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# HIGH-SPEED HIGH-PRECISION CONTROLLER

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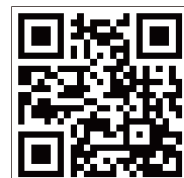
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Developing powerful and efficient CNC systems has long been Syntec's mission. With fast innovating PC technology and our dedicated research in both hardware and software, we are able to provide the best total solution of control system in the machine tool industry. Performance-wise, our outstanding High-Speed High-Precision (HSHP) functions are perfect for mold or high speed milling purposes. Multi-axis & multi-program applications allow Mill-Turning Machines to easily execute complicated simultaneous multi-tool cutting interpolations. Abundant G/M codes and friendly user interface allows inexperienced operators to quickly catch on to the Syntec control. More over, our integration capability and flexibility are a great match for machine builder to develop unique application for specialized products at will. Syntec's professional and responsible engineer regiment provide solid and instant technical support; and our passionate service teams are able to help any customer globally. We leave you no worry to reach end users, and we are always standing by to deliver on-demand, unlimited backup.

Syntec will always be your best technical and service partner.

## SIMPLICITY & CONVENIENCE

- Machining preparation, dry run function, clear and easy -to-use machining monitor.
- Complete operating support, and customized help screens.
- 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 4000 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.





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## 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 on PC.
- Provide optional vision system or pick-and-place equipments for highly automated integration solutions.

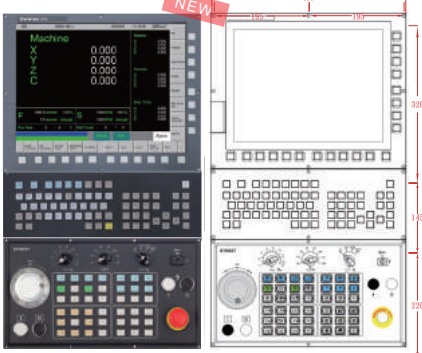
## Application

- 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.

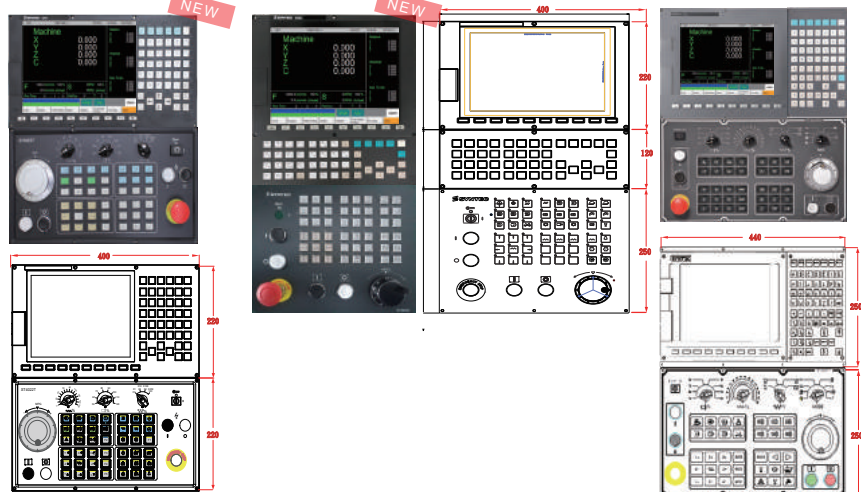
## SYNTEC Lathe Controller

Mono block controller features high standardization, low wiring costs and low floor area. Significantly reduces wiring costs and space requirements, therefore improved CP value. Combined with the latest M2/M3 embedded technology of Ethernet-based serial communication methods, customers are provided with better servo control functionalities and more comprehensive integration of electric machinery.

### 15 inches



### 10 inches



### 8 inches Lathe Controller



Controller type	Standard			General Mill-Turn								Multi - Axis Group Mill-Turn					
	6TA	6TB	6TA-E	11TA**	21TA	21TA-E	21TB	21TB-E	22TA	22TB	11TB	200TB-5	210TB-H	210TB-H5	220TB	220TB-5	
Axis no.	3	4	3(4)	4			6(8)		4	6(8)	8	12(16)	12(16)		12(16)		
DA	2			2						-	2	1	2		-		
Max I/O	32/32			32/32	96/96				128/128		128/128	96/96	96/96		128/128		
Display	8"			10.4"	8"/10.4"				8"/10.4"/15"		10.4"	8"/10.4"	8"/10.4"/ rear half		10.4"/15"		
Servo	General Purpose		M3/ECAT/RTEX	General Purpose	M2	M3/ECAT/RTEX		M2	M3/ECAT/RTEX		M3/ECAT/RTEX	General impulse	M2	M2/M3/ECAT/RTEX		M3/ECAT/RTEX	
VGA	-			-						-		-	0	0*		-	
Connection	Ethernet RS485		Ethernet RS485 SRI	Ethernet RS485						Ethernet RS485 SRI		Ethernet RS485	Ethernet RS232 RS422 RS485	Ethernet RS485 SRI		Ethernet RS485 SRI	
Multi-Program No.	1		1	2						2		2	4	4	4	4	4
Memory	256MB		512MB	512MB						4GB		512MB	256MB	4GB	4GB	4GB	4GB
Inclined Plane process	-			-									△	-	△	-	△
HPCC	-			-									△	-	△	-	△

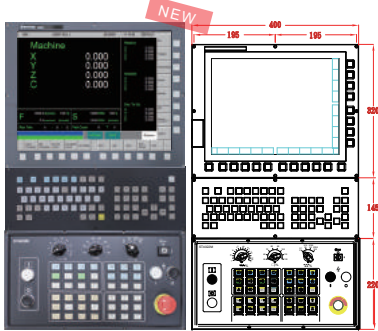
\*VGA is only provided for the rear half

Marking: "o" denotes standard function; "△" denotes optional function; "-" denotes none.

# SYNTEC Milling Controller

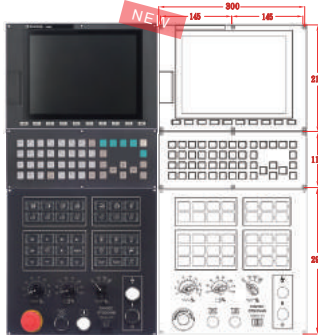
Controllers use the latest embedded technology to give high efficiency, stability and reliability. Communication supports M2, M3 Ethernet-based serial communication that reduces noise interference and further provides better control synchronization of multi-axis as well as scalability for integration with electric machinery.

