JANOME DESKTOP ROBOT

JR2000N Series

Operation Manual

PCB Cutting Applications

Thank you for purchasing a Janome Robot.

- **Read this manual thoroughly in order to ensure proper use of this robot. Be sure to read "For Your Safety" before you use the robot. The information will help you protect yourself and others from possible dangers during operation.**
- **After reading this manual, keep it in a handy place so that you or the operator can refer to it whenever necessary.**
- **This manual is written according to IEC 62079.**

JANOME

PREFACE

The Janome Desktop Robot JR2000N Series is a new low-cost, high-performance robot. We have succeeded in reducing the price while maintaining functionality. Energy- and space-saving qualities have been made possible through the combined use of stepping motors and special micro step driving circuits.

This manual describes printed circuit board cutting applications of the JR2000N Series. Refer also to the following individual manuals during actual operation of this robot.

Setup	Explains how to set up the robot. **Be sure to read this manual before you operate the robot.**
Maintenance	Explains maintenance procedures for the robot.
Basic Instructions	Provides part names, data structures, and the basic knowledge necessary to operate the robot. **Be sure to read this manual before you operate the robot.**
Quick Start	Explains the actual operation of the robot with simple running samples.
Teaching Pendant Operation	Explains how to operate the robot via the teaching pendant.
PC Operation	Explains how to operate the robot from a computer (using the JR C-Points software.)
Features I	Explains point teaching.
Features II	Explains commands, variables, and functions.
Features III	Explains features such as run mode parameters, sequencer programs, etc.
Features IV	Explains features in the Customizing mode.
External Control I (I/O-SYS)	Explains the I/O-SYS control.
External Control II (COM Communication)	Explains the COM communication control system (COM1 – COM3).
Camera & Sensor Features	Explains the camera & sensor features using the camera and the Z sensor.
Specifications	Provides comprehensive specifications, including mechanical or electrical requirements.
PCB Cutting Applications	This book

Please be sure to follow the instructions described in these manuals. Proper use of the robot will ensure continued functionality and high performance.

BE SURE TO PROPERLY GROUND THE ROBOT WHEN INSTALLING.

Be sure to save data whenever it is added or modified. **Otherwise, changes will not be saved if the power to the robot is cut off.**

The following marks used in the operation manuals indicate:

TP : Teaching pendant operation

PC : PC (JR C-Points software) operation

Response to EC Directive

Janome certifies that the Janome robots comply with EMC, LVD, and MD of CE. However, you are requested to conduct compliance test of the whole equipment including the robot to obtain CE approval.

CONTENTS

PCB Cutting Applications

PREFACE i
CONTENTS iii
FOR YOUR SAFETY v

PACKAGE CONTENTS LIST 1

INSTALLATION 6
Model JR2203NERT 6
Models JR2303NERT and JR2403NERT 19

EXTERNAL DIMENSIONS 30
Model JR2203NERT 30
Model JR2303NERT 31
Model JR2403NERT 32
Filter Dust Collector 33
Nozzle Base 33

PRECAUTIONS FOR OPERAITNG THE PCB CUTTING APPLICATIONS MODELS: PART 1 34

I/O FUNCTIONS 35
Switching I/O Types 35
I/O-SYS Function Assignments A (I/O-A) 36
I/O-1 Function Assignment A (I/O-A) 43

TIMING CHART 44

PRECAUTIONS FOR OPERAITNG THE PCB CUTTING APPLICATIONS MODELS: PART 2 47

TEACHING DATA 49
How to Confirm the Application Version Number 49
Point Types 49
Board Cut Condition (Program Data) 52
Job and Sequencer on Run Mode 53

PRECAUTIONS FOR OPERATION 55

TEACHING 57
Program and Points 57
Straight Cutting 58
Zigzag Cutting 59
Arch Cutting 60
Board Cut Condition 61
Z-Axis Position Adjustment for Checking the Point Position 62

TEACHING PENDANT OPERATION 63
How to Control the Spindle Motor, Vacuum, and Air Flow Manually 63

REQUIRED ACTION UPON A SPINDLE ERROR 64

MAINTENANCE 65
How to Replace the Cutter 66
How to Clean and Replace the Vacuum Nozzle 67
How to Replace the Nozzle Base Bulkhead (Protrector) 68
How to Replace the Spindle Motor 69
How to Replace the Spindle Motor Bearing 71
How to Replace the Ejector 72
How to Replace the Dust Collector Filter 73
If the PCB Cutting Applications C & T Data Is Deleted 75
How to Update Customizing Data for the PCB Cutting Applications 77

SPECIFICATIONS 78

FOR YOUR SAFETY

Safety Precautions

The precautions in this manual are provided for the customer to make the best use of this product safely, and to provide preventive measures against injury to the customer or damage to property.

・・・・・Be sure to follow the instructions・・・・・

Various symbols are used in this manual. Please read the following explanations of each symbol.

- **Symbols Indicating the Degree of Damage or Danger**

  The following symbols indicate the degree of damage or danger which may be incurred if the safety notes are ignored.

Warning	The Warning symbol indicates the possibility of death or serious injury.
Caution	The Caution symbol indicates the possibility of accidental injury or damage to property.

- **Symbols Indicating Details of Danger and Preventive Measures**

  The following symbols indicate the type of safety measure that should be taken:

	Indicates the safety measures that should be taken.
	Be careful. (General caution)
	Indicates a forbidden action.
	Never do this. (General prohibition)
	Do not disassemble, modify, or attempt to repair.
	Do not touch. (Contact prohibition)
	Indicates a necessary action.
	Be sure to follow instructions.
	Be sure to unplug power cord from wall outlet.
	Be sure to check that the machine is grounded.

FOR YOUR SAFETY

⚠ Warning

Do not use the unit where flammable or corrosive gas is present.
Leaked gas accumulated around the unit can cause fire or an explosion.

Use the unit in an environment between 0 and 40 degrees centigrade with a humidity level of 20 to 95 percent and without condensation.
Use outside these conditions may result in unit malfunction.
IP Protection Rating: IP30 (IP40 for CE specification models)

Use the unit in an environment where no electrical noise is present.
Failure to do so may result in unit malfunction or breakdown.

Use the unit in an environment that is not exposed to direct sunlight.
Direct sunlight may cause unit malfunction or breakdown.

Install the unit in a place appropriate for its weight and conditions while running.
Placing the unit on a surface that is unstable, or not strong enough to support its weight may cause the unit to fall, overturn, or break down. This could result in operator injury. Be sure to leave a space of at least 30cm between the back of the robot (equipped with a cooling fan) and the wall. Insufficient space can lead to overheating or fire.

Power the unit only with the rated voltage.
Failure to do so may cause electric shock, fire, or unit malfunction.

If the unit is equipped with the I/O-S, install an area sensor or a safety barrier of adequate strength.
Otherwise, a person entering anywhere within the robot's operating range may be injured.

Plug the power cable into the wall outlet firmly.
Failure to do so may cause the plug to heat up and may result in fire.

Wipe the power plug with a clean, dry cloth periodically to eliminate dust.
Dust accumulation can deteriorate the electrical insulation and cause fire.

FOR YOUR SAFETY

⚠ Warning

Be sure to check grounding before you use the unit.
Improper grounding can cause electric shock or fire.

Be sure to use the unit within the voltage range indicated.
Failure to do so may cause fire or unit malfunction.

Do not allow water or oil to come in contact with the unit or the power cable.
Contact with water or oil can cause electric shock, fire, or unit malfunction.
IP Protection Rating: IP30 (IP40 for CE specification model)

Be sure to confirm that tools such as the electric screwdriver unit are properly connected.
Failure to do so may result in injury or breakdown.

Check the mounting screws regularly so that they are always firmly tightened.
Loose screws may cause injury or breakdown.

Be sure to check the wiring to the main unit.
Improper wiring may result in unit malfunction or breakdown.

Be sure to secure the movable parts of the unit before transportation.
Failure to do so may result in injury or breakdown.

Do not bump or jar the unit while it is being transported or installed.
Doing so can cause breakdown.

Before operating the unit, be sure to check that there is no danger in or around the operating range.
Failure to do so may result in injury.

FOR YOUR SAFETY

⚠ Warning

Do not attempt to disassemble or modify the unit.
Disassembly or modification may cause electric shocks or unit malfunction.

When lubricating or inspecting the unit, unplug the power cable from the power outlet.
Failure to do so may result in electric shock or injury.

If anything unusual occurs (e.g. a burning smell or unusual sound), stop operation and unplug the cable immediately. Contact the dealer from whom you purchased the robot or the office listed on the last page of this manual.
Continuous use without repair can cause electric shock, fire, or unit breakdown.

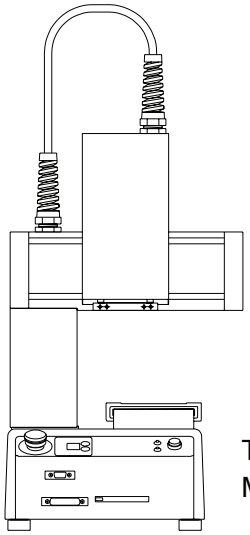
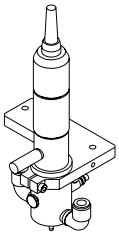
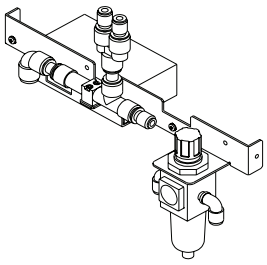
Be sure to unplug the power cable from the power outlet when the unit is not in use for long periods of time.
Dust accumulation can cause fire.

