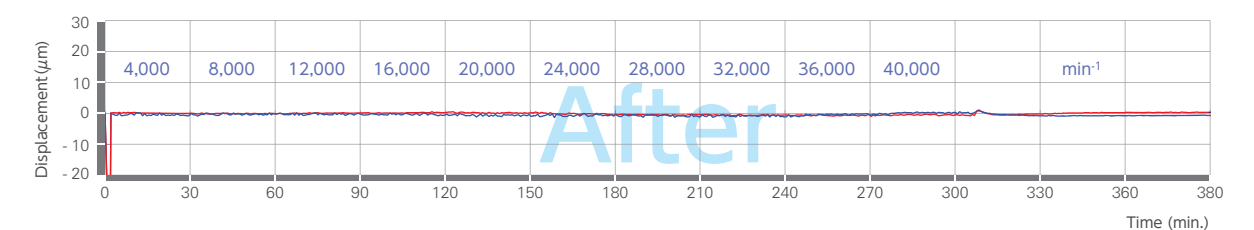### X- and Y-axis thermal distortion measurement

Measured value in full rotation range (~40,000 min⁻¹)

Thermal distortion offset invalid

4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 min⁻¹

Before

Thermal distortion offset valid

4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 min⁻¹

After

Easier User Interface

Operation and functionality are improved by new FANUC iHMI

Touch-panel type 15-inch display mounted with FANUC iHMI

A large-sized display with touch panel and the OpeNe Version 2.0 provides intuitive operation.
The manual viewer makes the FANUC instruction manual and machine user manual appear on the display.

HAS-4 realizes higher speed and higher precision machining

YASDA's high-precision machining function HAS-4, essential for machining molds, has 5 basic modes (M300 to M304) including rough machining and finish machining.

It is possible to reduce machining time and improve machining accuracy by changing parameters such as acceleration/deceleration and tolerance according to machining purpose.

On the machining assist screen, it is possible to select from 5 basic machining modes and to finely adjust machining parameters for each mode according to machining conditions. It is also possible to select smoothing and other functions on the screen, thus allowing optimal conditions to be established according to each type of machining including 3D-shaped mold machining and 5-axis machining.

For HAS-4, machining time is reduced by eliminating the stop time between blocks and surface quality is improved by more finely controlling servo-control feedback signals.

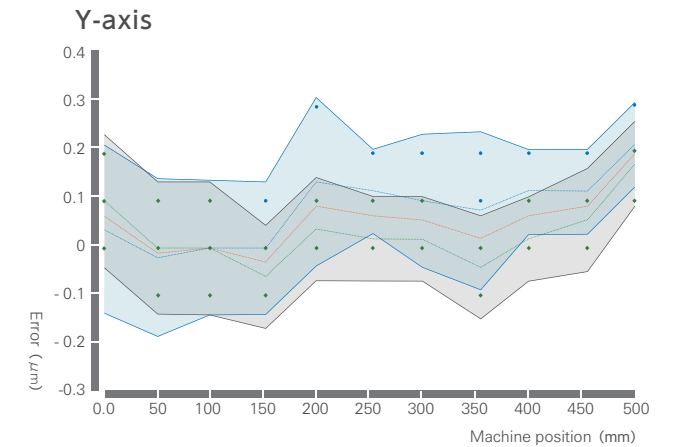## High stability achieved by all-axis controlled linear motor drives

YASDA's pursuit for "infinitely flat" and "infinitely square"

High-precision positioning

ISO 230-2（1988）   unit（mm）

	X	Y	Z
Accuracy : A	0.0009	0.0007	0.0005

ISO 230-2（2014）   unit（mm）

	X	Y	Z
Accuracy : A	0.0008	0.0006	0.0004
Repeatability : R	0.0002	0.0003	0.0003

Positioning accuracy
Y-axis

Motion performance data (X-Y axis)