## 15 inches

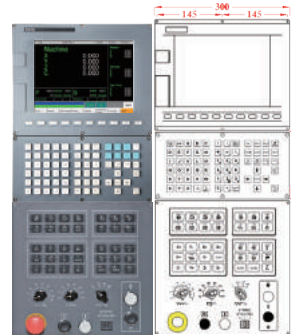


Keyboard: VK15  
 Panel: ST4022M

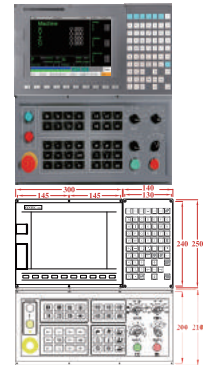
## 10 inches



Keyboard: VK10  
 Panel: 3030M5

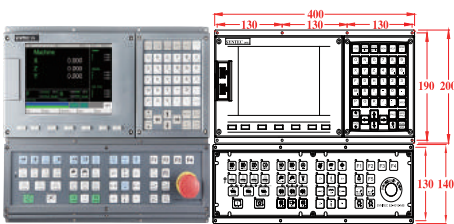


Keyboard: VK  
 Panel: 3030M3

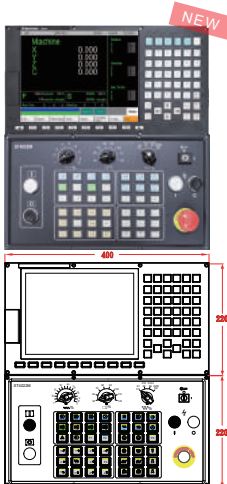


Keyboard: HK  
 Panel: 4421M2

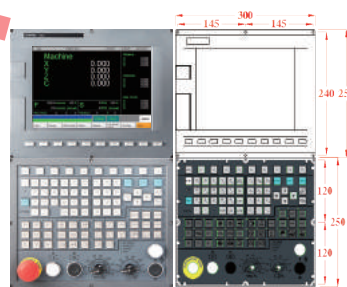
## 8 inches



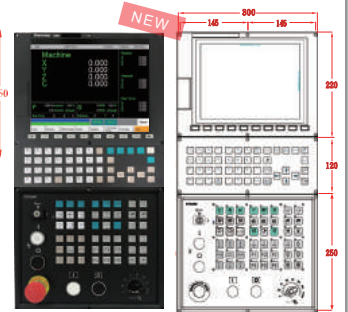
Panel: 4012M



Panel: ST4022M



Panel: SK6M



Keyboard: VK10  
 Panel: 3025M

Controller type	Standard				Multi-Function Milling					Composite Milling				Five-Axis					
	6MA	6MB	6MA-E	6MB-E	11MA	11MB	21MA	21MA-E	22MA	210MA-H	210MB-H	220MA	220MB	200-MA-5	200MB-5	210MA-H5	210MB-H5	220MA-5	220MB-5
Axis no.	3	4	3	4(5)	4	8	6	6	6	8(9)	12(16)	8(9)	12(16)	8(9)	12(16)	8(9)	12(16)	8(9)	12(16)
DA	2				2				-	2		-		1		2		-	
Max I/O	32/32				32/32	128/128	96/96	96/96	128/128	96/96	128/128	(RIO-M3 IO-SRI)	96/96	96/96	96/96	128/128	(RIO M3 IO SRI)	128/128	
Display	8				10.4/rear half		8/10.4/12/15	8/10.4/15	8/10.4/15	10.4/rear half		10.4/15	10.4/15		10.4		10.4/15		
Servo	General Purpose		M3/ECAT/RTEX		General Purpose		M2	M3/ECAT/RTEX	M3/ECAT/RTEX	M2/M3/ECAT/RTEX		M3/ECAT/RTEX		M2		M2/M3/ECAT/RTEX		M3/ECAT/RTEX	
VGA	-				-				-	○*		-		○		○*		-	
Connection	Ethernet RS485				Ethernet RS485			Ethernet RS485 SRI	Ethernet RS485 SRI	Ethernet RS485 SRI		EthernetRS485 SRI		Ethernet RS232 RS422 RS485		Ethernet RS485 SRI		Ethernet RS485 SRI	
Mult-Program No.	2				2				2	4		4		4				4	
Memory	256MB		512MB		512MB				4GB	4GB		4GB		256MB				4GB	
RTCP	-				-				-	-	-	-	-	△		△		△	△
Inclined Plane Process	-				-		△		△	-	-	-	-	△		△		△	△
HPCC	-				○				○		○		△		○				

\*VGA is only provided for the rear half

Marking: "o" denotes standard function; "△" denotes optional function; "-" denotes none.



## Versatile panel layout

Dual  
USB



Ethernet, RS485



Variable control panel  
option



Product 6TA 6TB 6TA-E

Product	6TA	6TB	6TA-E
Axis no.	3	4	3 (4)
Spd no.	2	2	4
Multi-Program no.	2	2	1
DA no.	2	2	2
IO no.	32/32	32/32	32/32

- Lately developed hardware design for application of 2-4-axis lathes
- Enclosed design without CF card.
- Highly reliable motherboard.
- USB and network supported.
- Comprehensive lathe functionalities
- 6TA-E supports serial communication such as

Brand new hmi for agile operation and easy learning

Offers 6 series for versatile product selection and panel layout.

## SYNTEC serial package solution

Controller servo integration screen

SYNTEC 22TA/B serial lathe controller



/ Drive auto fine-tune function/



/ Axial and spindle load ratio monitoring/



MECHATROLINK

Yaskawa Axis motor



SYNTEC spindle package

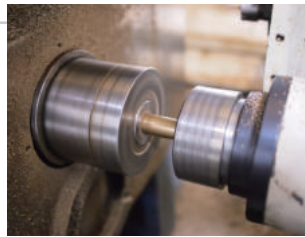
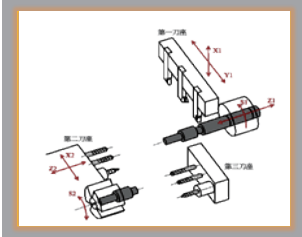


## Multi-Program Mill-Turn Solution



- 200, 210, 220 series
- Up to 4 axis groups controlled
- Simultaneous execution of 4 independent program paths

## Dual-paths Mill-Turn Solution



- Dual-paths interface
- Dual-paths 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

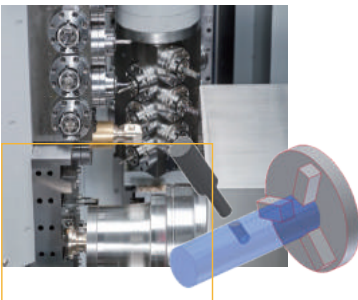
## Turning function: Specific, Powerful, Practical



### Extreme Speed Threading Mode

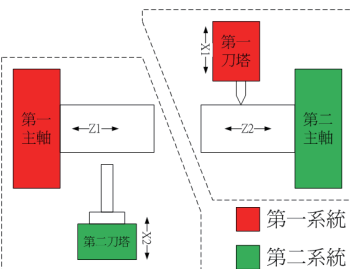
Overlapping technology improves tool retraction in threading cycle.

1000 Times Threading	General Threading
G21 Threading	36789(Sec)
G78 Threading	24685(Sec)



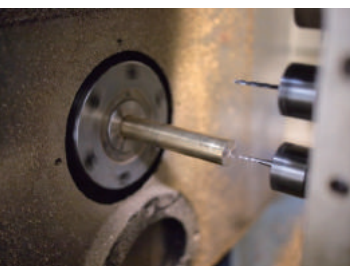
### Tilted Plane Machining

Function of rotating coordinates simplifies 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 path 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.



### Synchronized Tapping

Spindle has no need to decelerate or stop, the dynamic control of tapping-head allows spindle to remain rotating while tapping. This significantly reduces the tapping time.



## SYNTEC milling machine serial controller



### Powerful Controller with M3 Bus Protocol

SYNTEC serial controller supports yaskawa M2/M3 ethernet-base serial communication system, significantly increasing band width to 100mbps; max. Resolution up to 24bit, effectively improves smoothness of process.

