Canon

Dental Milling Machine

MD-500

Instruction Manual



Please read this instruction manual before operate this product. After you finish reading this instruction manual, store it in a safe place for future reference.

Introduction

Thank you for your purchase of MD-500 dental milling machine.

To operate your MD-500 safely and to obtain its full performance and functionality, please read through this instruction manual before operating your MD-500.

Be sure to follow the safely precautions listed in the for Safe MD-500 Operation section

After reading this instruction manual, please store it where it can be easily retrieved as needed. The manual is useful to figure out how to operate your MD-500 and learn its functionality in detail.

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For Safe MD-500 Operation



This instruction manual contains descriptions of safety precautions that must be observed at all times to ensure safe operation of your MD-500 and its accessories. Milling machines, if not handled correctly, present various dangers that could lead to unexpected accidents, serious or fatal injuries, and fires or other physical damage.

In addition, be sure to read all labels and other precautions affixed to your MD-500. Ensure that you read the following safety precautions closely prior to operating the product and use the product correctly.

Explanation of Symbols Used in This Manual

The meanings of the symbols used in this manual are explained below. The following symbols are used in this manual to denote important instructions for the safe operation of the product. Be sure to observe these instructions.



Warning

A warning that indicates the potential for a serious or fatal injury if instructions are not followed correctly. Be sure to observe all warnings to ensure safe operation of the product.



Caution

A caution that indicates the potential for an injury or physical damage if instructions are not followed correctly. Be sure to observe all cautions to ensure safe operation of the product.



Caution Rotating equipment



Finger injury risk



Caution Electric shock risk



These symbols warn of situations where there is potential for injury or electric shock if the symbols are ignored and instructions are not followed correctly. Be sure to observe these symbols at all times.



This symbol warns of situations where operating the product is potentially dangerous unless the power plug is disconnected from its electrical outlet.

Be sure to observe this symbol at all times.

Important

This symbol indicates important or prohibited matters that must be observed when operating the product. Be sure to read all important instructions to prevent mechanical malfunctions or damage.

Note

Supplementary or reference information provided to facilitate operation of the product.

$(\rightarrow P.XX)$

Indicates a reference page. The number in brackets is the page number where a detailed explanation begins.

Danger of Electric Shock or Fire



0	
During milling, sparks may fly. Caution Fire risk	 Do not place the milling machine beside machinery that generates dust. Fire may be caused by dust or fine particles. Do not use or place sources of fire, combustible solutions (such as alcohol, thinners, or gasoline), or flammable sprays near the milling machine. Such materials may ignite and start a fire. Carefully confirm the milling tools and milling conditions to be used before starting milling. Inappropriate milling tools or milling conditions may trigger fire or smoke.
Milling chips may start a fire. Caution Fire risk	Never mill magnesium, magnesium compounds, or other flammable materials with the milling machine.
High voltages and high temperatures are present in the milling machine. Caution Caution Electric shock risk	 Do not spill liquids or combustible solutions (such as alcohol, thinners, or gasoline) inside the milling machine. Never use an air gun to clean the milling machine. For details, please check the "cleaning guide". Do not disassemble or modify the milling machine.
Moisture or dampness can lead to electric shocks. Caution Electric shock risk	 Do not place the milling machine outdoors, in locations directly exposed to high humidity, moisture, or dampness, or in locations exposed to briny air. Do not operate the milling machine with wet or moist hands.
Control circuit boards may fail. Caution Fire risk Caution Electric shock risk	 Do not use the milling machine if you notice any of the following abnormalities. They may be signs of an electrical fault, short circuit, or abnormal current inside the milling machine. The circuit breaker will not turn on. The spindle makes abnormal sounds, becomes hot, or becomes scorched. Smoke comes from inside the control panel.

Use of an inadequate power supply is dangerous.







- Do not power the milling machine with a voltage other than the indicated power-supply voltage.
- Handle the power cord, plug, and electrical outlet correctly and with care. Do not place heavy objects on the power cord or pull with excessive force, bend or twist with undue force, modify, tie, or bundle the power cord.
- Firmly insert the power plug all the way in the electrical outlet and do not let milling chips land directly on the power plug or power cord.
- Do not place objects near the electrical outlet and always hold the power plug when pulling the power plug out of the electrical outlet.
- Do not use a damaged power cord, plug, or electrical outlet (such as exposed or broken conductors). If damaged, request replacements from our Customer Support & Service Center $(\rightarrow P.113)$.
- Connect the milling machine to ground. This can prevent fire or electric shock in the event a malfunction causes a short circuit or electrical fault.
- Do not use extension cords or power strips with the milling machine. They may cause fire. If you must use an extension cord, select a cable with more than adequate electric power capacity and connect it to an earthed electrical outlet. Do not use the extension cord to power any other equipment.



A Caution

Chips generated during milling have the potential to cause dust explosions.



Caution Fire risk

Exercise due caution when using a vacuum cleaner to remove milling chips, such as using a vacuum cleaner that is specified to have dust explosion* safety measures.



Supplementary or reference information provided to facilitate operation of the product.

The Milling Machine Weighs Close to 110 Kg

A Warning

The machine may cause a serious accident if it tips over.

- Install the milling machine in a location that is level, stable, free of vibrations, and able to bear its weight.
- Do not place objects on top of the milling machine. This may cause the machine to become unbalanced.



A Caution

The weight of the machine may cause injuries.

Do not move the milling machine. Doing so may lead to pinching or other physical injuries. Contact our Customer Support & Service Center (→P.113) if you wish to move the milling machine.

Danger of Physical Injuries



A Caution

Potential for neck, back, and other joint injuries during work operations.

- Ensure there is sufficient space around the milling machine when performing maintenance operations. Do not carry out work operations without sufficient space.
- Avoid awkward body positions when inserting a LAN cable in the LAN port.
- Avoid awkward body positions when operating the circuit breaker or power switch.

Potential for cuts and other injuries during work operations.



- Exercise due caution when moving around the milling machine to not trip on LAN cables or air hoses.
- Always wear safety boots, protective eyewear, work clothes, a mask, protective gloves (cut-resistant gloves), and other protective gear when performing work operations.
- Exercise due caution around milling chips when fixing or removing disk, or milling tools.
- Do not hold the cutting head directly when replacing milling tools. Exercise due caution when opening the safety door to ensure the safety door does not hit your body.
- Exercise due caution when closing the safety door to ensure your hand or fingers are not caught. Do not open the door while the spindle is rotating. The spindle is dangerous because it rotates at high speeds.
- Exercise due caution when handling milling tools to not drop milling tools.
- Exercise due caution when inserting a milling tool in a milling tool holder to ensure your fingers are not cut or injured by the milling tool.
- Exercise due caution when picking up a broken milling tool to ensure your fingers are not cut or injured.
- Wear protective gloves (cut-resistant gloves) when touching milled disk with your hands. Exercise due caution with milled disk as burrs may remain.
- Exercise due caution when touching disk immediately after milling because the disk and milling tools will be hot.
- Wear protective gloves (cut-resistant gloves) when removing a milling tool from a milling tool holder. Exercise due caution as milling chips may be stuck to the milling tool.

- Carefully confirm the state of the milling tools to be used before starting to mill. Worn milling tools may become unexpectedly hot, leading to burns.
- Carefully confirm whether the appropriate milling conditions (template) are being used before starting to mill. Using inappropriate milling conditions (template) can cause unexpectedly high temperatures, leading to burns.

Inappropriate handling may lead to physical harm.

- Wear protective eyewear and a mask while milling. Milling chips may fly in all directions while milling. Exercise due caution that milling chips do not get in your eyes or mouth.
- Wear protective eyewear and a mask when opening the safety door. Exercise due caution that flying milling chips do not get in your eyes or mouth.
- Exercise due caution when draining fluid from the filter regulator to ensure the fluid doesn't splatter and get in your eyes.

Danger of Damage to the Milling Machine



A Caution

Use the milling machine in a suitable environment.



- Use the milling machine in an environment with an ambient temperature between 0 and 40°C.
- Do not expose the milling machine to direct sunlight.
- Avoid locations where temperatures fluctuate abruptly. Condensation that forms inside the milling machine can lower the quality of milled materials and cause machine malfunctions. Use the milling machine in the following environments.
 - Location: Indoors (free of vibrations)
 - Ambient temperature: 0 to 40°C (accuracy is guaranteed at 23 $\pm 5^{\circ}C$
 - Relative humidity: Lower than 20 to 75 percent (free of condensation)
- Do not place machinery that emits electrical noise (such as a welding machine) near the milling machine. Electrical noise may cause the milling machine to behave incorrectly.

Handle the milling machine and its parts correctly.





Caution Electric shock risk

Caution Rotating equipment



- Press buttons and switches with your fingers and do not apply excessive force. The use of tweezers or other sharp instruments may damage equipment.
- If you discover sparks, smoke, abnormal odors, abnormal sounds, or other abnormalities while the milling machine is in operation, immediately stop all operations. Operating the machine in an abnormal condition may damage equipment.
- Always turn off the power switch and the circuit breaker before unplugging or plugging in the power plug.
- Do not place objects on the machine, as it may affect performance of equipment.
- Do not disassemble or modify the milling machine, as it may lead to electric shock or damage equipment.
- Do not supply air at a pressure over 0.7 MPa (over 0.4 MPa when using the optional pressure booster unit) to the milling machine. Supplying high-pressure air may damage the filter regulator or rupture an air hose.
- Carefully confirm the state of the milling tools to be used before starting to mill. For example, using a milling tool longer than specified may damage equipment.
- Do not move the milling machine. Its accuracy may be lowered depending on how it is carried. Contact our Customer Support & Service Center (\rightarrow P.113) if you wish to move the milling machine.
- Be sure to contact your dealer or our service center when changing the host computer running the app that controls the milling machine.

Important Notice for Cardiac Pacemaker Users



A Warning

For cardiac pacemaker users: If you feel an abnormal change in your physical condition, move away from the milling machine and consult your physician.

The milling machine emits a weak magnetic field that may adversely affect pacemakers.

1. Preparations

1.1 Unpacking

When MD-500 milling machine is delivered, please check the main unit and the accessory boxes. Ask your dealer about how to unpack MD-500 and its accessories.

Accessory Box No. 1

One (1) disk fixing plate type C unit

Accessory Box No. 3

- Ten (10) milling bur holders
- One (1) 0.3N · m torque screwdriver
- One (1) filter regulator
- Small tools box
 - Two (2) wrenches (12 mm and 14 mm)
 - One (1) cap $\phi 4 \phi 6$
 - One (1) 3.0mm bit
 - One (1) ϕ 6 plug
 - Two (2) M4 hexagon-head bolts (20 mm)
 - Two (2) M4 hexagon-head bolts (8 mm)

Accessory Box No. 4

One (1) milling bur replacement jig

Other included accessories

- Dust collection hose connector
- AC power code(3m)
- App and instruction manual (provided as digital files)

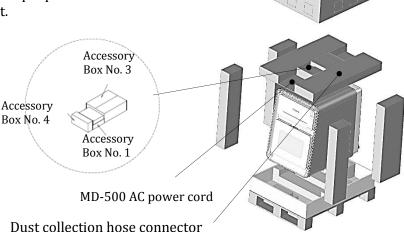
Optional equipment

Pressure booster unit (\rightarrow P.92)



Important

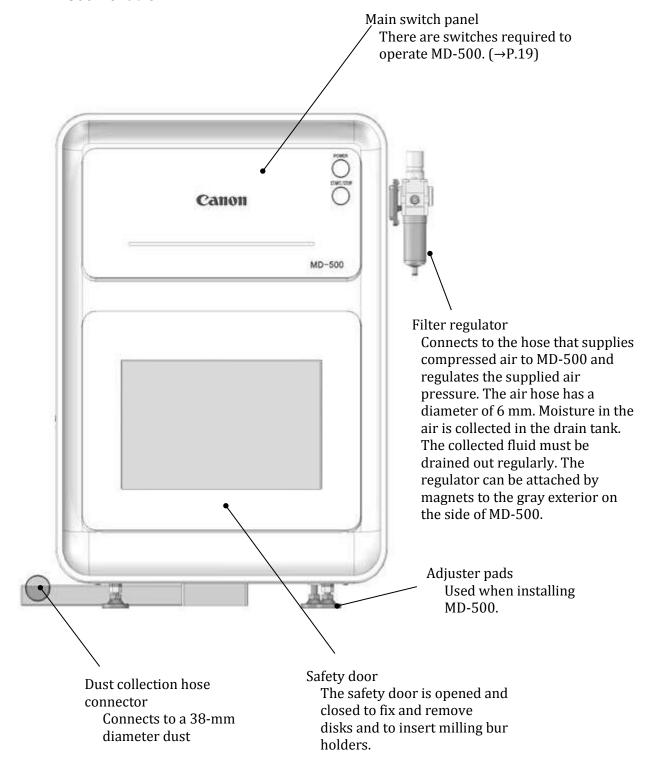
This product weighs approximately 110 kg. Always use four or more people to Transport the product.



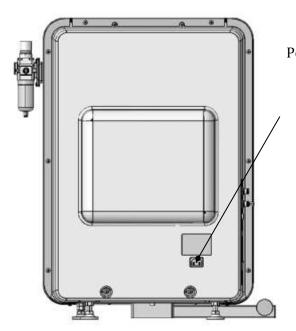
1.2 Names of Parts and Their Functions

This section describes the names and functions of each main part of MD-500.

MD-500 front view



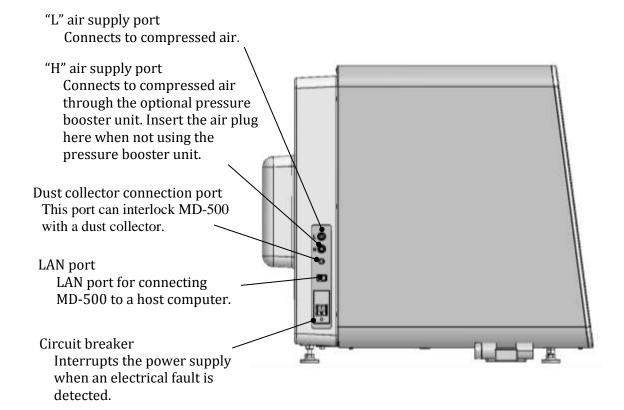
MD-500 rear view



Power connector

Be sure to connect the power connector to a grounded outlet using the supplied power cord.

