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# HIGH-SPEED HIGH-PRECISION CONTROLLER



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SYNTEC has made efforts in achieving high-performance, high-efficiency CNC controller. We have long invested in the research and development of CNC hardware and software technology, with the aid of rapid evolution of PC technology, combined with industrial design and high-reliability manufacture, Syntec can provide the best control system solution for the machine tool industry.

On the performance, SYNTEC provides outstanding high-speed, high-precision functions to satisfy needs of areas such as molds and high-speed milling. Multi-axis control and multi-program applications ease the mill-turn and multi-axis interpolation control. With the abundant and complete GM code and the easy-to-learn interface, first-time users can get started quickly. With the high-degree of horizontal integration capabilities and scalability of the operating interface, machine manufacturer can provide a variety of products to meet customers' demands.

It's important to choose our products for fast and attentive services. With the whole sales and service team around the world, you do not have to worry about the inadequate services, and there are no technical support limitations. SYNTEC will always be your best partner in technology and services.



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## SIMPLICITY & CONVENIENCE

- Machining preparation, dry run function, clear and easy-to-use machining monitor.
- Complete operating support, and customize helping screen
- With graphic input interface, users can also edit programs easily even when they are not familiar with G code.
- Provide network and USB disk interface, the most complete PC interface for input and output.

## HIGH EFFICIENCY

- High speed and high precision, with a maximum of 2000 blocks look-ahead.
- High speed drilling and tapping, high speed threading.
- Support up to control to meet demands of multi-program machining.
- Axis-coupling, axis-exchange, and virtual axis function to increase the flexibility of machine.
- Support functions of 5-Axis Simultaneous Machining and feature coordinate-function.

## FEATURES

- Provide eHMI application for users to customize operation interface conveniently.
- Customized G/M code, dedicated machine can be used easily.
- Provide dipole architecture, users can integrate the customized software onPC.
- Provide optional vision system or pick-and-place equipments for highly automated integration solutions.

## PURPOSE

- Standard Machine: Lathe, milling machining center, engraving and milling machine, mill-turn machine.
- Dedicated machine: Tapping center, glass cutting machine, cutter grinding machine, PCB molding machine, spring machine, laser processing machine, flame cutting machine, stone processing machine...ect.

# SYNTEC Turning Controller

All in one controller, high standard, lower distribution power cost and space saver. Equipped with Mechantrolink-II serial bus protocol. Low power loss, simple wiring system, high computational speed.

## 10.4 inches Turning Controller



## 8吋 inches Turning Controller

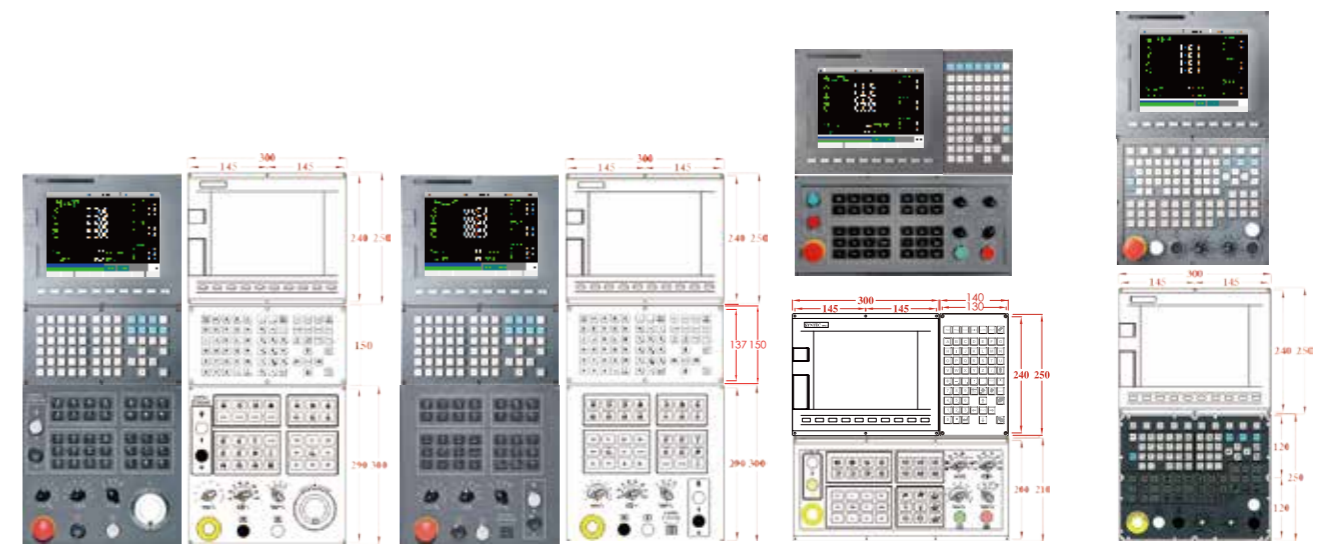


Controller		Axis no.	DA	Max I/O	Display	Servo	VGA	Connection	Multi-Program No.	RAM
Standard	6TA	3	2	32/32	8"	General Purpose	-	Ethernet RS-485	2	256MB
	6TB	4	2							
General Mill-Turn	11TA	4	2	32/32	10.4"	General Purpose	-	Ethernet RS-485	2	256MB
	21TA	4	2	96/96	8"/10.4"					
	21TB	6	2	32/32	10.4"	General Purpose	0	Ethernet RS-232 RS-422 RS-485	2	128MB
	10TA	4	1							
20TA	4 (6)	1	96/96	8"/10.4"	Serial Bus	0	Ethernet RS-232 RS-422 RS-485	2	128MB	
Multi-Program Mill-Turn	11TB	8	2	128/128	10.4"	General Purpose	-	Ethernet RS-485	2	256MB
	10TB	8	1							128MB
	10TF	8	1	96/96	8"/10.4"	Serial Bus	0	Ethernet RS-232 RS-422 RS-485	2	512MB
	200TA	8 (9)	1							
	200TB	12 (16)	1							

