# **MRA600**

5-Axis high speed machining center designed for precision mold, precision parts, complex hardware processing, positioning processing and 5-axis simultaneous processing of heavy workpiece.

HIGHSPEED

**MRA600** 



JINGDIAO 5-AXIS HIGH-SPEED MACHINING CENTER

# **MRA600**



## **Highlights**

- 01 Heavy load rotary table (max 881.84lb) with good stability, and the a-axis uses double-drive technology.
- 02 The machines are capable of milling, grinding, drilling, boring, tapping and other composite processing.
- 03 63 capacity tool magazine capacity, meeting the needs of complex mold processing.
- 04 Workpiece position on-machine measuring and size deviation intelligent modifing, dimensional accuracy is improved.

## 01 02 03 04

Max. load (kg/lb): 400/881.84

Flywheel Housing Die Casting

Size (mm/in): 578×560×178/22.76×22.05×7.01

Material: ADC12 (HB90) 12% Silicon

**Highlights:** + The workpiece can be clamped

+ Using 51 tools;

at one time to complete

multi-position processing;

+ Milling, boring, drilling, tap-

ping, reaming and other pro-

cessing methods are used.

## **Machining Samples**



#### Turbo Molecular Pump 7-Level Impeller

**Size (mm/in):** φ350×286/φ13.78×11.26 Material: Aluminum Alloy (7075-T6)

- **Highlights:** + The virtual processing technology ensures the 5-axis processing safety;
  - + Roughing and finishing of 249 blades can be completed with one clamping for 16h;
  - + Unbalance is less than 0.6 gmm.











#### **Gear Cover Die Casting**

- Size (mm/in): 470×335×40/18.50×13.19×1.57 Material: ADC12 (HB90) 12% Silicon Highlights: + JINGDIAO on-machine measurement technology
  - workpiece position; + Remaining stock of surface is at least 0.2 mm after CNC machining, the distance error from the reference

surface is less than 0.1 mm.

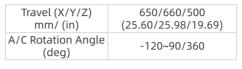
# intelligently compensates

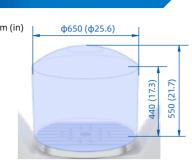
- Unit:mm (in) 590 (23.2) 940 (37.0)
- prove comfort level and reduce fatigue.
- tor to use and maintain the machine.
- venient loading and unloading.
- workload of manual chip cleaning.

## **Machine Structure**

### Max. Workpiece Dimension Unit: mm (in)

Max. load (kg/lb): 400/881.84









#### **Optimum Structural Design Good Thermal Stability**

- + Moving beam gantry structure design.
- + Symmetrical design and the motion axis distribution is reasonable.
- + All round cooling design, using rotary cooling technology.

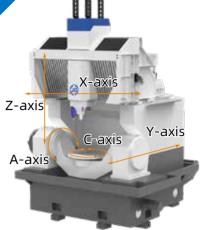


## **Ergonomics**

Ergonomic factors is taken into account in the design of structure layout, chip removal device and human-machine coordination of machine, effectively improve the use comfort and convenience.

(68.9)

table cooling, bearing cooling, screw





#### **Linear Glass Scales**

+ Equipped with linear scale to compensate the transmission error and the lead screw elongation caused by temperature change.

## **Convenient for Chip Cleaning**

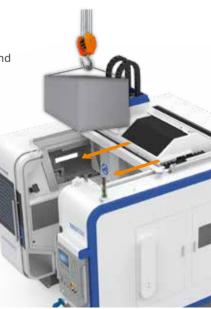
Internal spray device , 23°gradient machine bed and spiral chip conveyor, more convenient for chip disposal. (Match with the scraper type chip conveyor system (page 9) outside the machine, ensures a good chip removal effect).

