M2-5AX

Total Solution 5-Axis Universal Machining Center

HWACHEON

5-AXIS UNIVERSAL MACHINING CENTER WITH TOTAL SOLUTION

This highly precise machining center is capable of performing 5-axis machine on entire production process with a single setting

Hwacheon M2-5AX can work on a complex workpiece which requires many different production processes with just a single setting. Coupled with the Hwacheon Total Solution, it is the ultra-precision 5-axis production solution you've been looking for everything from tool selection to final product.

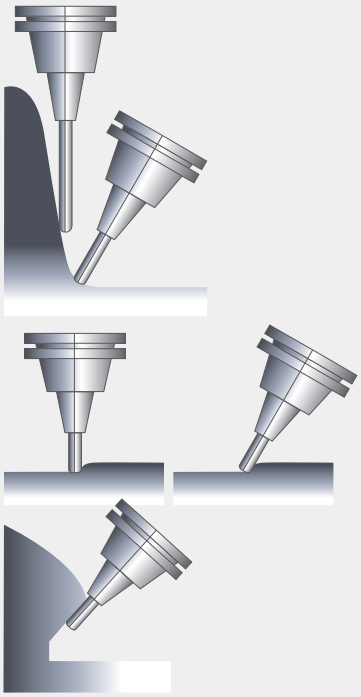
1 LCD Back Cover (Core) / Home appliances / NAK80 **2** Mission Case / Automobile / KP4M **3** Head Lamp / Automobile / KP4M
4 Part or Head Light / Automobile / KP4M **5** Slide Core / Automobile / KP4M

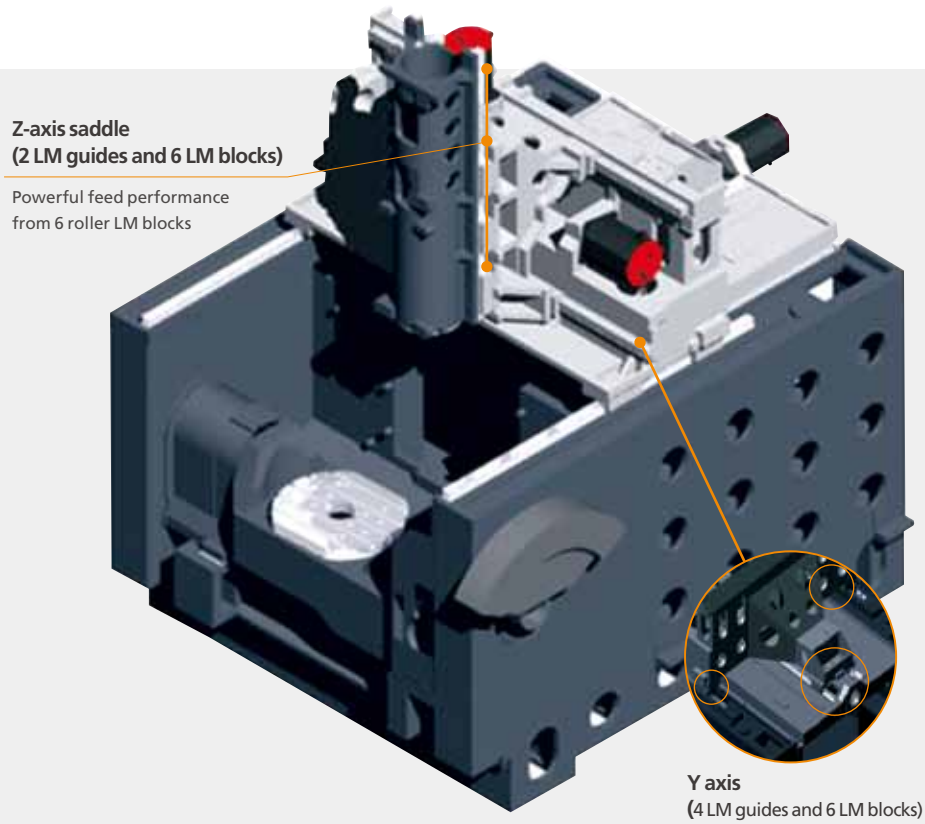
HWACHEON TOTAL SOLUTION MEETS MACHINING EXCELLENCE

Find out what we mean by machining optimization

Hwacheon's universal 5-axis center gives you the total machining solution- everything from tool selection to final product.