### High Speed, High Precision, High Quality

SYNTEC serial controller is capable of processing 2000 single segments and possesses versatile advanced high-speed high precision functions such as smooth precision advanced (SPA), high precision contour control (HPCC), process path smoothing, multi-group processing conditions (G120.0), quick parameter setting, quick threading tool retraction, multi-spindle synchronous threading, which is the optimal choice for high efficiency and high precision in the milling machine industry.

### Flexible & Competitive Solution

SYNTEC serial controller is capable of controlling 4-16 CNC axes if required; supporting ROT servo elements; exclusion of tool magazine motor from total axes facilitates higher flexibility in axes combination. In addition to general interface and da interface, the spindle may also be combined with SYNTEC serial communication spindle package for higher definition and better processing performance. Capable of external connection with SYNTEC communication IO modules via SRI interface for free allocation of IO contacts based on actual needs.



## Machining Serial Bus Solution

### Machining Serial Bus Solution



#### Yaskawa axis motor



#### Syntec spindle set



#### Syntec DD motor



#### Syntec servo magazine



### High Performance & Better Configuration

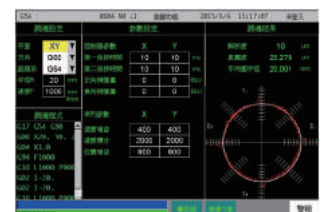
#### Syntec latest Milling machine serial bus solution

- 22MA milling machine controller
- High definition drive
- Axial optical ruler (option)
- SYNTEC HD spindle electric machinery package
- SYNTEC DD fourth axis, fifth axis
- Central water outlet spindle electric machinery (option)
- High-speed spindle positioning
- High-speed rigid threading
- High-speed high precision (HPCC) function

### Highly integrated configuration and diagnostic



/ Axis and spindle setting /



/ Serial bus oscilloscope /

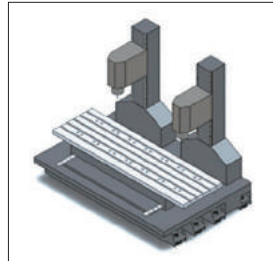
## Mill Function

### 攻牙快速退刀

退刀百分比	100%	150%	200%	300%
百孔時間	310	273	255	240
節省百分比	-	11.94%	17.74%	22.58%

- 攻牙退刀速度可參數設定，最高可達300%
- 同時支援鐘型加減速，兼顧速度及機台平穩性

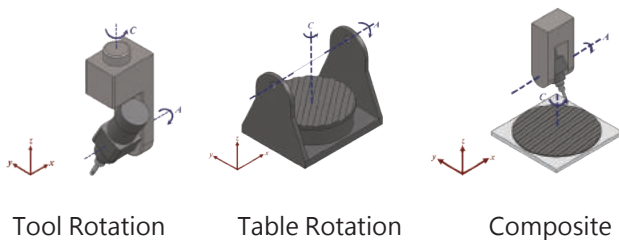
### 多主軸攻牙



- 提供單機多主軸方案，對應相同程式，達到單機多產的效果
- 可根據加工條件不同，彈性選擇加工主軸
- 支援多主軸攻牙，提高生產效率
- 最高可支援至6主軸

## Five-Axis Control Function(Optional Feature for Special Controller)

### Support Various Types of Five-Axis Compensation



Tool Rotation

Table Rotation

Composite

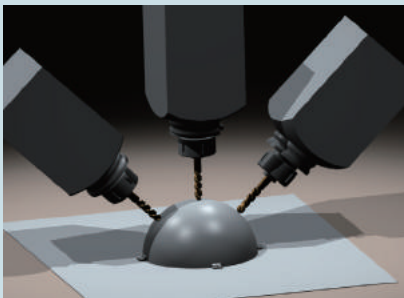
### Tilt Working Plane Machining

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 )

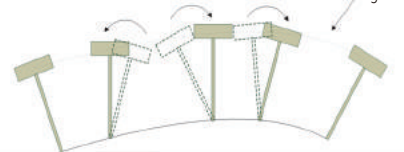
特定機型可選配

Imperfect Tool Angle Generated by CAM Software  
cutting angle various resulting in poor surface smoothness



Smoother Tool Angle

decrease cutting angle variation, increase surface smoothness and shorten cutting time



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

## High Efficiency Machining

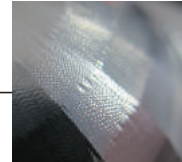
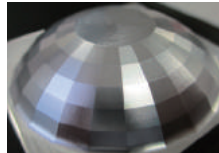
### High-Speed, High-Precision Machining (HSHP)



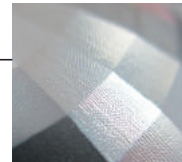
The WinCE system can process 1000 blocks and look-ahead 2000 blocks each second. These enable smooth motion and enhance surface quality. In order to advance the precision, HSHP function also controls the corner and arc feedrate

### Smooth Precision Advanced (SPA)

High-Speed Machining



SPA OFF



SPA ON

Due to limitation of machine condition, servo mismatch can be found even the servo loop gain has been optimized. This error causes dimensional shrinkage especially in high-speed machining. SPA

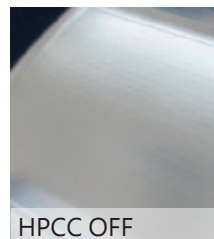
### Path Smoothing Feature



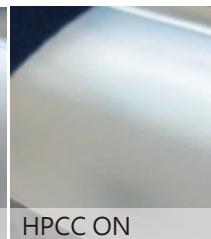
Enhance the brightness of the surface and reflect obviously

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)



HPCC OFF



HPCC ON

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)



Loading and running the programs from external devices(USB disk, Ethernet) directly, which saves the disk space and the time for transferring huge programs.



## User Friendly Operation Interface

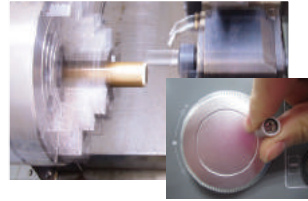
Users can get started easily and immediately operate it right for the first time.

### Graphic Conversational Input



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

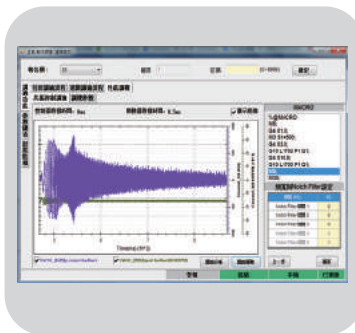
### My Favorites



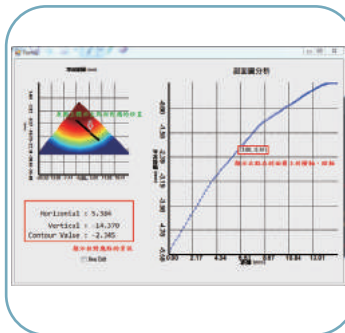
New F6/F7/F8 [My Favorites] function key allow user or machine maker to set their favorite interface shortcut and access designated interface faster.

