

DOOSAN



FM 200/5AX

Ultra-high-speed, High-precision
Vertical Machining Center Equipped
with Linear Motors



**MACHINE
GREATNESS™**

Basic Information

Basic Structure
Travel Axis

Detailed Information

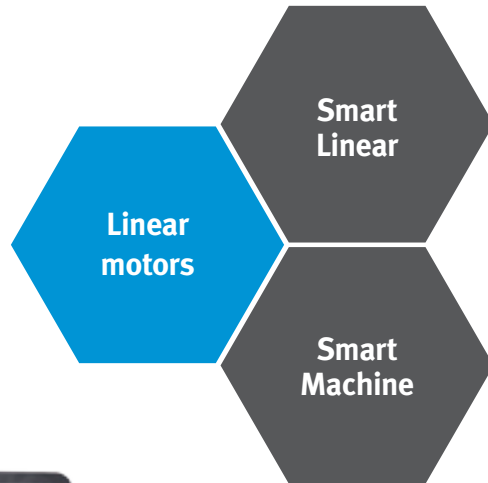
Options
Capacity Diagram
Specifications

Customer Support Service



FM 200/5AX

The FM 200/5AX offers super-fast traveling and great reliability with its high-speed spindle and linear axes driven by linear motors, in addition to excellent stability in cutting operation due to the adoption of anti-vibration materials.



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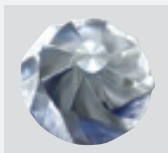
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Sample work



Stable bed and structure design

Stable cutting based on anti-vibration materials and symmetrical gantry structure.

Stable cutting based on anti-vibration materials and symmetrical gantry structure.

Outstanding productivity and cutting accuracy are delivered with 42,000 rpm spindles, linear motors, and direct-drive motors.

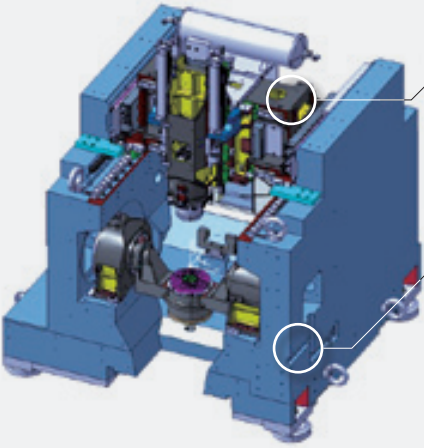
Heidenhain controller for maximum reliability

The adoption of Heidenhain controllers optimized for high-speed processing enhances machine reliability, visibility, and display applicability.

Basic Structure


Stable cutting based on symmetrical gantry structure and anti-vibration materials (mineral casting).

Structural and Material Features

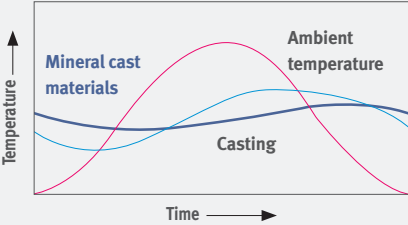


Gantry structure
Horizontally-symmetrical structure suitable for high-speed, high-precision machining
Guaranteed structural stability

Built with a mineral cast bed for stable performance



Built with a mineral cast bed for stable performance



Temperature ↑

Time →

Mineral cast materials

Ambient temperature

Casting

Normal cast materials

Mineral cast materials

↑ 25 times
Thermal stability
25 times greater

Axis System

The linear axes and rotary axes deliver high speed and superior accuracy.

Linear Axes Equipped with Linear Motors

The X / Y / Z linear axes are driven by linear motors to realize high speed and accuracy, as well as superior positioning and repeatability.

| Description | | Unit | FM 200/5AX |
|---------------------|-----------|--------------------|--|
| Rapid | X / Y / Z | m/min (ipm) | 50 / 50 / 50 (1968.5 / 1968.5 / 1968.5) |
| Acc. / Deceleration | | m/sec ² | 14.7 / 14.7 / 14.7 [1.5G / 1.5G / 1.5G] |

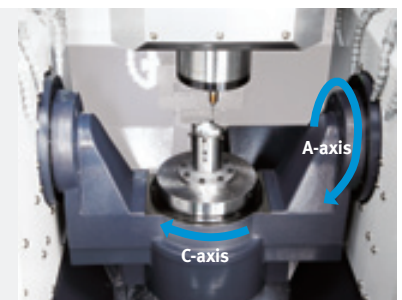
Up to **2G**



Rotary Axes Equipped with Direct Drive Motors*

The rotary table is equipped with a direct drive motor for rapid rotation coupled with rapid acceleration and deceleration. Thermal error is minimized by the water cooling system.

| Description | | Unit | FM 200/5AX |
|---------------|-------|---------|------------|
| Rapid | A / C | r/min | 100 / 200 |
| Travel | | deg | 140 / 360 |
| Load Capacity | | kg (lb) | 15 (33.1) |

