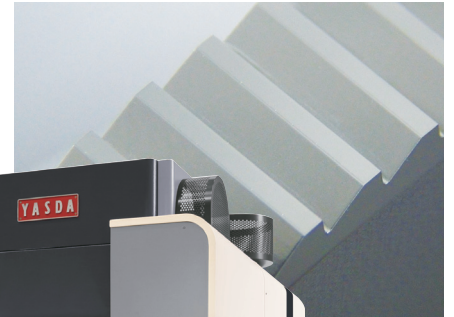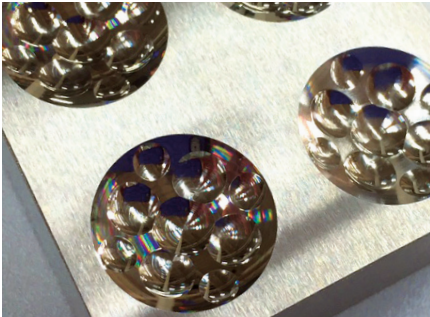Higher accuracy produces greater profitability

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
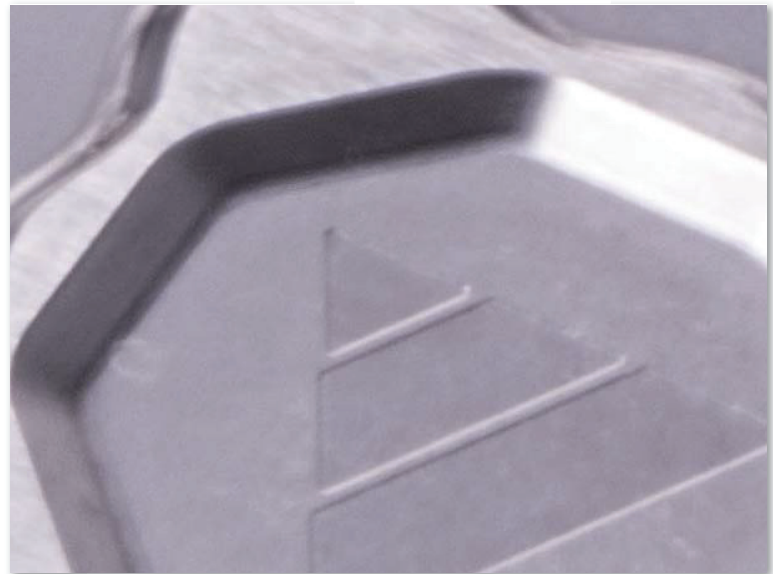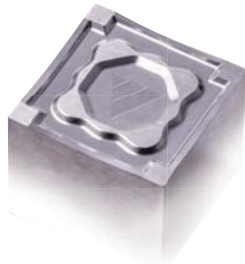
YMC 650 E

Dimples

Mirror Finish

STAVAX(52HRC)

Indexable
Tool

CARBIDE(93HRA)

Stepped level
Machining

Mirror Finish

STAVAX(52HRC)

YMC 650

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

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

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.

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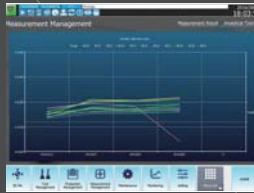
OpeNe Version 2.0 integrates correction information, measurement information, axis specific information, etc., during operation. Appropriate sharing of this information by operators, administrators and higher-order equipment allows on-site interoperability to be improved.

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.

Symmetrical frame design offers high rigidity

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

## 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.
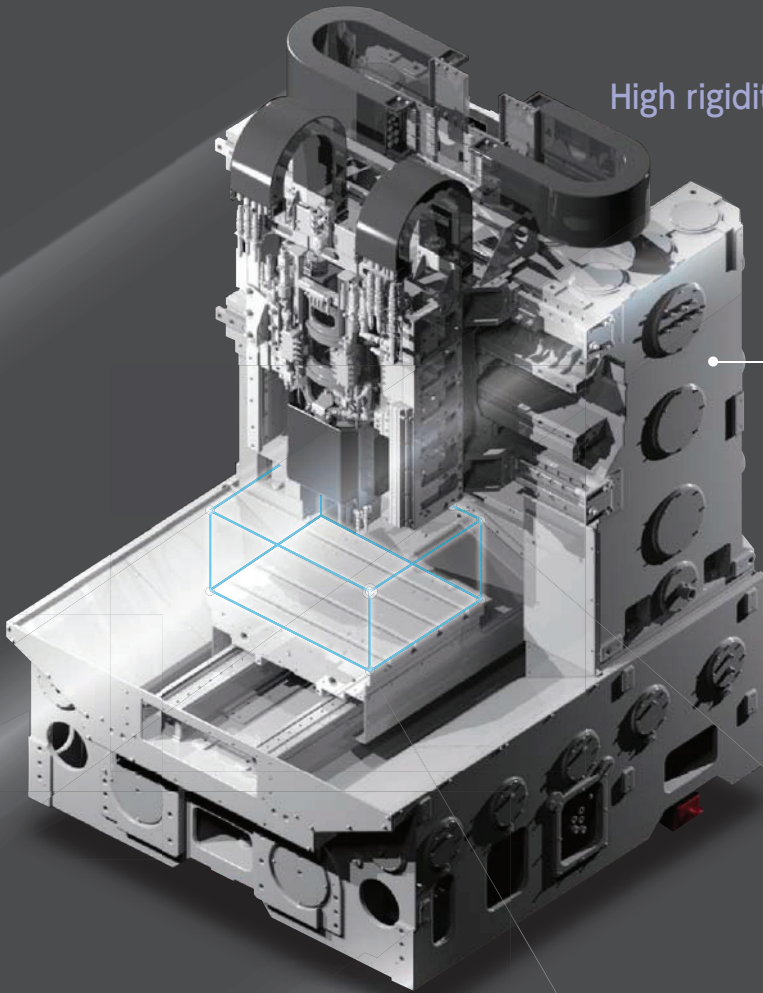
Supporting the need for larger workpieces in micromachining

