nmv1500 dcg
nmv1500 dcg hsc

high-precision, 5-axis control vertical machining center

nmv1500 dcg

www.dmgmori.com
The best suited machine for 
high-speed, 5-axis machining

The NMV1500 DCG HSC is the smallest model in the Series and is specialized in high-speed 5-axis machining. With the spindle, 5-axis feed systems and table height optimally designed for high-speed 5-axis machining, the machine can complete machining of a 50-mm-diameter turbo charger impeller for automobiles (see the photo on the front cover) in 100 seconds or less.

This machine is the best suited for complex-shaped impellers that require high-speed machining and take time to be machined, as well as high-speed and high-precision machining of crowns and complex parts of semiconductor manufacturing equipment and communication equipment.
Features of machine

**Basic structure**

- **Spindle**
  - X-axis: 420 mm (16.5 in.)
  - Y-axis: 210 mm (8.3 in.)
  - Z-axis: 400 mm (15.7 in.)
- **Table**
  - B-axis: +160° to −180°
  - C-axis: 360°
- **Access to the table**
  - The overhead crane can be brought to the table center. The distances from the front of the machine to the center of the table (400 mm <15.7 in.>) as well as from the floor to the table surface (850 mm <33.5 in.>) are optimally designed for easy loading and unloading of workpieces.
- **Max. workpiece swing diameter**
  - φ250 mm (φ9.8 in.)
- **Max. workpiece height**
  - 250 mm (9.8 in.)
- **Table loading capacity**
  - 50 kg (110 lb.)

**Top Box-in-Box Construction**

The machine uses the top Box-in-Box Construction that guides and drives the center of gravity of the moving parts with excellent balance. It also improves servo motor’s responsiveness, making unprecedented speed and acceleration possible.

- **Stable accuracy due to the heat-symmetrical structure**
- **Support structure with no overhang**
- **Less affected by temperature variations caused by chips or coolant**
The high-speed, high-output spindle <42,000 min\(^{-1}\), 15.5 kW (20.7 HP)> provided as standard allows the machine to perform a wide range of machining from high-speed machining to heavy-duty cutting.

### Spindle

<table>
<thead>
<tr>
<th>Max. spindle speed</th>
<th>Spindle output</th>
</tr>
</thead>
<tbody>
<tr>
<td>42,000 min(^{-1})</td>
<td>15.5/14.7/13.5 kW (20.7/19.6/18.0 HP) (S6-40% &lt;2 min.&gt;/S6-60% &lt;2 min.&gt;/cont) *</td>
</tr>
<tr>
<td>12,000 min(^{-1})</td>
<td>7.5/5.5 kW (10/7.5 HP) (30 min./cont)</td>
</tr>
<tr>
<td>20,000 min(^{-1})</td>
<td>7.5/5.5 kW (10/7.5 HP) (25%ED/30 min./cont)</td>
</tr>
<tr>
<td>60,000 min(^{-1})</td>
<td>9.6/8.5/7.4 kW (12.8/11.3/9.9 HP) (S6-40% &lt;2 min.&gt;/S6-60% &lt;2 min.&gt;/cont) *</td>
</tr>
</tbody>
</table>

* "S6-40% (2 min.)" is a continuous running cycle.

The spindle can cut at the rated power for 48 seconds & then must run with no load for 72 seconds.

If you select a spindle speed of 12,000 min\(^{-1}\), the machine name will be the NMV1500 DCG.

### Table-in-Table Construction

The Table-in-Table Construction, in which the C-axis table is placed within the B-axis table, has been adopted. Its highly rigid structure allows stable machining accuracy.

### Table

- **B-axis max. rotational speed**
  - 50 min\(^{-1}\)
- **C-axis max. rotational speed**
  - 150 min\(^{-1}\)
  - 3,000 min\(^{-1}\) (Turning specifications)
- **Table working surface**
  - \(\phi\ 250\) mm (\(\phi\ 9.8\) in.)

* Max. spindle speed: 12,000 min\(^{-1}\), 20,000 min\(^{-1}\)

When the C-axis rotates, unbalanced weight of the workpiece (including fixtures) on the table causes vibration, so it may not be possible to rotate at the required speed.

In that case, it is necessary to adjust the balance of the workpiece by adding weights to the fixtures.
Driven at the Center of Gravity

Our DCG technology controls vibration, which is one of the main enemies of high speed and high precision, by driving structural parts at their center of gravity.

