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TTGroup | Tongtai HONOR APEC

Aerospace Industry Solutions

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Content Manual

TTGroup | Tongtai | HONOR | APEC | QUICK-TECH | Contrel

Tongtai started out from the manufacturer of customized machine tools and therefore customization and turnkey projects are the core value of Tongtai.

According to customers' requirements, andlysis of machining operations, arrangement of production lines, design of tooling & fixtures, machining programs and cutting tests are all carried out in Tongtai's site and finally approved by customers, it realizes immediate benefits in customers' site.

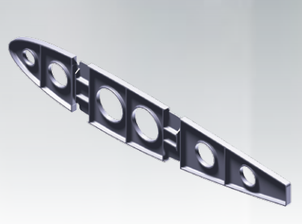
Tongtai has been dedicated in the aerospace industry for many years and even more decades ago Tongtai machines have been working for the leading manufacturer of aerospace industry in Taiwan. Until now, Tongtai machines are still running for the main production line in the customer's site.

Tongtai has much experience in customization, as well as the flexibility and quick response to meet with customers' critical requirements. In recent years, Tongtai has been working with the aerospace parts manufacturer together in developing the 5-axis horizontal machining center to make the part of engine casing. The final result we've got is improving the machining efficiency by nearly 20% against our competitor.

Most of aerospace parts have features of large size, complex shape, hart-to-cut and high precision. To satisfy these requirements, Tongtai works with Honor Seiki and APEC together to develop the specific equipment subject to aerospace industry, including the 5-axis vertical and horizontal machining centers, high speed gantry type 5-axis machining centers, vertical machining centers, vertical CNC lathes and high precision grinding machines. For the engine parts, structure components of aircraft body, mold and fixture for aerospace industry, Tongtai Group can provide all quality equipment to work with.

Combining with the equipment of high-speed, high-rigidity, high-precision and the customized experience for over 40 years provided by Tongtai Group, we are confident that our equipment can perfectly satisfy all the requirements subject to the machining process and high precision for aerospace industry, and also Tongtai Group would be your reliable partner for cooperation.

Structure Parts



Wing rib structure

Landing gear

Engine Components

Engine casing

Blisk

Composites & Die

Composite parts

Mold for composite

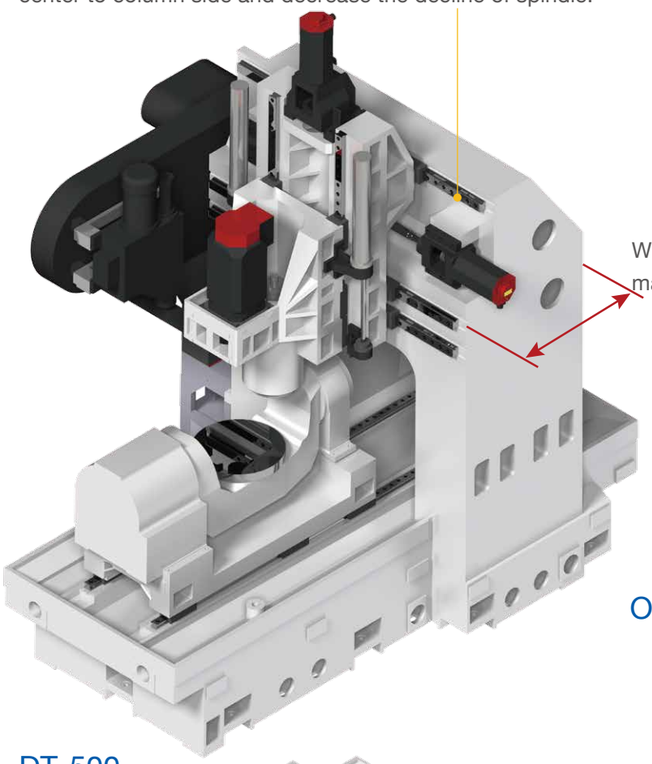
Structure Parts

5-axis Machining Center

DT-500

Triple linear guide structure

The structure is not only improve rigidity but move the gravity center to column side and decrease the decline of spindle.



Machining Part

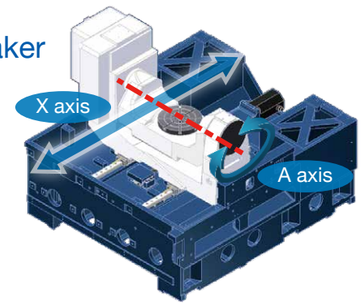
Engine mount

Wide column structure ensures machining stability.

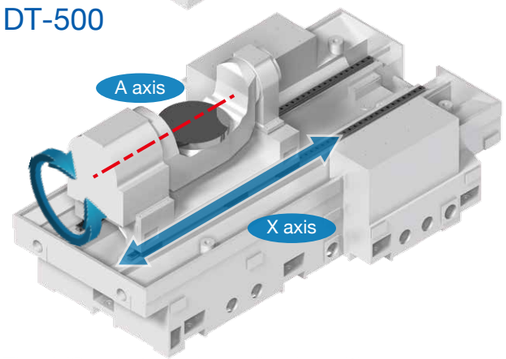
Features

- High rigidity double column structure
- Triple linear guide structure is adopted on Y-axis
- Double nut ballscrews are used on each axis

Other maker



DT-500



The A/C-axis table is on fixed position, compared with other maker's model, there is no pendulum motion by the cradle when each axis moves at high speed. It's can improve the A-axis positioning.

Specification

Specification	Unit	DT-500	
Table size (L×W)	mm	Ø500	
X/Y/Z axis stroke	mm	510/730/510	
X/Y/Z axis rapid traverse	m/min	30/30/30	
Spindle taper		7/24 Tapre NO.40	7/24 Tapre NO.50
Spindle speed	rpm	15,000 (Built-in type) 20,000 (Built-in type)	3,500 (Belt type)
Spindle motor	kW	40/40 40/30	15/11
A/C axis stroke	deg	+30°~-120°/360°	
A/C axis speed	rpm	30/50	

High Speed 5-axis Gantry Machining Center

GM Series

GM Series is for 5-axis high speed milling and material removal time reduction of large Al structures and titanium alloy in aircraft. It has a grounded table and linear motor XYZ driving, making an impressive 60 m/min feed rate. Germany-made 5-axis head brings precious 5-axis motion. Symmetrical “box-in-box” design can reduce structure transformation. One-piece columns enhance rigidity.

