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WUHAN HUAZHONG NUMERICAL CONTROL CO.,LTD

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股票简称：华中数控
股票代码：300161



HNC8 High Performance CNC Controller

WUHAN HUAZHONG NUMERICAL CONTROL CO.,LTD



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Table of HNC8 high-performance CNC system functions

Product	Matched machine tool	Basic parameter	Features	Intelligent function
<p>HNC-848 series High-grade Full-featured</p> 	<p>性能 ↑</p>  <p>Five-axis machine, heavy-duty machine, lathe mill combo</p>	<ul style="list-style-type: none"> • 17" color LCD screen (touch screen is optional) • Single panel version and upper-lower panel version are supported • Up to 9 feed axes and 4 spindles in each channel • 9 simultaneously controlled axes at maximum (RTCP is not supported) • Typical matching machine tool: mill lathe combo, 5-axis machine, cam grinder 	<ul style="list-style-type: none"> • High-speed high-precision control • 5-simultaneously-axis control • 5-axis auto calibration • 5-axis RTCP function • 5-axis large circular interpolation • Hyperbolic interpolation • 5-axis orientation machining • Synchronization control • Error compensation • Direct drive • Intelligent control • Lathe-mill combination • Multi-channel control • Seamless integration of CAM software • Touch screen is supported • Backlash elimination for multiple motors 	<ul style="list-style-type: none"> • IBig data of CNC machine tool • IBroken tool detection • IMachine health protection • ITechnological process optimization • IIntelligent tool life management • ICloud service • Thermal error compensation
<p>HNC-818 series Medium grade Compact</p> 	 <p>Turning center, high speed machining center, lathe mill combo, gantry machining center, grinder, horizontal machining center, glass cutting machine, high gloss machine</p>	<ul style="list-style-type: none"> • 12.1", 17" color HD LCD monitor (touch screen is optional) • Up to 2 channels • Up to 5 feed axes and 4 spindles in each channel • 3+2 simultaneously controlled axes at maximum (RTCP is not supported) • Typical matching machine tool: Longitudinal lathe, turning center, engraving-milling machine, glass cutting machine 	<ul style="list-style-type: none"> • High-speed high-precision control • Max. acceleration rate is 1.8G (3G when linear motor is mounted) • Dual channel control (optional) • Dual axis synchronization control • Full-closed loop control (optical grating, magnetic grating) • Supporting bidirectional 20000 points pitch error compensation • Auto measurement • Supporting deformation compensation both with sensor and without sensor (optional) • Machine assembly quality analysis software (optional) • Customization • Touch screen (optional) 	<ul style="list-style-type: none"> • IBig data of CNC machine tool • IBroken tool detection • IMachine health protection • ITechnological process optimization • IIntelligent tool life management • ICloud service • Thermal error compensation
<p>HNC-808 series Popular</p> 	 <p>CNC lathe, machining center</p>	<ul style="list-style-type: none"> • 10.4" HD LCD monitor • Single channel control • Up to 4 feed axes, 2 spindles • Up to 4 simultaneously controlled axes • Built-in UPS power supply • Typical matching machine tool: flat bed lathe, slant bed lathe, machining center, surface grinder, cylindrical grinder 	<ul style="list-style-type: none"> • Supporting NCUC, etherCAT bus protocols • 16,000,000PPR high-precision encoder • Supporting high-speed asynchronous spindle motor\permanent magnet synchronous spindle motor • 8000rpm high-speed rigid tapping (permanent magnet synchronous spindle motor) • Supporting bidirectional 20000 points pitch error compensation (optional) • Customization (optional) • Supporting TCP/IP, Ethernet communication protocols 	<ul style="list-style-type: none"> • IBig data of CNC machine tool • IBroken tool detection • IMachine health protection • ITechnological process optimization • IIntelligent tool life management • ICloud service • Thermal error compensation

CNC System

Lathe system



HNC-808XP-T
9-inch



HNC-808Di-T
10.4-inch



HNC-818Di-T
12.1-inch

Grinding system



HNC-808xp-G
9-inch



HNC-808Di-G
10.4-inch

Milling/machining center system



HNC-808Di-M
10.4-inch

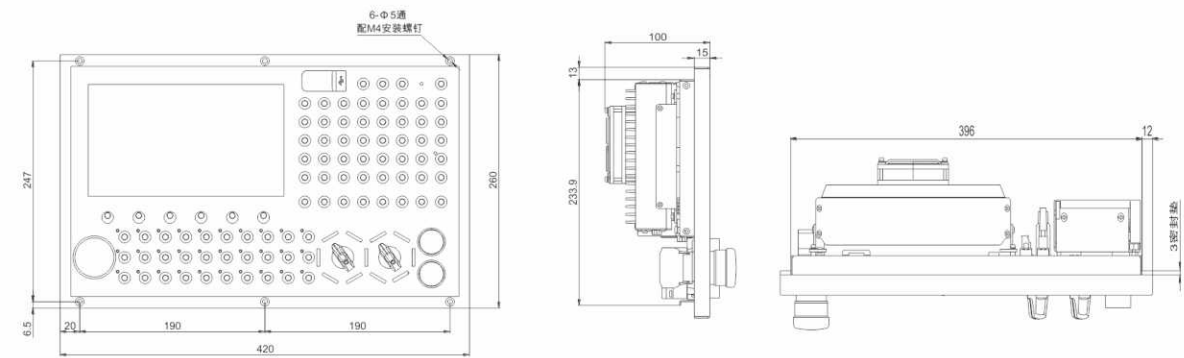


HNC-818Di-M
12.1-inch



HNC-848Di-M
17-inch

HNC-808XP series install dimensions



Servo Drive

HSV-160 series low voltage servo drive



- AC220V input
Supporting NCUC bus and pulse interfaces
- Two encoder types: standard, full function

HSV-180 series high voltage servo drive



- AC380V input
- Two series: feed axis drive, spindle drive
- For spindle, NCUC and Ethercat are supported
- For analog control, feed axis supports NCUC bus and pulse interfaces
- Two encoder types: standard, full function

HSV-130 series all-in-one servo drive



- AC380V input
- All-in-one modular structure
- Composition of modules: power supply module, servo module, spindle module
- Supporting NCUC bus interface

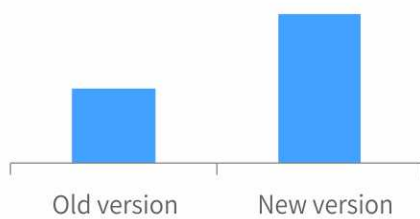
Basic performance improvement of servo drive

New servo parameter self-tuning function → Servo gain and filter are automatically configured based on the measured load inertia

Improving servo current loop response → Achieving higher gain and higher control precision

Optimizing notch filter, adding vibration suppression filter → Reducing actual output current drop caused by notch filter and improving overload capacity

Feed servo current response doubled



High response, high precision

Higher servo gain, achieving high speed high precision machining



Overcut and chatter marks at corner

The corner is uniform and bright, and there is no chatter marks

Servo motor

LDD series low voltage feed motor



- High-torque density
- High-efficiency density
- Low cogging torque
- High stability
- Excellent product consistency

GK series high voltage feed motor



- High torque, high-power density
- High speed, wide output range
- Low torque ripple
- High rotary precision
- Sturdy structure
- Adapting to various of encoders
- Always magnetic

Series GM high voltage spindle motor

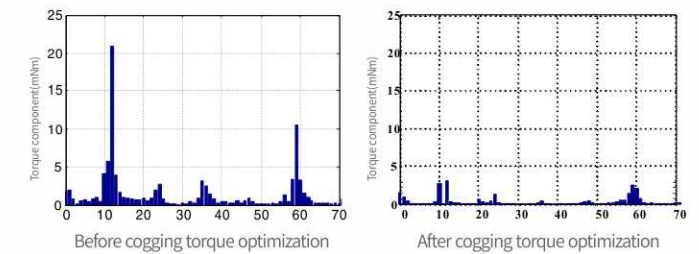


- High torque/inertia ratio, quick dynamic response
- Energy efficient
- Compact size, light weight
- Excellent product consistency
- Small noise vibration, long service life
- High rotation speed

Series LDD servo motor performance is improved—High stability, high resolution, high response

(1) High stability

The new LDD servo motor significantly lowers the motor cogging torque and torque ripple, improves the dynamic balance with high precision, and runs more stably.



(2) High efficiency

The new LDD series servo motor has an increase of more than 85% in efficiency, and dramatically reduces the energy consumption

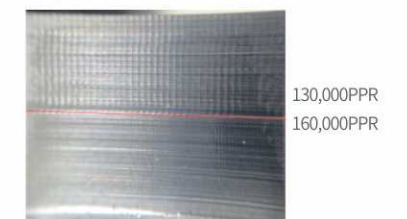
(3) High resolution

With the 16,000,000PPR high-resolution photoelectric encoder (24bit), the standard LDD motor significantly improves the machining precision and finish,

(4) High torque density

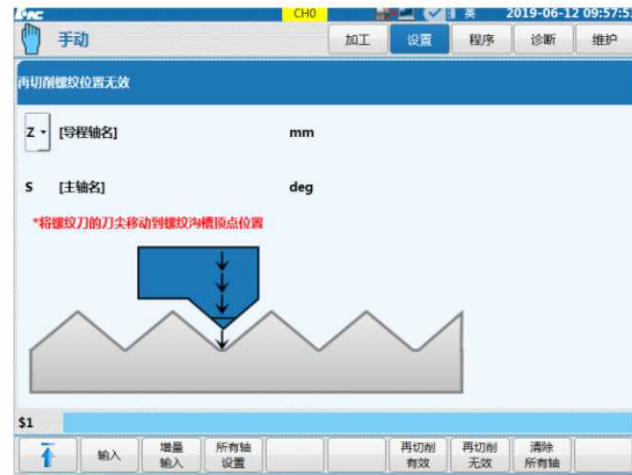
Series LDD has a compact structure--the length of stator shortens 20% in the same torque, high torque density and a small size

Quality difference of machined surface



Typical Turning Function

Thread repair



After the thread is machined, perform the clamping again, and record the coordinate onto the thread repair interface, and open the corresponding function key to perform the second machining of the thread.

Chip breaking

This function makes use of the low-frequency reciprocating movement of the cutting axis to form an empty vibration time. The chips will be removed after being finely broken. This function is most suitable for the processing of difficult-to-process materials, and is also extremely conducive to the processing safety (including workpiece and machine tool safety)



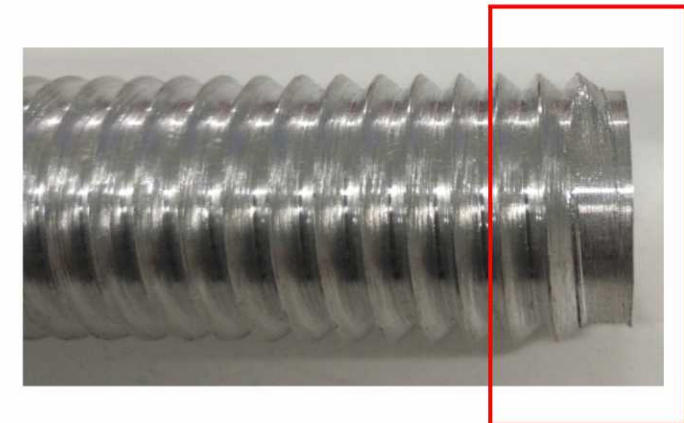
Handwheel interrupt

In auto mode, by rotating the MPG, the handwheel feed can be superimposed in the movement based on the auto operation. The smallest unit of movement per graduation is a length resolution unit (1/(length resolution)mm)
 The maximum cyclic superimposition (PARM.100057/101057/102057): to set the maximum superimposition of each axis in each cycle. The unit is mm. The parameters are used to limit the superimposition amount in each cycle.



