



Linear Motor Drive, Ultra High-Speed Milling Center



Linear Motor Drive
Ultra High-Speed
Milling Center

UH430L
UH650L

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UH430L UH650L



The UH series is a compilation of Sodick's cutting machines that have come about 30 years. With our know-how of high-speed milling processing accumulated so far, and by constructing a processing support system useful in actual practice and using an updated external design, we will achieve performance that leads the industry.

PHILOSOPHY OF SODICK

2011

Linear Motor Drive
Ultra High-Speed Machining Center
TT1-400A



2007

Linear Motor Drive
High-Speed Milling Center
HS Series



2005

Linear Motor Drive
Nano Machining Center
AZ150



1999

Linear Motor Drive
Machining Center
MC180L



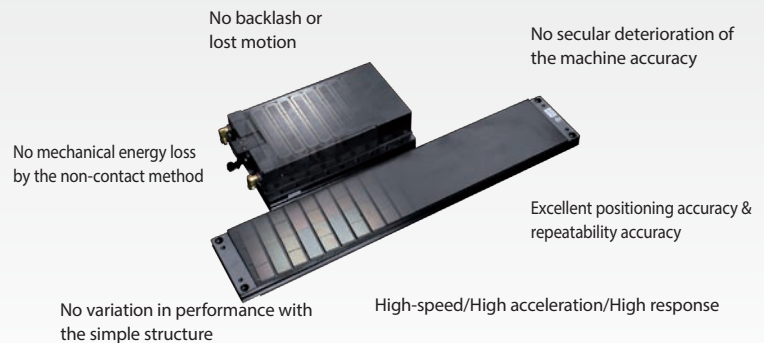
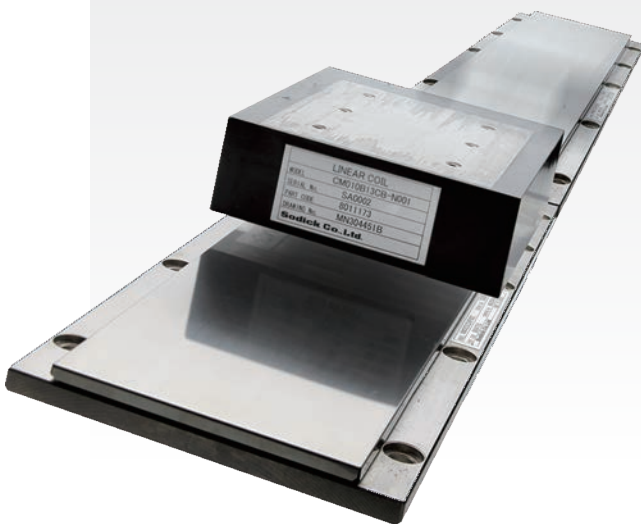
Superiority of Linear Technology

The simple configuration of the magnet plate and the coil unit maintains high repeatability accuracy with no backlash and without friction due to contact.

Since there is no secular change, stable positioning accuracy of the machining axes can be maintained over a long period.

Even during high-speed feeding between minute distances, this machine demonstrates the best drive performance for high-speed milling machining without positioning deviation or speed errors.

Since a unique cooling method to directly cool the coil unit by a temperature controlled coolant has been adopted, the generated heat is removed efficiently which minimizes thermal displacement.



Sodick's Linear Technology

Leads the world with reliable experience and knowhow

In 1998, Sodick released the world's first linear motor drive die-sinker EDM, and has accumulated our experience, knowhow and reliability over 20 years with total shipments of 50,000 machines. We will continue to improve the linear technology into the future, based on the theme of "how to operate a machine more smoothly at high-speeds in the micrometer and nanometer range."

1997

Machining Center
MC Series



1986

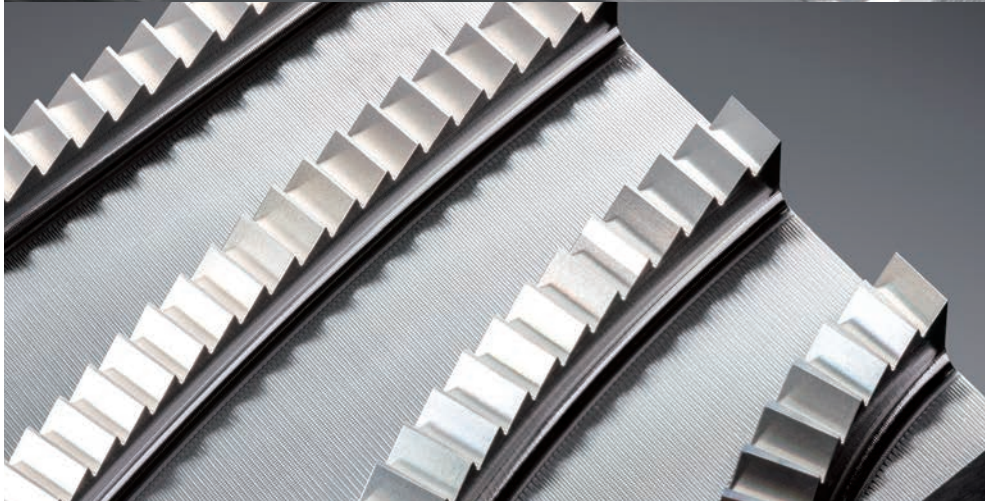
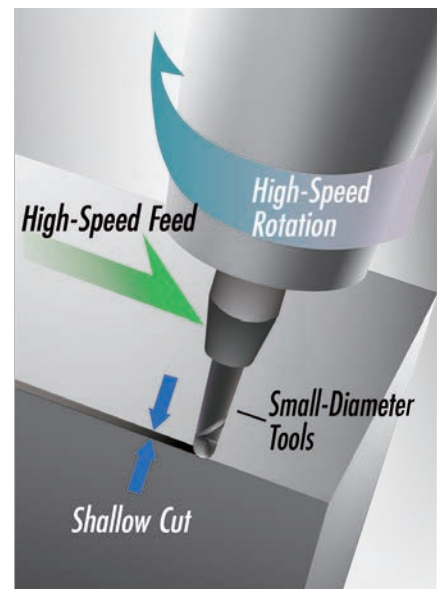
NC Electrode
Milling Machine
APM Series



The cutting machine of Sodick was started with the in-house development of an electrode milling machine in 1986, because we truly wanted to manufacture high precision electrodes with a uniform surface finish without burrs. After we developed the world's first linear motor drive wire-cut EDM through several model changes, we developed the linear motor drive machining center "MC180L" in 1999. In 2007, we developed the industry's first linear motor drive "HS Series" which specialized in high-speed milling machining, aiming for a machining center that realized high accuracy and surface quality at high-speeds that had never been accomplished before.

