
Preface



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1 Extent of documentation

The machine documentation consists of the following components.

OPERATING INSTRUCTIONS

The operating instructions include all information needed for machine operation and the safety instructions as well as a description intended use of our product.

PROGRAMMING

These instructions contain information as to operation and programming the control unit.

ELECTRICAL DOCUMENTATION

This documentation contains the electrical diagrams for the machine as well as the parts list and layout drawings.

PARTS LIST

The parts list includes the standard components parts of the machine.

ACCESSORY DEVICE

Documentation on the accessory device used in the machine.

2 About Declaration of Conformity

<Declaration of EC Conformity>

DMG MORI declares that the machine tool shipped to Europe (machining center) is designed and manufactured in conformity with the following requirements.

1. EC directive
Machinery Directive 2006/42/EC
EMC Directive 2004/108/EC
2. EN standards
EN ISO 12100
EN 50370-1
EN 50370-2
EN 60204-1
EN 12417

<CE Marking (EMC Directive)>

This machine was designed and built with the conditions to be used in the industrial environment satisfying the EMC standards: EN50370-1 and EN50370-2 that are for machine tools. To use this machine in the light-industrial environment or the mixed (residential and light-industrial) environment, additional treatment is required.

<Machine Model>

Description of machine models is omitted because this manual applies to multiple machine models.

<Manufacturer>

DMG MORI CO., LTD.
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<Contact Address for Inquiry Regarding Technical Files>

For the contact addresses in or around your country, the latest information on our business sites is available on the website.
DMG MORI website
www.dmgmori.co.jp

3 About the Machine

The product shipped to you (the machine and accessory equipment) has been manufactured in accordance with the laws and standards that prevail in the relevant country or region. Consequently it cannot be exported, sold, or relocated, to a destination in a country with different laws or standards.

The export of this product is subject to an authorization from the government of the exporting country. Check with the government agency for authorization.

This product is also subject to the U.S. Export Administration Regulations (EAR). Exporting this product from the US, or from a country other than the US to another country, requires US government authorization. These regulations may also apply to reexports of the products. Contact DMG MORI when exporting this product.

<Basis>

This machine was designed and built using state-of-the-art technology for the purpose of machining workpieces with cutting tools. This machine complies with generally recognized safety regulations, standards and specifications at the time of manufacture.

This machine is suitable for manual and automatic operation.

<Tools>

This machine is capable of using common tools such as milling cutters, drills, taps, and boring bars. Contact DMG MORI before using grinding tools or special tools.

<Materials>

This machine is designed for machining metal, resin, and plastics. It was not intended for the machining of materials such as magnesium, carbon, ceramics, and wood. Contact DMG MORI before using these materials.

4 About this Manual

- Before starting operation, maintenance, or programming, carefully read the manuals supplied by DMG MORI, the NC unit manufacturer, and equipment manufacturers so that you fully understand the information they contain.
Keep the manuals carefully so that they will not be lost.
 - This is an original instruction manual officially issued by DMG MORI.
 - The contents of this manual are subject to change without notice due to improvements to the machine or in order to improve the manual. Consequently, please bear in mind that there may be slight discrepancies between the contents of the manual and the actual machine. Changes to the instruction manual are made in revised editions which are distinguished from each other by updating the instruction manual number.
 - Should you discover any discrepancies between the contents of the manual and the actual machine, or if any part of the manual is unclear, please contact DMG MORI and clarify these points before using the machine. DMG MORI will not be liable for any damages occurring as a direct or indirect consequence of using the machine without clarifying these points.
 - Keep this manual in a clearly marked location to ensure easy access when necessary.
 - Contact the DMG MORI Service Department if any part of the manual is unclear.
 - Contact the DMG MORI Service Department or your distributor if this manual is lost or damaged.
 - The contents of this manual are subject to change without prior notification due to improvements to the machine.
 - All rights reserved: reproduction of this instruction manual in any form is not permitted without the written consent of DMG MORI.
 - Various manuals and documents are supplied with the machine in addition to this manual. Keep them close to the machine to enable easy reference.
 - The important precautions are compiled in the "Precautions" section. You must read this section before performing any operations relating to the machine.
 - The following number formatting is used in this manual:
Thousand separator: "," (comma)
Decimal separator: "." (period)
- <Registered Trademark>**
- Company names and product names are trademarks or registered trademarks of the individual companies.

5 Signal Word Definition

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor injury or damage to the machine.

