Higher accuracy produces greater profitability

YASDA MICRO CENTER

YMC 430

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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*Export of the products and associated software and related services are subject to prior approval of the Japanese government according to “Foreign Exchange and Foreign Trade Law.”
Excellent high quality surface finish and superior high accuracy machining achieved

The best solution for the next generation of more sophisticated and diversified machining needs

YASDA Micro Center YMC430 is the state-of-the-art high-end machine that answers the demand for ultra-high precision and high quality in the always advancing "high precision micro machining" fields. Al basix (X, Y, Z) controlled high-speed linear motor drives and highly rigid symmetrical frame structure as well as a thermal distortion stabilizing system that achieves consistent high-precision machining in long cycle time operation – Ensuring unsurpassed, extremely high accuracy, the YMC430 provides the best solution that the times demand.

Beautiful high quality surface Always consistent positioning accuracy Submicron accuracy backed by years of accumulated technology
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

Symmetrical H-shaped column
The highly rigid frame structure is representative of the YASDA machining center series. YMC430 adopts an innovative H-shaped column analogous to a double column design.

Symmetrically cylindrical spindle head
The spindle head adopts a cylindrical shape, symmetrical in the longitudinal and horizontal directions. This makes the spindle head less vulnerable to thermal deformation in the X- and Y-axis directions providing a greater degree of mechanical rigidity. Synchronized with the machine temperature, cooling fluid is circulated in the spindle head, allowing stable high-precision machining to be sustained over a longer period of time.

Bed
The sides of the bed are raised allowing for sufficient thickness. The integrated design with the column ensures further rigidity.

“Low Vibration” and “High Accuracy” achieved by the X-Y table

YASDA’s pursuit for “infinitely flat” and “infinitely square” as well as adoption of linear motor drives has led to the development of the high-precision X-Y table

X-Y table
The moving element is mounted at a lower position of the bed center, and the light weight and low center of gravity design minimizes vibration caused by the reaction force during high-speed feeding. These mechanisms also contribute to high precision machining.

Ultra-precision linear guides
Adoption of ultra-precision linear guides significantly minimizes the effects from waging and improves assembly accuracy. Combined adoption of these linear guides and linear motor drives realizes a high level of straightness and smoothness during axis feeding.

High-precision positioning
Two feedback scalars mounted at the same height prevent any influence from temperature differences of the upper and lower level environment to accomplish high configuration accuracy.

Straightness (Measured value)

<table>
<thead>
<tr>
<th>Direction</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td>0.448μm</td>
<td>0.220μm</td>
<td>0.373μm</td>
</tr>
<tr>
<td>Vertical</td>
<td>0.124μm</td>
<td>0.088μm</td>
<td>0.464μm</td>
</tr>
</tbody>
</table>

* Measurement by a 100 mm optical flat
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: 2000 – 40,000 (min⁻¹)
- Spindle output: 750W (continuous)
- Motor type: M5K-E32
- Spindle torque: 180N-m (continuous)

**Spindle power and torque diagram**

- Spindle power
- Spindle torque

Positioning accuracy and circularity (Actual value)

<table>
<thead>
<tr>
<th>Positioning accuracy</th>
<th>Accuracy A</th>
<th>±</th>
<th>±</th>
<th>±</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 230-2 (2014)</td>
<td>0.0006</td>
<td>0.0009</td>
<td>0.0006</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Repeatability A</th>
<th>±</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 230-2 (2014)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

X-axis bidirectional positioning accuracy and repeatability

Motion performance data (X-Y axis)

- Circular: 0.60 μm
- Accuracy: ±0.0005
- Repeatability: ±0.0001

Advanced thermal distortion stabilizing measures cultivated from experience and technology

YMC430’s thermal distortion stabilizing system for sustaining stable high-precision machining

YMC430’s thermal distortion stabilizing system

By circulating temperature-controlled heat exchange liquid through inside of the column and spindle head, the X-Y table, etc., YMC430 regulates thermal distortion of each axis for stable high-precision machining.

In particular, the column, due to the horizontally and vertically symmetrical H-shaped design, controls distortion caused by temperature change.
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 (M3300 to M3304) 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.

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.

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.