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

Y-axis   X-axis

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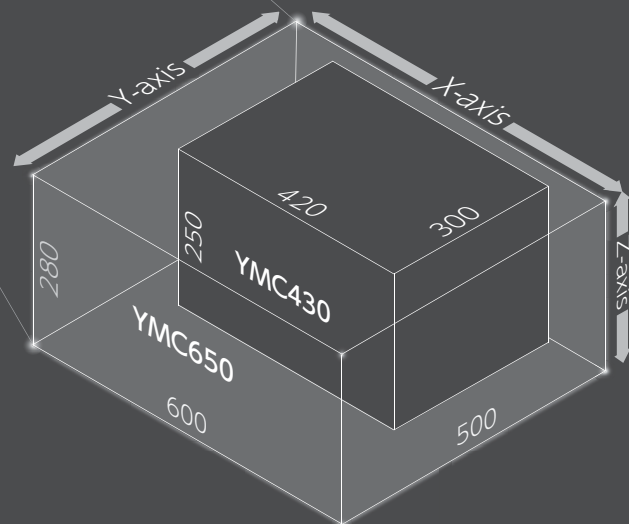
Machine specification

Travel (X/Y/Z)	600/500/280mm	Cutting feed rate	12,000mm/min
Table working surface	700x550mm	Drive system	All axes controlled by linear motor drives.
Table loading capacity	200kg	Least input increment	$0.01\mu m$
Rapid traverse rate	20,000mm/min	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
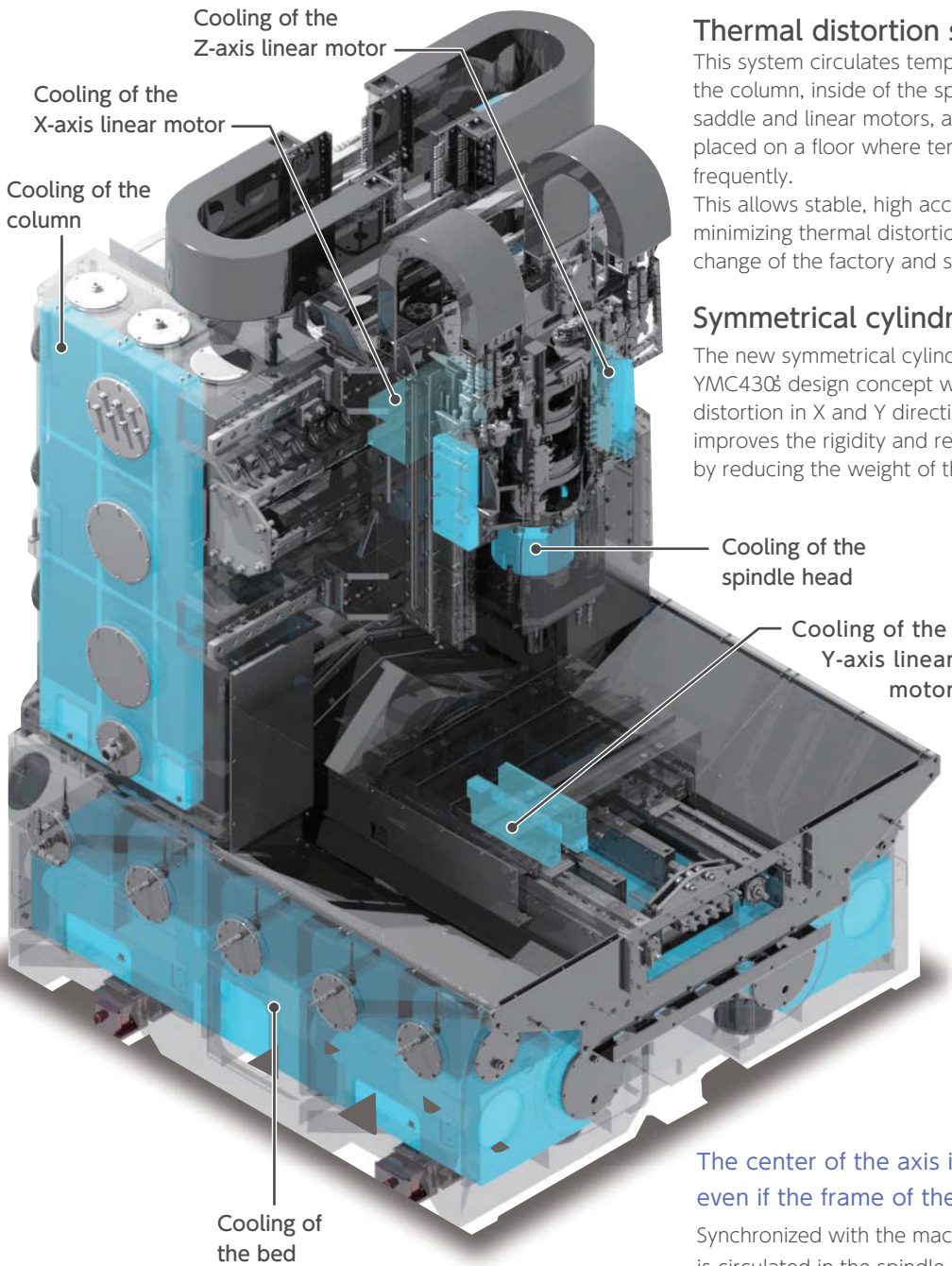
Thermal distortion stabilizing system