[] Failure to observe the precautions (hazards, warnings and cautions) will lead to the hazards indicated in square brackets [], injuries or machine trouble.

NOTE

Indicates items that must be taken into consideration.



Indicates items to be referred to.



Indicates hints.

Example:

Indicates program-applied examples.

1-2

CHECKS AFTER INSTALLING MACHINE

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1 Checks before Turning ON Power for First Time



WARNING

After pressing the NC power button [ON], do not touch any of the operation-related keys on the NC operation panel before the screen shows “(WARNING)”.

[Machine damage/Serious injury]

Prior to turning on the main power for the first time after installation, check the following points.

- Machine external appearance
- Covers, components (for damage), paint condition
- Connectors, cable connection points (electrical cabinet checks not necessary)
- Power input voltage, secondary voltage
- Ground faults and short circuits for 200 VAC



Connecting power supply: Installation

- Ground faults for 24 VDC



Connecting power supply: Installation

- Machine specifications (purchase order conformity)
- Instruction manuals, tool box, spare parts
- Transit clamp, lifting hook/eyebolt removal
- Bolt tightening
- Pneumatic piping connections
- Main air pressure at set value
- Level check for lubricating oil and coolant
- Auxiliary equipment (robot etc.) wiring/piping (special specifications)
- Sliding surface anti-corrosive coating removal
- Shower coolant nozzle (option) direction in machining chamber

2 Checks after Turning ON Power for First Time

If no problems occur at checks before turning ON the main power for the first time after installation, turn ON the main power and perform additional checks in the order of the following tables.

2.1 Installation Check

No.	Check Item
1	Machine Surrounding Space Confirm environment conditions satisfy requirements.  Environmental conditions: Installation
2	Oil/Coolant Leakage Check for oil or coolant leakage from all joints, pipes and hoses.
3	Maintenance Space Confirm maintenance area around the machine is sufficient.  Installation diagrams: Installation
4	Safety  Precautions
5	Transit Clamp Removal Confirm all transit clamps have been removed.  NOTE For transit clamps that require power ON for removal, select the handle mode and then carefully remove transit clamps.  Removing transit clamps: Installation

2.2 Power-related

No.	Check Item
6	Main Power ON/OFF After turning ON the main power, turn OFF the main power and check for abnormalities.  Turning ON/OFF power: Machine operation
7	Main Power ON → NC Power ON After turning ON the main power, turn ON the NC power and check for abnormalities.  Turning ON/OFF power: Machine operation
8	Emergency Stop → Emergency Stop Release When the [Emergency Stop] button is pressed, confirm the machine enters the emergency stop condition. If operating conditions are normal, release the emergency stop.  Turning ON/OFF power: Machine operation

2.3 Interlock Operation

No.	Check Item
9	Interlock Functions - Door interlock  Door interlock function: Machine operation - Electrical cabinet door interlock*  Power-related: Machine operation - Operation selection key-switch  [OFF]  Operation selection key-switch: Machine operation  NOTE *Equipped depending on the model.

2.4 Machine Inside

No.	Check Item
10	Machine Inside Check if there is any damage on slideways, spindle or table (pallet).

2.5 Lubricating Oil

No.	Check Item
11	Lubricating Points Ensure that lubricating oil is fully supplied to relevant parts of the machine.  Lubricating point: Maintenance

2.6 Maintenance/Inspection List

No.	Check Item
12	Maintenance/Inspection Points  Regular inspection list, maintenance route map: Maintenance

2.7 Manual Operation

No.	Check Item
13	All Axis Movements in Handle Mode Check all axis movements in the handle mode including over travel function.  Handle switches: Machine operation
14	All Axis Movements in Rapid Traverse Mode Move all the axes in the rapid traverse mode and check for noise or vibration.  Axis feed buttons: Machine operation
15	Spindle Rotation  CAUTION Before rotating the spindle, the tool is clamped in the spindle and confirm that the vertical soft-key [TOOL CLAMP] is illuminated in white. Rotate the spindle to check for abnormal noise or vibration.  Spindle rotation buttons: Machine operation <Conditions>  Conditions for starting spindle rotation: Machine operation
16	Magazine Rotation Rotate the magazine to check for abnormal noise or vibration.  Magazine operation panel: Machine operation
17	Coolant Discharge  CAUTION Before discharging coolant, confirm that the coolant tank is filled with coolant. Discharge coolant and check for noise or vibration.  Coolant buttons: Machine operation