Also, the Machining Optimization system configures itself to fit your machining condition and application to give you the best product result. The 2-axis rotary table at ø500 lets you create a product either by 5-axis or 3+2 axis processing method. M2-5AX is built from 3D FEM analysis, and the software components specially created in-house by Hwacheon will increase the machine's productivity and process speed. The machine comes with many functional options that will make your production more efficient.





Highly efficient multi-axis machining

Not only can a 5-axis machine move in the same three directions of a 3-axis machine, but the cutting tool can also rotate to approach the work from any direction, enabling easy access to the undercuts that a 3-axis machine can't reach. Also, the end mill sweeping provides significant savings in machining time up to one fifth of the time it would take for the ball-end mill to be fed back and forth along a curvilinear path at close intervals when producing complex three-dimensional surfaces. Another benefit behind a 5-axis system is that the length of the tools can be compact, which used to be made longer to match the size and shape of workpieces; and the cutting is done with the side of the ball end mill, not just with the tip of it, which increases the life of the tool and results in the cut surface that is ultra fine.

Spindle assembly

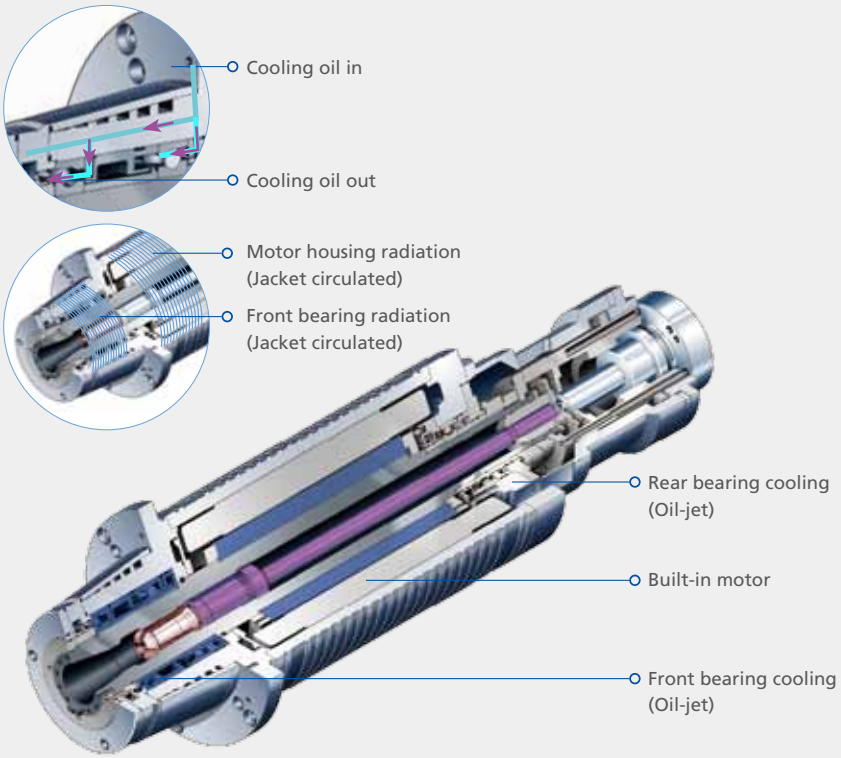
The Hwacheon clean room assembly facility, where the super-precision, super-speed spindle built inside M2 is manufactured, maintains optimal temperature and humidity, and is kept free of any foreign substances. Only the most skilled master engineers are allowed in the assembly facility, in the production of only the best equipment to comply with the toughest quality standard in the industry.

Oil-jet Cooling System

The jet of oil is injected directly onto the spindle bearing for effective cooling, and the motor and the spindle assembly are jacket-cooled to limit the displacement caused by heat.

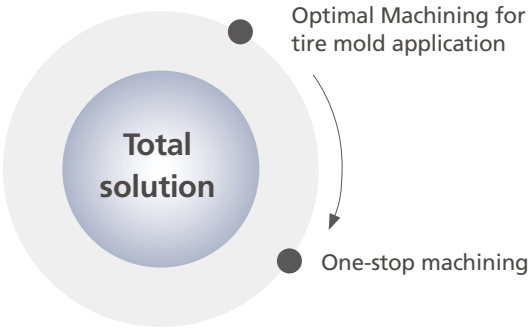
High-precision gantry design

The base frame includes two wide columns to achieve unibody stability, and the machine has adopted the gantry-type feed drive whose axial system travels over the base frame in three different directions along the X, Y, and Z axes. This design helps the machine to maintain rapid yet precise feedrate, and constant control performance regardless of the workpiece. The Z axis is firmly supported by 6 LM blocks; and for the Y axis, 6 LM blocks are triangle-positioned on 4 rails, in attempt to maximize feed drive rigidity.