## M&E integration analysis platform

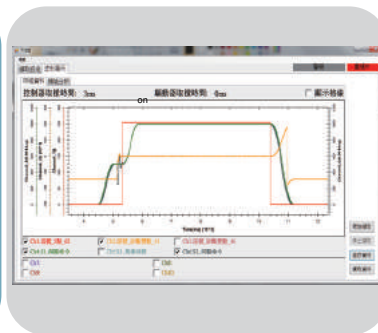
SYNTEC provides analysis software to assist electrical control personnel adjusting servo gain promptly; also provides analytic tools capable of graphitize NC commands and feedbacks, enabling electrical control personnel quick identification of any root cause.



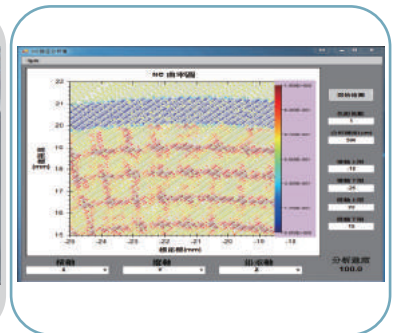
Comprehensive servo adaptation function



neighboring channel analysis

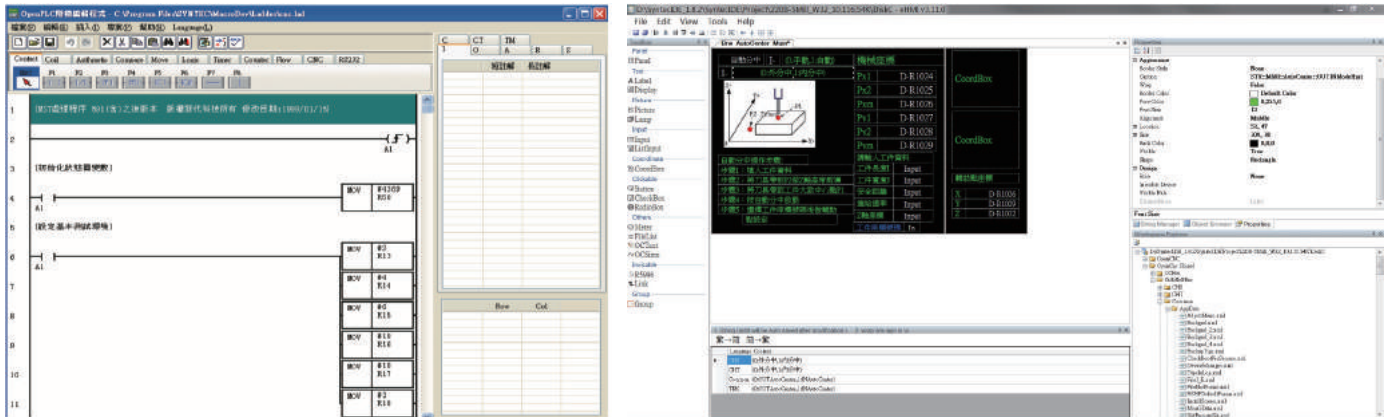


PLC interface sequential analysis



3D curvature analysis

## Introduction - Open Platform, Easy to Learn and Easy to Use Environment

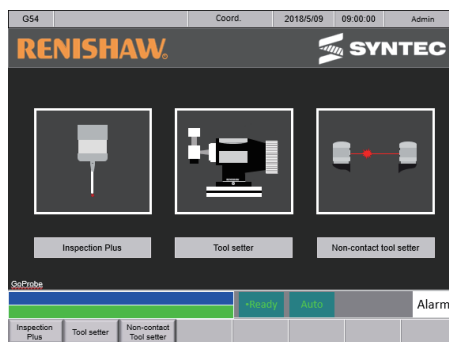


PLC edit tool supports open file, save, notes, long remark, cut, paste, copy and syntax check.

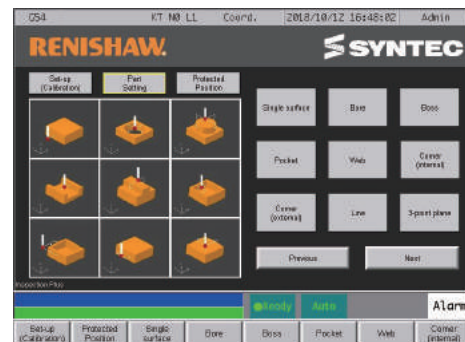
Easy to understand EHMI development tool, edits the screen just by dragging elements, effectively shortens time of project development.

## Master controller integrated measuring function

Jointly developed with Renishaw, an on-line measuring HMI.



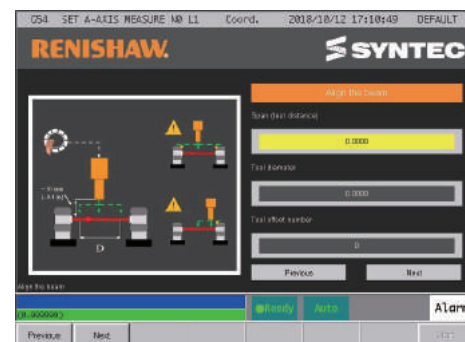
Measuring function portal



Inspection plus work



AXISSET 5-axis error measurement



NC4 tool measuring

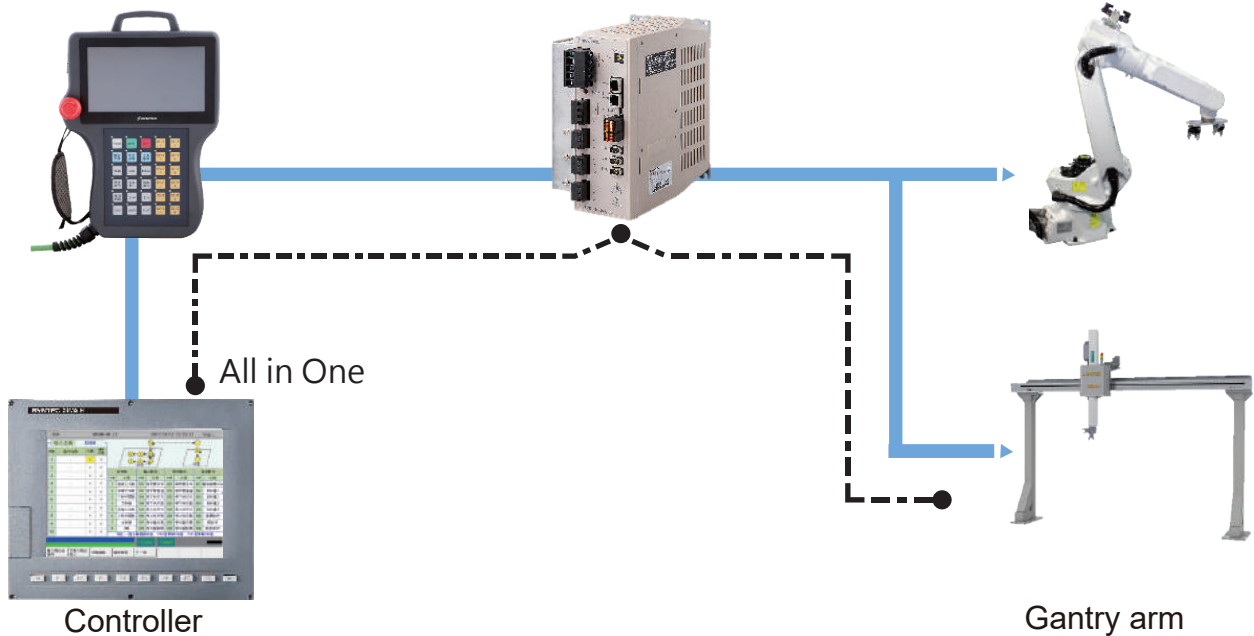
- Jointly developed with renishaw, including:
  - Probe work measuring (Inspection plus)
  - Contact tool measuring (RTS)
  - Non-contact tool measuring (NC4)
  - Five-axis mechanism error measurement solution (AXISSET)
- Calibration and measurements are accomplished via dialogic proprietary measuring HMI for easy operation and time and effort saving.