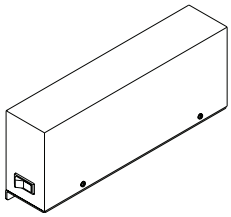
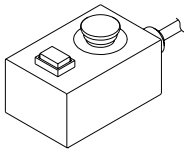
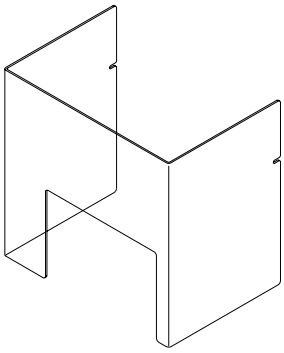
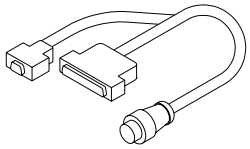
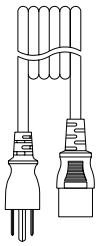
Be sure to turn off the unit before inserting or removing cables such as the teaching pendant cable.
Failure to do so may result in electric shock, fire, data loss, or unit malfunction.

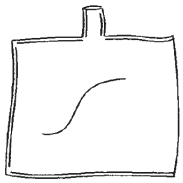
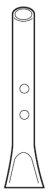
Keep the emergency stop switch within reach of an operator while teaching or running the robot.
Failure to do so may be dangerous since it may not be possible to stop the robot immediately and safely.

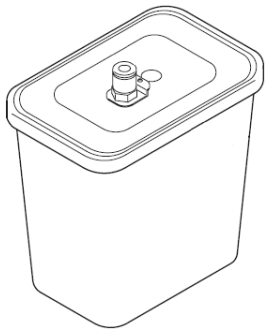
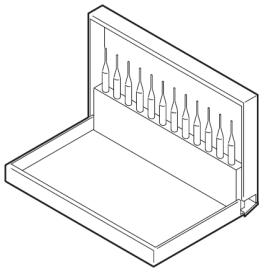
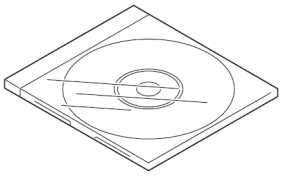
Regularly check that the emergency stop switch works properly.
For models with I/O-S circuits, also check that they work properly.
Failure to do so may be dangerous since it may not be possible to stop the robot immediately and safely.

PACKAGE CONTENTS LIST

Item illustration	Name	Quantity	
		JR2203NERT	JR2303NERT JR2403NERT
 This illustration shows Model JR2203NERT.	Robot (Body)	1	1
	Spindle motor	1	Assembled on the robot
	Filter regulator	1	Assembled on the robot
	Slotted/Phillips bind head screw (M4)	Assembled on the robot	2
	Hexagonal socket bolt (M5) (Socket size across the flats: 5mm)	2	Assembled on the robot

Item illustration	Name	Quantity	
		JR2203NERT	JR2303NERT JR2403NERT
	Unit box	1	1
	Switch box	1	1
	Safety cover	1	1
	I/O cable	1	1
	Power cable	1	1
	Thumbscrew	2	2
	Nylon clip	Nil	3

Item illustration	Name	Quantity	
		JR2203NERT	JR2303NERT JR2403NERT
	Binder (for the air tube)	6	1
	Grounding cable	1	1
	Air tube ϕ12mm (incl. the grounding wire) ϕ6mm ϕ4mm	1 each	1 each (ϕ4mm tube is assembled on the robot)
	Air tube ϕ6mm ϕ8mm	2 each	Assembled on the robot
	Dust collector filter	3	3
	Binder (for the dust collector filter)	3	3
	Diffusion nozzle	1	1

Item illustration	Name	Quantity	
		JR2203NERT	JR2303NERT JR2403NERT
	Filter dust collector	1	1
	(10pc) Cutter set	1	1
	Vacuum nozzle (Spare)	1	1
	Operation manual CD-ROM (See the next page for details)	1	1

Contents of the Operation Manual CD-ROM

File Name	Contents
963807111 Setup.pdf	Operation manual
963818104 Maintenance.pdf	Operation manual
963800103 Basic Instructions.pdf	Operation manual
963801104 Quick Start.pdf	Operation manual
963808101 Teaching Pendant Operation.pdf	Operation manual
963806109 Specifications.pdf	Operation manual
970802107 Features I.pdf	Operation manual
970803108 Features II.pdf	Operation manual
970804109 Features III.pdf	Operation manual
970805100 Features IV.pdf	Operation manual
963811107 External Control I.pdf	Operation manual
970810108 External Control II.pdf	Operation manual
970813101 Camera & Sensor Features.pdf	Operation manual
PSDBKUPE.exe	Software to backup the individual configuration information of the robot
JSYLOADE.exe	Software to download the robot system software
JRN_STD_xxx.jsy*1	Standard robot system software*2
JCPSExxxL*1 (Folder)	JR C-Points Limited Edition software (Needs to be installed)*3
JR2203NERT_xxx_cps*1	PCB cutting applications C & T data for Model JR2203NERT
JR2303NERT_xxx_cps*1	PCB cutting applications C & T data for Model JR2303NERT
JR2403NERT_xxx_cps*1	PCB cutting applications C & T data for Model JR2403NERT
JR2000NERT_xxx_VerUp.cfs *1	PCB cutting applications Customizing data for Models JR2203NERT, JR2303NERT, and JR2403NERT.

*1: [xxx] indicates the customizing data version number.

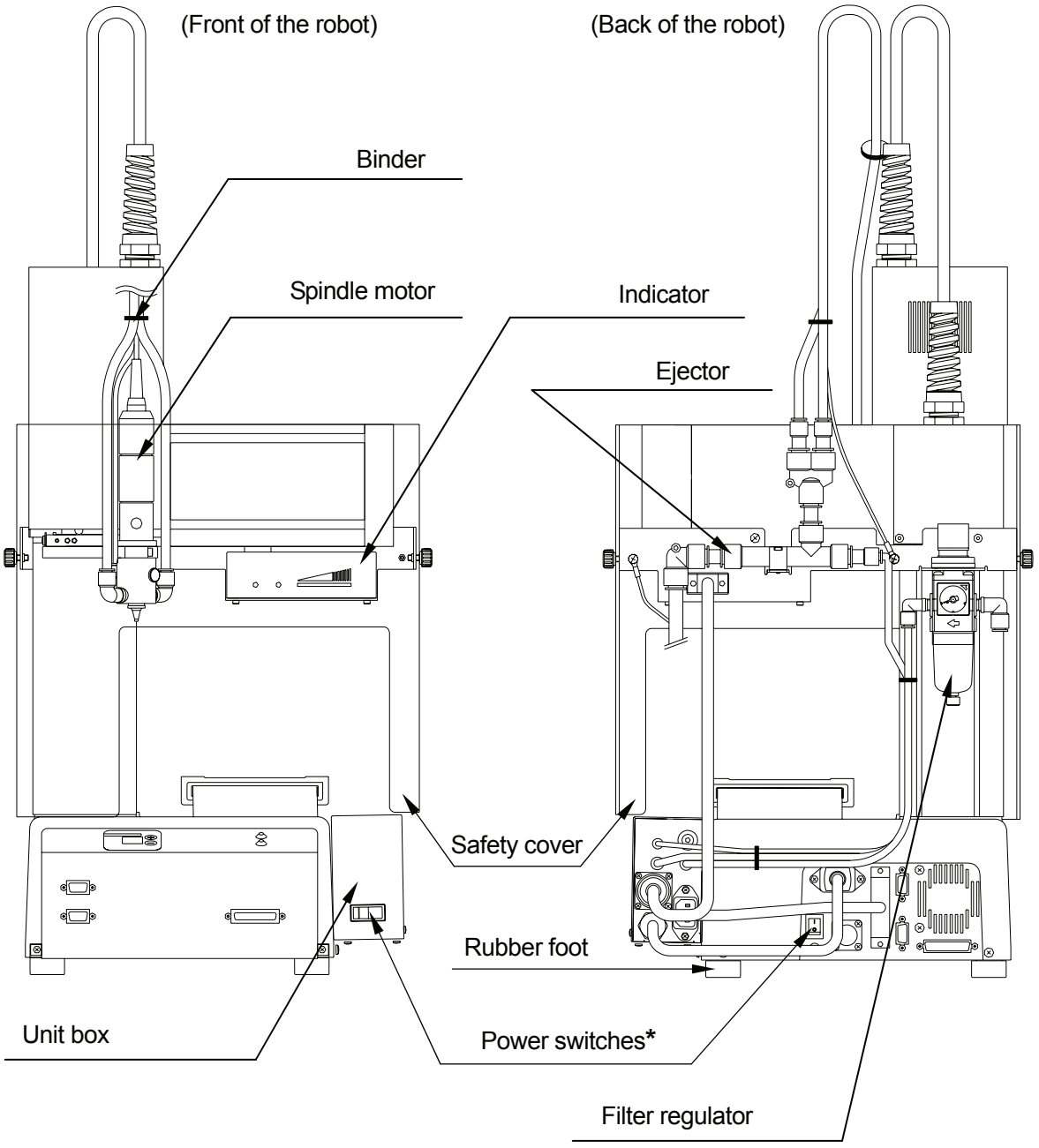
*2: To activate the PCB cutting applications, add customizing data for the PCB cutting applications (e.g. dedicated point types such as [Cut Start Point] and the program data [Board Cut Condition]) to the standard robot system software.

