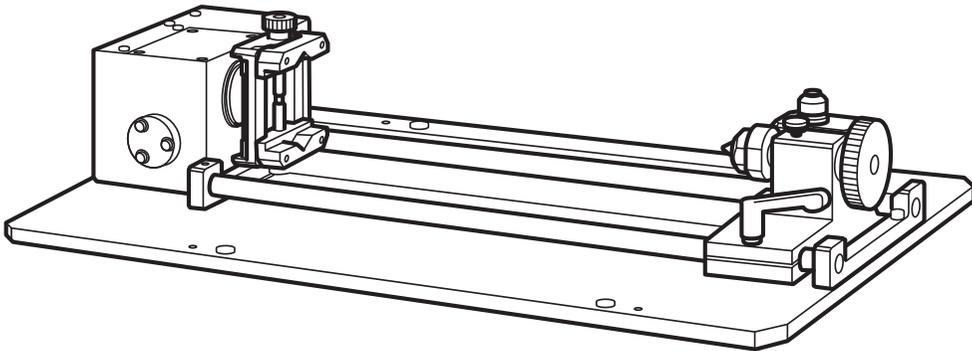


# **ZCL-40A**

## **ROTARY AXIS UNIT**

### **User's Manual**



#### ***About This Document***

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Installation and operation this unit require prior knowledge of the handling and operation of the modeling machine. Before you read this document, be sure to familiarize yourself with the handling and operation of the modeling machine.

This document describes the following.

- How to install the unit
- How to adjust and perform maintenance for the unit
- Explanations of features added by the unit

For matters not described by this document, refer to the documentation included with the modeling machine.

---

Thank you very much for purchasing this product.

- To ensure correct and safe usage with a full understanding of this product's performance, please be sure to read through this manual completely and store it in a safe location.
  - Unauthorized copying or transferral, in whole or in part, of this manual is prohibited.
  - The contents of this operation manual and the specifications of this product are subject to change without notice.
  - The operation manual and the product have been prepared and tested as much as possible. If you find any misprint or error, please inform us.
  - Roland DG Corp. assumes no responsibility for any direct or indirect loss or damage which may occur through use of this product, regardless of any failure to perform on the part of this product.
  - Roland DG Corp. assumes no responsibility for any direct or indirect loss or damage which may occur with respect to any article made using this product.
-

# Contents

 To Ensure Safe Use .....	3
Important Notes on Handling and Use.....	7
<b>Chapter 1 Getting Started .....</b>	<b>9</b>
1-1 Machine Highlights.....	10
Features.....	10
Installable Model .....	10
1-2 Part Names and Functions .....	11
External View.....	11
VPanel.....	11
<b>Chapter 2 Installation and Setup .....</b>	<b>13</b>
2-1 Checking the Included Items.....	14
2-2 Installation.....	15
Before Installation .....	15
Installing the Rotary Axis Unit .....	15
Cable Connection.....	17
<b>Chapter 3 Basic Operation.....</b>	<b>19</b>
3-1 Moving the A-axis.....	20
Manual Feed of the A-axis.....	20
About the A-axis Coordinate.....	20
3-2 Rotary Center Vise and Tailstock .....	21
What is Rotary Center Vise/Tailstock?.....	21
Installing or Detaching the Live Center / Center Drill .....	22
<b>Chapter 4 Preparation for and Performing Cutting .....</b>	<b>25</b>
4-1 STEP1: Preparation for Cutting .....	26
Operations at "STEP1: Preparation for Cutting".....	26
Correction of Tool Sensor Position .....	26
Setting for the A Origin .....	28
Detection of the Center of Rotation .....	29
4-2 STEP2: Selecting Workpiece and Tool .....	33
Types (materials) of workpieces that can be processed in the machine.....	33
Loadable Workpiece Size.....	33
Limitations on Tool Length .....	34
Actual Size That Can Be Cut.....	35
4-3 STEP3: Cutting .....	36
Mount the Workpiece .....	36
Set the Z Origin .....	40
Set the X Origin .....	41
Start Cutting .....	42
Recovery of Operation from Emergency Stop or Emergency Shutdown .....	42

<b>Chapter 5 Appendix .....</b>	<b>43</b>
5-1 Y and Z Origins: Concepts and Fine-tuning .....	44
Y and Z Origins: Concepts and Making the Settings .....	44
Fine-tuning the Y and Z Origin Points.....	44
How to Obtain the “displacement amount” of the Y- and Z-axis Coordinates.....	46
5-2 Daily Care .....	48
Cleaning.....	48
Care of the Detection Pin.....	49
Replacing the Center Drill .....	49
5-3 What to Do If... ..	50
The Machine Doesn't Run. ....	50
The Cutting Location is Not As Intended.....	50
In Multiple-surface Cutting, Differences in Levels Occur at Seams.....	50
Responding to an Error Message.....	50
5-4 NC Code Specifications .....	52
Items Related to the Mechanical Specifications .....	52
A-axis Movement Commands and Actual Operation .....	52
5-5 Unit Specifications .....	53
Dimensional Drawings .....	53
Main Specifications.....	56

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# To Ensure Safe Use

Improper handling or operation of this machine may result in injury or damage to property. Points which must be observed to prevent such injury or damage are described as follows.

## About WARNING and CAUTION Notices

 <b>WARNING</b>	<p>Used for instructions intended to alert the user to the risk of death or severe injury should the unit be used improperly.</p>
 <b>CAUTION</b>	<p>Used for instructions intended to alert the user to the risk of injury or material damage should the unit be used improperly.</p> <p>Note: Material damage refers to damage or other adverse effects caused with respect to the home and all its furnishings, as well to domestic animals or pets.</p>

## About the Symbols

	<p>The  symbol alerts the user to important instructions or warnings. The specific meaning of the symbol is determined by the design contained within the triangle. The symbol at left means "danger of electrocution."</p>
	<p>The  symbol alerts the user to items that must never be carried out (are forbidden). The specific thing that must not be done is indicated by the design contained within the circle. The symbol at left means the unit must never be disassembled.</p>
	<p>The  symbol alerts the user to things that must be carried out. The specific thing that must be done is indicated by the design contained within the circle. The symbol at left means the power-cord plug must be unplugged from the outlet.</p>

 **Incorrect operation may cause injury.**

 **WARNING**

 **Be sure to follow the operation procedures described in this documentation. Never allow anyone unfamiliar with the usage or handling of the machine to touch it.**

Incorrect usage or handling may lead to an accident.



**Keep children away from the machine.**

The machine includes areas and components that pose a hazard to children and may result in injury, blindness, choking, or other serious accident.



**Never operate the machine while tired or after ingesting alcohol or any medication.**

Operation requires unimpaired judgment. Impaired judgment may result in an accident.



**Conduct operations in a clean, brightly lit location.**

Working in a location that is dark or cluttered may lead to an accident, such as becoming caught in the machine as the result of an inadvertent stumble.



**Never use the machine for any purpose for which it is not intended, or use the machine in an undue manner that exceeds its capacity.**

Doing so may result in injury or fire.



**Never use a cutting tool that has become dull. Perform frequent maintenance to keep and use the machine in good working order.**

Unreasonable usage may result in fire or injury.

 **WARNING**

 **For accessories (optional and consumable items, power cord, and the like), use only genuine articles compatible with this machine.**

Incompatible items may lead to an accident.



**Before attempting cleaning, maintenance, or attachment or detachment of optional items, disconnect the power cord.**

Attempting such operations while the machine is connected to a power source may result in injury or electrical shock.



**Never attempt to disassemble, repair, or modify the machine.**

Doing so may result in fire, electrical shock, or injury. Entrust repairs to a trained service technician.

 **CAUTION**



**Never climb or lean on the machine.**

The machine is not made to support a person. Climbing or leaning on the machine may dislodge components and cause a slip or fall, resulting in injury.

 **The cutting waste or workpiece may catch fire or pose a health hazard.**

 **WARNING**

 **Never attempt to cut magnesium or any other such flammable material.**  
Fire may occur during cutting.

 **Keep open flame away from the work area.**  
Cutting waste may ignite. Powdered material is extremely flammable, and even metal material may catch fire.

 **When using a vacuum cleaner to take up cutting waste, exercise caution to prevent fire or dust explosion.**  
Taking up fine cuttings using an ordinary vacuum cleaner may cause danger of fire or explosion. Check with the manufacturer of the vacuum cleaner. When the safety of use cannot be determined, clean using a brush or the like, without using the vacuum cleaner.

 **CAUTION**

 **Wear dust goggles and a mask. Wash away any cutting waste remaining on the hands.**  
Accidentally swallowing or inhaling cutting waste may be hazardous to the health.

 **Danger of pinching, entanglement, and burns.**

 **WARNING**

 **Never attempt operation while wearing a necktie, necklace, loose clothing, or gloves. Bind long hair securely.**  
Such items may become caught in the machine, resulting in injury.

 **Securely fasten the cutting tool and workpiece in place. After securing in place, make sure no wrenches or other articles have inadvertently been left behind.**  
Otherwise such articles may be thrown from the machine with force, posing a risk of injury.

 **WARNING**

 **Exercise caution to avoid being pinched or becoming caught.**  
Inadvertent contact with certain areas may cause the hand or fingers to be pinched or become caught. Use care when performing operations.

 **Caution: cutting tool.**  
The cutting tool is sharp. To avoid injury, exercise caution.

 **Caution: high temperatures.**  
The cutting tool and spindle motor become hot. Exercise caution to avoid fire or burns.

 **Danger of electrical short, shock, electrocution, or fire**

 **WARNING**



**Never use out of doors or in any location where exposure to water or high humidity may occur. Never touch with wet hands.**

Doing so may result in fire or electrical shock.



**Never allow any foreign object to get inside. Never expose to liquid spills.**

Inserting objects such as coins or matches or allowing beverages to be spilled into the ventilation ports may result in fire or electrical shock. If anything gets inside, immediately disconnect the power cord and contact your authorized Roland DG Corp. dealer.



**Never place any flammable object nearby. Never use a combustible aerosol spray nearby. Never use in any location where gases can accumulate.**

Combustion or explosion may be a danger.



**Never use cutting oil.**

This machine is not designed for the flow of cutting oil. Oil may get inside the machine and cause fire or electrical shock.



**Never use a pneumatic blower.**

This machine is not compatible with a pneumatic blower. Cutting waste may get inside the machine and cause fire or electrical shock.

 **WARNING**



**If sparking, smoke, burning odor, unusual sound, or abnormal operation occurs, immediately unplug the power cord. Never use if any component is damaged.**

Continuing to use the machine may result in fire, electrical shock, or injury. Contact your authorized Roland DG Corp. dealer.

# Important Notes on Handling and Use

This machine is a precision device. To ensure the full performance of this machine, be sure to observe the following important points. Failure to observe these may not only result in loss of performance, but may also cause malfunction or breakdown.

## ***This machine is a precision device.***

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- Handle carefully, and never subject the machine to impact or excessive force.
- Diligently keep clean of cutting waste.
- Use within the range of specifications.
- Never attempt to turn the A-axis by hand with undue force.
- Never needlessly touch anywhere inside the machine except for locations specified in this manual.

## ***Install in a suitable location.***

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- Install in a location that meets the specified conditions for temperature, relative humidity, and the like.
- Install in a quiet, stable location offering good operating conditions.
- Never install in out of doors.
- Never use the machine in an environment where silicone substances (oil, grease, spray, etc.) are present. Doing so may cause poor switch contact.

## ***This machine becomes hot.***

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- Never cover the ventilation holes with cloth, tape, or anything else.
- Install in a well-ventilated location.

## ***About Tools***

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- Use a cutter that is suitable for the workpiece and the cutting method.
- The tip of the tool is breakable. Handle with care, being careful not to drop it.



# ***Chapter 1***

## ***Getting Started***

---

This section describes the features of the machine, part names, and functions.

1-1 Machine Highlights .....	10
Features .....	10
Installable Model.....	10
1-2 Part Names and Functions .....	11
External View.....	11
VPanel.....	11

# 1-1 Machine Highlights

## Features

### **Rotary processing and double side processing become possible**

By installing this machine to the modeling machine in order to enable rotary processing and double face processing, "A-axis" (rotary axis) becomes available to use in addition to X-, Y-, and Z-axis. As a result, multifaceted processing including "rotary processing" and "double side processing" become possible.