## Syntec Robotics Pick and Place Solutions

81R Handheld controller

All-in-one drivers

Robot arm



- Highly integration between controller and robotic arm to minimize the automation barriers
- All in One: By using multi-axis structure to control truss arm and to meet the demands of pick and place
- Available for secondary development to modify for own specialties

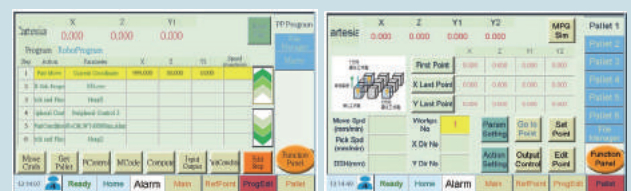
## Features of Robotic Arms

### 81R supports various types of arms



- Supports various types of arms (SCARA 、 six -axis arm 、 DELTA 、 4 axis robot...)
- Synchronize movement and end point linear motion control

### 81R & All in One teaching features



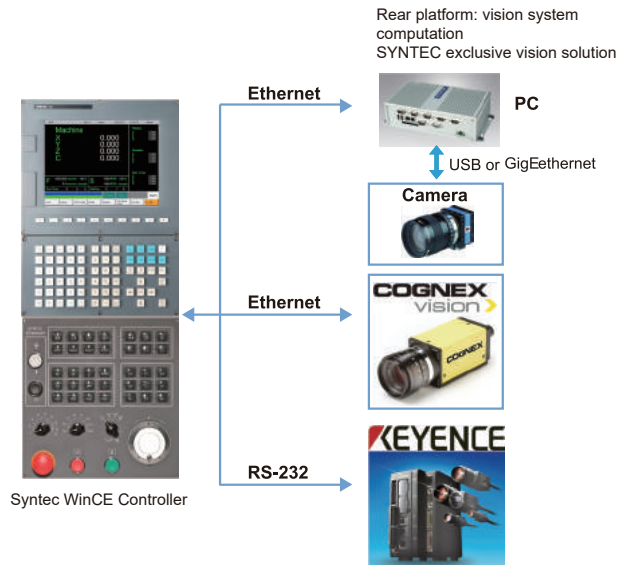
- Make it easier with conversational teaching
- Special material plate setup and module
- Reduce the teaching time by setting up reference point



## 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 and teaching interface, supports up to 4 CCDs, and is very convenient for users'setting.

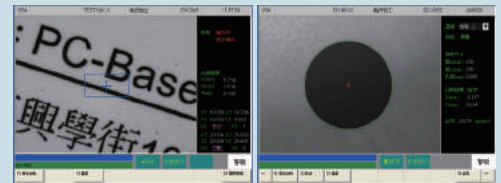


- **Easy to Operate**  
All operations can be reached on the controller, another monitor or control box is unnecessary.
- **Easy to Use**  
Provide standard alignment macro for general application. For different size of work piece, users only need to modify parameters.
- **Easy to Set Up**  
Provide 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.

## Syntec Vision Package

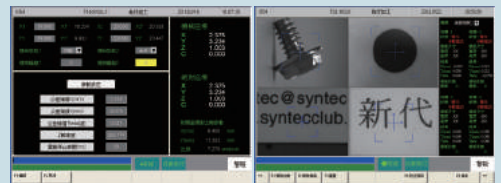
Feature	A type Economical,dedicated	B type All with fixed distance	C type All with different distance
Appliance	Glass Metal mark	Glass: rarely Other: OK	All
Camera	1.3 megapixel CCD  USB Interface DMK-72AUC02  GigE:DMK-23K445		
Lens	Telecentric Lens (coaxial) 	Telecentric Lens 	CCTV Lens 
Lighting	Spot 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	110mm	110mm	110mm-500mm

## Identify Targets



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

## Standard Visual Pages



- Includes parameter setting
- Multiple camera display

## 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

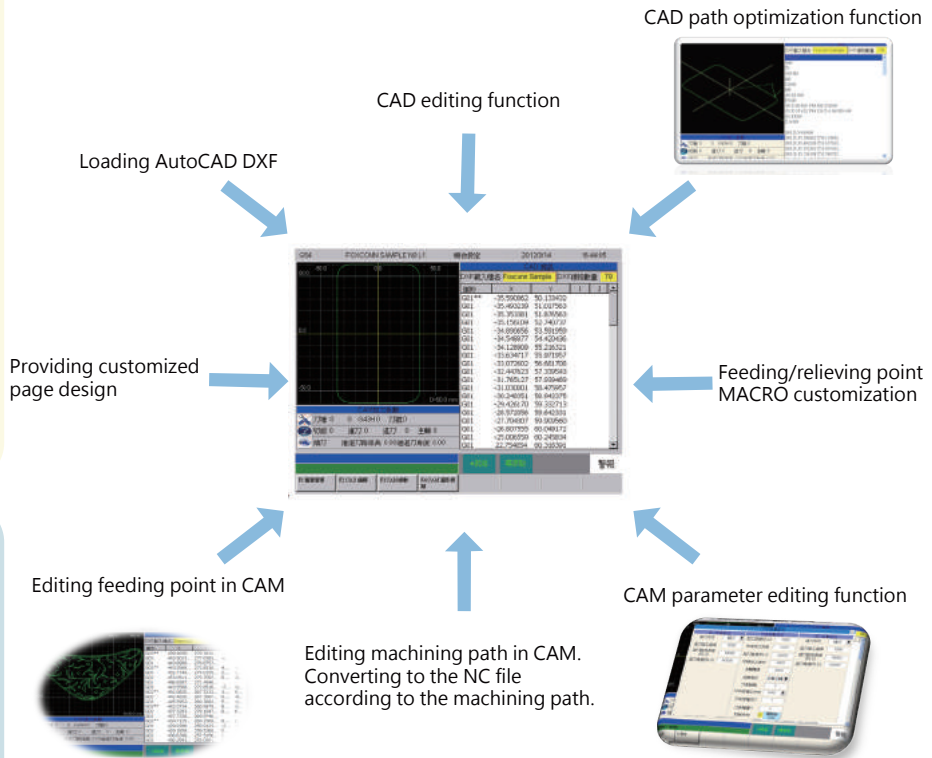
### Open Development Platform

#### Function of Editing CAM Parameter

SYNTEC provides customers with CAM parameters page to self-define or self-customize dedicated customized surface.