2.8 Level Adjustment

No.	Check Item
18	Machine Level Adjustment Confirm the machine level result agrees with the Accuracy Test Results Chart delivered with machine.  Adjusting machine level: Installation

2.9 Automatic Operation (MDI Mode)

No.	Check Item
20	Zero Return/Movement of All Axes  CAUTION Check that there is no interference when the axes are moved.  G28 machine zero (reference position) return, G30 second (third or fourth) zero (reference position) return: Programming  G00 positioning cutting tool at rapid traverse rate: Programming <Procedure> 1. Press the mode selection button  [MDI] (MDI) → Function selection key  (PROG). [The 'PROGRAM CHECK' screen is displayed.] 2. Input G91 G28 X0 Y0 Z0; and press the  (INSERT) key → automatic operation button  [Start]. [The X- and Z-axes return to the zero points.] 3. Input G91 G00 Z-10.0; and press the  (INSERT) key → automatic operation button  [Start]. [The Z-axis travels 10 mm in the negative direction.] 4. Input G91 G00 X-10.0; and press the  (INSERT) key → automatic operation button  [Start]. [The X-axis travels 10 mm in the negative direction.]
21	Spindle Rotation  CAUTION Before rotating the spindle, the tool is clamped in the spindle and confirm that the vertical soft-key [TOOL CLAMP] is illuminated in white.  M03 spindle start (normal), M04 spindle start (reverse), M05 spindle rotation stop: Programming <Procedure> 'PROGRAM CHECK' screen: 1. Input S500 M03; and press the  (INSERT) key → automatic operation button  [Start]. [The spindle rotates in the normal direction at 500 min⁻¹] 2. Input M05; and press the  (INSERT) key → automatic operation button  [Start]. [The spindle is stopped.] 3. Input S500 M04; and press the  (INSERT) key → automatic operation button  [Start]. [The spindle rotates in the reverse direction at 500 min⁻¹] 4. Input M05; and press the  (INSERT) key → automatic operation button  [Start]. [The spindle is stopped.]
22	Checks for Magazine Rotation  • T function: Programming • Tool registration: Machine operation <Procedure> 'PROGRAM CHECK' screen: 1. Input T01; and press the  (INSERT) key → automatic operation button  [Start]. [T01 is called to the tool change position]

No.	Check Item
23	Checks for Tool Change  M06 Tool change: Programming <Procedure> 'PROGRAM CHECK' screen: 1. Input M06; and press the  (INSERT) key → automatic operation button  [Start]. [T01 is inserted into the spindle.]
24	Coolant Function  CAUTION Before discharging coolant, confirm that the coolant tank is filled with coolant.  M08 coolant discharge ON, M09 coolant discharge OFF: Programming <Procedure> 'PROGRAM CHECK' screen: 1. Input M08; and press the  (INSERT) key → automatic operation button  [Start]. [The coolant is discharged.] 2. Input M09; and press the  (INSERT) key → automatic operation button  [Start]. [The coolant discharge is stopped.] <Conditions> The door is closed.
25	Optional Auxiliary Device Operation • Chip Conveyor  M200 chip conveyor forward rotation start, M201 chip conveyor stop (Option): Programming <Procedure> 'PROGRAM CHECK' screen: 1. Input M200; and press the  (INSERT) key → automatic operation button  [Start]. [The chip conveyor rotates in the forward direction.] 2. Input M201; and press the  (INSERT) key → automatic operation button  [Start]. [The chip conveyor rotation is stopped.] <Conditions> The door is closed.

2.10 Automatic Operation (Memory Mode)

No.	Check Item
26	Sample Program Execution  CAUTION Check that there is no interference when the axes are moved. Confirm program input and execution.  Operation confirmation sample program: Installation
27	Single Block Function Activate single block and execute program. Confirm the program stops at each block.   [SINGLE BLOCK] (Single Block) button: Machine operation
28	Feed Hold Function Confirm the feed hold function is valid.  Press automatic operation button  [Stop] to execute or cancel emergency stop: Machine operation

2.11 Spindle Warm-up

No.	Check Item
29	Spindle Warm-up Following completion of all checks, perform spindle warm-up.  Spindle warm-up: Maintenance

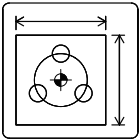
3 Procedure of Workpiece Cutting

<Procedure>

1) Develop a machining plan (desk work).