**Max. acceleration**
- X-axis: 0.37 G (3.6 m/s²)
- Y-axis: 0.38 G (3.7 m/s²)
- Z-axis: 2.12 G (20.8 m/s²)

**Effects of DCG**
- Improved surface quality
- Outstanding acceleration
- Improved roundness
- Longer tool life

**Vibration controlled**

For positioning, machines with DCG virtually eliminate vibration, while machines without DCG continue to vibrate for a long time. It controls the rotational vibration which appears at every acceleration start point, and which is proportional to the distance between the drive point and the center of gravity. This prevents deterioration of the quality of the machined surface.

**Residual vibration comparison**

**Effects of ORC**
- Superior damping characteristics
- Controls thermal displacement
- Achieves high-speed, high-precision feed
High precision equipment

**Ball screw core cooling**

The ball screw core cooling system circulates cooling oil through the support bearings, maintaining high-precision machining.

![Ball screw core cooling diagram]

**Direct scale feedback**

An absolute magnetic linear scale (full closed-loop control) made by Magnescale is equipped as standard to offer high-precision positioning.

- High accuracy, high resolution
- Greater accuracy than optical scale
- X, Y, Z-axis: Option

**Coolant cooling system (separate type)**

Raised coolant temperature causes thermal displacement in the fixtures and workpiece, affecting the machining accuracy of the workpiece. Use this unit to prevent the coolant from heating up. When using oil-based coolant, the coolant temperature can become extremely high even with the standard coolant pump, so please be sure to select this unit.

*When using oil-based coolant, please be sure to consult with our sales representative.*

- We cannot guarantee that this unit will completely control the coolant temperature. It is designed to help prevent oil temperature increases.

**SVC function (Standard feature for F31iA5)**

The SVC function, in which the program commands for tool tip control are read in advance and compensation is automatically applied to achieve smooth tool feed, is equipped as standard. By combining this function with DDM (Direct Drive Motor), the machine offers greatly improved surface quality and reduced cycle time during 5-axis machining.

**Motion of the SVC function**

![Motion of the SVC function diagram]

The SVC function includes the following functions:
- AI contour control
- Nano smoothing
- Smooth TCP
- Machining mode selection
- G332 tolerance command

**Tool center point control/Cutting point command** (Standard features for F31iA5)

**Tool center point control**

Main features
- The tool path can be controlled from the tool center point.
- No reprogramming is needed when the tool length and the tool diameter are changed.
- NC automatically calculates cutter radius compensation and tool length offsets based on the program commands for tool tip control.
- Cutting point command is available as standard for the turning specification only.

**Cutting point command**

Main features
- The tool path can be controlled from the cutting point.
- By using cutting point commands, machining using radius end mills or square end mills can be performed without reprogramming when tool length, cutter radius or tool tip corner R are changed.

SVC: Smooth Velocity Control
Peripheral equipment

In-machine measuring system

- Spindle
  - Optical type

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Receiver</th>
</tr>
</thead>
</table>

- Centering
- Measurement

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>The workpiece setter function can be added</td>
</tr>
<tr>
<td></td>
<td>Workpiece zero point setting and centering are possible</td>
</tr>
</tbody>
</table>

- Table
  - Touch sensor

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Receiver</th>
</tr>
</thead>
</table>

- Tool length measurement
- Tool breakage detection

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<tr>
<th>Mode</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Manual</td>
<td>The tool setter function can be added</td>
</tr>
<tr>
<td></td>
<td>Allows tool length offset and tool diameter offset</td>
</tr>
</tbody>
</table>

Through-spindle coolant system

The through-spindle coolant system effectively eliminates chips, cooling the machine point and lengthening the lives of your tools.

- Center through
- High-pressure coolant system (separate type)
- High-pressure coolant system (unit on coolant tank)

Recommended equipment

Coolant cooling system (separate type)

The high-pressure coolant system generates a lot of heat because it discharges coolant at high pressure. The coolant cooling system controls the temperature of the coolant and suppresses temperature increases in the workpiece, tools and table, ensuring stable machining accuracy. This is essential equipment when using high-pressure coolant. A unit with a heater will be customized.

- Coolant tank

Manual
- Allows tool geometry offset

Automatic
- Tool length measurement
- Tool breakage detection

Manual
- Allows tool length offset and tool diameter offset

• The tool setter function is included.
**External chip conveyor**

**Available specifications**

<table>
<thead>
<tr>
<th>Workpiece material and chip size</th>
<th>Possible</th>
<th>Not suitable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Ringer type + Drum filter type**
- **Scraper type + Drum filter type**

Chip size guidelines:
- Short: Chips shorter than 50 mm (2.0 in.), blocks of chips shorter than φ40 mm (φ1.6 in.).
- Long: Chips larger than those indicated above.