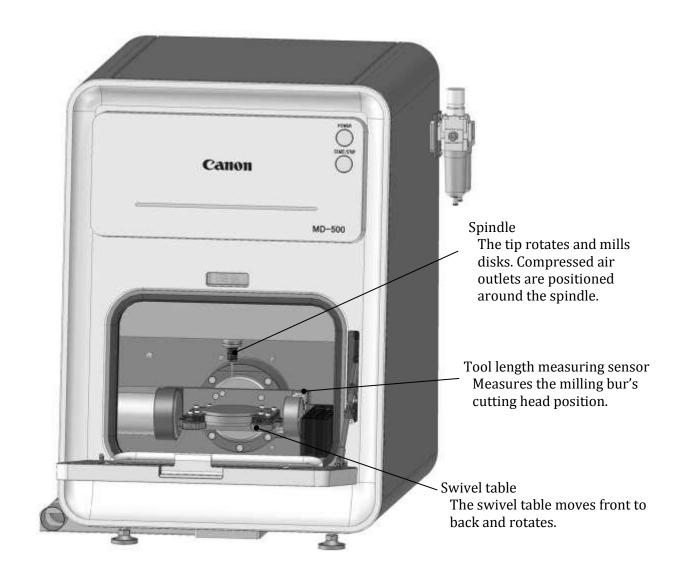
MD-500 left side view



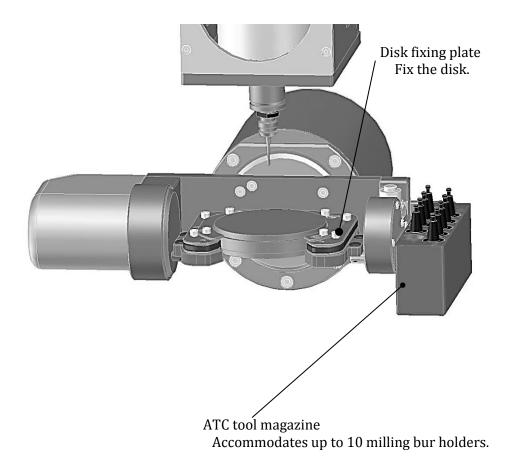
MD-500 viewed with the safety door open



See Section 2.7 Safety Door (→P.28) for safety door



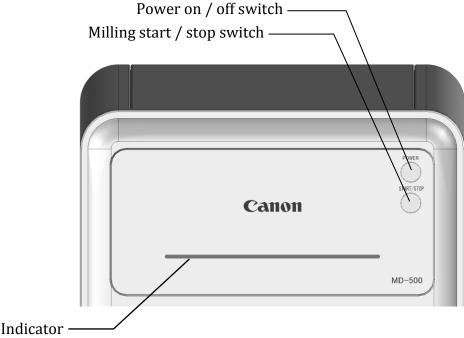
• Swivel table



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Main switch panel

- Power on / off switch
 - Pressing the switch turns the power on and the homing operation begins. A long press turns the power off.
 - Pressing the power switch when the power is on lights the light.
 Press it again to turn it off.
- Milling start / stop switch
 - Pressing the switch during automatic milling pauses the milling. A second press resumes milling. A long press stops the milling operation.
 - Pressing the switch during manual operation does not pause the milling. A long press stops the milling operation.
 - Pressing the switch while MD-500 is ready will move the swivel table to the front or the back.
 - Pressing the switch while the safety door is open, turns the dust collector off or on.



The indicator color and pattern changes according to the current operation.

While homing, manual operation, file sending
Ready
Solid blue
Solid green
Paused
Flashing green
Safety door open, minor fault
Serious fault
Auto power off processing
Flashing green
Flashing green
Flashing preple



- A long press of the power switch will not turn the power off in some cases when MD-500 is preforming an operation.
- When first turned on, MD-500 will automatically return the stage position and milling tool length to their home position. The blue indicator light will flash as they move to the home position and then remain on once the operation finishes.

1.3 Other Required Equipment

Host (control) computer : Windows 10 Pro 64-bit

Windows 11 Pro 64-bit

: Ethernet (LAN) connector port (Network standard: 100BASE-T)

: Minimum specifications

· Windows 10

CPU: Intel® Core™ 2 Duo CPU T8700 @ 2.53 GHz or better

Memory: 2.0 GB or more

Free storage space: 1.5 GB or more Monitor resolution: 1024 x 768 or larger

· Windows 11

CPU: Intel® CoreTM i7-7820HQ CPU @ 2.90 GHz or better

Memory: 32.0 GB or more

Free storage space: 1.5 GB or more Monitor resolution: 1024 x 768 or larger



- If you are using a 32-bit computer, the application may freeze when you send a large file, in that case, recommended to use a 64-bit computer.
- It is recommended to dedicate this Ethernet port for communications with MD-500. See Section 1.4 Network (IP Address) Settings (→P.21) for an example of the network configuration.
- MD-500 does not support wireless LAN connections.
- For computers with multiple Ethernet connector ports, some ports may not connect to MD-500. If the computer will not connect to MD-500, try a different port.

CAM computer : For the minimum specifications of the CAM computer,

please contact the sales manufacturer or the CAM

manufacturer.

Power supply : 100-120 Vac +/-10%,12-10A,50/60 Hz

Compressed air : Pressure between 0.6 and 0.7 MPa, air flow of 60 L/min or

greater (for MD-500 only)

: Connectors accept a 6-mm external diameter air hose



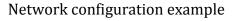
- Be sure to remove dust and moisture from supplied air with filters and air dryers. (see Section 2.2 Adjusting the Air Pressure(→P.25))
- If there is fluid in the drain tank, check the condition of the compressor immediately and remove the fluid. If fluid adheres to the drain tank, it has also entered the inside of the milling machine and may cause a malfunction.
- Set the air pressure to within 0.35MPa to 0.4 MPa when using the pressure booster unit.
- Supply compressed air to MD-500 using a 6-mm-diameter air hose.

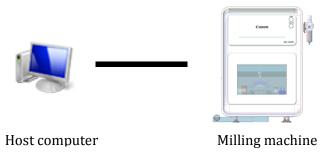
This product does not have both CAD software function and CAM software function capability.

1.4 Network (IP Address) Settings

MD-500 requires a network connection to a host computer to operate the milling machine and check its status.

The following illustration shows an example of a network configuration that works with MD-500.





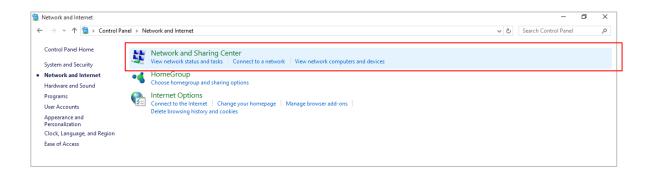
The following instructions explain how to set up the network on the host computer.

Important

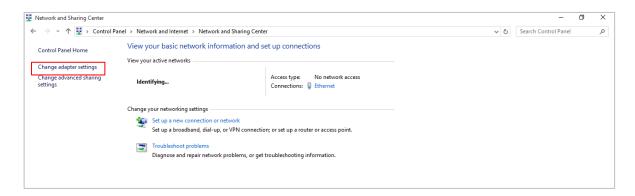
- Do not connect to external networks. To connect, prepare two LAN adapters on your PC before connecting.
- Please confirm with your system administrator before making network settings. We recommend using a fixed IP address for MD-500. Its default IP address is 192.168.100.252.

The network settings given below assume the host computer is running Windows 10.

1. From Control Panel, click Network and Internet to open the Network and Sharing Center window.



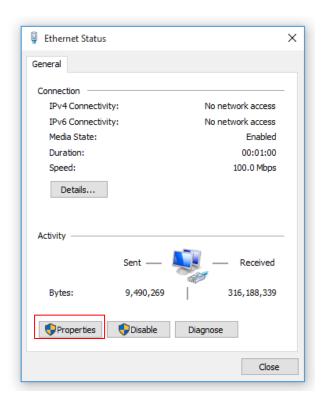
2. Click Change adapter settings on the left side to open the Network Connections window.



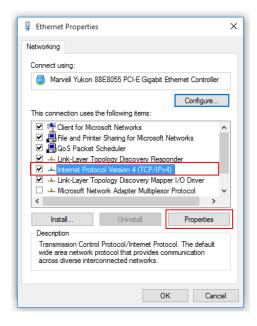
3. Double-click on the adapter that is connected to MD-500 to open the adapter.



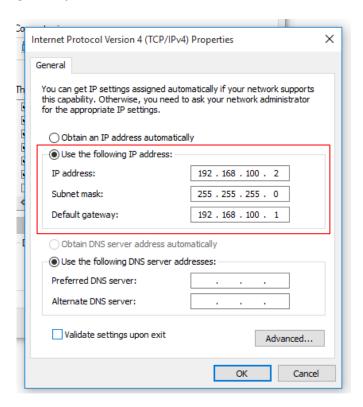
4. Click the Properties button.



5. Select Internet Protocol Version 4 (TCP/IPv4) and click the Properties button.



6. Select Use the following IP address and set the IP address, Subnet mask, and Default gateway.



The following table gives the recommend values for the IP address, Subnet mask and Default gateway settings.

IP address	192.168.100.2
Subnet mask	255.255.255.0
Default gateway	192.168.100.1

2. Basic Operations of MD-500 Dental Milling Machine

2.1 Checks Prior to Operation

The following checks must be performed prior to operating the milling machine.

- 1. Is the milling machine's power plug connected correctly to an appropriate rated electrical outlet (120 VAC)?
- 2. Is the compressed air hose (6-mm diameter) connected to the milling machine's filter regulator coupling?
- 3. Is the compressed air pressure between 0.6 and 0.7 MPa? (Set the air pressure to within 0.35MPa to 0.4 MPa when using the pressure booster unit.)
- 4. Is the milling machine turned on?

2.2 Adjusting the Air Pressure

■ How to set the air pressure

Adjust the pressure adjustment knob on the filter regulator (see the diagram below) until the air pressure gauge reads between 0.6 and 0.7 MPa. Set the air pressure to within 0.35MPa to 0.4 MPa when using the pressure booster unit.

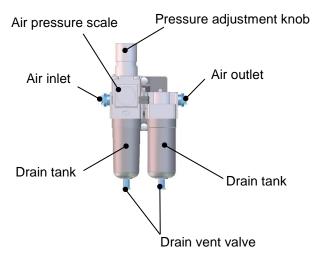


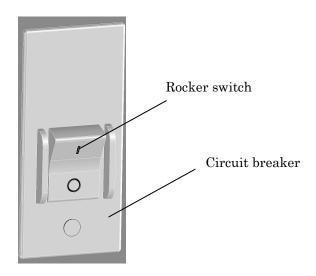


Fig: Filter regulator

The supplied air may contain significant moisture, depending on your compressor setup. Therefore, always check the drain tank before operating the milling machine. If the drain tank contains fluid, turn the drain valve to the left and drain out the fluid. Collect the fluid released from the tip of the drain valve with a tray or other container to avoid fluid getting inside the milling machine. You can also prepare a 4-mm-diameter air hose and connect it to the joint to extend the discharge path. Should fluid get inside the milling machine, promptly wipe up the fluid with a dry towel or cloth. If fluid adheres to the drain tank, it has also entered the inside of the milling machine and may cause a malfunction.

2.3 Operating the Circuit Breaker

■ Turning the circuit breaker on and off
The Circuit Breaker's rocker switch is located on the left side of MD-500. Press the side with the " | " mark to turn the circuit breaker on. Press the side with the "○" mark to turn the circuit breaker off. Leave the circuit breaker on at all times.



2.4 Turning on the Host Computer

■ Launching the host computer

Turn on and launch the host computer following the manual for your computer.

2.5 Turning On MD-500

■ Operating the power switch

MD-500 is turned on and off with the power switch on the main switch panel. Pressing the power switch will turn the milling machine on. Applying a long press to the switch again will turn the milling machine off.





A Warning

When you reboot the milling machine, wait for 3 seconds or more after confirming that the indicator is turned off, and then turn on the power. Turning the power on and off in a short period of time cause machine malfunctions.



When first turn on MD-500 will automatically return the stage position to their Home position and measure the milling tool length. The blue indicator light will flash as they move to the home position and then remain on once the operation finishes. Warm-up is required when starting to use in winter or in low temperature environments. Turn on the power, start the return to home (homing) operation, and press and hold the START / STOP switch to stop the operation. Leave the safety door closed for at least 15 minutes to warm it up.

2.6 Launching MD-500 Dental Milling Machine App

■ Launching the dental milling machine app Double-click the "md-gear" (app) icon on the desktop to launch the app





Firewall settings are required the first time the app is launched Refer to Section 3.4 Firewall Settings (\rightarrow P.47) to make the firewall settings.

2.7 Safety Door

- Opening the safety door
 - Open the safety door to perform such operations as fixing or removing disks or inserting or removing milling tools. Note that if the milling machine is in operation (stage transport or spindle rotation), opening the safety door will stop the operations.
- Closing the safety door

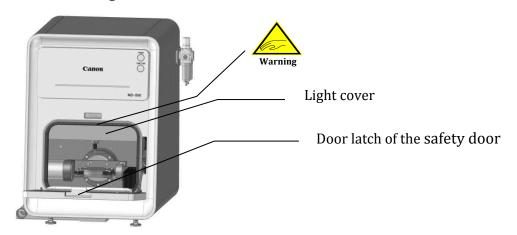
 Be sure to close the safety door after completing the operation, such as fixing or removing a disk from the fixing plate or inserting or removing a milling tool.

A Warning

- Since the spindle cannot stop suddenly, it may rotate for a while even if the power is turned off due to inertial force.
- Never put your hands or objects in the spindle as it may cause injury or serious accident while rotating.

Important

- Grasp the door latch of the safety door with your fingers when opening and closing the safety door.
- Do not lean or place materials on the surface of the open safety door.
- Use a dry cloth to clean the safety door and the safety door window.
 Vacuum-cleaner nozzles or other hard objects will scratch the safety door surfaces.
- If the safety door is opened while the spindle is rotating, the milling machine will stop the current operation, but the spindle will take time to come to a stop. Ensure that the spindle has come to a complete stop before attempting to work with your fingers or other body part near the spindle.
- Do not hold the light cover.