Features

- Box in Box
- XYZ driven by linear motors
- High dynamic response
- 5 axis continuous motion
- Customized dual cross beam

G Series

G Series is for 5-axis high speed milling of medium-to-large Al structures in aircraft. Its full enclosed loop structural design could increase the cutting rigidity and stability significantly, and save machine floor area. Precious 5-axis motion is mainly given by Germany-made 5-axis head, 24,000 rpm spindle, high dynamic response in XYZ, XY axis with linear motor drive, and Z axis with dual ball screws.

Features

- Linear motor driving
- High dynamic response
- 5-axis continuous motion

Specification

Specification	Unit	MAGLEV (linear motor driving)	DYNA (ball screw driving)
X/Y/Z axis stroke	mm	4,000/2,000/1,000	
Rapid traverse	m/min	X=60 Y=60 Z=40	X=20 Y=20 Z=20
Spindle speed	rpm	24,000	
Spindle power (S1/S6)	kW	37/46	
Spindle torque (S1/S6)	Nm	60/73	
B/C axis max. swivel/rotation speed	rpm	B=30 C=30	
B/C axis max. swivel/rotation torque (S1-100%)	Nm	B=760 C=800	
B/C axis max. swivel/rotation angle	deg	B= ±105° C±200°	

Machining Part

Wing rib structure

Specification

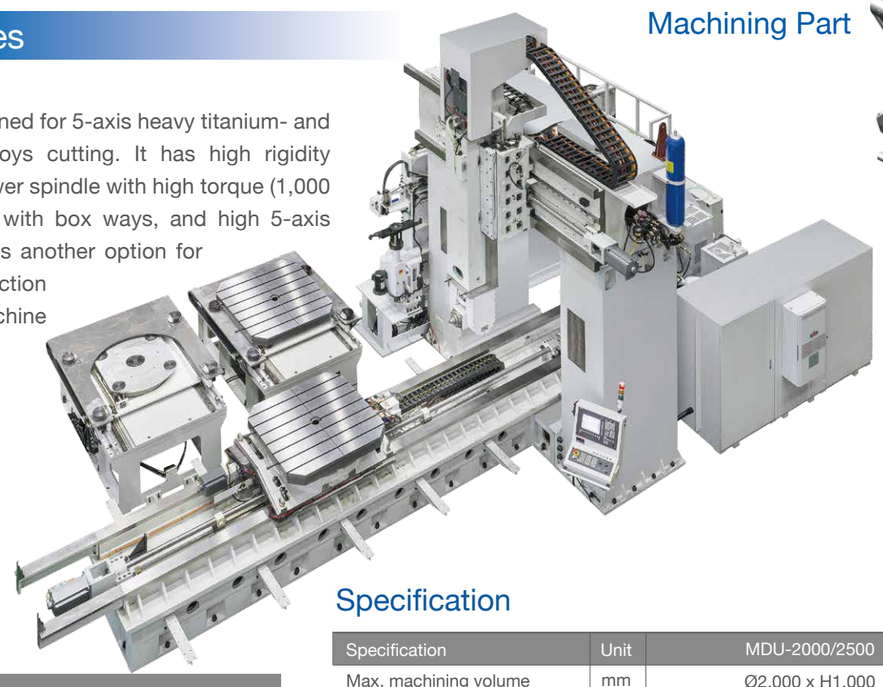
Specification	Unit	GM3060
X/Y/Z axis stroke	mm	6,000/3,000/1,000
Spindle speed	rpm	24,000
Spindle motor (S1/S6)	kW	37/46
Spindle torque (S1/S6)	Nm	60/73
Max. swivel/rotation torque (S1-100%)	Nm	B=760 C=800
Max. swivel/rotation angle	deg	B= ±105° C±200°
Rapid traverse	m/min	XYZ=50

*HSK 100A, 12,000 rpm (opt.)

Heavy Duty 5-axis Machining Center

MDU Series

MDU is designed for 5-axis heavy titanium- and nickel-based alloys cutting. It has high rigidity design, high power spindle with high torque (1,000 Nm), XYZ axes with box ways, and high 5-axis accuracy. APC is another option for automatic production to increase machine duty rate.



Features

- 5 axis continuous motion
- High power spindle
- High rigidity machine structure
- Auto pallet exchange for mass production

Specification

Specification	Unit	MDU-2000/2500
Max. machining volume	mm	Ø2,000 x H1,000
X/Y/Z axis stroke	mm	2,000 (exclude APC travel)/2,000/800
Spindle speed	rpm	3,000
Spindle power (S1/S6)	kW	30/36
Spindle torque (S1/S6)	Nm	840/1,000
B axis swivel torque (S1/S6)	Nm	3,200/3,700
B axis clamping force	Nm	5,000

Machining Part

Landing gear

High Speed 5-axis Double Column Machining Center

MT Series

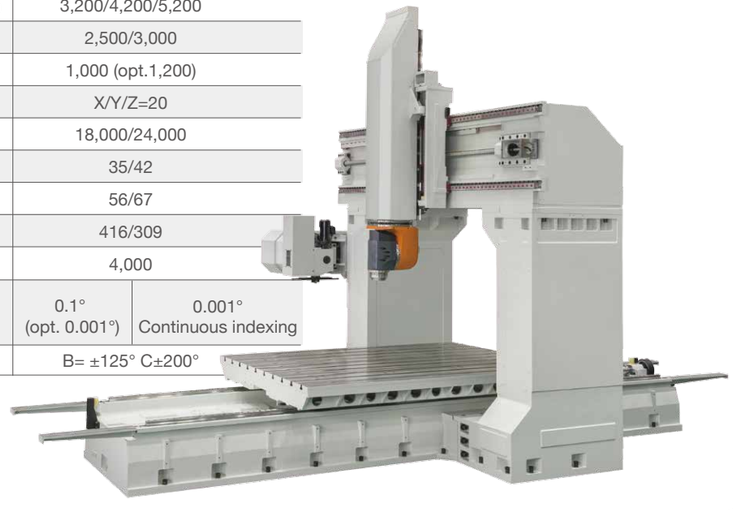
MT24 is for 5-axis high speed milling of long medium-sized aluminium structures in aircraft. Its excellent performance and efficiency is mainly given by high rigidity machine structure design, XYZ-axis with high rigidity roller linear guideways, 5-axis head driven by torque motor, and Z axis with dual ball screw.