### **Easy detection by using the tool sensor.**

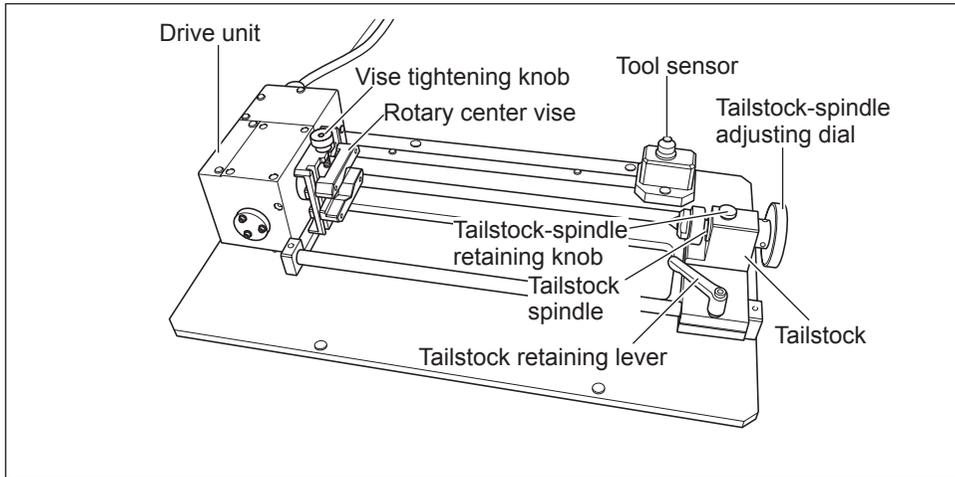
Equipped with a tool sensor that can detect the center of rotation and automatically set the reference position (origin point). This makes the complex setting easier and enables accurate processing

## Installable Model

- MDX-40A
- MDX-40 (However, a version upgrade of the firmware etc. is required. For detailed information, please contact your authorized Roland DG Corp. dealer or Roland DG Corp.)

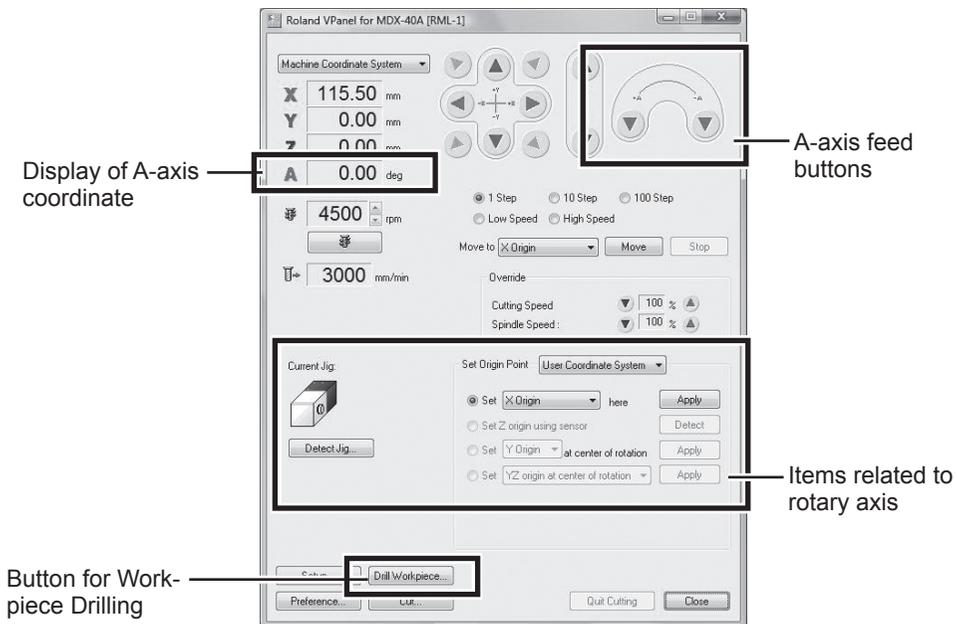
# 1-2 Part Names and Functions

## External View



## VPanel

Installing the rotary axis unit enables you to perform operations for items that involve the rotary axis unit. For other items, refer to the user's manual for the modeling machine.





# ***Chapter 2***

## ***Installation and Set-up***

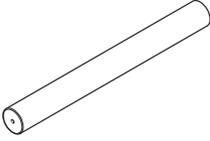
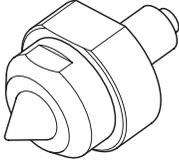
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This describes what you need to do before you use the machine, including checking and verifying the included items, how to install the machine.

2-1 Checking the Included Items .....	14
2-2 Installation.....	15
Before Installation.....	15
Installing the Rotary Axis Unit.....	15
Cable Connection .....	17

## 2-1 Checking the Included Items

The following items are included with the machine. Make sure they are all present and accounted for.

 Detection bar	 Detection pin	 Center drill	 Live center
 Cap screws	 Rubber caps	 User's manual (this document)	

# 2-2 Installation

## Before Installation

### Inspection and caution before installation

- Verify that the modeling machine setup (installation of the modeling machine, software installation, computer connection) is completed. For the setup method, refer to the user's manual of the modeling machine.
- Before installing, clean away any cutting waste and any soiling on the installation surface. Any foreign matter that becomes caught between components may reduce accuracy.

## Installing the Rotary Axis Unit

### ⚠ CAUTION

Before you carry out this operation, switch off the power to the cutting machine.

Failing to do so may result in sudden movement of the cutting machine, causing the hands or fingers to become caught and resulting in injury.

### ⚠ CAUTION

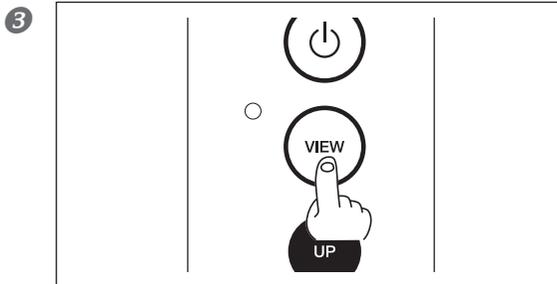
When installing the rotary axis unit, be careful not to let it drop or fall.

Doing so may result in injury.

### Procedure

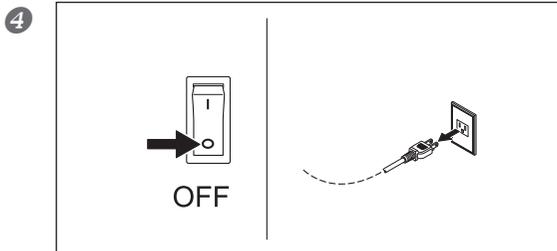
1 If a tool is installed, then remove it.

2 Start the modeling machine.

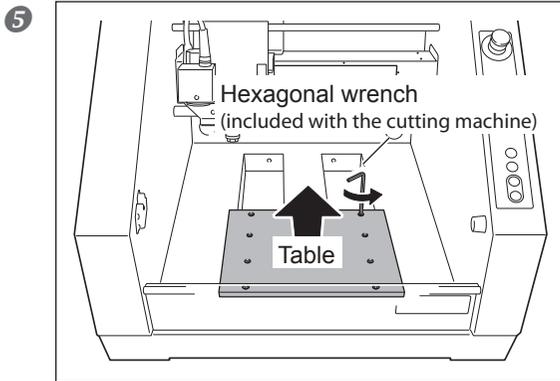


Close the front cover, and push the **VIEW** button.

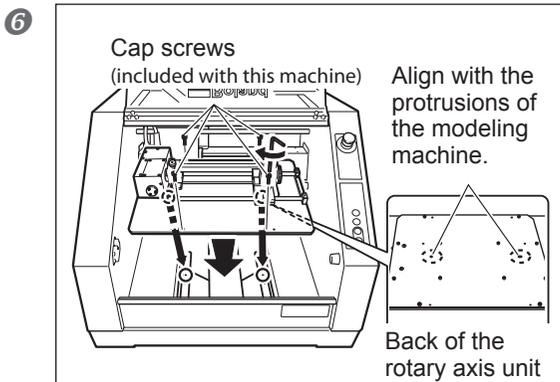
The table moves to the view position.



Turn off the modeling machine and unplug the power cable.



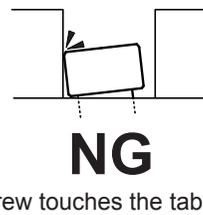
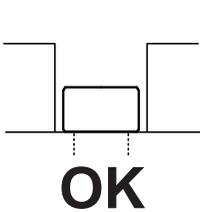
Remove the table from the cutting machine.



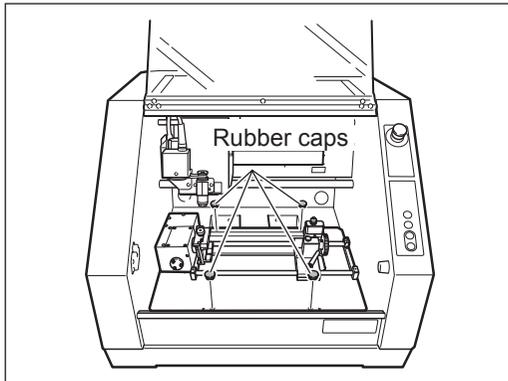
Attach the rotary axis unit.  
To make the installation easier, loosely tighten, and then fully tighten the unit.

**! Notice**

The included cap screw must be used. Make sure that dust is not attached and secure the screw straightly. If the cap screw is not tightened straightly, the head of the screw may touch the table of the rotary axis unit, or dust may get wedged next to the screw. As a result, the tool sensor will not operate correctly.



6

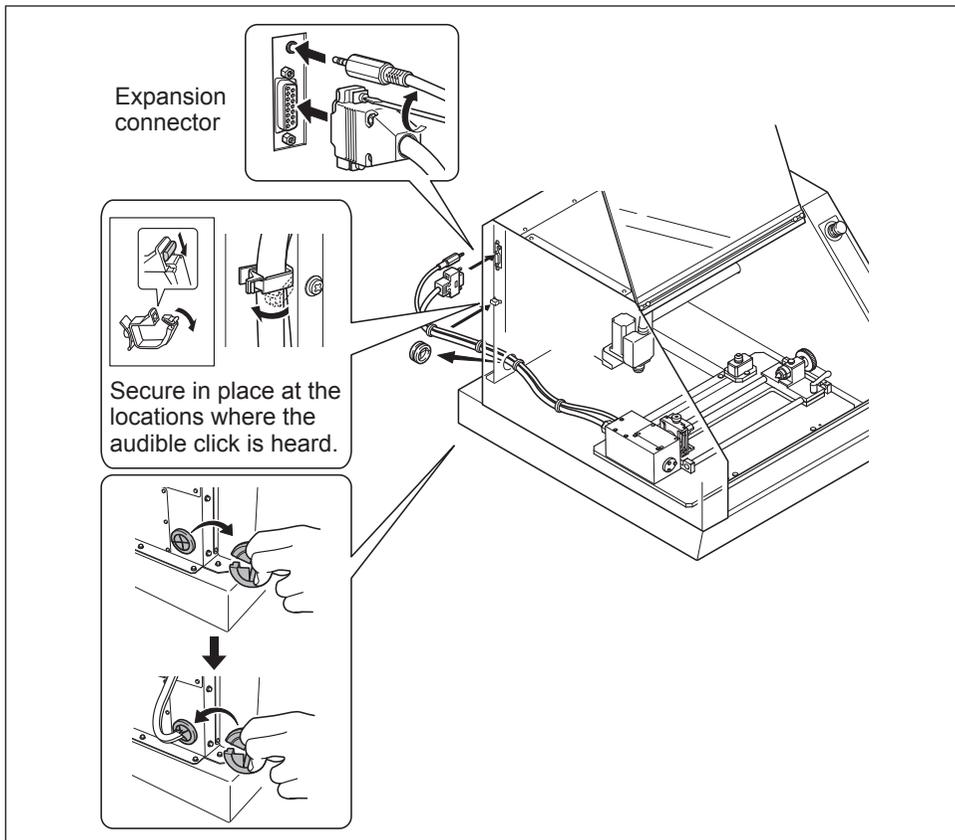


**Place 4 rubber caps on the location where the cap screws are secured.**

This can prevent cap screws from catching dust, which will cause faulty operation of the tool sensor.