UTILIZATION OF OPTIMAL MACHINING SYSTEM FOR THE CREATION OF TIRE MOLD

"Optimal Machining" is a part of Hwacheon's Total Solutions, and the Optimal Machining System increases the productivity by up to 200%. From setting up a tire mold to quality inspection, the whole process can be achieved in one stop process. This was made possible with the creation of proprietary machining software for the purpose of making tire molds. The result Lowered worker dependency and defect rate; and increased product quality and productivity.

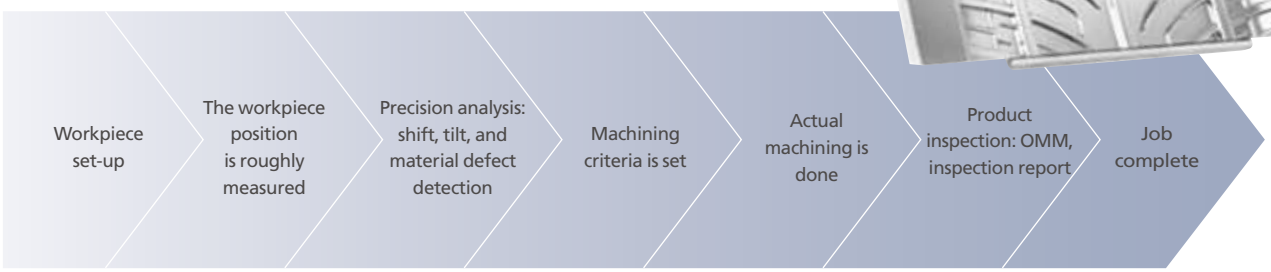


❶ Benefits

Increased productivity with "One-stop Machining."
Set-up is easy even for the most complex shaped workpiece.
Less dependent on the operator's skill
Less work load per worker = increased productivity
Defects are easily identified and found
Reduced product defect

❷ Process

In the tire mold machining process using a 5-axis machine, a casting material is virtually measured, and then the setup deviation is automatically calculated and corrected before actual machining.



MACHINING SOFTWARE

The Hwacheon Machining Software Components

The Hwacheon's developed machining software monitors different variables related to the work environment and machining conditions automatically makes adjustments for best quality results and optimum work efficiency.

+ RELIABILITY

HTDC (HSDC + HFDC)

Hwacheon Thermal Displacement Control System (HSDC + HFDC)

HTDC integrates the Hwacheon Spindle Displacement Control system and the Frame Displacement Control System.

HFDC

Hwacheon Frame Displacement Control System

HFDC is equipped with highly sensitive thermal sensors located at various locations where thermal activity is suspected; monitoring and correcting displacement.

HSDC

Hwacheon Spindle Displacement Control System

When the spindle rotates at high speed, the centrifugal force drives the taper to expand, causing errors in Z axis. HSDC constantly monitors the temperature at each spindle region and makes optimal prediction for thermal displacement. The system then makes necessary adjustments and effectively minimizing thermal displacement.

Static displacement compensation

The HSDC system corrects the Z-axis error occuring from the taper expansion during the spindle's high speed rotation.

PRECISION +

HTLD

Hwacheon Tool Load Detect System

HTLD constantly monitors the tool wear to prevent accidents, which may occur from a damaged tool and help to stop tool wear from deteriorating the workpiece.
(The load is measured every 8 msec to ensure accuracy)

HTLD™ Hwacheon Tool Load Detect

HECC

Hwacheon High-Efficiency Contour Control System

HECC offers an easy-to-use programming interface for different work-pieces and different processing modes. The system provides a precise, custom contour control for the selected workpiece, while prolonging the life of the machine and decreasing process time. The customizable display provides real-time monitoring and quick access.

- Program offers different options for different cutting speed accuracy and for roughness and shapes.
- The customizable display provides real-time monitoring and quick, easy access.
- The program is executable on an existing NC DATA system and works with the G Code system.