Features

- 5 axis continuous motion
- High power spindle
- High rigidity machine structure

Specification

Specification	Unit	MT24		
		3 axis	3+2 axis	5 axis
X axis	mm	3,200/4,200/5,200	3,200/4,200/5,200	
Y axis	mm	2,300	2,500/3,000	
Z axis	mm	1,000 (opt.1,200)	1,000 (opt.1,200)	
Feedrate	m/min	X/Y/Z=20	X/Y/Z=20	
Spindle speed	rpm	18,000/24,000	18,000/24,000	
Spindle power (S1/S6)	kW	35/42	35/42	
Spindle torque (S1/S6)	Nm	56/67	56/67	
B/C axis motor torque (max.)	Nm	-	416/309	
B/C axis clamping torque	Nm	-	4,000	
B/C axis indexing	deg	-	0.1° (opt. 0.001°)	0.001° Continuous indexing
Swivel/rotation angle	deg	-	B= ±125° C±200°	

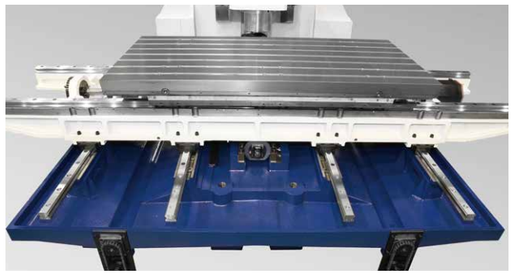


Vertical Machining Center

TMV-1500A

Features

- Huge size table with long X-axis stroke.
- High efficiency chip disposal
- The Y axis employs four guideways to offer superior support of the X axis saddle and best accuracy.



Specification

Specification	Unit	TMV-1500A
Table size (L×W)	mm	1,600 x 762
X/Y/Z axis travel	mm	1,525/762/710
X/Y/Z axis rapid traverse	m/min	18/18/18
Spindle taper		7/24 Taper No.40
Spindle speed	rpm	8,000 (10,000)
Spindle motor	kW	9/7.5 (18.5/15/11)
Spindle torque	Nm	114/95 (44/36/26)

Machining Part

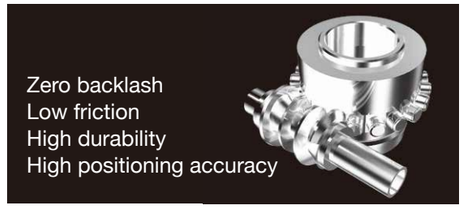
Wing rib structure

5-axis Horizontal Machining Center

HTH-1250

Features

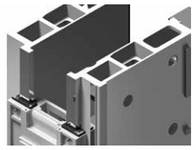
- Minimum indexing accuracy of A/B axis is 0.001°.
- Roller gear cam rotary table with high torque swivel spindle.
- Full-circle hydraulic braking system offer high rigidity and stability during heavy duty cutting.



B-axis rotary table is driven by roller gear cam with rolling contact between roller and cam. It can start at a lower torque. Benefits are zero backlash with double-sided contact, low vibration, long life, high accuracy, and better than conventional worm-gear mechanism.

Specification

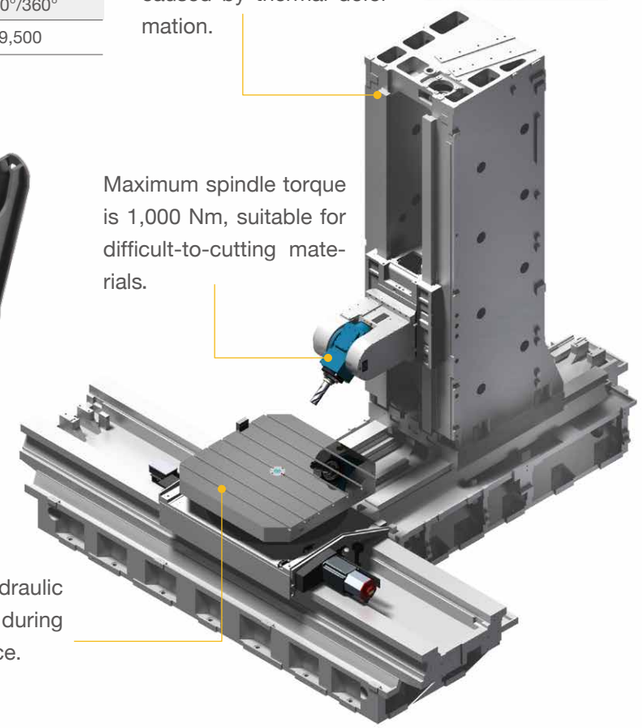
Specification	Unit	HTH-1250
Table size (L×W)	mm	1,250 x 1,250
X/Y/Z axis travel	mm	2,000/1,400/1,600
X/Y/Z axis rapid traverse	m/min	20/20/20
Spindle taper		7/24 No.50
Spindle speed	rpm	5,000 (8,000)
Spindle motor	kW	44/37
Spindle torque	Nm	1,000/840
A/B axis stroke	deg	110°~+110°/360°
Max. A/B axis torque	Nm	32,000/9,500



Double-wall and symmetrical structure are used to improve structure rigidity and reduce accuracy error caused by thermal deformation.

Machining Part

Landing gear



Maximum spindle torque is 1,000 Nm, suitable for difficult-to-cutting materials.

High precision positioning cones with hydraulic locking device to ensure the table stability during machining. It can produce 20 ton braking force.
Braking torque 16,500 Nm
Driving torque 8,550 Nm

Engine Components

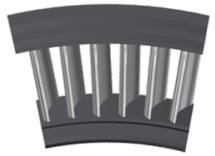
5-axis Horizontal Machining Center

HB-800-5AX

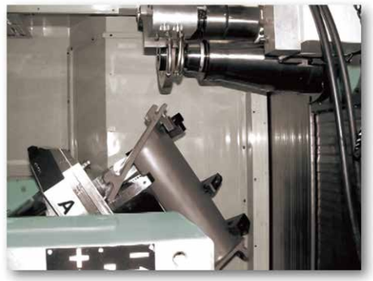
Features

- Equipped with tilting/rotary table to achieve synchronous 5-axis machining.
- Auto pallet exchange system improves production availability.
- High rigidity roller linear guide structure.

Machining Part



Vane



A/C axis rotary table

High precision positioning cones with hydraulic locking device, generating 18 tons of clamping force to ensure the table stability during machining.

Specification

Specification	Unit	HB-800-5AX
Table size (L×W)	mm	800 x 800
X/Y/Z axis travel	mm	1,400/1,200/1,000
X/Y/Z axis rapid traverse	m/min	50
Spindle taper		7/24 Taper No.50
Spindle speed	rpm	Built-in type10,000 (Opt.gear box type 6,000)
Spindle motor	kW	30/25
A/C axis stroke	deg	-20°~+110°/360°

Vertical CNC Lathe

VL-200C

The vertical lathes from Honor Seiki are perfectly suitable for the turning of engine parts. Because the engine parts are made of high temperature nickel-based alloys and therefore the machining resistance is quite high, to machining such engine parts, the machine rigidity and tool stability are very important. The vertical lathes from Honor Seiki have been trusted by customers not only in the aerospace industry for engine parts, but also been trusted to make the components for rocket.