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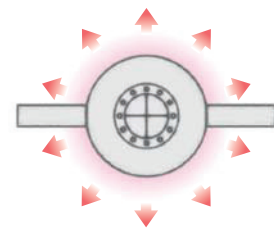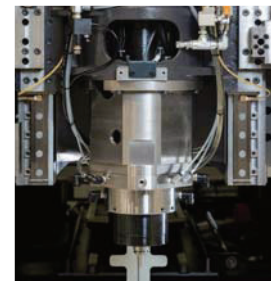
The center of the axis is maintained, even if the frame of the spindle expands.

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
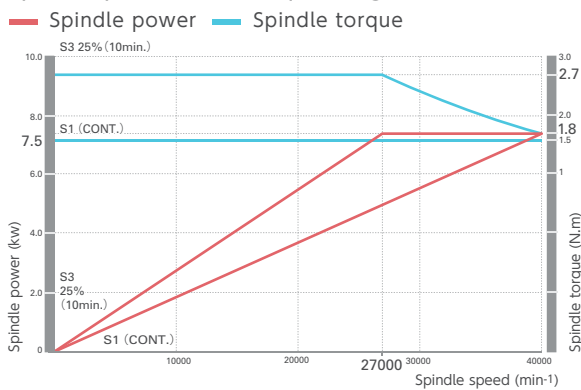
High stability

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.
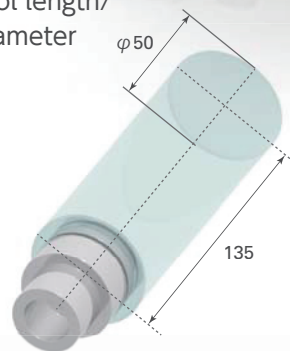
Spindle specification

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

Spindle power (kw)
Spindle torque (N.m)
Spindle speed (min^{-1})
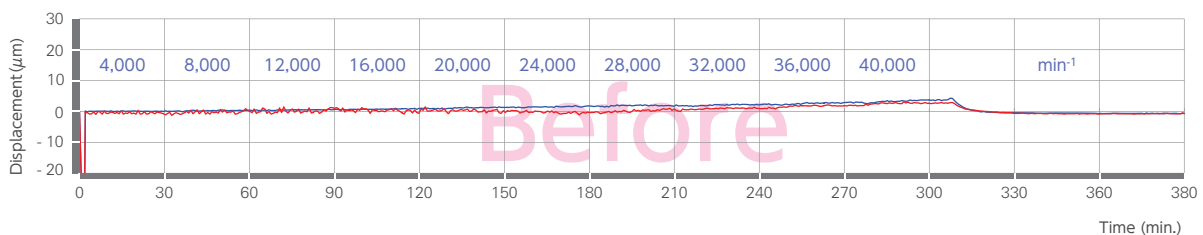
S3 25% (10min.)
S1 (CONT.)
S3 25% (10min.)
S1 (CONT.)