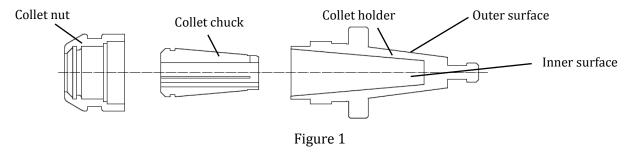


2.8 Fixing and Removing Milling Burs

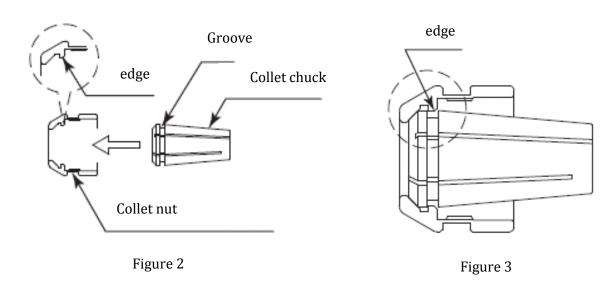
■ Method 1 for fixing and removing milling burs (i.e., without using the milling bur replacement jig)

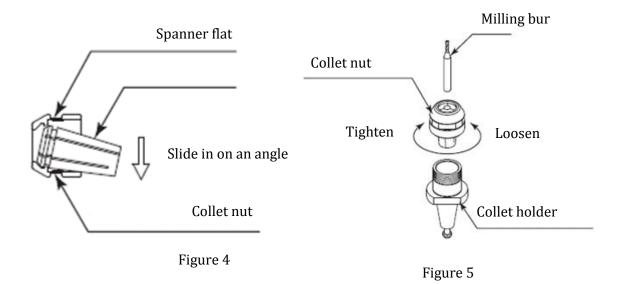
Use the included spanner and follow the instructions below to replace milling burs.

1. Before fixing the milling bur, wipe the inner and outer surfaces of the collet nut, the collet chuck, and the collet holder with a dry cloth to remove any milling chips.



2. Fix the collet chuck in the collet nut. Set the collet chuck so that edge of the collet nut fits tightly into the groove of the collet chuck (see Figure 2 and Figure 3). Sliding the collet chuck in on an angle to the collet nut makes it easier to fix (see Figure 4).



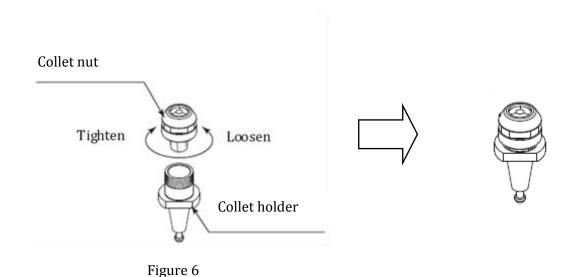


Collet chuck

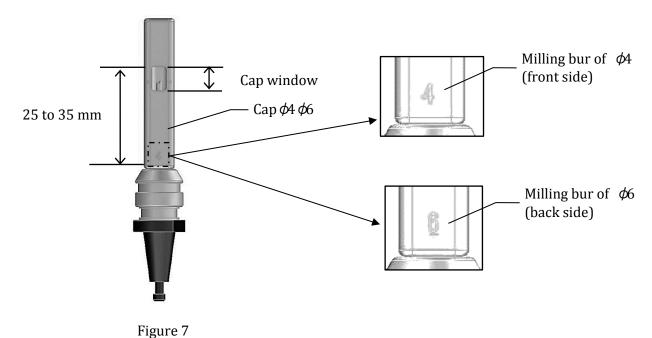


- Make sure not to tighten the collet nut when no milling bur is in the collet chuck.
 Overtightening the collet chuck may cause the collet nut's edge to slip out of the
 collet chuck's inner groove. If the edge slips out of the groove, the collet chuck may
 stay stuck in the collet holder even when the collet nut is loosened, making it
 impossible to remove the collet chuck.
- When fixing the collet chuck in the collet nut, check that the collet nut's edge is firmly mated with the groove of the collet chuck. When the edge is firmly mated with the collet chuck's groove, the collet chuck will not come out even when pulled in its axial direction. If the collet nut is tightened when the edge is not firmly in the groove, the collet chuck may stay stuck in the collet holder, making it impossible to remove the collet chuck.
- Clean the collet holder and collet nut and collet chuck before inserting a milling bur. Fixing a milling bur while chips are present on the collet holder and collet nut and collet chuck may cause bur runout and affect milling accuracy.

3. Gently screw the collet chuck and collet nut into the collet holder with your fingers. Note: Do not screw the collet chuck and collet nut all the way in (see Figure 6).



4. Insert the milling bur in the milling bur holder, letting it protrude by between 25 and 35 millimeters, measured from the tool tip to the collet nut's face. Sliding the cap down to make contact with the collet nut's face and to adjust the bur so that its tip can be seen in the cap window will ensure the bur protrudes by between 25 and 35 millimeters (see Figure 7).



Finish tightening the collet chuck and collet nut in the collet holder using the two included spanners. The recommended tightening torque is 7 N · m. Use the 14-mm spanner on the collet nut and the 12-mm wrench on the collet holder. Turn in a clockwise direction to fasten the milling bur (see Figure 8).

A Caution

- If the tightening torque is too loose, it may cause milling defects or broken milling burs.
- If the milling bur protrudes by less than 25 millimeters, the spindle may contact the swivel table and cause damage to the milling machine.
- If the milling bur protrudes by more than 35 millimeters, it will lead to milling defects or a broken milling bur.

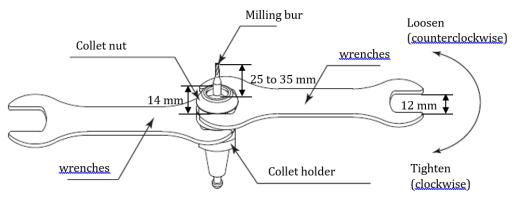
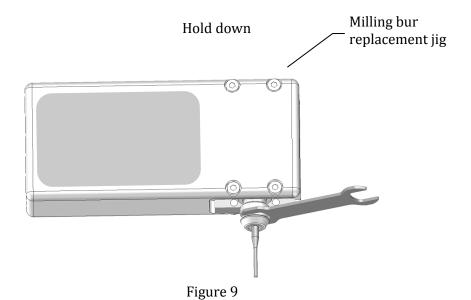


Figure 8

- 6. To remove the milling bur, position the wrench on the collet nut and turn in a counterclockwise direction. This will loosen the collet chuck so you can remove the milling bur. During much of the first rotation of the collet nut, the collet nut and collet chuck will tighten for a moment, but continuing to turn the collet nut will open the collet chuck.
- 7. To remove the collet chuck, grip the collet nut in your hand, angle the collet chuck down in the direction of the wrench flat, and slide the collet chuck out. If the collet chuck does not come out, angle it again toward the wrench flat on the collet nut (see Figure 4).

- Method 2 for fixing and removing milling burs (i.e., using the milling bur replacement jig)
 - Follow Steps 1 through 4 given in Method 1.
- 5. Place the milling bur replacement jig on a table and insert the milling bur holder. Firmly hold the milling bur replacement jig down with your hand on the section shown in gray in the diagram below while turning the wrench down toward the table (in the direction indicated by the arrow) and finish tightening the milling bur. The recommended tightening torque is 7 N · m (see Figure 9).



6. To remove the milling bur, insert the milling bur holder in the opposite side of the replacement jig. Place the milling bur replacement jig on a table and firmly hold the milling bur replacement jig down with your hand on the section shown in gray. Turn the spanner down toward the table (in the direction indicated by the arrow) and remove the milling bur. During much of the first rotation of the collet nut, the collet nut and collet chuck will tighten for a moment, but continuing to turn the collet nut will open the collet chuck (see Figure 10).

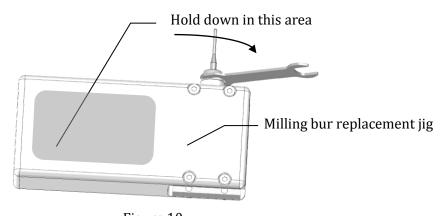


Figure 10

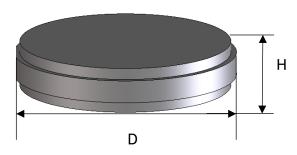
2.9 Compatible Workpieces

Compatible workpieces and their dimensions.

Materials: Zirconia, Wax, PMMA, PEEK, Hybrid Resin

Туре	Size
Disks	Diameter (D): 98.5 mm Height (H): 10 to 35 mm

Disk workpiece dimensions



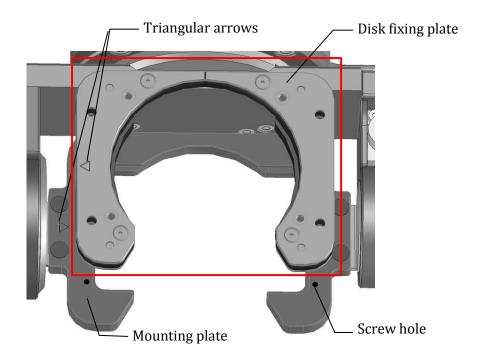
Important

Ensure that you use disks designed for dental milling.

2.10 Attaching and Removing the Disk Fixing Plate

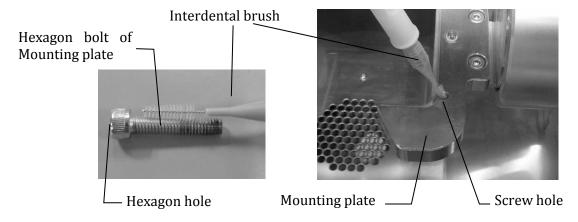
The disk fixing plate is used while attached to the swivel table. Disks can be fixed and removed when the disk fixing plate is removed from the swivel table. Therefore, if you have two or more disk fixing plates (extra fixing plates are available as an option), it is possible to fix or remove disks on other disk fixing plates while milling another disk.

1. Clean the disk fixing plate and Mounting plate, indicated by the rectangle in the diagram below with dry cloth.

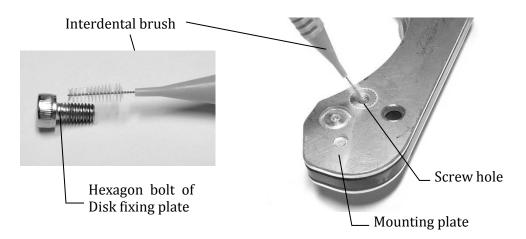


Be sure to clean the screw surface and hexagon hole, and inside of the screw holes of Mounting plate.

Remove milling chips and powder with an interdental brush to prevent chips and powder from sticking.



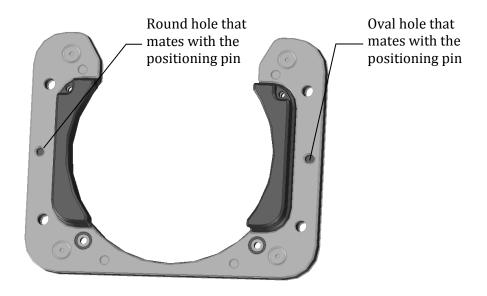
Be sure to clean the surface of screw and hexagon hole, and inside of the screw holes of Disk fixing plate.



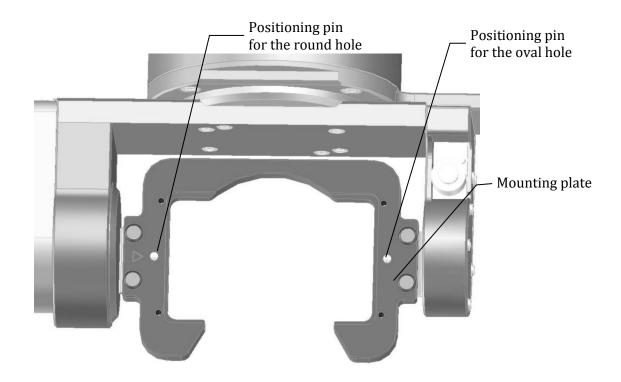
Caution

If milling chips remain in the screw holes, the screws may not provide the proper clamping force. In particular, the screw holes in the disk fixing plate may be damaged if they are not cleaned properly.

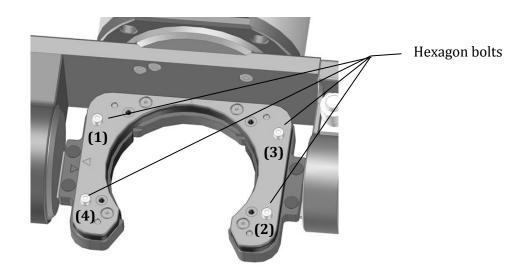
2. Place the disk fixing plate on the swivel table's mounting plate. Fit the location holes on the back of the disk fixing plate with the positioning pins on the mounting plate. The back of the disk fixing plate has one round location hole and one oval location hole. Following the diagram below, the round location hole is underneath the arrow on the left side. (Match the triangular arrows on the mounting plate and the disk fixing plate when placing the plate on the mounting plate.)



Reverse side of the disk fixing plate



3. After fitting the disk fixing plate to the mounting plate, fasten the plate down with four hexagon bolts. Use the included torque screwdriver (0.3 N·m) and bit (3 mm width) to tighten the bolts. Tighten bolts in opposite corners first, like the order (1) through (4) shown in the diagram below. You may tighten the bolts in any order, as long as bolts in opposite corners are tightened first.



Important

- Attach the disk fixing plate so the round location hole is on the left side.
- Do not remove anything from the milling machine other than the disk fixing plate. Loosening or removing the mounting plate or other screws may interfere with proper milling operations.

- Take care not to knock the disk fixing plate while attaching it to the swivel table, as it may affect the finish of the workpiece.
- When attaching a disc on the disc fixing plate, Use the included torque screwdriver (0.3 N•m) and bit (3 mm width) to fix (retighten) the hexagon bolts from (1) to (4). Otherwise it will result defective processing because of the move of the disc fixing plate by the loosen hexagon bolts.