Threading pushing

Remove the incomplete teeth at the cut-in and cut-out positions of the thread to have the bolt better threaded into the nut.



Servo parameter self-tuning function

The debugging interface is user friendly, and the debugging is efficient. After parameter setting, self-tuning is completed with one click.



Servo vibration suppression filter function

Comparing with original notch filter, the axis acceleration of vibration suppression filter can increase 20%;
Comparing with original notch filter, there is no attenuation for vibration suppression filter



Radius/Diameter programming including Y axis

Command format: G36.1 X_(Y_Z_A_B_C_U_V_W)
When the value after the axis is 0, the current axis is in radius programming; when the value is 1, the current axis is in diameter programming. Please note that similar as G36, this function can be activated after 040032 parameter "radius/diameter programming" is turned on.

参数号	参数名	参数值	生效方式
040030	通道的缺省进给速度(mm/min)	5000.0000	保存
040031	空运行进给速度(mm/min)	6000.0000	保存
040032	直径编程使能	0x0	复位
040033	UVW增量编程使能	0	保存
040034	倒角使能	0	复位
040035	角度编程使能	0	保存
040036	车削复合循环选择屏蔽字	0x0	保存
040037	手摇加速时间系数	0.0000	保存
040038	手摇减速时间系数	0.0000	保存
040039	手摇加工速度系数	0.0000	保存

两个轴加工工件的径向尺寸通常以直径方式标注，因此编程时可以直接使用标注的直径方式编写程序。当前面上一个编程单位的变化，对应轴向进给半个单位的移动量。该参数用来选择当前轴的编程方式：0x0 半径编程方式；0x1 X轴直径编程方式开；0x2 Y轴直径编程方式开；0x3 X、Y轴直径编程方式开。
注意：此参数打开后编程模式为G36时，直径编程才生效。

Three tapping modes and online debugging

Supporting rigid tapping, PWM spindle following tapping, and dual spindle load tapping

- 速度环
- 位置环
- 圆度测试
- 刚性攻丝
- 陷波器
- 龙门同步
- 主轴升降速
- 变频器刚攻
- 乘载攻丝
- 换刀时间
- 自定义
- 全闭环诊断
- Z轴热误差
- 主轴热误差
- 诊断记录
- 调机报表

Dual spindle synchronization

Synchronization of two spindles is completed at the time of S2000rpm. After the second spindle clamps workpiece, and the cutting is completed, the synchronization ends and the machining in channel 2 starts.
Typical application: The two channels run simultaneously. When users need to exchange workpieces, execute the electronic gear box command to synchronize the two spindle speed and the phase for workpiece exchange. After that, users cancel the electronic gear box function, and the two channels performs machining separately. This function can be used on playgon machine.



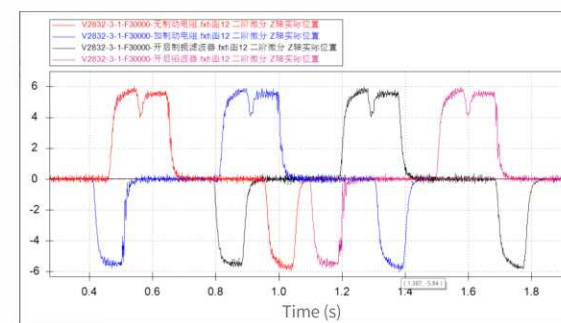
Milling of 3rd axis

Channel 1 performs the outer thread machining, and channel 2 performs spindle indexing and milling on four sides, radius drilling and tapping, axial drilling and tapping, and end face circular turning.



High acceleration/deceleration

The maximum acceleration on X/Z axis can reach 0.6G with maintaining high machining precision and maximum speed of motor, and without overtravel.



New interface

Based on the QT development framework, interface styles such as the interface frame, menu, display style, and display color can be modified on-site through configuration files.



Dual channel monitoring

- Automated truss application
- Dual channel turning center application
- Supporting multi-spindle load display
- Supporting truss teaching
- Supporting multi-workstation display
- Supporting multi-workstation graphics display



Supporting class A command programming

Use parameter to select the system programming format, and real time switching is supported



Easy data exchange

All configuration files can be easily exported and imported by powerful customization.



Built-in debugging tool

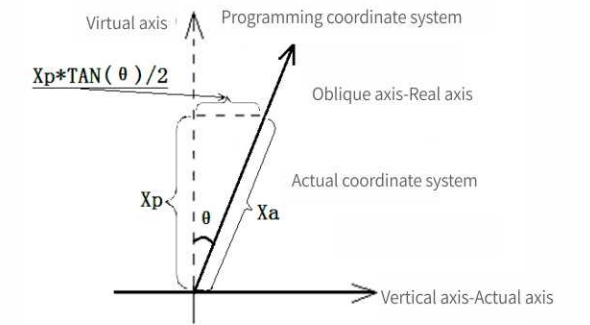
The debugging of the system and the servo is simple and intuitive, and the system guidance and the recommended value increase the efficiency of the debugging. The three tapping debugging speed loop, position loop and current loop are included.



Oblique axis function

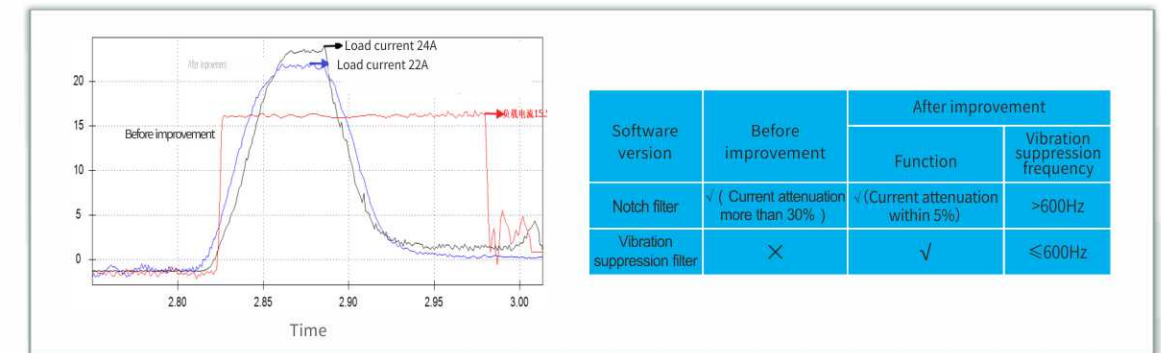
When the horizontal axis is not perpendicular to the vertical axis but at an angle to the vertical axis, this axis is referred to as the oblique axis. The oblique axis control function controls the movement distance of each axis based on the oblique angle. X axis is generally defined as the oblique axis and Z axis as the vertical axis in this function.

040310--Oblique axis control enable (0 is set when an oblique axis is mounted on machine tool; otherwise 0 is set)
 040311--Channel axis number of orthogonal axis (X-0; Z-2)
 040312--Channel axis number of oblique axis (X-0; Z-2)
 040313--Negative value of oblique angle (unit: degree); clockwise rotation indicates the negative value, and counterclockwise rotation indicates the positive value. Generally a negative value is set.



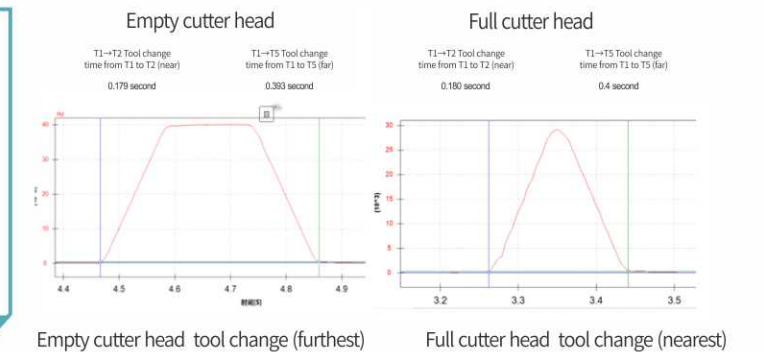
Notch filter and vibration suppression filter

The notch filter function is improved to reduce the current and acceleration attenuation caused when the notch filter is turned on. While suppressing vibration, it also guarantees the high acceleration and high response of the machine tool. The vibration and abnormal noise under high gain of machine tool is suppressed, the fluctuation range of machining tracking error is reduced, and the machining performance is improved.



High speed servo tool change

The high-performance drive adopts the vibration suppression filter and new notch filter functions, which significantly reduces current and acceleration attenuation. While suppressing vibration, it also guarantees the high acceleration and high response of the machine tool, greatly increasing the tool change efficiency of the servo tool post.



One-click import of pitch error compensation

The pitch error data or text collected by the laser interferometer can be directly imported into the system to automatically generate the pitch error compensation parameters; for the axis that has been compensated, the .rtl file can be imported again for incremental accumulation compensation.



Efficiency of pitch error compensation is greatly improved

Standardized PLC program

I/O mapping table function

- There are two mapping tables: user switch mapping table and MCP panel switch mapping table;
- Display the I/O point number and register number corresponding to the name of the switch;
- Modifying the I/O points or register definitions in the mapping table can complete the modification of the original PLC program, which facilitates the management of PLC signals and improves the convenience of adaptation of standard PLC

索引	寄存器(I/O)	IO点(X/Y)	电平	线圈	符号名	注释
1	IO.0	X1.1	1	1	紧刀到位	紧刀到位
2	IO.1	X1.2	1	1	松刀到位	松刀到位
3	IO.2	X2.5	1	1	刀臂和刀	和刀
4	IO.3	X2.6	1	1	刀臂零点	刀臂零点
5	IO.4	X2.4	0	1	刀臂刹车	刀臂刹车
6	IO.5		0	0		
7	IO.6	X2.1	0	0	刀库计数	刀库计数
8	IO.7	X2.0	0	1	刀库零位	刀库零位
9	IO.8	X2.3	0	0	前进/换刀...	前进/换刀...
10	IO.11	X2.2	0	0	后送/回刀...	后送/回刀...
11	IO.2		0	0		
12	IO.3	X1.4	1	0	润滑油报警	润滑油报警
13	IO.4		0	0	中出水报警	中出水报警
14	IO.5	X1.5	0	0	气压报警	气压报警

Standard PLC module directly called by K parameter

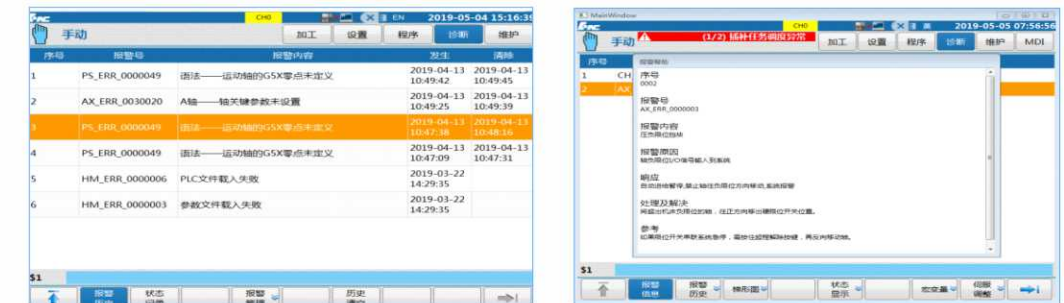
- By turning on/off standard PLC module corresponding to the K parameter, the standardized management of PLC can be easily achieved.

Debugging efficiency is improved.