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

Displacement (μm)

| 4,000 | 8,000 | 12,000 | 16,000 | 20,000 | 24,000 | 28,000 | 32,000 | 36,000 | 40,000 | min^{-1} |

Before

Time (min.)

Thermal distortion offset valid

Displacement (μm)

| 4,000 | 8,000 | 12,000 | 16,000 | 20,000 | 24,000 | 28,000 | 32,000 | 36,000 | 40,000 | min^{-1} |

After

Time (min.)
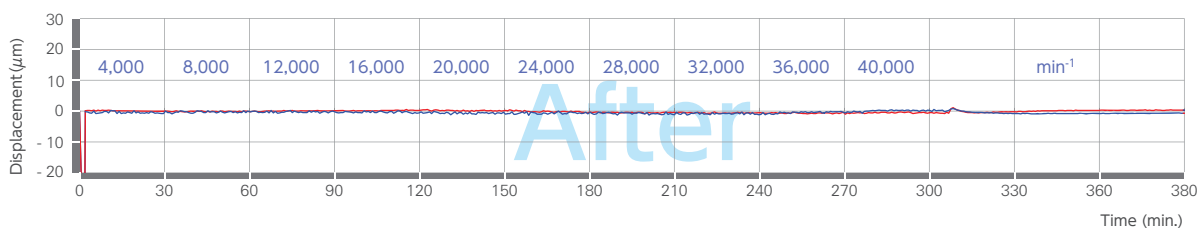
Easier User Interface

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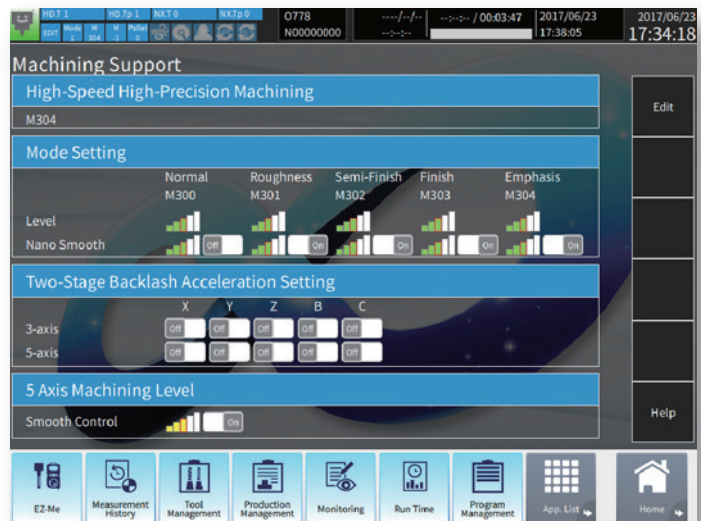
High stability achieved
by all-axis controlled linear motor drives

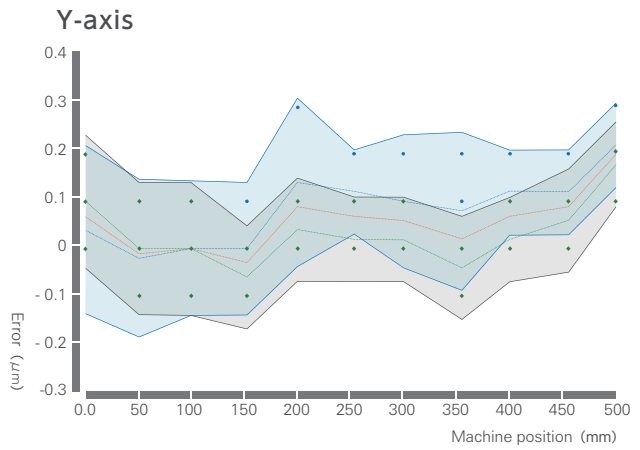## YASDA's pursuit for "infinitely flat" and "infinitely square"

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

Error (μm)

Machine position (mm)

Motion performance data (X-Y axis)
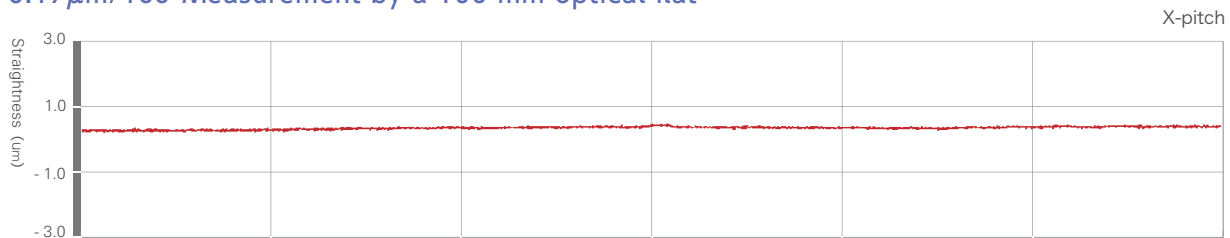
KGM Grid Encoders