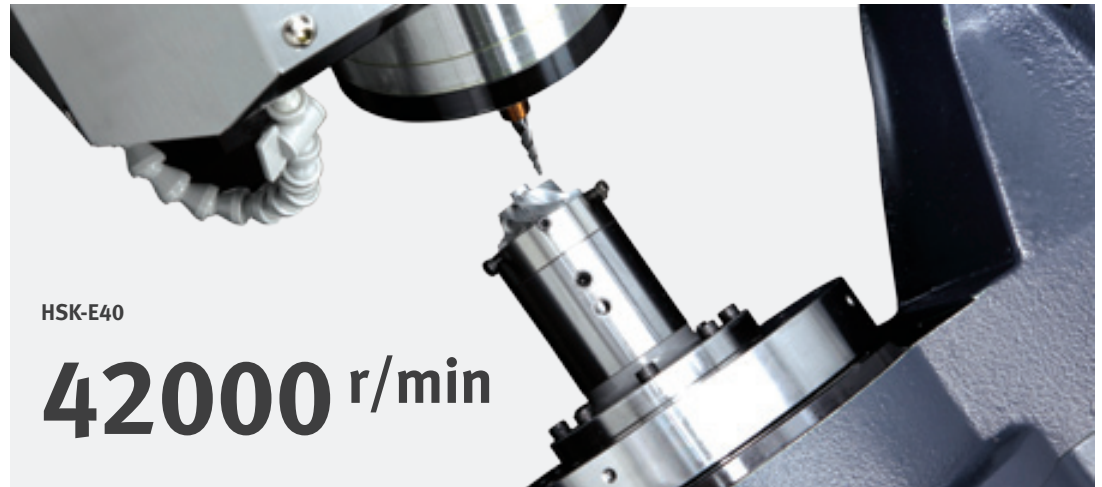


Spindle

The spindle provides incomparably high productivity and machining accuracy.

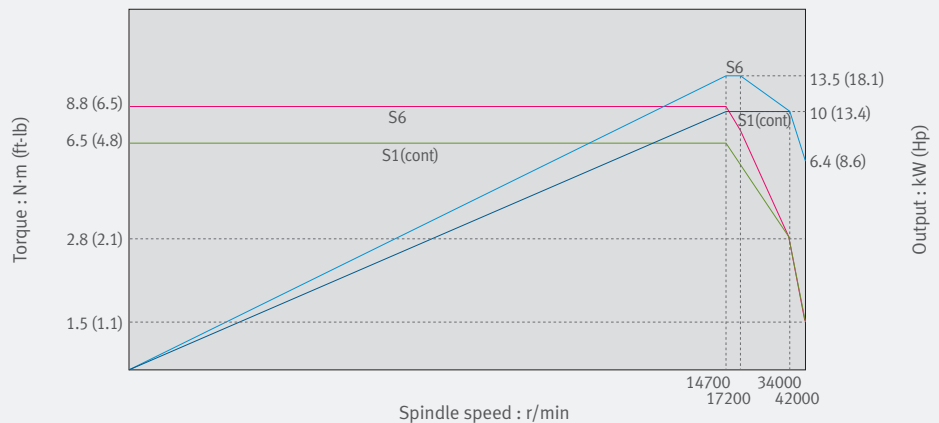
Ultra-high-speed Spindle

One of the highest-speed spindles in its class, the ultra-high-speed enhances productivity and machining accuracy.



HEIDENHAIN

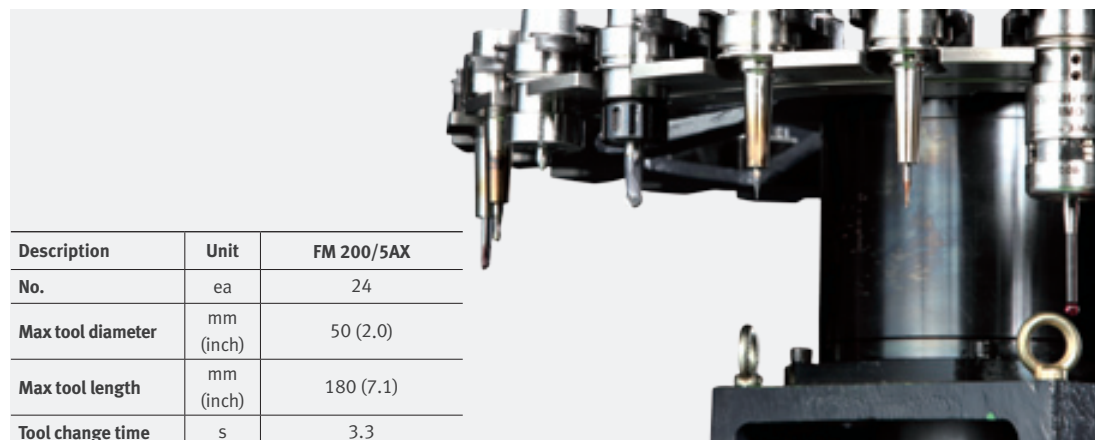
Spindle Speed : 42000 r/min
Spindle Motor : 10 kW (13.4 Hp)



Magazine

The machine's structure has been simplified with the addition of a direct-drive motor, while the operator's convenience has been enhanced by manual magazine operation for tool storage.

Tool Magazine



* FM 200/5AX model



Standard / Optional Specifications

Diverse optional features are available for customer-specific requirements.