HIGH-SPEED MILLING

High-speed milling machining is a highly efficient milling process in which a small diameter tool is mounted on a highly rigid main spindle that rotates at high speed, minimizing the dynamic and static deflection accuracy and vibration, and is able to cut shallow amounts at high feed rates. Unlike conventional machining which dynamically cuts deep cutting amounts relying on power, the cutting depth is shallow, so the cutting resistance becomes small and the amount of heat generated between the tool and the workpiece is suppressed. Therefore, deformation of the workpiece, heat affected layers of the machined surfaces, deflection and wear of the tool are reduced, and it is effective in improving the machining accuracy and tool life. In order to improve the machining efficiency under conditions with shallow cutting amounts, it is necessary to have a highly rigid machine and an advanced control unit which consists of axis characteristics that enable high accuracy operation at high-speeds, in addition to high-speed rotation and a highly rigid main spindle.

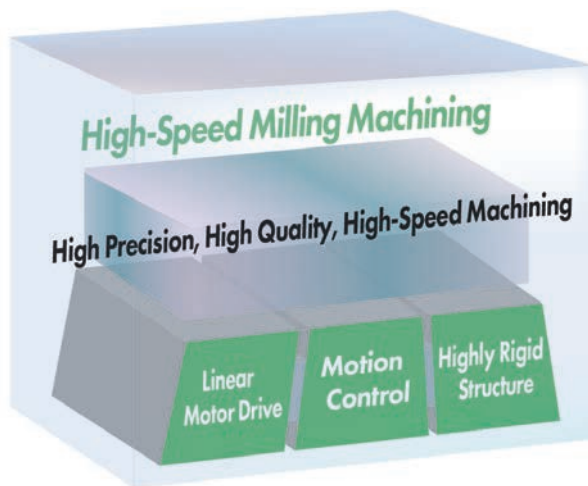


The advantage of high-speed milling machining is the high quality machining of complicated minute and small shapes. The machining process is often used in the machining of mold parts for forming components such as small optical components that require high precision and high-quality surface conditions and for which applying polish machining is difficult, or for narrow-pitch and low-profile multi-core connectors and the like to be installed in compact portable communication equipment typified by smart phones.



Mirror surface machining of a 100 mm diameter parabolic curved surface. Accurate high-precision curvature processing with 3-axis linear and motion control.

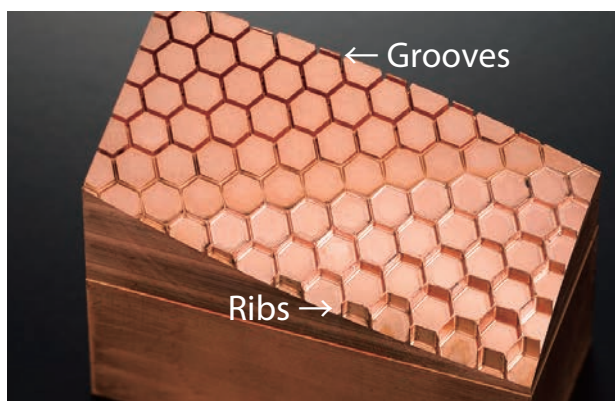
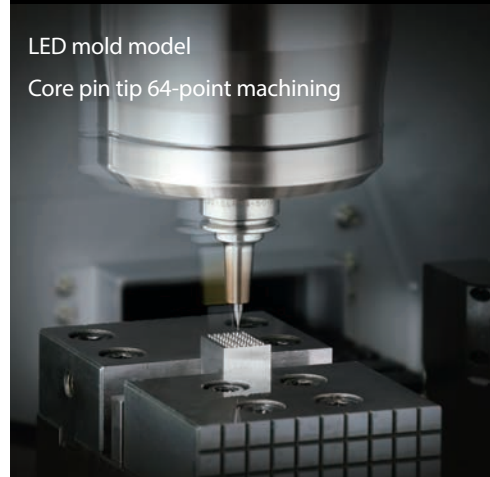
For precise fine shapes, the machining path involves a sudden reversal movement between minute distances, high-precision position control is required while operating at high speed, and high acceleration and high response that can reach a predetermined machining speed instantaneously are required. What makes this possible is linear motor drive and motion control that governs its behavior. In order to realize a stable and excellent machining performance in three-dimensionally designed shapes, the establishment of a comprehensively balanced optimum and perfect synchronous control is required for all machining axes, and also requires a highly rigid machine structure that suppresses vibration.



LED mold core pin tip



LED mold model
Core pin tip 64-point machining



Honeycomb Shaped Ribs & Grooves, Three-dimensional Electrode

Machining Material: Cu

Machining Time: 2 Hrs. 27 Min.

Machining Conditions: Main Spindle Rotation Speed 20,000 to 35,000min⁻¹
Feed Rate 300 to 4,500mm/min

Tools Used: Ball end mill R1.5

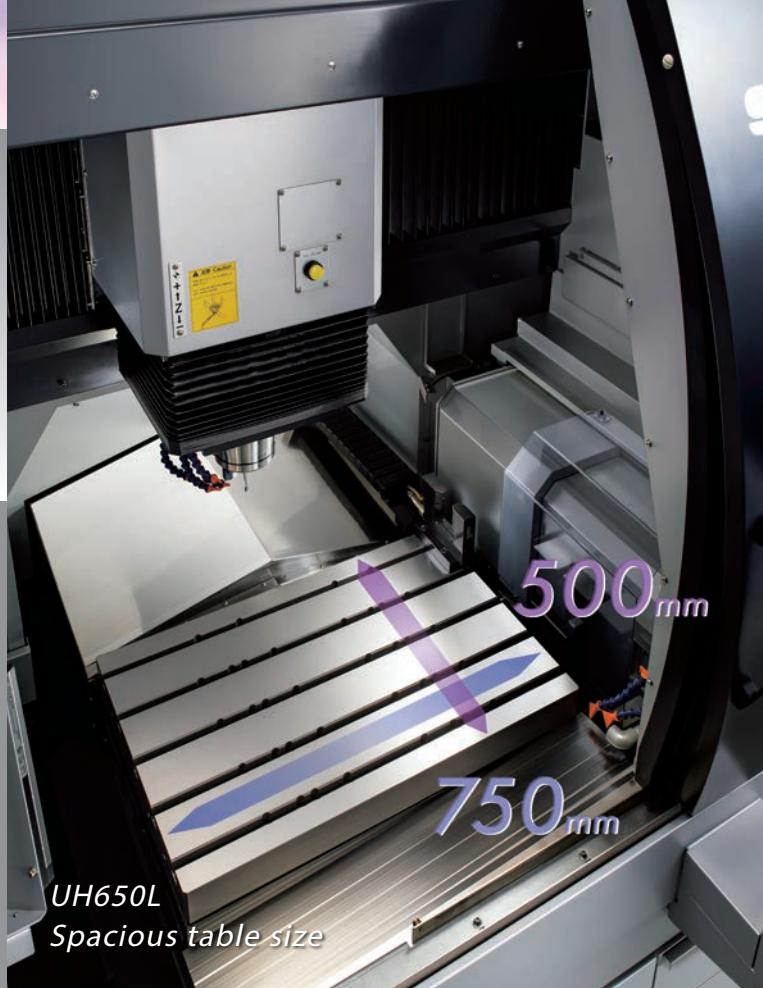
Ball end mill R0.5×3.0

Ball end mill R0.3×2.5 (ribs)

Ball end mill R0.2×2.5 (grooves)

Characteristics: Ribs = Width 0.1mm, Maximum height 2.5mm

Grooves = Width 0.4mm, Maximum depth 2.5mm



UH650L
Spacious table size

Highly Rigid Machine Structure

Machine structures having excellent attenuation characteristics, high rigidity and low center of gravity

A rigid and stable casting structure is employed so that a very high level of power and accuracy can be optimally applied to the workpiece.