X-Y R50 F1000
CIRCULARITY
0.98μm
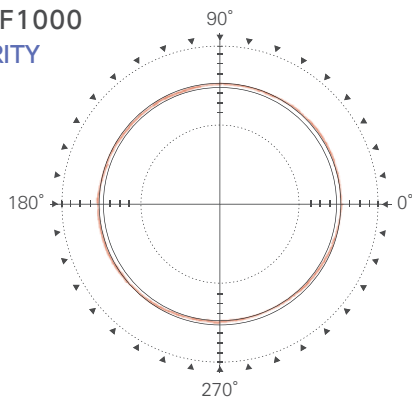
X-Z R0.5 F100
CIRCULARITY
0.55μm
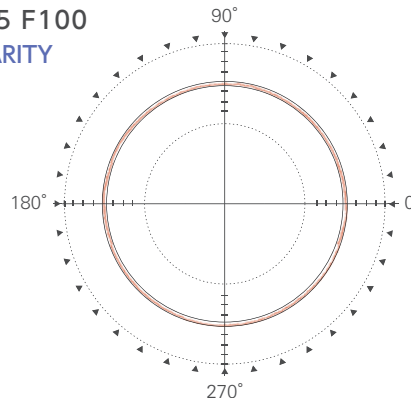
X axis   Straightness in vertical direction (EXZ)
0.17μm/100 Measurement by a 100 mm optical flat

X-pitch

Straightness (um)

OpeNe serves as an intermediary between human and machine

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
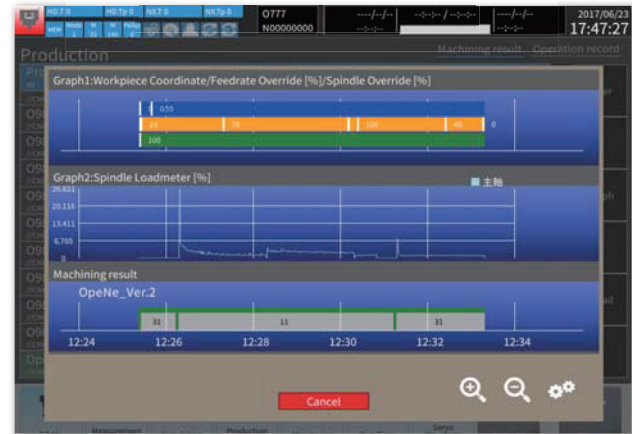
On this screen, not only machine running information but also mechanical information such as load on each axis while running, workpiece coordinates and tool compensation values are displayed. It is possible, in case of machining failure, to carry out a follow-up check because various types of mechanical 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.
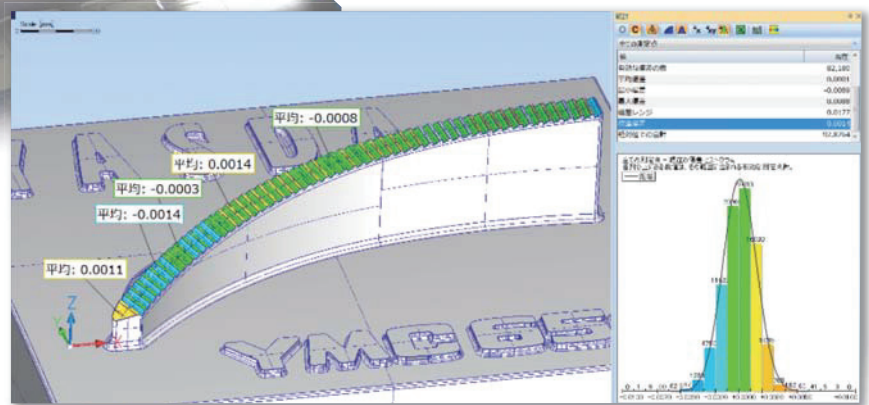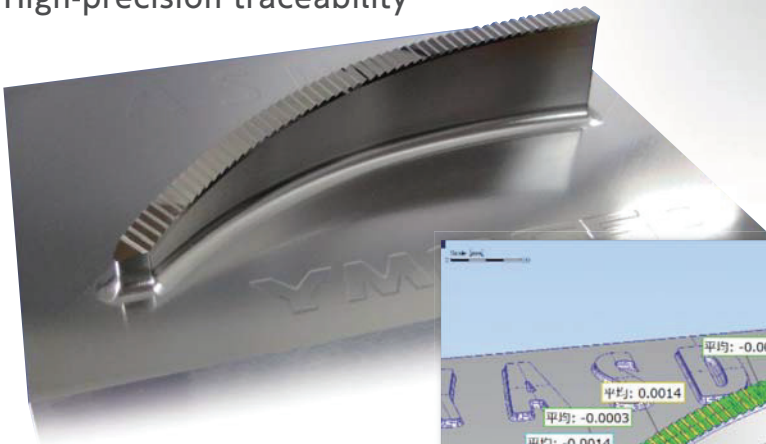
High Precision Application