+ Relevant parts designing such as the console, worktable and viewing window based on the operator's anthropometric data, im-

+ Multiple-door design makes it easy for operar-

+ The front door has a large opening size and the top is equipped with automatic door, con-

+ The chip conveyor is completed by the in-machine spiral chip conveyor rod, reduce the



## Key Components

## **JINGDIAO High-Speed Precision Spindle** - Strong Cutting Ability

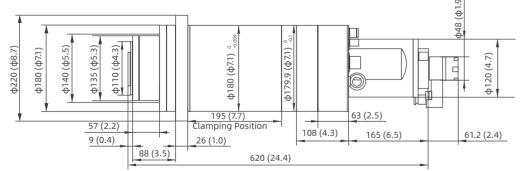
Various types of spindle can meet the MRA600 machine for heavy workpiece, large amount of chip cutting, deep cavity and other conditions processing.Can not only process cornering processing with small cutting tools, but also realize the boring processing with large cutting tools.

4 types high-speed precision spindles with large torgue can be choosed, such as JD150S-20-HA50/C, JD150SC-20-HA50/A, JD180SC-15-HA63/B, JD180S-15-HA63/ B.Among them, JD150S-20-HA50/C is the standard spindle, others are optional spindles, JD150SC-20-HA50/A and JD180SC-15-HA63/B are coolant through spin-dles.





#### **Dimension** Unit:mm (in)



#### **Features**

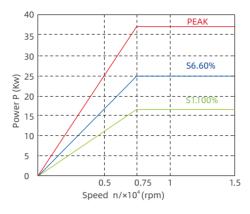
- + The coolant can be ejected from the tool's front end and applied directly to the cutting position.
- + Used for drilling, tapping, reaming, corn side milling, etc.
- + High pressure coolant liquid can directly take out the chip, avoiding tool winding and breaking.
- + MCP machine tool operation panel.
- + High cutting efficiency, good cooling performance.

## High Speed & Low Vibration

#### JD180SC-15-HA63/B (Coolant Through Spindle)

Optionally 5Mpa (725.18Psi) 180mm  $(\phi 7.08 \text{In})$  coolant through spindle and internal cooling tool, realizing deep hole and deep cavity machining, good cutting cooling effect.

#### **Output Performance**



#### **Basic Specification**

Clamping Diameter (mm/in): Ф180/Ф7.1 (0, -0.009) Output Power (S6-60%) (Kw): 25 Output Torque (S6-60%) (Nm): 32 Speed (rpm): 15,000 Tool Holder: HSK-A63 Weight (kg/lb): 71/156.5

#### **Available Tools (Part)**

Variety of tools like disc tool, boring tool, drill, screw tap, gang feed reamer, internal cold corn milling tool, internal cooling drill etc. can be used, meeting the complex mold composite processing need.





Boring Tool



Standard

JD150S-20-HA50/C

Speed (rpm): 20,000

Tool Holder: HSK-A50





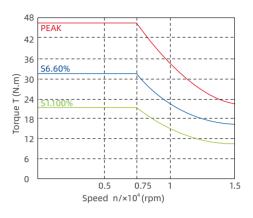
Internal Cold Corn Milling Tool Internal Cooling Drill

#### Optional

#### JD180S-15-HA63/B Speed (rpm): 15,000 Tool Holder: HSK-A63

Speed (rpm): 20,000 Tool Holder: HSK-A50





#### Performance

- + Taper bore radial runout  $\leq 1.5 \,\mu m (5.9 \times 10^{-5} \,in)$
- + Rotor end face axial runout  $\leq 1 \,\mu m (3.9 \times 10^{-5} \,in)$
- + Vibration at maximum speed  $\leq 0.6$  mm/s (1.44 ipm)



## **JD50 CNC System**

The JD50 CNC system is developed independently by Beijing JINGDIAO. The control is highly efficient, reliable and very precise. Additionally, it has Rich Programming Functions, Convenient Operation, Flexible Peripheral Control, and Can Meet the processing requirements of high machining accuracy and fine surface finishing.