A Caution

- Clean the screw holes in the mounting plate after use. If milling chips become
 lodged in screw holes, it may not be possible to tighten the screws the next time
 the plate is used.
- When using the Hexagon bolt, insert the bit straight into the hexagon bolt. If you use it at an angle, the hexagon bolt may wear.

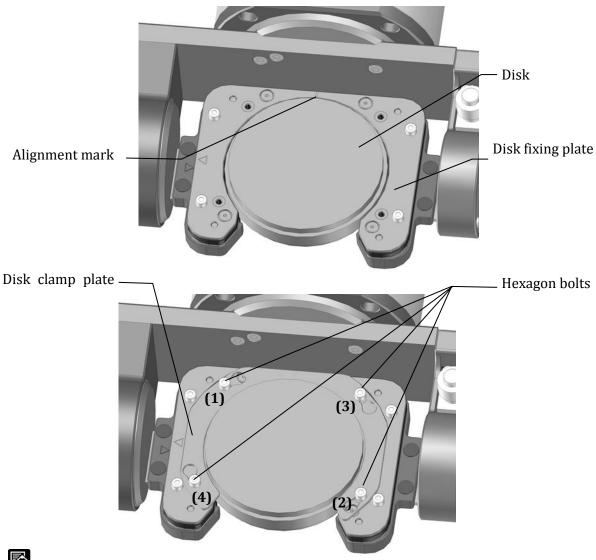


Note

To remove the disk fixing plate, position the bit of the included torque screwdriver (0.3 N·m) in the head of the hexagon bolt and turn the torque screwdriver in a counterclockwise direction. In this way, remove all four bolts.

2.11 Fixing Disk

Place a disk on the disk fixing plate and then place the disk clamp plate over the disk. Use the included torque screwdriver (0.3 N·m) and bit (3 mm width) to fasten down the disk clamp plate with four hexagon bolts. Tighten bolts in opposite corners first, like the order (1) through (4) shown in the diagram below. You may tighten the bolts in any order, as long as bolts in opposite corners are tightened first.



Note

Both the disk fixing plate and the disk clamp plate have an alignment mark. The marks help align the disk when taken out and then remounted.

Important

When attaching a disk on the disk fixing plate, also fix (retighten) the four hexagon bolts that secure the disk fixing plate to the mounting plate of swivel table.

(See "**Important**" in the Section 2.10 Attaching and Removing the Disk Fixing Plate $(\rightarrow P.35)$)

3. MD-500 Dental Milling Machine Application

This chapter describes "**md-gear**", the dental milling machine software application (app) for MD-500.

3.1 Installing the App

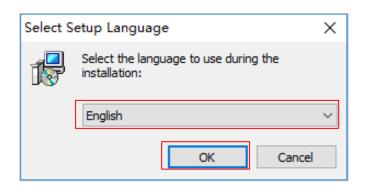
An installer installs the app. The installation steps are described below.

1. Double-click on md-gear_X.X.XXX.X_installer.exe. Note that X.X.XXX.X is the app's version number.

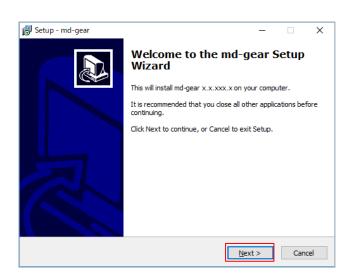
The screen is from md-gear_0.1.50.0_installer.exe.



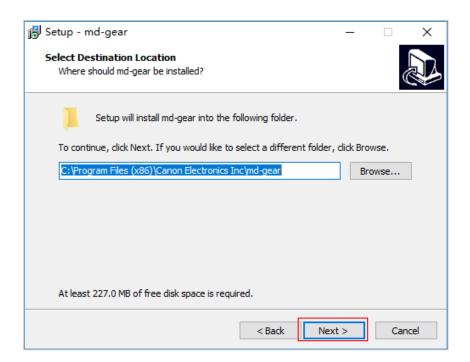
2. Select English for the language and click the OK button.



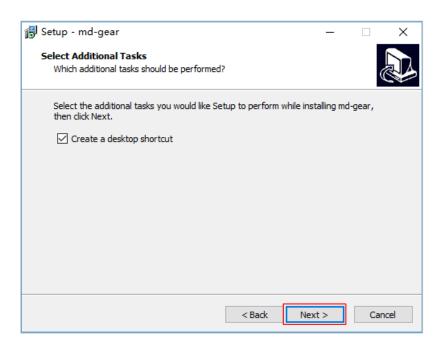
3. Click Next.



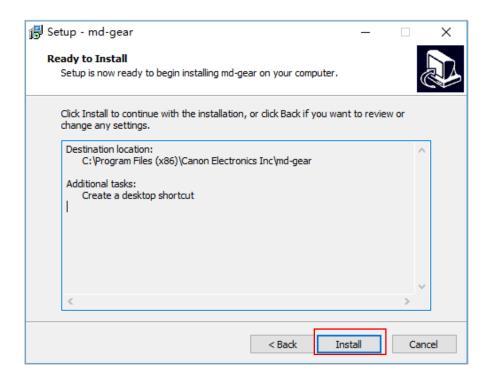
4. Click Next.



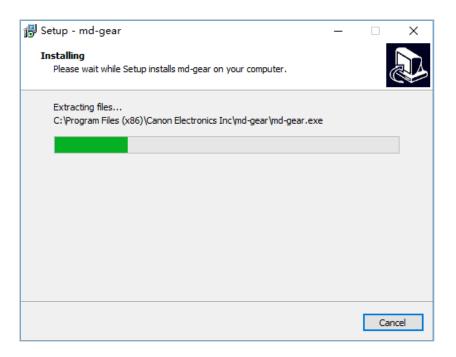
5. Check create a desktop shortcut and click Next.



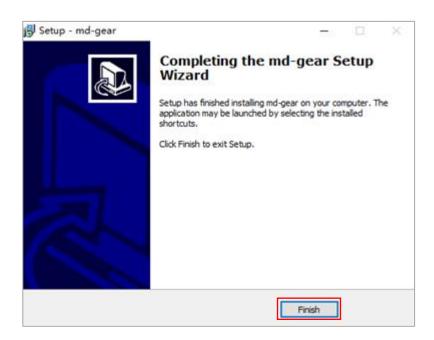
6. Click Install.



7. Wait for the installation to complete.



8. Click Finish.

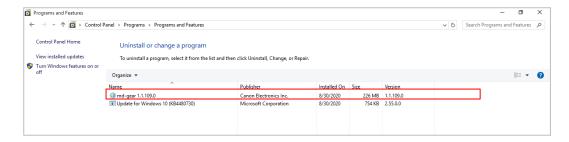


Note

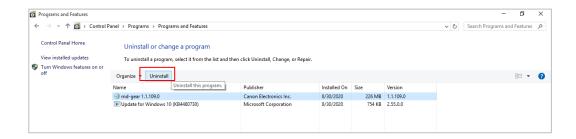
The description above uses screenshots from Windows 10. The screens will look somewhat different in other Windows versions.

3.2 Uninstalling the App

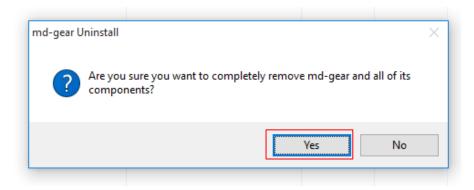
1. Open Programs and Features from Control Panel and select md-gear.



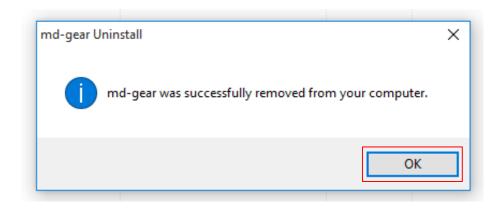
2. Click Uninstall.



3. Click Yes.



4. Click OK.



Note

The description above uses screenshots from Windows 10. The screens will look somewhat different in other Windows versions.

3.3 Launching the App

Double-click on the desktop icon to launch the app





The first time the app is launched after installation, a firewall settings window will open, described in Section 3.4 Firewall Settings(\rightarrow P.47) Make the firewall settings as instructed in Section 3.4 After initializing the app will look for MD-500 milling machine on the network.

Important

- If the app fails to connect to MD-500 after about one minute, try the following operations.
 - 1. Check that the network cable is connected properly.
 - →Try unplugging and plugging in the connector
 - →Replace the LAN cable (it may be defective)
 - 2. The host computer and MD-500 may be set to different networks.
 - →Check the host computer's network settings (IP address) on Control Panel
 - →Ask for help your network administration department or our Customer Support & Service Center (\rightarrow P.113) if you still have troubles
 - 3. Restart MD-500.
 - →The MD-500 may be refusing communications. In this case, either restart MD-500 or wait until it is able to connect. See Section 2.5 Turning On MD-500(\rightarrow P. 27) if you do not know how to restart MD-500.
- Communications between MD-500 and the app will be interrupted if the host computer goes into sleep mode. For this reason, the app blocks the host computer from going to sleep while the app is open. This block function prevents the computer from going to sleep after a preset time while the app is running. However, if the computer is forced into sleep mode (such as closing a laptop computer), MD-500 and the app will be disconnected.
- Do not disconnect and connect the LAN cable while the app is connected to MD-500. A communications error may occur.

Note

- The app will not connect to other network devices. The app can only discover MD-500 on the network. It cannot search for other company's milling machines or other network devices.
- The app screenshots are simulated images. They are subject to change without notice.

3.4 Firewall Settings

Windows operating systems require changes to the Windows firewall settings to permit communications between the app and MD-500.

The settings are described below.

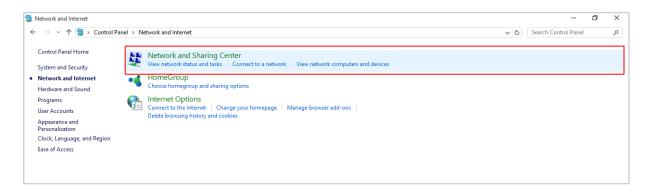
First, launch the app (see Section 3.3 Launching the App(\rightarrow P.46) for instructions on how to launch the app). The following window will appear the first time you launch the app. How to make firewall settings may vary slightly depending on your operating system version.



Check the type of network MD-500 is connected to (either private or public) and click the Allow access button. Check public networks if the host computer and MD-500 are connected on a one-to-one basis and click the Allow access button. If there are no overriding circumstances, checking both types of networks is recommended.

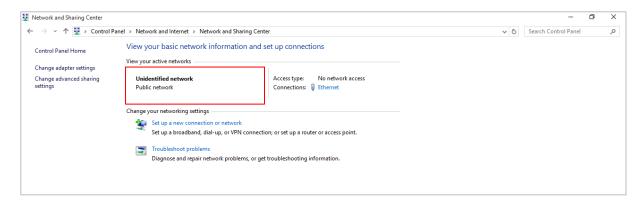
Follow the steps below to verify the network type.

1. Open Control Panel and click Network and Sharing Center.

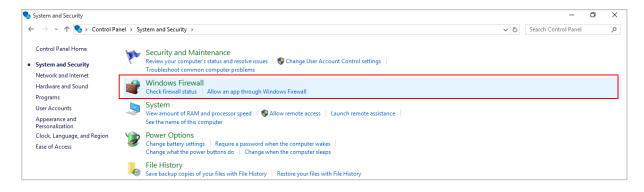


2. The network type will be shown in the View your active networks field.

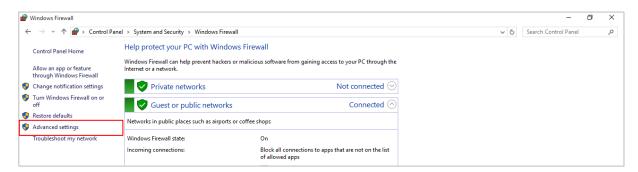
The host computer is connected to Public network in the sample screenshot below.



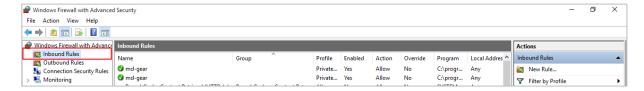
3. Check whether the firewall settings have been updated. Open Control Panel.



4. Click Advanced settings.



5. Click Inbound Rules.

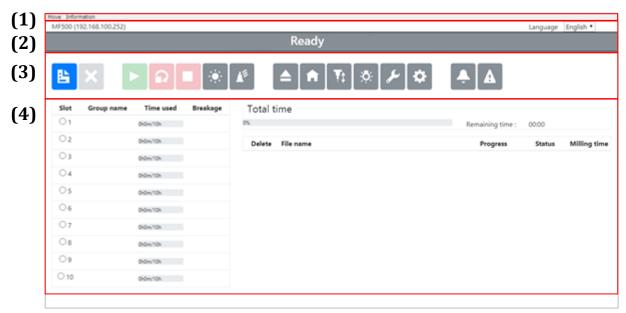


6. Check that rules for md-gear have been created. In the sample screenshot below, md-gear has been allowed to access private networks and public networks.



3.5 Operations Window

The app consists of a menu bar, a tool bar, and various other windows. See the subsequent pages for details.



- (1) Menu bar Allows you to quit the app or display the app version.
- (2) Status bar Indicates MD-500 status.
- (3) Tool bar Provides details about MD-500 status, and allows you to control its operations.
- (4) Main window
 Lists milling bur information and the status of milling reservations, and allows
 you to reorder milling reservation data items (jobs).



- It is recommended to operate the app while it is connected to MD-500. Operating the app when not connected may cause either MD-500 or the app to behave incorrectly.
- If MD-500 is turned off while executing continuous milling work, be sure to relaunch the app.

3.6 Menu Bar

Move Information

Move

Under this menu option, you can select Load Milling Data, Network Settings, and Quit.

Information

Under this menu option, you can display the Version and the License.



Shortcut keys are shown in the table below.

Operation	Shortcut	Details
Load milling data	Ctrl + R	See Section 4.2 Select Milling Data (→P.85)
Network settings	Ctrl + N	See Section 3.19 Network Settings(→P.81)
Quit	Ctrl + Q	Quits the app

3.7 Status Bar

MD-500 (192.168.100.252)		
	Ready	

MD-500 status

The status bar indicates the status of MD-500. The displayed status states and MD-500 states are as follows.

Initializing

Initializing after power has been turned on.

Milling

Performing milling operations.