地址	注释	7	6	5	4	3	2	1	0
K0	面板类型	0	0	0	0	0	0	0	0
K1	刀库类型	0	0	0	0	0	0	0	0
K2	刀库调试1	0	0	0	0	0	0	0	0
K3	刀库调试2	0	0	0	0	0	0	0	0
K4	主轴功能	0	0	0	0	0	0	0	0
K5	轴移动选择	0	0	0	0	0	0	0	0
K6	进给轴	0	0	0	0	0	0	0	0
K7	手摇功能	0	0	0	0	0	0	0	0
K8	润滑功能	0	0	0	0	0	0	0	0

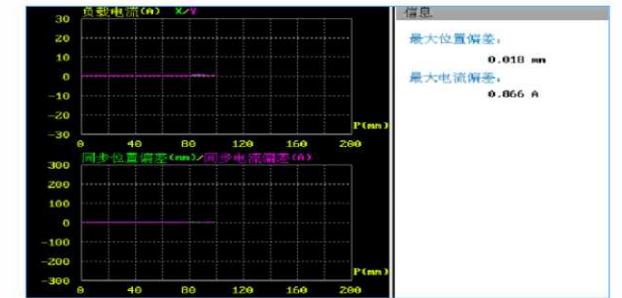
Alarm one-click help

When an alarm occurs, the alarm help can be called with one click, and the cause of the alarm, the alarm response state, solutions, and reference content can be displayed. Remote operation and maintenance configuration. Solutions are provided for users through the cloud.



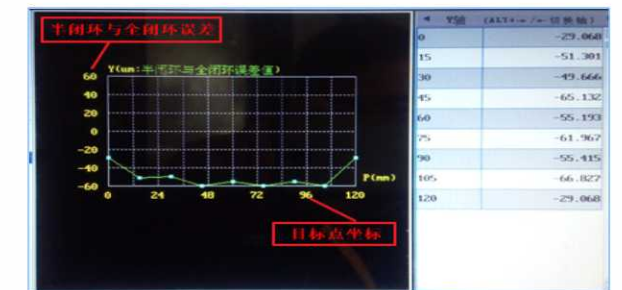
Gantry synchronization diagnosis function

Real-time collection of the load current and position deviation values between the master and slave axes of the gantry synchronization, to provide a basis for the assembly quality of the gantry axis.



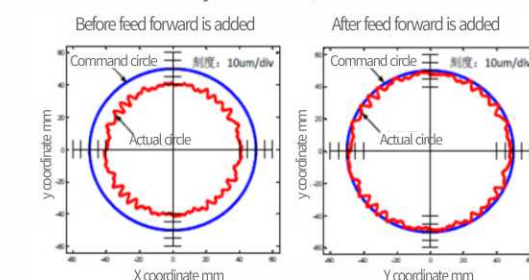
Fully closed loop diagnosis function

The feedback error data of the semi-closed loop and the fully closed loop is graphically displayed, which provides a basis for the quality of the fully closed loop assembly.



Speed feedforward control

Through the speed feedforward control, the tracking error fluctuation during the high-speed processing can be effectively reduced, and the contour accuracy can be improved.



High-speed, small-diameter circular machining accuracy is significantly improved

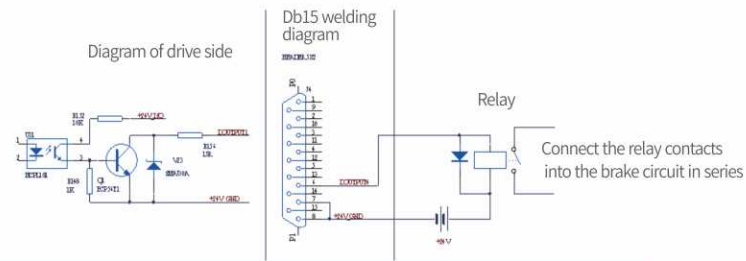


Machining speed	Without feed forward error (mm)	With feed forward error (mm)
F1000	0.027	0.007
F3000	0.023	0.009

R0.8 Super-small cylinder processing

Servo brake control function

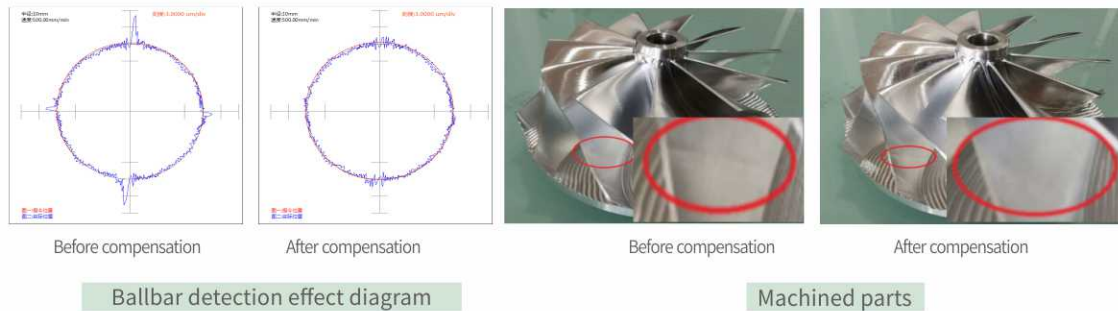
When an alarm of gravity axis or sudden power failure occurs, the system control will cause the brake to be delayed and the gravity axis to drop due to a delay in the communication cycle. Through the external relay of the built-in I/O terminal, the motor brake can be directly controlled with quick response, and the falling distance is significantly reduced.



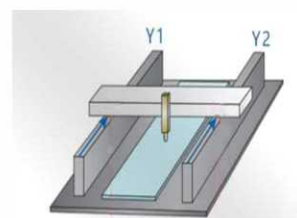
Test conditions	System PLC control	Servo brake
The falling distance for power failure when Z axis is at rest	1 st time:0.336 2 nd time:0.36	1 st time:0.006 2 nd time:0.001
Power failure when Z axis is at F3000 speed	1 st time:1.051 2 nd time:1.115	1 st time:0.373 2 nd time:0.433
The falling distance or encoder disconnection when Z axis is at rest	1 st time:4.0174 2 nd time:4.7413	1 st time:0.0061 2 nd time:0.0055
The falling distance or encoder disconnection when Z axis is at F3000 speed	1 st time:8.063 2 nd time:11.787	1 st time:1.0803 2 nd time:0.0055

Adaptive friction compensation

According to different conditions, the amount of static friction compensation is automatically adjusted to eliminate contour or curved surface quadrant marks and improve surface quality.



Multi-axis synchronization and coupling



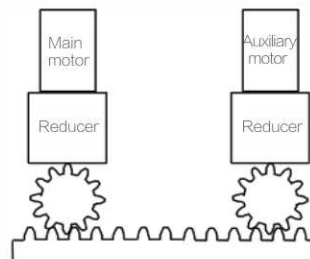
Gantry dual servo synchronization

The synchronous axes receive same position command, and can be used as a axis at the time of operation and programming.



Multi-head synchronization milling

The position deviation between two axes need to be monitored in real time, and the out-of-tolerance needs to be protected in time.

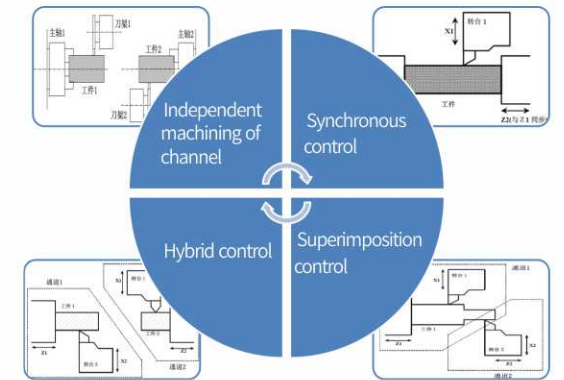


Multi-axis synchronization anti-backlash of gear step bar and rotary table

After the power is turned on, the reference point return must be performed to establish machine coordinate. After the reference point return, the positional misalignment between axes is eliminated by compensation.

Multi-axis and multi-channel technology

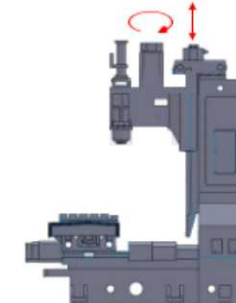
Multi-axis and multi-channel control can effectively solve the needs of multi-axis coordinated control such as combination machine tools, flexible production lines, and gear processing. It can realize composite control function and reduce manufacturing cost. Multi-channel and multi-spindle machining can be realized, which improves machining efficiency. It can improve automation and reduce the cost of use. It can reduce the number of workpieces clamping times and improve the processing accuracy.



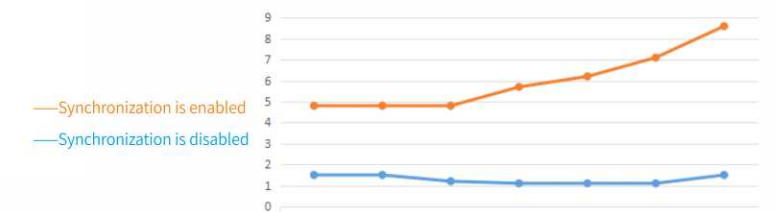
Tapping synchronization error compensation

When performing rigid tapping, according to the characteristics of the tapping synchronization axis, the tapping synchronization can be effectively reduced by automatic compensation of synchronization error without depending entirely on the gain matching of tapping axis, so as to achieve higher speed and quality thread processing.

The error of the tapping rotary axis and the tapping feed axis is compensated in real time by the servo to realize high-synchronization tapping



Comparison of tapping synchronization errors at different tapping speeds							
Rigid tapping spindle speed (r/min)	1000	2000	3000	4000	5000	6000	7000
Error when rigid tapping synchronization compensation is enabled (um)	1.5	1.5	1.2	1.1	1.1	1.1	1.5
Error when rigid tapping synchronization compensation is disabled (um)	4.8	4.8	4.8	5.7	6.2	7.1	8.6



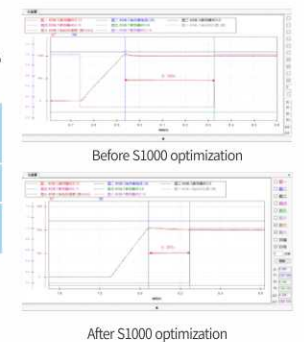
Axis orientation optimization

Lots of orientation problems can be solved by optimization of spindle servo, C/S switching, PLC time sequence control, and the orientation stiffness and efficient is also improved.

First-hole tapping orientation efficiency is increased by 7%
Spindle orientation efficiency is increased by 10%

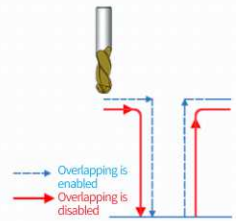
Number of holes	Before optimization	After optimization	Efficiency improvement
1 hole	24.195s	22.486s	7%
Entire program (8 holes)	3min 22s	3min 7s	7.4%

Spindle orientation efficiency is increased by 10%

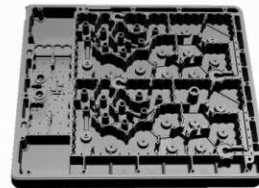


Idle stroke superposition

When running a canned cycle such as drilling and tapping, the idle stroke is superimposed, the positioning path is shortened, the deceleration of the program block is reduced, and the processing efficiency is improved.



The positioning blocks of the drilling cycle overlapping according to the set overlap amount

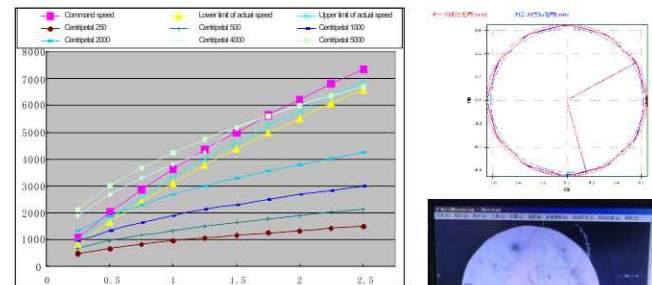


The effect of improving the efficiency of the drilling cycle of a 5G filter part

Before upgrade	Before upgrade	Efficiency improve
4min 19s	4min	7.3%

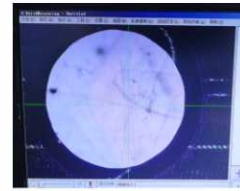
High-speed small circle machining

The centripetal acceleration is limited based on the axis acceleration and deceleration ability to avoid the impact of the machine tool movement during small circle machining, which will produce the processing vibration marks at corner.