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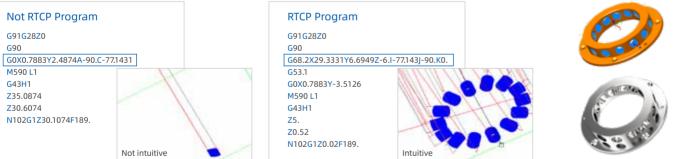
#### Configurations

- + The programming resolution and control resolution are 0.1  $\mu$ m (3.9×10 -6 in).
- + Supports linear, plane arc, space arc, spiral line, spline and involute interpolation methods.
- + Support pitch compensation and reverse clearance compensation.
- + Support RTCP multi-axis motion control.



0.1µm Feed, 1µm Cutting

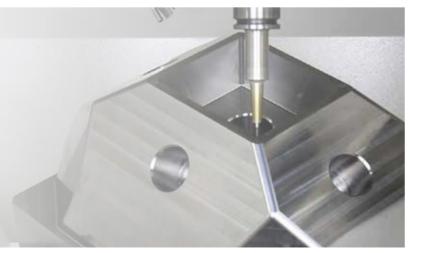




RTCP

#### **Five-Axis Programming Features**

- + Tool center point control function.
- + Inclined pane machining function.
- + Cylinder interpolation function.
- + Polar coordinate interpolation function.



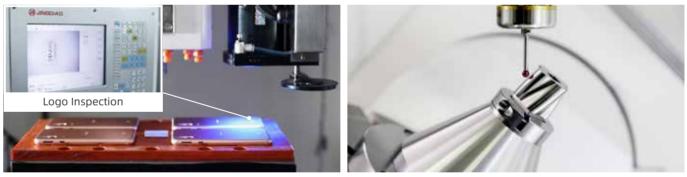


#### System Advantages

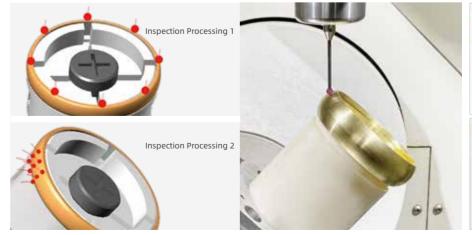
- + Various programming methods and flexible technical process desi
- + Abundant types of interfaces and buses, and strong peripheral exp capabilities.
- + Unique external extended function instructions (G100), which can instruction-level peripheral control, human-computer interaction complex data operations.

#### **Advanced Features**

- + Includes on-machine contact and non-contact measurement functions, which results in high-precision 2D and 3D measurements.
- machining.
- + Incorporates multiple communication protocols and remote monitoring.



Non-Contact Measurement



Surface Deformation Compensation

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+ Built-In CAM technology and intelligent modification technology supports the on-machine tool-path deformation compensation

**Contact Measurement** 

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Remote Monitoring of Machines



## **Tool Magazine**

Maximum 63 tool magazine capacity, meeting the needs of complex mold processing, and a variety of tool magazine for you to choose, to meet different production needs.



Туре	with Manipulator
Capacity	63
Tool Holder	HA50
Allowable Maximum Tool Length (mm/in) (From End of Spindle)	270/10.6
Maximum Diameter of Contiguous Tools (Full) (mm/in)	50/2.0
faximum Diameter of Contiguous Tools (Vacant) (mm/in)	140/5.5
Max. Load of Each Position (kg/lb)	4/8.8
Max. Load of Tool Magazine (kg/lb)	120/264.6

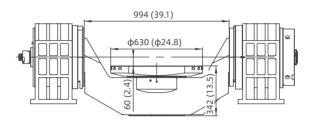
Chain Type Tool Magazine

BA1	Туре	Chain Type Tool Magazine with Manipulator
TAN A GUUNUUS	Capacity	51
End and	Tool Holder	HA63
	Allowable Maximum Tool Length (mm/in) (From End of Spindle)	270/10.6
	Maximum Diameter of Contiguous Tools (Full) (mm/in)	65/2.6
	Maximum Diameter of Contiguous Tools (Vacant) (mm/in)	140/5.5
	Max. Load of Each Position (kg/lb)	6/13.2
	Max. Load of Tool Magazine (kg/lb)	120/264.6