Homing

Returning to the home position.

Ready

Has stopped operations successfully.

Stopped on fault

Has stopped operations due to an error.

Moving

Performing an operation.

• Paused

Operations are paused.

Canceling milling

Canceling milling operations.

• Resuming milling

Resuming milling operations.

3.8 Tool Bur



Load milling data

Use this button to load milling data. Clicking the button will open the Select file dialog. Select a milling data file to load data. Multiple files can be selected.



Delete from data list

Use this button to delete checked data items from the data list. Use the button to remove reservations or delete completed data items (jobs). Milling data items (jobs) in progress cannot be deleted.



Start milling

Use this button to start milling. Clicking the button will start milling using the first milling data item (job) in the data list. Clicking the button after milling has been paused will resume milling.



Stop continuous milling

Use this button to cancel continuous milling. Clicking the button will cancel continuous milling. When continuous milling is canceled, MD-500 will ready after completing the current milling job even if there are other jobs waiting on the data list.



Stop operations

Use this button to stop milling, other operations, or homing. Clicking the button will immediately stop all operations. After stopping, MD-500 will return a minor fault status.



Auto power off

Use this button to enable or disable the auto power down function. The auto power down states are given in Section 3.16 Auto Power Off Settings $(\rightarrow P.79)$.



Milling bur holder cleaning

Use this button to enable or disable Milling bur holder cleaning. The Milling bur holder cleaning states are given in Section 3.18 Milling Bur Holder Cleaning (\rightarrow P.80).



Move to front

Use this button to move the swivel table to the front position in order to fix or remove workpieces. Clicking the button will move the swivel table to the front position.



Return to home

Use this button to return moving parts to their home positions. Clicking the button will start the return to home (homing) operation. Normally, you do not need to use this function.



Tool length measurement

Use this button to measure the tool length. Clicking this button will measure the length of the milling bur.



Light

Use this button to turn the interior light on or off.



Maintenance

Use this button for maintenance. Clicking the button opens the Maintenance window. See Section 3.12 Maintenance Window (\rightarrow P.57) for details about the Maintenance window.



Advanced settings

Use this button to configure MD-500. Clicking the button opens the Advanced Settings window. See Section 3.13 Advanced Settings Window (\rightarrow P. 64) for details about the Advanced Settings window.



Alarm

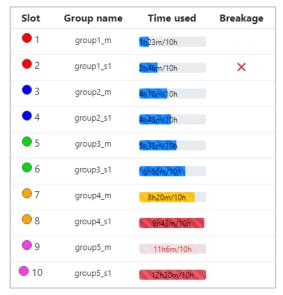
Use this button to display information about alarms. The button will flash red when an alarm has occurred. Clicking the button opens the Alarm Details window. See Section 3.14 Alarm Details Window (\rightarrow P. 74) for details about the Alarm Details window.



Error

Use this button to display information about errors. The button will flash red when an error has occurred. Clicking the button opens the Error Details window. See Section 3.15 Error Details Window (\rightarrow P. 77) for details about the Error Details window.

3.9 Milling Bur Information



Slot

Indicates the ATC tool magazine position of each milling bur.

Group name

Indicates the group names set with the Smart ATC function.

• Time used

Indicates the time each milling bur has been used. The upper limits on milling bur usage times can be set (see Section 3.13 Advanced Settings Window $(\rightarrow P. 64)$)

Breakage

Indicates breakage information about each milling bur. If the milling bur breaks, a "x" will be displayed.

3.10 Progress Bar



Total time

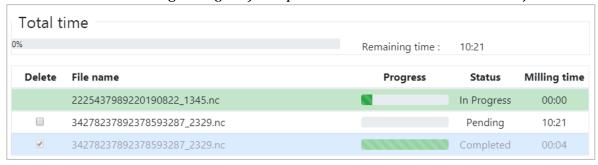
Indicates with a progress bar the milling progress of all reserved milling jobs (data files).

Remaining time

Indicates the estimated remaining time to complete all reserved milling jobs. The estimated time may differ from the actual time needed to complete all milling jobs.

3.11 Data List

This list indicates milling data (jobs) and provides various controls for each job.



Delete

Clicking the Delete from Data List button while a delete check box is checked will delete the corresponding milling data from the data list.

• File name

Indicates the corresponding file name for each data (job).

Progress

Indicates with a progress bar the milling progress of the corresponding data (job).

Status

Indicates the status of the corresponding milling data (job). The status changes according to the conditions given in the table below.

Pending	Shown when the corresponding milling data (job) is reserved and waiting to begin.
In Progress	Shown when the corresponding milling data (job) is in progress.
Completed	Shown when the corresponding milling data (job) has been completed.
Error	Shown when an error occurred while the corresponding milling data (job)
	was in progress or when the job stopped while in progress.
Disconnected	Shown when communications have been disconnected while the milling data
	(job) is in progress.



Clicking on the status when showing either Completed, Error, or Disconnected will display the milling result, the start time, the end time, and the file name.

Milling time

Indicates the time relating to the corresponding milling data (job). The milling time indicates the following times accord to the job's status.

Pending	The estimated time to perform the milling data (job).	
In Progress	The remaining time to complete the milling data (job).	
Completed	The actual milling time from start to finish.	
Error	The actual milling time from start to when the error occurred.	
Disconnected	The actual milling time from start to when the disconnection	
	occurred.	

Note

 Right-clicking on a pending milling data (job) opens the following contextual menu.



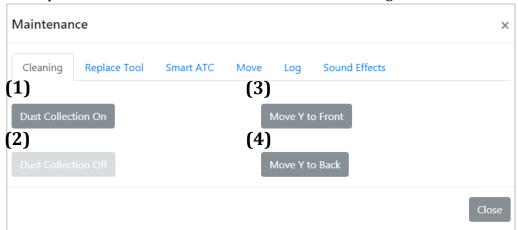
Sort by ... Sorts pending milling jobs. Pending milling jobs can be sorted by name, date or milling time.

3.12 Maintenance Window

This window is used to perform maintenance operations. Clicking the Maintenance button opens this window. The following operations are available from this window.

Cleaning tab

This option moves the table and swivel table for cleaning.



1. Dust Collection On

Turns the dust collector on.

2. Dust Collection Off

Turns the dust collector off.

3. Move Y to Front

Moves the swivel table to the front of Y-axis position.

4. Move Y to Back

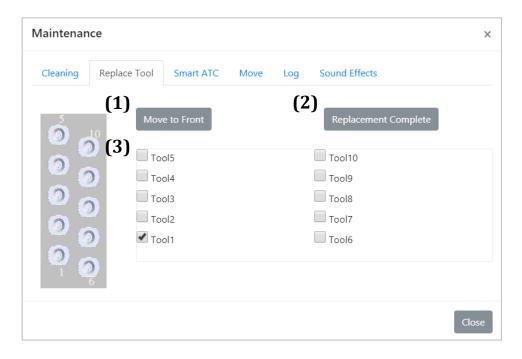
Moves the swivel table to the back of Y-axis position.



1 and 2 can be used only when interlocking.

Replace Tool tab

This tab is used to measure and set the milling burs length after replacing the milling bur.



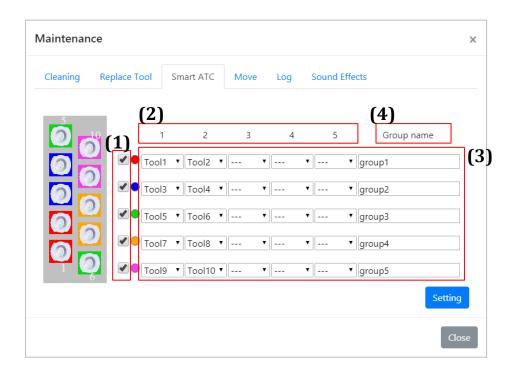
- 1. Move to Front
 - Moves the swivel table to the front position.
- 2. Replacement Complete
 - Click this button when the tool replacement is complete. When this button is clicked, the app resets the usage time for the selected milling bur(s) and commands MD-500 to measure the milling bur length(s).
- Milling bur selection check boxes
 The check boxes are used to select the replaced milling bur(s).

Note

- See Section 4.4 Replacing Milling Burs (→P. 87) for instructions on replacing milling burs.
- Be sure to always measure the tool length from this window after replacing a milling bur. Failure to measure the tool length will result in milling defects or tool breakage due to tool-mounting deviations.

Smart ATC tab

Smart ATC changes to the next preset milling bur automatically when a milling bur breaks or has another fault during milling or when the tool reaches the end of its service life. Smart ATC in this way can extend milling for long periods while maintaining milling quality. This tab is used to create groups of milling burs for automatic changes. Up to five tools can be assigned to one group.



1. Enable or disable a tool group

Toggles between enabling and disabling a saved tool group.

2. Order of tools in the tool group

Tools are used in order starting from the left side of the tab.

3. Group settings

Up to five tool groups can be defined.

Ensure all milling burs assigned to a group are the same tool type.

4. Group name

You can set a name for each group.

Group names appear on the Main window.

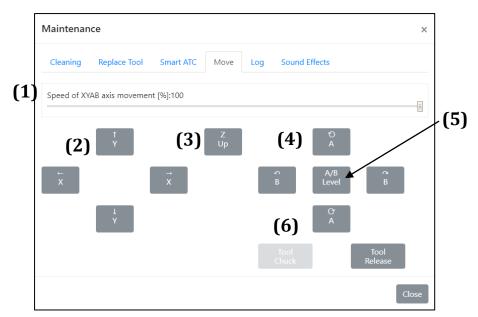
Note: Names can be up to 20 single-byte characters long or 10 double-byte characters long.

Note

- Smart ATC settings can be confirmed from the window described in Section 3.9
 Milling Bur Information (→P. 54).
- If a milling bur not assigned to any group breaks or has another fault, milling operations will continue without changing milling burs. Milling operations will stop when a bur breaks or other fault occurs. Therefore, it is recommended that all burs used for milling operations be assigned to a group to ensure milling quality over long time periods.

Move tab

This tab can be used to move swivel table and spindle along each axis. This function is available only when the safety door closed.



1. Speed of XYAB axis movement [%]

This control lets you set the movement speed in the XYAB directions.

2. XY direction controls

These controls move the spindle and swivel table in the direction of the arrows. These movements are only possible when the spindle has been retracted in the Z axis.

3. Z up control

This controls raise the spindle.

4. AB direction controls

These controls move the swivel table in the directions indicated by the arrows. These movements are only possible when the spindle has been retracted in the Z axis.

5. A / B Level

This control levels the A axis and B axis horizontally.

6. Tool Chuck / Release

Milling bur attachment / detachment operation.

Click the Tool Chuck button closes the chuck section of spindle.

Click the Tool Release button opens the chuck section of the spindle.

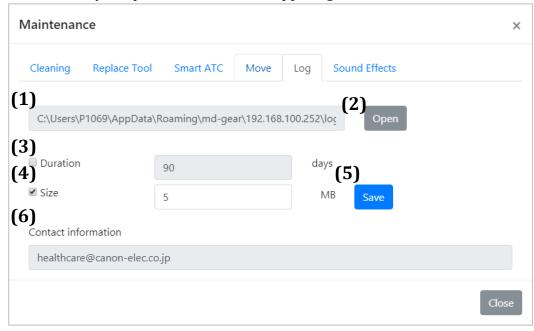


Tool chuck / release button is for checking the operation of the chuck section of the spindle. Do not operate it with the tool attached to the spindle.

If the tool release button is clicked while it is still attached to the spindle, it may drop and damage its milling bur or workpiece.

Log tab

This tab lets you open and confirm the app's log folder.



1. Location

Indicates the path to the log folder.

2. Open folder button

This button opens the log folder.

3. Duration

This control is used to specify the duration, in days, of the log to be saved when the Save button (5) is used. When checked, log entries in the log folder starting from the specified number of days prior to the current time up to the current time will be saved. When not checked, log entries will be saved for a specified size.

4. Size

This control is used to specify the size of the log to be saves when the Save button (5) is used. When checked, the log from the present until the total size of the file reaches the specified size in the log folder will be saved. When not checked, log entries will be saved for a specified the duration.

Note

Only one of 3.duration and 4.size can be selected.

5. Save button

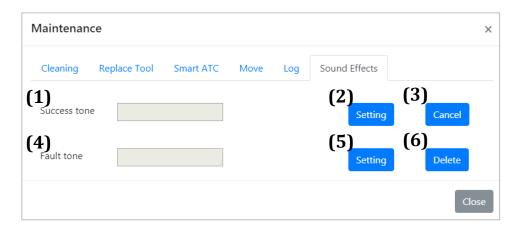
Clicking this button opens the Save file dialog. You can save the log entries to any folder. Logs are compressed and saved as a zip file.

6. Contact information

Display the contact information.

Sound Effects tab

This tab lets you set sound effects from the host computer when milling completes successfully (success tone) or when milling stops prematurely due to a fault (fault tone).



1. File name of the success tone

Indicates the file name for the tone that sounds when milling completes successfully.

2. Set success tone

This control sets the sound effect file that sounds when milling completes successfully. Clicking the button opens the File dialog where you can select and set the file for the success tone. Only sound effect files in wav format can be set.

3. Delete success tone

This control deletes the sound effect that sounds when milling completes successfully. Deleting the sound effect means no tone will sound when milling completes successfully. Set a sound effect again if you wish to restore the success tone.

4. File name of the fault tone

Indicates the file name for the tone that sounds when milling fails.

5. Set fault tone

This control sets the sound effect file that sounds when milling fails. Clicking the button opens the File dialog where you can select and set the file for the fault tone. Only sound effect files in wav format can be set.

6. Delete fault tone

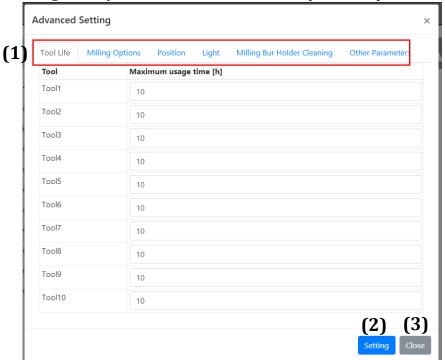
This control deletes the sound effect that sounds when milling fails. Deleting the sound effect means no tone will sound when milling fails. Set a sound effect again if you wish to restore the fault tone.