● Standard ○ Optional X N/A

| NO. | Description | Features | FM 200/5AX |
|-----|---------------------------------------|--|------------|
| 1 | Tool magazine | 24 tools | ● |
| 2 | | 40 tools | X |
| 3 | Tool shank type | HSK-E40 | ● |
| 4 | Auto door lock | | ● |
| 5 | Rotary table | ∅200 | ● |
| 6 | | ∅350 | X |
| 7 | Linear scale | X-axis | ● |
| 8 | | Y-axis | ● |
| 9 | | Z-axis | ● |
| 10 | Spindle | 42000 r/min | ● |
| 11 | | Spindle head cooling system | ● |
| 12 | | Thermal error compensation system | ● |
| 13 | Spindle motor power | 10 kW (HEIDENHAIN) | ● |
| 14 | Auto tool measuring device | NT-2_BLUM | ● |
| 15 | Auto work measuring device | OMP400_RENISHAW (W/Receiver) | ○ |
| 16 | | OMI-2C_RENISHAW (Receiver Only) | ○ |
| 17 | Master tool for auto tool measurement | CALIBRATION TOOL_BLUM (HSK E40) | ○ |
| 18 | Auto power cut-off | | ○ |
| 19 | Coolant | FLOOD (0.7kW_0.8MPa) | ● |
| 20 | | FLOOD (1.5 kW_0.69MPa) | X |
| 21 | | SHOWER | ○ |
| 22 | | Coolant level switch : Sensing level - Low / High ** | ○ |
| 23 | Chip bucket | | ○ |
| 24 | Chip conveyor | Chip pan | ● |
| 25 | | Hinged type | X |
| 26 | | Drum type | ○ |
| 27 | Table | 500 x 600 mm | X |
| 28 | Test bar | | ○ |
| 29 | AIR | AIR BLOWER | ● |
| 30 | MPG | Portable MPG | ● |
| 31 | MQL | | ○ |
| 32 | NC system | HEIDENHAIN iTNC530 | ● |
| 33 | OIL SKIMMER | BELT TYPE | ○ |
| 34 | | TUBE TYPE | X |

* Please contact Doosan to select detail specifications. ** Special Quotation.

Standard / Optional Specifications

Diverse options for enhanced work efficiency and operator convenience.

Convenient operation panel

The ergonomically-designed Heidenhain operation panel and 19-inch large screen enhance the operator's convenience



Tool length measurement device

The standard tool length laser measuring device secures the highest degree of accuracy even at super-high-speed operation. (The touch probe is optional.)



Roller LMG

The roller-type LM Guideway has been adopted to ensure excellent rigidity and accuracy of the linear travel axes.



Linear scale (standard for all axes)

All axes are equipped with the linear scale as a standard feature to maintain the highest degree of accuracy over many hours of operation.



Gantry loader option

Information on detailed specifications required prior to ordering.



OMP 400 option

FM 200/5AX implementation



Recommendations for Machine Operation

Unlike ball-screw-type machines, a water chiller is used to cool down the linear motors and direct-drive motors. As such, the machine is sensitive to the control temperature of the chiller. Since the water chiller is controlled according to the ambient temperature, machine accuracy can be maintained and guaranteed in a constant temperature environment.

- Recommended operating conditions: Ambient temperature: $20 \pm 1.5^\circ\text{C}$, Temperature change: 0.4°C/hr or less, $\pm 1.5^\circ\text{C}/24\text{hr}$, Relative humidity: 20~80%


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19" LCD

| Description | HEIDENHAIN 640 | Remarks |
|--------------------------------|----------------|-------------------------------|
| Screen size | 19" Std | - |
| Storage memory | 21GB Std. | - |
| Interference prevention system | Std. | - |
| Kinematic OPT. | Std. | Measuring device not included |
| Look-ahead block | 5000 blocks | - |
| 3D line graphics | Std. | - |

Convenient Features

Data are controlled in the folder structure; convenient communication enabled by USB devices.



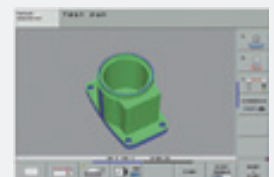
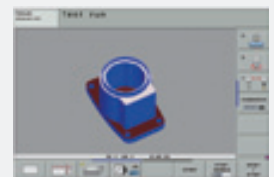
Various built-in pattern cycles for a wider scope of application.

Tool length, diameter and work pieces are measured using stored tool measurement graphic cycles.



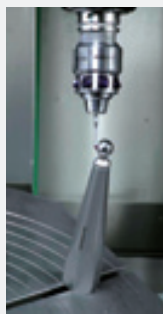
Graphic simulation

Before starting the actual cutting process, graphic process simulation of the NC program can be carried out using TEST RUN. The cutting time can be estimated.



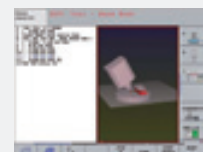
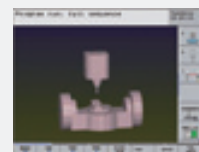
Kinematic Opt (rotary axes center correction)

The interactively (graphically) supported fixed cycle enables easy measurement of the centers of the rotary axes.