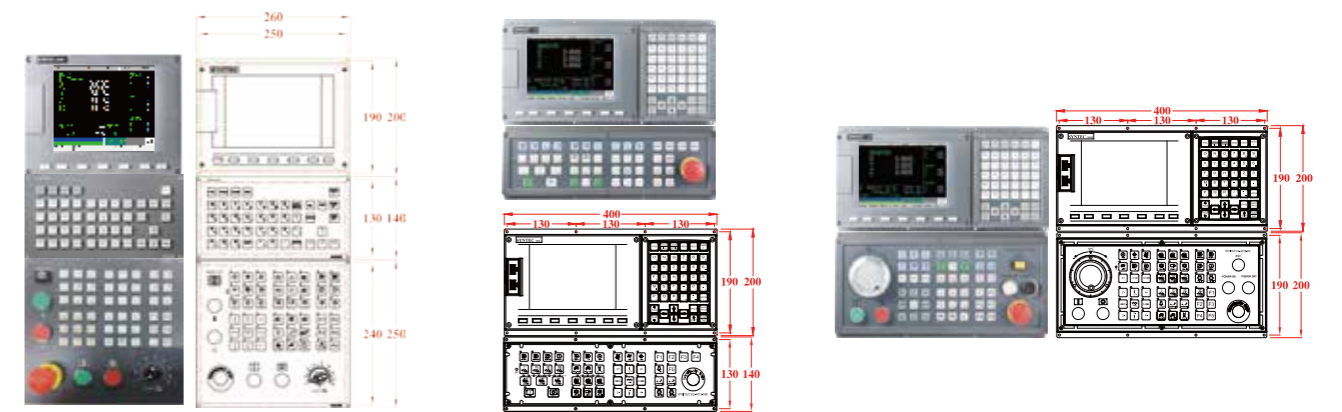
# SYNTEC Milling Controller

Using Windows CE operating system, user friendly and easy to be customized, with sealed structure to improve isolation against oil and mist, high controller reliability, with low failure rate.

## 10.4 inches Milling Controller

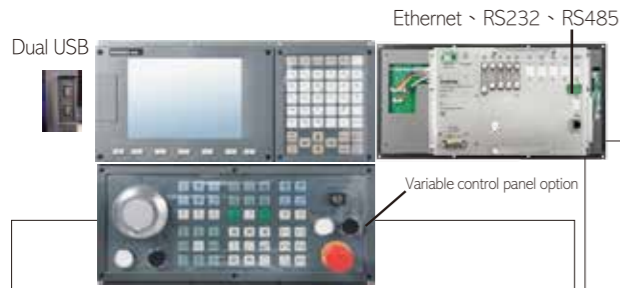


## 8 inches Milling Controller



Controller		Axis no.	DA	Max I/O	Display	Servo	VGA	Connection	Multi-Program No.	RAM	RTCP	HPCC
Standard	6MA	3	2	32/32	8"	General Purpose	-	Ethernet RS-485	2	256MB	-	-
	6MB	4										
	6MD	4 (5)				Serial Bus						
Multi-Function Milling	11MA	4	2	32/32	10.4"	General Purpose	-	Ethernet RS-485	2	256MB	-	0
	11MB	8		128/128	8"/10.4"							
	21MA	6	96/96	8"/10.4"	Serial Bus	0	Ethernet RS-232 RS-422 RS-485	2	128MB	-	Δ	
	10MA	4	32/32	10.4"	General Purpose							
	10MB	8	128/128	8"/10.4"	Serial Bus							
	20MA	4(6)	96/96	8"/10.4"	Serial Bus							
Composite Milling	10MF	8	1	128/128	10.4"	General Purpose	0	Ethernet RS-232 RS-422 RS-485	4	512MB	-	Δ
	200MA-5	8 (9)		96/96							Serial Bus	
	200MA	8 (9)	12 (16)	96/96	10.4"	Serial Bus	0	Ethernet RS-232 RS-422 RS-485	4	512MB	-	Δ
	200MB	12 (16)										

## Standard Turning Solution



- Latest developed hardware, special designed for 2-4 axis turning machine
- Non CF card (sealed) design
- High reliability mainboard
- Supports USB, internet
- Complete turning features

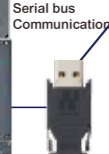


New interface, faster operation, and easier to learn.

Product	6TA	6TB
Axis no.	3 axis	4 axis
Spd no.	2	2
Multi-Program no.	2	2
DA no.	2	2
IO no.	32/32	32/32

Provide 3,6 series variable product option and control panel

### SYNTEC 21A



Yaskawa Axis motor

20 bit high resolution control, support absolute type.



SYNTEC spindle set

17 bit high resolution control, improve machining efficiency

### SYNTEC Serial BUS total solution

Auto turning interface in controller



Inverter auto tuning feature



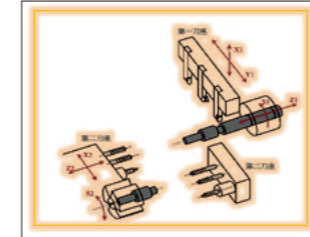
Axis and spindle motor load monitor

## Multi-Program Mill-Turn Solution



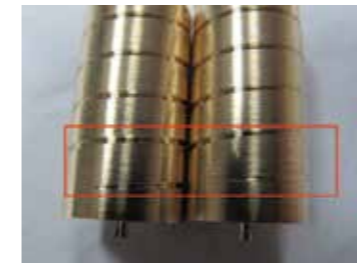
- New 200 Series
- Up to 4-program
- 4 Simultaneous independent program

## Multi-Program Mill-Turn Solution



- Dual-program interface
- Dual-program operation panel
- Support advanced functions for multi-program application, such as synchronized and non-synchronized axis-coupling, axis exchange, and ect.
- Synchronize motion in-between multi-program
- Synchronized spindles function

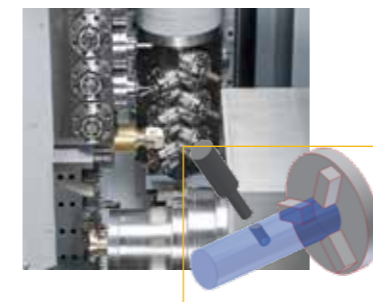
## Turning function: Specific, powerful, practical



### Extreme Speed Threading Mode

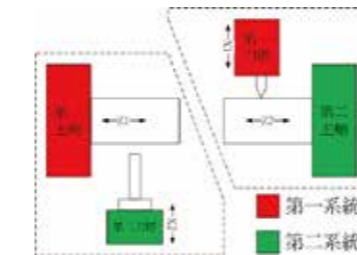
Improves threading result and efficiency by overlapping technique.

1000 Time Threading	General Threading	Extreme Speed Threading Mode	Time Saving
G21 Threading	36789(Sec)	29303(Sec)	20.3%
G78 Threading	24685(Sec)	18803(Sec)	23.8%



### Tilting Plane Machining

Function of rotating coordinates simplified the programming on the inclined surface. Milling, drilling, and tapping on the inclined plane can be implemented with NC program input manually, without complex CAD / CAM processing.



### Axis-Exchange Feature

The turret of the first axis group can machining with the second spindle; and at the same time the first spindle occupies the second turret to machine. Reduces the number of machine tools, improves the flexibility and efficiency of machining.



### Twin Spindles Tapping

Spindle does not need to decelerate speed to zero, or even maintains the original speed, proceed tapping via the speed difference between twin spindles, which significantly reduces the tapping time.

## 21MA Milling Controller

### High performance controller with serial bus connection structure

SYNTEC 21MA controller comes with serial bus Mechanrolink-II connection motion control, improves machining performance by decreasing Interpolation time and increasing surface's smoothness. Serial bus communication control also improves traditional pulse delay of differentiate transfer time between axis, provides a simpler system and easier to install and setup.