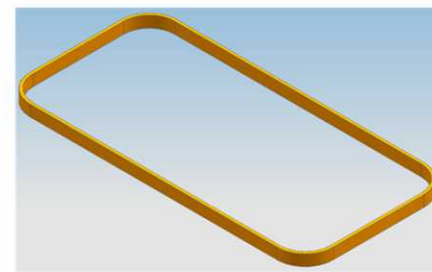
Original centripetal acceleration speed limit curve

Φ2mm small circle processing. On the basis of the sudden jump up to the standard, the speed can reach 1800mm/min, which is close to SYNTECH

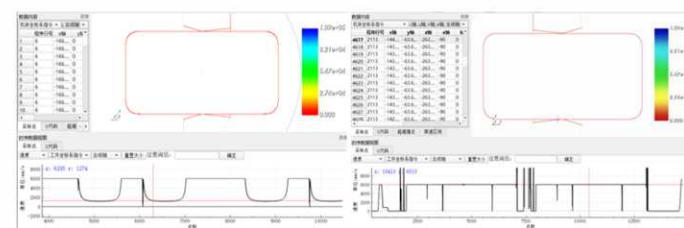


Cutting at constant linear speed

The processing efficiency is increased by about 25%, there is no overspeed or acceleration, and there is a slight tool mark at the intersection of the arc and the straight line.



	Constant linear speed is not enabled	Constant linear speed is enabled	Improvement
Constant linear speed is not enabled	910s	421s	1331s
Constant linear speed is enabled	676s	314s	990s
Improvement	25.7%	25.4%	25.6%

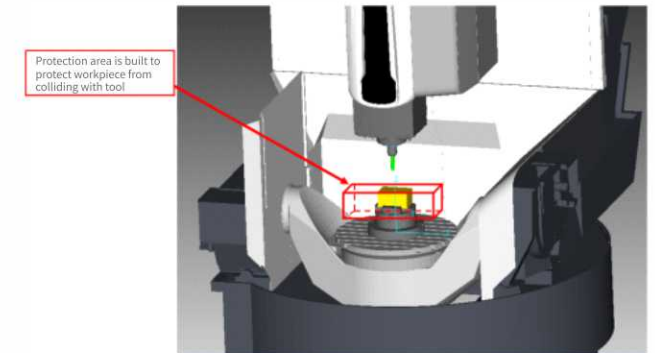


Constant speed feed function is not enabled

Constant speed feed function is enabled

Dual-channel anti-collision, multi-head synchronization, multi-channel extension (8 channels)

Online multi-head synchronization function realizes the internal synchronization of the system, greatly simplifying the operation. The anti-collision function of 5-axis system establishes a protection zone to avoid collisions between workpieces and tools. The 8-channel software can support multi-station spindle polishing machines.



Protection area is built to protect workpiece from colliding with tool

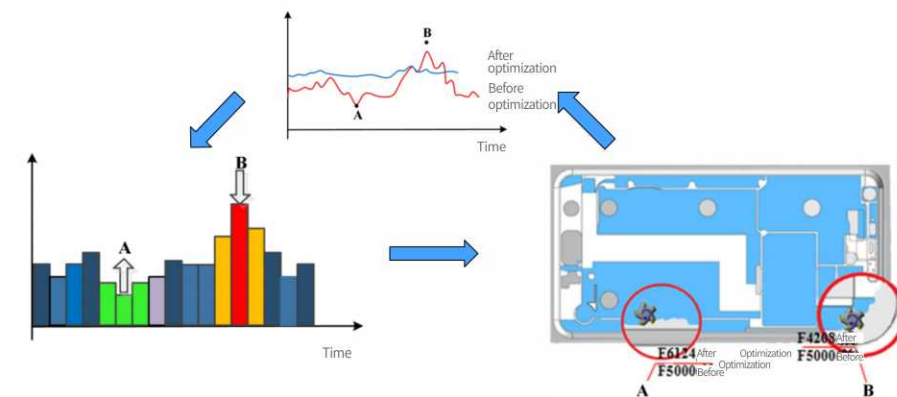
Milling at excellent speed

It is especially suitable for cavity machining and rough machining of parts with large speed and direction changes.



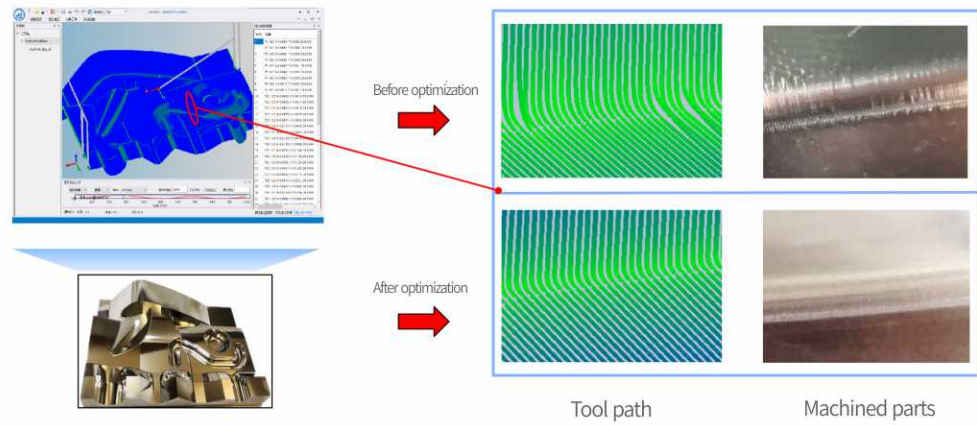
Status	Quality	Efficiency
Before optimization		Efficiency is increased by 10.6%
After optimization		

According to the load during cutting, the intelligent speed adjustment not only improves the processing efficiency, but also the load is more balanced, so that safety is guaranteed.

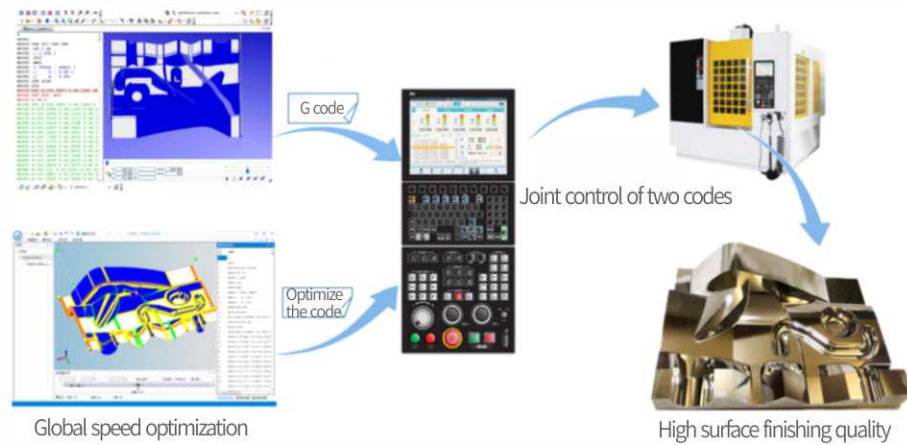


Smart surface processing

After optimization, the tool trajectory is clear and consistent, and the surface of the processed part is uniform without overcut or undercut lines

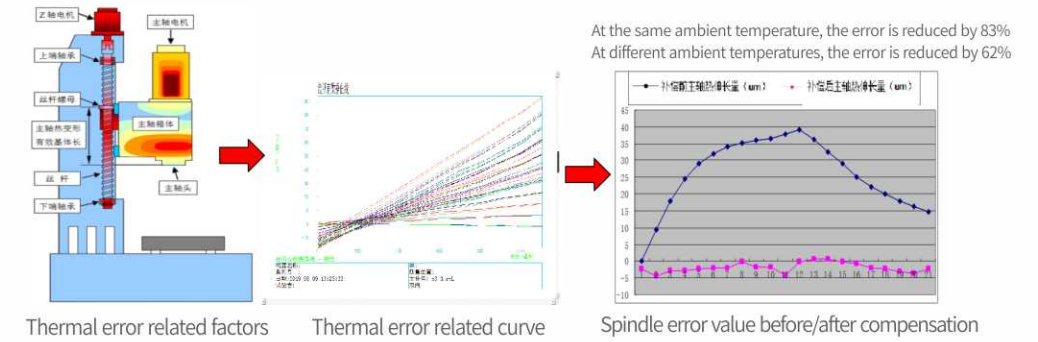


According to the overall trajectory of the part, the processing speed is planned and automatically smoothed to achieve high surface quality processing with high speed and efficiency.



Thermal error compensation with sensor

With the sensor, the correlation curve of the position deviation caused by the thermal change is collected and the compensation is automatically performed to save the machine tool warm-up



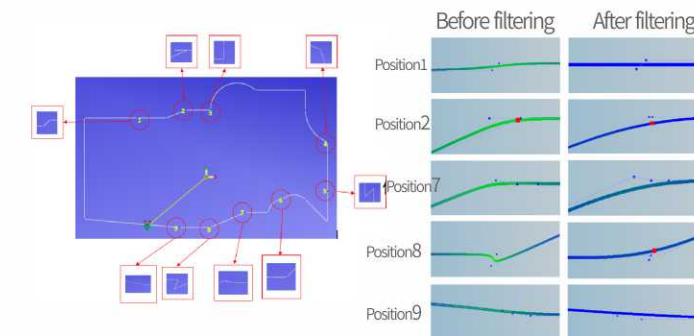
Suitable for machine tools without high precision, and can reduce warm-up time well



Maximum positioning position change of X and Z axes before compensation
Maximum positioning position change of X and Z axes after compensation

Cross-block inscribing transition and noise filtering on-line processing function

Filter small line segments, perform normal inscribed corners, modify the calculation of inscribing transition radius, use contour tolerance and corner speed reduction factor to avoid noise-induced speed reduction to zero, and realize normal corner transition.



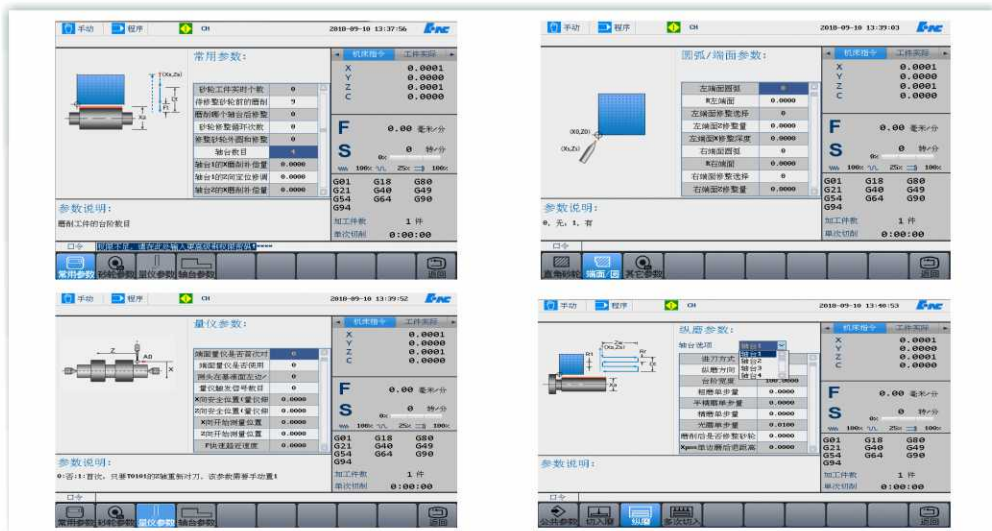
Typical Grinding Function

Professional grinding process

In response to the application requirements of cylindrical grinding and surface grinding commonly used in the market, the process standardization was carried out, and the graphical programming function and the process module function were developed. The graphical programming process is comprehensive and abundant, covering the requirements of common grinding processes. The operator does not need professional knowledge for programming. System operation is optimized and practicality is improved.