## Cradle Type Double Direct Drive Rotary Table

+ Heavy Load (kg/lb): Max 400 (881.84) + Large Diameter mm (in): Max φ630 (φ24.8) + Good Rigidity, High Stability

#### Dimension Unit:mm (in)



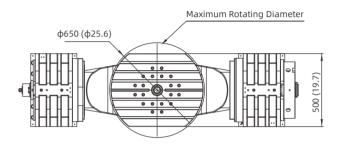
#### **Features**

- + A-axis symmetrical double motor structure, uniform output, small deformation.
- + The a and c axis of rotary table is equipped with brake mechanism, ensure the rigidity of the rotary table.
- + Bridge deck tailstock structure, high precision and stable operation.
- + Circulating water cooling reduces the thermal deformation.
- + Optionally equipped with revolving joint for easy fixture arrangement.

#### Specification

Item	Tilt Axis	Rotation Axis
Drive Mode	Direct Motor Drive	Direct Motor Drive
Table Diameter (mm/in)		Φ630/Φ24.80
Maximum Load (kg/lb)		400/881.84
Position Accuracy (")	8	8
Repeatability (")	5	5
Rapid Feed Rate (rpm)	60	60
Rotation Angle (°)	210 (-120~90)	360 (Continuous)
Cooling Mode	Circulating Water Cooling	Circulating Water Cooling
Positioning Locking Mode	Hydraulic Locking	Hydraulic Locking
Positioning Locking Air Pressure (Mpa/Psi)	0.35~0.4/50.76~58.02	0.35~0.4/50.76~58.02
Brake Mode	Pneumatic Locking	







## Accessories

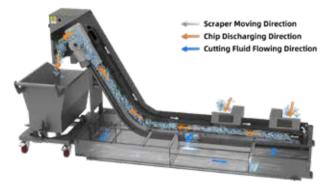
## Scraper Type Chip Conveyor System — Suitable for Large Amount of Chip Cutting Processing

It can be used to separate and collect waste liquid and chip effectively, prolong the cycle of waste chip cleaning, and avoid the blocking of chip outlet of machine tool to affect the continuity of machining.

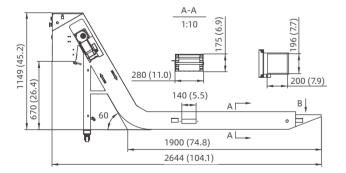
#### **Features**

- + Improves maintenance by moving the chips into disposal container.
- + Cutting fluid service life is extended by using a multistage filtration unit.
- + Equipped with a cleaning mechanism and drop recovery mechanism which is self cleanng resulting cutting fluid recovery.

#### **Chip Conveyor Principle**



#### Dimension Unit: mm (in)



## **Cutting Fluid Tank**

The cutting fluid circulation system plays the role of cooling, lubrication, cleaning and chip removal, which can improve product quality, reduce tool wear.

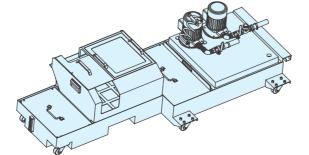


Filtering Tank

Chip Collector

#### **Appropriate Chip Types**





## **Minimal Quantity** Lubrication (MQL)

Equipped with MQL, the temperature fluctuation in the machine can be controlled within 0.5 °C (32.9 °F).

#### **Specification**

Item	Spec	-
Pressure (Mpa/Psi)	0.5~0.8/73.5~117.6	
Working Pressure (Mpa/Psi)	0.55/80.8	
Air Volume (L/min)	0~220	
Air Consumption per Nozzle (L/min)	100	
Oil Consumption per Nozzle (mL/h)	0~30	e_11
Nozzle Quantity	2	
Weight (kg/lb)	1.5/3.3	
Mounting Pitch (mm/in)	70/2.8	

## **Oil Mist Collector**

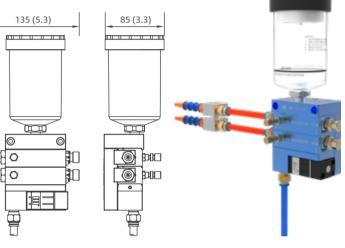
The oil mist collector reduces the rise of internal temperature caused by the oil mist accumulation. It eliminates the diffusion of oil mist, reduces the Internal electrical fault of the machine tool, Improves the stability of equipment operation, reduces air pollution, and protects the workshop environment.