## Cable Connection

Make sure that the power to the modeling machine is turned off. Install the cable of the rotary axis unit to the expansion port of the modeling machine.





# ***Chapter 3***

## ***Basic Operation***

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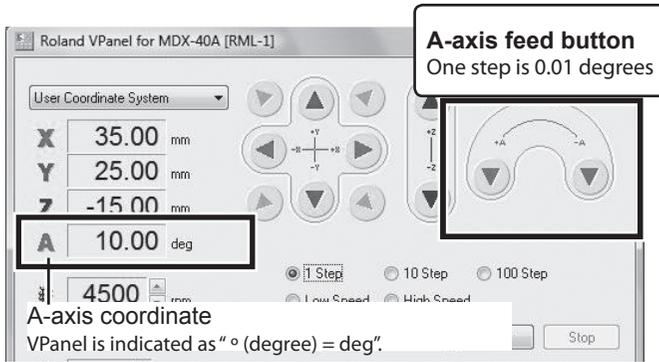
This describes the basic operation methods. If you're using the machine for the first time, then before you start operations, be sure to read this.

3-1 Moving the A-axis .....	20
Manual Feed of the A-axis.....	20
About the A-axis Coordinate.....	20
3-2 Rotary Center Vise and Tailstock.....	21
What is Rotary Center Vise/Tailstock? .....	21
Installing or Detaching the Live Center / Center Drill.....	22

# 3-1 Moving the A-axis

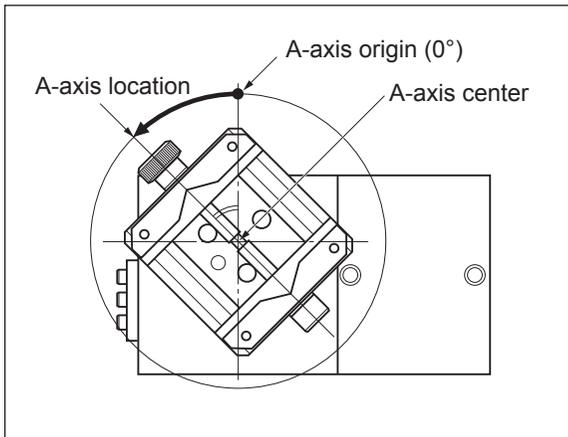
## Manual Feed of the A-axis

In the same way as for the X, Y, and Z axes, perform this using VPanel. Installing the rotary axis unit enables the use of "A-axis feed button" of VPanel.



**A-axis Operating Range**  
±99999.999°  
➤ Infinite turning is not possible

## About the A-axis Coordinate



The location of the A-axis is indicated as an angle of rotation. In this way it differs from how the X-, Y-, and Z-axes are indicated. Despite this difference between angles and distances, in other respects it is treated the same as X-, Y-, and Z-axes coordinates. As with any of the other axes, you can freely set location of the origin (despite it being an "angle" and not strictly a "point") and select the coordinate system.

## 3-2 Rotary Center Vise and Tailstock

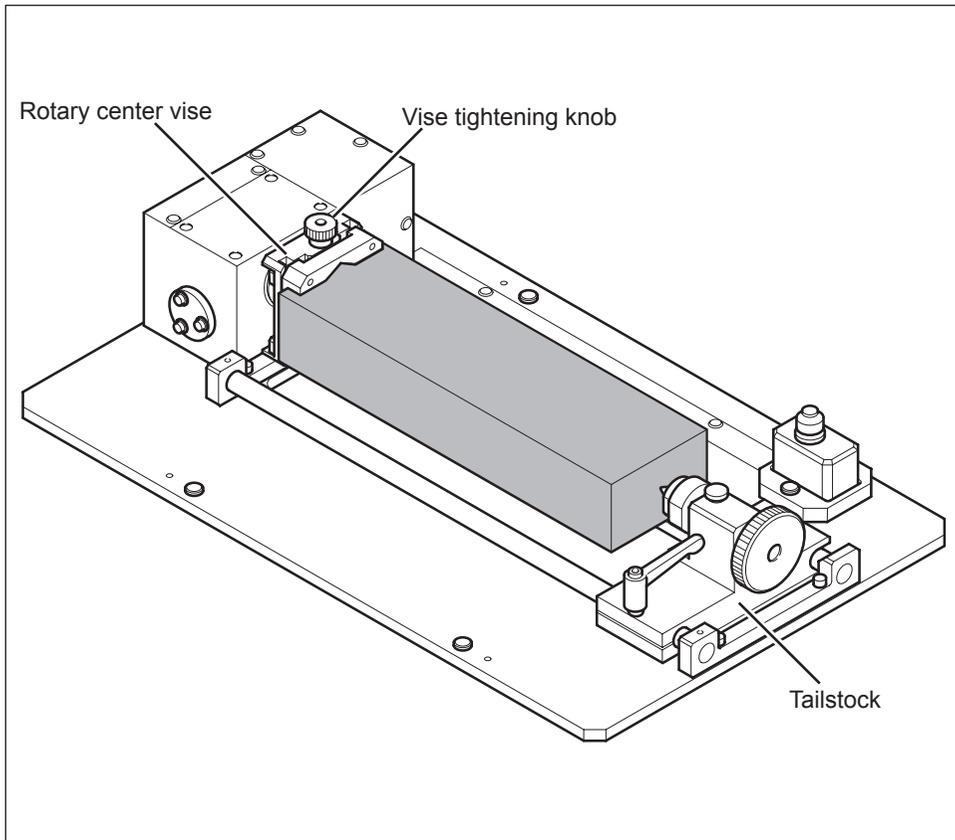
### What is Rotary Center Vise/Tailstock?

#### Rotary center vise

A jig to secure workpiece with two tabs. This jig can secure both of the square and round materials in place. Using manual feed to orient the vise tightening knob to face upward beforehand can make this task easier to accomplish.

#### Tailstock

You use the tailstock to help secure the workpiece (the material being cut) in place. You use it in combination with the live center and the center drill.

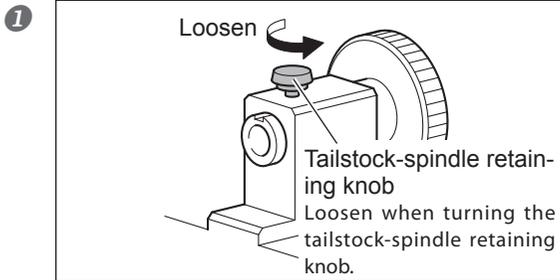


## Installing or Detaching the Live Center / Center Drill

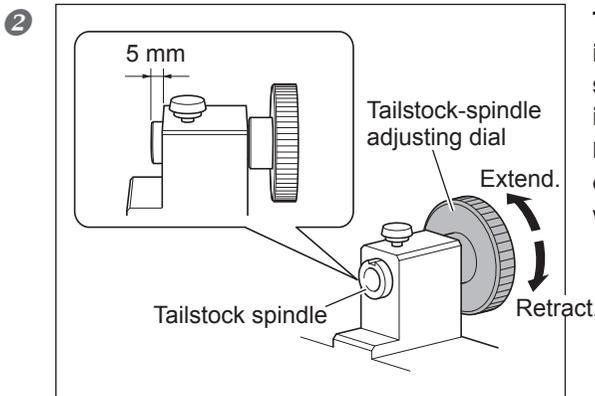
This section describes how to install/remove the live center and center drill. This figure shows the state when the live center is in use. However, the center drill can be installed/removed by the same method as the live center.

### Installing

#### Procedure

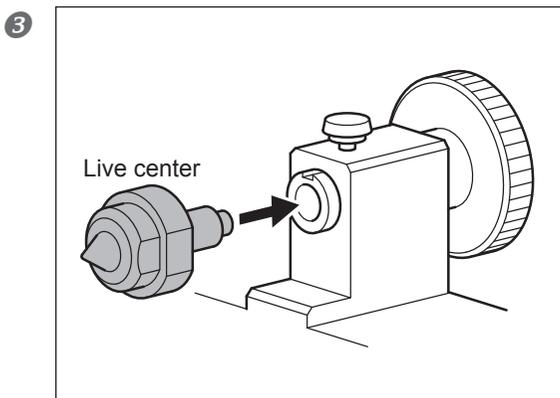


**Loosen the tailstock-spindle retaining knob.**



**Turn the tailstock-spindle adjusting dial and protrude the tailstock spindle about 5 millimeters (0.197 in.).**

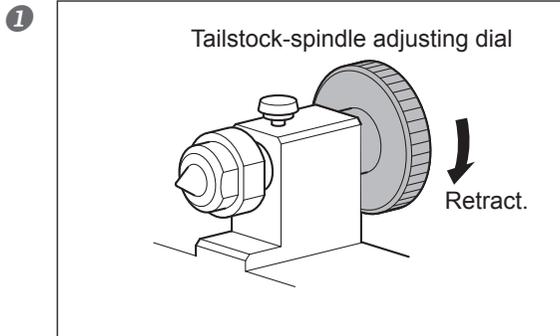
If the tailstock spindle is not protruded enough, it cannot be inserted all the way.



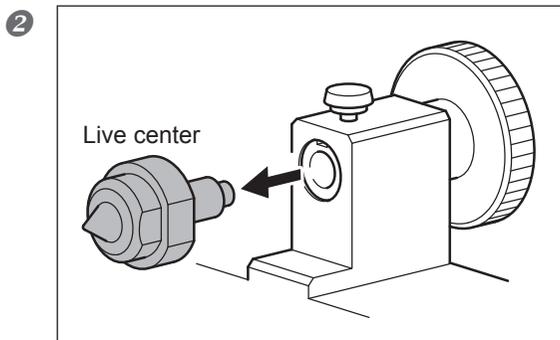
**Insert the live center (or the center drill) into the hole of the tailstock spindle.**

## Detaching

### Procedure



**Turn the tailstock-spindle adjusting dial and retract the tailstock spindle.**

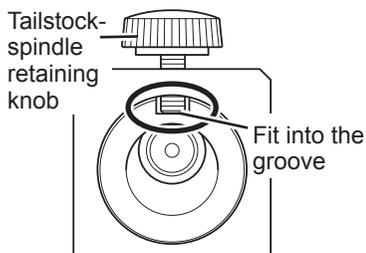


**Remove the live center (or the center drill).**

Retracting the tailstock spindle all the way makes the removal easier.



### Point



The tailstock-spindle adjusting dial may run idle and it may not be possible to remove the live center. In this case, the end of the tailstock-spindle retaining knob is dislocated from the groove of the tailstock spindle. Adjust the position so that the end of the tailstock-spindle retaining knob fits into the groove of the tailstock spindle, and then turn the tailstock-spindle adjusting dial.



# ***Chapter 4***

## ***Preparation for and Performing Cutting***

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This section explains from preparation to starting the cutting.

4-1 STEP1: Preparation for Cutting .....	26
Operations at "STEP1: Preparation for Cutting" .....	26
Correction of Tool Sensor Position .....	26
Setting for the A Origin.....	28
Detection of the Center of Rotation .....	29
4-2 STEP2: Selecting Workpiece and Tool .....	33
Types (materials) of workpieces that can be processed in the machine .....	33
Loadable Workpiece Size .....	33
Limitations on Tool Length.....	34
Actual Size That Can Be Cut.....	35
4-3 STEP3: Cutting.....	36
Mount the Workpiece.....	36
Set the Z Origin .....	40
Set the X Origin .....	41
Start Cutting.....	42
Recovery of Operation from Emergency Stop or Emergency Shutdown.....	42

# 4-1 STEP1: Preparation for Cutting

## Operations at “STEP1: Preparation for Cutting”

“STEP1: Preparation for Cutting” is a required procedure when using the machine for the first time. It is not necessary to perform all of the following operations after the first cutting. Follow the explanations of each item and perform each operation at an appropriate time.