*3: Refer to the Setup operation manual (page 13 “HOW TO BACK UP THE C & T DATA”) on how to operate the JR C-Points Limited Edition software.

INSTALLATION

Model JR2203NERT

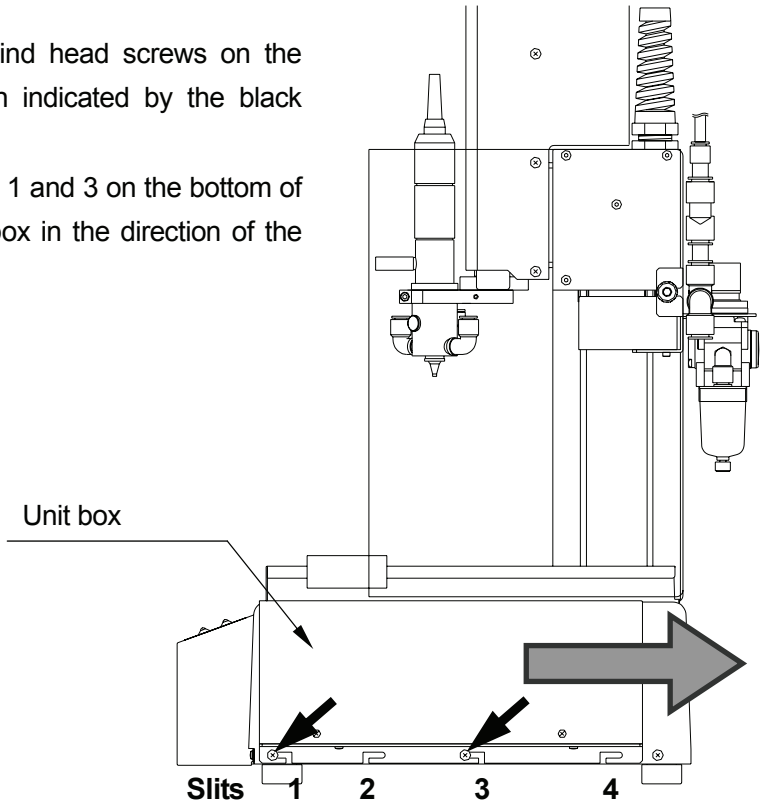
Turn the rubber feet on the bottom of the robot to adjust the height and to secure the robot on the installation surface.



*: Turn on (Press the [|] side of) the two power switches to turn on the robot.

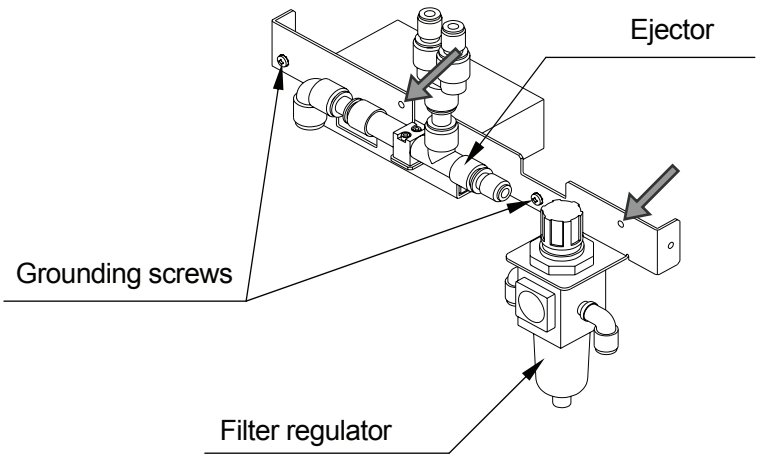
Unit Box

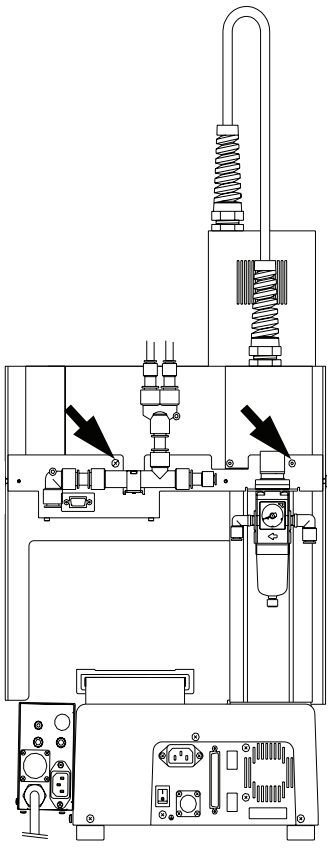
Loosen the two slotted/Phillips bind head screws on the side of the robot (to the position indicated by the black arrows).
Insert the two screws into the Slits 1 and 3 on the bottom of the unit box, and then slide the box in the direction of the gray arrow as far as it will go.
Then tighten the screws firmly.



Ejector and Filter Regulator

Remove the two slotted/Phillips bind head screws (indicated by the black arrows in the illustration to the right) on the back of the robot, and then tighten the ejector and the filter regulator to the back of the robot using the screws (through the holes indicated in the gray arrow in the illustration below).



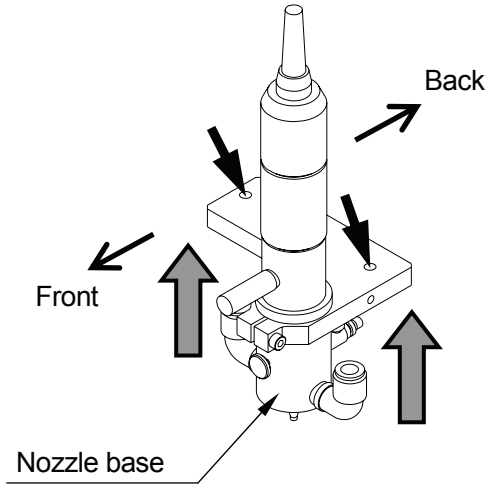


Spindle Motor

Install the spindle motor on the bottom of the Z mechanism using the two hexagonal socket bolts (M5) included in the package (at a 7Nm tightening torque).

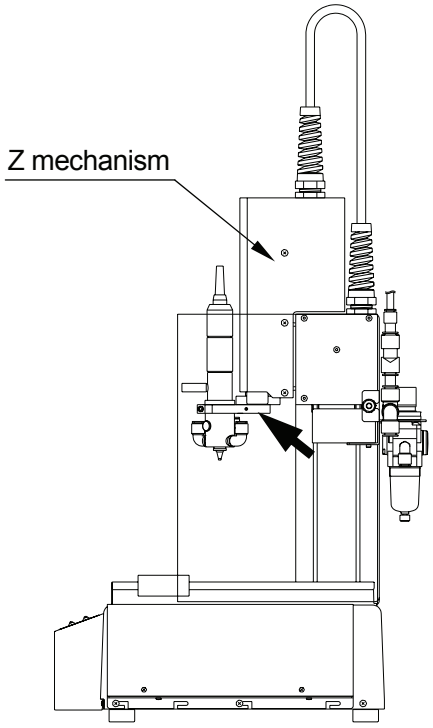
Then connect the grounding cable included in the package using the screw on the side of the spindle motor (see Illust. 3) and the grounding screw on the back of the robot (indicated by the black arrows in the Illust. 4).

A toothed washer comes with the grounding screw on the back of the robot. Insert the grounding cable terminal between the washer and the screw, and then tighten them to the motor. (See Illust. 3)

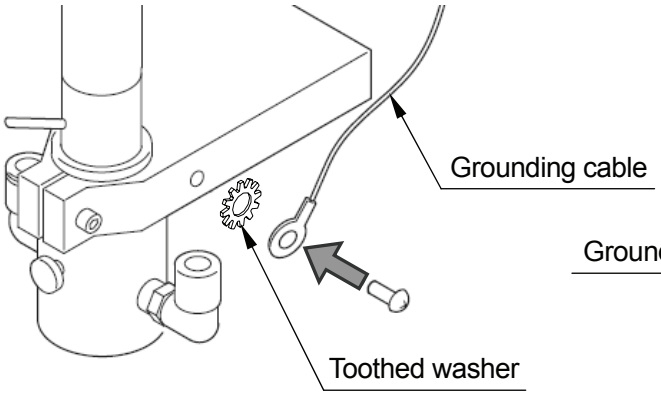


(Tighten the bolts in the direction of the gray arrows.)