- The options table shows the general options when using coolant. Changes may be necessary if you are not using coolant, or depending on the amount of coolant, compatibility with machines, or the specifications required.
- Please select a chip conveyor to suit the shape of your chips.
- When using special or difficult-to-cut material (chip hardness HRC45 or higher), please consult with our sales representative.
- Chip conveyors are available in various types for handling chips of different shape and material. For details, please consult with our sales representative.

**Chip disposal**

- **Table**
  - By rotating the table, chips fall straight down into the center conveyor.

- **Shower coolant**
  - As well as preventing chips from scattering during machining, this makes them fall smoothly into the flush coolant system.

**AWC**

Long-term operation is possible by using the large capacity AWC (Automatic workpiece changer).

- **Allows long-term unmanned operation**
- **Shortened Setup times**

**AWC size (Width × Depth)**

1,498 mm × 2,140 mm (59.0 in. × 84.3 in.)

**Workpiece size**

<table>
<thead>
<tr>
<th></th>
<th>NMV1500 DCG HSC</th>
</tr>
</thead>
</table>
| AWC           | Stations        | 34 | 96 | 90 (Max(ple)**
|               | Max. workpiece diameter (mm (in) | φ 250 (φ 9.8) | — | φ 250 (φ 9.8) | — |
|               | Without adjacent workpieces | — | — | — | — |
|               | With adjacent workpieces | — | — | — | — |
|               | Max. workpiece height (mm (in) | 250 (9.8) | 250 (9.8) | 250 (9.8)** | 150 (5.9)** |
|               | Workpiece mass (kg (lb)) | 50 (110) | 50 (110) | 50 (110) |

- **Note**: When the workpiece size is φ200×150 mm (φ7.8×5.9 in.), the 90-station AWC can hold up to 90 workpieces. However, the storage capacity may differ depending on the workpiece restrictions such as 3 and 4.
- **3** There are restrictions on the shape of the workpiece when the height is 114 mm (4.5 in.) or more.
- **4** There are restrictions on the shape of the workpiece when the height is 100 mm (3.9 in.) or more.

For details, please consult with our sales representative.
High-performance operating system that pursues ease of use, and combines the best hardware in the industry with the advanced application/network systems.

- **Outstanding operability thanks to upgraded hardware**
- **Enhanced functionality by using CAM software**
- **New functions for easier setup and maintenance**
- **Various types of monitoring, including internal monitoring, are possible on the screen (option)**
- **In the event of trouble, DMG MORI SEIKI’s remote maintenance service solves it smoothly.**

### Outstanding operability

**Vertical soft-keys**

Vertical soft-keys are arranged on the left and right sides of the screen. The vertical soft-keys can be used as option buttons or shortcut keys to which you can assign your desired screens and functions, allowing you to quickly display the screen you want.

**Keyboard**

A PC-type keyboard is used as standard, making key input easy. A keyboard with a conventional key layout is also available as an option.

### Functions for multi-axis machining

- **3D interference checking function**
  Checks for interference in 3D for spindles, tables, tools, workpieces and fixtures. If interference is detected, the machine will stop operation regardless of whether it is in the automatic or manual mode, providing the highest level of protection against interference.

- **Faster creation of programs**
  ESPRIT® allows you to create complex 3D programming with high-added value. By just installing the software on your PC with connection to LAN, you will be able to use it. (Once the software is started on the computer, it can be used for up to 7 days without LAN connection.)

### Improved ease of setup and maintenance

MAPPS IV is packed with new functions for easier setup and maintenance, including the File Display and Memo function that displays operating instructions and manuals on the screen and the Alarm help function that provides instructions when alarms occur.

### Improved work efficiency

**Fixed-point in-machine camera**

Images taken by cameras installed inside/outside the machine can be viewed on the programming screen. This function is useful for maintenance.

### ESPRIT®

- **Postprocessor as standard**
- **CAM software will be ready to use once your machine is installed**
- **Cost for introducing CAM software can be saved**
- **ESPRIT® data can be modified on the machine**
  (through Remote Desktop connection)
- **The software can be installed on multiple PCs on the network**
  (it cannot be simultaneously started up on more than one PC)
- **2-year warranty support** (including free update)

**CAM software**

ESPRIT®

- A PC is required to use ESPRIT®. Please prepare PCs by yourself.