## Correction of Tool Sensor Position



**WARNING**

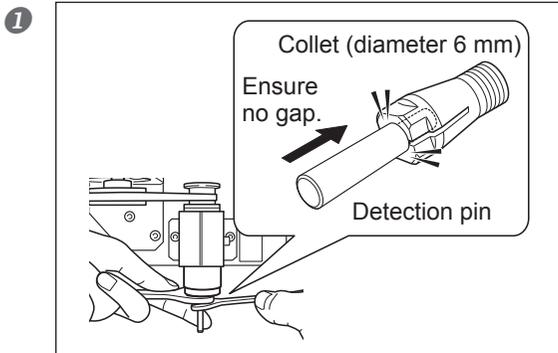
**Never inadvertently touch the operation panel while performing this task.**

Unintended operation of the machine may result in injury.

Tool sensor is used to measure the tool length when setting the Z origin. In this case, because the tool needs to be placed at the center of the sensor, correct any error, which occurs per machine.

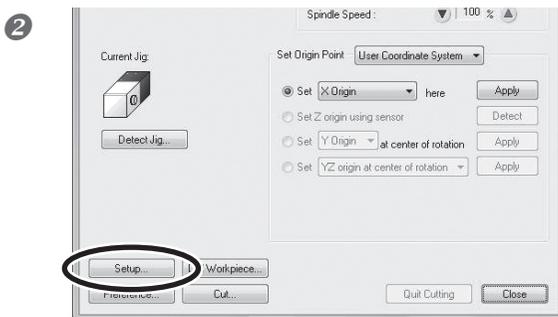
This operation must be performed when using the machine for the first time after purchase.

### Procedure



**Open the front covers and install the detection pin.**

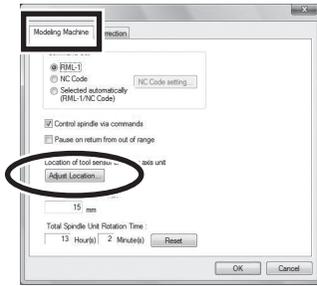
Install the detection pin so that the narrower end of the detection pin is against the collet. If the detection pin is protruded excessively, detection operation may fail. The installation method is the same as the cutting tool. Refer to the user's manual of the modeling machine. Also, use the collet with a 6-millimeter (0.236 in) diameter that is included with the modeling machine.



**Close the front covers, then in VPanel, click [Setup].**

The [Setup] window appears.

3



Click [Adjust Location] on the "Modeling Machine" tab.

The "Tool-sensor Location Adjustment" window appears.



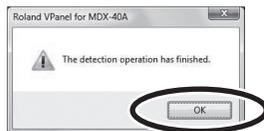
Click [Start Sensing].



Make sure no buildup of cutting waste is present on the tool sensor, then click [Continue].

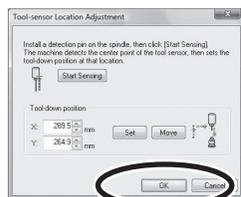
Start correction of tool sensor position.

4



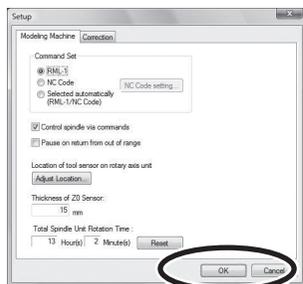
When the window shown in the figure appears, click [OK].

Click [OK].



Click [OK].

Correction of tool sensor position is completed.



## Setting for the A Origin

### **WARNING**

**Never inadvertently touch the operation panel while performing this task.**

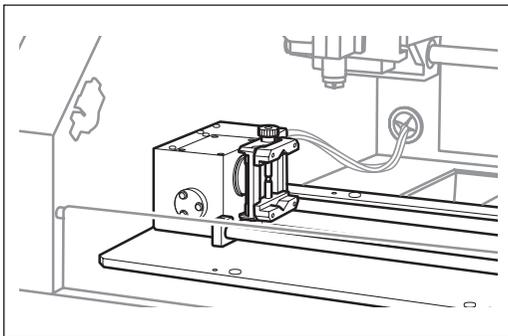
Unintended operation of the machine may result in injury.

There is no standard operating procedure for setting the position of the A origin. The position of the A origin can be set freely in this machine. In this section, the position of the A origin is set so that the vise tightening knob is located above the A origin. This is to make the vise tightening knob easier to handle when mounting the workpiece.

This operation must be performed when using the machine for the first time after purchase.

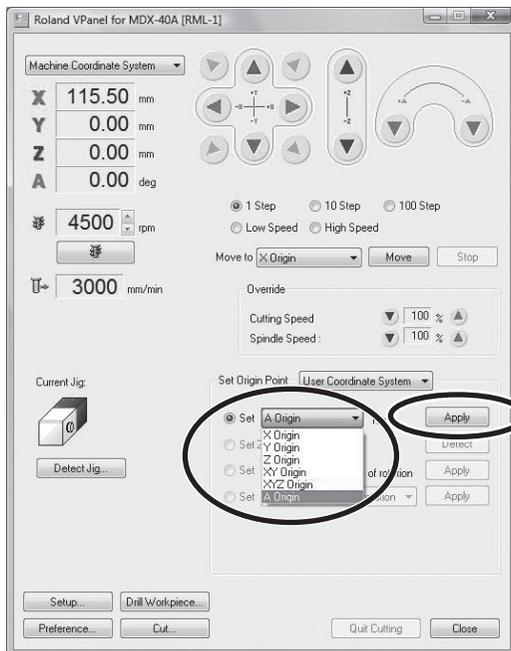
### Procedure

1



**Rotate the A-axis by manual feed so that the vise tightening knob is above the A origin.**

2



**Select “Set [A origin] here” in the VPanel and click [Apply] button.**

The start position of the A origin has now been set.

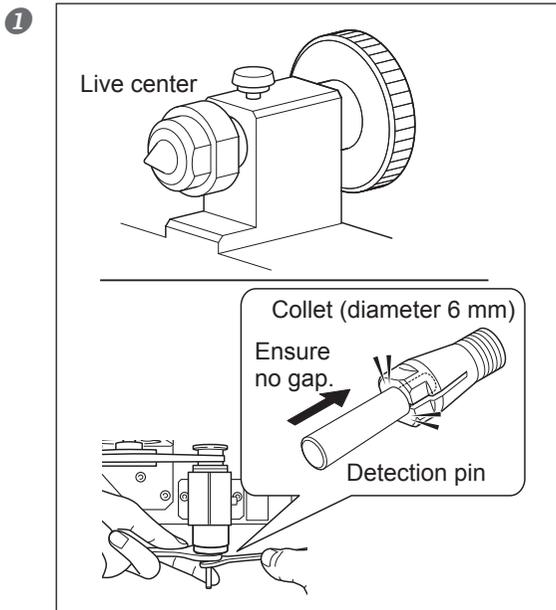
## Detection of the Center of Rotation

- ⚠ WARNING** Never inadvertently touch the operation panel while performing this task.  
Unintended operation of the machine may result in injury.

Detect the center of rotation of the A-axis, and set the Y origin on the axis of the center of rotation.

- This operation must be performed when using the machine for the first time after purchase. Changes in temperature and the like can cause mechanical misalignment. Therefore, it is recommended to perform periodic detection.
- Make sure the detection bar, detection pin, and tool sensor are clean and free of any buildup of cutting waste or the like. Any buildup on these may prevent correct response by the sensor and make correct detection of the jig location impossible. In some cases, such buildup may result in injury or damage.

### Procedure

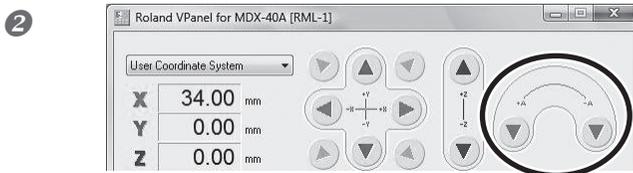


**Open the front cover, and mount the live center on the core support.**

☞ P. 22, "Installing or Detaching the Live Center / Center Drill"

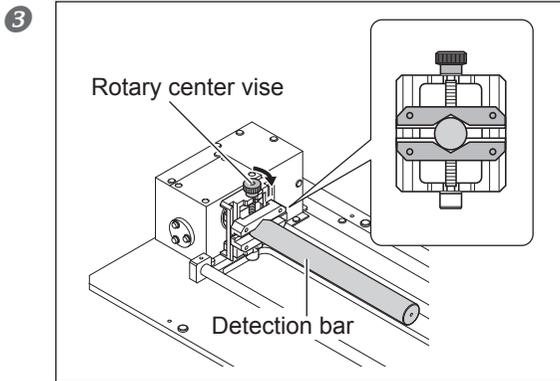
**If the detection pin has not been installed, install the pin.**

Install the detection pin so that the narrower end of the detection pin is against the collet. If the detection pin is protruded excessively, detection operation may fail. The installation method is the same as the cutting tool. Refer to the user's manual of the modeling machine. Also, use the collet with a 6-millimeter (0.236 in) diameter that is included with the modeling machine.



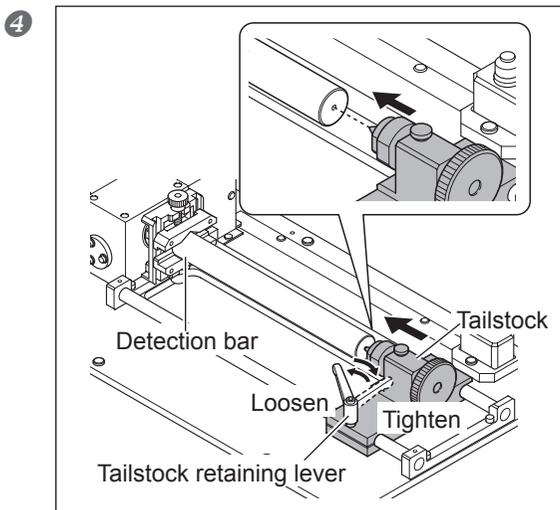
**Move the position of rotary center vise tightening knob by manual feed to the place where an operator can easily touch the knob.**

## 4-1 STEP1: Preparation for Cutting



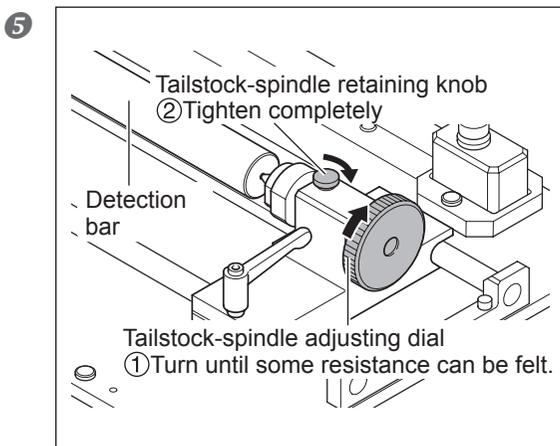
**Install the detection bar to the rotary center vise.**

Install the bar straightly.



**Loosen the tailstock retaining lever, move the tailstock, and make the end of the live center hit against the hole on the center of the detection bar.**

**After bringing it against the hole, tighten the tailstock retaining lever.**



**① Turn the tailstock-spindle adjusting dial towards the arrow direction until some resistance can be felt.**

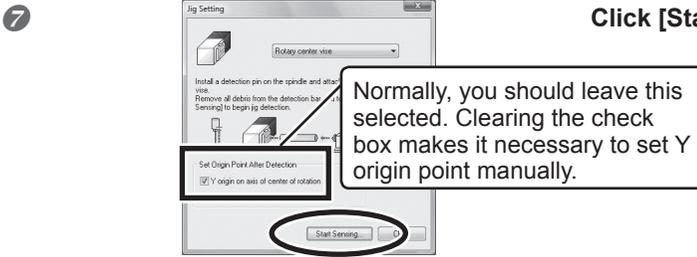
If the handle is turned excessively, the tailstock spindle etc. may deform, which deteriorates the cutting accuracy. Exercise caution.

**② Tighten the tailstock-spindle retaining knob completely.**

Make sure the detection bar is attached securely so that it is loosened even when an operator tries to move it by hand.



6 **Close the front covers, then in VPanel, click [Detect Jig].**  
The "Jig Setting" window appears.



7 **Click [Start Sensing].**



**Make sure no buildup of cutting waste is present on the tool sensor, then click [Continue].**  
Detection of the location of the jig starts.