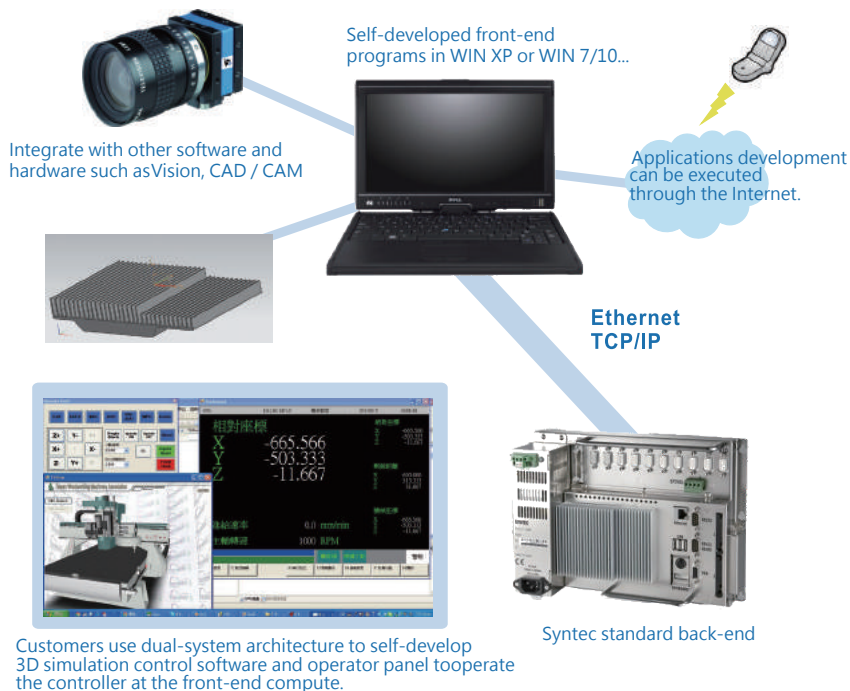
#### MACRO Program to Set Tool Feeding/Relieving In CAM

SYNTEC provides customers with CAM parameters page to self-define or self-customize dedicated customized surface.



## 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

				General purpose				Serial											
				6 series		11 series		6 series	21 series				22 series		200 series	210 series		220 series	
Category	Item	Unit	Remark	TA	TB	TA**	TB	TA-E	TA	TA-E	TB	TB-E	TA	TB	TB-5	TB-H	TB-H5	TB	TB-5
Product spec	Max. Axes group in system	Axes group		1	2	2		1	2				2		4	4		4	
	Max. PLC axes group	Axes group		—	1	1		—	1				1		3	3		3	
	Standard controlled axes (standard)	Axis		3	4	4	8	3	4	6		4	6	12	12	12	12	12	
	Max. controlled axes (option)	Axis		3	4	4	8	4	4	8		4	8	16	16	16	16	16	
	Max. Number of spindles	Axis		2		2		6	1	2	4		2	4	6	6		6	
	Max. Axes in synchronous control (single axes group)	Axis		3	4	4	4	3	4	4		4	4	5	4	5	4	5	
	Min. Control unit-mm			0.0001		0.0001		0.0001	0.0001				0.0001		0.0001	0.0001		0.0001	
	Max. Number of work coordinates system	Set		32		100		100	100	100		100		100	100	100		100	
	Max. Groups of tool compensation	Set		96		96		32	96	96		96		96	96	96		96	
	Number of multi-channel function groups	Set		4		4		4	4	4		4		4	4	4		4	
	Number of pre-read segments			64		1000		1000	1000	1000		1000		1000	2000	2000		2000	
Segment process time			300		1000		300	1000	1000		1000		1000	4000	1000	4000	1000	4000	
Hardware spec	Storage DISKA	MB		256		512		512	512				4096		256	4096		4096	
	I/O standard	Point		32/32		32/32	64/64	32/32	32/32	32/32		32/32		32/32	32/32	32/32		32/32	
	I/O optional	Point		None		None		128/128	—	96/96		96/96		128/128	96/96	96/96		128/128	
	DA	Set		2		2		2	2	2		—		2	2	2		2	
	Display	Inch		8		10.4		8	8/10.4	8/10.4		8/10.4/15		8/10.4	8/10.4/rear half***	10.4/15		10.4/15	
	CF card	Set	Frontal port	—		—		—	—		—		—		—	—		—	
	USB	Set		2		2		2	2	2		2	1	2	2	2			
	RJ-45	Set		1		1		1	1	1		2	2	1	2	2	2		
	VGA output	Set	Rear port	—		—		—	—		—		—		1	1***		—	
	PS/2	Set		—		—		—	—		—		—	1	—		—		
	RS-232	Set		—		—		—	—		—		—		1	—		—	
	RS-422	Set		—		—		—	—		—		—		1	—		—	
	RS-485	Set		1		1		1	1	1		1	—	1	1	1	1	1	
	USB	Set		—		—		—	—		—		2		2	—		2	
	SRI	Set		—		—		1	—	1	—	1	1	—	—	1	1	1	1
Servo control	General purpose (A/B phase)			0		0		—	—				—		—	—		—	
	General purpose (CW/CCW)			0		0		—	—				—		—	—		—	
	Mechatrolink II			—		—		—	0	—	0	—	—	0	0		0		
	Mechatrolink III			—		—		0	—	0	—	0	0	—	0	0		0	
	EtherCAT			—		—		0	—	0	—	0	0	—	0	0		0	
	RTEX			—		—		0	—	0	—	0	0	—	0	0		0	
Compensation	Back gap compensation			0		0		0	0		0		0	0	0	0		0	
	Pitch error compensation			0		0		0	0		0		0	0	0	0		0	
	Spike compensation			0		0		0	0		0		0	0	0	0		0	
	Temp. Rise compensation			0		0		0	0		0		0	0	0	0		0	
	2D compensation			0		0		0	0		0		0	0	0	0		0	
	Handwheel simulation			0		0		0	0		0		0	0	0	0		0	
Operation	Program empty run			0		0		0	0		0		0	0	0	0		0	
	Selective stop			0		0		0	0		0		0	0	0	0		0	
	Segment execution			0		0		0	0		0		0	0	0	0		0	
	Virtual handwheel			0		0		0	0		0		0	0	0	0		0	
	Pause point start			0		0		0	0		0		0	0	0	0		0	
	Tool interrupt point start			0		0		0	0		0		0	0	0	0		0	
	Tool retract			—		—		—	—		—		—	—	—	—		—	
	Offset setting			0		0		0	0		0		0	0	0	0		0	
	Handwheel offset function			—		—		—	—		—		—	—	—	—		—	
Program input	Selective jump			0		0		0	0		0		0	0	0	0		0	
	B-STOP/ program end			0		0		0	0		0		0	0	0	0		0	
	Absolute zero coordinates system	G92/G92.1		0		0		0	0		0		0	0	0	0		0	
	Interrupt MACRO	M96/M97		0		0		0	0		0		0	0	0	0		0	
	M 198 call subroutine			0		0		0	0		0		0	0	0	0		0	
	G-code extension			0		0		0	0		0		0	0	0	0		0	
High speed high precision	Constant Jerk control			0		0		0	0		0		0	0	0	0		0	
	Cross-segment S-curve acceleration/ deceleration			0		0		0	0		0		0	0	0	0		0	
	Auto deceleration at corner			0		0		0	0		0		0	0	0	0		0	
	Corner radius speed limit			0		0		0	0		0		0	0	0	0		0	
	Multiple high speed high precision parameter set			—		—		—	—		—		—	—	—	—		—	
	User quick parameter			—		—		—	—		—		—	—	—	—		—	
	SPA function			—		—		—	—		—		—	—	—	—		—	
	Virtual circle radius function			0		0		0	0		0		0	0	0	0		0	
	High speed high precision control mode i	G05.1Q1		—		—		—	—		—		—	—	—	—		—	
High speed high precision control mode ii	G05P1000 0		—		—		—	—		—		—	—	—	—		—		
NURBS interpolation function			—		—		—	—		—		—	—	—	—		—		