Specifications

Specifications	Unit	VL-200C
Table Diameter	mm	2,000
Max. swing diameter	mm	2,500
Max. turning diameter	mm	2,500
Max. turning height	mm	1,600
Table speed	rpm	200
Tool capacity		16

Machining Part

Fan casing

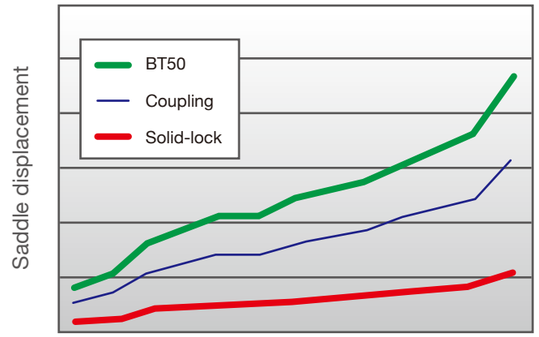
Combustion casing

Turbine disc

VL-160C

For Honor Seiki machines, one of the most important reasons to make the parts for aerospace industry is given to its unique tool-clamping system “Solid Lock Double Faced Contact Clamping System”, which gains the clamping force 3 times more than the BT-50 tool system on the market, maintain tool stability, improve tool life and save more machining costs for customers.

Comparison of tool clamping system



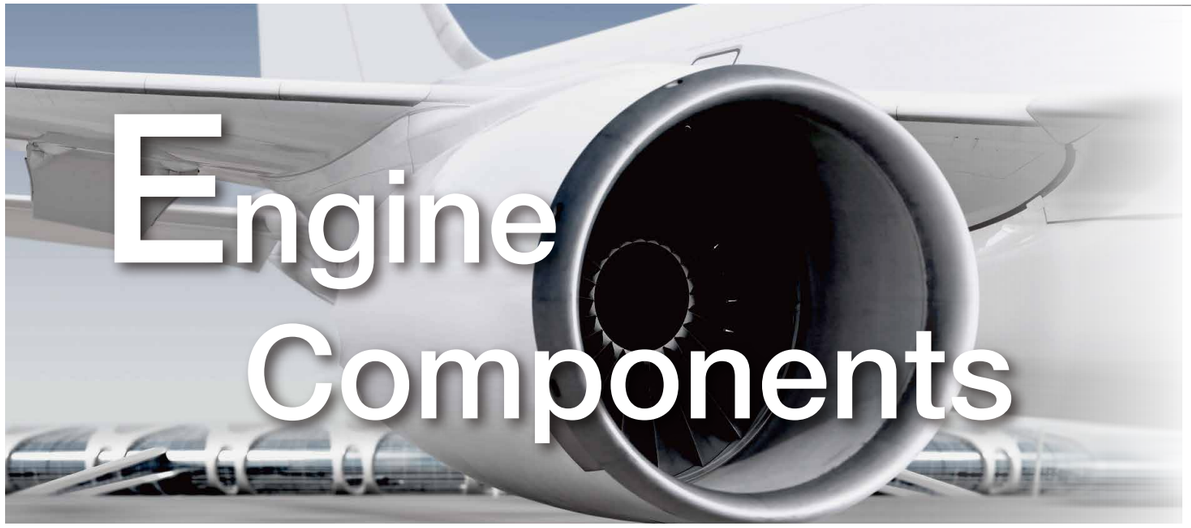
Specifications

Specifications	Unit	VL-160C
Table Diameter	mm	1,600
Max. swing diameter	mm	2,000
Max. turning diameter	mm	2,000
Max. turning height	mm	1,200
Table speed	rpm	250
Tool capacity		16

Features

- Solid Lock Double Faced Contact Clamping System
- 4 times tool clamping rigidity, provide optimum tool stability
- Better reliability, better efficiency, higher accuracy
- Save tool-change time and tool wear-out
- In particular case, save 40% machining time for Japanese customer

Vertical Grinding Machine



VG-120GB

Vertical grinding machine VG-120GB adopts the swing head specifically designed for aerospace industry. Except for the traditionally rigid structure, the machine also adopts the precision B-axis with the transmission system of high rigidity roller cam. Grinding wheel can change any angle. The machine works with the software of thermal compensation to enhance the grinding precision and dimension stability, especially for the grinding of engine fan.

Features

- Design of high rigidity structure
- Surpass width of X-axis stroke
- Large torque and high rigidity built-in spindle
- Stepless B-axis indexing
- Thermal distortion compensation system
- Excellent machining precision: 1.5 micro ~ 2.5 micro

Machining Part

Fan disc

Specifications

Specifications	Unit	VG-120GB
Table diameter	mm	1,200
Max. swing diameter	mm	1,400
Max. turning diameter	mm	1,200
Max. turning height	mm	500
Table speed	rpm	6,000
B axis swivel angle	deg.	± 45°

Vertical Machining Center

TMV-1600A

Specifications

Specifications	Unit	TMV-1600A
Table size	mm	1,700 x 850
X/Y/Z axis travel	mm	1,600/800/700
X/Y/Z axis rapid traverse	m/min	15/15/12
Spindle taper		7/24 Taper No.50
Spindle speed	rpm	3,500 /6,000(Gear box) (Opt. 3,500/6,000 belt type)
Spindle motor	kW	15/11(Opt. 18.5/15)
Spindle torque	Nm	731/536 (382/280)

Z axis is blanced by counter-weight to reduce the loading of servo motor and improve its machining precision.

Casting components on this machine are made of high quality cast iron, and through finite element analysis(FEA), the static and dynamic rigidity can be ensured.

- With huge size box-way design, heat treatment, and precision grinding, these features can reach the requirements of heavy duty cutting and high rigidity.
- Turcite-B and precise scraping is applied on slide surface of box-way to ensure the best lubrication effect.
- The Y axis employs four guideways to offer superior support of the X axis saddle and best accuracy.