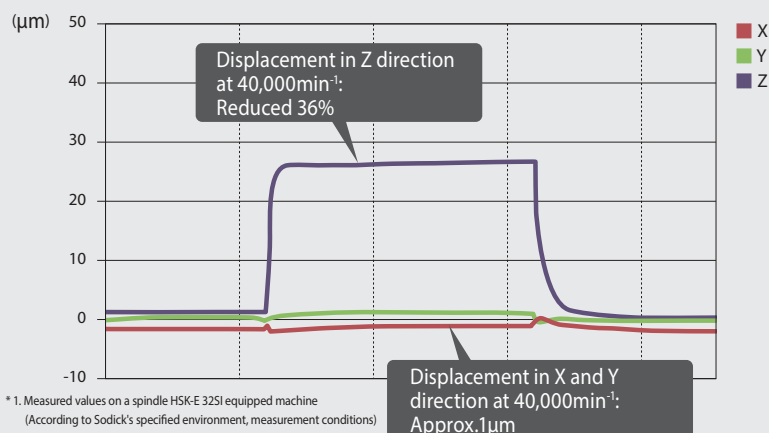
- Intuitive operating environment to improve workability
- Bilaterally symmetrical gantry structure that suppresses thermal displacement of machine posture
- "Main shaft thermal displacement correction function" for shortening warm-up operation time (Special accessory)

SUPERIORITY

Unique cooling system that suppress heat generation

Suppresses heat generation of the linear motor with a proprietary method of directly cooling the coil unit. Thermal displacement is drastically reduced due to the synergistic effect with Sodick's own spindle of which the internal structure and cooling circuit is thoroughly verified.

Thermal displacement
36% reduction*¹



Realizes high accuracy and high speed machining without vibration at 2 to 3 times that of normal acceleration

In the case of a head weight reduction by CFRP adoption, even with a setting of maximum acceleration that is much higher than usual, a uniform high quality surface with no waviness and shortened machining time can be obtained.

Maximum acceleration
0.2G

Performance evaluation of adopted CFRP weight saving head

Conventional

CFRP Head



Workpiece Material	Aluminum
Workpiece Material	50×50×50mm
Machining Process	Rough → Semi-finish → Finish
Tool	Ball end mill R2
Rotation Speed	25,000min ⁻¹
Feed Rate	5,000mm/min

Evaluation of accuracy of upper surface quality and circumference of a 5 mm diameter cylinder

Conventional

CFRP Head

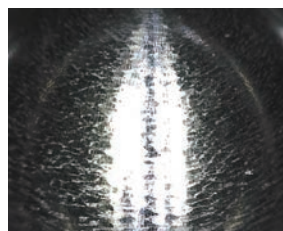
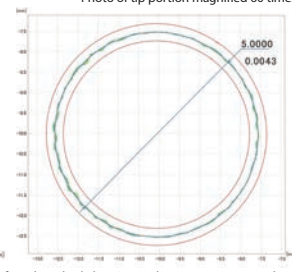
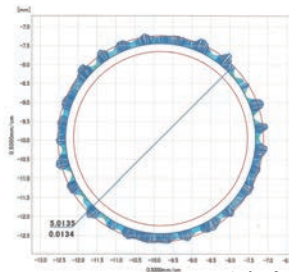
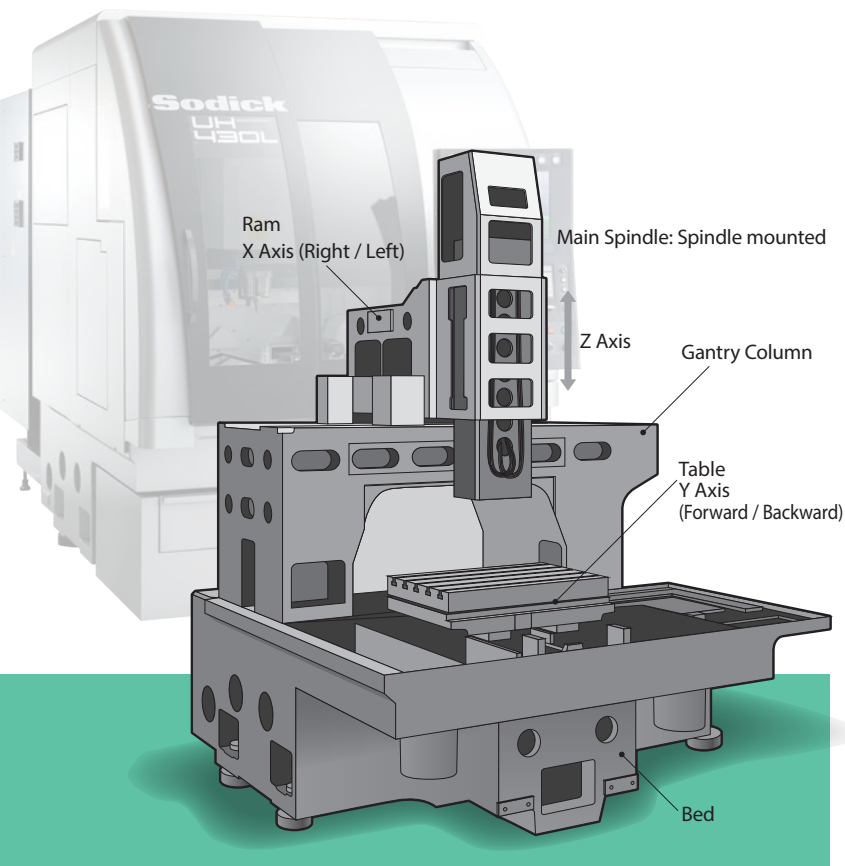


Photo of tip portion magnified 60 times



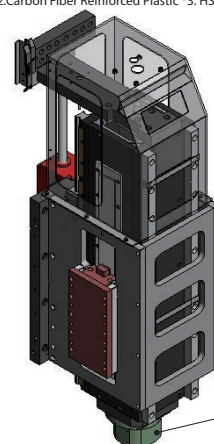
Surface finish of machined side by 3D coordinate measuring machine



All Linear perfect balance is achieved with a weight reduction head^{*3} that employs CFRP^{*2}.