Tool management	Auto tool align screen		—	—	—	—	—	—	—	—	—
	Auto work measurement	Renishaw h/w required	0	0	0	0	0	0	0	0	0
	Tool lifespan management	Only the screen; function requires customization	0	0	0	0	0	0	0	0	0
Auxiliary function	Mechanical lock (R-Bit)		0	0	0	0	0	0	0	0	0
	Software travel limit		0	0	0	0	0	0	0	0	0
	Spindle speed detection		0	0	0	0	0	0	0	0	0
	Axial coupling function		0	0	0	0	0	0	0	0	0
	Axial dynamic coupling function		0	0	0	0	0	0	0	0	0
	Feedback coupling function		0	0	0	0	0	0	0	0	0
	Threading quick tool retract		0	0	0	0	0	0	0	0	0
	Virtual axis function		0	0	0	0	0	0	0	0	0
	Axle exchange function		0	0	0	0	0	0	0	0	0
	Axial torque control		—	—	0	0	0	0	0	0	0
	Serial adjustment function (CNC axis)		—	—	0	0	0	0	0	0	0
	Driver data display (CNC axis)		—	—	0	0	0	0	0	0	0
	Spindle adaptation function (CNC axis)		—	—	0	0	0	0	0	0	0
	Serial PLC axis		—	—	0	0	0	0	0	0	0
	High speed spindle positioning	SYNTEC spindle required	—	—	0	0	0	0	0	0	0
	ROT element		—	—	0	0	0	0	0	0	0
	Dipole foreground/ background configuration		—	0	—	0	0	0	0	0	0
	Data backup and recover	Maker backup	0	0	0	0	0	0	0	0	0
	Start-up screen customization		0	0	0	0	0	0	0	0	0
	My favorite	Only support ARM 8-key system	—	0	0	0	0	0	—	0	0
Programming	Project protection function		0	0	0	0	0	0	0	0	0
	Access management		0	0	0	0	0	0	0	0	0
	Remote AP monitoring		0	0	0	0	0	0	0	0	0
	Background edit		0	0	0	0	0	0	0	0	0
PLC	Edit protection		0	0	0	0	0	0	0	0	0
	Real time syntax check of processing program		0	0	0	0	0	0	0	0	0
DATA TRANSFER FUNCTION	PLC diagnosis function (FORCE I-point)		—	0	0	0	0	0	0	0	0
	NETWORK		0	0	0	0	0	0	0	0	0
	FTP		0	0	0	0	0	0	0	0	0
	RS-485		0	0	0	0	0	0	0	0	0
	DNC(Network)		0	0	0	0	0	0	0	0	0
Data display	DNC(USB)		0	0	0	0	0	0	0	0	0
	Operation history display		0	0	0	0	0	0	0	0	0
	Graphic simulation		0	0	0	0	0	0	0	0	0
	Partial graphic simulation		0	0	0	0	0	0	0	0	0
G-code	Dynamic multi-language switch-over		—	0	0	0	0	0	0	0	0
	Oval cutting (clockwise)	G02.1	0	0	0	0	0	0	0	0	0
	Parabolic cutting (clockwise)	G02.2	0	0	0	0	0	0	0	0	0
	Cylinder interpolation	G07.1	0	0	0	0	0	0	0	0	0
	Start-up polar coordinates	G12.1	0	0	0	0	0	0	0	0	0
	OD/ID turning cycle	G20	0	0	0	0	0	0	0	0	0
	Threading cycle	G21	0	0	0	0	0	0	0	0	0
	Intermediate threading feed cycle	G21.2	0	0	0	0	0	0	0	0	0
	End face turning cycle	G24	0	0	0	0	0	0	0	0	0
	Jump function	G31	0	0	0	0	0	0	0	0	0
	Treading	G33	0	0	0	0	0	0	0	0	0
	Variable pitch threading	G34	0	0	0	0	0	0	0	0	0
	Polygon turning	G51.2	0	0	0	0	0	0	0	0	0
	Work coordinates system setting	G54~G59.9	0	0	0	0	0	0	0	0	0
	Mirror function (lathe)	G68	0	0	0	0	0	0	0	0	0
	Complex turning cycle	G72~G78	0	0	0	0	0	0	0	0	0
	Fixing cycle for drilling	G80 , G83-G89	0	0	0	0	0	0	0	0	0
	Absolute zero coordinates system preset	G92.1	0	0	0	0	0	0	0	0	0
	Inverse time feed	G93	—	—	—	—	—	—	—	—	—
	Constant surface cutting speed	G96	0	0	0	0	0	0	0	0	0
	Spindle synchronization function	G114.1	—	—	0	—	0	0	0	0	0
	Spindle load function	G114.3	—	—	0	—	0	0	0	0	0

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 O: standard function,  
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 -: Not available function