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	

Additional 2 axis supports precise 5-axis machining Option

YASDA's tilting rotary table,
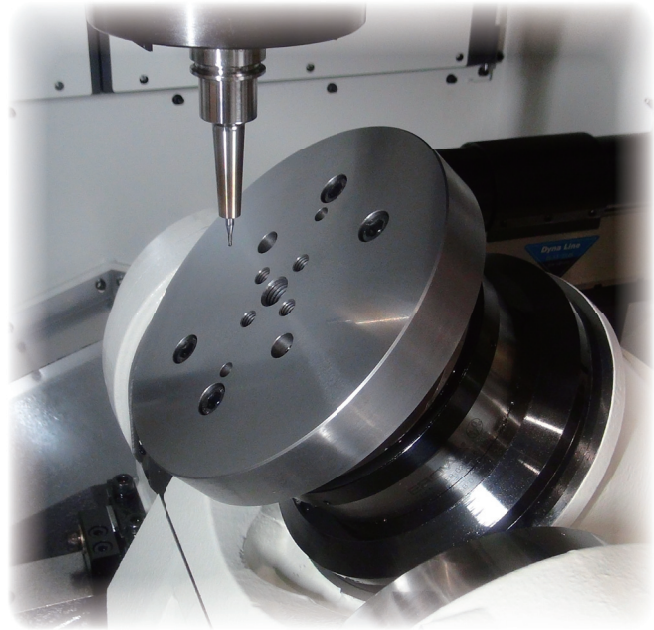realizing highly accurate 5-axis
micro machining of larger work.

RT20

■ The high precision micro machining center,
YMC650 equipped with a DD(Direct Drive)
motor- driven high precision tilting rotary table.

■ By having a new larger table surface,
RT20 can hold a workpiece up to φ330mm

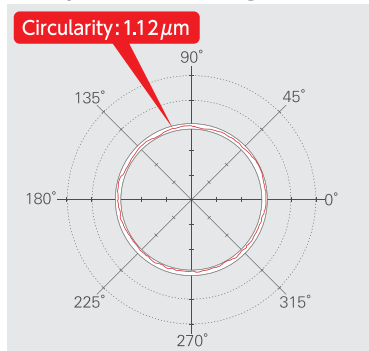## Rotary axis indexing accuracy

ISO 230-2 (1997)   unit(sec)

Accuracy : A	B	C
	1.20	1.12

Circularity of tilted cone shape machining

Circularity: 1.12μm

RT20 main specifications

Table tilting(B-axis)	-10 ～ 100deg
Table rotation(C-axis)	360deg (Continuous)
Distance from tilting axis center to spindle nose face	175 ～ 455㎜
B/C-axis maximum rotation speed	100min-1
Pallet loading capacity	35kg (including pallet)
Minimum input increment	0.00001deg
Chucking system	EROWA　power chuck(ER-029436) system 3R macro magnum(3R-SP26712)
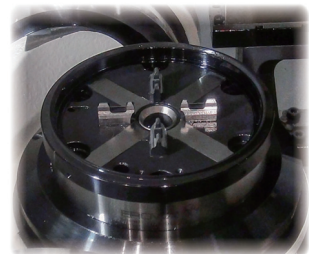
EROWA power chuck P

DIMENSION

Each chacking system's dimensions

		EROWA	system 3R
Workpiece dimensions	Pallet	ER-041912	3R-681,156-A
	A	242	247
	B	163	168
Table dimensions	φD	148	156
	E	116	110.3
	F	59	64.7

630 (X-axis travel)
440   190
105
B0°
B-90°
70
B-axis tilting center

φ330
Work piece dimensions
280
(Z-axis travel)
SR365
φD
70
B-axis tilting center

490 (Y-axis travel)
250   240
B
A
E
175
B-axis tilting center
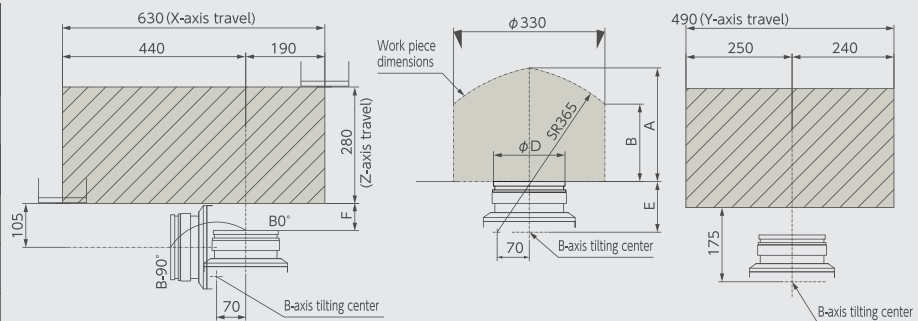
Additional 1 axis supports precise 4-axis machining Option