HECC® Hwacheon Efficency Contour Control

OPTIMA

Cutting Feed Optimization System

OPTIMA utilizes an adaptive control method to regulate the feed rate in real time, to sustain the cutting load during a machining process. As a result the tools are less prone to damage and the machining time is reduced.

OPTIMA™ Cutting Feed Optimization

HRCC

Hwacheon Rotation Center Calibration System

Hwacheon's Rotation Center Calibration System automatically measures and sets the reference point of pivot in a 5-axis machine in under one minute, to lower the workpiece setup time and increase the machining quality. The system also creates and manages a database of the reference points for different temperature and time to limit the deviation of the rotation center.

HRCC™ Hwacheon Rotation Center Calibration System

SPEED +

USER FRIENDLY DESIGN, A WIDE RANGE OF OPTIONAL FEATURES

M2-5AX offers user friendly design and a wide variety of useful options for practical applications, so you can concentrate on what you do best: creating quality products- without losing your valuable time to the worries of machine failure and safety. A wide variety of performance upgrade options are available for faster, more precise machining.

Hwacheon Rotation Center Calibration System-HRCC (Option)

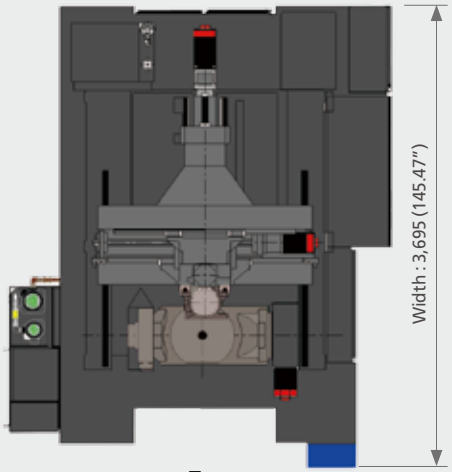
Hwacheon's Rotation Center Calibration System automatically measures and sets the reference point of pivot in a 5-axis machine in under one minute, to lower the workpiece setup time and increase the machining quality. The system also creates and manages a database of the reference points for different temperature and time to limit the deviation of the rotation center.

2-Axis Tilting rotary table for extra stability

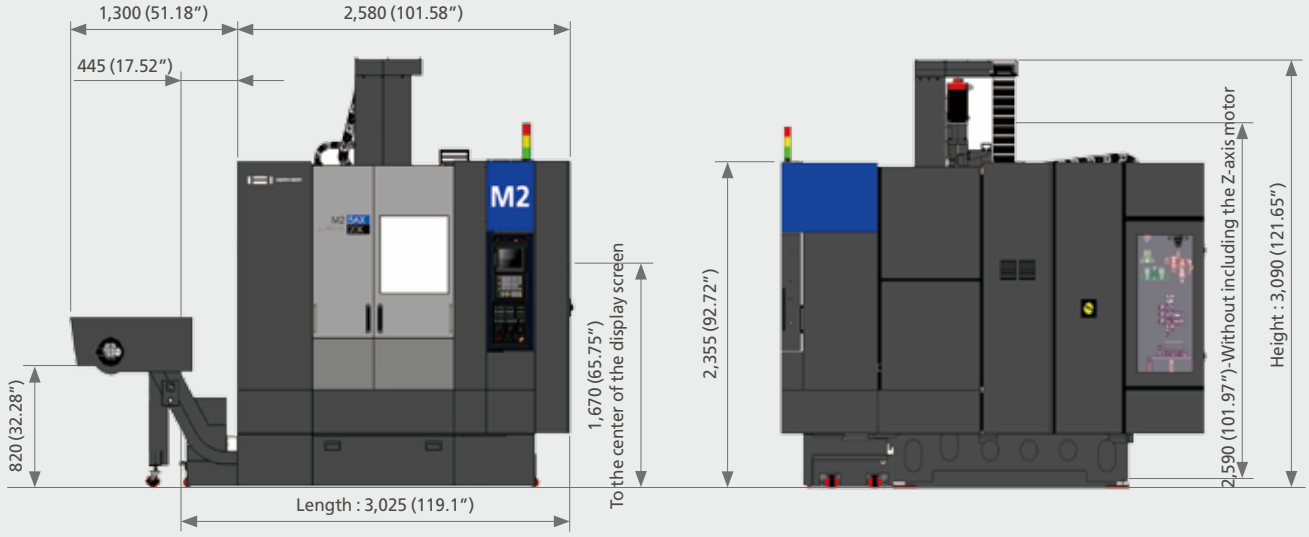
The 2-axis rotary table secured on top of the base frame is installed separately from the gantry-type X, Y, Z 3-axis feed drive to rotate the workpiece uninterrupted from the rapid on the linear axis. The fixed OTT worm gears and rotary encoder allow for 0.001 degree of high-precision angle division and consecutive rotation cut; and the powerful hydraulic brake system with 4,670Nm of force provides the rigidity more than sufficient for any 3+2 axis job. As an option, the table can incorporate up to 6 grooves for hydraulic and air tubing, to make it easy to integrate gantry robotics to M2-5AX in your automated production line.