### Synonym of high speed, high precision and high quality

SYNTEC 21MA controller equipped with 1000blocks/sec. computational ability, and High speed High precision feature, such as SPA, HPCC, surface smoother, quick parameter setup, high speed tapping, multiple spindles synchronize motion tapping etc. SYNTEC 21MA is the best solution for high efficiency and high precision machining.

### High performance and competitive solution

SYNTEC 21MA control capable to control up to 6 axis, with up to 4-axis simultaneous machining in each axis group, and competitive serial bus spindle provides a great performance machine. DA output or pulse command spindle is also available in order to create more economical value solution. Moreover, standard I/O connections supports up to 32 direct output and output, also can be expanded with external I/O module by RIO serial bus interface to provide more flexible options.

## Maching center serial bus solution

SYNTEC 21MA Serial Bus Controller



Yaskawa axis motor



Syntec spindle set



Syntec DD motor



### High Performance & Better Configuration

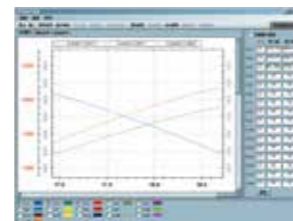
#### Syntec latest Machining center solution

1. High speed and high precision controller
2. High resolution Yaskawa axis motor
3. Linear scale (optional)
4. 24000RPM High speed spindle
5. High speed rigid tapping
6. High speed spindle positioning
7. Supports DD motor(4/5 axis)
8. Coolant from center (optional)

### Highly integrated configuration and diagnostic



Axis and spindle setting



Serial bus Oscilloscope

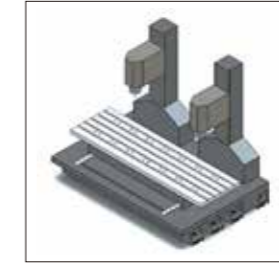
## Mill Function

### Rapid Tool Retraction In Tapping Process

The Percentage Of Retraction	100%	150%	200%	300%
Tapping Time(100 Holes)	310	273	255	240
Save percentage	-	11.94%	17.74%	22.58%

- Use parameter to set tool retraction speed, maximum to 300%.
- Support the bell-shaped curve of acceleration and deceleration with the advantage of high speed and stability.

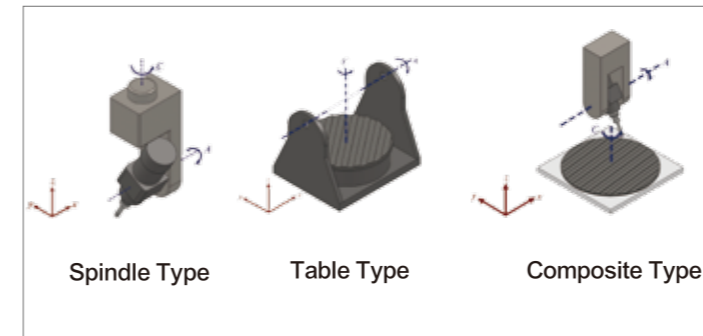
### Multi-Spindle Tapping



- Provide multi-spindle machine to enhance the productivity corresponding to the same program.
- Support multi-spindle tapping, improve the productivity.
- Flexibly select the machining spindle according to different machining conditions
- Support up to 6 spindles

## Five-Axis Control Function(Optional feature for Special controller)

### Support Various Types of Five-Axis Compensation



### Tilt Working Plane Machining

For oblique cutting tool or rotating worktable provides correction function to define the tilt machining plane conveniently .

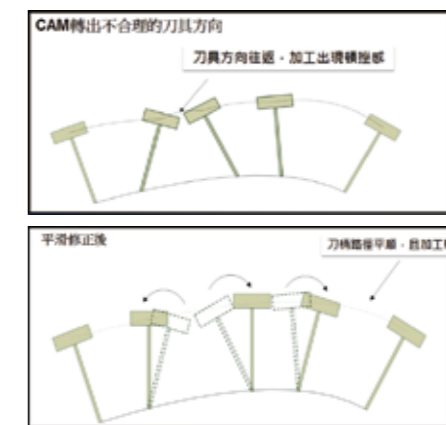


### Rotation Tool Center Point Feature (RTCP)

Support 3D tool length compensation feature, user only needs to program product in CAM program, controller will automatically implement tool length and wear, and the tool tip will always on the perpendicular against product contour.



### Smooth RTCP Feature (SMTCP)



5 Axis SMTCP will overcome the defects of path generated by CAM software, especially for side blade machining.

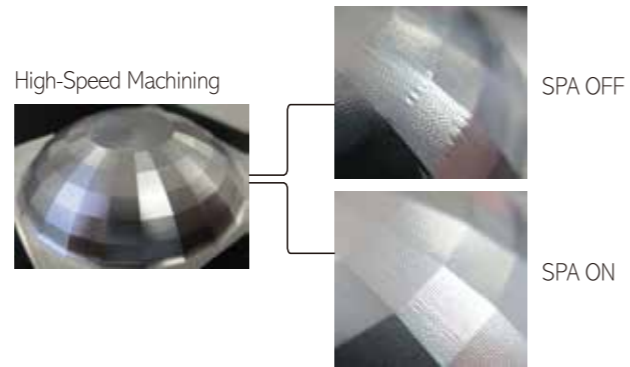
# High Efficiency Machining

## High-Speed, High-Precision Machining (HSHP)



The HSHP function can process 1000 blocks per second in WINCE with 2000 blocks look-ahead. These enable smooth motion and enhance surface quality. In order to advance the precision, HSHP function also controls the corner and arc feedrate efficiently.

## Smooth Precision Advanced (SPA)



Due to limitation of machine condition, and although servo's Kp is already set to best condition, but servo lag issue still appears during machining, especially in HSHP mode and cause size shrinking. Syntec design SPA features to overcome and compensate precision issue.

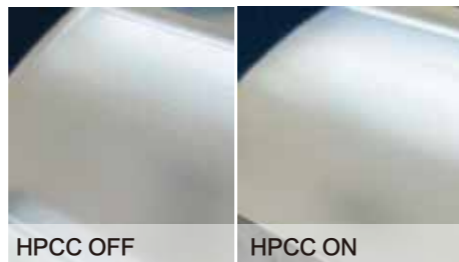
## Path Smoothing Feature



Enhance the brightness of the surface and reflect obviously

By trimming the rough program path generated by CAD/CAM software with a tolerance, the desired smooth and fine path is estimated by Path Smoothing function. This improves the surface finish, machining efficiency and stability of machine tool.

## High Precision Contour Control (HPCC)



The tool path generated by CAD/CAM software is generally discontinuous, and it causes negative effects on machining operations. The problems will be more serious because of larger CAD/CAM tolerance. HPCC function fits the discontinuous blocks into a smooth-curve path, and this will enhance the machining precision and reduce the mechanical shock.