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)
Rotary table Max. rapid feed rate	150min^{-1}
Loading capacity	40kg
Min.input	0.00001deg
Height up to table center	200mm

OUTLINE

unit:mm

160   360

(215)   298

167.6

ϕ200

367.6

(75)   200

700
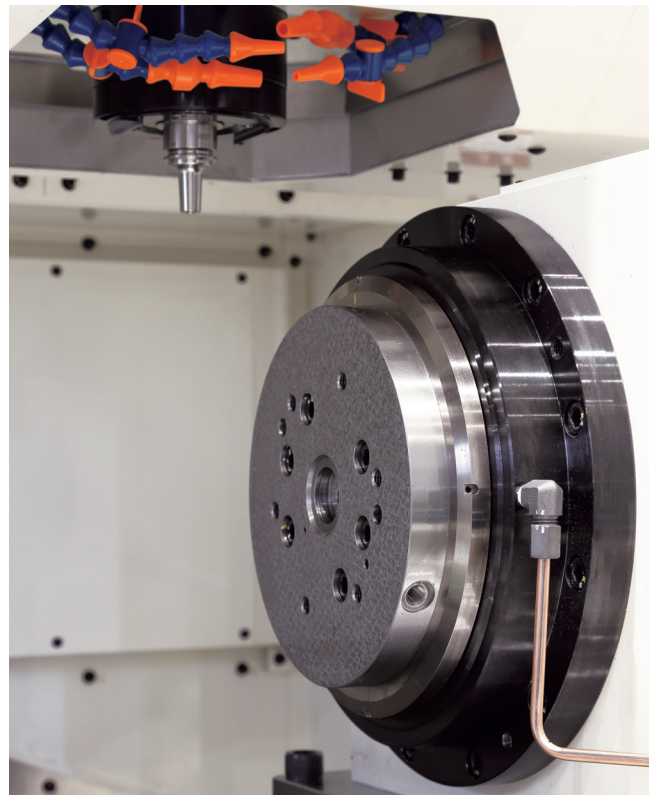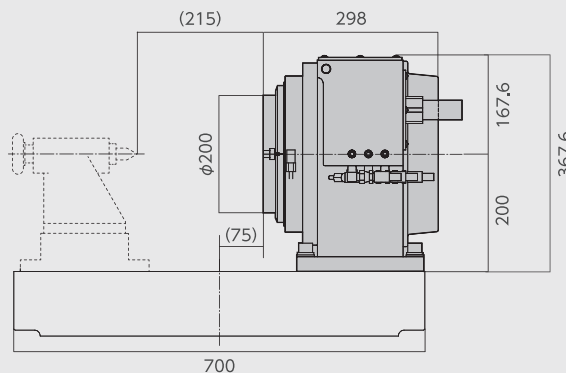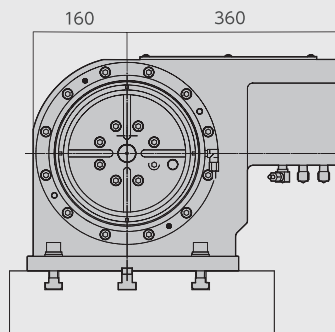
32 tool-ATC (standard)