8 **When the window shown in the figure appears, click [OK].**



**Click [Close].**

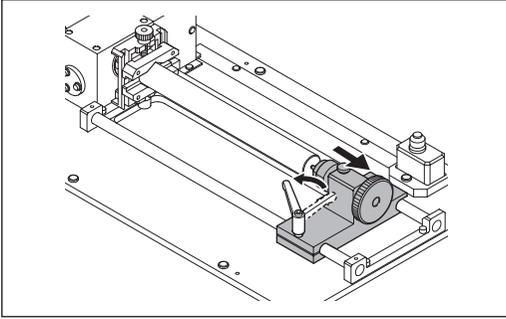


In the illustration for "Current Jig" on the VPanel, a rotary center vise is displayed.

## 4-1 STEP1: Preparation for Cutting

---

9



Open the front cover.  
Turn the tailstock retaining lever  
to move the tailstock.

10

**Detach the detection bar, detection pin and live center.**

Detection of the center of rotation is complete.

## 4-2 STEP2: Selecting Workpiece and Tool

### Types (materials) of workpieces that can be processed in the machine

➤ Resins such as chemical wood and modeling wax

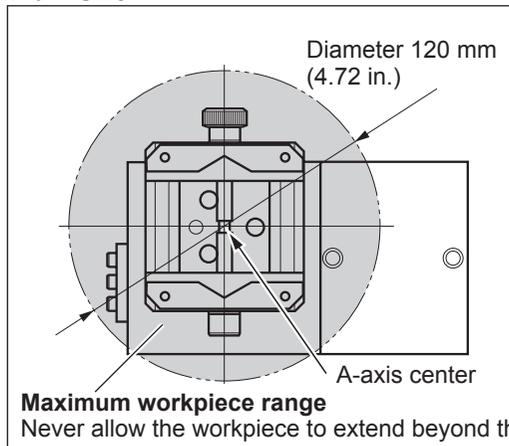
NOTE: Metal not supported

### Loadable Workpiece Size

There is a limitation on the size of the workpiece (the material to cut) that can be mounted on the machine. Exceeding the size may cause damage to the workpiece or a malfunction in the machine.

#### Height and Depth of the Workpiece

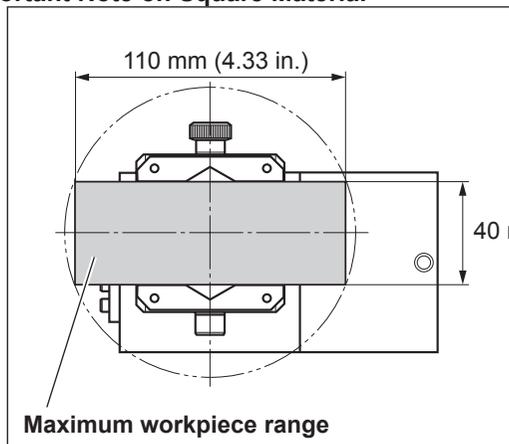
##### Maximum Size



Never exceed the range shown in the figure under any circumstances. Also be careful to note that this may be further restricted by the amount of tool extension.

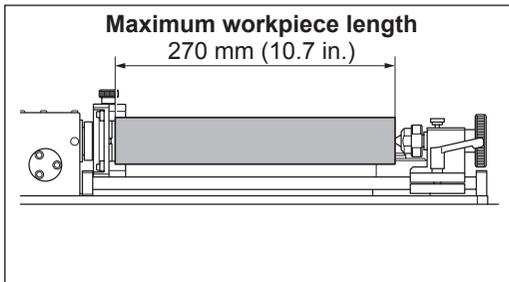
☞ P. 34, "Limitations on Tool Length"

##### Important Note on Square Material



Make sure that the corner of the workpiece does not exceed the maximum workpiece range. For example, when you're using square material whose height is 40 millimeters (1.57 in.), the maximum depth is 110 millimeters (4.33 in.).

### Length of the Workpiece



The length of a workpiece that can be loaded is as indicated left. If an item exceeds this, contact with the live center is impossible.

### Limitations on Tool Length

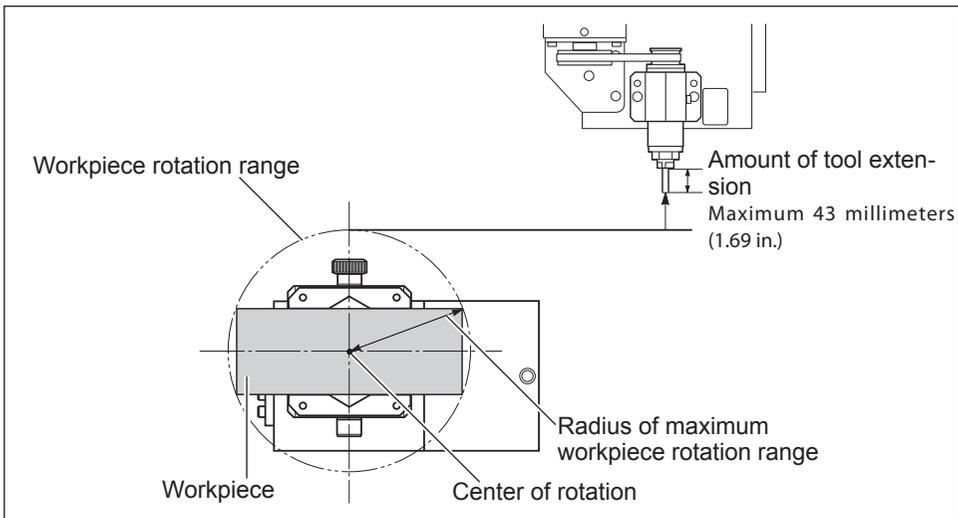
The length of the tool is also subject to restrictions. Exceeding these may cause tool breakage, damage to the workpiece, or malfunction. Be sure to comply with all of the conditions described below. Otherwise, the tool may collide with the workpiece or the tailstock during initialization, damaging the tool or the unit.

#### Limitations Due to Workpiece Size

- Amount of tool extension  $\leq (66 - \text{radius of maximum workpiece rotation range})$  mm  
Make sure that when the tool has been moved to the highest position, the tip of the tool is higher than the rotation range of the workpiece.

#### Maximum Amount of Tool Extension

- 43 mm  
Exceeding the length may cause contact with the tailstock.



## Actual Size That Can Be Cut

Cutting the full size of the workpiece is not necessarily possible. The rotary center vise and the tailstock are located at the two ends of the workpiece. The chucking of the workpiece makes it difficult to cut both ends. Also, the possible cutting-in depth is generally determined by the length of the tool. However, using a lengthy tool to achieve deep cutting reduces allowable size of the workpiece by a corresponding amount. It's also necessary to remember that the workpiece rotates during cutting. Depending on the shape of the workpiece and the angle, ensuring the clearance for the tool may not be possible.

It is also necessary to check the tool path, regardless of the amount of tool extension. Depending on the cutting data and the location of the origin point, collision with the rotary axis unit or the like may occur.

The size of what you can cut varies according to the shape of the object you want to create and the tool you use. Give careful thought to this ahead of time, before you start work.

# 4-3 STEP3: Cutting

## Mount the Workpiece

### **WARNING**

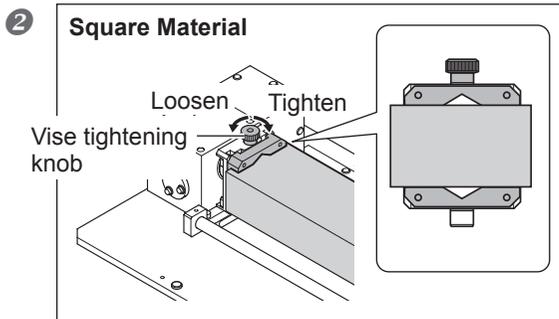
Never inadvertently touch the operation panel while performing this task.

Unintended operation of the machine may result in injury.

## 1. Prepare to secure the workpiece.

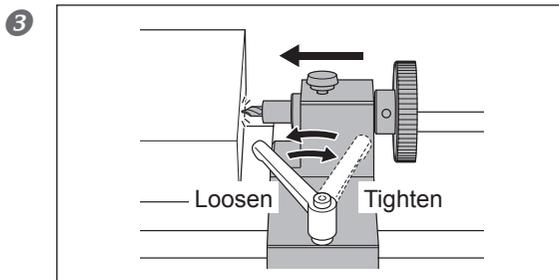
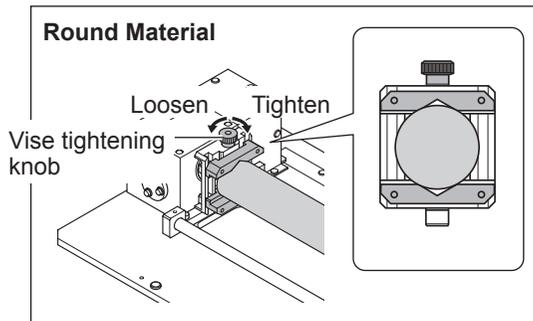
### 1 Open the front cover. Mount the center drill on the tailstock.

☞ P. 22, "Installing or Detaching the Live Center / Center Drill"



### Use the rotary center vise to secure the workpiece in place.

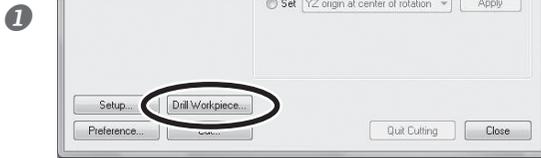
Secure the workpiece (the material to cut) in place firmly, so that it doesn't slip or wobble. Move the position of the vise by manual feed to a position where the vise tightening knob is positioned above to make the operation easier.



### Bring the blade of the center drill against the surface of the workpiece and secure it.

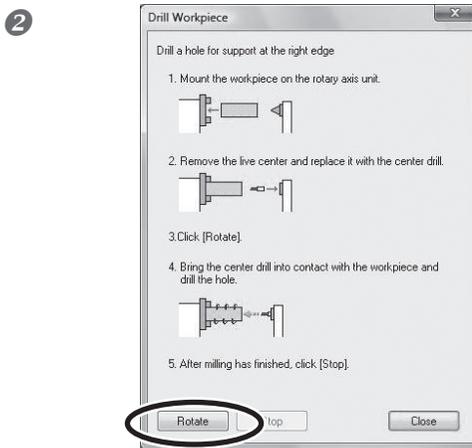
Loosen the tailstock retaining lever and move the tailstock. When the position of the tailstock is determined, tighten the tailstock retaining lever.

## 2. Drill a hole for retaining the workpiece.



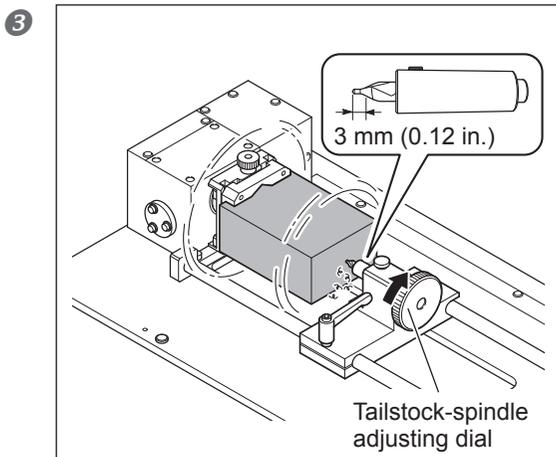
**Click [Drill Workpiece] on the VPanel.**

The "Drill Workpiece" dialog box appears.



**Click [Rotate].**

The rotary axis starts to turn.



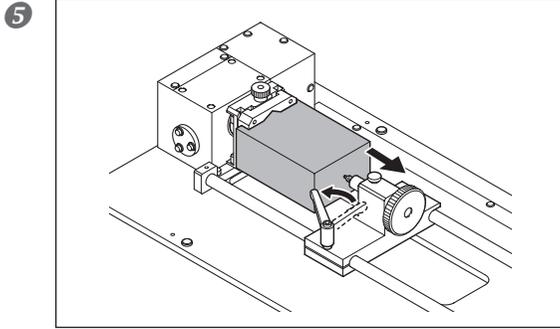
**Turn the tailstock-spindle adjusting dial adjuster slowly to drill the hole by center drill.**

Cut in about 3 millimeters (0.12 in) from the blade tip.