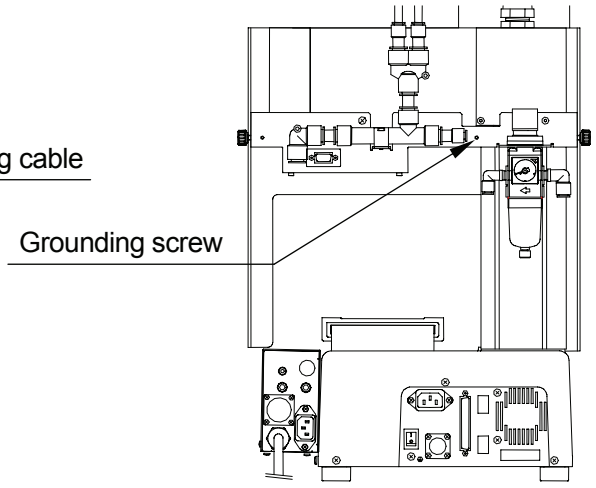
Illust. 1: Spindle motor



Illust. 2: Robot

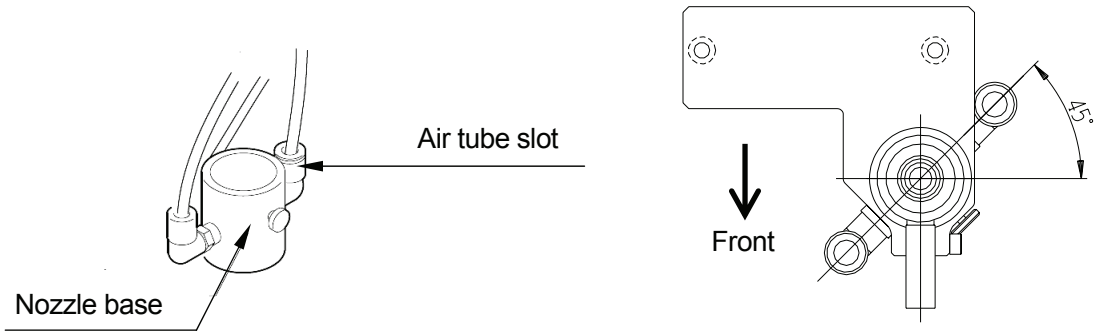


Illust. 3: Spindle motor (side)



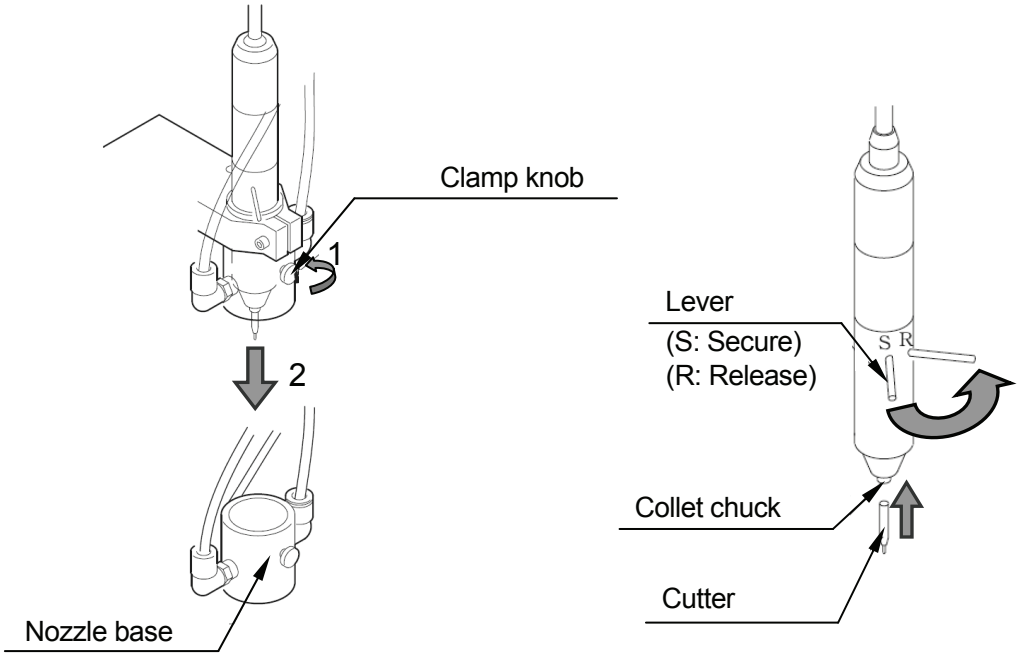
Illust. 4: Robot (back)

Adjust the nozzle base so that the air tube slots come at a 45-degree angle to the robot. Otherwise, the air tube slot will hit the safety cover when the Y-Axis moves.



Cutter

Loosen the clamp knob to draw the nozzle base vertically from the spindle motor.



Turn the lever on the spindle motor to the [R] position to release the collet chuck.
Insert the cutter into the collet chuck as far as it will go, and then turn back the lever to the [S] position to secure the cutter.

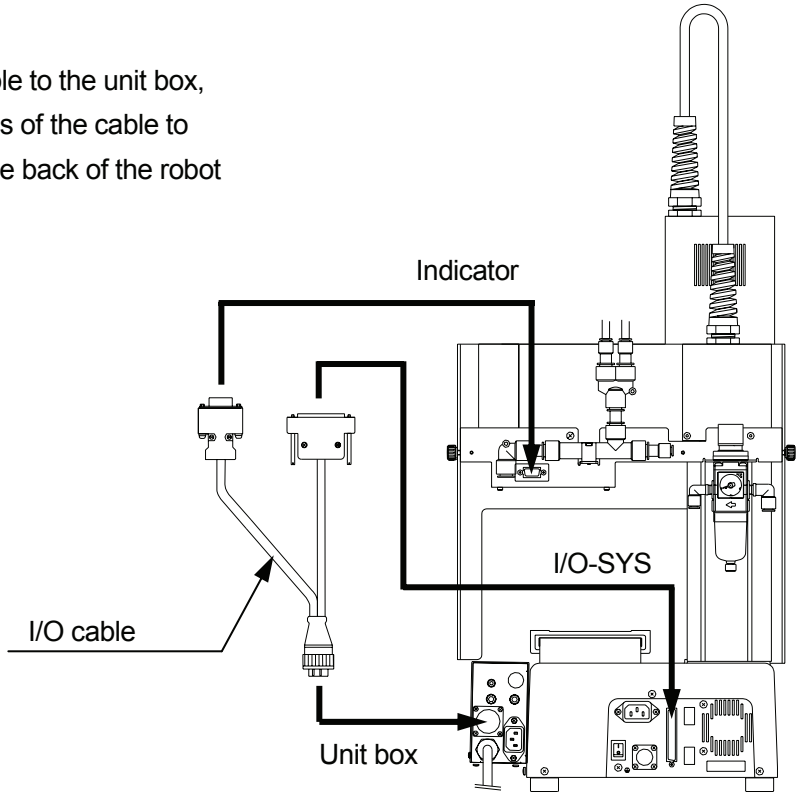
Reattach the nozzle base, and then tighten the clamp knob. Be careful not to damage the cutter.

Caution

- Be sure to turn the lever to the [S] (locking) position before starting the unit. Otherwise, the spindle motor will be broken.
- The cutter is secured with a three-jaw collet chuck. Check that the chuck is clean before inserting the cutter. The chuck cannot hold the cutter firmly if chips or dust got inside the chuck.
- Clean the collet chuck regularly.
- When reattaching the nozzle base, push it back firmly. A loose nozzle cannot collect dust efficiently.

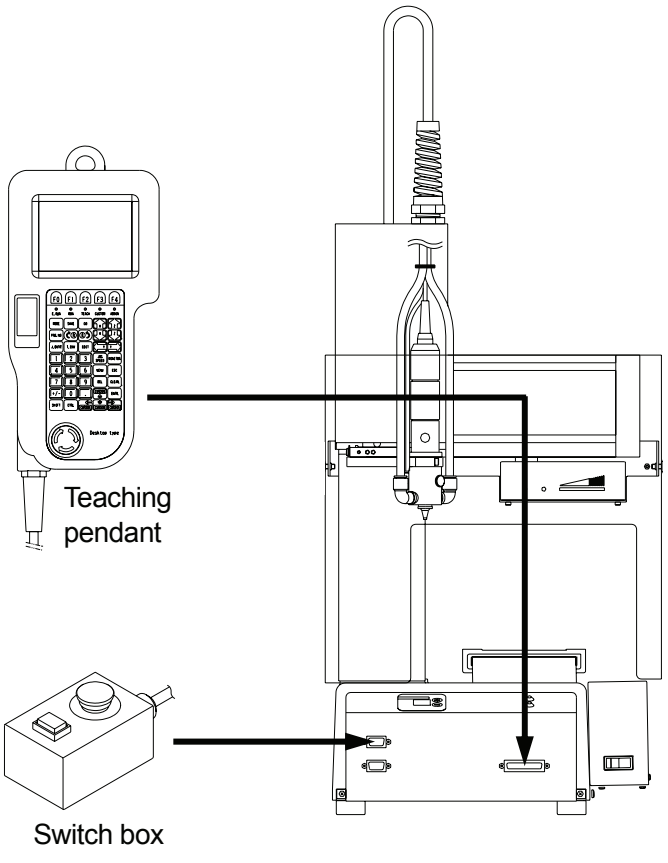
I/O Cable

Connect one end of the I/O cable to the unit box, and then connect the other ends of the cable to the indicator and I/O-SYS on the back of the robot as illustrated to the right.



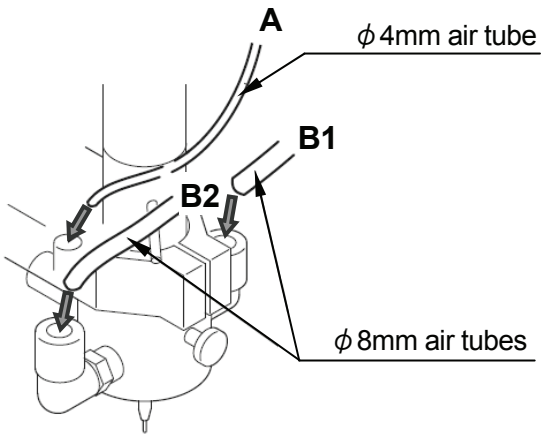
Switch Box and Teaching Pendant

Connect the teaching pendant to the teaching pendant connector (TPU) on the front of the robot.
Connect the switch box to the switch box connector on the front of the robot.