Machining Part

Combustion chamber

Features

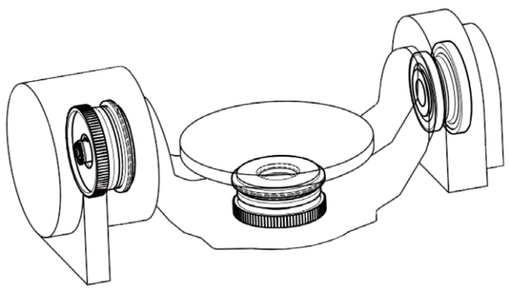
- High rigidity box-way structure
- Suitable for heavy machining
- High efficiency chip disposal
- Y axis is supported by four guides to provide enough rigidity while heavy cutting

Gantry Type 5-axis Machining Center

GT-630 / GT-800

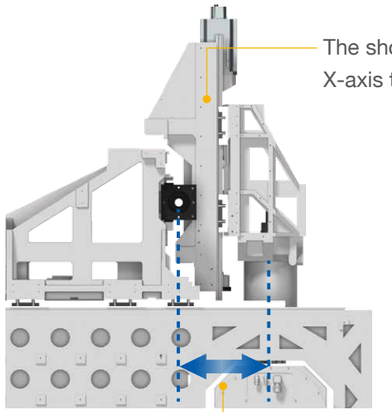
Direct-drive type tilting/rotating table

Direct-drive motor is used as the driver of A/C-axis tilting and rotating. It's one of the best solutions for high speed machining. The advantages of DD motor are less volume, less error, higher resolution, higher torque, and higher speed.

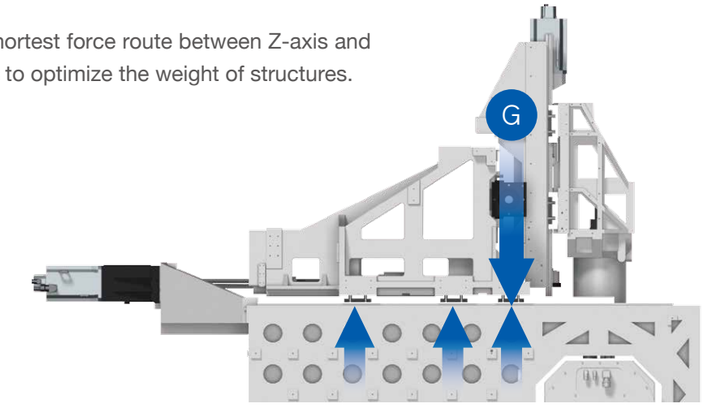


Features

- Gravity center driven and weight optimized of moving component
- Direct-drive type tilting/rotating table
- Standard 15,000 rpm built-in spindle (opt. 20,000 rpm)



Less overhung spindle provides excllent rigidity in heavy duty machining.



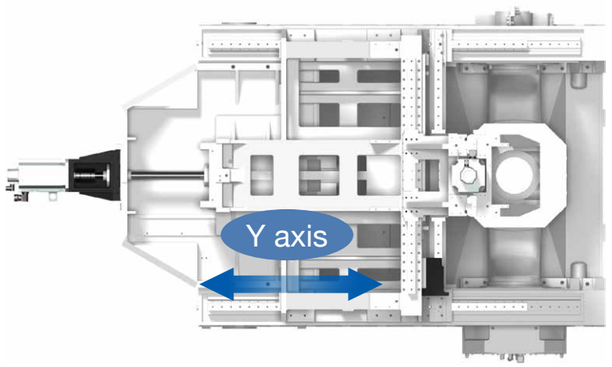
The gravity center of Y-axis moving components falls within the supporting range of sliding block, it decreases the decline of spindle and improves dynamic stability.

Machining Part

Turbine disc

Gravity center driven and weight optimized of moving component

New slide structure patent M436522



Y axis is driven by single ballscrew at the center of gravity to ensure the parallelism of slide moving.

Specifications

Specifications	Unit	GT-630	GT-800
Table size (LxW)	mm	Ø630	Ø800
X/Y/Z axis travel	mm	760/820/560	850/1,020/610
Spindle speed	rpm	Built-in type 15,000 (opt. 20,000)	
Spindle motor	kW	40/40 (opt. 40/30)	
X/Y/Z axis servo motor	kW	6.5/8.6/8.6	
A/C axis rapid traverse	rpm	30/50(DD motor)	16/30(DD motor 16/50)