## Simplified HSHP parameter



User may choose [Precision level<---> Speed level], [Original path<--->Smoothing path level], and SPA features to control machining result

## Direct Numerical Control Feature (DNC)



Put program in external drive (USB, ethernet), transferring and machining, saving controller disk space benefits and no need wait for file transfer.

[Only applicable with Arm-based controller]

# User Friendly Operation Interface

Users can get started easily and immediately operate it right for the first time.

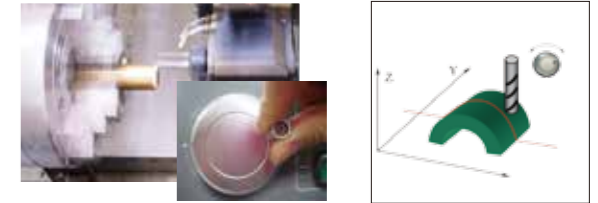
## Graphic Conversational Input



Lathe Mill

Provide various graphic conversational input in program editing menu. Customized graphic conversational input is also available.

## MPG Simulation



Lathe Mill

In the dry run process, users can decide the cutting speed and direction with moving MPG forward or backward.

## Permission management feature



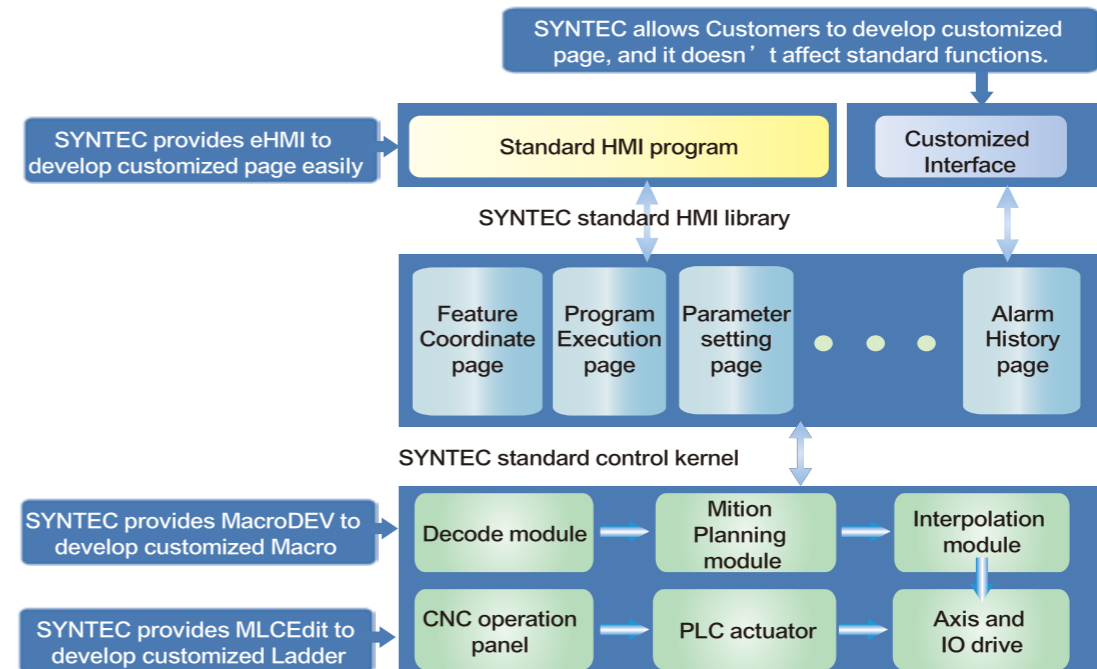
Provides machine maker or operation manager permission management feature, different permission allowed according to different level user, to avoid operational mistake and confidential protection.

## My favorites



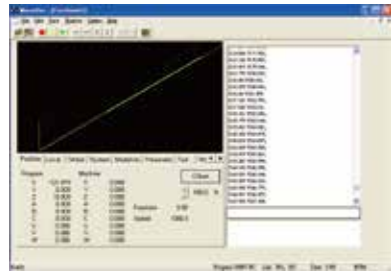
New F6/F7/F8 [My Favorites] function key allow user or machine maker to set their favorite interface shortcut and faster to designated interface.

# Open-Architecture System



## Complete Development Tools

SYNTEC' Macro Editor Program  
Software-MacroDEV



- Marco Support
- Windows Based development environment
- Totally compatible with CNC development environment
- Open file, save file for 3D simulation
- System variable confirmation

SYNTEC' Ladder Editor Program  
Software-MLCEdit



- Ladder Support
- Windows Based Ladder Tool
- Online Ladder display, easier to debug
- Support Ladder save, open file, adding comment
- Long element comment, copy paste, cut, auto check features

## Open Human-Machine Interface Editing Software - eHMI

Introduction - Open Platform, Easy To Learn And Easy To Use Environment



Man-machine browser editing



Man-machine Fenubar editing

eHMI can help developer to edit HMI intuitively without complicated programming process. It provides a more efficient, easier and more user-friendly operation interface to reduce development process.