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 time and with accuracy enables optimal utilization of equipment and smooth production.
YASDA’s machine option design details

Highly reliable automatic tool changer (ATC) unit
Comfortable operability with excellent usability

Armless automatic tool changer (ATC)

The ATC unit adopts an armless type automatic tool changer that exchanges tools by the tool magazine moving along its stroke. Since a large capacity, compact 90-tool ATC (option) that can contain as many as 90 tools occupies the same installation space as that for a standard ATC unit, it can be installed without expanding machine space.

EZ-Me (Equipped with auto measuring system)

The EZ-Me easily performs work centering with the use of a manual pulse generator (MPG). The measurement accuracy is the same as the one obtained by automatic measurement.

Improvement in maintainability

A tilted side cover to improve cutting chip discharge capacity as well as a standard-equipped washing gun helps maintain a clean work environment. An automatic side lubrication system is also equipped as standard to improve maintainability.

90-tool ATC (Option)

Flat checker / Equipped with tool length/radius compensation and breakage sensor

The flat checker is a system that performs repeated tool length measurement during high-speed spindle rotation, checks that there is no displacement in the Z-axis direction and automatically starts machining.

YASDA’s all-new 80,000min⁻¹ spindle realizes an even higher level of micro and high surface quality machining.

Supreme Rotation Accuracy

The 80,000min⁻¹ spindle adopts an aerostatic bearing with less heat generation and vibration. Compared to a high rotation spindle with ball bearing, the rotation accuracy of the new spindle is increased by 50%. This realizes a higher surface quality.

Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation Speed</td>
<td>1500—35000min⁻¹</td>
</tr>
<tr>
<td>Tool Holder Type</td>
<td>70°-E-25</td>
</tr>
<tr>
<td>Spindle Power</td>
<td>3.8kW</td>
</tr>
<tr>
<td>Spindle Torque</td>
<td>0.35N-m</td>
</tr>
</tbody>
</table>

Reduced Thermal Distortion

Thermal distortion in the X and Y-axis directions caused by heat generation during high-speed rotation is one of the biggest factors in micro machining errors. Compared to existing spindles, the spindle construction that reduces thermal distortion by one-third and proven compensation software provided for this new spindle are adopted. By combining these two features, the new 80,000min⁻¹ spindle realizes stable high accuracy machining.

Special note: Consider the following points when selecting this option.

- We recommend using a single tool holder with high balance that can rotate at high-speed when machining with this spindle.
- This spindle requires high-quality compressed air of the grade 4.3.1 (UL B 339-7/2003/ISO 8573-1:2001)

YASDA’s original runout controlling function

Even a small imbalance of the tool holder may cause vibration of the spindle and lead to amplification of tool runout during high speed rotation. This amplified tool runout may degrade surface quality. YASDA has created a new function for the tool length and radius measurement device “Dyna-Line” that reduces tool runout by arranging the phase of the holder in order to automatically minimize the imbalance caused by the spindle and holder. By minimizing the tool runout with this runout controlling function, YASDA’s new spindle realizes high surface quality and longer tool life. (Patent pending)
Mounted tilting rotary table supports 5-axis machining

YASDA’s tilting rotary table realizes highly accurate 5-axis machining.

**RT 10**

The high-precision, micro machining center YMC-430 is equipped with a DD (Direct Drive) motor-driven, high-precision tilting rotary table. This combination enables multi-face indexing/machining as well as simultaneous 5-axis machining which requires high traceability, without re-chucking. Adoption of a DD motor to a tilted axis and a rotary axis has also realized backlash-free, high-speed, high-precision positioning.

![Helical gears of DIN grade 4 achieved.](image)

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

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.95 sec</td>
<td>0.95 sec</td>
<td>1.19 sec</td>
<td></td>
</tr>
</tbody>
</table>

**Circularity of tilted cone shape machining**

- Circularity: 1.24 μm

**I-CAL rotation center calibration function (Equipped with RT10 and auto measuring system)**

With the use of the “YASDA auto measuring system,” the I-CAL rotation center calibration function calculates the table rotation center coordinates, feeds the coordinates back to the NC, and promotes further high-precision 5-axis machining.

**Various chucking systems**

- System 3R Haas chuck
- EROWA TS-10D chuck

**C-axis bidirectional positioning and repeatability**

- Positioning accuracy: 0.005 mm
- Repeatability: 0.002 mm

**Machining sample**

- Lens barrel STAVAX (52HRC)
- Punch HAP (60HRC)
- Pull-top (punch die) CEMENTED CARBIDE (65HRA)