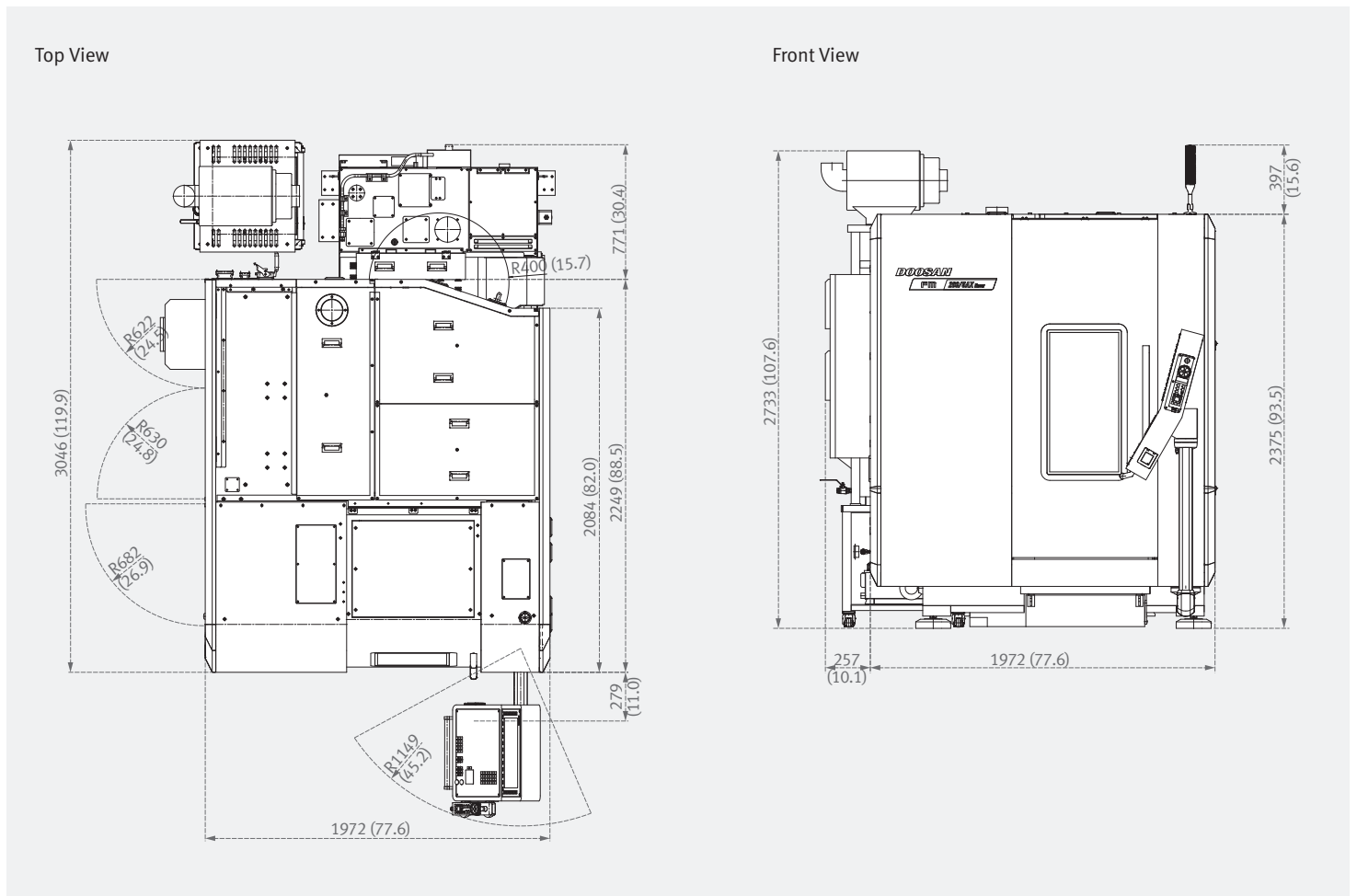
Collision Protection System option

The motion of the machine can be simulated on a 3D basis to substantially prevent mechanical interference. (Tool length is also recognized.)



External Dimensions

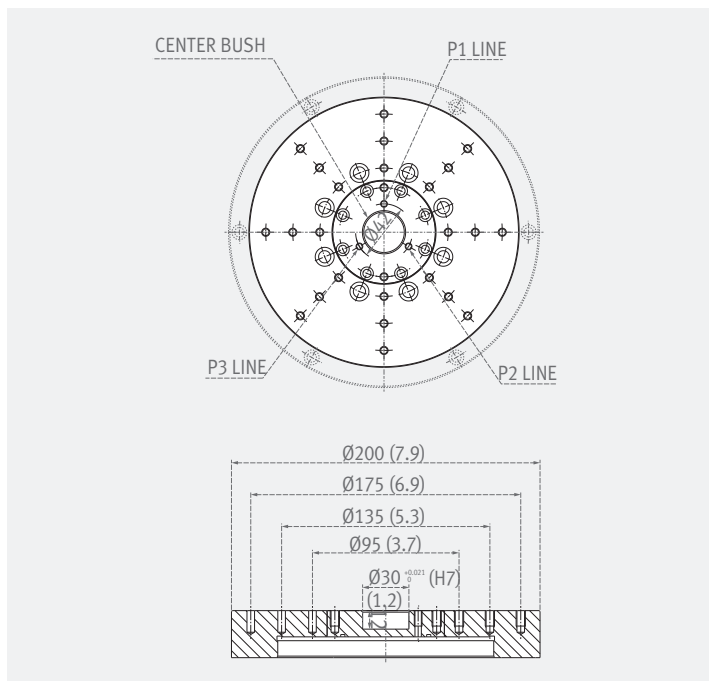
Unit: mm (inch)