3.13 Advanced Settings Window

This window is used to set various MD-500 parameters. Clicking the Advanced Settings button opens this window. Details of each parameter setting are given below.

Common controls

The Advanced Settings window's controls consist of parameter tabs, a Set button, and a Close button. Settings are grouped under each parameter tab. After changing settings on any tab, click the Set button to update the parameters on MD-500.



1. Parameter tabs

Settings are changed under the parameter tabs. Changes do not take effect until the Set button is clicked. Changes that have not taken effect are indicated by a yellow background in the entry field.

2. Setting button

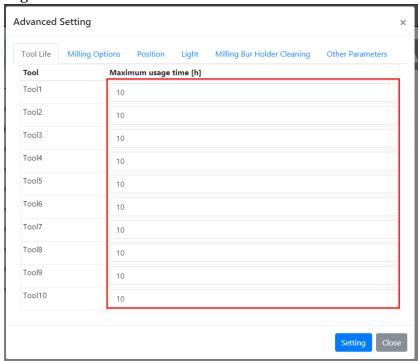
The Set button writes the values in edited settings (entry fields and check boxes with yellow backgrounds) to MD-500. When the values have been written successfully to MD-500, the backgrounds of edited entry fields and check boxes will turn white.

3. Close button

The Close button discards all edited settings (entry fields and check boxes with yellow backgrounds) and closes the window.

• Tool Life tab

This tab lets you set the service life of each milling bur stored in the ATC tool magazine.



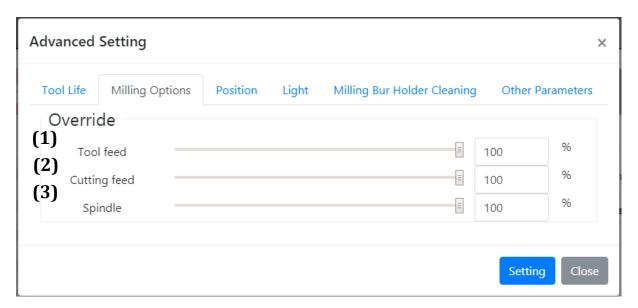
Maximum usage time

These parameters set the maximum usage time for each milling bur stored in the ATC tool magazine.

Default value: 10 [h]Minimum value: 1 [h]

• Maximum value: 1000 [h]

Milling Options tab



• Override

1. Tool feed

This parameter adjusts the tool feed speed (tool feeding other than cutting).

Default value: 100 [%]Minimum value: 1 [%]Maximum value: 100 [%]

2. Cutting feed

This parameter adjusts the cutting feed speed.

Default value: 100 [%]Minimum value: 0 [%]Maximum value: 100 [%]

3. Spindle

This parameter adjusts the spindle's rotational speed.

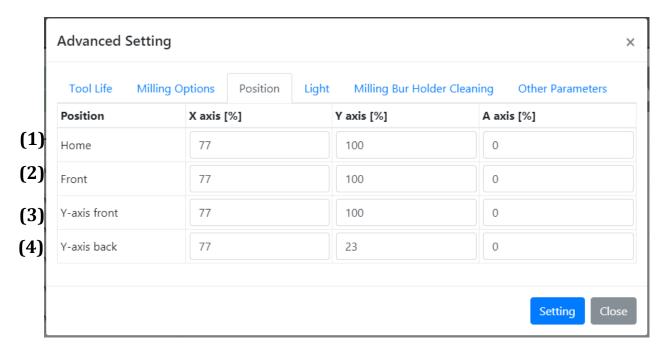
Default value: 100 [%]Minimum value: 1 [%]Maximum value: 100 [%]

Note

The override function lets you increase or decrease, in one percent increments, the rotational speed of the milling bur or the movement speed of the swivel table while a milling program is running.

Position tab

This tab lets you set MD-500's default positions.



• Minimum value: 1 [%] (A axis: -100 [%])

• Maximum value: 100 [%]

1. Home

This parameter sets the home position moved to with the Return to Home button on the tool bar (see Section 3.8 Tool Bur).

2. Front

This parameter sets the position moved to with the Move to Front button on the tool bar (see Section 3.8) or the Move to Front button on the Maintenance window (see Section 3.12 Maintenance Window).

3. Y-axis front

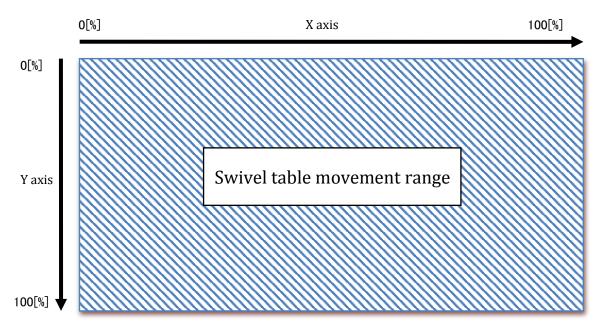
This parameter sets the position moved to with the Move Y to Front button on the Cleaning tab on the Maintenance window (see Section 3.12 Maintenance Window).

4. Y-axis back

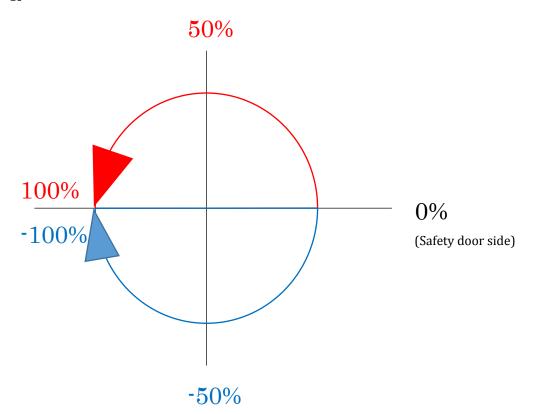
This parameter sets the position moved to with the Move Y to back button on the Cleaning tab on the Maintenance window (see Section 3.12 Maintenance Window).

References for position settings

Positions are set in percent. The following diagrams illustrate the correspondence between position settings in percent and actual positions.



A axis [deg]



• Light tab

This tab lets you adjust the how long the interior light stays on.

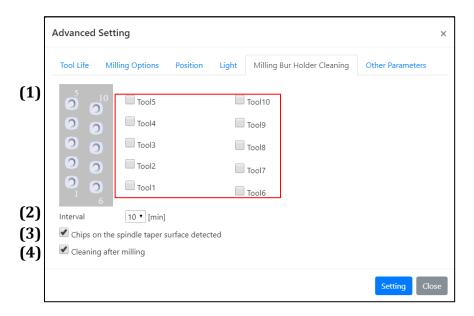


- Auto lighting time [min] (The duration the light is on)
 This parameter sets how long the light stays on since the most recent operation.
 - Default value: 5 [min]
 - Possible settings [min]

1/2/3/4/5/10/15/20/25/30/45/60

• Milling bur holder Cleaning tab

This tab lets you set the milling bur holder cleaning.



1. Enabled tools

The check boxes are used to select the holder cleaning tool(s).



Select the milling bur to be used for rough machining.

2. Interval

This parameter sets time intervals between milling bur holder cleaning run during rough milling.

Default value: 10[min]

Possible setting: 5 / 10 / 15 [min]

3. Chips on the spindle taper surface detected

This parameter either enables or disables dust detection on the milling bur holder during milling. When enabled, this function adds an operation to check for milling there is no dust on the tool prior to milling.

• Default value: enabled (To disable, uncheck the check box)

Note

This is a situation the spindle chucks the tool with work chips sticking on the surface of its collet holder.

*The chips milled from large chips of resin materials such as PMMA disk.

Milling in this situation may affect the workpiece.

This operates only when milling bur holder cleaning is enabled.

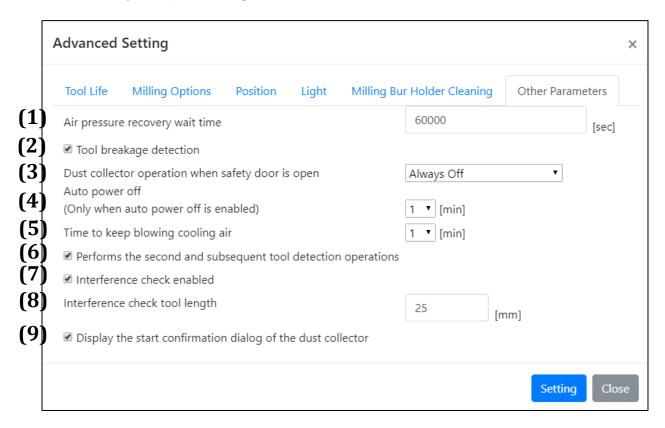
4. Cleaning after milling

This parameter either enables or disables holder cleaning operation at the end of machining.

• Default value: enabled (To disable, uncheck the check box)

• Other Parameters tabs

This tab lets you adjust other parameters.



1. Air pressure recovery wait time

This parameter sets the wait time for air pressure to recover when the air pressure is too low.

Default value: 60000 [sec]

Minimum value: 1

• Maximum value: 60000



When the parameter is set to 60000, MD-500 will wait until the air pressure recovers regardless of the set value.

2. Tool breakage detection

This parameter either enables or disables bur breakage detection during milling. When enabled, this function adds the tool length measurement operation in order to check for bur breakage when replacing tools while milling.

• Default value: enabled (To disable, uncheck the check box)

- 3. Dust collector operation when safety door is open This parameter sets the dust collector operation when the safety door is open. The following options are available.
 - Always Off: The dust collector does not run when the safety door is open.
 - Always On: The dust collector runs when the safety door is open.
 - Run One Time After Milling: The dust collector runs the first time the safety door is opened after milling finishes.
 - Default value: Always Off



Can be used only when interlocking.

4. Auto power off [min]

When auto power down is enabled, this parameter sets the time from a successful milling completion to auto power down.

This parameter either enable or disable settings can be confirmed from the window described in Section 3.16 Auto Power Off Settings (\rightarrow P. 79).

- Default value: 1 [min]
- Possible settings [min] 1 / 2 / 3 / 4 / 5 / 10 / 15 / 20 / 25 / 30 / 45 / 60
- 5. Time to keep blowing cooling air

Set the time to keep on the cooling air and dust collector after machining, after tool change operation, or for tool length measurement operation.

- Default value: 1 [min]
- Minimum value: 1[min]
- Maximum value: 10[min]



When the dust collector is interlocked, you can set the time to keep the dust collector function.

- 6. Performs the second and subsequent tool detection operations Normally, after closing the safety door, the tool detection operation is performed only when the tool is first removed, the tool detection operation is not performed after the subsequent tool removal operation. But when this setting is turned ON, the tool detection operation is performed every time.
 - Default value: enabled (To disable, uncheck the check box)

7. Interference check enabled

Set whether to perform interference check when registering NC files. When this check is turned ON, it is confirmed whether the spindle and the moving table interfere with each other when registering the NC files. If there is interference, file registration will be canceled.

Default value: enabled



It cannot check for interference with milling tools.

8. Interference check tool length

Set the amount of tool protrusion that is expected when checking the interference of NC files.

Default value: 25 [mm] Minimum value: 25[mm]

Maximum value: 35[mm]

9. Display the start confirmation dialog of the dust collector Enables or disables display the start confirmation dialog of the dust collector at the start of milling.

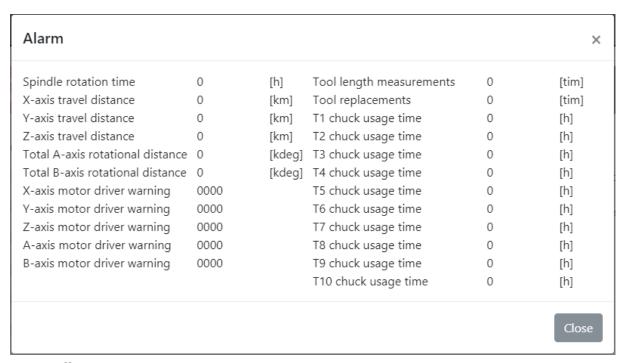
Default value: enabled (To disable, uncheck the check box)



Display of the dialog is a reminder to start the dust collector. Please check if it is working.

3.14 Alarm Details Window

The Alarm Details window displays warnings that do not interrupt MD-500 operations. Clicking the Alarm Details button opens this window. When an alarm occurs, the corresponding parameter turns red. Alarms are described below.



• Spindle rotation time

This parameter displays the spindle's cumulative rotational time. An alarm is raised when the spindle's cumulative rotational time reaches the time defined in the specifications.

• X-axis travel distance

This parameter displays the swivel table's cumulative travel distance in the X axis. An alarm is raised when the cumulative X-axis travel distance reaches the distance defined in the specifications.

Y-axis travel distance

This parameter displays the swivel table's cumulative travel distance in the Y axis. An alarm is raised when the cumulative Y-axis travel distance reaches the distance defined in the specifications.

• Z-axis travel distance

This parameter displays the swivel table's cumulative travel distance in the Z axis. An alarm is raised when the cumulative Z-axis travel distance reaches the distance defined in the specifications.

Total A-axis rotations

This parameter displays the total number of rotations in the A axis measured in rotational degrees. An alarm is raised when the total A-axis rotations reach the rotational angle defined in the specifications.

Total B-axis rotations

This parameter displays the total number of rotations in the B axis measured in rotational degrees. An alarm is raised when the total B-axis rotations reach the rotational angle defined in the specifications.

X-axis motor driver warnings

This parameter displays X-axis motor driver warnings. An alarm is raised when an X-axis motor driver warning occurs.

Y-axis motor driver warnings

This parameter displays Y-axis motor driver warnings. An alarm is raised when a Y-axis motor driver warning occurs.

Z-axis motor driver warnings

This parameter displays Z-axis motor driver warnings. An alarm is raised when a Z-axis motor driver warning occurs.

• A-axis motor driver warnings

This parameter displays A-axis motor driver warnings. An alarm is raised when an A-axis motor driver warning occurs.

• B-axis motor driver warnings

This parameter displays B-axis motor driver warnings. An alarm is raised when a B-axis motor driver warning occurs.

· No. of tool length measurements

This parameter displays a count of the number of tool length measurements. An alarm is raised when the number of tool length measurements reaches the number defined in the specifications.