Product Data

* Unit: mm(inch)



Top

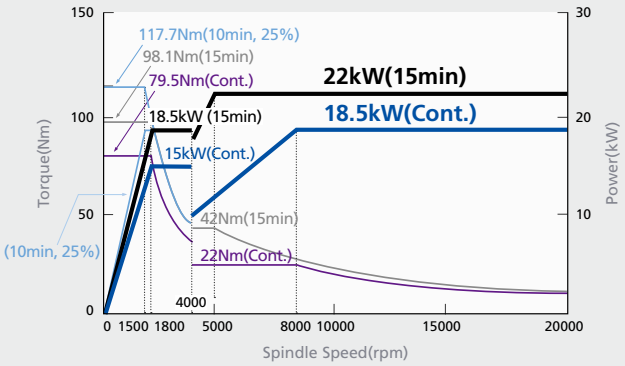


Front

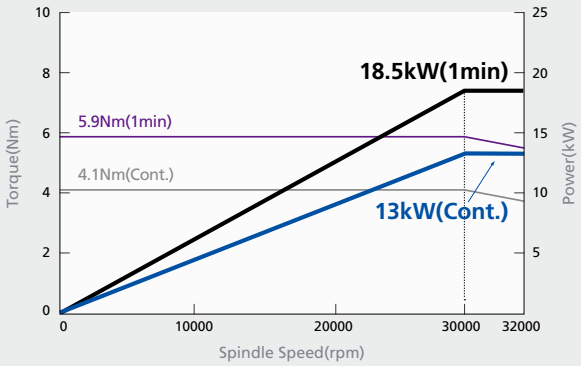
Right side

Spindle Power – Torque Diagram

Standard (20,000rpm)

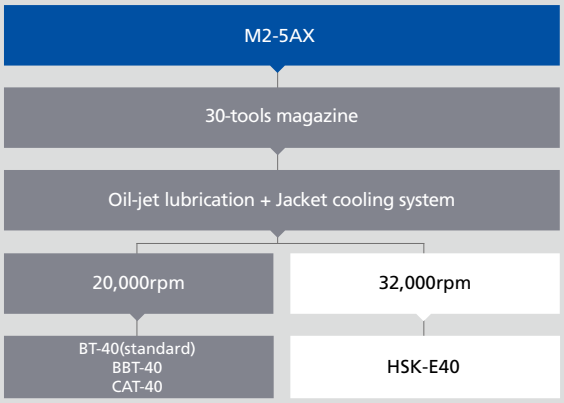


Option (32,000rpm)



Product Configuration

Each product can be configured to fit your application.