**Click [Stop].**

The rotation stops, then click [Close].



**5** Detach the center drill from the workpiece.

**6** Remove the center drill from the tailstock.

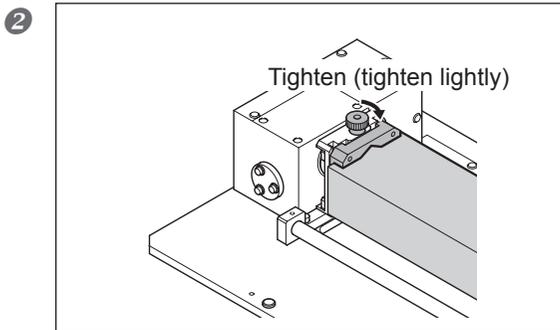
If the workpiece stands in the way, detach the workpiece first, and then remove the center drill.

☞ P. 22, "Installing or Detaching the Live Center / Center Drill"

### 3 Use the live center to secure the workpiece.

**1** Mount the live center on the core support.

☞ P. 22, "Installing or Detaching the Live Center / Center Drill"



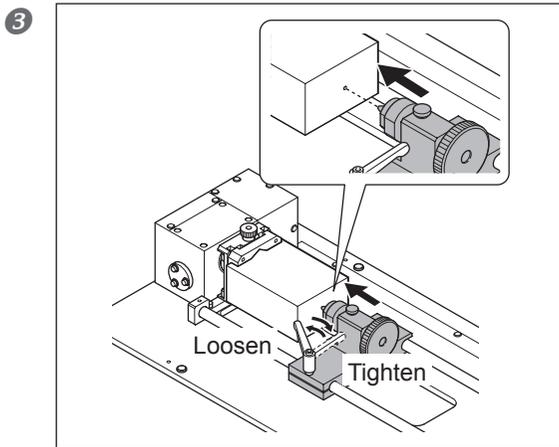
**"When the workpiece is detached."**

**Lightly secure the workpiece with the rotary center vise.**

At this point, loosely tighten so that the workpiece can still be moved manually.

**"When the workpiece is not detached."**

**Proceed to step 3.**

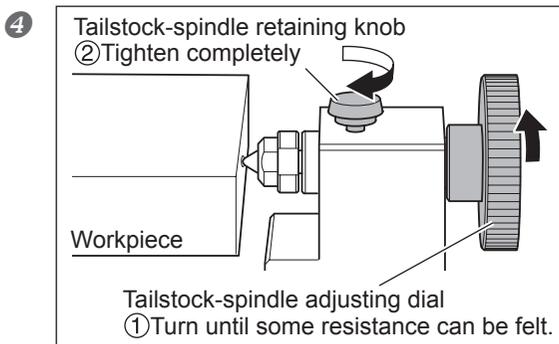


**Bring the tip of the live center against the hole that was made by the center drill, and secure the tailstock.**

Loosen the tailstock retaining lever and move the tailstock. When the position of the tailstock is determined, tighten the tailstock retaining lever.

### Point

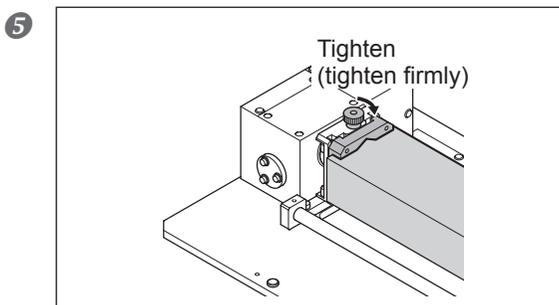
If the workpiece is detached temporarily, the position of the hole made by the center drill and the tip of the live center may not align. If the positions are not aligned, do not use force to align the positions, but adjust the position of the workpiece. If the positions are aligned by force, accuracy may be reduced when processing.



**①Turn the tailstock-spindle adjusting dial towards the arrow direction until some resistance is felt.**

If the handle is turned excessively, the tailstock spindle etc. may deform, which deteriorates the cutting accuracy. Exercise caution.

**②Tighten the tailstock-spindle retaining knob.**



**"When the workpiece is detached."**

**Secure the workpiece firmly.**

Secure the loosely tightened workpiece firmly.

**"When the workpiece is not detached."**

**Proceed to step ⑥.**

- 6 Operate the VPanel to rotate the A-axis and check the status of the workpiece.

**OK: The workpiece and the live center rotate in the same way.**

⇒The workpiece was secured. Proceed to "Set the Z Origin".

**NG: Only the workpiece rotates, but not the live center.**

⇒The workpiece is not secured. Loosen the tailstock-spindle retaining knob once, and next turn the tailstock-spindle adjusting dial. And then tighten the tailstock-spindle retaining knob.

## Set the Z Origin



**WARNING**

**Never inadvertently touch the operation panel while performing this task.**

Unintended operation of the machine may result in injury.



**CAUTION**

**Never needlessly touch the tip of the center drill or the live center.**

Doing so may result in injury.

Detect the length of the tool (protrusion length) and set the Z origin to the center of the rotary axis (the center of A-axis). Not necessary to set for each processing. However, when the tool is replaced or the extension length is changed, be sure to perform this operation.

### Procedure

- 1 Remove the detection pin and install the tool for cutting.

For installation of the tool, refer to the user's manual of the modeling machine.

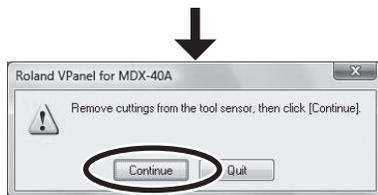
Adjust the amount of tool extension to match the size of the workpiece and the cutting depth.

Depending on the amount of tool extension, the tool may encounter interference with the rotary axis unit or the workpiece. Exercise caution.

☞ P. 34, "Limitations on Tool Length"

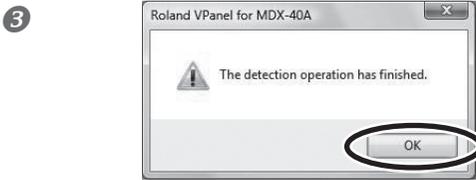


**Select the [Set the position of "Z origin" to the center of rotary axis] on the VPanel and click [Apply] button.**

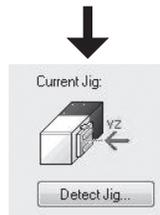


**Make sure no buildup of cutting waste is present on the tool sensor, then click [Continue].**

The tool moves and descends to the position where it touches the tool sensor.



When the window shown in the figure appears, click [OK].



The Z origin (and Y origin) has been set at the center of rotary axis (the location shown by the red arrow at the illustration of the rotary center vise on the VPanel). The Z origin has now been set.

## Set the X Origin

### **⚠ WARNING**

**Never inadvertently touch the operation panel while performing this task.**

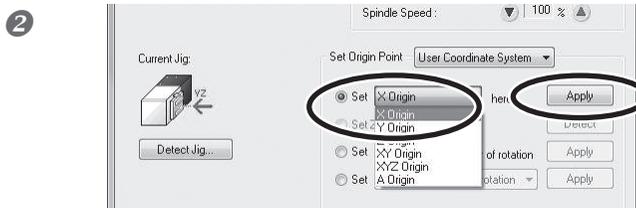
Unintended operation of the machine may result in injury.

Set the X origin based on the corresponding cutting data. The X origin differs according to the cutting data. Therefore, decide the origin based on the corresponding data.

### Procedure

- 1 **Move the end of the tool to the position where an operator wants to set the X origin.**

Set the X origin so that neither the tool nor the spindle strikes the rotary center vise during cutting.

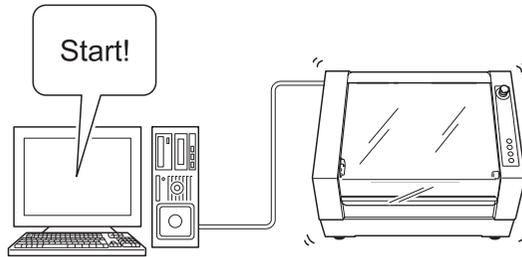


Select [Set “X origin” here] in the VPanel and click [Apply] button.

The X origin has now been set.

## Start Cutting

Confirm that all the preparations and origin setting (each operation described in P. 26 to 42) that are necessary for cutting are completed. Send the cutting data from the computer and start cutting.



NOTE: For information about creating cutting data, refer to the documentation for the program you're using to create the data.

## Recovery of Operation from Emergency Stop or Emergency Shutdown

If an emergency stop or an emergency shutdown occurs during cutting, remove the tool and the workpiece from the machine. When the operation resumes, initialization is performed on the modeling machine. At this time, the tool and the workpiece may collide depending on the position in which the tool and workpiece stopped, which can cause damage to the machine while restarting. Refer to the contents displayed in the error message of the VPanel or the user's manual of the modeling machine to find the details of how to resume the operation.

# ***Chapter 5***

## ***Appendix***

---

This section explains about the Y and Z Origins, how to maintenance, FAQ, and the machine specifications.

5-1 Y and Z Origins: Concepts and Fine-tuning.....	44
Y and Z Origins: Concepts and Making the Settings.....	44
Fine-tuning the Y and Z Origin Points .....	44
How to Obtain the “displacement amount” of the Y- and Z-axis Coordinates .....	46
5-2 Daily Care .....	48
Cleaning .....	48
Care of the Detection Pin .....	49
Replacing the Center Drill.....	49
5-3 What to Do If.....	50
5-4 NC Code Specifications.....	52
Items Related to the Mechanical Specifications .....	52
A-axis Movement Commands and Actual Operation.....	52
5-5 Unit Specifications .....	53
Dimensional Drawings.....	53
Main Specifications.....	56

# 5-1 Y and Z Origins: Concepts and Fine-tuning

## Y and Z Origins: Concepts and Making the Settings

When cutting with the rotary axis, it is common to set the Y- and Z-axis coordinates to the center of A-axis (center of the rotary axis). This is because rotating the A-axis changes the positional relationship between the workpiece and the origin points, making it impossible to know the reference position for cutting.

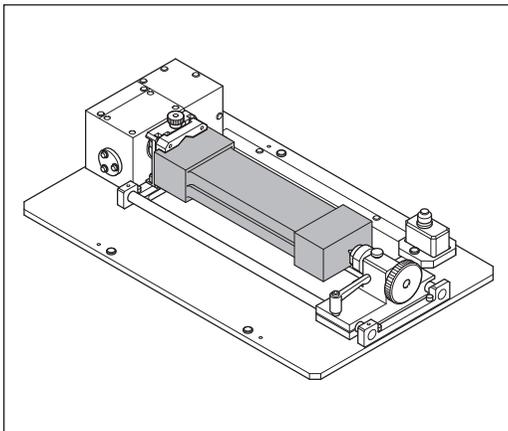
On this machine, during detection of the jig (rotary center vise) location, the center of the A-axis is detected. The machine is also designed to set the respective origin points for the Y-, and Z-axes at the detected center of the A-axis. Therefore, Y and Z origin can be set to the center of A-axis by setting according to the steps described in "4-3 STEP3: Cutting" in Chapter 4 of this document.

## Fine-tuning the Y and Z Origin Points

To adjust more precisely the position of the A-axis center obtained through "detection of the center of rotation" (p. 29) = Y and Z origin, refer to the method described below.

### Procedure

1

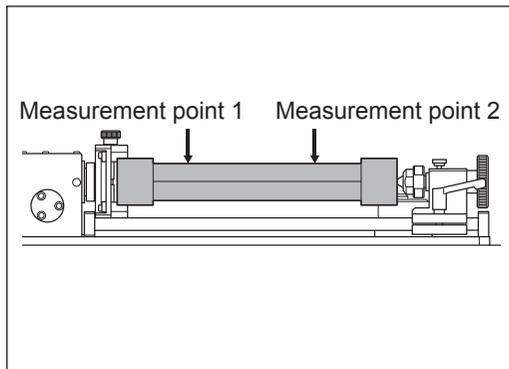


**Perform two-surface cutting of rectangular solid workpiece.**

The cut object to be created is for the purpose of checking how much the Y-axis and Z-axis coordinates are displaced. Instead of using a workpiece with a complicated shape, it is better to use a workpiece with a simple shape, with which cutting can be started from both the upper and lower surfaces as the diagram on the left shows.