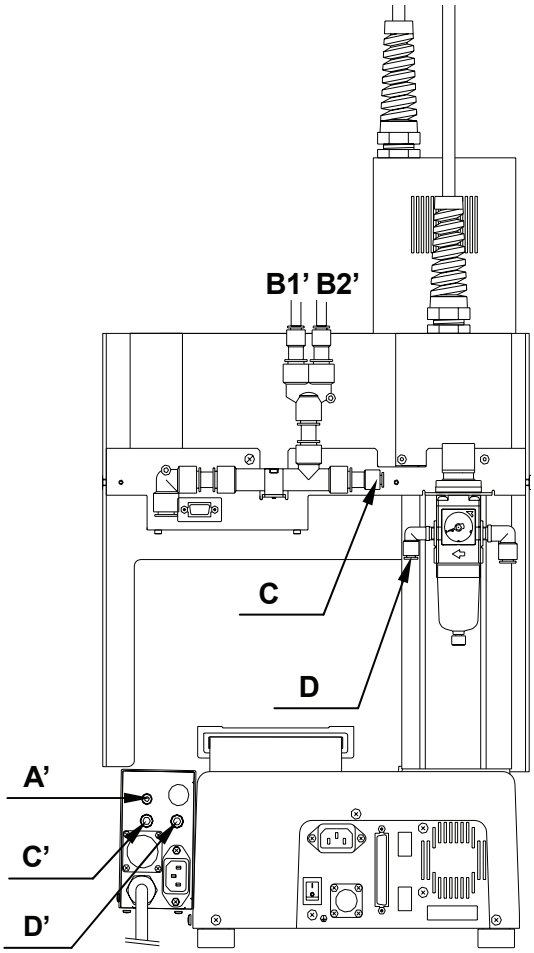


Air Tubes

Connect parts A and A', B1 and B1', B2 and B2', C and C', and D and D' (indicated in the illustrations below) using the air tubes included in the package.
(A: ϕ4mm, B: ϕ8mm, C and D: ϕ6mm)



Spindle motor

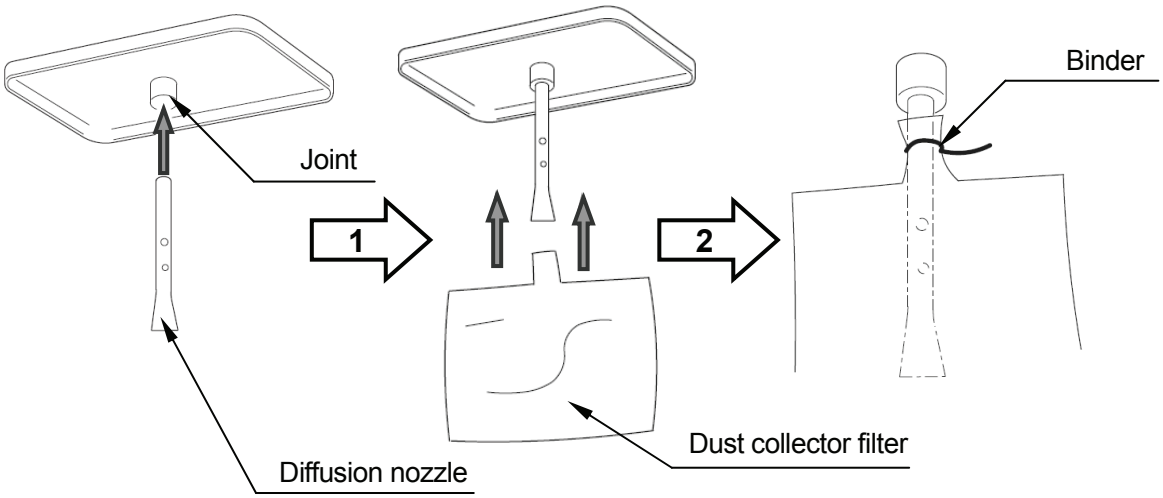


Filter Dust Collector

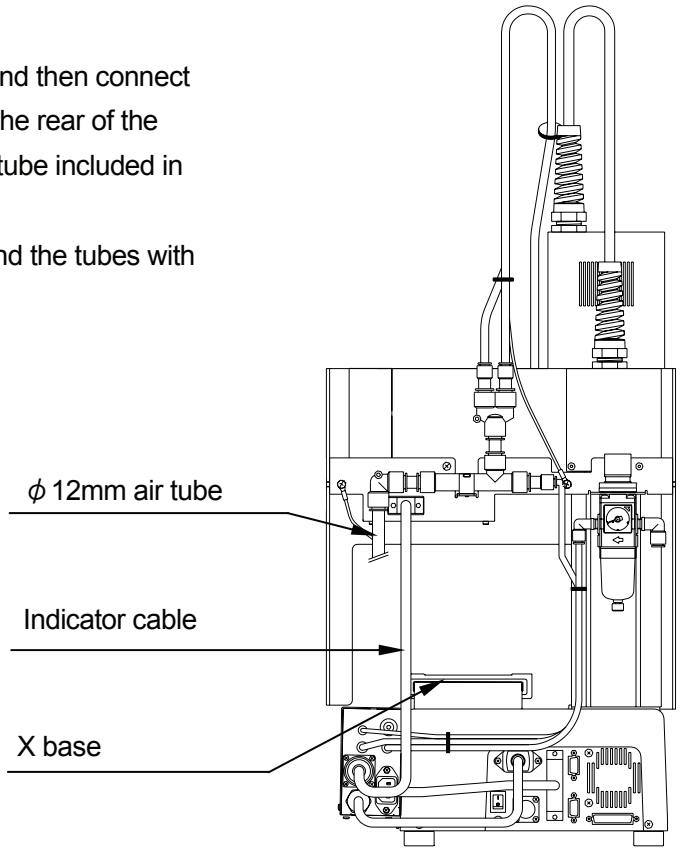
Caution

- Be sure to ground the robot to prevent dust explosion.
- Do not cut materials which may cause a dust exprosion.

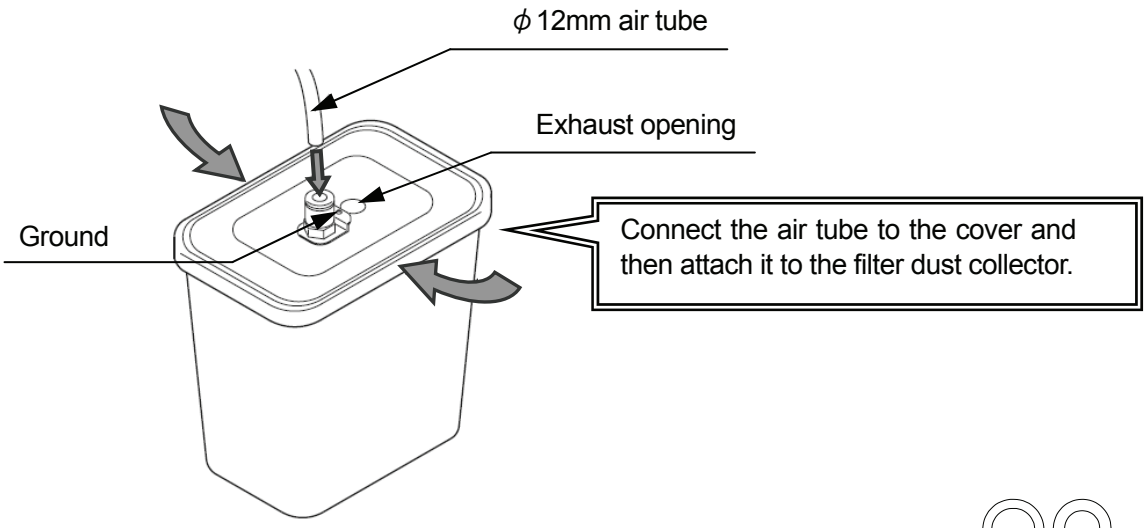
Connect the diffusion nozzle to the joint on the rear surface of the filter dust collector cover. Then insert the diffusion nozzle into the dust collector filter and secure the filter with the binder.



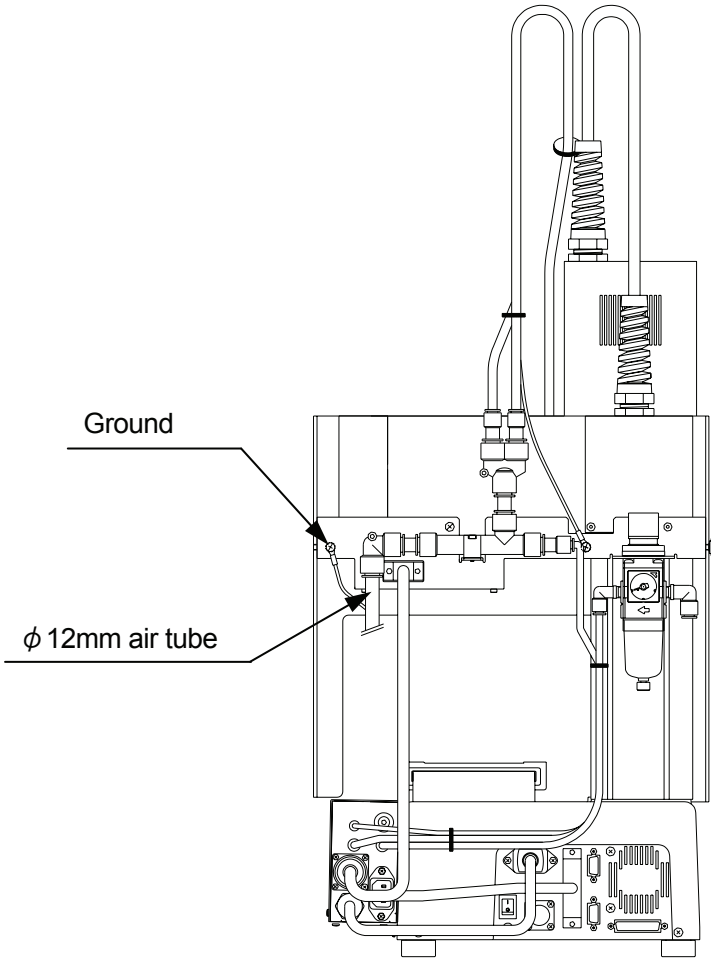
Put the cover on the filter dust collector and then connect the joint on the cover and the ejector on the rear of the Y-Axis of the robot using the ϕ 12mm air tube included in the package.
If the air tubes collide with the X base, bind the tubes with the indicator cable.