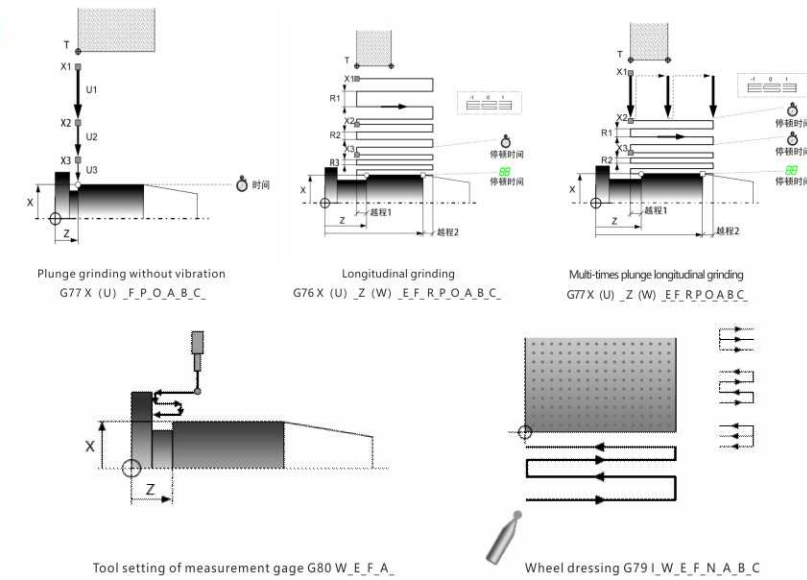
HN0808xpG processing interface display



Interface of HNC-808DG grinding system

Grinding process module

Considering the customer's flexible programming needs, the system integrates a process module package, including: plunge grinding without vibration, surface grinding, multiple plunge grinding, tool setting and grinding wheel dressing, etc. Users can call it flexibly based on the actual situation.



Secondary interface development function

In response to the customized needs, HNC8 provides a secondary development platform. The secondary development is easy to operate. Users only need to modify the XML file without professional software development knowledge to obtain their own exclusive interface.



Simple, understandable XML file

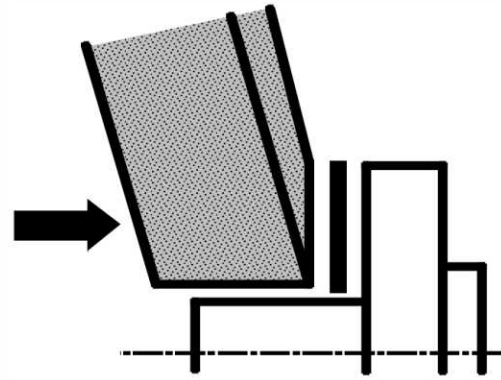


Customized interface for secondary development

Advanced Features

Oblique axis

The programming follows the Cartesian coordinate system programming to realize the Z-axis moving at the same time with X axis. It can not only grind the outer circle, but also grind the end face efficiently.



Electronic gear

The movement of a certain following axis can be controlled by a linear movement group of up to five master axes. Each master axis can define the relationship between the master axis and the slave axis through the coupling coefficient. In the case of activating a certain electronic gearbox axis combination, by multiplying the single master axis motion component by its coupling coefficient, the calculated slave axis motion component is formed by addition. This feature is commonly used for hobbing machining including straight teeth, helical teeth, and spiral teeth.

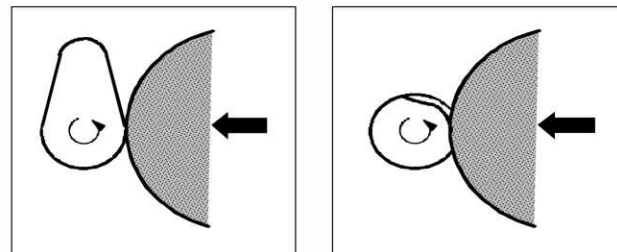
Video-assisted tool setting

The high-definition camera is used to collect the processing pattern information, which is processed by the CNC, converted into a color image, and displayed on the tool compensation interface. The tool setting is safe and convenient, and the processing status can be observed at any time.



Tangent following

Control the X-axis to follow the C-axis movement, and always keep the outer surface of the grinding wheel tangent to the surface of the workpiece to be ground, so as to realize the grinding of eccentric circles and non-circular surfaces. High-speed and high-frequency response of motor, algorithm optimization, and error compensation technology can be realized.



Technical configuration

- 1.The item marked with * means HNC-808DG high-end function. Standard and optional configurations are provided.
- 2.The market of HNC-808xpG aims at the economical grinding system; HNC-808DG is a medium and high grade grinding system

Basic configuration

Project		HNC-808xpG	HNC-808DG
Feed axis /channel	Standard	2	3
	Maximum	3	9
Spindle /channel	Standard	1	1
	Maximum	1	4
Number of channels	Standard	1	1
	Maximum	1	4
Maximum number of axes in simultaneous motion		3	20
Maximum number of feed axes		3	64
Maximum number of simultaneously controlled axes/ channels		3	9
Number of PMC control axes		2	32
Interpolation cycle (ms)		4	0.125 ~ 4
Maximum input/output points		32/24	2048/2048
Encoder		Incremental/absolute	Absolute
Servo motor		Single drive, dual-axis drive	
Scope of application		Economical	Mid-to-high end

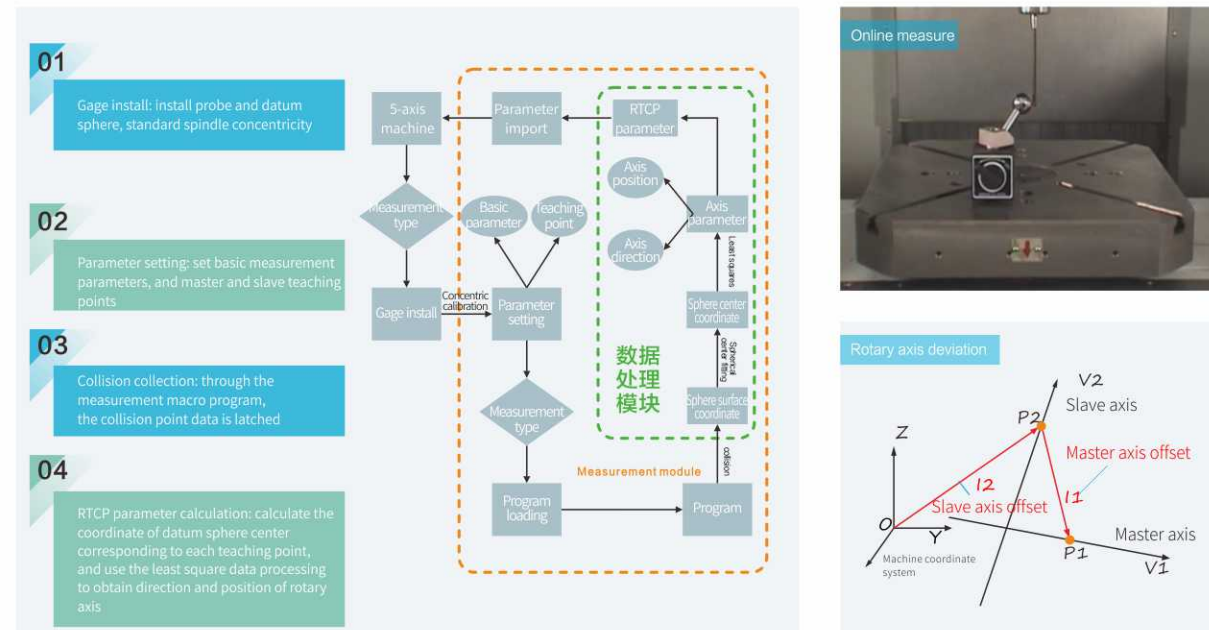
Functional technical configuration

No.	Features	HNC-808xpG	HNC-808DG	Configuration
1	Handwheel simulation	√	√	Standard
2	Handwheel insertion	√	√	Standard
3	PMC	√	√	Standard
4	C/Switching	√	√	Standard
5	Built-in oscilloscope	√	√	Standard
6	Grating ruler	√	√	Standard
7	SSTT sampling	×	√	Standard
8	*Inclined axis	×	√	Standard
9	*Multi-channel	×	√	Standard
10	PLC online programming	×	√	Standard
11	Multi-group DIA	×	√	Optional
12	*Electronic gear box	×	√	Optional
13	*Crankshaft grinding	×	√	Optional
14	*Cam grinding	×	√	Optional
15	*Tool setting by video of grinding wheel	×	√	Optional
16	*Multi-axis synchronization control	×	√	Optional
17	*Thermal error compensation	×	√	Optional

Typical five-axis function

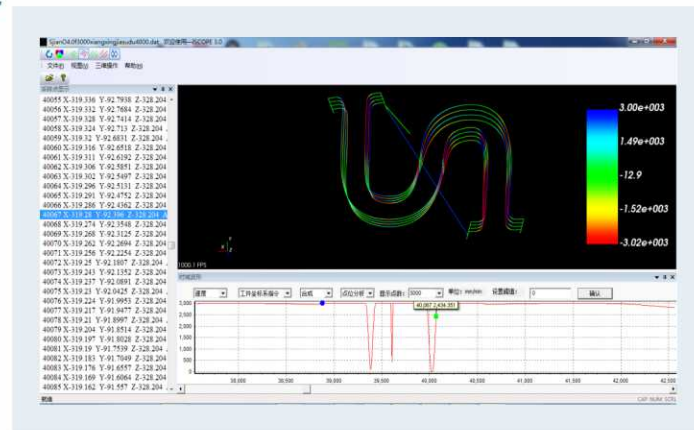
Automatic calibration of the structure size of kinematic chain

With the measurement macro program, data points are collected to fit the five-axis machine tool structure parameters using trigger probe and datum sphere. The measurement accuracy and measurement efficiency can be improved. The parameter calibration can be completed without the need for professional operators. It is suitable for five-axis machine tools of any structure type.



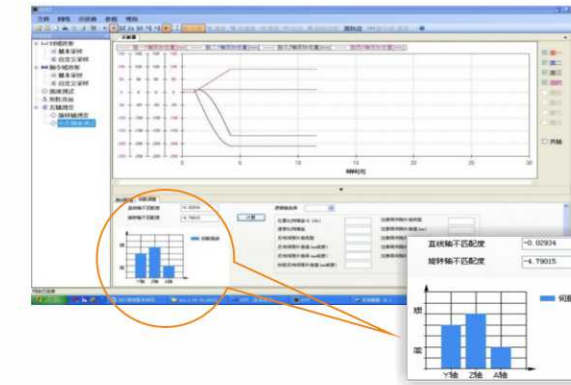
Processing quality analysis and dynamic characteristics evaluation

Visual analysis of the processing data such as sampling command position, actual position, speed, acceleration, jerk and current can be performed, and the mapping relationship between the tool position trajectory and the processing data waveform can be visually displayed for quick finding of machining deficiency.



Multiple five-axis programming formats

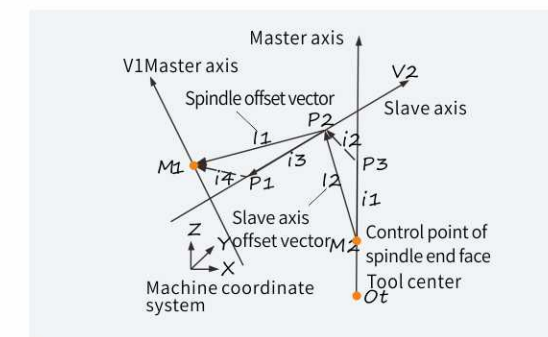
The system has RTCP function, and the worker can carry on the programming directly in the workpiece coordinate system regardless of the machine tool structure. It supports three programming formats: ABC angle programming, IJK vector programming, hyperbolic spline programming.