KGM Grid Encoders

X-Y R50 F1000
CIRCULARITY
0.98μm
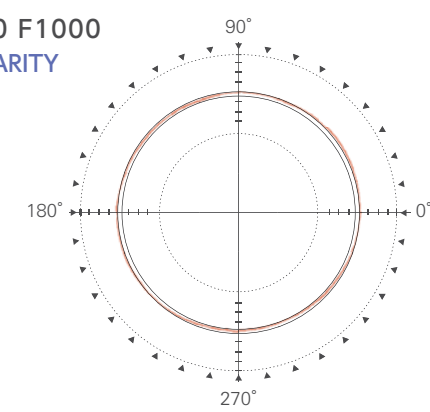
X-Z R0.5 F100
CIRCULARITY
0.55μm
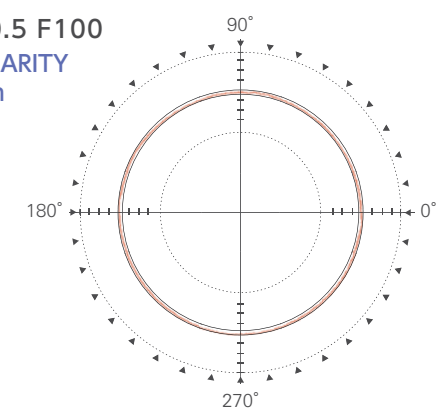
X axis　Straightness in vertical direction（EXZ）
0.17μm/100 Measurement by a 100 mm optical flat
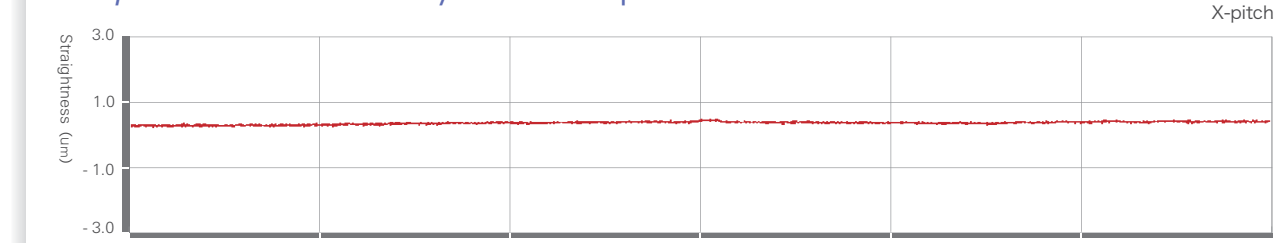
OpeNe serves as an intermediary between human and machine

YASDA

Each function of OpeNe Version 2.0 provides the operator with complete details of the machine.

Edge Computing — Self Diagnosis

EZ Operation

Tool Information Management

On this screen, not only basic tool information but also associated tool information such as machining load and measurement history are collectively managed.
It is also possible to monitor spindle load in real time in comparison with past record data and check changes in same tool length and diameter.
It is also possible to set a tool selected on the screen into the spindle (tool change) and tool measurement operation in interactive mode from the screen without program instructions.

Production Control

On this screen, not only machine running information but also mechanical information such as load on each axis while running, workpiece coordinates and tool compensation values are displayed. It is possible, in case of machining failure, to carry out a follow-up check because various types of mechanical information are displayed on the same time axis as that of program progress graph. It is also possible to graphically display actual machine running status on a daily, weekly and monthly basis. Machine running status data can be utilized in Excel format.

Maintenance Management

On this screen, various data such as number of operations and running status of peripherals are automatically acquired and saved. Use of acquired data allows for planned and efficient maintenance and predictive maintenance on equipment. A check if current machine status is appropriate or not is carried out automatically by acquiring servo wave data and comparing it with past data.

Program Management

On this screen, machining time for any registered program can be easily calculated by simulation even while the machine is operating.
Knowing machining end time with accuracy enables optimal utilization of equipment and smooth production.