After cutting is completed, do not detach the workpiece from the rotary center vise.

2



**As the diagram on the left shows, determine two arbitrary measurement points on the same surface of the workpiece and make a mark.**

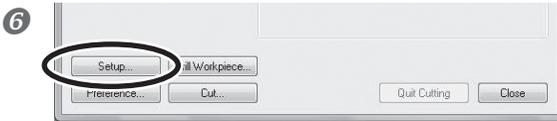


**3** Set the coordinate system to “Machine Coordinate System.”

**4** Move the tool to the position above the Measurement Point 1 and record the value of X-axis coordinate.

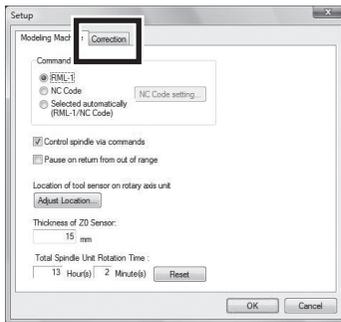
Move the tool to the position above the Measurement Point 2 and record the value of the X-axis coordinate.

**5** Detach the workpiece.

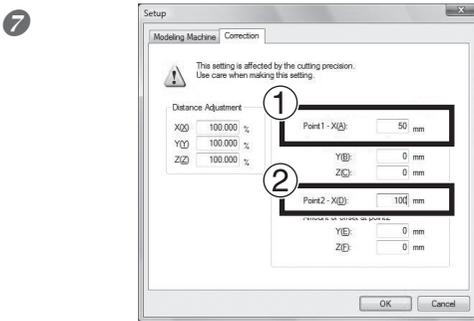


**6** Click [Setup] button on the VPanel.

The operation setting screen appears.



Click the “Correction” tab.



**7** Enter the X-axis coordinate at Measurement 1 and 2, which were recorded at step 4.

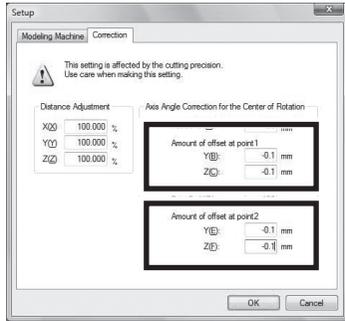
① Measurement point 1 ⇒ “Point1 – X(A)”

② Measurement point 2 ⇒ “Point2 – X(D)”

**8** Measure how much the Y-axis and Z-axis coordinates are displaced at Measurement Point 1, and 2, which were marked at step 2.

Refer to “How to obtain the “displacement amount” of Y- and Z-axis coordinates” on p. 46 to find the detailed method of measuring the displacement amount.

9

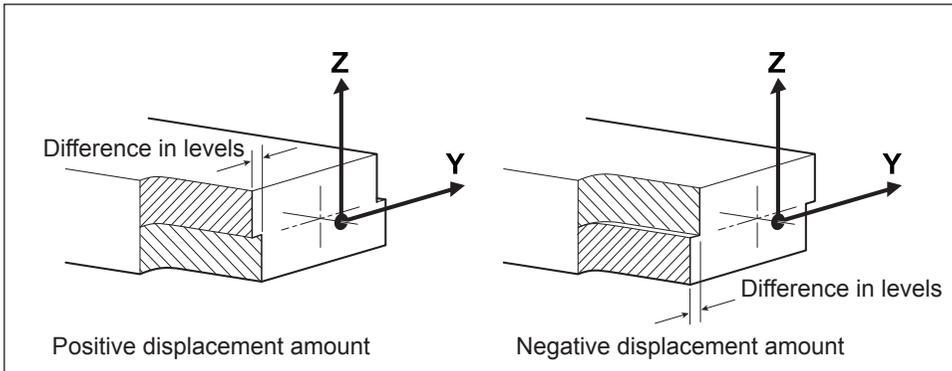


Enter the displacement amount of Y- and Z-axis coordinates at Measurement Point 1 and 2.

### How to Obtain the “displacement amount” of the Y- and Z-axis Coordinates

#### Displacement amount for the Y Origin

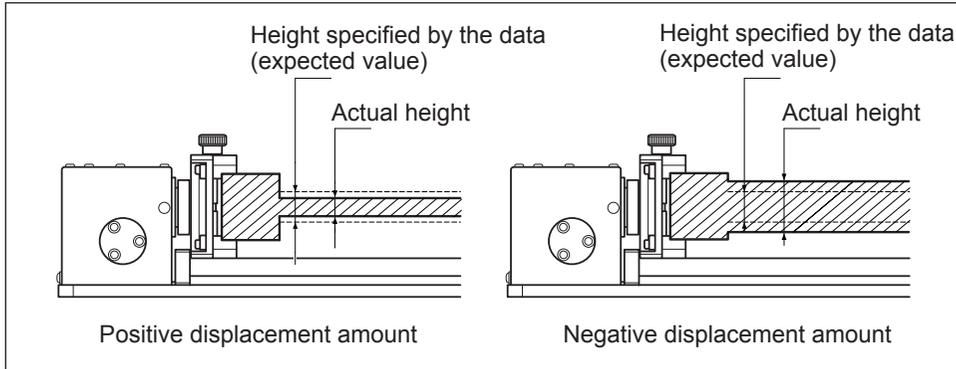
You determine the displacement amount from the difference in levels at the seam produced between the first and second surfaces in two-surface cutting. The estimated displacement amount is one-half the difference in levels. However, be careful to note the sign of the value (plus or minus). As the figure shows, the sign of the displacement amount (positive or negative) changes depending on the direction of the misalignment. As an example, when the difference in levels is 0.2 millimeters, with the upper level misaligned in the positive direction and the lower level misaligned in the negative direction along the Y axis, then the estimated displacement amount is -0.1 millimeters.



**Displacement amount for the Z Origin**

You determine the displacement amount from the discrepancy between the height specified by the data and actual values for the thickness of the finished result of two-surface cutting. The estimated displacement amount is one-half the discrepancy. However, be careful to note the sign of the value (plus or minus). When the actual value is larger than the height specified by the data value, the displacement amount is negative.

As an example, if data for a height of 50 millimeters yields cutting results that are 50.1 millimeters, the estimated displacement amount is -0.05 millimeters.



## 5-2 Daily Care

### Cleaning

 **WARNING**

**Never use a pneumatic blower.**

This machine is not compatible with a pneumatic blower. Cutting waste may get inside the machine and cause fire or electrical shock.

 **WARNING**

**Never use a solvent such as gasoline, alcohol, or thinner to perform cleaning.**

Doing so may cause fire.

 **WARNING**

**Disconnect the power cord before performing cleaning or maintenance.**

Attempting such operations while the machine is connected to a power source may result in injury or electrical shock.

 **WARNING**

**When using a vacuum cleaner to take up cutting waste, exercise caution to prevent fire or dust explosion.**

Taking up fine cuttings using an ordinary vacuum cleaner may cause danger of fire or explosion. Check with the manufacturer of the vacuum cleaner. When the safety of use cannot be determined, clean using a brush or the like, without using the vacuum cleaner.

 **CAUTION**

**Caution: high temperatures.**

The cutting tool and spindle motor become hot. Exercise caution to avoid fire or burns.

 **CAUTION**

**When performing maintenance, be sure to keep the tool detached.**

Contact with the blade may cause injury.

- This machine is a precision device. Carry out daily care and maintenance.
- Carefully clean away cutting waste. Operating the machine with a large amount of cutting waste present may cause malfunction.
- Never apply silicone substances (oil, grease, spray, etc.) to the machine. Doing so may cause poor switch contact.
- Never apply lubrication.

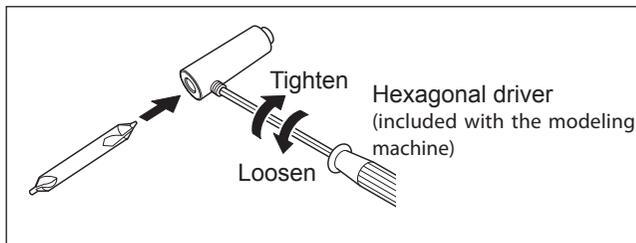
## Care of the Detection Pin

Carry out daily care for the detection pin. The presence of rust or grime on the detection pin makes accurate detection impossible, which in turn may make it impossible to perform cutting as intended, and may even damage the machine.

### Care, Maintenance, and Storage Methods

- After use, wipe clean using a clean cloth, apply rust-preventive oil generously, and store.
- When the item will be out of use for a prolonged period, store in a location with low humidity and little fluctuation in temperature.

## Replacing the Center Drill



The center drill is fitted with a bit at each end. When the one in use becomes worn, reverse the orientation and reinstall. When both ends become worn, then replace.

## 5-3 What to Do If...

### The Machine Doesn't Run.

#### Is the rotary axis unit connected to the modeling machine?

Make sure that the cable of the rotary axis unit is connected to the modeling machine. Also, make the cable connection while the power is switched off. Otherwise the unit may not be detected.

☞ P. 17, "Cable Connection"

### The Cutting Location is Not As Intended.

#### Are the Y and Z origins set correctly?

It is most common to align the Y and Z origins with the center of the A-axis, although this may vary according to the cutting method. Follow the procedure to set the Y and Z origins.

☞ P. 29, "Detection of the center of rotation," p. 40, "Set the Z Origin"

### In Multiple-surface Cutting, Differences in Levels Occur at Seams.

#### Are the Y and Z origins misaligned?

In multiple-surface cutting, the Y and Z origins are set at the center of the A-axis, but mechanical misalignment may occur due to changes in temperature or the like. This misalignment can cause differences in levels. To maintain accuracy, we recommend periodically setting the origins. In addition, fine-tuning is possible manually.

☞ P. 29, "Detection of the center of rotation," p. 40, "Set the Z Origin," p. 44, "Y and Z Origins: Concepts and Fine-tuning"

### Responding to an Error Message

**This section describes the error messages that may appear on the monitor of the computer you're using, and how to take action to remedy the problem. This section describes the messages added by installing the unit. For other messages, see the documentation for the modeling machine.**

**If the action described here does not correct the problem, or if an error message**

**not described here appears, contact your authorized Roland DG Corp. dealer.**

#### The detection operation can not be started.

As for the operation that uses the tool sensor, which utilizes flow of electricity, the detection operation could not be initiated because of factors blocking the flow of electricity occurred. The following are possible factors that could have occurred. Eliminate these factors, and then retry the operation from the beginning.

➤ The machine is not installed properly.

If the cap screw for installation touches the table of the machine, an unintended flow of electricity is created. Make sure that the machine is installed securely.

☞ P. 15 "Installing the Rotary Axis Unit"

➤ Tools are dropped around the table of the machine.

If there are tools and other objects around the table, which are conductive, an unintended flow of electricity is caused.

#### The detection operation was failed.

As for the operation that uses the tool sensor, which utilizes flow of electricity, the detection operation failed because of factors blocking the flow of electricity occurred. The following are possible factors that could have occurred. Eliminate these factors, and then retry the operation from the beginning.

➤ The protrusion amount of the detection pin is too large.

Bring the narrower end of the detection pin against the collet.

☞ P. 26, "Correction of tool sensor position," p. 29, "Detection of the center of rotation"

➤ Detection bar, detection pin, tool sensor, and cutting tool are not clean due to cutting waste etc.

If these parts are not free of dust, the sensor does not respond correctly.

If detection still fails even after the above factors are eliminated, mechanical failures such as cable disconnection are considered to be possible causes. In such cases, contact your authorized Roland DG Corp. dealer.

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**The MDX-40A has performed an emergency stop. A-Limit switch not found.**

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The initialization failed because the operation of rotary axis was impeded. The following are possible factors that could have occurred. Turn the power off first, eliminate these factors and retry the operation from the beginning.

- Too much cutting waste.
- The size of workpiece is too big.

If the message persists even after redoing the operation from the beginning, contact your authorized Roland DG Corp. dealer.

## 5-4 NC Code Specifications

### Items Related to the Mechanical Specifications

This section describes the NC codes that are dependent on the machine's mechanical specifications.

☞ "NC Code Reference Manual"

#### Dimension word (A)

Dimension word A becomes available when this unit is installed. Specifying all four (X, Y, Z, and A) in a single block is possible (simultaneous four-axes feed).