Servo sequencing: The axis with a lower cylinder has a weaker following ability which needs to be enhanced by servo parameters.

Simultaneous-5-axis-control RTCP

The unified five-axis kinematics model is adopted to realize the RTCP function of dual rotary table, dual swing head and rotary table swing head.



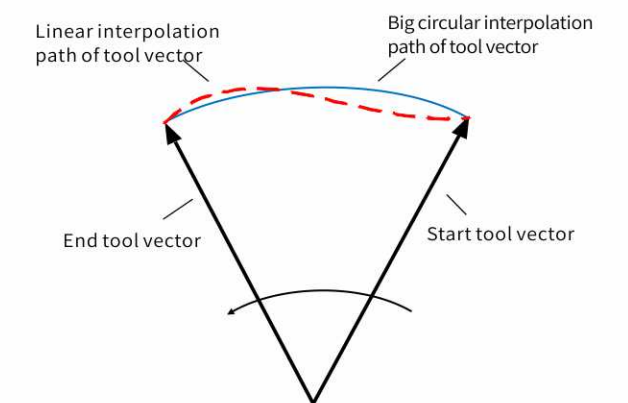
5-axis kinematics model

$$V_t = R1(R2 \cdot (O_t M2 + I2) + I1) + M1 M2$$

$$V_w = (I1 + I2) - R1(R2 \cdot (I2 - O_t W) + I1)$$

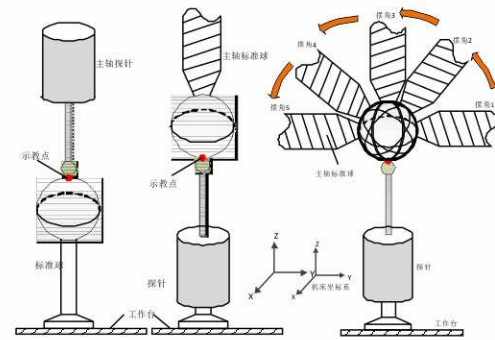
Five-axis large circular interpolation

Carry out tool axis interpolation in the workpiece coordinate system to ensure the coplanar interpolation of tool axis between adjacent path points.



Automatic measurement and identification of machine tool structure parameters

Online measurement of datum sphere is used to realize the automatic and accurate measurement and identification of structural parameters such as the axis direction of the rotary axis and the deviation of the rotary axis of any type of five-axis machine tool, which ensures the precise control of the center point of the rotating tool.



Conversion between vertical and horizontal machines

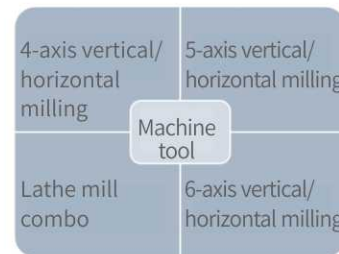
Supporting conversion between vertical and horizontal machines of 4-axis, 5-axis, 6-axis, and lathe mill combo, realizing two programming modes of Cartesian and characteristic coordinates, containing vertical-horizontal zero offset function, table rotation zero-point compensation function, inclined surface processing function, and rear module of vertical-horizontal machining.



MH100S



VMT100A



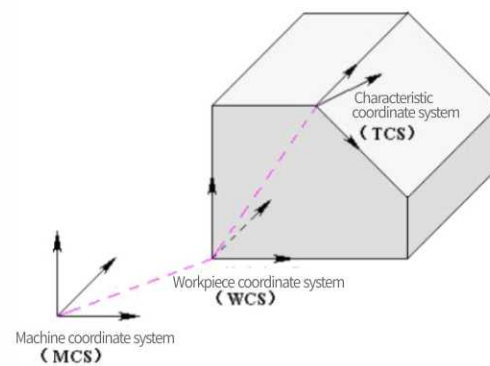
S43



DMU-80P

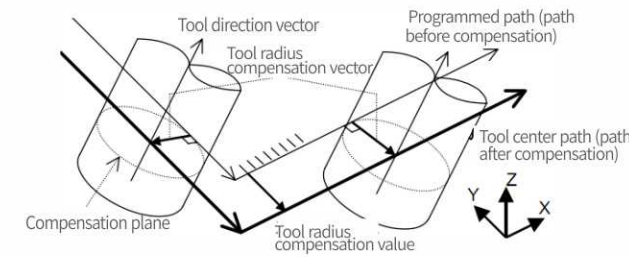
Orientation processing

For five-axis machining, 3 + 2 orientation machining function is often used. The function can establish a characteristic coordinate system (TCS) on the inclined plane and the programming can be performed in this coordinate system. Since the characteristic coordinate system is compatible with the inclined plane, the programming on the inclined plane is as simple as the programming on the plane. Multiple ways are supported to establish characteristic coordinate planes, simplifying the process of space conversion.



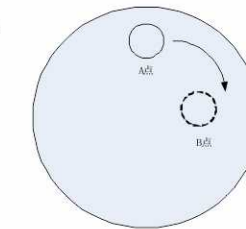
3D tool radius compensation

In five-axis actual machining, due to the change of the tool posture, the three-axis plane compensation cannot meet the requirements. The direction vector of the tool is calculated by the position of the rotary axis, and the compensation vector is calculated on the plane (compensation plane) perpendicular to the direction vector of the tool, thereby achieving a three-dimensional tool radius compensation.



Indexing axis

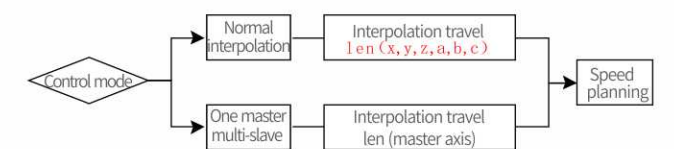
The index axis is a positioning axis used to determine a specific angle. The axis is locked after positioning. When there is a rotary axis command, the specified axis is automatically released; when there is no rotary axis command, the rotary axis is automatically clamped. After enabling the RTCP function on a five-axis machine tool, the indexing axis function can also be supported. It is often used in mixed programming of five-axis oriented processing and multi-simultaneous-axis processing. Through the indexing axis function, the rotary axis can be automatically locked during oriented processing to ensure processing rigidity; the rotary axis is automatically turned on during multi-simultaneous-axis processing to realize the multi-simultaneous-axis motion.



There is no need to use the M code in the process of simultaneous 5-axis control to perform automatic loosening and tightening.

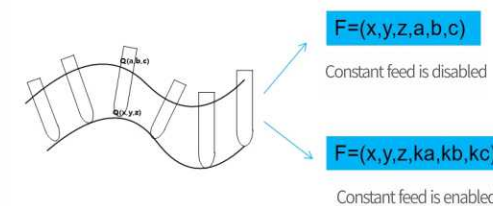
One master, multiple slaves

It is mainly used for mixed interpolation motion of linear axis and rotary axis. For special process requirements similar to winding machines, it is required that the single rotary axis runs at a constant speed, and other axes cooperate for interpolation motion.



Constant feed control technology

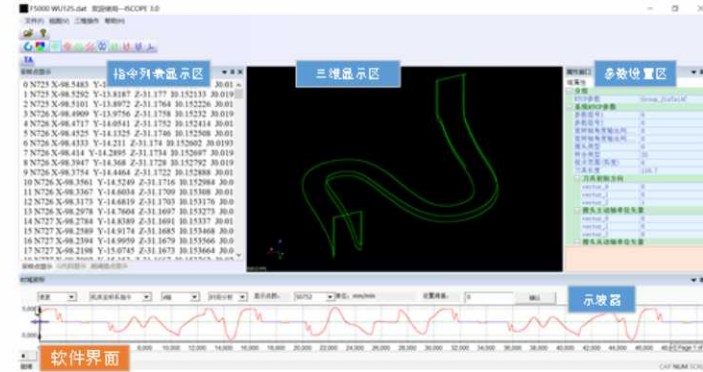
By weakening the travel of the rotary axis in the five-axis movement, and maintaining the tool nose moving at a constant feed speed, the constant linear speed cutting is realized. With the constant feed control technology, the problem of low processing surface speed caused by the large movement of the rotary axis and the small movement of the linear axis.



Programming speed is the 6-axis composite speed. The length of the rotary axis is weakened, and the programming speed is the composite speed of 3 linear axes and 3 weakened rotary axes. When $k=0$, the programming speed is the tool nose moving speed, when $k=1$, the programming speed is the one when the constant feed function is not enabled.

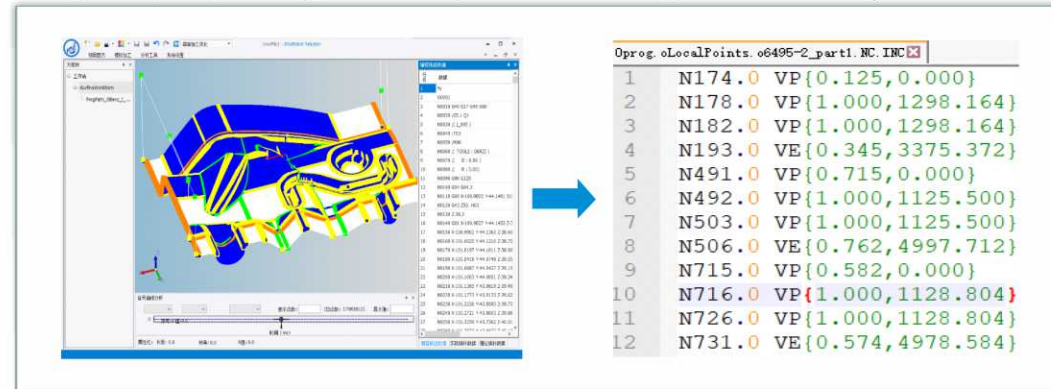
Big data analysis software for multi-axis machining process

Collect real-time processing data of the HNC8 five-axis CNC system, calculate the position, speed and jerk parameters of command data and actual data through the built-in analysis algorithm of the software, analyze and evaluate the simultaneous-axis-control performance of the system, and realize the analysis and optimization of the processing technology. It has a variety of visual display functions such as data charts, three-dimensional chromatograms, etc. of the calculation and analysis results.



iSurfine processing optimization software

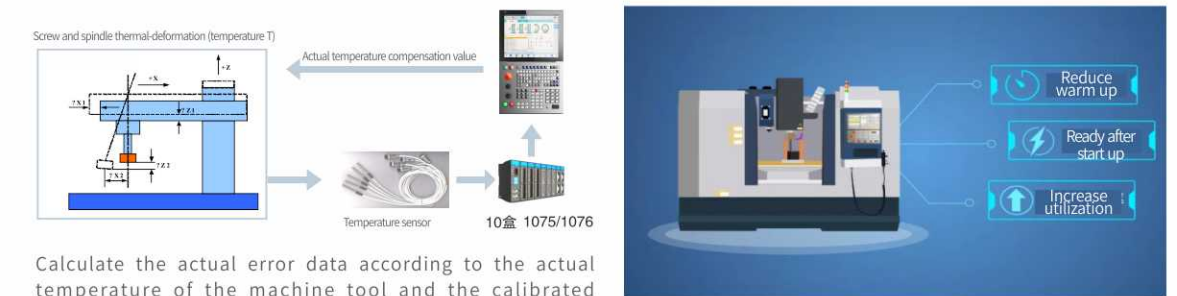
Through the external programming software, the speed pre-planning is carried out based on the global G code tool trajectory, and the identified speed of the shifting point generates the i code containing the second type of speed planning information, and the i code is applied to the CNC system.