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

1850

527   2675   865

Thermal distortion
stabilizing system

675

2700

1850   675

2675   865

YMC 650 SPECIFICATIONS

YASDA
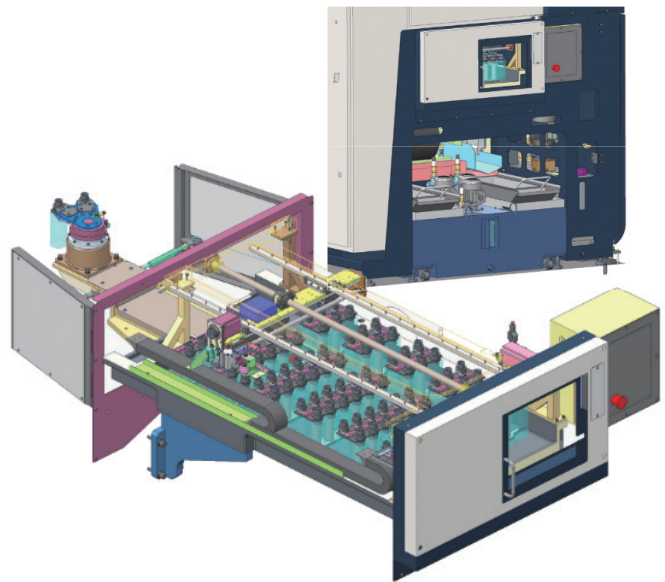
1. Base machine specifications

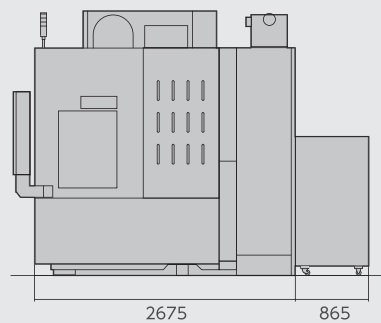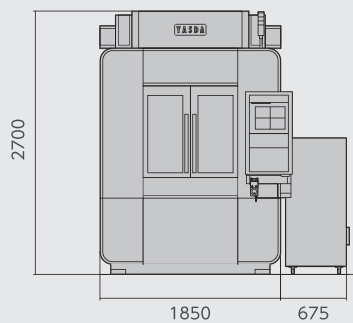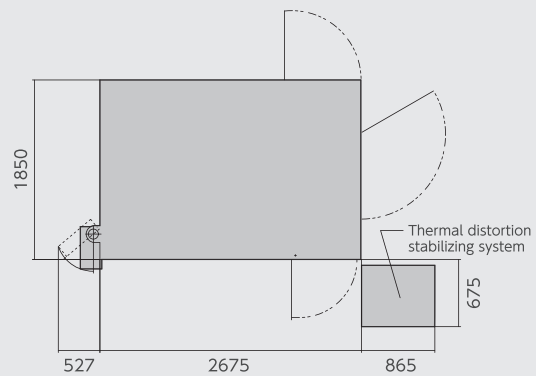|			
1) Travel	X-axis travel		600mm
	Y-axis travel		500mm
	Z-axis travel		280mm
	Table to spindle nose distance		135~415mm
2) Spindle	Spindle speed range		200~40,000min⁻¹

1) Travel — X-axis travel — 600mm
Y-axis travel — 500mm
Z-axis travel — 280mm
Table to spindle nose distance — 135~415mm

2) Spindle — Spindle speed range — $200\sim40{,}000\,\text{min}^{-1}$
Spindle drive motor — 7.5 kW AC (Continuous)
Spindle taper — HSK-E32

3) Table — Table working size — 700mm×550mm
Loading capacity — 200kg
Table surface configuration — 4T-slots, width 18 mm H8, pitch 125 mm

4) Feed rate — Rapid feed rate — 20,000mm/min
Cutting feed rate — Max. 5,000 mm/min
Min. input increment — $0.00001\,\text{mm}(0.01\,\mu m)$

5) ATC — Tool shank type — HSK-E32
Tool storage capacity — 32tools
Maximum tool dia. / length / mass — $\phi50\text{mm}$ /135mm /500g

6) Mass of machine — Approx. 9,000kg

7) Electric power capacity — 30kVA

8) NC unit — FANUC 31i-B5

2. Standard equipment

1) Optical scale feed back X-,Y-,Z-axes $0.000001\text{mm}(0.001\,\mu m)$ command compliant
2) Washing gun — 1 (Operator position), Standard tank capacity: 200 L
3) Splash guard — Manual slide door with celling cover,1 LED light
4) Compensation for spindle thermal displacement — Standard data
5) OpeNe Version 2.0

3. CNC standard options

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

4. Optional equipment

1) Number of additional stored tools — 90tools
2) Signal tower (Multilayer signal lamp) — Red,yellow,green(Flashing)
3) Coolant temperature controller
4) External mist coolant — Manufactured by Bluebe / 2 nozzles
5) Oil skimmer — Oil Pure
6) Coolant unit (AA type) — 2 nozzles
7) Mist collector — Mistresa
8) Tool measurement & Tool breakage detection system — NT-H(by BLUM)
9) Tool measurement & Tool breakage detection system — Dyna Vision Pro(by BIG Daishowa)
10) Tool measurement & Tool breakage detection system — Dyna Line(by BIG Daishowa)
11) Automatic workpiece measuring system — Touch prove OMP400(by Renishaw)
12) High-speed machining function (YASDA HAS-4 system) — Max.12,000mm/min
13) Thermal distortion stabilizing system — With weekly timer
14) Weekly timer
15) Compensation for spindle thermal displacement — 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) 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 pairs
12) Addition of workpiece coordinate pair — 48pairs,300pairs
13) Tool management function
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

YASDA

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