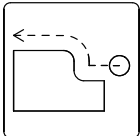
Checking drawings: Machine operation

Reading the Drawing 	Check Items		Check Column
	1.	The tolerance is clear.	
	2.	The accuracy indication is clear.	
	3.	The raw material configurations and materials are clear.	
	4.	The processes before and after machining are checked.	
	5.	There is no unreasonable demand in terms of cutting accuracy.	
	6.	The keys for machining are clear.	
	7.	The workpiece zero point is determined.	
	8.	The use of the workpiece is clear.	
	9.	All the dimensions and listings in the diagrams have been checked.	
	10.	No dirt or unnecessary information is on the drawing.	

2) Determine tools and fixtures to be used and machining processes.



- Tool shank dimensions: Installation
- Tools: Tool manufacturers' catalogs

Order and Conditions of Machining 	Check Items		Check Column
	1.	The cutting order and cutting conditions are appropriate for the workpiece material and workpiece shape.	
	2.	The method of clamping the workpiece and the setting of the fixture are appropriate.	
	3.	Cutting tools and replaceable tool tips are selected properly.	
	4.	The cutting process is appropriate for the workpiece material and workpiece shape.	
	5.	Component interference will not occur.	
	6.	The process chart is prepared.	

3) Turn ON the power.



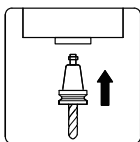
- Checks before turning ON power for first time: Installation
- Turning ON/OFF power: Machine operation

4) Register the tool.

 Tool registration: Machine operation

a) A tool is mounted in the spindle and returned to the magazine by ATC.

 Mounting/removing a tool: Machine operation

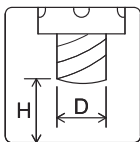
Mounting the Tools 	Check Items		Check Column
	1.	Tool holders and cutting tools are cleared before mounting.	
	2.	The tapered surface of the tool holder has no scratches or asperities.	
	3.	Cutting tools are free of abnormal wear and breakage.	
	4.	Tool shape and material are appropriate for intended operation.	
	5.	If the tool holder uses a retention knob, the retention knob must be installed correctly.	
	6.	Cutting tools are mounted on the tool holders correctly.	
	7.	The tool overhang is appropriate.	
	8.	When mounting a boring bar in the spindle, the tool tip is set in the direction opposite to the tool shift direction.	
	9.	All cutting tools are registered.	
	10.	Large diameter, medium diameter and small diameter tools are classified.	
	11.	Tool numbers of large, medium and small diameter tools are appropriate.	
	12.	Tools are mounted taking the diameter of the adjacent tools into consideration.	
	13.	Pots adjacent to a large diameter tool are assigned for small diameter tools or left empty.	

5) Clamp the workpiece.

 Mounting a workpiece (When it is carried in by crane): Machine operation

6) Set the tool offset data.

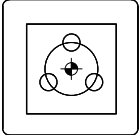
-  Tool offset data setting: Machine operation
- Tool offset: Programming

Tool Offset 	Check Items		Check Column
	1.	Possible interference during measurement of tool offset data is checked.	
	2.	Rotation speed for centering tool is proper (only tools to be rotated when used).	
	3.	The [INTERLOCK MODE] key-switch is placed in the [NORMAL] position.	
	4.	Close the door.	
	5.	Offset direction is correct.	
	6.	Tool offset number is correct.	
	7.	Tool geometry offset data, tool wear offset data, and coordinate system are identified correctly.	
	8.	Tool radius offset data and tool length offset data are identified correctly.	

7) Set the workpiece zero point (work coordinate).

-  Workpiece zero point setting: Machine operation
- Setting work coordinate system: Machine operation

- G54 to G59 selecting work coordinate system: Programming

Workpiece Zero Point (Work Coordinate System) 	Check Items		Check Column
	1.	Possible interference during measurement of tool offset data.	
	2.	Possible interference during the setting for the work coordinate systems is checked.	
	3.	The [INTERLOCK MODE] key-switch is placed in the [NORMAL] position.	
	4.	Close the door.	
	5.	The workpiece zero point coordinate values are set for the work coordinate system.	
	6.	The workpiece zero point is determined taking the diameter of the centering tool into consideration.	
	7.	When measuring the tool length offset data, the relative coordinate value is set "0" with the Z-axis positioned at the machine zero point.	
	8.	The measured dimension is correct.	
	9.	The calculation for offset data is correct.	
	10.	Offset direction is correct.	
	11.	Tool offset number is correct.	
	12.	Tool geometry offset data, tool wear offset data, and coordinate system are identified correctly.	
	13.	Tool radius offset data and tool length offset data are identified correctly.	