Changing the material of the main parts from conventional casting to CFRP greatly reduced the weight of the Z Axis, and also reduced the operating weight of the X Axis which supports the Z Axis. The reduced load on the X Axis realized a favorable balance with the Y Axis, and improved the comprehensive dynamic and static characteristics of all three axes of the linear motor drive.

^{*2}Carbon Fiber Reinforced Plastic ^{*3} HSK-E25G, HSK-E25IK/UH430L only



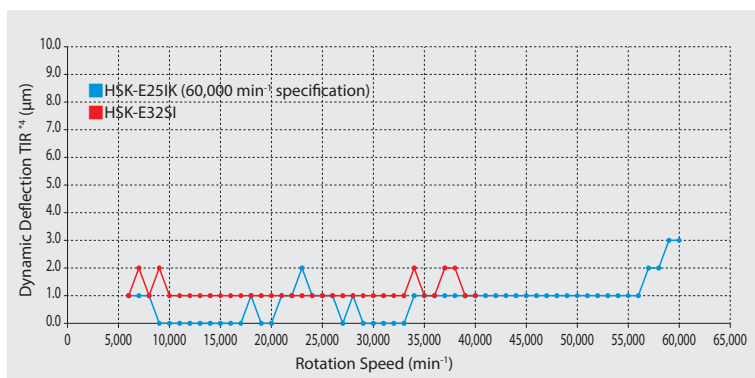
Weight Saving Head That Employs CFRP

(HSK-E25G, HSK-E25IK/UH430L only)

Spindle Lineup of 4 types

Z Axis Head

41% weight reduction



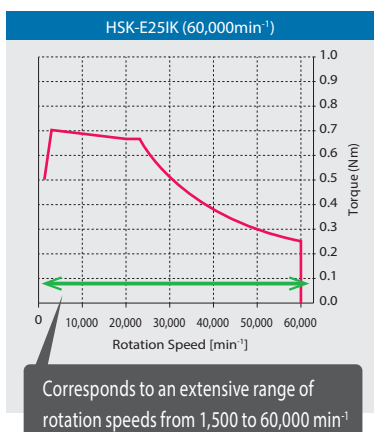
^{*4} TIR: Total Indicator Reading: The measurement portion is rotated once centered on a reference axis

Maintains stable processing with a highly rigid spindle.

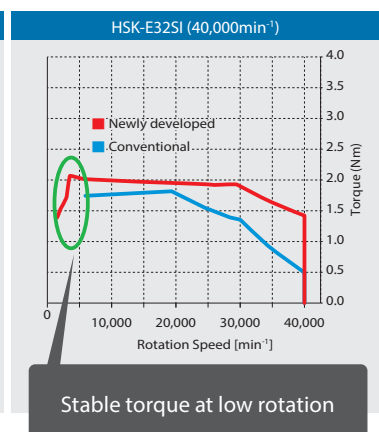
Equipped with a high-speed rotation and highly rigid spindle which adopted a shrink fit type dual face contact HSK type holder. Sodick offers a lineup of five types spindles, including three types for the HSK-E25 type and two types for the HSK-E32 type to respond extensive machining needs.

Dynamic deflection accuracy

Improved 50%



Corresponds to an extensive range of rotation speeds from 1,500 to 60,000 min⁻¹



Stable torque at low rotation

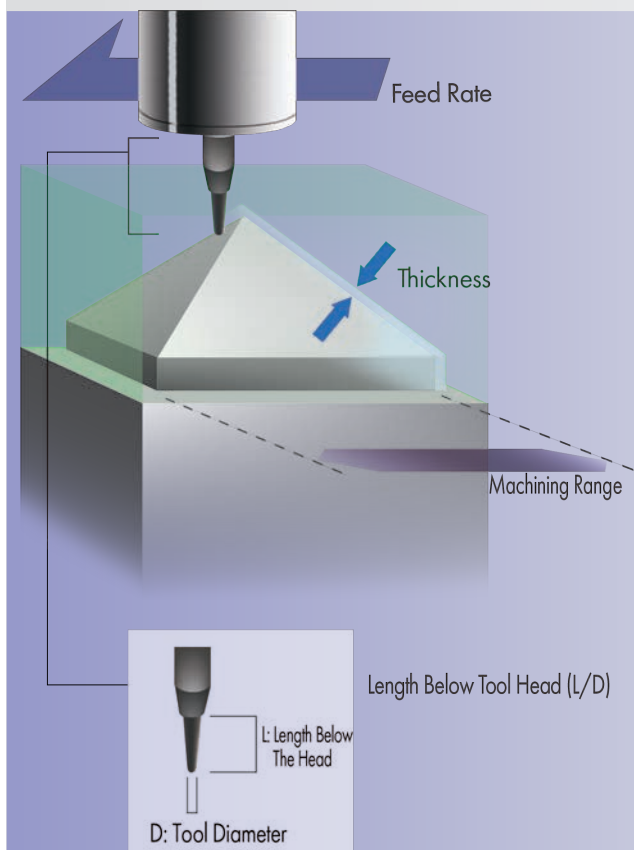
Stable torque output in low rotation range

Outputs stable rotation torque from low to high rotation.

The torque was increased 17% compared to conventional in the low rotation range of the HSK-E32SI, and generates a torque three times that compare to conventional at 40,000 min⁻¹, so that direct milling can be applied to very hard materials.

Spindle

Torque increased 17%



► *Select Four Steps*

- STEP1 Residual Margin
- STEP2 Length Below Tool Head (L/D)
- STEP3 Machining Range
- STEP4 Cutting Feed Rate

Q Number (Machining parameter number suitable for a machining process)

► *Fine adjustment of machining parameters*

For the Q number,
it is possible to finely adjust items to be emphasizes from
the items of Velocity, Surface, Shape.

Q number reflected in the NC code *Machining is started*

Developed and
manufactured by Sodick
NC Unit

LN4X

- Improved machining quality by speeding up drive system servo response
- New interface with usability increased
- Processing support system "SEPTune"



"New screen design" Clear visibility and direct operation

"LN4X" equipped with a high-speed CPU and optimized multi-core resources. The speed of analysis and execution of the NC program has been improved. In addition, renewing the operation screen, clear visibility and intuitive direct operation are possible. Equipped with many new functions such as being able to display the processing progress in real time with a 3-dimensional model.