Connect the grounding wire assembled on the ϕ12mm air tube with the grounding screws on the top surface of the filter dust collector cover and the back of the robot.
A toothed washer comes with each grounding screw. Insert the grounding wire end between the washer and the screw, and then tighten them to the cover and the robot.
Do not block the exhaust opening on the filter dust collector cover. Otherwise, efficient dust collection cannot be ensured.



(Filter dust collector)



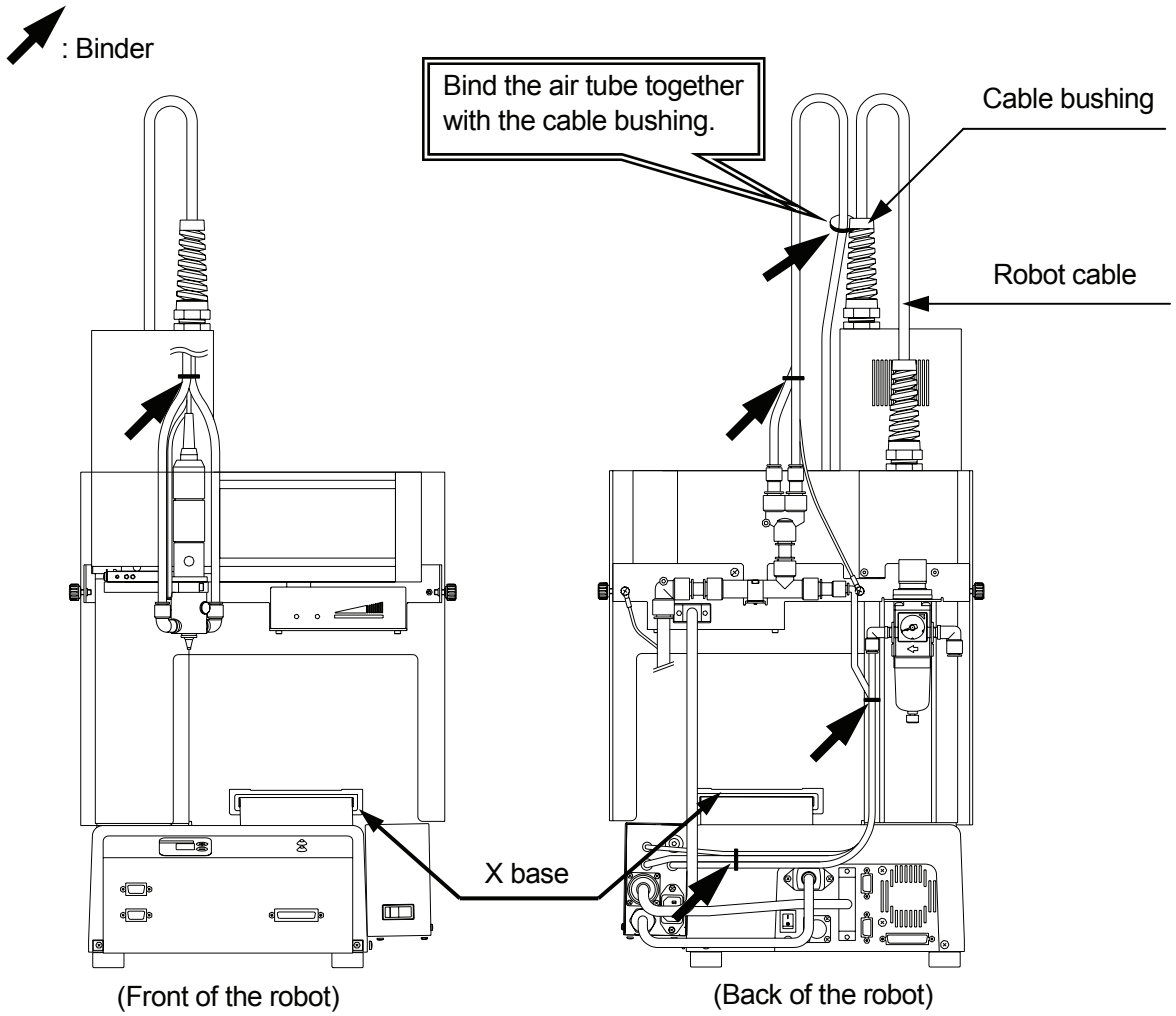
(Robot)

Binder

Caution	Be careful not to pinch or bend the air tube by binding it too tightly. A pinched or bent tube creates suction that is insufficient to capture dust and may lead to malfunction.

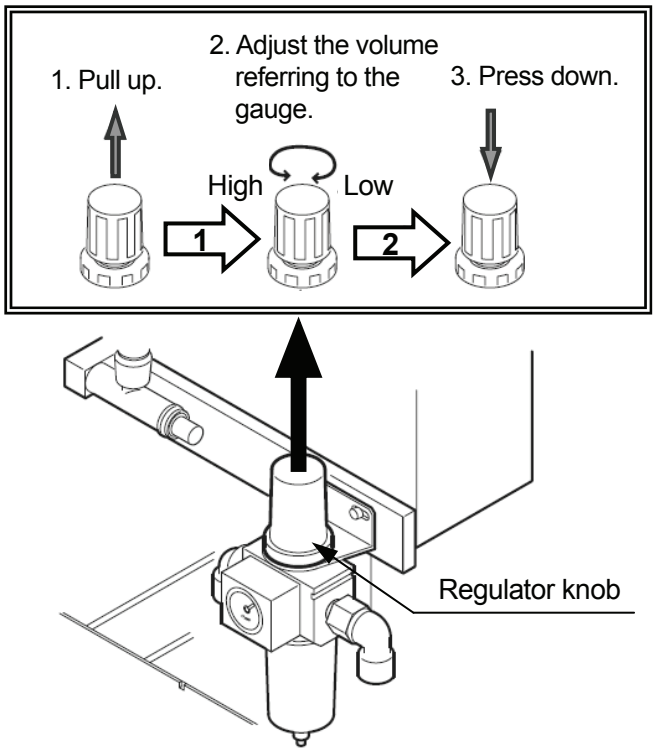
Caution	Do not bind the robot cable with air tubes and grounding wire. Doing so may damage the robot cable and may lead to malfunction.

Secure the air tubes at the six positions (see the illustrations below) with the binders included in the package so as to prevent interfering operation, especially colliding with the X base.



Air Flow Adjustment

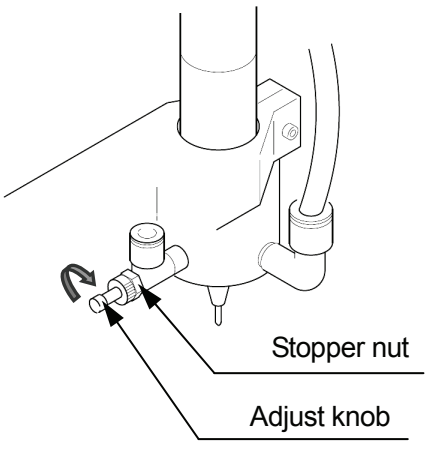
To adjust supply air, turn the regulator knob to set supply air pressure at the standard setting (0.5MPa {5kgf/cm^2}).



Caution

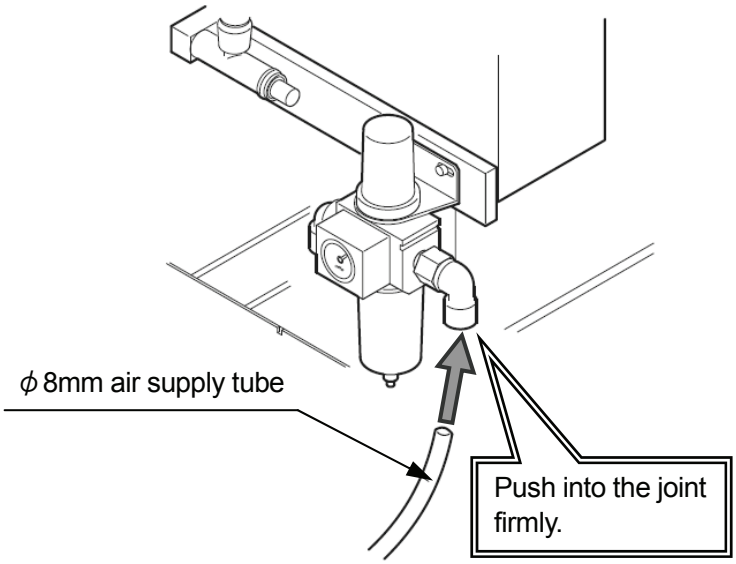
- Set the air pressure regulator to 0.5MPa so as to maintain the dust collection efficiency.
- Insufficient air supply may result in pressure failure while vacuuming.
- Use dry air contains no oil and water.