* Some peripheral equipment can be placed in other places

Table

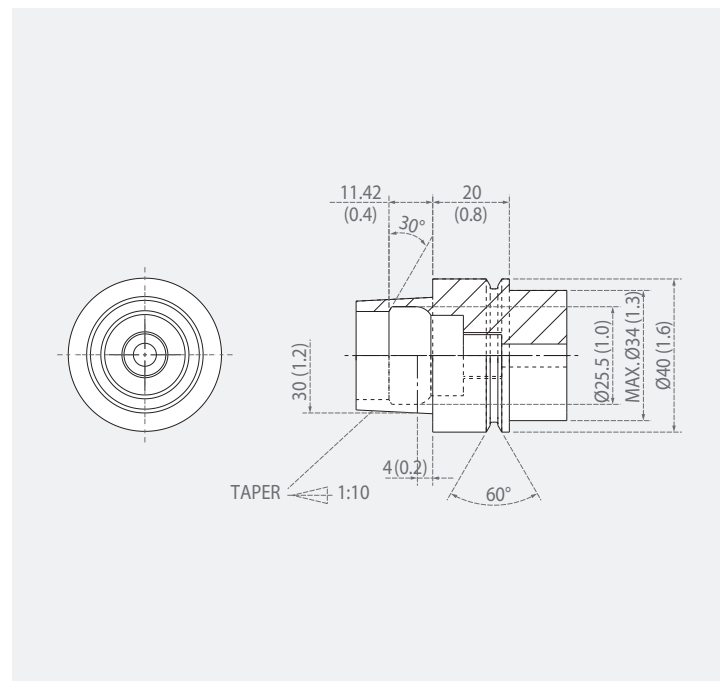
Unit: mm (inch)



* Some peripheral equipment can be placed in other places

Tool Shank (HSK E40)

Unit: mm (inch)



Machine Specifications

Basic Information

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| Description | | Unit | FM 200/5AX |
|--|---|-------------|-------------------------|
| Travel | Travel distance | X-axis | mm (inch) 200 (7.9) |
| | | Y-axis | mm (inch) 340 (13.4) |
| | | Z-axis | mm (inch) 300 (11.8) |
| | | A-axis | deg 140 (-10 ~ +130) |
| | | C-axis | deg 360 |
| | Distance from spindle center to table top | | mm (inch) |
| Distance from spindle center to column | | mm (inch) | 230 (9.1) |
| Feed rate | Rapid traverse rate | X-axis | m/min (ipm) 50 (1968.5) |
| | | Y-axis | m/min (ipm) 50 (1968.5) |
| | | Z-axis | m/min (ipm) 50 (1968.5) |
| | | A-axis | r/min 100 |
| | | C-axis | r/min 200 |
| Cutting feed rate | | m/min (ipm) | 20 (787.4) |
| Table | Table size | | mm (inch) ø 200 (ø 7.9) |
| | Loading capacity | | kg (lb) 15 (33.1) |
| Spindle | Max. spindle speed | | r/min 42000 |
| | Spindle taper | | - HSK E40 |
| | Max. spindle torque | | N·m (ft·lb) 6.5 (4.8) |
| Automatic tool changer | Tool shank type | | - HSK E40 |
| | Tool storage capacity | | ea 24 |
| | Max tool diameter | | mm (inch) 50 (2.0) |
| | Max. tool length | | mm (inch) 180 (2.9) |
| | Max. tool weight | | kg (lb) 1 (2.2) |
| | Tool selection | | - FIXED |
| | Tool change time (tool to tool) | | s 3.3 |
| Tool change time (chip to chip) | | s 4.1 | |
| Motor | Spindle motor power | | kW (Hp) 10 (13.4) |
| | Coolant pump motor power | | kW (Hp) 0.7 (0.9) |
| Power Source | Power consumption | | kVA 66.4 |
| | Compressed air pressure | | MPa (psi) 0.54 (78.3) |
| Tank Capacity | Coolant tank capacity | | L 310 |
| | Lubricant tank capacity | | L 5 |
| Tank Capacity | Height | | mm (inch) 2375 (93.5) |
| | Length | | mm (inch) 2249 (88.5) |
| | Width | | mm (inch) 1972 (77.6) |
| | Weight | | kg (lb) 6800 (14991.2) |
| Controller | | - | HEIDENHAIN TNC 640 |

Recommended operating conditions:

Ambient temperature: 20 ± 1.5°C
Temperature change: < 0.4°C/h < ±1.5°C/24h
Relative humidity: 20~80%