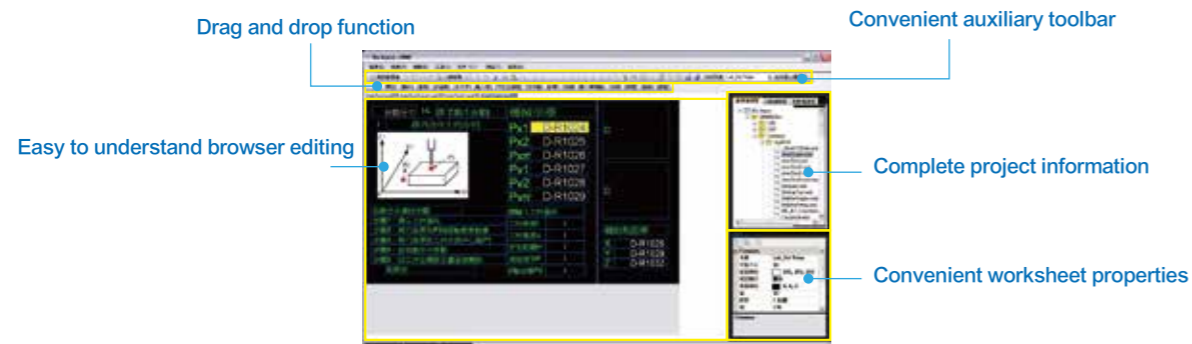


Integrated test results with the same display on the controller



Package the project and then install directly on the controller

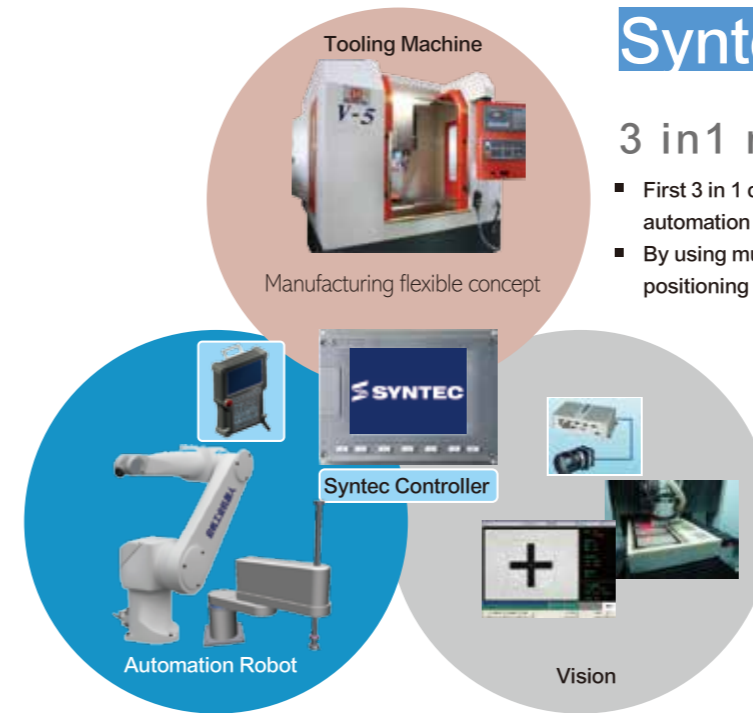
## Convenient And User-Friendly Operation Interface



## Syntec Robotics

### 3 in1 robot controller

- First 3 in 1 controller in the industry field, CNC machining, vision and robot automation in one unit
- By using multi-program system structure to control CNC and robot with vision positioning and monitoring in one unit controller, easier to reach automation world



### Combine vision control and display



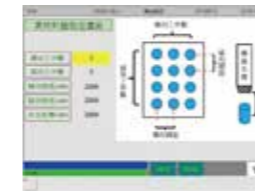
- Control and display captured image in controller
- Apply for application such as positioning, monitoring, glass grinding, and etc.

## Types of robot control

### Cartesian axis, pick-and-place solution

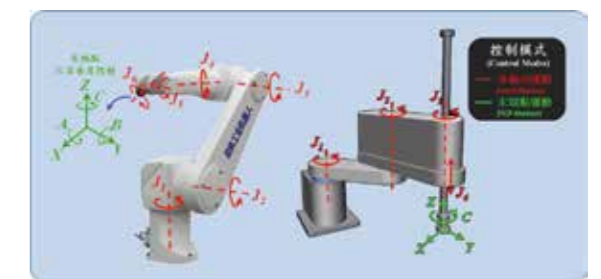


Easy teach feature for pick-and-place control



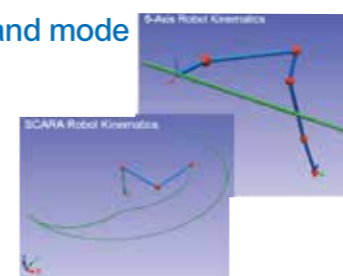
Material plate setting interface

### Robot arm controller



Syntec controls SCARA robot, 4 axis robot, 6 axis robot synchronize movement and end point linear motion control

### Muti command mode



Supports G code language to satisfy every operational needs

### Teaching feature



Convenient in teaching every motion path and behavior

## Vision Alignment System

Combined with vision system, the offset and rotation information of work piece can be obtained and compensated by control. In this way, the machining accuracy can be significantly improved.

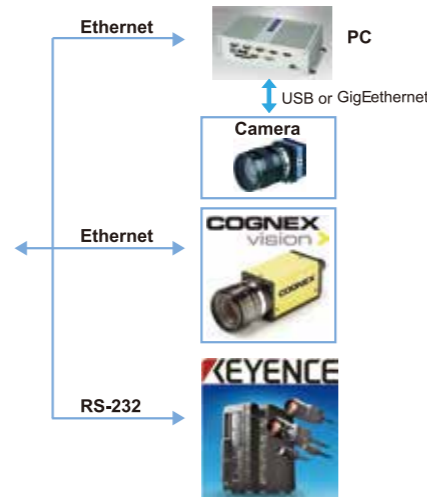
Our vision system provides simple and intuitive manipulation interface, supports up to 4 CCDs, and is very convenient for users' setting.

Front platform: operation interface and control kernel



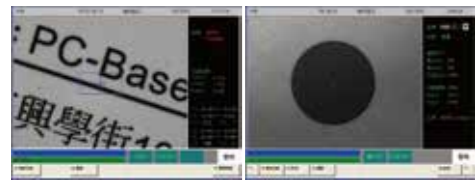
Syntec WinCE Controller

Rear platform: vision system computation  
SYNTEC exclusive vision solution



- **Easy To Operate**  
All operations can be reached on the controller, another monitor or control box is unnecessary.
- **Easy To Use**  
Provide standard alignment macro for general application. For different size of work piece, users only need to modify parameters.
- **Easy To Set Up**  
Provide waterproof box. All the vision accessories are calibrated and set up inside. Users only need to install the waterproof box.
- **Easy To Customize**  
Through eHMI, users can easily modify the browser layout.
- **High Openness**  
Modify macro to reach different needs.
- **High Compatibility**  
Support Cognex, Keyence, and Omron visual system.

## Identify Targets



- Cross mark
- Circular mark
- Arbitrary pattern
- Line
- L-mark
- Intersection

## Standard Visual Pages



- Include parameter setting
- Image monitoring, and result display.