5-axis Horizontal Machining Center

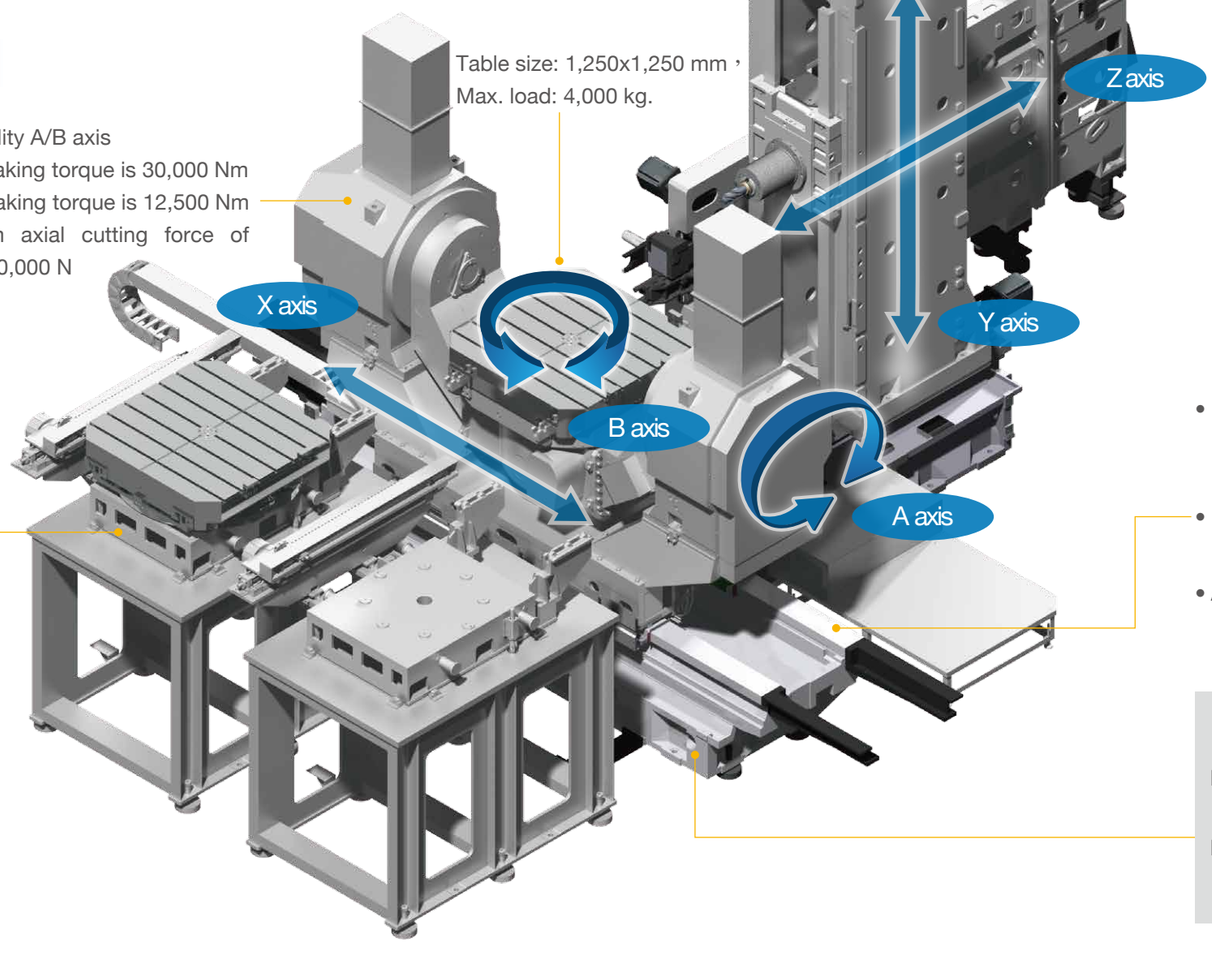
HTT-1250

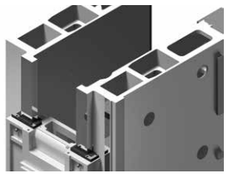
Features

- 5-axes machining with 0.001° indexing increment
- Ultra high spindle torque
- APC system is available to enhances availability
- Excellent contour accuracy

High rigidity A/B axis
A axis braking torque is 30,000 Nm
B axis braking torque is 12,500 Nm
Maximum axial cutting force of table is 20,000 N

With APC system, while the machine is running, another working table is able to load and unload workpiece. This increases availability.



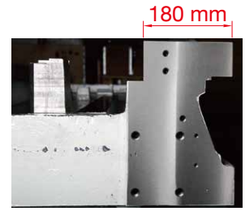


Double-wall and symmetrical structure are used to improve structure rigidity and reduce accuracy error caused by thermal deformation.

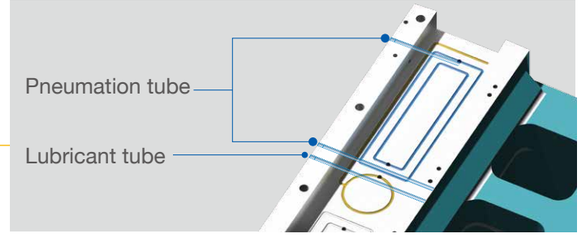
Specifications

Specifications	Unit	HTT-1250
Table size (LxW)	mm	1,250 x 1,250
X/Y/Z axis stroke	mm	2,000/1,800/1,250
X/Y/Z axis rapid traverse	m/min	10/10/10
Spindle speed	rpm	6,000 (8,000)
Spindle motor	kW	22/18.5 (26/22)
A/B axis rapid traverse	rpm	5/5

Casting components on this machine are made of high quality cast iron, and through finite element analysis(FEA), the static and dynamic rigidity can be ensured.



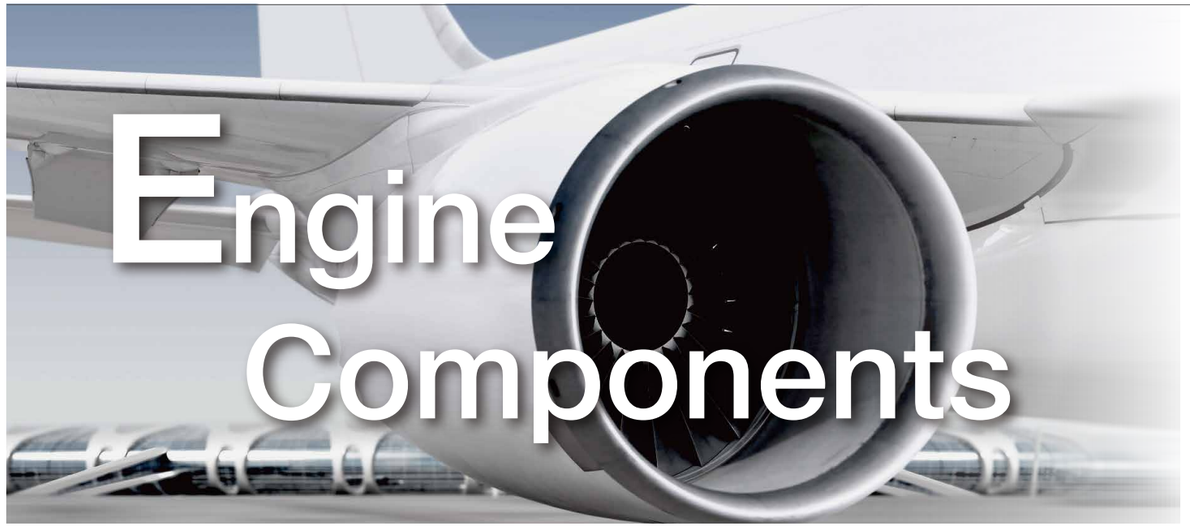
- With huge size box-way design, heat treatment and precision grinding can reach the requirements of heavy duty cutting and high rigidity.
- Turcite-B and precise scraping are applied on slide surface of box-way to ensure the best lubrication effect.
- Air levitation is adopted on slide surface to reduce friction and improve positioning and repeatability accuracy of slide.



Machining Part

Combustion Casing

Heavy Duty 5-axis Machining Center



MDU Series

MDU is specified for aircraft engine casing, and increase duty rate by automatic production. Its compact head can cut outer profile and narrow inner profile of component without other tool handlers. It meets practical requirements and breaks bottlenecks with high rigidity, high power spindle with high torque (1,000 Nm), XYZ axes with box ways, and high 5-axis accuracy.

Machining Object

Engine Casing

Blisk

Engine Casing

Auto pallet exchange to boost up duty rate.

Minimum machining interference

Compact milling head can cut internal and external profile, no additional attachments needed, which solves the problem of space limitation.