High Precision Application

Handles various types of machining from 3D micro machining to high precision parts machining

High-precision traceability

Excellent positioning accuracy

| Measuring point	X coordinate value (error)	Y coordinate value (error)	Pitch accuracy (error)
A	-70.0003 (-0.0003)	-45.0000 (+0.0000)	A-B 140.0009(+0.0009)
B	70.0006 (+0.0006)	-45.0000 (+0.0000)	C-D 140.0011(+0.0011)
C	70.0008 (+0.0008)	45.0001 (+0.0001)	A-D 90.0002(+0.0002)
D	-70.0003 (-0.0003)	45.0002 (+0.0002)	B-C 90.0001(+0.0001)
E	0	0	

32 tool-ATC (standard)

The ATC unit adopts an armless type automatic tool changer that directly changes tools by tool magazine moving along its stroke. A 90-tool ATC (optional), which has a larger capacity, requires virtually the same installation space as the 30-tool ATC. Therefore, the 90-tool ATC can be installed without increasing the machine space.

90 tool-ATC (optional)

OUTLINE

unit:mm

Thermal distortion stabilizing system

Additional 1 axis supports precise 4-axis machining `Option`
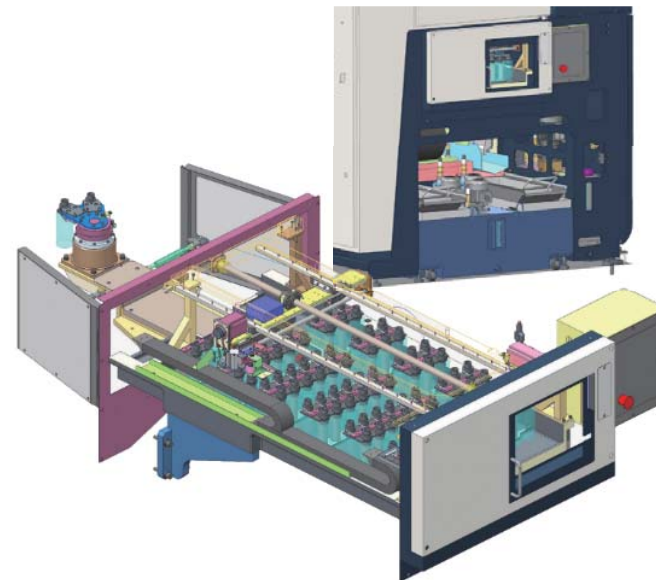
### YASDA's 1 axis rotary table realizes highly accurate 4-axis machining.

RS20

Adoption of a DD (Direct Drive) motor offers high speed and high-precision positioning.
Enables multi-face indexing machining as well as highly accurate simultaneous 4-axis machining.

Rotary axis indexing accuracy
(Measured value)
ISO 230-2 (1997)

Accuracy : A	0.99sec

RS20 specifications

Table diameter	φ200mm
Table surface configuration	4 T-slots x 90 degree pitch Slot width:12mm H8 (standard)
Table center hole diameter	φ30mmH7(Depth:10mm)
Table rotational axis travel	360°(Continuous)
Max. rotation speed (rapid traverse)	150min^{-1}
Allowable workpiece loading capacity	40kg
Least input increment	0.0001°
Height up to table center	200mm
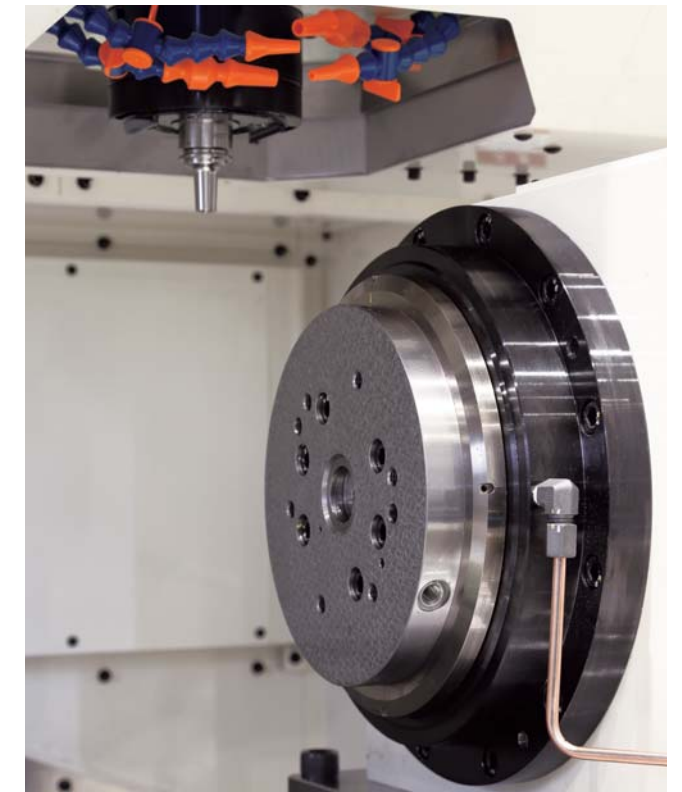
OUTLINE