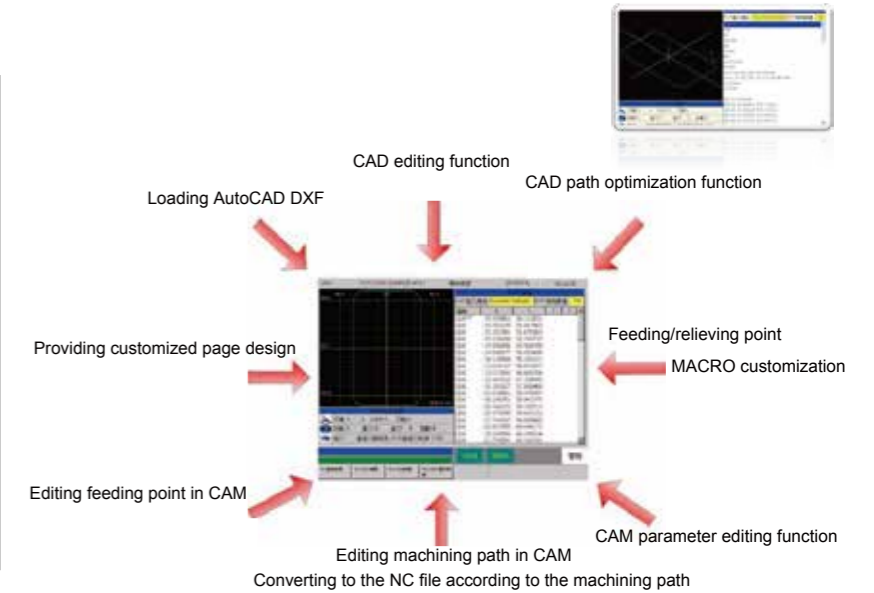
## Syntec Vision Package

Feature	A type Cheap, dedicated	B type All with fixed distance	C type All with different distance
Appliance	Glass Metal mark	Glass: rarely Other: OK	All
Camera	1.3 megapixel CCD		
	 USB Interface DMK-72AUC02	 GigE:DMK-23K445	
Lens	Telecentric Lens (coaxial) 	Telecentric Lens 	CCTV Lens 
Lighting	Spot Light 	Direct Ring Light 	Coaxial Light 
Dimmer LED-Power	1CH Analog Dimmer 	1CH Analog Dimmer 	1CH Analog Dimmer 
Resolution	=5um/pixel	=5um/pixel	=5-50um/pixel
Field of View-FOV	≈ 4.8mm*6.4mm	≈ 4.8mm*6.4mm	≈ 5mm*7mm ~50mm*70mm
Working Distance (WD)	110mm	110mm	110mm-500mm

## 2D DXF Import and CAD/CAM Solution

### CAD/CAM Platform

- **Loading AutoCAD DXF File**  
SYNTEC provides the function of loading DXF files, the complex graphic can also be loaded.
- **Editing The Image File Loading From AutoCAD**  
Providing the editing function after loading DXF files, users can delete or add the line segment in DXF files.
- **CAM Path Optimization Function**  
Providing the capability to optimize the machining path in the DXF file, complex segments of DXF can be automatically determined and arranged to create the smooth machining path.
- **Function of Setting CAM Machining Program**  
Users can edit their own machining processes; do not need to follow these steps: the tool feeding → the machining path → the tool relieving ... converting to NC files.
- **Function of Setting Relieving Point in CAM**  
Allowing users to choose feeding points accordingly

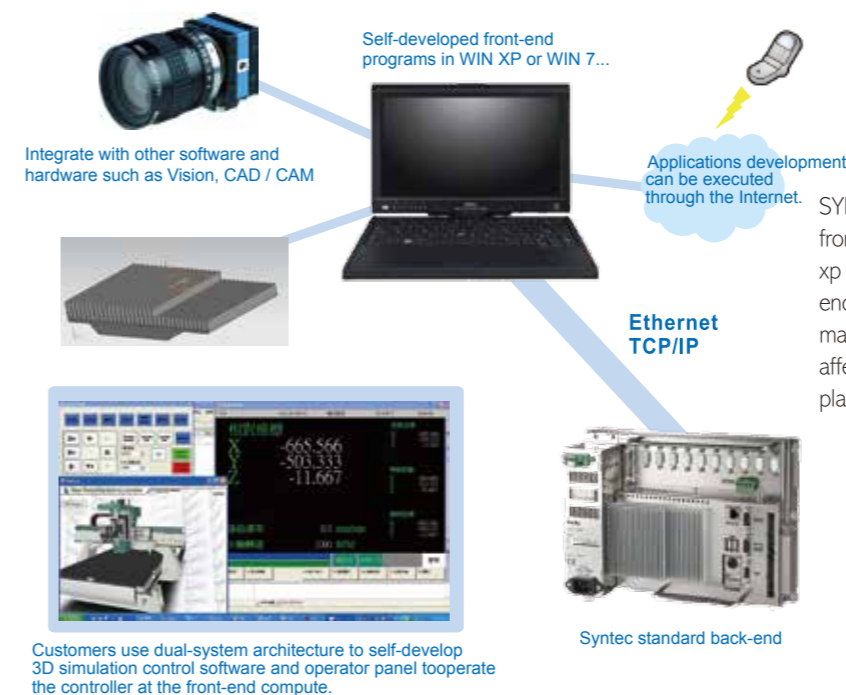


### Open Development Platform

- **Function Of Editing CAM Parameter**  
SYNTEC provides customers with CAM parameters page to self-define or self-customize dedicated customized surface.
- **MACRO Program To Set Tool Feeding/Relieving In CAM**  
Providing the MACRO program to design the tool feeding/relieving in CAM, users can design the tool feeding/relieving path according to operation of dedicated machine.

## Dual System Dipole Structure

SYNTEC provides dual-system architecture with expectation that users can benefit from PC-Based CNC. Dual-system architecture provides connection between front-end computer and back-end CNC by cable. Front-end computer can process various applications such as Vision, CAD/CAM and other high level software applications, allowing customers to integrate hardware and software resources.



SYNTEC provides standard API to facilitate customers to develop front-end application programs. Front-end computer can use Win xp or Win7 and other platforms, easy to integrate with other Front-end computer develops relatively fast in order to PC, and all human-machine interface is executed in the front-end computer, does not affect the back-end CNC's performance. SYNTEC provides standard platform ensuring real-time quality at the back-end.