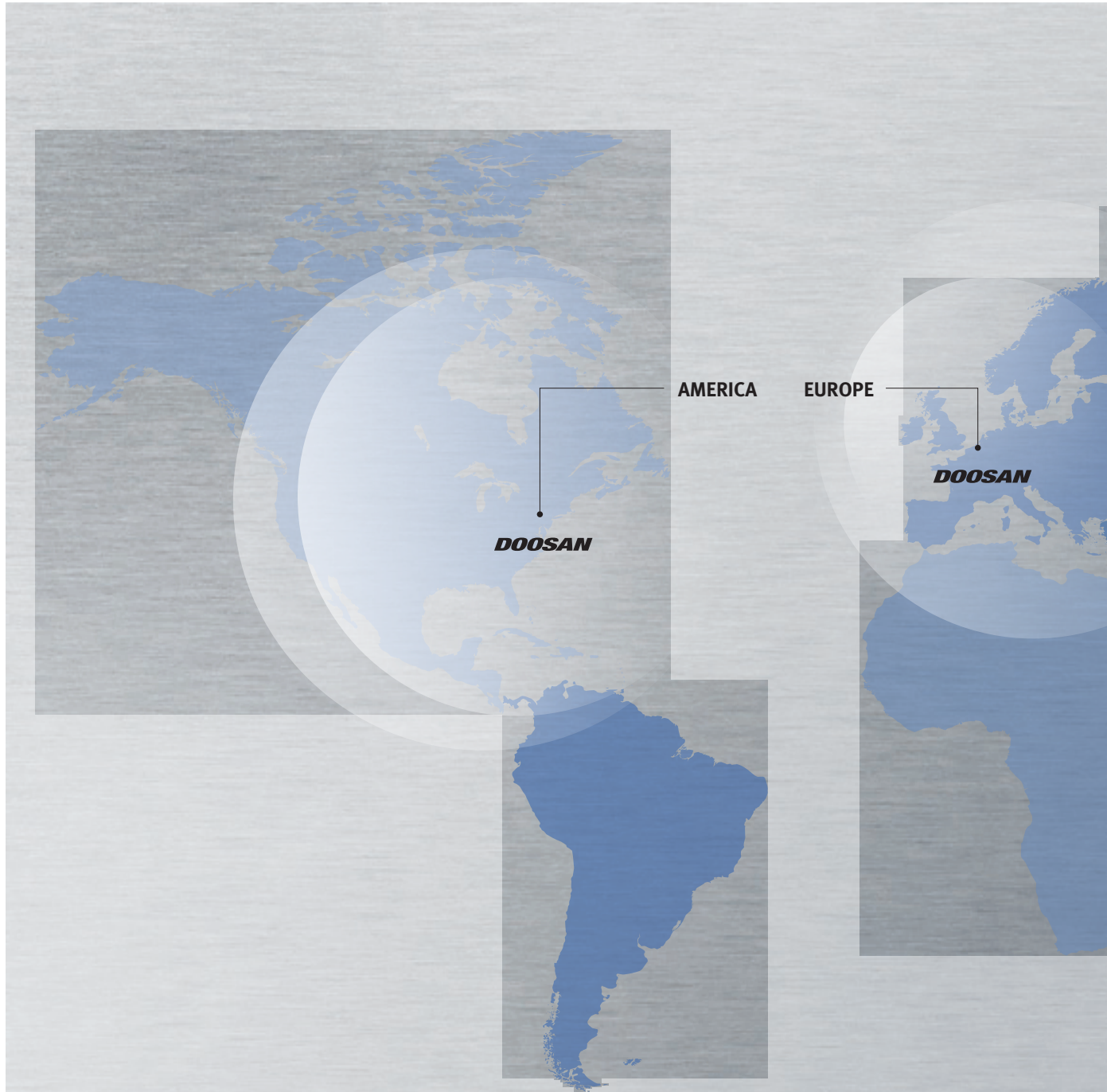
NC Unit Specifications

● Standard ○ Optional X N/A

HEIDENHAIN

| No. | Item | Spec. | TNC 640 | |
|-----|---|--|---|-------------------|
| 1 | Controlled axis | 3 axes | X | |
| 2 | | Controlled axes | 4 axes | X |
| 3 | | | 5 axes | X,Y,Z,C,A |
| 4 | | Additional controlled axes | 6 axes | X |
| 5 | | Simultaneously controlled axes | Controlled axes | ● |
| 6 | | Controlled axes | Max. 18 axes in total | OPT(Max. 18 axes) |
| 7 | | Least command increment | 0.0001 mm (0.0001 inch), 0.0001° | ● |
| 8 | | Least input increment | 0.0001 mm (0.0001 inch), 0.0001° | ● |
| 9 | | Maximum commandable value | ±99999.999mm (±3937 inch) | ● |
| 10 | | Axis feedback control | Double-speed control loops for high-frequency spindles and torque/linear motors | ○ |
| 11 | | MDI / DISPLAY unit | 19 inch TFT color flat panel | ● |
| 12 | | Program memory for NC programs | SSDR | 21GB |
| 13 | | Block processing time | | 0.5 ms |
| 14 | | Cycle time for path interpolation | CC 61xx | 3 ms |
| 15 | | Encoders | Absolute encoders | EnDat 2.2 |
| 16 | Interpolation | Straight line | 5 AXES | |
| 17 | | Circle | 3 axes | |
| 18 | | Helix, Combination of circular and linear motion | ● | |
| 19 | | Spline interpolation | ● | |
| 20 | Configuration | Numerical structure | X | |
| 21 | | Machine parameters | Tree structure with symbolic names of the parameters | ● |
| 22 | | | Tabular representation | X |
| 23 | Commissioning and diagnostics | Integrated oscilloscope | ● | |
| 24 | | OnLine monitor (OLM) | ● | |
| 25 | | BUS diagnostics | ● | |
| 26 | | DriveDiag | ● | |
| 27 | | ApiData function | ● | |
| 28 | | Trace function | ● | |
| 29 | | Table function | ● | |
| 30 | | Logic diagram | ● | |
| 31 | | I/O-Force List | ● | |
| 32 | | Log | ● | |
| 33 | | Machine operating panel | TE 735 | ● |
| 34 | | | TE 745 | ○ |
| 35 | | Electronic handwheels | HR 410 | ● |