Machine Specifications

ITEM		M2-5AX	
		20,000	32,000
Travel			
Stroke (X / Y / Z)	mm(inch)	750 (29.53") / 650 (25.29") / 500 (19.69")	
Tilting(A) / Rotation(C)	˚(deg)	(+)30" ~ (-)120" / 360"	
Distance from table surface to spindle gauge plane (Long nose type)	mm(inch)	75 (2.95") ~ 575 (22.64")	
Table			
Working surface	mm(inch)	Ø500 (19.69")	
Table loading capacity	kg(lb)	300 (661.39)	
Table surface configuration (T slots WxP – No. of slots)	mm(inch)	14 (0.55") x 80 (3.15") - 5ea	
Spindle			
Max. Spindle speed	rpm	20,000	32,000
Spindle Motor	kW(HP)	22 / 18.5 (30 / 25)	18.5 / 13 (25 / 18)
Feedrate			
Rapid Speed (X / Y / Z)	m/min(ipm)	50 (1,969) / 50 (1,969) / 50 (1,969)	
Rapid Speed (A / C)	rpm	8.3 / 33.3	
Feedrate (X / Y / Z)	mm/min(ipm)	1 (0.04) ~ 24,000 (945)	
ATC			
Type of tool shank	-	BT-40 (Opt. : BBT-40, CAT-40)	HSK-E40
Type of pull stud	-	MAS P40T-1 (45˚)	-
Tool storage capacity	ea	30	
Max. Tool diameter [Without adjacent tools]	mm(inch)	Ø80 (3.15") / Ø170 (6.69")	Ø60 (2.36") / Ø90 (3.54")
Max. Tool length	mm(inch)	300 (11.81")	250 (9.84")
Max. Tool weight	kg(lb)	8 (17.64)	3 (6.61)
Tool changing time (T to T / C to C)	sec	1.5 / 4	2.5 / 5
Motor			
Feed motor (X / Y / Z)	kW(HP)	4.0 (5.5) / 7.0 (9.5) / 4.0 (5.5)	
Feed motor (A / C)	kW(HP)	4.0 (5.5) / 4.0 (5.5)	
Coolant motor (Spindle), Chip Flushing	kW(HP)	0.4 (0.55) / 0.9 (1.2)	
Spindle cooler (50 / 60Hz) – Inverter type	kW(HP)	5.0 (6.71) / 5.6 (7.51)	8.0 (10.73) / 9.0 (12.07)
Power Source			
Electric power supply	kVA	65	
Compressed air supply (Pressure x Consumption)	-	0.5 ~ 0.7MPa x 690Nℓ/min	
Tank Capacity			
Spindle Cooling / Lubrication / Hydraulic	ℓ(gal)	60 (15.85) / 12 (3.17) / 20 (5.28)	
Coolant	ℓ(gal)	400 (105.67)	
Machine Size			
Height	mm(inch)	3,090 (121.65")	
Floor space (Length × Width)	mm(inch)	3,025 (119.1") x 3,695 (145.47")	
Weight	kg(lb)	11,000 (24,251)	
NC Controller		Fanuc 31i-A5	

Standard and Optional product components

Standard Accessories		Optional Accessories	
· Adjust bolt, block & plate	· Slant control for 5-axis guidance installation	· Air dryer	· Mist collector
· Air blower	· Spindle cooler	· Air gun	· Oil mist (Semi dry cutting system, Eco booster)
· Base around splash guard	· Tool kit & box	· Auto door	· Oil skimmer
· Coolant system	· Workpiece coordinate system (48ea)	· Addition of Jig and fixture hydraulic	· Signal lamp (R / G / Y, 3 color)
· Cutting diameter correction for 5-axis tools	· Work light	groovings for rotary table (4 / 6part)	· Tool life management
· Data server 256MB	· Hwacheon Efficient Contour Control System (HECC)	· BBT Spindle	· Tool measuring system-Renishaw / Blum
· Door interlock	· Hwacheon Spindle Displacement Control	· CNC-integrated 3-dimensional interference check system	(Touch type, Laser type)
· Hydraulic system	System (HSDC)	· Coolant Gun	· Tool radius compensation for 5 axis
· Lubrication system	· Hwacheon Tool Load Detect System (HTLD)	· Coolant through spindle (30bar, 70bar)	· Transformer
· MPG Handle (1ea)	· Cutting Feed Optimization System (OPTIMA)	· Data server (1,024MB)	· Workpiece measuring system-Renishaw / Blum
· Operation manual & parts list	· Hwacheon AI Nano Contour Control	· Data server Interface	(Touch type)
· Pneumatics system	System(HAI) 600 block buffer	· Lift up chip conveyor (Hinge type, Scraper type)	· Hwacheon Rotation Center Calibration System (HRCC)
· Rigid tapping	· 5-axis tool cutting point control	· Nano Smoothing Interpolation	- Include work measuring system-Renishaw (touch type)
· Scale (X / Y / Z / A / C)		· NC Cooler	· Hwacheon AI Nano Contour Control System
· Signal lamp (R / G, 2 color)		· NURBS Interpolation	(HAI) 1000 block buffer

NC Specifications [Fanuc 31i-A5]