#### A-axis coordinate range (a)

The range for parameter a is as follows. Parameter a is used for positioning (G00), linear interpolation (G01), data setting (G10), and the coordinate system (G92). The unit of measurement for angles is 0.001 degrees when no decimal point is used, or degrees when a decimal point is present.

Parameter: a

Acceptable range: -99999.999 to 99999.999

Effective range: Maximum cutting area

#### A-axis feed rate (F)

The valid parameter range for F is 7 to 3,000 mm/min (0.28 to 118 in./min), regardless of whether the A-axis is present. Note that the feed rate for the A-axis is also specified as millimeters (or inches) per minute. The actual speed of rotation is determined by the specified F code and the tool position, but cannot exceed the unit's operating speed (11.79 rpm).

### A-axis Movement Commands and Actual Operation

The operating range of the A-axis is approximately  $\pm 99999.999$  degree. Angles of 360 degrees or higher are recognized during execution of a single NC program. For instance, executing an absolute specification of G01A720.0 performs two full rotations. Also, executing G01A0.0 performs rotation of two turns in reverse. Note, however, that the coordinate view in VPanel and on the handy panel is from 0 to 359.99 degrees. The display of any angle of 360 degrees or higher is truncated.

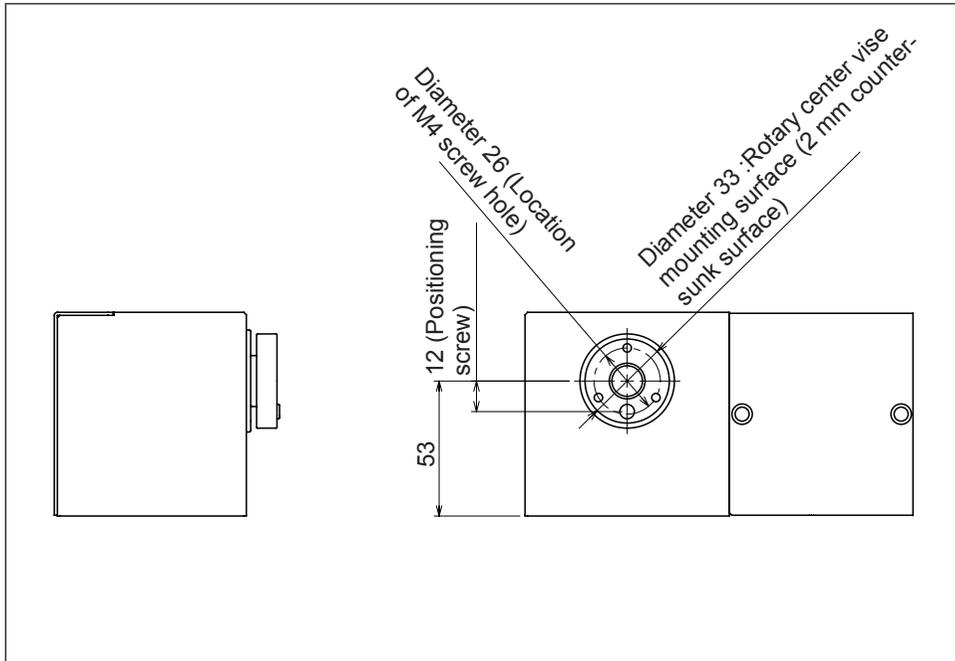
An angle of 360 degrees or higher is truncated when execution of an NC program has ended or during standby (that is, when performing manual feed). For example, if an NC program ends at an A-axis coordinate of 750 degrees and manual feed for movement to an A-axis coordinate of 0 degrees is then performed, the result is a return not by 750 degrees, but by 30 degrees.

# 5-5 Unit Specifications

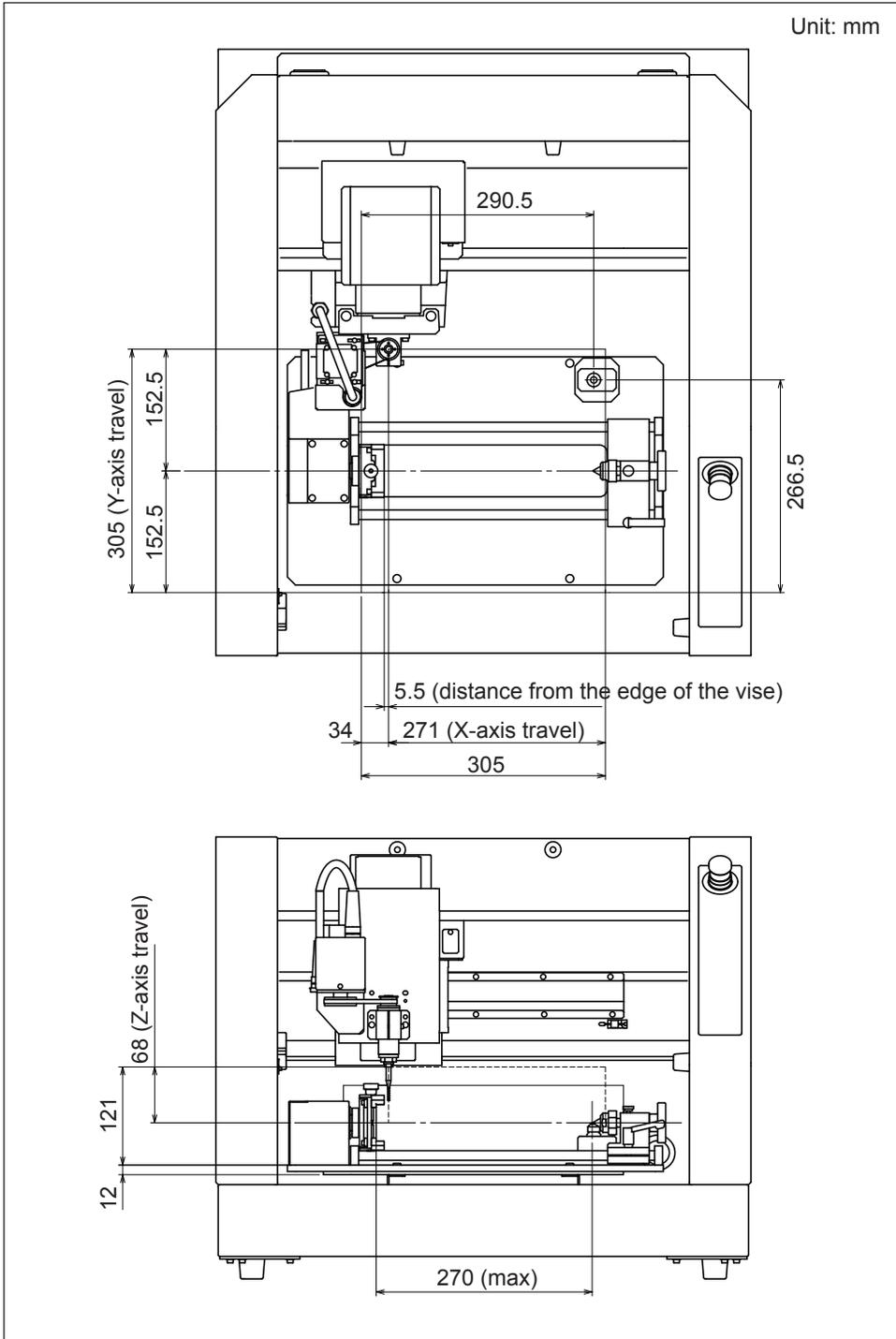
## Dimensional Drawings

Unit: mm

### Rotary Axis



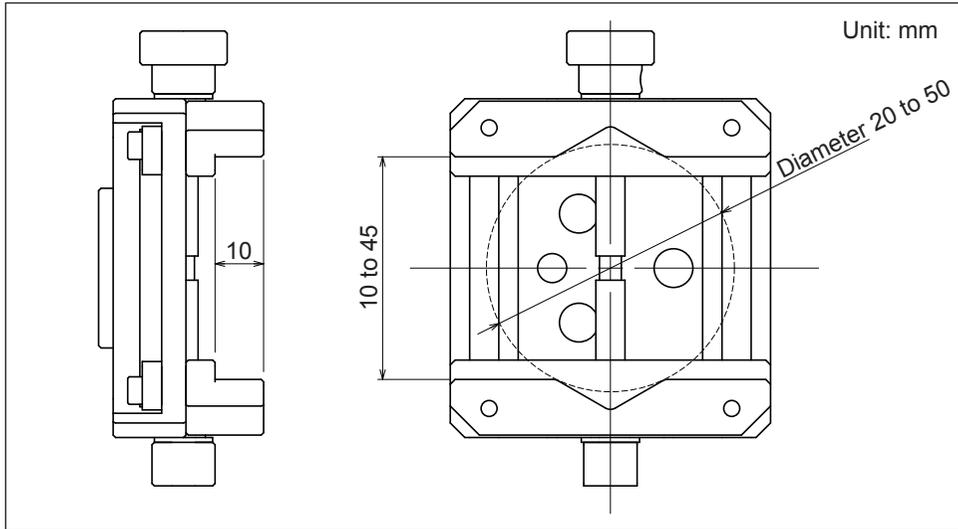
When mounted to MDX-40A



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**Size of Rotary Center Vise**

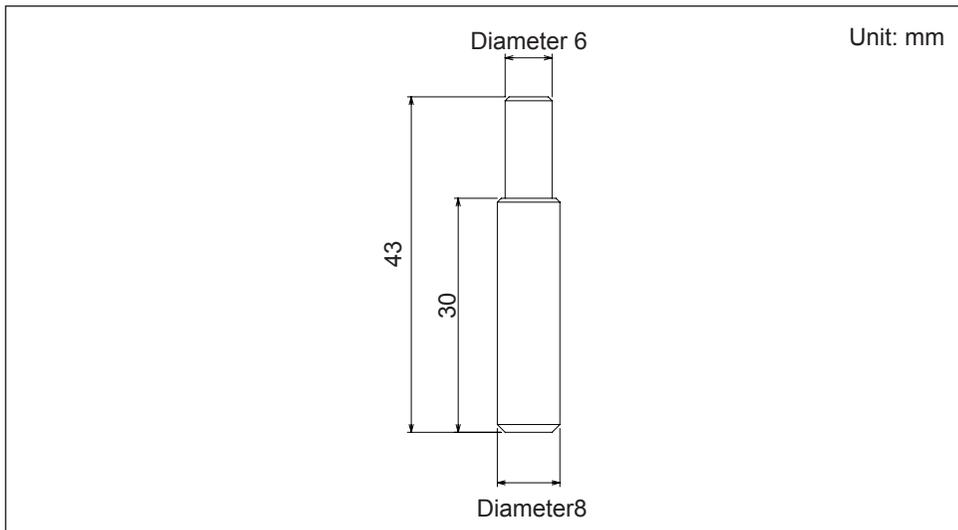
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**Size of Detection Pin**

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## Main Specifications

	<b>ZCL-40A</b>
<b>Cuttable material</b>	Resins such as chemical wood and modeling wax (metal not supported)
<b>Maximum angle of rotation</b>	$\pm 99999.999^\circ$
<b>Loadable workpiece size</b>	Items within the range of a 60 mm (2.36 in.) radius from the center of the rotary axis by long 270 mm (10.7 in.) The actual cuttable range is smaller than this.
<b>Workpiece size holdable by rotary center vise</b>	Thickness: 10 to 45 mm Diameter: 20 to 50 mm
<b>Loadable workpiece weight</b>	1 kg (including weight of jig)
<b>Feed rate</b>	Maximum 11.79 rpm
<b>Software resolution</b>	0.001 °
<b>Mechanical resolution</b>	0.005625°/ step (micro-step control)
<b>Dimensions</b>	Width x depth x height: 470 x 286 x 115 mm (18.5 x 11.3 x 4.53 in.)
<b>Weight</b>	7.5 kg
<b>Included items</b>	Detection bar, detection pin, center drill, live center, cap screws, rubber cap, user's manual (this document)

When this unit is installed, the X-, Y-, and Z-axis travel path of the MDX-40A (or MDX-40 with the up-graded version of firmware) are as follows.

- X, Y, Z: 271 x 305 x 68 (mm)





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