To decrease exhaust air, turn the adjust knob on the bottom of the spindle motor to the right.
After the adjustment, tighten the stopper nut to secure the knob.



Air Supply Tube

Connect the ϕ8mm air supply tube to the joint on the right side of the regulator.

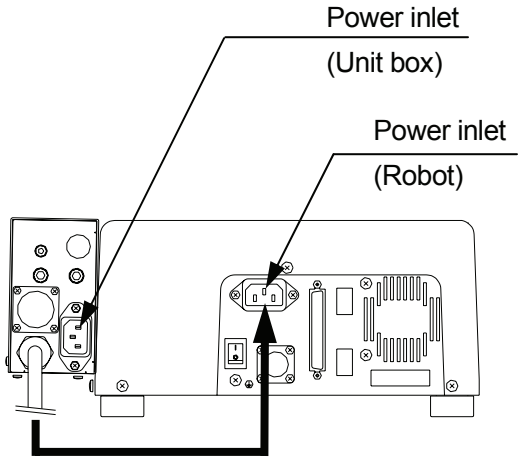


Caution

- For your safety, install the manual air supply shut off mechanism (e.g. hand valve) to each unit.
- The air joint is manufactured by SMC Corporation. We recommend you to use the air supply tube manufactured by SMC Corporation or equivalent.

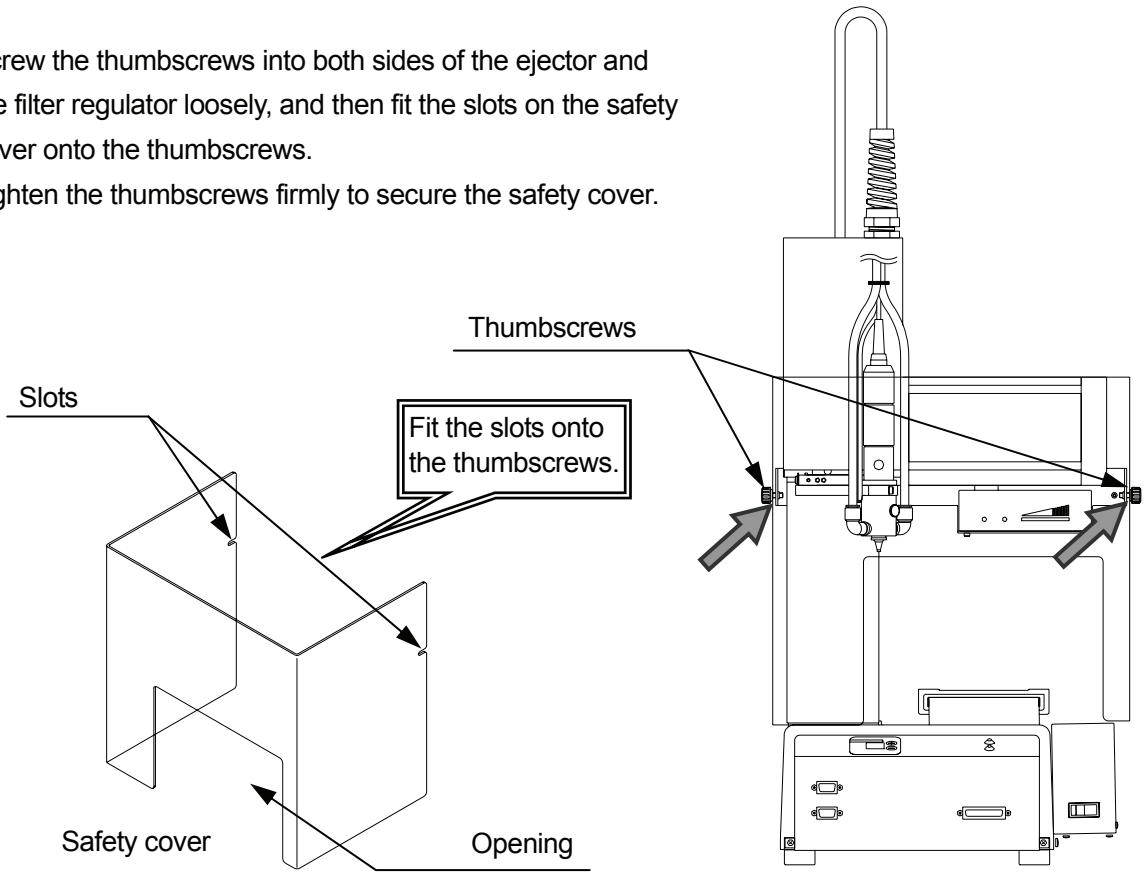
Power Cable

Connect the unit box power cable to the power inlet on the robot, and then connect the power cable included in the package to the power inlet on the unit box and the power supply.



Safety Cover

Screw the thumbscrews into both sides of the ejector and the filter regulator loosely, and then fit the slots on the safety cover onto the thumbscrews.
Tighten the thumbscrews firmly to secure the safety cover.

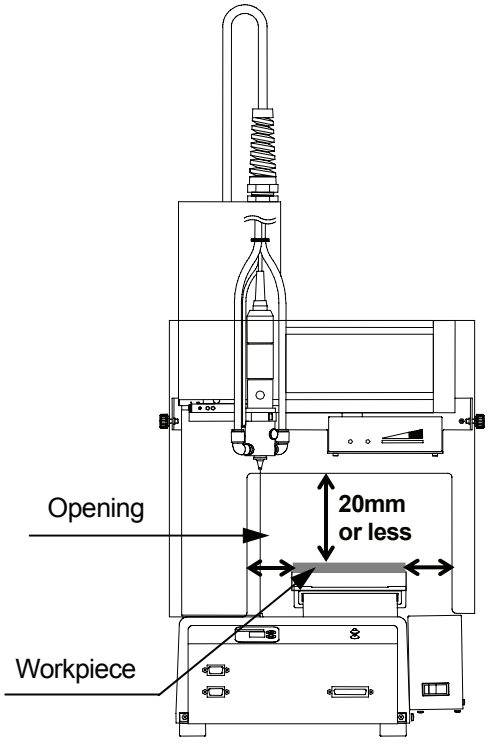


Caution

- Make sure that cables and air tubes do not contact with the safety cover or other instruments, such as covers and jigs, installed additionally.
- The safety cover included in the package may not be strong enough depending on the jigs or applications you have prepared. For your safety, replace it with a new safety cover* according to ISO13857**.

*: The left, right, upper, or lower side distance between the opening of the safety cover and the workpiece should be 20mm or less, so as not to enter your hands within 120mm of the cutter.

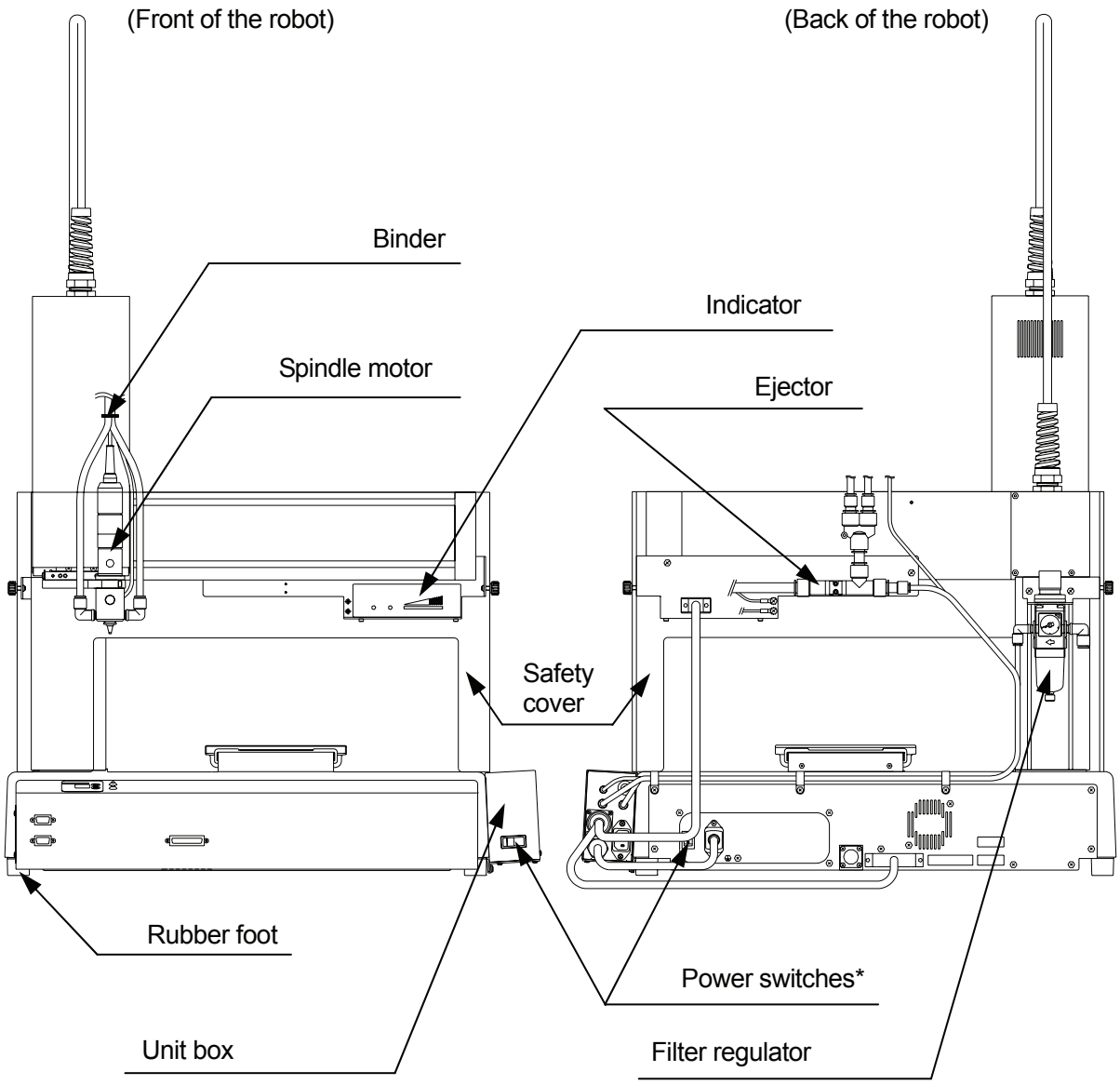
**: ISO13857: Safety of machinery – Safety distances to prevent hazard zones being reached by the upper and lower limbs



Models JR2303NERT and JR2403NERT

Turn the rubber feet on the bottom of the robot to adjust the height and to secure the robot on the installation surface.