※ — : Not available S : Standard O : Option

ITEM	SPECIFICATION	
Controlled axis		
Controlled axis	5 - Axes	S
Simultaneously controlled axes	5 - Axes	S
Least input increment	0.001mm, 0.001deg, 0.0001inch	S
Least input increment 1 / 10	0.0001mm, 0.0001deg, 0.00001inch	O
inch/metric conversion	G20, G21	S
Store Stroke Check 1 / 2		S
Mirror Image		S
Operation		
Automatic & MDI operation		S
DNC operation by memory card	PCMCIA card is required	S
Dry Run, Single Block		S
Manual handle feed / feed rate	1Unit / x1, x10, x100	S
Interpolation function		
Positioning / Linear interpolation / Circular interpolation / Dwell (Per seconds)	G00 / G01 / G02,G03 / G04	S
Helical interpolation	Circular interpolation plus max.2axes linear interpolation	S
Nano Smoothing		O
Reference position return check / return	G27 / G28, G29	S
2nd reference position return	G30	S
Skip	G31	S
NURBS interpolation (64Bit RISC board is required)		O
Feed function		
Rapid traverse override	F0, F25, F50, F100	S
Feedrate (mm/min)		S
Feedrate override	0 ~ 150%	S
Jog feed override	0 ~ 4,000mm/min	S
Override cancel	M48, M49	S
Program input		
Optional block skip	1ea	S
Program number	O4 - Digits	S
Sequence number	N8 - Digits	S
Decimal point programming		S
Coordinate system setting	G92	S
Workpiece coordinate system	G54 - G59	S
Workpiece coordinate system preset		O
Addition of workpiece coordinate pair	48ea	S
Addition of workpiece coordinate pair	300ea	O
Manual absolute on and off		S
Chamfering / corner R		S
Programmable data input	G10	S
Sub program call	10 folds nested	S
Custom Macro B		S
Addition of custom macro common variables	#100 - #199, #500 - #999	O
Canned Cycles for Drilling		S
Small-hole peck drilling cycle		O
Automatic corner override		O
Feedrate clamp based on arc radius		S
Scaling		O
Coordinate system rotation		S

ITEM	SPECIFICATION	
Programmable Mirror Image		O
Tape format for Fanuc series 15		O
Manual Guide i		-
Spindle speed function		
Spindle override	50 - 120%	S
Spindle orientation		S
Rigid tapping		S
Tool function / compensation		
Tool function	T4 - digits	S
Tool offset pairs	±6 - digits 200ea	S
Tool offset pairs	±6 - digts 400ea, 999ea	O
Tool offset memory C		S
Cutter compensation C		S
Tool life management		O
Tool length compensation / Tool length measurement		S
Editing operation		
Part program storage length / Number of register able programs	128kB / 250ea	S
Part program storage length / Number of register able programs	256kB / 500ea, 512kB/ 1,000ea 1MB / 1,000ea, 2MB / 1,000ea	O
Background editing / extended editing functions		S
Play Back		O
Setting and display		
Display unit	8.4" Color LCD	S
Clock function		S
Self-diagnosis function / Alarm history display		S
Help function / Graphic function		S
Run hour and parts count display		S
Multi-language display	English, German, French, Italian, Chinese, Spanish, Korean, Portuguese, Polish, Hungarian, Swedish, Russian	S
Data input / output		
Reader / Puncher interface CH1	RS232C	S
Data server	256MB	S
Data server	1,024MB	O
Ethernet interface / Memory card interface		S
Auto Data Backup	SRAM + Part Program	S
HWACHEON Artificial Intelligence		
AI Nano Contour Control System (HAI) 600 Block Buffer		S
AI Nano Contour Control System (HAI) 1000 Block Buffer		O
Hwacheon Efficient Contour Control System (HECC)		S
Hwacheon Tool Load Detect (HTLD)		S
Cutting Feed Optimization System (OPTIMA)		S
Hwacheon Spindle Displacement Control System (HSDC)		S
Hwacheon Rotation Center Calibration System (HRCC)		O
5-axis native functions		
Smooth tool center point control for 5-axis		S
Tiltied working plane command for 5-axis		S
Workpiece setting error compensation for 5-axis		S
Tool radius compensation for 5 axis		O

Hwacheon Global Network

Hwacheon Headquarters Hwacheon Europe Hwacheon Asia Hwacheon America

Please call us for product inquiries.

www.hwacheon.com

The product design and specifications may change without prior notice.
Read the operation manual carefully and thoroughly before operating the product,
and always follow the safety instructions and warnings labels attached on the surfaces of the machines.

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