# Dedicated Lathe Functions

	Items	Units	Remark	General Purpose						Serial BUS				
				6 Series		10 Series		11 Series		20Series	21 Series		200Series	
				TA	TB	TA	TB	TA	TB	TA	TA	TB	TA	TB
Product Specification	Max. multi-program	Program group		2		2		2		2	2		4	
	Max. PLC axis	Program group		1		1		1		1	1		3	
	Standard axis	Axis		3	4	4	8	4	8	4	4	6	8	12
	Max. axis (optional)	Axis		3	4	4	8	4	8	6	4	6	9	16
	Max. spindle	Axis		2		2		2		2	2		6	
	Max. Simultaneous axis control	Axis	single program group	3	4	4		4		4	4		4	
	Min. control unit	mm		0.0001		0.0001		0.0001		0.0001	0.0001		0.0001	
	Max. number of program coordinate	Set		32		100		100		100	100		100	
	Max. number of table tools	Set		96		96		96		96	96		96	
	Look-ahead	Block		64		1000		1000		1000	1000		2000	
	Block processing time	Block/Sec.		300		500		500		500	300	500	1000	
	Hardware Specifications	Standard I/O	Point		32/32		32/32		64/64		32/32	32/32		32/32
Optional I/O		Point		-		128/128		-		128/128	-		96/96	
DA		Set		2		1		2		1	2		1	
Monitor		Inch	Color LCD	8		10.4		10.4		8/10.4	8/10.4		8/10.4	
RJ-45		Set		1		1		1		1	1		2	
VGA output		Set		0		1		0		1	0		1	
PS/2		Set		0		1		0		1	0		1	
RS232/RS422/RS485		Set		-/-/1		1/1/1		-/-/1		1/1/1	-/-/1		1/1/1	
CF Card		Set	Front side	-		1		-		-	-		-	
USB		Set	Front side	2		1		2		2	2		2	
Compensation	Backlash compensation			○		○		○		○	○		○	
	Pitch error compensation			○		○		○		○	○		○	
	Angular error compensation			○		○		○		○	○		○	
	Temperature error compensation			○		○		○		○	○		○	
	2 dimension error compensation			-		○		○		○	○		○	
Operation	MPG simulation			○		○		○		○	○		○	
	Dry Run			○		○		○		○	○		○	
	Optional stop			○		○		○		○	○		○	
	Single block			○		○		○		○	○		○	
	Virtual MPG			○		○		○		○	○		○	
	Restart at feedhold			○		○		○		○	○		○	
	Restart			○		○		○		○	○		○	
	Fixture offsets			○		○		○		○	○		○	
MPG offsets			-		-		-		-	-		-		
Programm- ing	Optional skip	Ignore block with ' / '		○		○		○		○	○		○	
	B-stop			○		○		○		○	○		○	
	Interrupt Macro	M96/M97		-		-		○		-	○		○	
	M198 call subroutines			-		-		○		-	○		○	
	Expandable G Code			○		○		○		○	○		○	
HSHP	Constant Jerk Control			○		○		○		○	○		○	
	Multiblocks S-curve motion plan			-		○		○		○	○		○	
	Auto declaration in corner			○		○		○		○	○		○	
	Speed limit for round radius			○		○		○		○	○		○	
	Multiple sets of HSHP parameters			○		○		○		○	○		○	
	Quick parameter setup			-		-		-		-	-		-	
	SPA feature			-		-		-		-	-		-	
	Virtual radius function (for rotary axis)			-		-		○		-	○		○	
	HSHP control mode I (G05.1 Q1)	G05.1 Q1		-		-		-		-	-		-	
	HSHP control mode II (G05P10000)	G05P10000		-		-		-		-	-		-	
NURBS interpolation ability			-		-		-		-	-		-		

	Items	Dimensions	Remark	General Purpose						Serial BUS					
				6 Series		10 Series		11 Series		20Series	21 Series		200Series		
				TA	TB	TA	TB	TA	TB	TA	TA	TB	TA	TB	
Tool Management	Auto tool setting			○		○		○		○	○		○		
	Tool life management			○		○		○		○	○		○		
Accessibility	Machine lock (R bit)			○		○		○		○	○		○		
	Software limit			○		○		○		○	○		○		
	Spindle speed arrival check			○		○		○		○	○		○		
	Axis Synchronize feature			○		○		○		○	○		○		
	Dynamic Axis Synchronize feature			-		○		○		-	○		○		
	Feedback synchronize feature			-		-		○		-	○		○		
	Rapid retraction for rigid tapping			○		○		○		○	○		○		
	Virtual axis feature			-		○		○		○	○		○		
	Axis change feature			-		○		○		○	○		○		
	Serial bus setting feature			○		○		○		○	○		○		
	High speed spindle positioning (C61)	C61		-		○		○		○	○		○		
	Dipole front and back system			-		○		○		○	○		○		
	Data backup recovery	MB		○		○		○		○	○		○		
	Customized Opening screen			○		○		○		○	○		○		
	My favorites			-		-		○		-	○		-		
	Project protection feature			-		-		○		-	○		○		
	Limit access manager			-		-		-		-	-		-		
	Remote AP monitor			○		○		○		○	○		○		
	Program Edit	Background edit			○		○		○		○	○		○	
		Edit protection			○		○		○		○	○		○	
Data Transfer	NETWORK/FTP			○/○		○/○		○/○		○/○	○/○		○/○		
	DNC(Network)			○		○		○		○	○		○		
	DNC(USB)			-		-		○		-	○		-		
Information Display	Program simulation			○		○		○		○	○		○		
	Linear scale loss pulse auto detection			-		○		○		○	○		○		
Inclined Plane	Feature coordinate	G68.2 (Incline plane machining)		-		-		-		-	-		-		
	Feature Coordinate Teach			-		-		-		-	-		-		
5 axis feature	5 Axis RTCP	G43.4 (RTCP)		-		-		-		-	-		-		
	Smooth TCP	Smooth TCP		-		-		-		-	-		-		
G code command	Elliptical interpolation	G02.1		○		○		○		○	○		○		
	Parabolic interpolation	G02.2		○		○		○		○	○		○		
	Cylindrical interpolation	G07.1		○		○		○		○	○		○		
	End Face interpolation	G12.1		○		○		○		○	○		○		
	Outer/inner diameter cutting cycle	G20		○		○		○		○	○		○		
	Threading cycling	G21		○		○		○		○	○		○		
	Threading continuous cycling	G21.2		○		○		○		○	○		○		
	End Face turning cycling	G24		○		○		○		○	○		○		
	Skip function	G31		○		○		○		○	○		○		
	Threading	G33		○		○		○		○	○		○		
	Variable pitch threading	G34		○		○		○		○	○		○		
	Tool tip control	G43.4		-		-		-		-	-		-		
	Polygon turning	G51.2		○		○		○		○	○		○		
	Inclined plane tool correction	G53.1		-		-		-		-	-		△		
	Program coordinate setting	G54~G59.9		○		○		○		○	○		○		
	Mirror feature (turning)	G68		○		○		○		○	○		○		
	Bevel Machining	G68.2		-		-		-		-	-		△		
	Complex machining cycling	G72~G78		○		○		○		○	○		○		
	Drilling cycling	G80, G83~G89		○		○		○		○	○		○		
	Zero point coordinate setting	G92.1		○		○		○		○	○		○		
	Reverse time finish information	G93		○		○		○		○	○		○		
	Surface cutting speed control	G96		○		○		○		○	○		○		
	Spindle synchronize feature	G114.1		○		○		○		○	○		○		
Spindle carry feature	G114.3		○		○		○		○	○		○			