| 36 | Data interfaces | Ethernet interface | ● | |
| 37 | | USB interface (USB 2.0) | ● | |
| 38 | Machine functions | Feedrate override | 0 - 150 % (10% unit) | ● |
| 39 | | Spindle orientation | | ● |
| 40 | | Spindle speed command | S5 digits | ● |
| 41 | | Spindle speed override | 0 - 150 % | ● |
| 42 | | Monitoring functions | Position monitoring | ● |
| 43 | | | Movement monitoring | ● |
| 44 | | | Standstill monitoring | ● |
| 45 | | | Positioning window | ● |
| 46 | | | Temperature monitoring | ● |
| 47 | | | Amplitude of encoder signals | ● |
| 48 | | | Edge separation of encoder signals | ● |
| 49 | | | Nominal speed value | ● |
| 50 | | | Buffer battery | ● |
| 51 | | | Run-time of PLC program | ● |
| 52 | | Emergency-stop monitoring | ● | |
| 53 | | Internal power supply and housing fan | ● | |
| 54 | | Gantry axes and master-slave torque control | | ● |
| 55 | Look-ahead (Intelligent path control by calculating the path speed ahead of time) | Max. 1024 blocks. | X | |
| 56 | | Max. 5000 blocks. | ● | |
| 57 | ADP (Advanced Dynamic Prediction) | | ● | |
| 58 | HSC filters | | ● | |
| 59 | Switching the traverse ranges | | ● | |
| 60 | C-axis operation | Spindle motor drives the rotary axis | ● | |
| 61 | User functions | According to ISO | ● | |
| 62 | | Program input | With smarT.NC | X |
| 63 | | | With smartSelect | ● |
| 64 | | Position entry | Nominal positions for lines and arcs in Cartesian coordinates | ● |
| 65 | | | Incremental or absolute dimensions | ● |
| 66 | | | Display and entry in mm or inches | ● |

Responding to Customers Anytime, Anywhere



Global Sales and Service Support Network

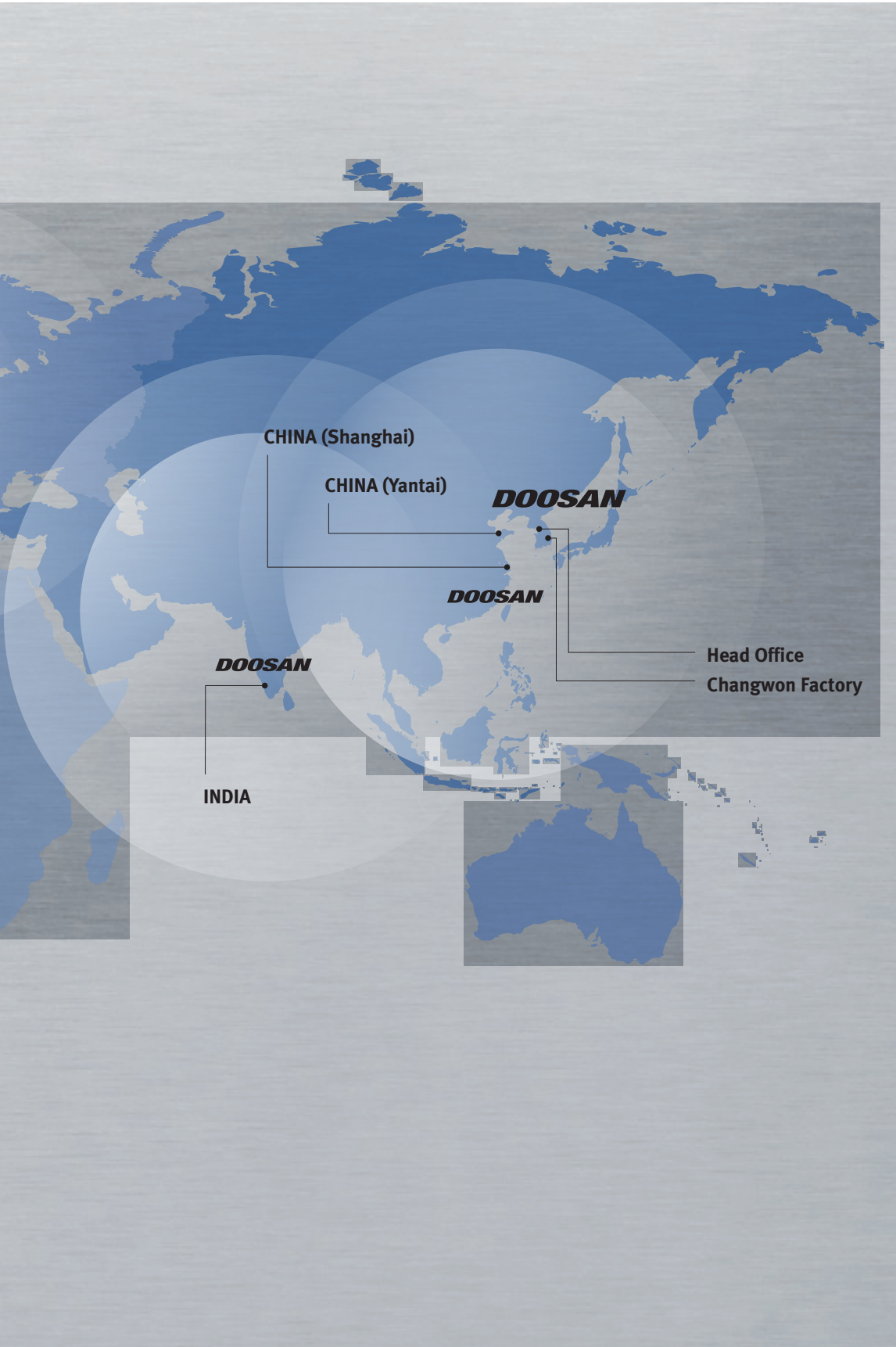
| Corporations | Dealer Networks | Technical Centers | Service Post | Factories |
|--------------|-----------------|-------------------|--------------|-----------|
| 4 | 164 | 51 | 198 | 3 |