unit:mm
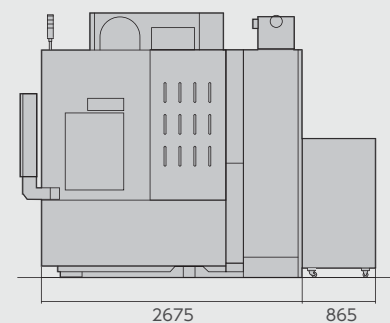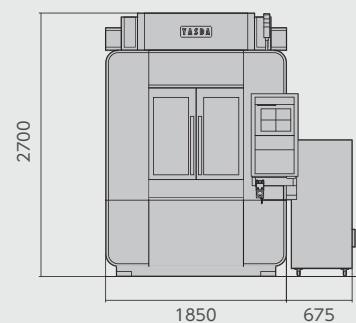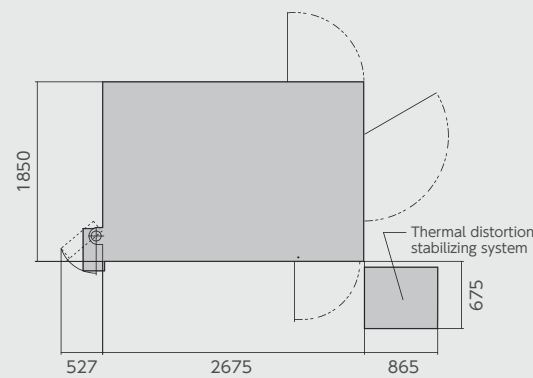
YMC 650 SPECIFICATIONS
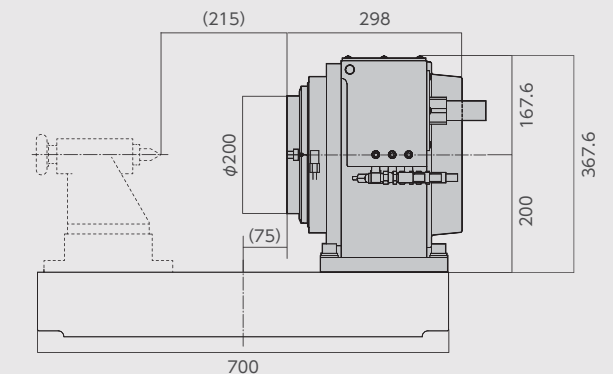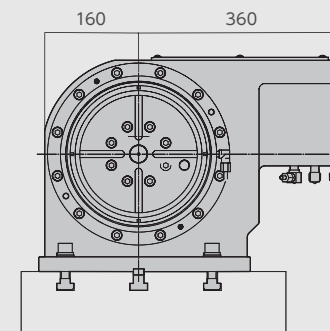
1. Base machine specifications