OPERABILITY



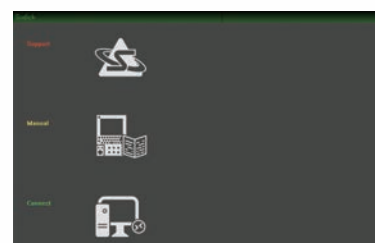
Machining support system of NC Unit LN4X **SEPTune**

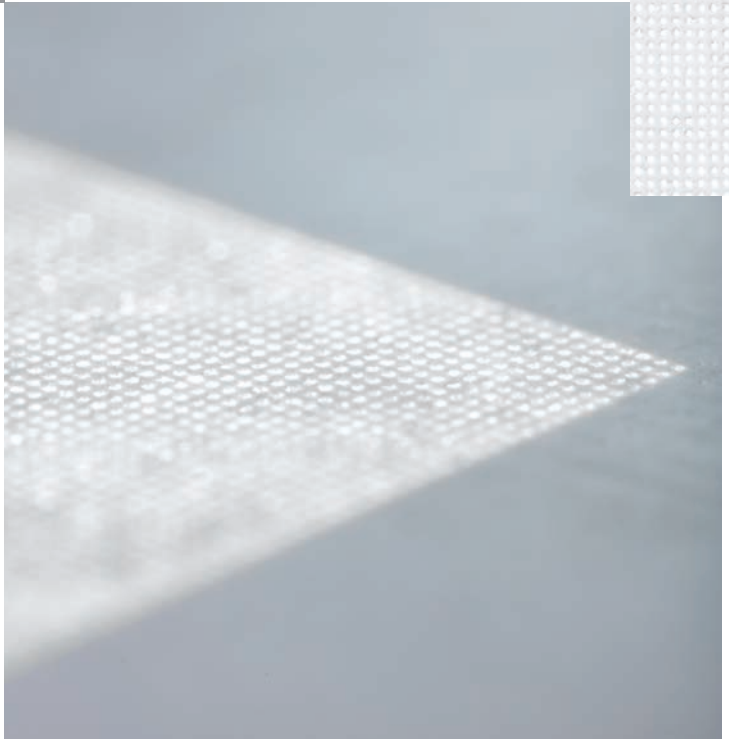
Supports easy selection of the optimum cutting operation conditions,
and parameter setting.

Processing support system SEPTune pursues ease of use by adopting graphical design. Optimum processing parameters are provided for a machining process with a simple operation that requires only 4 steps of machining information.



"UTILITY" stores the operation manual (electronic data) in addition to providing processing support, making it possible to check the operation manual, code manual, and message guide.





Reflector

Machining Material: STAVAX (52HRC)

Machining Time: 3 Hrs. 12 Min. (Finishing)

Machining Conditions: Main Spindle Rotation Speed 25,000 to 40,000min⁻¹

Feed Rate 300 to 2,500mm/min

Tools Used: Ball end mill R1 Finishing CBN

Features: Polish-less processing due to a high-quality surface

No corner edge sag with a high-acceleration finish

It is possible to accurately finish shapes that are difficult to be manually polished and that are defined by an optical formula.



Perforation of Machinable Ceramics

Machining Material: 20×20×5mm

Machining Time: (Center Drill) 1.43 sec./hole (Drill) 1.93 sec./hole

Machining Conditions: Main Spindle Rotation Speed 14,000min⁻¹

Feed Rate 40mm/min

Tools Used: Center drill Φ0.08 mm (for positioning/drilling)

Features: Many holes can be machined with high accuracy and precise pitch in highly hard workpieces such as ceramics and super engineering plastics.

Stepped Optical Shape

Machining Material: STAVAX (52HRC)

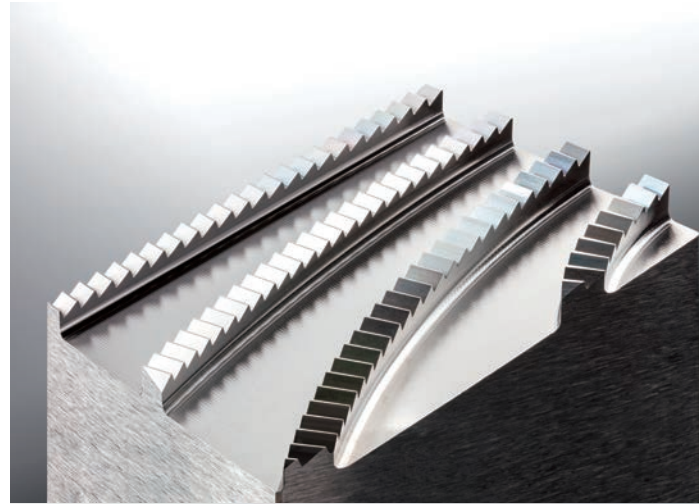
Machining Time: 5 Hrs. 29 Min. (Finishing)

Machining Conditions: Main Spindle Rotation Speed 22,000 to 40,000min⁻¹
Feed Rate 350 to 3,000mm/min

Tools Used: Ball end mill R1.5 to R0.05

Finishing CBN ball end mill R0.05

Features: High-precision and high-quality finish (Ra 0.1 μm or less)
Small diameter tool (R 0.05)
Mold shapes used for designing automobile headlight trimming have been created.



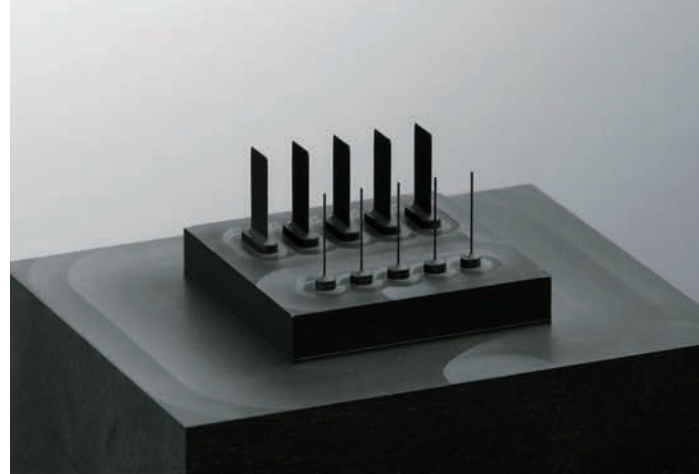
Graphite Thin Ribs and Pin Shape

Machining Material: Graphite TTK8

Machining Conditions: Main Spindle Rotation Speed 8,000min⁻¹
Feed Rate 500mm/min

Tools Used: Long neck flat diamond coat

Features: Rib = Plate thickness 0.05 × Height 2.5 mm
Pin = Diameter 0.1 × Height 2.5 mm



The advantage of high-speed milling machining is the high quality machining of complicated minute and small shapes. Widely used for machining mold parts for forming multi-core connectors having a narrow pitch and low profile, and small optical parts that are difficult to polish and require high precision and high quality surface.

UH SERIES HIGH-SPEED MILLING MACHINING PERFORMANCE



Cutter Shape

Machining Material: STAVAX (52HRC)

Machining Time: 2 Hrs. 14 Min.