**ESP**

Consultation required

#### File display and Memo function

- **Alarm help function**

- **Examples of camera locations**
  - Inside machine
    - (to check machining)
  - Tool magazine
    - (to check cutting tools)
  - Chip bucket
    - (to check chip accumulation)
A criterion capacity to select a compressor is 90 L/min (23.8 gpm) per 0.75 kW (1 HP).

Compressed air supply: Please be sure to supply clean compressed air (air pressure: 0.7 MPa (101.5 psi), pressure dew point: 10 ℃ (50°F) or below).

### Machine specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>NMV1500 DCG HSC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel</strong></td>
<td></td>
</tr>
<tr>
<td>X-axis travel &lt;longitudinal movement of spindle head&gt;</td>
<td>mm (in.) 420 (16.5)</td>
</tr>
<tr>
<td>Y-axis travel &lt;cross movement of saddle&gt;</td>
<td>mm (in.) 210 (8.3)</td>
</tr>
<tr>
<td>Z-axis travel &lt;vertical movement of ram&gt;</td>
<td>mm (in.) 400 (15.7)</td>
</tr>
<tr>
<td>Distance from table surface to spindle gauge plane &lt;horizontal table position&gt;</td>
<td>mm (in.) 100<del>500 (3.9</del>19.7)</td>
</tr>
<tr>
<td>B-axis travel</td>
<td>° 160°~180°</td>
</tr>
<tr>
<td>C-axis travel</td>
<td>° 360°</td>
</tr>
<tr>
<td>Height from the floor to the upper face of the table</td>
<td>mm (in.) 850 (33.5) &lt;Standard&gt;</td>
</tr>
<tr>
<td>Table working surface</td>
<td>μ (ft) 250 (9.8)</td>
</tr>
<tr>
<td>Table loading capacity</td>
<td>kg (lb) 50 (110)</td>
</tr>
<tr>
<td>Table surface configuration</td>
<td>≤ 12 mm (0.5 in) T-slot×8 B &lt;radial arrangement&gt;</td>
</tr>
<tr>
<td>Max. workpiece swing diameter</td>
<td>μ (ft) 250 (9.8)</td>
</tr>
<tr>
<td>Max. workpiece height</td>
<td>μ (ft) 250 (9.8)</td>
</tr>
<tr>
<td>Rotational speed of the table</td>
<td>B-axis mm/min 50</td>
</tr>
<tr>
<td></td>
<td>C-axis mm/sec 150 (3,000)</td>
</tr>
<tr>
<td>Spindle</td>
<td></td>
</tr>
<tr>
<td>Max. spindle speed</td>
<td>mm/min 42,000 (12,000) [20,000] [60,000]</td>
</tr>
<tr>
<td>Type of spindle taper hole</td>
<td>HSK-E40 [HSK-A40 (12,000 min -1, 20,000 min -1)] [HSK-E32 (60,000 min -1)]</td>
</tr>
<tr>
<td>Feedrate</td>
<td></td>
</tr>
<tr>
<td>Rapid traverse rate</td>
<td>mm/min (ipm) X: 50,000 (1,968.5), Y: 45,000 (1,771.7), Z: 40,000 (1,574.8)</td>
</tr>
<tr>
<td>Cutting feedrate</td>
<td>mm/min (ipm) X: 50,000 (1,968.5), Y: 45,000 (1,771.7), Z: 40,000 (1,574.8)</td>
</tr>
<tr>
<td>With AI contour control</td>
<td>mm/min (ipm) B: 50, C: 150</td>
</tr>
<tr>
<td>Without AI contour control</td>
<td>mm/min (ipm) B: 16.37, C: 16.37</td>
</tr>
<tr>
<td>Jog feedrate</td>
<td>mm/min (ipm) X, Y, Z: 0<del>5,000 (0</del>196.9)</td>
</tr>
<tr>
<td></td>
<td>B, C: 0~13.88</td>
</tr>
<tr>
<td>ATC</td>
<td></td>
</tr>
</tbody>
</table>
| Type of tool shank        | HSK-E40 [HSK-A40 <12,000 min -1, 20,000 min -1>][HSK-E32 <60,000 min -1>]
| Tool storage capacity     | 21 [61] (121) |
| Max. tool diameter        | mm (in.) φ 52 (2.0), φ 52 (2.0) <12,000 min -1, 20,000 min -1> [φ 30 (1.1) <60,000 min -1>]
| Without adjacent tools    | mm (in.) φ 52 (2.0) [φ 65 (2.5) <12,000 min -1, 20,000 min -1> [φ 30 (1.1) <60,000 min -1>]
| Max. tool length          | mm (in.) 300 (12) |
| Max. tool mass            | kg (lb) 2 (4.4) [2 (4.4) <12,000 min -1, 20,000 min -1> [1 (2.2) <60,000 min -1>]
| Max. tool mass            | N m (ft lb) 1.8 (1.32) [1.8 (1.32) <12,000 min -1, 20,000 min -1> [0.8 (0.59) <60,000 min -1>]
| Method of tool selection  | Fixed address |
| Tool changing time        | Tool-to-tool sec. 2.0 |
| Motors                    |                 |
| Spindle drive motor       | 42,000 min -1 kW (HP) 15.5/14.7/13.5 kW (20.7/18.6/18.0 HP) <56.40% <2 min.>/56.60% <2 min.>/cont.> |
|                          | [12,000 min -1 kW (HP) 7.5/5.5/10/7.5 <30 min.>/cont.> |
|                          | [20,000 min -1 kW (HP) 7.5/5.5/10/7.5 <25%<60/50 min.>/cont.> |
|                          | [60,000 min -1 kW (HP) 9.6/8.5/7.4/12/8/11/3.9/9.8 <56.40% <2 min.>/56.60% <2 min.>/cont.> |
| Feed motor                | kW (HP) X: 3 (4.0), Y: 3.4 (4.0) [2.5 (3.3)/2 |
| B-axis table              | kW (HP) 5.2 (9.9) |
| C-axis table              | mm/min (ipm) 150 min -1 [3,000] kW (HP) [22 (30) <12,000 min -1, 20,000 min -1> |
| Coolant pump motor        | kW (HP) 1.2 (1.6) |
| Power sources (Standard)  |                 |
| Electrical power supply   | kVA 42.1 |
| Compressed air supply     | MPa (psi), L/min (gpm) 0.5 (72.5), 500 (132.0) <ANR> |
| Tank capacity             | L (gal) 550 (145.2) |
| Machine height <From floor> | mm (in.) 2,820 (110.0) [2,856 (112.4) <60,000 min -1> |
| Machine size              | 1,995~3,190 (78.5~125.6) <excluding chip conveyor> |
| Mass of machine           | kg (lb) 7,500 (16,500) |
| Noise data                | A-weighted, time-average radiated sound pressure level dB 61~73 (measurement uncertainty is 4 dB) |