Intelligent features

Thermal error compensation based on temperature sensor

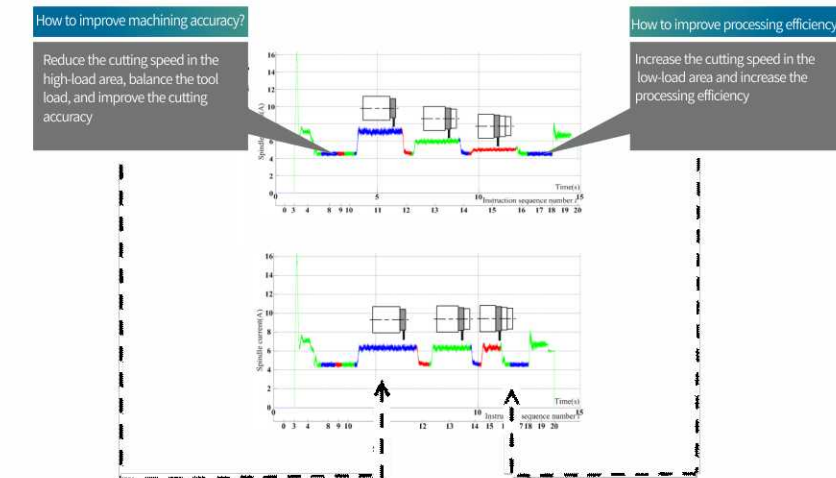
The HNC8 intelligent CNC system supports sensor-based thermal error compensation technology, and is equipped with high-precision temperature sensors to reduce the warm-up time, realize processing at the start of the machine, and increase the utilization rate of the machine tool.



Calculate the actual error data according to the actual temperature of the machine tool and the calibrated temperature/error table.

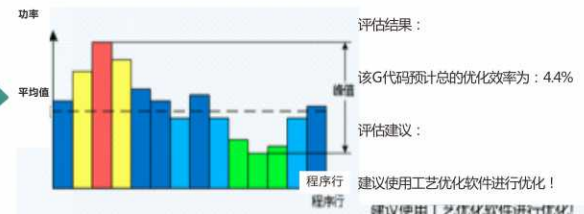
Intelligent optimization of process parameters based on command domain big data

Based on the command domain big data, and the potential tapping of process optimization at the data level, the optimization efficiency is evaluated in the background and reasonable prompts are given. Through the process optimization software, the process parameter optimization is performed online, and the second machining code is output without changing, realizing the improvement of processing efficiency.

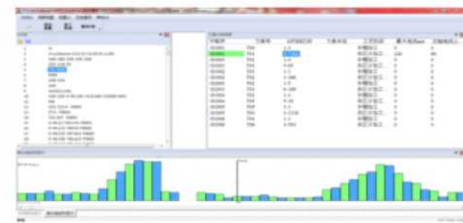




V2.0 machining technology evaluation



Evaluate during machining and calculate optimization efficiency



Process parameter optimization

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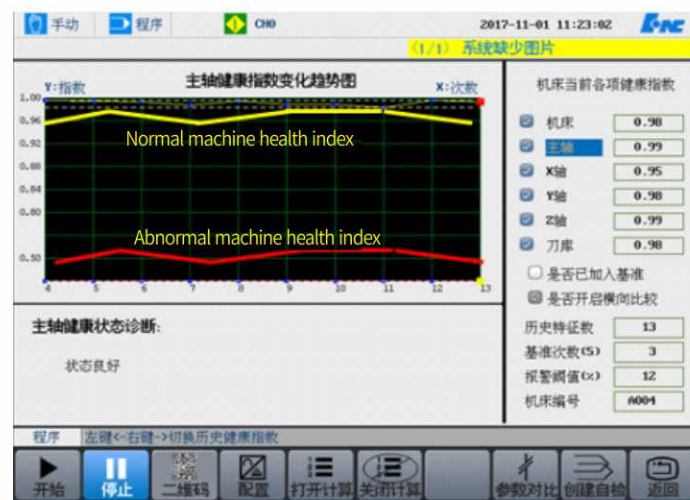
N334 R-1000.0      N331 G1 X237.871 Y237.871 Z-7.000 F15000
N372 R-1000.0      N332 G1 X237.900 Y237.900 Z-6.983 F5000
N411 R-1000.0      N333 G1 X238.300 Y238.300 Z-6.752
N412 R1206634.0    N334 G1 X238.400 Y238.400 Z-6.694
N641 R9057895.0    N335 G1 X238.900 Y238.900 Z-6.406
N641 R9057895.0    N336 G1 X239.000 Y239.000 Z-6.348
N975 R1206634.0    N337 G1 X239.600 Y239.600 Z-6.002
N1004 R0.0         N338 G1 X239.700 Y239.700 Z-5.944
N1005 R-1000.0    N339 G1 X240.200 Y240.200 Z-5.655
N1043 R-1000.0    N340 G1 X240.300 Y240.300 Z-5.597
N1082 R-1000.0    N341 G1 X240.900 Y240.900 Z-5.251
N1083 R-1000.0    N342 G1 X241.000 Y241.000 Z-5.193
N1121 R-1000.0
    