# Dedicated Milling Functions

				General Purpose						Serial BUS						
				6 Series		10 Series			11 Series		6Series	20Series	21Series	200 Series		
Items	Units	Remark	MA	MB	MA	MB	MF	MA	MB	MD	MA	MA	MA	MA-5	MB	
Product Specification	Max. multi-program	Program group		2		2		4		2	2	2		4		
	Max. PLC-axis	Program group		1		1		3		1	1	1		3		
	Standard axis	Axis		3	4	4	8	4	8	4	4	6		8	12	
	Max. axis (optional)	Axis		3	4	4	8	4	8	5	6	6		9	16	
	Max. spindle	Axis		1	2	2	6	2	6	2	4	4		6		
	Max. Simultaneous axis control	Axis	single program group	3	4		4		4		4	4	4	4	5	4
	Min. control unit	mm		0.0001		0.0001		0.0001		0.0001	0.0001	0.0001		0.0001		
	Max. number of program coordinate	Set		32		100		100		32	100	100		100		
	Max. number of table tools	Set		96		96		96		96	96	96		96		
	Look-ahead blocks no.	Block		100		1000	2000	1000		100	1000	1000		2000		
Block processing time	Block/Sec.		350		1000	1500	1000		350	1000	1000		1500			
Hardware Specifications	Standard I/O	Point		32/32	32/32	64/64	32/32	64/64	32/32	32/32	32/32		32/32			
	Optional I/O	Point		—	—	128/128	—	128/128	—	96/96	96/96		96/96			
	DA	Set		2		1		2	2	1	2		1			
	Monitor	Inch	Color LCD	8		10.4		10.4	8	8/10.4	8/10.4		10.4			
	RJ-45	Set		1		1		1	1	1	1		2			
	VGA output	Set		—		1		—	—	1	—		1			
	PS/2	Set		—		1		—	—	1	—		1			
	RS232/RS422/RS485	Set		—/—/1		1/1/1		—/—/1	—/—/1	1/1/1	—/—/1	—/—/1		1/1/1		
	CF Card	Set	Front side	—		1		—	—	—	—		—			
	USB	Set	Front side	2		1		2	2	2	2		2			
Compensation	Backlash compensation			○		○		○	○	○	○		○			
	Pitch error compensation			○		○		○	○	○	○		○			
	Angular error compensation			○		○		○	○	○	○		○			
	Temperature error compensation			○		○		○	○	○	○		○			
	2 dimension error compensation			—		○		○	—	○	○		○			
Operation	MPG simulation			○		○		○	○	○	○		○			
	Dry Run			○		○		○	○	○	○		○			
	Optional stop			○		○		○	○	○	○		○			
	Single block			○		○		○	○	○	○		○			
	Virtual MPG			○		○		○	○	○	○		○			
	Restart at feedhold			○		○		○	○	○	○		○			
	Restart			○		○		○	○	○	○		○			
	Fixture offsets			○		○		○	○	○	○		○			
MPG offsets			○		○		○	○	○	○		○				
Programm-ing	Optional skip	Ignore block with F/L		○		○		○	○	○	○		○			
	B-stop			○		○		○	○	○	○		○			
	Interrupt Macro	M96/M97		—	—	○		○	—	—	○		○			
	M198 call subroutines			—	—	○		○	—	—	○		○			
	Expandable G Code			○		○		○	○	○	○		○			
HSHP	Constant Jerk Control			○		○		○	○	○	○		○			
	Multiblocks S-curve motion plan			—		○		○	—	○	○		○			
	Auto declaration in corner			○		○		○	○	○	○		○			
	Speed limit for round radius			○		○		○	○	○	○		○			
	Multiple sets of HSHP parameters			—		○		○	—	○	○		○			
	Quick parameter setup			—	—	○		○	—	—	○		○			
	SPA feature			—		○		○	—	○	○		○			
	Virtual radius function (for rotary axis)			—	—	○		○	—	—	○		○			
	HSHP control mode I (G05.1 Q1)	G05.1 Q1		—		○		○	—	○	○		○			
	HSHP control mode II (G05P10000)	G05P10000		—		△	△	○	—	△	○		△			
NURBS interpolation ability			—		△	△	○	—	△	○		△				

				General Purpose						Serial BUS					
				6 Series		10 Series			11 Series		6Series	20Series	21Series	200Series	
Items	Dimensions	Remark	MA	MB	MA	MB	MF	MA	MB	MD	MA	MA	MA	MA-5	MB
Accessibility	Auto tool setting		○		○		○		○	○	○		○		
	Tool life management		○		○		○		○	○	○		○		
	Machine lock (R bit)		○		○		○		○	○	○		○		
	Software limit		○		○		○		○	○	○		○		
	Spindle speed arrival check		○		○		○		○	○	○		○		
	Axis Synchronize feature		○		○		○		○	○	○		○		
	Dynamic Axis Synchronize feature		—		○		○		—	○	○		○		
	Feedback synchronize feature		—	—	○		○		○	—	○		○		
	Rapid retraction for rigid tapping		○		○		○		○	○	○		○		
	Virtual axis feature		—		○		○		—	○	○		○		
	Axis change feature		—		○		○		—	○	○		○		
	Serial bus setting feature		—	—	—		○		—	○	○		○		
	High speed spindle positioning (C61)	C61		○		○		○		○	○		○		
	Dipole front and back system			—		○		○		—	○		○		
	Data backup recovery	MB		○		○		○		○	○		○		
	Customized Opening screen			○		○		○		○	○		○		
	My favorites			—		—		○		—	—		○		
	Project protection feature			—	—	○		○		—	—		○		
	Limit access manager			—		—		—		—	—		—		
	Remote AP monitor			○		○		○		○	○		○		
Program Edit	Background edit		○		○		○		○	○		○			
	Edit protection		○		○		○		○	○		○			
Data Transfer	NETWORK/FTP		○/○		○/○		○/○		○/○	○/○		○/○			
	DNC(Network)		○		○		○		○	○		○			
	DNC(USB)		—		—		○		○	—		○			
Information Display	Program simulation		○		○		○		○	○		○			
	Linear scale loss pulse auto detection		—		○		○		—	○		○			
Inclined Plane	Feature coordinate	G68.2(Incline plane machining)	—		—	△		—	—	—		—	△		
	Feature Coordinate Teach		—		—	△		—	—	—		—	△		
5 axis feature	5 Axis RTCP	G43.4(RTCP)	—		—		—		—	—		—	△		
	Smooth TCP	Smooth TCP	—		—		—		—	—		—	△		
G code command	High speed high precision	G05P10000	—		△	△		○		—	△		○	△	
	Smoothing path mode	G05.1	—		○		○		—	○		○	○		
	NURBS interpolation	G06.2	—		△	△		○		—	△		○	△	
	Thread cutting	G33	○		○		○		○	○		○	○		
	Auto tool measurement	G37	—		—	○		○		—	—		○		
	Tool offsets	G45~G48	—		○		○		—	○		○	○		
	Incline face machining	G68.2	—		—	△		—	—	—		—	△		
	Peck drilling cycle	G73	○		○		○		○	○		○	○		
	Left handed tapping	G74	○		○		○		○	○		○	○		
	Fine boring	G76	○		○		○		○	○		○	○		
	Drilling cycling	G81	○		○		○		○	○		○	○		
	Drilling cycle, spot boring	G82	○		○		○		○	○		○	○		
	Drilling cycle, counter boring	G83	○		○		○		○	○		○	○		
	Tapping cycle	G84	○		○		○		○	○		○	○		
	Boring cycle	G85	○		○		○		○	○		○	○		
	High speed boring cycle	G86	○		○		○		○	○		○	○		
Back boring cycle	G87	○		○		○		○	○		○	○			
Semi automatic Finishing boring cycle	G88	○		○		○		○	○		○	○			
Bottom Feed hold boring cycle	G89	○		○		○		○	○		○	○			