Technical Center: Sales Support, Service Support, Parts Support

Doosan Machine Tools' Global Network, Responding to Customer's Needs nearby, Anytime, Anywhere

Doosan machine tools provides a system-based professional support service before and after the machine tool sale by responding quickly and efficiently to customers' demands.

By supplying spare parts, product training, field service and technical support, we can provide top class support to our customers around the world.



Customer Support Service

We help customers to achieve success by providing a variety of professional services from pre-sales consultancy to post-sales support.

Supplying Parts



- Supplying a wide range of original Doosan spare parts
- Parts repair service

Field Services



- On site service
- Machine installation and testing
- Scheduled preventive maintenance
- Machine repair

Technical Support



- Supports machining methods and technology
- Responds to technical queries
- Provides technical consultancy

Training



- Programming / machine setup and operation
- Electrical and mechanical maintenance
- Applications engineering

Doosan Machine Tools **5-axis machine lineup**

The powerful and versatile 5-axis machine lineup at Doosan is an unbeatable option for machine shops that want to enjoy limitless part-making possibilities.

DNM / 5AX series

The perfect entry into 5-axis machining. Compact, productive and built off the classic DNM architecture.



DVF series

With cutting-edge technology and an automation-ready framework, this machine elevates your 5-axis capability.



VCF 850SR/LSR

Our traveling column vertical machining center with a rotating B-axis spindle head and C-axis table is a fantastically flexible way to get more 5-axis production out of a single machine.



FM / 5AX series

Our ultra high speed and ultra precise linear motor series. 42000 r/min spindle speed with outstanding accuracy.



DHF series

A powerful twin-pallet machine for larger, complex parts. Handle those big parts with maximum efficiency.



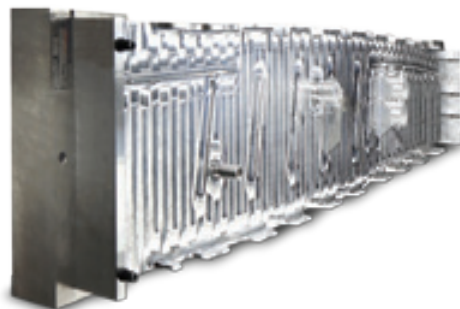
BM U series

A 5-axis super high performance machine for your larger aluminum structural components with 75 kW, 30000 r/min spindle.



HFP series

An accurate and rigid bridge mill VMC. Capably handles the biggest parts for the biggest industries— aerospace, construction, oil/gas and more.



Major Specifications

FM 200/5AX



| Description | Unit | FM 200/5AX |
|--|--------------|--|
| Max. spindle speed | r/min | 42000 |
| Motor power | kW (Hp) | 10 (13.4) |
| Tool taper | taper | HSK E 40 |
| Travel distance (X / Y / Z) | mm (inch) | 200 / 340 / 300 (7.9 / 13.4 / 11.8) |
| Tool storage capacity | ea | 24 |
| Table size | mm (inch) | Ø 200 (Ø 7.9) |
| Table tilting / rotation angle (A / C) | deg | 140 / 360 |

Doosan Machine Tools

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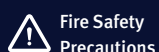
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* For more details, please contact Doosan Machine Tools.

* The specifications and information above-mentioned may be changed without prior notice.

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**Fire Safety
Precautions**

There is a high risk of fire when using non-water-soluble cutting fluids, processing flammable materials, neglecting use coolants and modifying the machine without the consent of the manufacturer. Please check the SAFETY GUIDANCE carefully before using the machine.

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