Safe and practical

- Full-enclosure guard, safetyfence, and reinforced window.
- Oil mist collection system
- Tool magazine with covers and door

Feature	
• 5 axis continuous motion	• High torque spindle
• High rigidity machine structure	• Patent by APEC
• Auto pallet exchange for mass production	
• Advanced 5-axis controller	
• Excellent 5-axis dynamic accuracy	

Specifications

Specifications	Unit	MDU-2000 / 2500
Max. machining volume	mm	Ø2,000 x H1,000
X/Y/Z axis stroke	mm	2,000 (exclude APC travel)/2,000/800
Spindle speed	rpm	3,000
Spindle power (S1/S6)	kW	30/36
Spindle torque (S1/S6)	Nm	840/1,000
B axis swivel torque (S1/S6)	Nm	3,200/3,700
B axis clamping force	Nm	5,000

Composites & Die

High Speed 5-axis Gantry Machining Center

G Series

G series is for 5-axis high speed milling of composite material. It has full-closed working zone, dust protection system for machine, and dust collecting and filter system. Precious 5-axis motion is mainly given by 20,000 rpm spindle, high dynamic response in XYZ, XY axis with linear motor drive, and Z axis with dual ball screws.

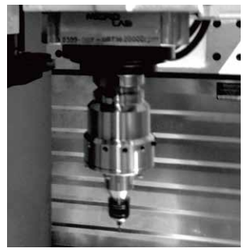
Features

- 5-axis continuous motion
- Dust collecting and filtering system
- Fully enclosure working space
- Power isolation system

Dust collector on 5-axis head

Machining Part

Composite wing component



Ultrasound spindle to cut honeycomb plate (opt.)

Specifications

Specifications	Unit	MAGLEV (linear motor drivint)	DYNA (ball screw driving)
X/Y/Z axis stroke	mm	7,000/4,000/1,000	
Rapid traverse	m/min	X=60 Y=60 Z=40	X=20 Y=20 Z=20
Spindle speed	rpm	24,000	
Spindle power (S1/S6)	kW	37/46	
Spindle torque (S1/S6)	Nm	60/73	
B/C axis max. swivel/rotation speed	rpm	B=30 C=30	
B/C axis max. swivel/torque (S1-100%)	Nm	B=760 C=800	
B/C axis max. swivel/rotation angle	deg	B= ±105° C±200°	

High Speed 5-axis Double Column Machining Center

MT Series

MT24 is for 5-axis high speed milling of die/mold, jig, and fixture for aircraft parts. Its excellent performance and efficiency is mainly given by high rigidity machine structure design, XYZ axis with high rigidity roller linear guideways, 5-axis head driven by torque motor, and Z axis with dual ball screws.

Features

- Best for complex mold surface
- High rigidity machine body
- XYZ with high rigidity roller linear guide ways
- 5-axis swivel head driven by torque motor

Specifications

Specifications	Unit	MT24		
		3 axis	3+2 axis	5 axis
X axis	mm	3,200/4,200/5,200		
Y axis	mm	2,300	2,500/3,000	
Z axis	mm	1,000 (opt. 1,200)		
Feedrate	m/min	X/Y/Z=20		
Spindle speed	rpm	18,000		
Spindle power (S1/S6)	kW	35/42		
Spindle torque (S1/S6)	Nm	56/67		
B/C axis motor torque (max.)	Nm	-	416/309	
B/C axis clamping torque	Nm	-	4,000	
B/C axis indexing	deg	-	0.1° (opt. 0.001°)	0.001° Continuous indexing
Swivel/rotation angle	deg	-	B= ±125° C±200°	

High Speed 5-axis Gantry Machining Center

G2540

G2540 is for 5-axis or 3+2 axis high speed milling of die/mold, jig, and fixture. Its smooth surface is mainly given by 24,000rpm spindle, high dynamic response in XYZ, Z axis with dual ball screws, and cooling system. Its high positioning accuracy is mainly given by shortest-force-loop structural design, and Germany-made 5-axis head with linear scale.

Features

- 5-axis cutting / 3+2 axis cutting
- High accuracy
- Excellent mold surface quality

Machining Part

Mold for composite

Specifications

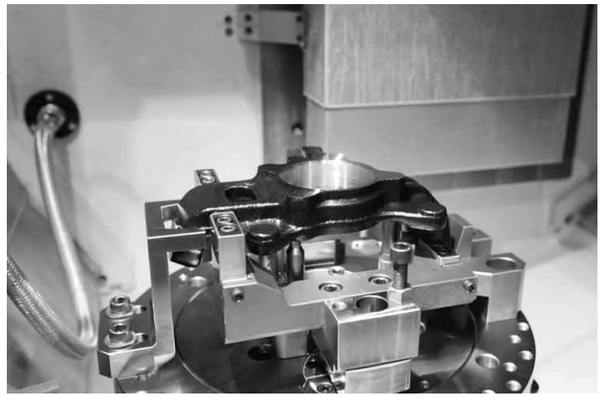
Specifications	Unit	MAGLEV (linear motor driving)	DYNA (ball screw driving)
X/Y/Z axis stroke	mm	4,000/2,000/1,000	
Rapid traverse	m/min	X=60 Y=60 Z=40	X=20 Y=20 Z=20
Spindle speed	rpm	24,000	
Spindle power (S1/S6)	kW	37/46	
Spindle torque (S1/S6)	Nm	60/73	
B/C axis max. swivel/rotation speed (max.)	rpm	B=30 C=30	
B/C axis max. swivel/rotation torque (S1-100%)	Nm	B=760 C=800	
B/C axis swivel/rotation angle	deg	B= ±105° C±200°	