*Option:
* 1. [S6-40% (2 min.)] is a continuous running cycle. The spindle can cut at the rated power for 48 seconds & then must run with no load for 72 seconds.
* 2. If you select a spindle speed of 12,000 min -1, the machine name will be the NMV1500 DCG.
* 3. Max. spindle speed: Depending on restrictions imposed by the workpiece clamping device, fixture and tool used, it may not be possible to rotate at the maximum spindle speed.
* 4. A tool with a mass moment greater than the maximum tool mass moment may cause problems during ATC operations even if it satisfies other conditions.
* 5. Compressed air supply: Please be sure to supply clean compressed air <air pressure: 0.7 MPa (101.5 psi), pressure dew point: 10 ℃ (50°F) or below>.
* 6. A criterion capacity to select a compressor is 90 L/min (23.8 gpm) per 0.75 kW (1 HP).
* 7. However, this figure may differ depending on the type of compressors and options attached. For details, please check the compressor specifications.
* 8. When the tool tip air blow is regularly used, air supply of more than 300 L/min (79.2 gpm) is separately required.
* 9. ANR: ANR refers to a standard atmospheric state; i.e., temperature at 20 ℃ (68°F); absolute pressure at 101.3 kPa (14.7 psi); and relative humidity at 65%.
* 10. Power sources, Machine size: the actual values may differ from those specified in the catalogue, depending on the optional features and peripheral equipment.
* 11. If you select the turning specification, the through-spindle coolant system is a center-through type only.
* 12. Please note that to attach turning tools, either a BT or HSK tool holder (two-face contact), which we have prepared according to machine specifications, is required.
* 13. When selecting the two-face contact tool specification, be sure to use a two-face contact tool.
* 14. When the C-axis rotates, unbalanced weight of the workpiece (including fixtures) on the table causes vibration, so it may not be possible to rotate at the required speed.
* 15. In that case, it is necessary to adjust the balance of the workpiece by adding weights to the fixtures.
* 16. For details, please consult with our sales representative.
* 17. The information in this catalog is valid as of January 2014.
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