• No. of tool replacements

This parameter displays a count of the number of tool replacements. An alarm is raised when the number of tool replacements reaches the number defined in the specifications.

T1 chuck usage time

This parameter displays how long the T1 chuck has been used.

T2 chuck usage time

This parameter displays how long the T2 chuck has been used.

T3 chuck usage time

This parameter displays how long the T3 chuck has been used.

T4 chuck usage time

This parameter displays how long the T4 chuck has been used.

T5 chuck usage time

This parameter displays how long the T5 chuck has been used.

• T6 chuck usage time

This parameter displays how long the T6 chuck has been used.

- T7 chuck usage time
 This parameter displays how long the T7 chuck has been used.
- T8 chuck usage time
 This parameter displays how long the T8 chuck has been used.
- T9 chuck usage time
 This parameter displays how long the T9 chuck has been used.
- T10 chuck usage time

 This parameter displays how long the T10 chuck has been used.

3.15 Error Details Window

MD-500 will go into an error state when a fault occurs that requires operations to stop. Clicking the Error Details button opens this window. This window also opens automatically when an error occurs and MD-500 automatically stops operations.

The Error Details window displays and resets error states on MD-500. Errors are displayed in the format Error description (hexadecimal error code). There are four main error types, shown below

Minor fault

A recoverable error that doesn't require MD-500 to be turned off and on again.



■ Reset

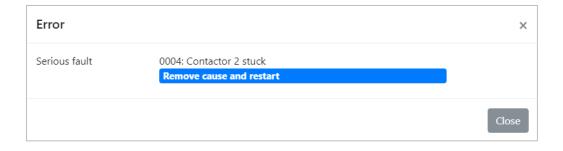
The red button shown in the picture above resets the minor fault error. MD-500 may automatically return to home when reset.

Close

The grey buttons in the corner both of the pictures close the Error Details window.

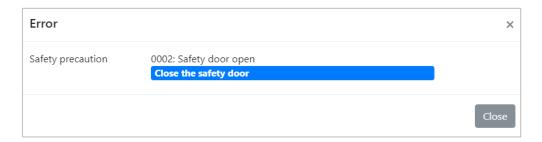
Serious fault

An error that requires MD-500 to be turned off and on again to recover.



• Safety precaution

An error that occurs when the safety door is open.



See Chapter 7. Troubleshooting (\rightarrow P. 97) for details on error messages and how to recover from errors.

3.16 Auto Power Off Settings

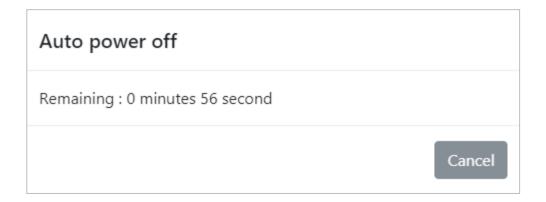
MD-500 auto power off function can be enabled and disabled. The setting is toggled by clicking the button. The state of the setting is shown below.



When the auto power off function is enabled and milling has completed successfully, MD-500 will automatically power off after the wait time set with the Auto power off parameter under the Other Parameters tab on the Advanced Settings window (see Section 3.13 Advanced Settings Window).

3.17 Auto Power Off

When the auto power off function is enabled and milling has completed successfully, MD-500 will run the auto power off process. The dialog below is displayed during the auto power off process.



Cancel

This button cancels the auto power down process. Once canceled, MD-500 will not auto power down.

3.18 Milling Bur Holder Cleaning

This feature regularly air blows the milling bur holder during roughing.

The function becomes active or inactive with clicking these icons.

The interval between each blow is selectable on the Advanced Setting window (see Section 3.13 Advanced Settings Window (\rightarrow P. 64)). The button color changes as shown below.







- MD-500 enables milling bur holder cleaning when milling resin workpieces, regardless of this setting.
- Using this function can be used prevent gripping the milling chips with the milling tool.

3.19 Network Settings

This window lets you access MD-500's network settings. Select Menu Bar > Operations > Network Settings to open this window. The parameters on this window are described below.



1. IP address

This parameter changes MD-500's IP address.

• Default value: 192.168.100.252

2. Subnet mask

This parameter changes MD-500's subnet mask.

• Default value: 255.255.255.0

3. Default gateway

This parameter changes MD-500's default gateway.

• Default value: 0.0.0.0

Important

- Check with your network administrator before changing network settings.
- After changing settings and the dialog below appears, turn off MD-500.



4. Operating Procedures

4.1 Milling Preparations

This section describes the normal procedure prepare MD-500 before starting automatic milling. See Chapter 2. Basic Operations of MD-500 Dental Milling Machine (\rightarrow P.25) and Chapter 3. MD-500 Dental Milling Machine Application (\rightarrow P.40) for details. Review the safety precautions given in the For Safe MD-500 Operation (\rightarrow P.5).

Ensure all the following prerequisites are in place before starting automatic milling.

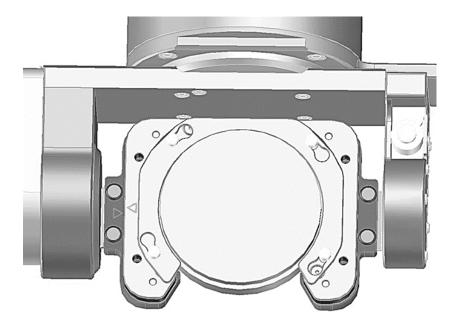
- MD-500 is turned on.
- MD-500 is in the normal standby state.
- The disk fixing plate is attached to the swivel table.
- The app is running and communications have been established with MD-500.
- The milling tools to be used for milling are set in the ATC tool magazine.
- The dust collector hose of the dust collector is connected to the dust collector hose connection port of MD-500, and the dust collector is in a state where it can operate normally.

Important

Be sure to carry out the daily inspection before using MD-500. See Chapter 5. Inspections and Maintenance (\rightarrow P. 89) for details.

■ Fix disk

Follow the steps below to fix disk using MD-500's disk fixing plate.





See Section 2.11 Fixing Disk (\rightarrow P.39) for the specifics of fixing disk.

A Caution

Be sure to use the included torque screwdriver (0.3 N·m) and bit (3 mm width) to securely fix the disk with disk clamp plate and four hexagon bolts. If a disk is not securely fixed, it may affect the finish as well as either damage or shorten the life of milling burs.

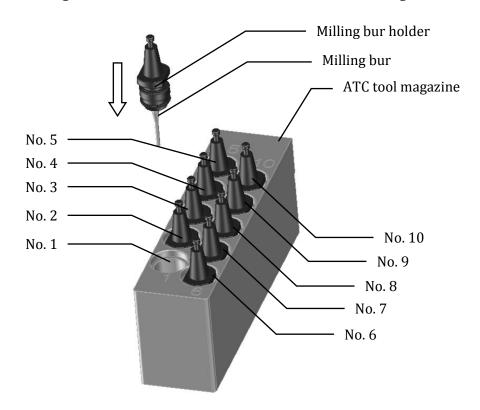
E Important

Be sure to check for dirt or contaminants on the faces of the disk fixing plate before fixing disk. Remove any dirt or contaminants with a vacuum cleaner or other suction source and then wipe the surfaces clean with a dry cloth.

Set milling tools

Fix the milling burs in milling bur holders (See Section 2.8 Fixing and Removing Milling Burs (\rightarrow P. 29)) and place them in the ATC tool magazine. MD-500 can then attach milling burs automatically to the spindle as needed.

- 1. Using the controls on the app's Maintenance window, move the assembly to a convenient position to place the milling bur holder.
- 2. Place the milling bur holder in the correct slot in the ATC tool magazine.

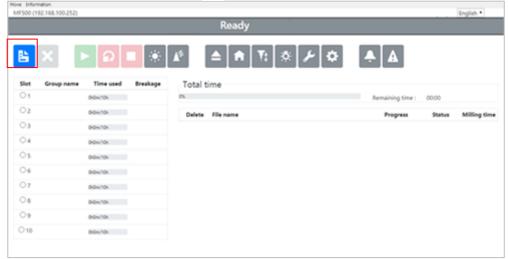


A Caution

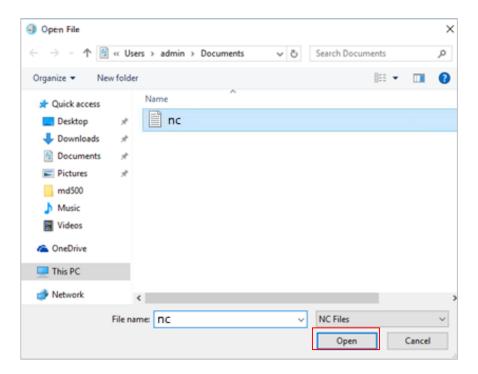
- Be sure to hold the milling bur holder when replacing and setting milling burs in the ATC tool magazine. You may cut your hand accidently if you hold tools by the cutting head.
- Be sure to exercise due caution not to drop the milling bur holder when replacing and setting milling burs. Dropping the milling bur holder may damage the milling bur or scratch a disk or table.
- Do not place a milling bur holder without a milling bur in the ATC tool magazine. The sensor that detects holder positions will not work correctly.

4.2 Selecting Milling Data

Click the **Load Milling Data** button to open the select file dialog.



Select the milling data you wish to send to MD-500 and click the Open button. You may select multiple files.

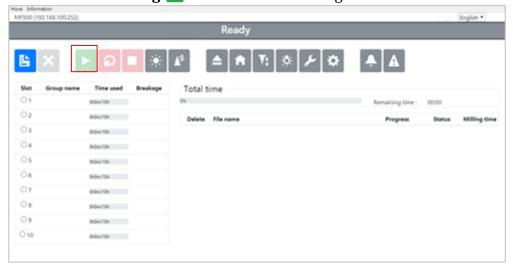


Note

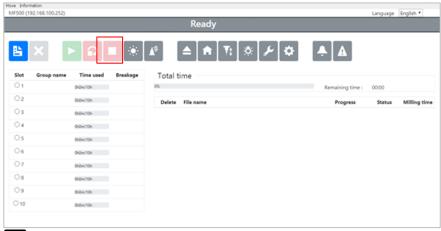
• The maximum milling data file size is 256MB. Files larger than 256MB cannot be registered. If you are using a 32-bit computer, the application may freeze when you send a large file, in that case, please use a 64-bit computer.

4.3 Starting and Stopping Milling

Click the **Start Milling** button to start milling.



To stop milling, click the Stop Operations \Box button. See Section 3.8 Tool Bur (\rightarrow P. 52) for details about these control buttons.





Please do not change the PC during processing. The screen may be unintended.



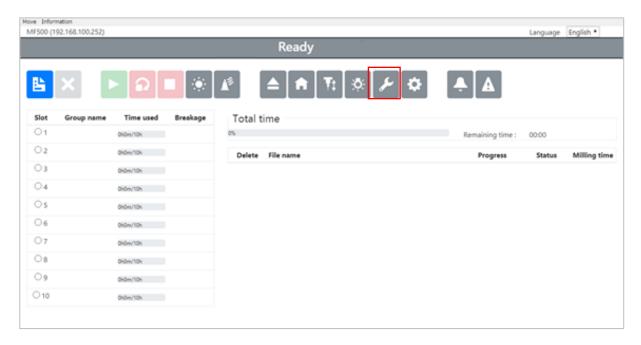
A Caution

• After pressing the **start milling** button do not open the safety door while sending the data file. Machining may not start normally.

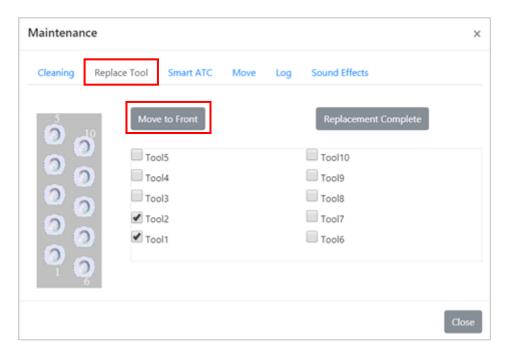
4.4 Replacing Milling Burs

Milling burs must be replaced when they have worn out. This section describes how to replace milling burs. In the example below, the tools in positions 1 and 2 have worn out and need to be replaced.

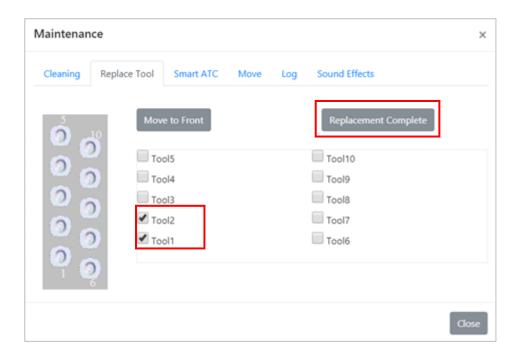
1. Click the Maintenance button and open the Maintenance window.



2. Select the Replace Tools tab and click the Move to Front button to move the swivel table to the front position.



- After the swivel table has moved to the front position, remove the milling bur holders from positions 1 and 2. Following the instructions in Section
 8 Fixing and Removing Milling Burs (→P. 29), replace the milling burs in the milling bur holders with new burs and set the milling bur holders in their original positions in the ATC tool magazine.
- 4. Select the tools that have been replaced and click the Replacement Complete button. When the Replacement Complete button is clicked, the app resets (to zero) the corresponding milling burs' usage time, and MD-500 automatically measures the length of the replaced milling tools. In this example, the usage time for Tool1 and Tool2 is reset to zero and the length of each bur is measured. The milling tool replacement is complete when the milling tool length measurements are finished.



5. Inspections and Maintenance

5.1 Inspections

To maintain your MD-500 at its optimal performance, please carry out the daily inspections given in the table below.