JDACM800 Oil mist collector



#### Dimension Unit: mm (in)



#### **Specification**

Item	Spec
Voltage (V)	AC380±10%
Power (W)	800
Current (A)	1.5
Frequency (Hz)	50±2%
Ambient Temperature (°C / °F )	5~40/41~104
Environmental Pressure	Atmos
Weight (kg/bl)	80/176.4
Max. Air Volume (m³/in³)	800/4.9×10 <sup>7</sup>
Filtration Efficiency	> 99%

## **Spindle & Rotary Table Refrigerator**

### **Good Refrigeration Effect**:

- + It is used for cooling of spindle, electric control cabinet and screw.
- + With constant temperature, follow and automatic three control modes.



#### Specification

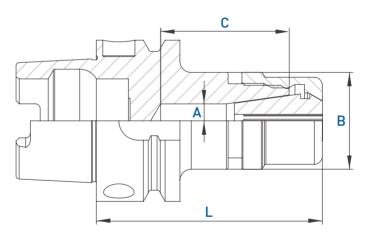
Туре	Specification
Input Voltage	AC three phase 380v±10% 50Hz
Apparent Power (KVA)	3.6
Rated Cooling Capacity (Kw)	5 (Environment temperature is 25°C /77 °F , compressor frequency is 50Hz)
Coolant Temperature Range (°C / °F )	5~40/41~104
Coolant Temperature Control Accuracy (°C / °F )	±0.1/31.82~32.18
Working Environment Temperature Range (°C / °F )	0~45/32~113
Compressor	20Hz~60Hz Frequency
Refrigerant	R410A
Refrigerant Charge (kg/lb)	1.32/2.871
Max Working Pressure (Mpa/Psi)	4.0/580.2
Water Tank Capacity (L/gal)	48/12.7
Coolant	Pure water & DOWTHERM
Water Pump Power (Kw)	0.80
Water Flow (L/min) / (gal/min)	≥2.0/0.53 (Related to the spindle and rotary table); ≥1.0/0.26 (Related to the screw)
Pump Max Lift (m/in)	52/2047.2
Noise (dB)	≤64
Net Weight (kg/lb)	140
Dimension (mm/in)	550×825×1075 (21.65×32.48×42.32)

## **Tool Holders**

Tool holders require good clamping performance such as high clamping accuracy, low vibration and the ability minimize oil mist during high-speed machining.

JINGDIAO tool holders have anticorrosive properties, minimize Air Resistance, and are designed good dynamic balance. And a variety of types are available to adapt to a variety of processing scenarios by using MRA600.

#### **Dimension Chart**



#### **Technical Parameter**

Tupo	Namo	Size mm (in)						
Туре	Name	Α	В	С	L	Thread		
	HSK-A50-ER11-080S	7 (0.28)	19 (0.75)	30 (1.18)	80 (3.15)	M14×0.75		
	HSK-A50-ER16-070S	10.5 (0.41)	30 (1.18)	40 (1.57)	71 (2.95)	M22×1.5		
HSK-A	HSK-A50-ER16-110S	10.5 (0.41)	30 (1.18)	40 (1.57)	111 (4.37)	M22×1.5		
	HSK-A63-ER32-0805	23.5 (0.93)	60 (2.36)	39 (1.54)	80 (3.15)	M40×1.5		



# **Distinctive Technologies**

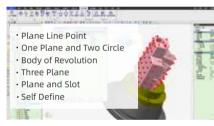
## **On-Machine Measurement and Intelligent Modification Technology**

IINGDIAO's innovative On-Machine Measurement and Intelligent Modification Technology (OMIM) is an Ideal solution that integrates CAD/CAM programming technology, numerical control processing and precision inspection technology. It's intelligent application can effectively shorten the production cycle of the workpiece, streamline the processing flow, and improve quality and efficiency for production and machining.