8) Input programs.

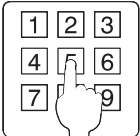
<Creating a new program>

- Register tool data on tool file.
- Create conversational programs.

 MAPPS CONVERSATIONAL PROGRAMMING MANUAL

<Using an existing program>

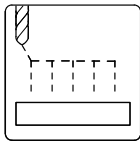
-  Programming
- Program editing, Input/output programs using external I/O device: Machine operation

Inputting the Program 	Check Items		Check Column
	1.	When a program is created for a particular process, the program for the next process is taken into consideration.	
	2.	The program is appropriate for the workpiece material and workpiece shape.	
	3.	The decimal points are entered correctly.	
	4.	The sign (+, -) preceding numerical values are entered correctly.	
	5.	The feed modes (rapid traverse and cutting feed) are used correctly.	
	6.	The approach paths and cutting feedrate are identified correctly.	
	7.	All input data using the keys are checked.	
	8.	No incorrect values are input by making an assumption.	

9) Carry out the no-load running.

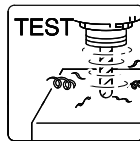


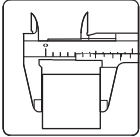
Program check: Machine operation

No-load Running 	Check Items		Check Column
	1.	The [INTERLOCK MODE] key-switch is placed in the [NORMAL] position.	
	2.	The door is closed.	
	3.	The single block function is turned on.	
	4.	The feedrate and spindle speed are appropriate for operation.	
	5.	The feed modes (rapid traverse and cutting feed) are used correctly.	
	6.	The tool retraction direction after cutting is correct.	
	7.	Tool movement is smooth in the calculated area.	
	8.	The cutting tools are free of interference with the workpiece, and fixture.	
	9.	The machine can be stopped immediately when necessary.	
	10.	After the completion of dry run mode operation, the buttons on the operation panel (dry run, feedrate override, etc.) are set to the proper positions.	
	11.	The conditions for starting automatic operation are checked.	

10) Carry out the test cutting (program check).

- Test cutting: Machine operation
- Program restart function (option): Machine operation
- MAPPS-DNC operation: Machine operation
- MAPPS DPRINT function: Machine operation

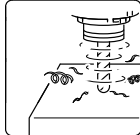
Test Cutting 	Check Items		Check Column
	1.	The [INTERLOCK MODE] key-switch is placed in the [NORMAL] position.	
	2.	The door is closed.	
	3.	The single block function is turned on.	
	4.	The cutting conditions (depth of cut, width of cut, feedrate, and spindle speed) are set properly.	
	5.	The order of machining and machining processes have been determined in accordance with the shape and material of the workpiece.	
	6.	The cutting tools have been selected properly.	
	7.	The selection of fixture is correct.	
	8.	The workpiece clamping method is correct.	
	9.	The progress of cutting can be observed.	
	10.	Coolant supply volume and direction are correct.	
	11.	The cutting tools are free of interference with the workpiece and fixtures.	
	12.	The dimensions are measured after the rough machining.	
	13.	The settings for feedrate override (100%) and rapid traverse rate override (minimum necessary feedrate) are correct.	
	14.	The machine can be stopped immediately when necessary.	

Measuring 	Check Items		Check Column
	1.	The measuring instrument is functioning correctly.	
	2.	The zero point adjustment of the measuring instrument is performed.	
	3.	The choice of measuring instrument is correct.	
	4.	The measuring order is correct.	
	5.	The measuring method is appropriate.	
	6.	The area to be measured is indicated clearly.	
	7.	The area to be measured is free of chips and coolant.	
	8.	The dimensions are measured after the rough machining.	
	9.	The workpiece is cool when the dimensions are measured.	

11) Carrying out mass production



- Mass production: Machine operation
- Program restart function (option): Machine operation
- MAPPS-DNC operation: Machine operation
- MAPPS DPRINT function: Machine operation

Mass Production 	Check Items		Check Column
	1.	The [INTERLOCK MODE] key-switch is placed in the [NORMAL] position.	
	2.	The door is closed.	
	3.	All NC functions such as single block functions used to check the program are turned OFF.	
	4.	Dimensional variation is measured.	
	5.	Target work time is set on the basis of the machining time for one workpiece.	
	6.	Tool wear is observed.	
	7.	The dimensions are measured after the rough machining.	