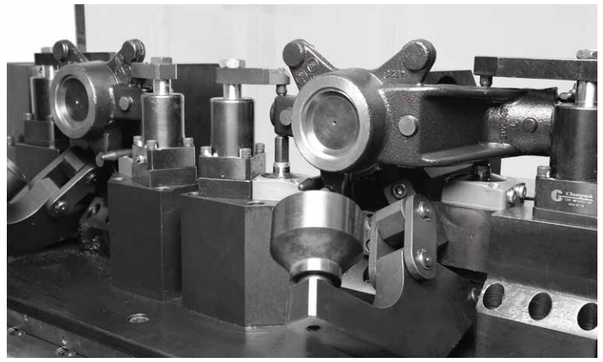
Jig & fixture technology

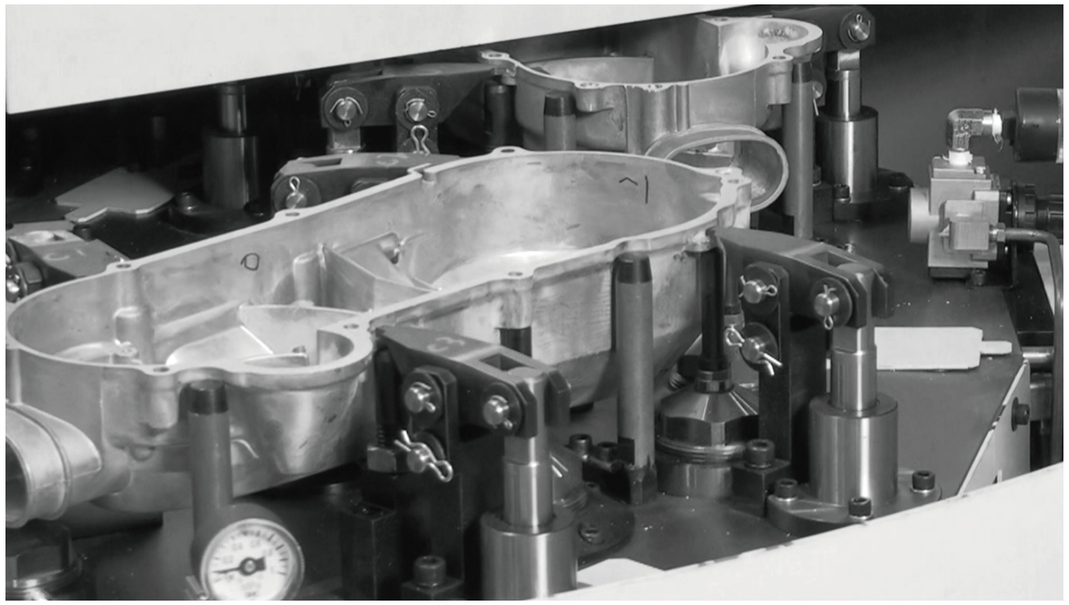
Tongtai group has years of experience of design and manufacturing production lines. From the early stage of machine selection to the final stage of machining process, Tongtai can offer total solutions. Customers can start production and benefit by Tongtai's unique technology support.

Also, the design and quality of fixture play an important role in the machining process, and result in the final accuracy. A well-designed fixture must have features of rapid clamping/unclamping, precise positioning and stable holding. No matter in manual manipulate or automatic transfer line, the part must be reachable easily and located precisely each time during loading. Aerospace parts often require longer machining time, so the hydraulic and pneumatic system must remain stable for a long period.

The jig & fixtures designed and manufactured by Tongtai need test for a long period to ensure smooth action and stable holding. Tongtai started out from the manufacture of customized machine tools, and had more than 40 years experience of jig & fixtures' design, and produced thousands of jig & fixtures. Tongtai is confident to satisfy customers with its excellent quality.







Flexible Manufacturing System (FMS)

Flexible Manufacturing System (FMS) means a reasonable, flexible and versatile machining system including machine itself, auto moving system, and software which can integrate both. Main application is suitable for products of low volume and high variety, in detail will include the machining unit, storage unit, logistic handling unit, accessory unit and control unit. First four units are hardware of flexible manufacturing system. The control unit will integrate each hardware, control the info flow between each unit and make the whole system flexible, reasonable and compactable.

Container

It allows temporary storage of machined parts and finished goods. The basic storage capacity is 10 sets and possible to expand to 20 sets maximum.

Stacker Crane

It assists workpiece movement from storage area to loading area, loading area to machining station, or between the stations.

Loading/unloading station

Raw material and finished workpiece can be loaded and unloaded at this station. One loading/unloading station is standard and the second one is available.

Manufacturing Management System, MMS

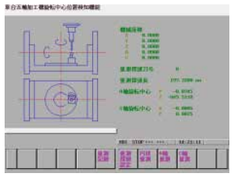
All control information of FMS can be set in this system. Moreover, it can combine with a monitoring module for collecting the production information and feedback.

- Based on following four conditions to decide the priority of handling sequence, “first in first out”, “optimization route ”, “machine intelligence judgments” and “manual priority sequence adjust”.
- Operator can control the raw material input, adjust priority sequence, and check workpiece history record.
- When one single machine is down, other machine can still work properly.

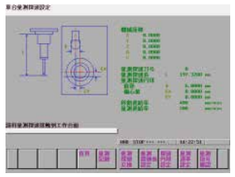
Rotating center detection for 5-axis machining center

The shape of aerospace part is more complicate, most of them require five-axis simultaneous machining. These complicate parts need high precision and repeatability in the long period machining process. For five-axis simultaneous machining, the machining precision can be influenced by the outer circumstance and the precision of machine itself, such as collision or main part replacement, which will lead to the center position error, and machining precision. Hence in the real machining, especially fine machining, five-axis precision calibration is necessary in order to increase the machining precision. Tongtai have developed its own rotating center detection which can easily do the calibration with a friendly operational interface, also include a tool measurement and part coordinate function.

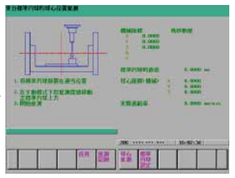
Only four steps, the rotation center alliance can be done in 10 minutes.



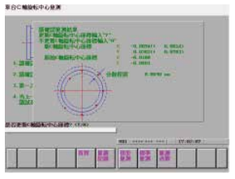
Main function display



Step 1: Probe setup

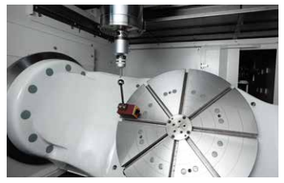


Step 2: Ball measurement



Step 3: First rotation axis auto calibration

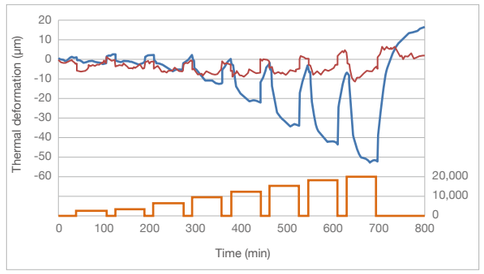
Step 4: Second rotation axis auto calibration



1. Calibration of rotating centers
2. Tool length measurement
3. Tool breakage detection
4. Manual workpiece position measurement
5. Automatic workpiece position measurement

Compensation of spindle thermal expansion (opt.)

Machine component will be influenced by the inner and outer temperature change during machine running and machining process. There will be a different grade of thermal deformation to affect machining precision due to the uneven distribution of heat and complex structure. Tongtai spindle have optional function of thermal deformation compensation, through measurement of temperature-displacement data model and feed back the data to the compensation card, which installed on the machine. During machining, compensation system will reach the sensor on the machine, and read the temperature data, then compare the thermal deformation compensation model data, and calculate the compensation value for compensation command. With this thermal deformation compensation function, the spindle precision for each axis can be controlled within 20 μm.



Z-axis thermal expansion chart