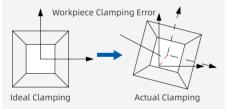
#### The Function of JINGDIAO OMIM is Mainly Reflected in Three Aspects

#### + Intelligent Workpiece Alignment

This feature automatically corrects the workpiece deviation through inspecting the offset of workpiece on machine and adjusting the program in control system. This reduces workpiece setup time, improves machining quality and increases production.



01-Support Multiple Workpiece Position Compensation Methods









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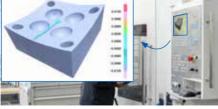
03-Workpiece Position Compensation

04-Verification of Position Compensation Accuracy

#### + Intelligent Workpiece Alignment

With this feature, the remaining stock at each machining step can be measured in real time, and the inspection results will be displayed on the machine's control. The operator can analyze the results in order to ensure that an even amount of material is removed at every machining step. This results in reduced tool wear, constant chip load, improved machining accuracy and improved surface finishes







Achieve Stable Precision Machining

#### + 5-Axis Path On-Machine Compensation

The CAM function embedded in the CNC system can compensate for the inaccurate machining path, which is created by an non-conforming geometric shapes, clamping deformation and clamping deviation.

diusted Path Surface Data Measurement

#### A New Model of Numerical Control Processing

- + Machining and inspection are achieved one machine, forming a new model of "integration of machining and inspection".
- + The digitalization of CNC machining experience enables a entry-level operator to complete precision machining.
- + The actual processing time proportion of CNC machines has increased from 25% -45% to 45% -70%.



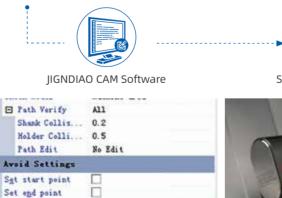


Before Using Integration of Machining and Inspection After Using Integration of Machining and Inspection

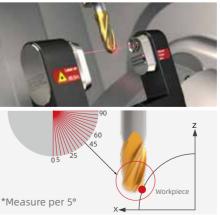
## **Tool Inspection System**

During the 5-axis machining process, JINGDIAO tool inspection system can inspect the errors of different positions of the Tool contour of the bull nose tool, ball-end tool and other tools for precision machining and compensate Intelligently. This can effectively reduce the ungualified workpiece accuracy caused by the tool Inaccuracy.

#### Realization

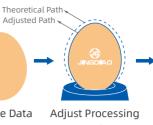


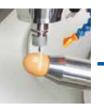




3D Tool Contour Compensation Function

Inspect Tool Contour on the Machine







Path

Egg Processing

Egg Demonstration





Ball-End Tool



Nose Tool



Taper Ball-End Too

\* Tool Type







JIGNDIAO CNC System





Compensate Tool Contour Deviation

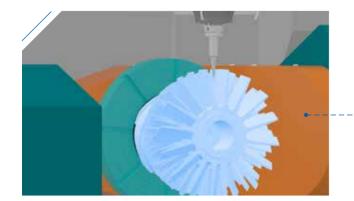
## **JINGDIAO Digital Twin (DT) Technology**

With Jingdiao's software, the actual production materials and process parameters are digitized to ensure the correct Information is selected by the process personnel, material preparation personnel and the operator. This creates a seamless integration process development, material preparation and machine operation, and improves the accuracy and fluency of the machining process.