Machining Conditions: Main Spindle Rotation Speed 40,000min⁻¹
Feed Rate 180 to 2,500mm/min

Tools Used: Ball end mill R0.5×2.5

Ball end mill R0.3×1.5

Finishing CBN ball end mill R0.3×1.5

Features: High-precision, fine processing
(Cutter edge flat end portion: 20 μm)

Machining simulation software for supporting
high-speed and high-precision machining

MotionExpert®-AI※5



Accurate estimation of machining time

Because the NC device is developed and manufactured by Sodick, accurate estimation of processing time is possible.*6

- Able to accurately estimate total length of edges /machining time considering acceleration/deceleration from the NC program.
- Able to graphically display and confirm the estimation of machining quality from a speed distribution display.
- Able to confirm machining simulation by a graphic display.
- Equipped with a SEPT assist function, making it possible to search parameters of the machining support system SEPTune.



CAD/CAM Room

*Before
machining*

*Accurate machining time is
clearly indicated.*

Peace of mind because accurate simulation is performed.
Smooth operation to the next process without missing the
timing of the end of machining.

Machining

Peace of mind due to simulation

*Smart schedule management
for the next process*



Reduction of lost time through
optimization of the setup timing

*End of
machining*

Accurate estimate · Delivery time ►► Improved reliability

Compatible Models*7 UH430L / UH650L (LN4X)

Operating Environment

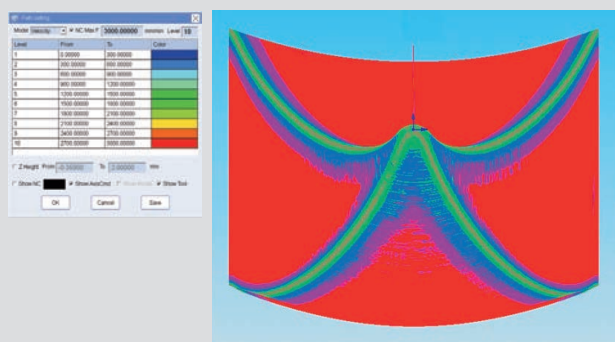
To install MotionExpert®-AI, the following environment is required.

OS Windows 10 *8 (64 bit, Japanese/English/Chinese)
CPU Intel Core i5 *9 or later
Memory 4 GB or more is recommended.
Display Resolution 1280 × 1024, 1366 × 768 or more

HDD 100MB or more free space (required for installation)
Optical Drive DVD drive (required for installation)
USB For MotionExpert®-AI dongle 1 port
Input Device Keyboard, Mouse

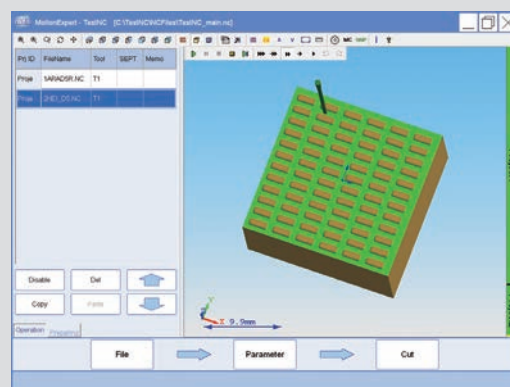
Machined Surface Quality Estimation

Machining quality by speed change can be checked from a graphic display of the velocity distribution.



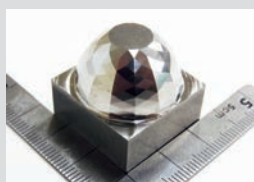
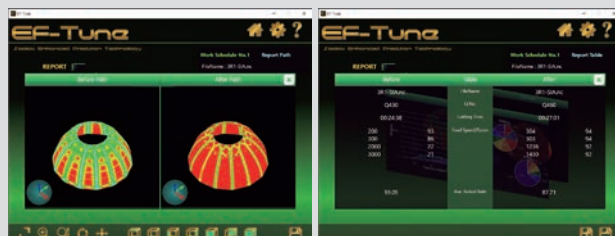
Machining Simulation

Simulation of the machining process with a 3D graphic display. Before actual machining, the same operation as the machine can be confirmed.



EF-Tune

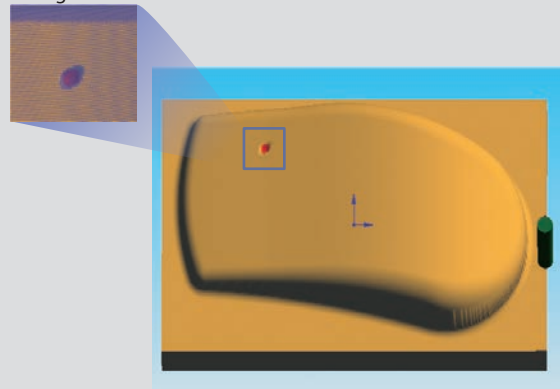
By adopting AI for the analysis unit, it can automatically calculate the ideal cutting feed rate and contour control parameters from simply inputting NC program, leftovers, tool neck length, and cutting range information.



Gouge (Interference) Check (Option)

Before machining with the actual machine, problems between the machining model and the axis command trajectory and gauging (interference) can be detected.

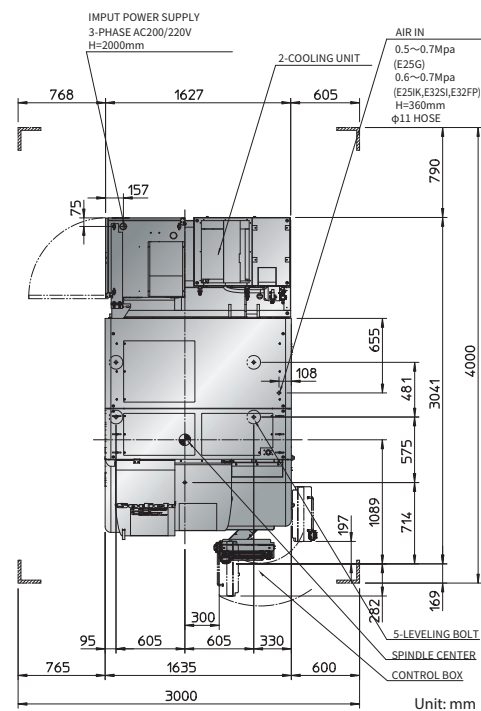
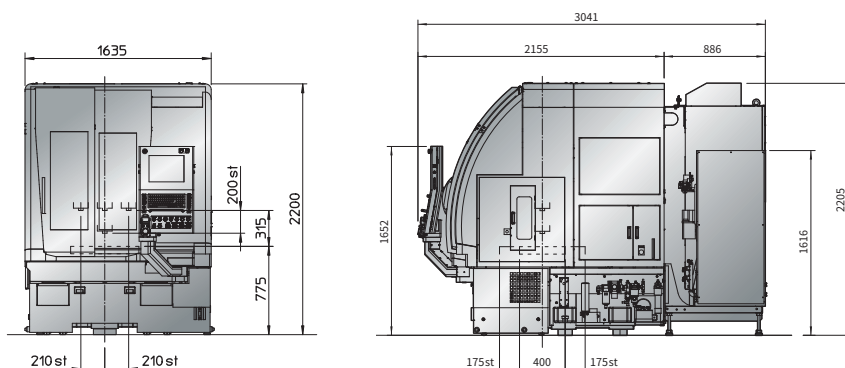
Enlarged View



The gouge portion can be displayed in red so as to be obvious.