1) Travel	X-axis travel (Cross movement of table)		600mm
	Y-axis travel (Longitudinal movement of table)		500mm
	Z-axis travel (Vertical movement of spindle head)		280mm
	Distance from table surface to spindle nose face		
			135~415mm
2) Spindle	Spindle speed range		200~40,000min^{-1}
	Spindle drive motor		7.5 kW AC (Continuous)
	Spindle taper		HSK-E32
3) Table	Table working surface		700mm×550mm
	Table loading capacity		200kg
	Table surface configuration	4T-slots, width 18 mm H8,	
		pitch 125 mm	
4) Feed rate	Rapid traverse rate		20,000mm/min
	Cutting feed rate		Max. 5,000 mm/min
	Least input increment		0.01μm
5) ATC	Tool shank type		HSK-E32
	Tool storage capacity		32tools
	Maximum tool dia. / length / mass	ϕ50mm /135mm /500g	
6) Mass of machine			Approx. 9,000kg
7) Electric power requirement			30kVA
8) CNC unit			FANUC 31i-B5

2. Standard equipment

1) Optical scale feed back		0.001μm
2) Washing gun		1 (Operator position),
		Standard tank capacity: 200 L
3) Splash guard	Manual door with roof and one LED light	
4) Spindle thermal displacement compensation		Standard data
5) OpeNe Version 2.0		

3. CNC standard options

1) Least input/travel increment		0.01μm
2) Display		15"LCD touch panel with iHMI
3) Program storage length		1280 m (512 KB)
4) Custom macro		Common variable: 600
5) Number of registerable programs		1000
6) Automatic corner override		
7) Tool offset pairs		64 pairs
8) Tool offset memory		Memory C
9) Extended part program editing		
10) Memory card/USB memory interface		Data input/output
11) Background editing		

4. Optional equipment

1) Number of additional stored tools		90 tools
2) Signal tower (Multilayer signal lamp)	Red, yellow, green (Flashing)	
3) Cutting liquid temperature control unit		
4) External mist coolant	Manufactured by Bluebe / 2 nozzles	
5) Oil skimmer		Oil Pure
6) Cutting oil unit (AA type)		2 nozzles
7) Mist collector		Mistresa
8) Automatic tool length compensation and tool breakage sensor		
	Manufactured by BLUM/NT type	
9) Automatic tool length compensation and tool breakage sensor		
	Manufactured by BIG Daishowa / Dyna Vision Pro	
10) Automatic tool length compensation and tool breakage sensor		
	Manufactured by BIG Daishowa / Dyna Line	
11) Automatic measuring system		
	Manufactured by Renishaw / Touch probe OMP400	
12) High-speed machining function (YASDA HAS-4 system)		
	Maximum feed rate 12,000 mm/min	
13) Thermal distortion stabilizing system	With weekly timer	
14) Weekly timer		
15) Spindle thermal displacement compensation	Individual data	
16) AWC door		
17) Robot interface	Compatible with System 3R and EROWA	

5. CNC Options

1) Part program storage	Total: 1 MB, 2 MB, 4 MB, 8 MB	
2) Extensional number of registerable programs	Total: 2,000, 4,000	
3) Helical interpolation		G02, G03
4) Conical/spiral interpolation	G02, G03 (Helical interpolation is required.)	
5) Inch/metric conversion		G20, G21
6) Scaling		G50, G51
7) Coordinate rotation		G68, G69
8) Programmable mirror image		G50.1, G51.1
9) Rigid tap		M29 (G84, G74)
10) Optional block skip		Total: 9
11) Tool offset pairs	Total: 99, 200, 400, 499, 999 sets	
12) Addition of workpiece coordinate	48 sets, 300 sets	
13) Tool management		
14) Normal direction control	G40.1, G41.1, G42.1	
15) Cs contouring control		
16) High-speed smooth TCP		G43.4, G43.5
17) Tilted working plane command with guidance	G68.2, G69, G53.1	
18) Work setting error compensation		G54.4 Pn
19) Ethernet function		FOCAS2/Ethernet
20) Data server function	Fast data server, Capacity: 1GB, 2GB, 4GB, 16GB	