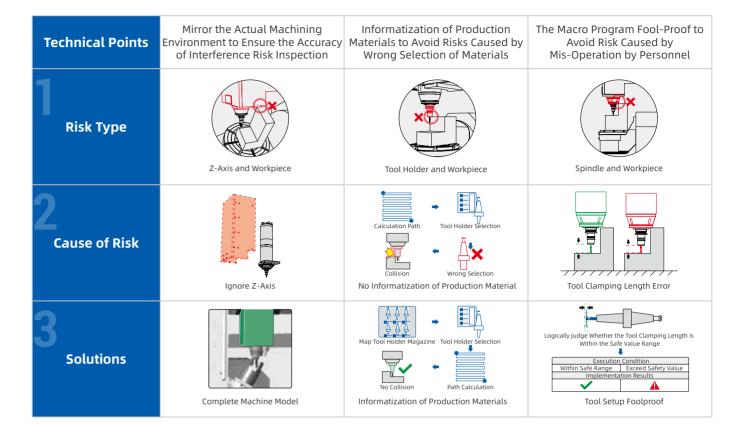
#### Ensuring the Safety of 5 Axis Machining

Five-axis milling is a complex machining process. During the machining there is the risk of collisions between tools, tool holders and the workpiece. Beijing JINGDIAO uses its SurfMill software to establish the connection between production materials, CAM programming and actual processing in a virtual environment. The user can build the same digital scene in the software, simulate the machining process, analyze and adjust the process, and eliminate the machining risk in the software programming stage.



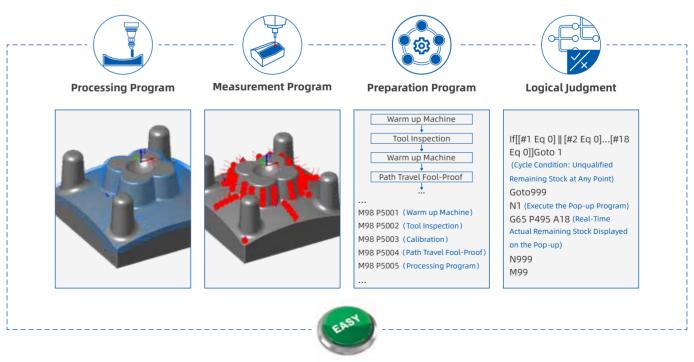


### **Application Scenarios of JINGDIAO DT Technology**



## **Easy Start**

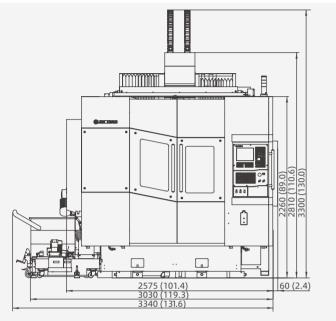
With this software, the program processing, measurement, preparation and logical judgment are combined into one program. The operator only needs to press the start button to begin the processing of the part which reduces machine setup time.