## Dedicated Milling Functions

				Pulse Train					Serial BUS							
				6 Series		10 Series		11 Series		6 Series		21 Series		200 Series		
	Items	Units	Remark	MA	MB	MF	MA	MB	MD	MD-H*	MA	MA-H*	MA	MA-5	MB	MB-5
Product Specification	Max. PLC Controlled Paths			2		4		2	2		2		4			
	Max. PLC Controlled Paths			1		3		1	1		1		3			
	Standard Axis	Axis		3	4	8	4	8	4		6		8		12	
	Max. Axis (Optional)	Axis		3	4	8	4	8	5		6		9		16	
	Max. Spindle	Axis		1	2	6	2	4	2		4		6			
	Max. Simultaneous Axis Control	Axis		3	4	4		4	4		4		4	5	4	5
	Min. Control	mm		0.0001		0.0001		0.0001	0.0001		0.0001		0.0001			
	Max. number of program coordinate	Set		32		100		100	32		100		100			
	Max. Number of Table Tools	Set		96		96		96	96		96		96			
	Multi-Channel Function Group	Set		4		4		4	4		4		4			
Look-Ahead Blocks no.	Blocks/Sec		100		2000		1000	100		2000		2000				
Block Processing time	Blocks/Sec		300		3000		2500	600		2500		3000	4000	3000	4000	
Hardware Specifications	Storage(DISK A)	MB		256		256		512	512		512		256			
	Standard I/O	—		32/32		64/64	32/32	64/64	32/32		32/32		32/32			
	Optional I/O	—		—		128/128	—	128/128	—		96/96		96/96			
	DA	Set		2		1		2	2		2		1			
	Monitor	Inch	Front side	8		10.4		10.4	8		8/10.4/12/15		10.4/15			
	CF Card	Set		—		1		—	—		—		1			
	USB	Set		2		1		2	2		2		1			
	CF Card	Set	Back side	0		2		0	0		0		2			
	RJ-45	Set		1		2		1	1		1		2			
	VGA Output	Set		0		1		0	0		0		1			
	PS/2	Set		0		1		0	0		0		1			
	RS-232	Set		0		1		0	0		0		1			
	RS-422	Set		0		1		0	0		0		1			
	RS-485	Set		1		1		1	1		1		1			
	USB	Set		0		2		0	0		0		2			
SRI	Set	—			—		—	—	1		—		1		—	
Servo Control	Pulse Train (A/B Phase)			0		0		0	—		—		—			
	Pulse Train (CW/CCW)			0		0		0	—		—		—			
	Mechatrolink II(Yaskawa serial bus)			—		—		—	0		0		0			
	Mechatrolink III(Yaskawa serial bus)			—		—		—	—	0	—	0	—			
Compensation	Backlash Compensation			0		0		0	0		0		0			
	Pitch Error Compensation			0		0		0	0		0		0			
	Angular Error Compensation			0		0		0	0		0		0			
	Temperature Error Compensation			0		0		0	0		0		0			
	2 Dimension Error Compensation			—		0		0	—		0		0			
Operation	MPG Simulation			0		0		0	0		0		0			
	Dry Run			0		0		0	0		0		0			
	Optional Stop			0		0		0	0		0		0			
	Single Block			0		0		0	0		0		0			
	Virtual MPG			0		0		0	0		0		0			
	Restart at Feedhold			0		0		0	0		0		0			
	Restart at Break Point			0		0		0	0		0		0			
	Tool Return			0		0		0	0		0		0			
Fixture Offsets			0		0		0	0		0		0				
MPG Offsets			0		0		0	0		0		0				
Programming	Optional Skip	Skip blocks starting with"/"		0		0		0	0		0		0			
	B-Stop			0		0		0	0		0		0			
	Absolute Zero Point Coordinate	G92/G92.1		0		0		0	0		0		0			
	Interrupt Macro	M96/M97		0		—		—	0		0		0			
	M198 call Subroutines			0		—		—	0		0		0			
	Expandable G Code			0		0		0	0		0		0			
HSHP	Constant Jerk Control			0		0		0	0		0		0			
	Multiblocks S-curve motion plan			—		0		0	—		0		0			
	Auto declaration in Corner			0		0		0	0		0		0			
	Speed Limit for Round Radius			0		0		0	0		0		0			
	Multiple Sets of HSHP Parameters			—		0		0	—		0		0			
	Quick Parameter Setup			—		0		0	—		0		0			
	SPA Feature			0		0		0	0		0		0			
	Virtual Radius Function (for Rotary Axis)			—		0		—	0		0		0			
	HSHP Control Mode I (G05.1 Q1)	G05.1 Q1		—		0		0	—		0		0			
	HSHP Control Mode II (G05P10000)	G05P10000		—		Δ		0	—		0		Δ			
NURBS Interpolation Ability			—		Δ		0	—		0		Δ				

				General Purpose					Serial BUS							
				6 Series		10 Series	11 Series		6 Series		21 Series		200 Series			
	Items	Units	Remark	MA	MB	MF	MA	MB	MD	MD-H*	MA	MA-H*	MA	MA-5	MB	MB-5
Tool Management	Auto Tool Setting			O	O	O			O		O			O		
	Auto Tool Management	Works with Renishaw hardware only		O	O	O			O		O			O		
	Tool Life Management	Function needs to be customized		O	O	O			O		O			O		
Accessibility	Machine Lock (R bit)			O	O	O			O		O			O		
	Software Limit			O	O	O			O		O			O		
	Spindle Speed Arrival Check			O	O	O			O		O			O		
	Axis Synchronize Feature			O	O	O			O		O			O		
	Dynamic Axis Synchronize Feature			O	O	O			O		O			O		
	Dynamic Axis Synchronize Feature			O	O	O			O		O			O		
	Rapid Retraction for Rigid Tapping			O	O	O			O		O			O		
	Virtual Axis Feature			O	O	O			O		O			O		
	Axis Change Feature			O	O	O			O		O			O		
	Axial Torque Limit			—	—	—			O		O			O		
	Serial Bus Setting Feature(CNC Axis)			—	—	—			O		O			O		
	Driver Information Display(CNC Axis)			—	—	—			O		O			O		
	Spindle Application Feature(CNC Axis)			—	—	—			O		O			O		
	Serial Bus PLC Axis			—	—	—			O		O			O		
	ROT Element			—	—	—			O		O			O		
	Dipole Front and Back System			—	O	O			—		O			O		
	Data Backup Recovery	Maker Backup		O	O	O			O		O			O		
	Customized Opening Screen			O	O	O			O		O			O		
	My Favorites	Only Eight key system supports		—	—	O			—		O			O		
	Project Protection Feature			O	O	O			O		O			O		
	Limit Access Manager			O	O	O			O		O			O		
	Remote AP Monitor			O	O	O			O		O			O		
Program Edit	Background Edit			O	O	O			O		O			O		
	Edit Protection			O	O	O			O		O			O		
	Immediate Grammar Check			O	O	O			O		O			O		
PLC	PLC Diagnosis Feature(FORCE I Point)			—	O	O			O		O			O		
Data Transfer	Network			O	O	O			O		O			O		
	FTP			O	O	O			O		O			O		
	RS-485			O	O	O			O		O			O		
	DNC(NETWORK)			O	O	O			O		O			O		
	DNC(USB)			O	—	O			O		O			O		
Information Display	Operation CV Display			O	O	O			O		O			O		
	Graphic Simulation			O	O	O			O		O			O		
	Partial Graphic Simulation			O	O	—			O		O			O		
	Dynamic Multi-Language Switch			—	O	O			O		O			O		
Inclined Plane	Feature Coordinate(Inclined Plane Process)	G68.2,G68.3		—	Δ	—			—		Δ			Δ		
	Feature Coordinate Teach			—	Δ	—			—		Δ			Δ		
5 axis feature	5 Axis RTCP	G43.4		—	—	—			—		—		—	Δ	—	Δ
	Smooth TCP			—	—	—			—		—		—	Δ	—	Δ
G code command	High Precision Locus Control Mode	G05P10000		—	Δ	O			—		O			Δ		
	Smoothing Path Mode	G05.1		—	O	O			—		O			O		
	NURBS Interpolation	G06.2		—	Δ	O			—		O			Δ		
	Thread Cutting	G33		O	O	O			O		O			O		
	Auto Tool Measurement	G37		O	O	O			O		O			O		
	Tool of Offsets	G45~G48		O	O	O			O		O			O		
	High Speed Peck Drilling Cycle	G73		O	O	O			O		O			O		
	Left Handed Tapping	G74		O	O	O			O		O			O		
	High Precision Boring Cycle	G76		O	O	O			O		O			O		
	Drilling cycling	G81		O	O	O			O		O			O		
	Chopping	G81.1		—	O	O			—		O			O		
	Bottom Feed Hold Drilling Cycle	G82		O	O	O			O		O			O		
	Peck Drilling Cycle	G83		O	O	O			O		O			O		
	Tapping Cycle	G84		O	O	O			O		O			O		
	Boring Cycle	G85		O	O	O			O		O			O		
	High Speed Boring Cycle	G86		O	O	O			O		O			O		
	Back Boring Cycle	G87		O	O	O			O		O			O		
	Semi Automatic Finishing Boring Cycle	G88		O	O	O			O		O			O		
	Bottom Feed Hold Boring Cycle	G89		O	O	O			O		O			O		
	Multi-Group HSHP Parameter	G120.1		—	O	O			O		O			O		

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