■ Maintenance check list

Item	Daily	Each Milling Operation	Weekly	Notes
Safety door cleaning	✓	✓		
Work table cleaning	✓	✓		
Optional dust collector cleaning	✓		√	
Cleaning in the milling area			✓	
Touch sensor measurement surface cleaning	√	✓		
Check for unusual noises during stage operation	√			
Drain (check) filter regulator	√			Dehumidifier use is mandatory
Dust collection hose connection and Operation check of dust collector	√			Must use dust collector

■ Maintenance and Inspection Chart

Item	Description	Daily Check	Weekly Check	
Exterior	Is there anything interfering with the movement of the swivel table in the work area?	Yes		
Air pressure	Is the air pressure at the filter regulator between 0.6 and 0.7 MPa?	Yes		
Fluid in regulator	Is there accumulated fluid in the filter regulator?	Yes		
Movement of parts	Do all parts move smoothly in each axis during automatic milling? Are there any abnormal noises?	While in operation		
	Does the spindle rotate smoothly during automatic milling? Are there any abnormal noises?	While in operation		
Air blower	Is air being blown from the air nozzles and removing chips from the vicinity of the milling point during automatic milling?	While in operation		
Air system	Is there any sound of air leaking from the couplers?		Yes	
Circuit breaker	Does the circuit breaker operate?		Yes	
Dust collection	Is the dust collector running during automatic milling?	While in operation		

- See Section 2.2 Adjusting the Air Pressure (→P. 25) for details about air pressure and the filter regulator.
- The circuit breaker's operation is tested as follows.
 - 1. Insert the power plug into the outlet.
 - 2. Turn the circuit breaker switch on.
 - 3. Confirm that MD-500 is off.
 - 4. If MD-500 is on, turn it off.

 Press the test button below the circuit breaker switch with a pen tip or other thin object.
 - 5. Confirm that the circuit breaker switch is thrown to the off position.
 - 6. Turn the circuit breaker switch on again.

Add other inspection items to the list as needed. Contact us at our Customer Support & Service Center (\rightarrow P.113) if you have any questions.

Confirm items marked "While in operation" while MD-500 is running.

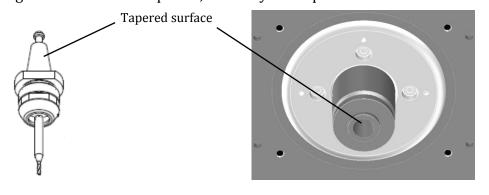
Daily inspection items: Please inspect these items every day.

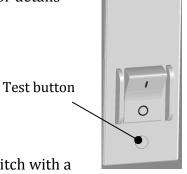
Weekly inspection items: Please inspect these items every week or after every 40 hours of operation, whichever is shorter.

Yearly inspection items: Please inspect these items every year or after 2,000 hours of operation, whichever is shorter.

Important

- The inspection items listed above are the absolute minimum required. Please perform these inspections every time before use to ensure your MD-500 is at its optimal performance.
- Be sure to clean out frequently any milling chips or fragments of disk that accumulate inside the machine.
- Be sure to clean the tapered surface of milling tool holders and the spindle with a dry cloth every time before use. If milling chips are stuck to the surface, the milling tool may not come off. In addition, a center runout may occur and milling failure may occur. Do not use rust preventive agent on the tapered surface of the milling tool holder or the spindle, as it may not separate even if oil adheres.





• If dust and chips are not collected properly during automatic machining, chips may get into the drive unit inside the machine and cause errors or malfunctions. Check if the dust collector is running normally.



A Caution

If there is fluid in the drain tank, check the condition of the compressor immediately and remove the fluid. If fluid adheres to the drain tank, it has also entered the inside of the milling machine and may cause a malfunction.

5.2 Regular Inspections

Regular inspections and servicing are done to always maintain your MD-500 in its optimal condition. For details about regular inspections, please talk to your dealer or our Customer Support & Service Center (\rightarrow P.113).

Important

A workspace of about 700 mm on the left side of the milling machine is needed to carry out inspections. Please install the milling machine to ensure this space is available.



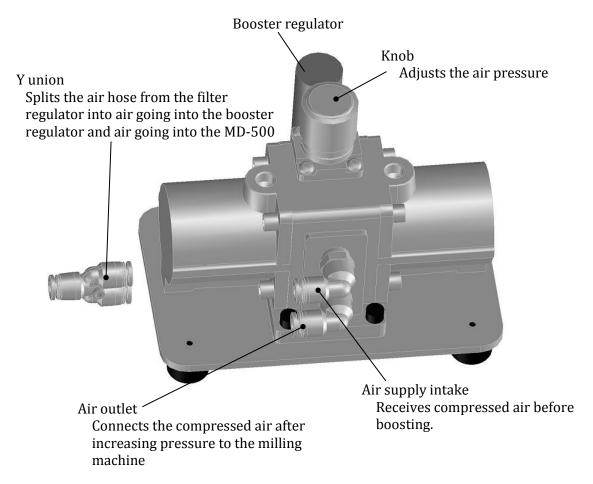
6. Optional Equipment

6.1 Pressure Booster Unit

When air at the pressure of 0.6 to 0.7 MPa cannot be supplied to the milling machine, you may use our pressure booster unit (available as an option). With the pressure booster unit, the milling machine can operate on a minimum air pressure of 0.35 MPa.

6.1.1 Names of Parts and Their Functions

The pressure booster unit consists of a booster regulator and Y union.



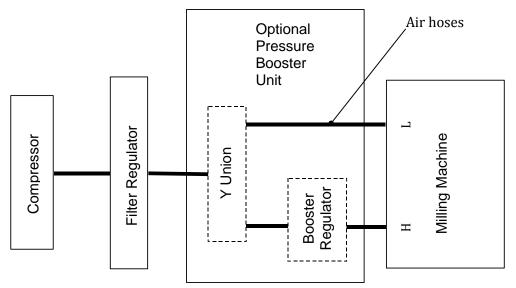
Important

Never adjust the knob because the air pressure has been preadjusted.

6.1.2 Air Supply Arrangement

The block diagram below shows the air hose connections when using the pressure booster unit.

• Thick lines indicate a 6 mm diameter air hose.



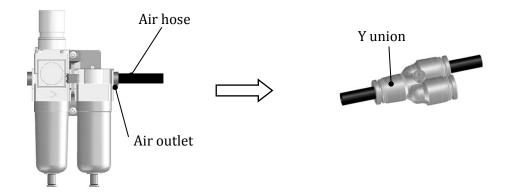


That the air hose is not included in the product. The customer must prepare the 6millimeters diameter air hose.

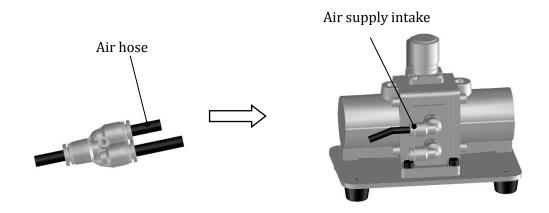
6.1.3 Air Supply Connection Procedure The air piping method is as follows.

- 1. Turn the milling machine off.
- 2. Place the pressure booster unit on a horizontal table beside the milling machine.
- 3. Turn the pressure adjustment knob on the filter regulator until the air pressure reads 0 MPa.

4. Connect one end of the included air hose to the filter regulator's air outlet and connect the other end to the Y union.



5. Connect one end of the included air hose to the Y union and connect the other end to the pressure booster unit's air supply intake.



- 6. Remove the plug inserted in the "H" air supply connection on the left side of MD-500.
- 7. Connect one end of the included air hose to the pressure booster unit's air outlet and connect the other end to the "H" air supply connection on the left side of MD-500.



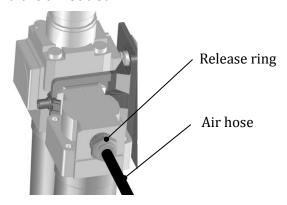
- 8. Turn the filter regulator's pressure adjustment knob until the air pressure reads between 0.35 and 0.4 MPa.
- 9. Turn the milling machine on and confirm that the homing operation and tool length measurement operation perform normally.

A Caution

Do not supply air pressure in excess of 0.4 MPa when using the pressure booster unit. Supplying high air pressure may damage internal pneumatic equipment or rupture an air hose.



To remove the air hose, pull on the air hose while pressing in on the release ring around the air outlet.



6.2 List of Optional Equipment

The table below lists the names and model numbers of optional equipment for additional orders.

Milling bur holder	6A2-0795
4-mm-collet chuck	6A2-0797
Wrenches	6A2-1856
0.3/Nm torque screwdriver	6A2-3493
3.0mm bit	6A2-3920
Disk fixing plate type C Unit	6G2-2526
Milling bur replacement jig	6G2-2653
Spindle	6A2-2038
Pressure booster unit	6G2-2710

7. Troubleshooting

Error Messages and Recovery Methods

This section lists error messages and their recovery methods. Please access the following address and check "How to resolve the error message" or contact our Customer Support & Service Center (\rightarrow P.113) if applying the solution does not remedy the error or if a message not listed here appears.

MD-500 / MD-500S

https://en.canon-elec.co.jp/products/dentalmilling/?auth=1

Error Code 0002: Safety door open

Problem: The safety door is open.

Solution: Close the safety door if it is open. If it is closed, check that it is completely closed. When the safety door is closed, MD-500 will automatically start the homing operation. Please wait until the homing operation has completed.

Error Code 0009: Error signal (spindle)

Problem: The spindle's motor controller has detected an error.

Solution: Adjust the milling conditions if the spindle is overloaded. Otherwise, replace the milling tool with a new tool and remove the cause of preventing milling operation. If the error persists after trying these solutions, please contact Customer Service Support.

Error Code 2005: Stopped by X-axis clockwise soft limit

Problem: The X axis has passed the soft limit position in the clockwise direction. Solution: Reset the machine using the Reset button on the Error Details window.

Error Code 2006: Stopped by X-axis counterclockwise soft limit

Problem: The X axis has passed the soft limit position in the counterclockwise direction.

Solution: Reset the machine using the Reset button on the Error Details window.

Error Code 2105: Stopped by Y-axis clockwise soft limit

Problem: The Y axis has passed the soft limit position in the clockwise direction. Solution: Reset the machine using the Reset button on the Error Details window.

Error Code 2106: Stopped by Y-axis counterclockwise soft limit

Problem: The Y axis has passed the soft limit position in the counterclockwise direction.

Solution: Reset the machine using the Reset button on the Error Details window.

Error Code 3003: Automatic milling stopped

Problem: Automatic milling has stopped because the Stop switch or the Stop Operations button has been pressed.

Solution: Reset the machine using the Reset button on the Error Details window.

Error Code 3551: Milling tool breakage detected

Problem: A broken milling tool has been detected.

Solution: Replace the broken milling tool with a new milling tool and set it in the ATC tool magazine. (See the instructions in Section 4.4 Replacing Milling Burs (→P. 87) for details.)

Error Code 4011: Spindle chuck sensor error

6003: Air pressure confirmation error

Problem: Low air pressure has been detected.

Solution: Check that the filter regulator is supplying air at a pressure between 0.6 and 0.7 MPa. (At a pressure between 0.35 and 0.4 MPa when using the optional pressure booster unit.)

Error Code 5001: Cutting head detection sensor error

Problem: A problem with the cutting head measurement sensor has been detected.

The cutting head measurement sensor is already on before starting the cutting head detection operation.

Solution: Reset the machine using the Reset button on the Error Details window. Check for and remove any foreign substances around the cutting head measurement sensor.

Error Code 5007: Milling tool protrusion length measurement range error

Problem: An out-of-spec milling tool length has been detected.

Solution: Adjust the milling bur length to between 25 and 35 mm. See Section 2.8 Fixing and Removing Milling Burs (→P. 29) for instructions on how to perform milling bur adjustments.

8. MD-500 Specifications

Name			MD-500		
Installation and operating conditions			erating conditions	Indoors (free of vibrations) Ambient temperature: 0 to 40°C Relative humidity: Below 20 to 75% (free of condensation) Maximum specification altitude: 1000 m Pollution degree: 2	
Ventilat	ion			Forced exhaust by means of a suction unit	
Milling	ondit	ions		Dry milling	
Dimensi	ons			500 x 740 x 680 mm (w x d x h), excluding adjuster pads	
Weight				110 kg	
Control	axes			Five (X, Y, Z, A, and B axes)	
Range o	Range of movement in rotational axes		t in rotational axes	A axis: $\pm 360^{\circ}$, B axis: $\pm 30^{\circ}$	
Compati	Compatible materials		als	Zirconia, Wax, PMMA, PEEK, Hybrid Resin	
Compati	ble di	sks		Disks for dental milling	
Maximu	Maximum number of disks		of disks	One	
Disk din	Disk dimensions			Diameter: 98.5 mm Height: 10 to 35 mm	
Control resolution	A, I, L IIIIcai axcs		Z linear axes	0.00005 mm	
resolutio	JII	A and B rotational axes		0.00005°	
Spindle	Rota	Rotational speed		5,000 to 60,000 revolutions per minute	
	Outp	utput power		0.35 kW	
	Cooling method		nethod	Air cooling	
ATC	Clan	Clamping method		Tool holder method	
AIC	Milling tool length		ol length	45 to 60 mm	
	Shaft diameter		neter	4 mm	
	Number of milling tools		of milling tools	10	
Tool feed speed			Max. cutting feed speed: 5 m/min in X, Y, and Z axes Max. tool feed speed: 15 m/min in X, Y, and Z axes		
Utilities	Utilities Power supply		Power supply	100-120 Vac +/-10%,12-10A,50/60 Hz Overvoltage category: II (IEC60664-1)	
Air supply		Air supply	Air pressure: 0.6 to 0.7 MPa, Air flow: 60 L/min Connectors accept a 6-mm-diameter air hose Be sure to remove dust and moisture from supplied air with filters and air dryers.		

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TOPPERS/FI4 Kernel

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FatFs for TOPPERS

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17. dateformat

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18. javascript-obfuscator

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About disposal

When disposing of MD-500 and its accessories, be sure to dispose of them according to

the law and local regulations, or contact your nearest sales representative.

Revision history

Version	Date	Revision Details
01	2022.01.14	First issue
02	2022.02.03	Revised "6.2 List of Optional Equipment"
03	2022.04.04	Revised "2.10 Attaching and Removing the Disk Fixing Plate"
04	2022.06.17	Revised "2.10 Attaching and Removing the Disk Fixing Plate", "Move tab" of "3.12 Maintenance Window", "Milling bur holder cleaning tab" and "Other Parameters tab" of "3.13 Advanced Settings Window", "3.14 Alarm Details Window"

How to Contact Us

Please contact us at the address below regarding questions or inquiries about MD-500 dental milling machine.

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