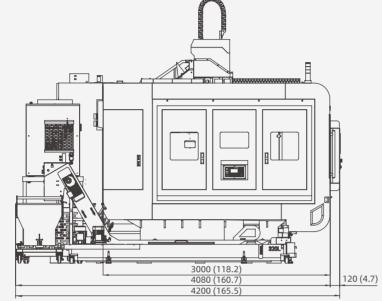


**Processing Easy Start** 

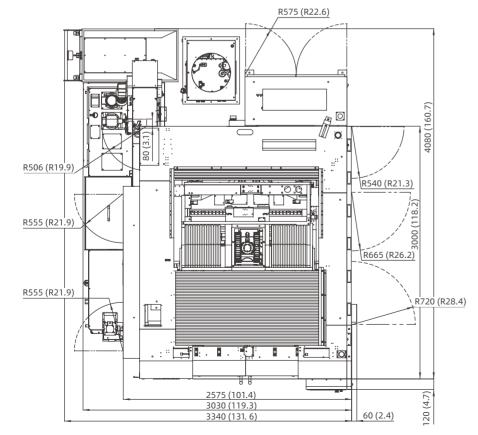
# **Technical Specification**

#### **Dimension** Unit: mm (in)





#### Layout Unit: mm (in)



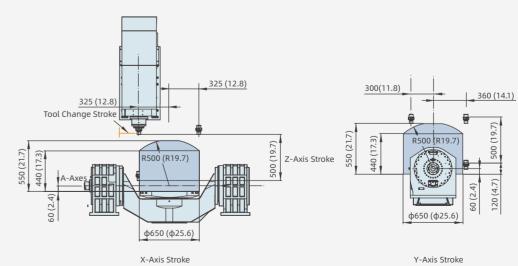
Items	Standard Value
Position Accuracy (X/Y/Z) mm/ (in)	0.003/0.003/0.003 (0.00012/ 0.00012/0.00012)
Position Accuracy (A/C) sec	8/8
Repeatability (X/Y/Z) mm/ (in)	0.002/0.002/0.002 (0.000079/ 0.000079/ 0.000079)
Repeatability (A/C) sec	5/5
Travel (X/Y/Z) (mm/in)	650×660×500 (25.60/25.98/19.69)
A/C Rotation Angle deg	-120~90/360
Table Diameter (mm/in)	φ630/φ24.8
Max. Load (kg/lb)	400 (881.85)
	20,000 (HSK-A50)
May, Chindle Cheed rom	20,000 (HSK-A50)
Max. Spindle Speed rpm	15,000 (HSK-A63)
	15,000 (HSK-A63)
Tool Magazine/Capacity	63 (Chain-Type Tool Magazine)
Rapid Speed (X/Y/Z) m/min (in/min)	15 (590.6)
Rapid Rotation Speed (A/C) rpm	60/60
Max. Cutting Feed Speed (X/Y/Z) m/min (in/min)	10 (393.7)
Max. Cutting Feed Speed (A/C) rpm	60/60
Drive System	AC Servo
Voltage	3-Phase, 480V/60Hz,or Customized
Air Pressure (Mpa/Psi)	0.35~0.4/50.76-58.02
Machine Weight (kg/lb)	12000 (26455.47)

#### **Standard Features and Options**

Items	Configuration
Control System	
JD50 CNC System	•
CAM Soft	
JDSoft SurfMill 9.0	•
Spindle	
JD150S-20-HA50/C (HSK-A50)	•
JD150SC-20-HA50/A (HSK-A50)	0
JD180S-15-HA63/B (HSK-A63)	0
JD180SC-15-HA63/B (HSK-A63)	0

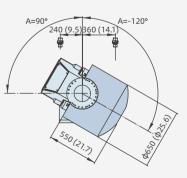
+ Parameters above calibrates with reference to international standard ISO 230-2.

#### Stroke Diagram Unit: mm (in)



Items	Configurat
Tool Magazine	
Chain Type Tool Magazine with Manipulator (63 Tools)	• (HSK-A50)
Chain Type Tool Magazine with Manipulator (51 Tools)	<ul> <li>(HSK-A63)</li> </ul>
Cooling System	
Coolant Device	•
Coolant Tank	0
Coolant Level Inspecting	•
Coolant Cooling System	0
Spindle Cooling	•
Rotary Table Cooling	•
Screw Cooling	•
Oil-Water Separator System	0
Oil-Mist Separator System	0
Micro Mist Lubrication	0
Chip Conveyor	0
Chip Conveyor (Spiral Type)	•
Chip Conveyor (Scraper Type)	•
Air Blow System	•
Chip Collecting	•
Internal Spray Device	•
Measurement System	
Contact-Type Tool Set	•
Laser Tool Set	•
JINGDIAO On-Machine Measurement System	0
Standard Calibrating Ball	0
Others	
MPG (Manual Pulse Generator)	•
Bag Type Filtration System	0
Low Oil Pressure Inspection Device	•
Low Air Pressure Inspection Device	•
Ground Protector of Power Leakage	•
Machine Foot	•
Alarm	•
Lubricating Oil Inspection	•
Auto Power off Function	•
Internal Lighting Switch	•

•: Standard O: Optional



Y-Axis Stroke



You can find more information at us.jingdiao.com





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The pictures of the equipment are for your reference only. The configurations and parameters are subject to change without notice. The final interpretation of this brochure is owned by Beijing JING-DIAO Group Co., Ltd.