```

Output the second machining code

Machine tool health protection technology

Machine tool "Triathlon" health self-check and health assessment

Triathlon health self-check and health assessment function: Through the self-check of the machine tool, the electrocardiogram of the machine tool is obtained, the change of the machine tool health index is checked, and the health condition of the machine tool is evaluated. Timely maintenance of the machine tool according to the assessment ensures the healthy operation of the machine tool. At the same time, horizontal comparison of the health status of the same supporting machine tools is used to ensure the consistency of assembly and debugging.



Intelligent tool life management

The HNC8 intelligent CNC system supports sensor-based thermal error compensation technology, and is equipped with high-precision temperature sensors to reduce the warm-up time, realize processing at the start of the machine, and increase the utilization rate of the machine tool.

刀号	管理方式	最大寿命	已用寿命	单位	权重	状态	
1	清除	设置	90%	-	70%	4%	未完
2	清除	设置	80%	-	60%	7%	未完
3	清除	设置	100%	-	80%	100%	已完
4	清除	设置	0%	-	0%	-	未完
5	清除	设置	0%	-	0%	-	未完
6	清除	设置	0%	-	0%	-	未完
7	清除	设置	0%	-	0%	-	未完
8	清除	设置	0%	-	0%	-	未完

管理方式	最大寿命	已用寿命	单位	权重
安装次数	600	32	次数	10%
切削时间	2000	96	分钟	10%
切削里程	45	4	千米	50%
切削能耗	9000	689	瓦时	20%
主轴转数	7000	156	万转	10%

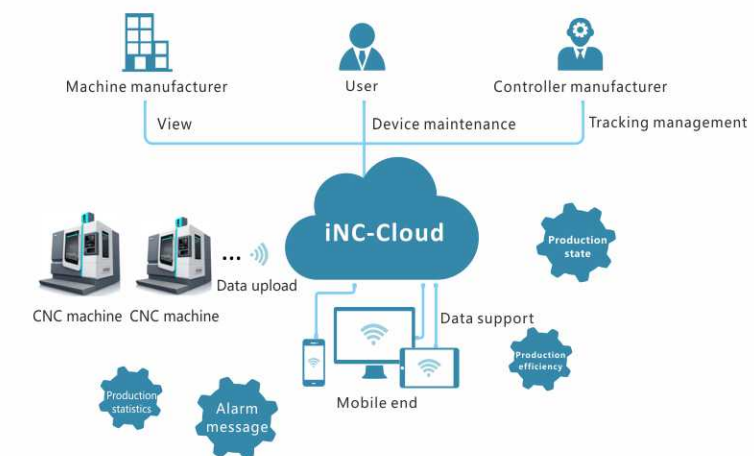
Broken tool detection function

If the tool breaks during processing, and it cannot be found in time, the subsequent processing will be affected. This is a problem that has plagued users for a long time.



iNC-Cloud

HuazhongCNC Cloud Service Platform iNC-Cloud is an intelligent and networked service platform centered on CNC systems for CNC equipment users and CNC equipment/system manufacturers. On the basis of industrial Internet of Things, big data, cloud computing, and new-generation artificial intelligence technologies, iNC-Cloud establishes a safe, reliable, efficient and intelligent cloud data center, and realizes the smart monitoring, maintain and management of production process through technologies such as big data aggregation, statistical analysis, and visualization. It provides users with equipment status monitoring, production efficiency analysis, intelligent remote operation and maintenance and other services



Detailed Specifications Table of CNC System

● : Standard ★ : Optional — : Not optional

Item	Specification	HNC-808Di		HNC-818Di		HNC-848Di
		M	T	M	T	M
System control						
Maximum number of simultaneously controlled axes in channel		4	3	5	3	9
Maximum number of feed axes		4	3	5	3	32
Maximum number of spindles in channel		2	3	4	3	4
Number of PMC control axes		1	1	3	1	32
Number of channels	Standard	1	1	1	1	1
	Maximum	1	2	2	2	10
Spindle/channel	Standard	1	1	1	1	1
	Maximum	2	3	2	3	4
Feed axis/channel	Standard	3	3	3	3	5
	Maximum	4	3	9	3	9
Maximum number of axes in simultaneous motion		3	3	8	3	80
Maximum number of feed axes		4	3	9	3	64
Number of input/output points at maximum		128/128		2048/2048		4096/4096
Axis name (single channel)	Three basic axes: X, Y, Z; additional axes: U, V, W, A, B, C	●	—	●	—	●
	Two basic axes: X, Z; additional axes: Y, U, V, W, A, B, C	—	●	—	●	—
Axis name (multi-channel)	One or two characters plus number, the first must be a character, e.g. X1	—	—	●	—	●
Gantry axis synchronization		—	—	★	—	●
Tangent synchronization control		—	—	★	—	★
Basic axis coupling control		—	—	★	—	★
Electronic gear box		—	●	★	●	★
Linear chart		—	—	★	—	★
Inclined axis control		—	—	★	★	★
Minimum input unit	mm deg inch	10 ⁻³		10 ⁻⁴		10 ⁻⁶
Metric/Inch	G20/G21	●	●	●	●	●
Pulse unit input	G22	●	●	●	●	●
Machine lock		●	●	●	●	●
Emergency stop		●	●	●	●	●
Overtravel		●	●	●	●	●
Spatial protection area	Providing protection for workpiece and tool	—	—	★	—	★
Software limit		—	●	●	●	●
Dynamic axis release/capture	G101/G102	—	★	★	★	●
Synchronization between channels	G104.0 ~ G104.7	—	★	★	★	●
Operation						
Auto		●	●	●	●	●
Single block		●	●	●	●	●
JOG		●	●	●	●	●
Incremental		●	●	●	●	●
MDI		●	●	●	●	●
MDI		—	—	●	—	●
Any line		●	●	●	●	●
Breakpoint		●	●	●	●	●
Rerun		●	●	●	●	●
Tool retraction	G106	—	—	★	—	●
Retraction in tapping		★	—	★	—	●
Dry run		●	●	●	●	●
Reference point return		●	●	●	●	●
Floating zero	Setting reference point manually	●	●	●	●	●
Handwheel feed		●	●	●	●	●
Handwheel feedrate override	× 1 × 10 × 100 × 1000	●	●	●	●	●
Manual handwheel interrupt		—	—	●	—	●
Three-dimensional anti-collision		—	—	—	—	★

● : Standard ★ : Optional — : Not optional

Item	Specification	HNC-808Di		HNC-818Di		HNC-848Di
		M	T	M	T	M
Interpolation						
Nano interpolation		●	●	●	●	★
Rapid traverse positioning	G00 (linear interpolation)	●	●	●	●	●
Unidirectional positioning	G60	●	●	●	●	●
Exact stop mode	G61	●	●	●	●	●
Cutting mode	G64	●	●	●	●	●
Exact stop	G09	●	●	●	●	●
Linear interpolation	G01	●	●	●	●	●
Circular interpolation	G02/G03 (three coordinate planes)	●	●	●	●	●
Three-dimensional circular interpolation	G02.4	—	—	★	—	●
Dwell	G04	●	●	●	●	●
Polar coordinate interpolation	G12/G13	—	—	—	—	—
Cylindrical interpolation	G07.1	—	—	—	—	—
Imaginary axis specifying	G07	●	●	●	●	●
Spiral line interpolation	Circular interpolation of two axes, and linear interpolation of the third axis	●	—	●	—	●
Thread cutting	G32/G33	—	●	—	●	—
Multi-thread cutting	G32/G33	—	●	—	●	—
Unequal-lead thread cutting	G32/G33	—	—	—	—	—
Circular thread cutting	G35.2/G35.3	—	—	—	—	—
Tapping	G34	●	●	●	●	●
Semi-following tapping	G34.1	—	—	★	—	★
Skip	G31	●	●	●	●	●
EGB axis skip	G31.8	—	—	—	—	★
Reference point return	G28	●	●	●	●	●
Return from reference point	G29	●	●	●	●	●
Reference point return check	G27	★	★	★	★	★
The second, third, and fourth reference point return	G30	★	★	★	★	★
High-speed high-precision mode	G05.1	—	—	★	—	●
Read-ahead control	G08	—	—	★	—	●
NURBS interpolation	G06.3/NURBS	—	—	★	—	●
Feed function						
Rapid traverse feedrate	999999 mm/min at maximum	●	●	●	●	●
Rapid traverse override	0%, 25%, 50%, 100%	●	●	●	●	●
Feed per minute	G94	●	●	●	●	●
Feed per revolution	G95	●	●	●	●	●
Inverse time feed	G93	—	—	★	—	★
Inverse time feed mode 1, 2, 3	G93.1/G93.2/G93.3	—	—	—	—	★
S-curve acceleration deceleration control		●	●	●	●	●
Feedrate limit		●	●	●	●	●
JOG override	0 to 120%	●	●	●	●	●
Circular radius speed clamping		●	—	●	—	●
Automatic deceleration at corner		●	—	●	—	●
Program input						
Block skip		●	●	●	●	●
Maximum programmed size	± nine digits (±99999.999mm)	●	●	●	●	●
Program number		0号+7位		0号+31位数		
Block number	N plus ten digits	●	●	●	●	●
Absolute/Incremental programming	G90/G91	●	●	—	●	●
Diameter/radius programming	G36/G37	—	●	●	●	—
Plane selection	G17/G18/G19	●	●	●	●	●
Rotary axis programming		●	●	●	●	●
Rotary axis cycle function		●	●	●	●	●
Polar coordinate programming input	G15/G16	★	—	●	—	●
Local workpiece coordinate system	G52	●	●	●	●	●
Workpiece coordinate system selection	G54 to G59	●	●	●	●	●
Machine coordinate system	G53	●	●	●	●	●
Workpiece coordinate system setting	G92	●	●	★	●	●
Extension workpiece coordinate system	From G54.1 to G54.60, in total of 60	—	—	—	—	●
Angular programming input		—	●	—	●	—
Chamfer/fillet input		—	●	●	●	—
Programmable data input	G10/G11	●	●	●	●	●
Subprogram call	Allowing 9 nesting levels	●	●	●	●	●
User macro program		●	●	—	●	●

● : Standard ★ : Optional — : Not optional

Item	Specification	HNC-808Di		HNC-818Di		HNC-848Di	
		M	T	M	T	M	
Local variable of macro program	#0 to #49 (current channel)	●	●	●	●	●	
Global variable of macro program	#50 to #199 (current channel)	●	●	●	●	●	
Non-modal calling subprogram	G65	—	—	●	—	●	
Interrupt-type user subprogram	M96/M97	—	—	★	—	★	
Coordinate system rotation	G68/G69	●	●	●	●	●	
Scaling	G50/G51	●	●	●	●	●	
Mirror image	G24/G25	●	●	●	●	●	
Dialog programming input		—	—	★	—	●	
Free contour programming		—	—	★	—	★	
Process cycle							
Drilling cycle	G73: High-speed deep hole drilling	●	—	●	—	●	
	G74: Reverse tapping cycle	●	—	●	—	●	
	G76: Fine boring cycle	●	—	●	—	●	
	G81: Centre hole drilling cycle	●	—	●	—	●	
	G83: Deep hole drilling cycle	●	—	●	—	●	
	G84: Tapping cycle	●	—	●	—	●	
	G85, G86, G89: Boring cycle	●	—	●	—	●	
G87: Back boring cycle	—	—	—	—	—		
Drilling style	G88: Manual boring cycle	●	—	●	—	●	
	G70: circumferential hole drilling	●	—	●	—	●	
	G71: Circular hole drilling	●	—	●	—	●	
	G79: Angular straight hole drilling	●	—	●	—	●	
	G181: Chess type hole drilling	●	—	●	—	●	
Milling cycle	G181: Grooves located on a circle (type 1)	★	—	●	—	●	
	G182: Grooves located on a circle (type 2)	★	—	●	—	●	
	G183: Circumferential groove	★	—	●	—	●	
	G184: Rectangular pocket	★	—	●	—	●	
	G185: Round pocket	★	—	●	—	●	
	G186: End face milling	★	—	●	—	●	
	G188: Rectangular boss	★	—	●	—	●	
G189: Round boss	★	—	●	—	●		
Simple turning cycle	G80: Inner (outer) diameter cutting	—	●	—	●	—	
	G81: End face cutting	—	●	—	●	—	
	G82: Threading	—	●	—	●	—	
Complex turning cycle	G74: End face deep hole drilling	—	●	—	●	—	
	G75: Outer diameter grooving	—	●	—	●	—	
	G71: Inner (outer) diameter rough turning multiple repetitive cycle	—	●	—	●	—	
	G72: End face rough turning multiple repetitive cycle	—	●	—	●	—	
Workpiece measurement cycle	G73: Closed turning multiple repetitive cycle	—	●	—	●	—	
	G76: Threading multiple repetitive cycle	—	●	—	●	—	
	G160: Workpiece probe calibration	—	—	★	—	★	
	G161: Workpiece contour measurement	—	—	★	—	★	
	G162: End face measurement	—	—	★	—	★	
	G163: Workpiece alignment in plane	—	—	★	—	★	
Tool measurement cycle	G163: Workpiece alignment in three-dimensional space	—	—	★	—	★	
	G164: Corner measurement	—	—	★	—	★	
	G150: Tool probe calibration	—	—	★	—	★	
Manual measurement cycle	G151: Tool length measurement	—	—	★	—	★	
	G152: Tool radius measurement	—	—	★	—	★	
User-defined cycle	USERDEF.CYC file modification	●	●	●	●	●	
Auxiliary/spindle function							
Auxiliary function	M plus 4 digits	●	●	●	●	●	
Grouping of auxiliary function		—	—	★	—	★	
The second auxiliary function	B code (It is invalid when B is specified as rotary axis.)	★	★	★	★	★	
MST lock		●	●	●	●	●	
Multiple M codes in a single line	Up to 4 M codes can be specified.	●	●	●	●	●	
Spindle speed control	S plus 5 digits	●	●	●	●	●	
Constant circumferential speed control	G96/G97	—	●	—	●	—	
Spindle speed override	0-120%	●	●	●	●	●	
Spindle speed fluctuation detection		—	—	★	—	●	
Cutting chatter suppressing		—	—	—	—	★	
Spindle synchronization control		—	●	★	●	★	
Multi-spindle control		—	●	★	●	★	
Spindle orientation		●	●	●	●	●	
Spindle positioning		—	●	●	●	●	
C/S switching	CTOS STOC	—	●	★	●	●	
Rigid tapping		●	●	●	●	●	
Tool function/tool compensation function							
Tool function	T plus 4 digits	●	●	●	●	●	
Number of tool compensations		—	100	—	500	—	1000
Tool radius compensation (C type tool compensation)	G40/G41/G42	●	●	●	●	●	

● : Standard ★ : Optional — : Not optional

Item	Specification	HNC-808Di		HNC-818Di		HNC-848Di
		M	T	M	T	M
Tool wear compensation		●	●	●	●	●
Tool length compensation	G49/G43/G44	●	●	●	●	●
Tool management		●	●	●	●	●
Magazine management		—	—	★	—	●
Automatic measurement of tool length		—	—	★	—	★
Automatic compensation of tool radius		—	—	★	—	★
Tool life management		●	●	★	●	●
Automatic tool offset input		●	●	★	●	★
Spatial length compensation		—	—	—	—	●
Characteristics coordinate system		—	—	—	—	●
Inclined surface machining	G68.1	—	—	—	—	●
Axial control of tool	G53.1	—	—	—	—	●
5-axis machining	RTCP	—	—	—	—	●
Precision control						
Backlash compensation		●	●	●	●	●
Pitch error compensation		●	●	●	●	●
Thermal error compensation		★	★	★	★	●
Deflection error compensation		—	—	★	—	●
Spatial error compensation		—	—	★	—	●
Edit						
Storage of part program		400M		400M		400M
Foreground programming		●	●	●	●	●
Background programming		●	●	●	●	●
Program protection		★	★	●	★	●
Dialogic programming		—	—	★	—	●
Program index		●	●	●	●	●
Set/display						
CNC state display		●	●	●	●	●
Clock display		●	●	●	●	●
Current position display		●	●	●	●	●
Parameter setting		●	●	●	●	●
Alarm display		●	●	●	●	●
Fault history		—	—	●	—	●
Operation history		—	—	★	—	★
Machining information display	Working time, number of machined parts, etc.	●	●	●	●	●
Feedrate display	F value display	●	●	●	●	●
Spindle speed display	S value display	●	●	●	●	●
T code display		●	●	●	●	●
Current programmed path display		●	●	●	●	●
Ladder editing software		—	—	●	—	●
Online ladder modification		—	—	●	—	●
Online ladder monitoring		—	—	●	—	●
Program preview		—	—	●	—	●
Servo adjustment interface		—	—	★	—	★
Three-dimensional solid dynamic simulation		—	—	—	—	★
Multi-language	Simplified Chinese	●	●	●	●	●
	English	★	★	★	★	★
Multi-level permission of data	Four levels: basic, machine manufacturer, CNC system manufacturer, administrator	●	●	●	●	●
Online help		●	●	●	●	●
Animated navigation		—	—	★	—	●
Monitor picture of oscilloscope	Real-time sampling output	●	●	●	●	●
External input/output monitoring display		●	●	●	●	●
Macro variable monitoring		●	●	●	●	●
Internal data monitoring	Data, such as the internal register of CNC, is displayed	●	●	●	●	●
Multi-channel combination display		—	★	●	★	●
Data import/export	Import or export of files such as parameter and PLC	●	●	●	●	●
Function upgrade registration		●	●	●	●	●
Online upgrade of system version		●	●	●	●	●
Characteristics coordinate system setting	20	—	—	—	—	●
Others (hardware)						
Spindle control and encoder interface	Resolution: 12-bit Output voltage: DA 0 to 10V or -10V to +10V Differential reception of square wave	●	●	●	●	●
User I/O	Can exten 4096/4096 at most	●	●	●	●	●
Dimension of display unit		10.4" color display		8.4" / 12.1" color display		15" color display
Resolution of display unit		640x480		800x600		1024x768
Standard PC keyboard interface		●	●	●	●	●
DNC unit		—	—	—	—	—
RS232 interface		—	—	—	—	—
USB interface		●	●	●	●	●
CF card interface		—	—	—	—	—
Ethernet interface	10MB/100MB adaptive speed Supporting NT/NOVELL network. Supporting file transfer via network	★	★	★	★	★
Manual pulse generator	Manual pulse generator (TTL level input) Coordinate select, override select. Emergency stop button, MPG activation button	★	★	★	★	★
Input terminal board	Support NPN and PNP 20-way switch	★	★	★	★	★
Output terminal board	Support NPN 16-way switch	★	★	★	★	★