*7. Please contact Sodick for details. *8. Windows is a trademark of Microsoft Corporation, USA. *9. Intel and Intel Core are trademarks of Intel Corporation.

UH430L



Machine Tool

Drive Method (X, Y, Z)	Linear Motor Drive Method
Each Axis Movement Amount (X, Y, Z)	420×350×200 mm
Main Spindle Speed	6,000 to 40,000 min ⁻¹ HSK-E25G (Grease Lubrication)
	1,500 to 50,000 min ⁻¹ HSK-E25IK (Oil Air Lubrication)
	1,500 to 60,000 min ⁻¹ HSK-E25IK (Oil Air Lubrication)
	1,500 to 40,000 min ⁻¹ HSK-E32SI (Oil Air Lubrication)
	6,000 to 40,000 min ⁻¹ HSK-E32FP (Oil Air Lubrication)
Tool Holder Type	Dual Face Contact Holder HSK
Distance from Table Surface to Spindle End	115 to 315 mm
Table Size	600×400 mm
Max. Loadable Mass	100 kg
Distance from Floor to Table Work Surface	775 mm
Machine Tool Dimensions (Including Power Supply Unit)	1635×3041×2205 mm
Machine Installation Dimensions	3000×4000 mm
Total Machine Weight	6000 kg

Power Requirements

Total Power Input	25 kVA
Input Power Supply	AC200V/220V±5% 50/60Hz±2%
Air Pressure	0.5 to 0.7 MPa (E25G)
	0.6 to 0.7 MPa (E25IK, E32SI, E32FP)
Air Consumption	400 NL/min (E25G)
	700 NL/min (E25IK, E32SI, E32FP)

Automatic Tool Changer (ATC)

Tool Selection Method	Turntable Fixed Address Method
Tool Storage Capacity	20 tools (E25), 16 tools (E32)
Max. Tool Length	100 mm (E25)/110 mm (E32)

Chip Tank

Tank Capacity	130 Liters
Cleaning Fluid	Water-soluble Coolant

Semi-dry Machining System

Cutting Fluid	Vegetable Oil
Cutting Fluid Consumption	0 - 50 mL/h (Semi-fixed Adjustable Type by Throttle Valve)
Mist Particle Size	About 3 μm
No. of Jet Nozzles	2 nozzles
Cutting Fluid Storage Capacity	1.2 Liters
Operating Pressure Range	0.2 - 0.7 MPa

NC Unit (LN4X)

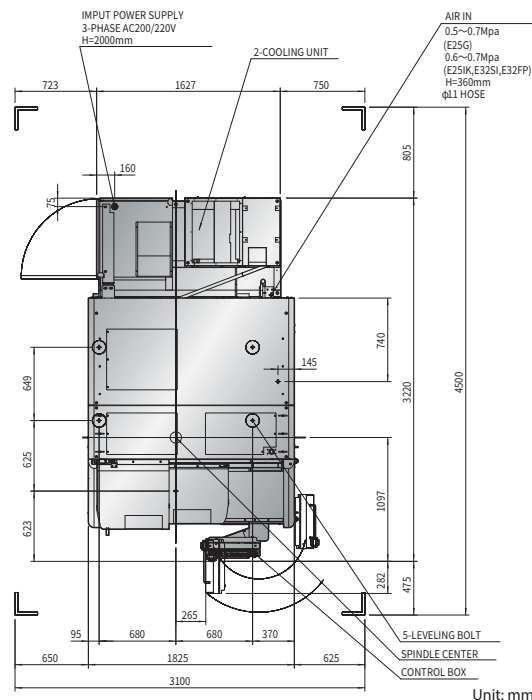
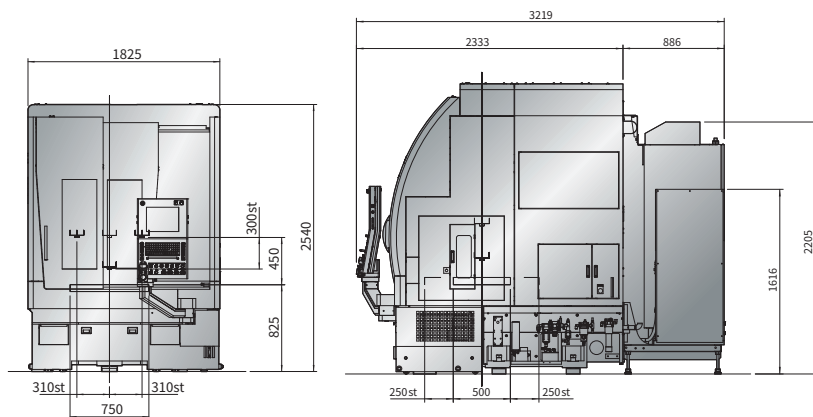
Control Axes	4 Axes X, Y, Z, Main Axis
Simultaneous Control Axes	Max. 4 Axes
Min. Setting Unit	0.00001 mm/0.000001 inch
Min. Travel Unit	0.00001 mm/0.000001 inch
Max. Command Value	±99999.99999 mm/±9999.99999 inch
Display	15" LCD Color Display (TFT)

Standard Accessories

Special Compatible Part

SPECIFICATION

UH650L



Unit: mm

Machine Tool

Drive Method (X, Y, Z)	Linear Motor Drive Method
Each Axis Movement Amount (X, Y, Z)	620×500×300 mm
Main Spindle Speed	6,000 to 40,000 min ⁻¹ HSK-E25G (Grease Lubrication) 1,500 to 50,000 min ⁻¹ HSK-E25IK (Oil Air Lubrication) 1,500 to 60,000 min ⁻¹ HSK-E25IK (Oil Air Lubrication) 1,500 to 40,000 min ⁻¹ HSK-E32SI (Oil Air Lubrication) 6,000 to 40,000 min ⁻¹ HSK-E32FP (Oil Air Lubrication)
Tool Holder Type	Dual Face Contact Holder HSK
Distance from Table Surface to Spindle End	150 to 450 mm
Table Size	750×500 mm
Max. Loadable Mass	150 kg
Distance from Floor to Table Work Surface	825 mm
Machine Tool Dimensions (Including Power Supply Unit)	1825×3220×2540 mm
Machine Installation Dimensions	3100×4500 mm
Total Machine Weight	8000 kg

Power Requirements

Total Power Input	30 kVA
Input Power Supply	AC200V/220V±5% 50/60Hz±2%
Air Pressure	0.5 to 0.7 MPa (E25G) 0.6 to 0.7 MPa (E25IK, E32SI, E32FP)
Air Consumption	400 NL/min (E25G) 700 NL/min (E25IK, E32SI, E32FP)

Automatic Tool Changer (ATC)

Tool Selection Method	Turntable Fixed Address Method
Tool Storage Capacity	20 tools (E25), 16 tools (E32)
Max. Tool Length	100 mm (E25)/110 mm (E32)

Chip Tank

Tank Capacity	165 Liters
Cleaning Fluid	Water-soluble Coolant

Semi-dry Machining System

Cutting Fluid	Vegetable Oil
Cutting Fluid Consumption	0 - 50 mL/h (Semi-fixed Adjustable Type by Throttle Valve)
Mist Particle Size	About 3 µm
No. of Jet Nozzles	2 nozzles
Cutting Fluid Storage Capacity	1.2 Liters
Operating Pressure Range	0.2 - 0.7 MPa

NC Unit (LN4X)

Control Axes	4 Axes X, Y, Z, Main Axis
Simultaneous Control Axes	Max. 4 Axes
Min. Setting Unit	0.00001 mm/0.000001 inch
Min. Travel Unit	0.00001 mm/0.000001 inch
Max. Command Value	±99999.99999 mm/±9999.99999 inch
Display	15" LCD Color Display (TFT)

Overall Splash Guard	Leveling Bolts, Leveling Pads
Atc Magazine Guard	Ethernet Communication (10BASE-T/100BASE-TX)
Atc Auto Door	Automatic Lubrication
Cooling System for Each Axis	Manual Pulse Generator
Scale Feedback (X/Y/Z)	Chip Bucket
Semi-dry Machining System	Simulation Function "MotionExpert®-AI"
Work Lighting System	Operation Status Collection Utility "S-Viewer"

Dyna Line (BIG DAISHOWA CO., LTD)
Dyna Vision (BIG DAISHOWA CO., LTD)

Optical measurement of tool diameter, tool length, runout at high speed and high precision.
Measure tool length and tool diameter (deflection) during high-speed rotation. (Equipped with CCD camera)

UH430L UH650L

Mist Collector	An apparatus that collects mist supplied to the machining unit, filters only oil, then discharges air through the filter.
After Filter	By being installed as a set in the mist collector, collects even finer mist.
Automatic Tool Length Measuring Device	Non-contact laser type Minimum tool diameter 0.05 mm Non-contact measurement of the length and diameter of the tool with laser light. Sold as a set with a macro function.
Automatic Tool Length Measuring Device	Non-contact laser type Minimum tool diameter 0.03 mm Non-contact measurement of the length and diameter of the tool with laser light. Sold as a set with a macro function.
Automatic Tool Length Measuring Device	Contact touch type (HSK-E25) Maximum tool diameter 6 mm Measures the tool length by touching the tip of the tool to the top surface of the measuring device. Sold as a set with a macro function.
Automatic Tool Length Measuring Device	Contact touch type (HSK-E32) Maximum tool diameter 6 mm Measures the tool length by touching the tip of the tool to the top surface of the measuring device. Sold as a set with a macro function.
45ATC-Z HSK-E25	Up to 45 tools can be stored and exchanged. One touch sensor can be mounted.
45ATC-Z HSK-E32	Up to 45 tools can be stored and exchanged. One touch sensor can be mounted.
Coolant Water Specification	Water soluble cutting fluid is sprayed on the machining area.
Coolant Oil Specification	Oil cutting fluid is sprayed on the machining area.
Touch Sensor (BIG/RENISHAW)	Centering of workpieces is possible with a contact type probe. Sold as a set with a macro function.
Signal Tower Light	The state is expressed with signals of three colors.
External Transformer	Step-down transformer for installation in areas having different voltages.
External Transformer (CE Specifications)	CE specification step-down transformer.
Washing Gun	For washing work and tools.
Tool Washing Unit	Improves reliability of measurement data from a non-contact type laser automatic tool length measuring device.
Oil Skimmer	Equipment for separating and discharging oil when using water-soluble cutting fluid in coolant water specification or standard tank.
Jet Anchor	A jet anchor for preventing machine movement due to high acceleration operation, etc.
CE mark Specification	Machine specification corresponding to CE mark.
KCs mark Specification	Machine specification corresponding to KCs mark.
Air Dryer (100 V/200 V)	Device for adjusting the air environment.
Air Tank	This air tank is necessary when the mounting compressor is a reciprocating type.
Three-phase Input Line	The cable length is approximately 5.5 m
Macro Functions	Program support functions.
M code Reserve	In addition to the standard 8 codes, 8 more codes can be added.
Program Extension Function (70 MB)	In addition to the standard 30MB, it further extends 70MB to a total capacity of 100MB.
Coordinate System Addition (47 coordinates)	In addition to the standard 12 coordinates, 47 additional coordinates are added, totaling 59 coordinates.
Fixed Cycle Macro	Soft dedicated to micro drilling.
Tool Offset Memory	Corresponds to tool offset memory for a total of 999 combinations, and is useful for tool management.
Chopping Function	Additional function for chopping.
Dedicated USB Memory	Adds 4GB of dedicated USB memory.

X・Y Axis Air Purge		Magic Center	
X Axis Air Purge		30/60AWC	Automatic work exchange device.
Y Axis Air Purge		30AWC (W150)	Automatic work exchange device.
Head Air Blow		Main Shaft Thermal Displacement Correction Function	The applicable spindle keeps the position of the tip of the E32SI main shaft (tool tip) constant in the entire range of rotational speeds.
Shrink Fit Equipment	Accessories for Japan/overseas	(High Speed Displacement Correction Specification)	
Relocation Detection Device	Necessary device for installation outside of Japan.	Main Shaft Thermal Displacement Correction Function	The applicable spindle keeps the position of the tip of the E251K/E32SI main shaft (tool tip) constant in the entire range of rotational speeds.
Variuos Cutting Oils		(General Purpose Displacement Correction Specification)	
Variuos Precision Vices	For Work Installation	Separate Filtering Device	Cuspon filter/rich filter (select between 50 Hz or 60 Hz)
Base Master		Air Booster	Increasing the pressure only on the air circuit for unclamping a chuck on the table.
		Scheduler Function for AWC	Simple scheduler for AWC.
		Tool Life Management Software	

MotionExpert®	Option Package (Retrofit only)	Added usage and options for a second and subsequent PCs.
MotionExpert®	Option Package (Software only)	Adds options to MotionExpert®.
MotionExpert®	Option Package	- File Expansion: Expands of maximum number of call files fo an NC file. - Gouge Check Function: Function for extracting the difference between axis command data and a model and check for gouging. - Waveform Reference Function: Function for referencing the velocity waveform and acceleration waveform. - Vibration Analysis Function: Function to referencing the cause analysis of vibration. - Error List: Enumerates error between NC command and axis command.

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