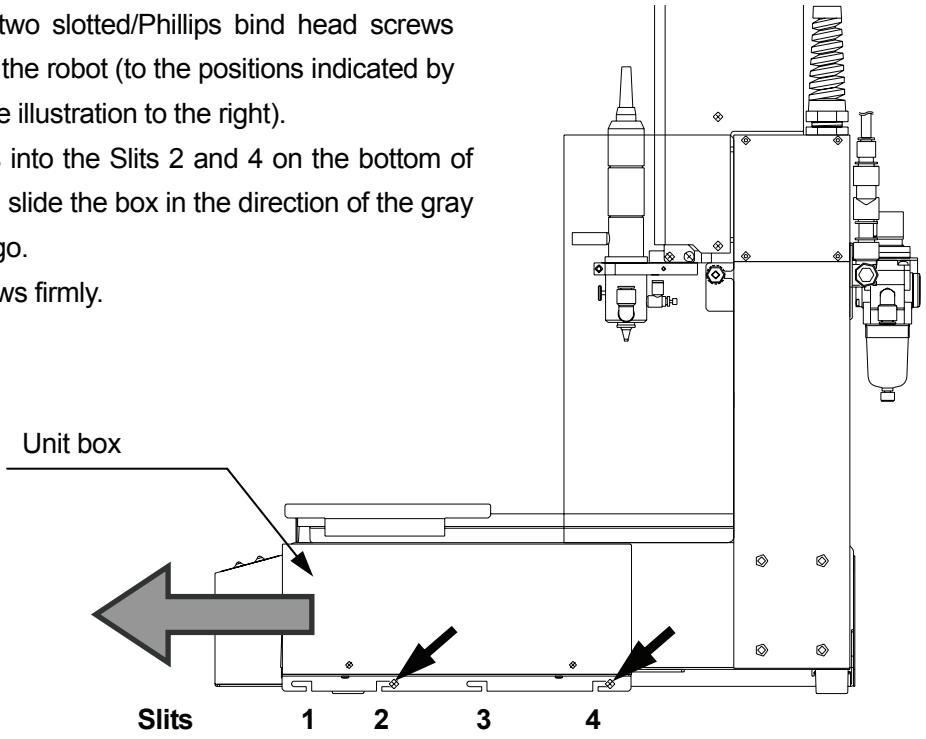
(These illustrations show Model JR2403NERT.)



*: Turn on (Press the [|] side of) the two power switches to turn on the robot.

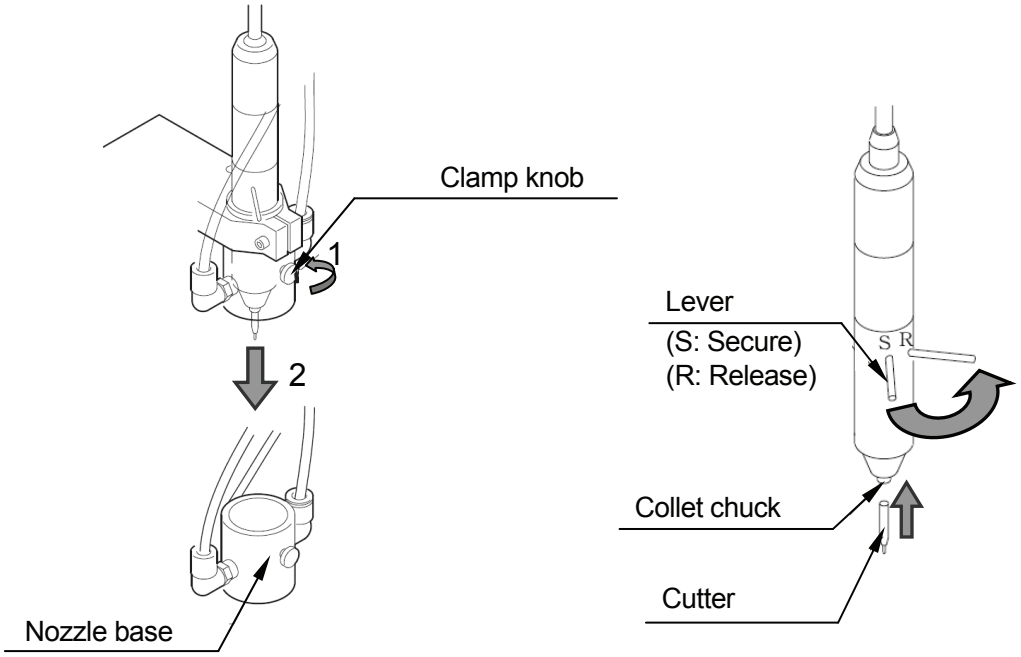
Unit Box

Tighten the two the two slotted/Phillips bind head screws loosely on the side of the robot (to the positions indicated by the black arrows in the illustration to the right).
Insert the two screws into the Slits 2 and 4 on the bottom of the unit box, and then slide the box in the direction of the gray arrow as far as it will go.
Then tighten the screws firmly.



Cutter

Loosen the clamp knob to draw the nozzle base vertically from the spindle motor.



Turn the lever on the spindle motor to the [R] position to release the collet chuck.
Insert the cutter into the collet chuck as far as it will go, and then turn back the lever to the [S] position to secure the cutter.

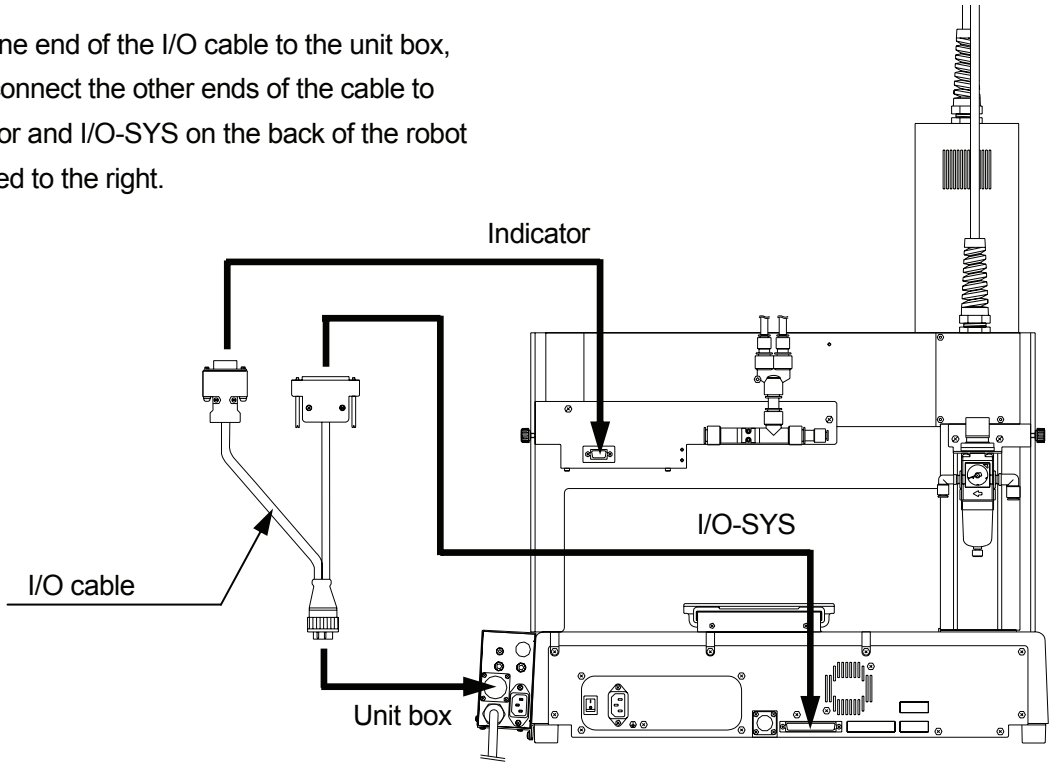
Reattach the nozzle base, and then tighten the clamp knob. Be careful not to damage the cutter.

Caution

- Be sure to turn the lever to the [S] (locking) position before starting the unit. Otherwise, the spindle motor will be broken.
- The cutter is secured with a three-jaw collet chuck. Check that the chuck is clean before inserting the cutter. The chuck cannot hold the cutter firmly if chips or dust got inside the chuck.
- Clean the collet chuck regularly.
- When reattaching the nozzle base, push it back firmly. A loose nozzle cannot collect dust efficiently.

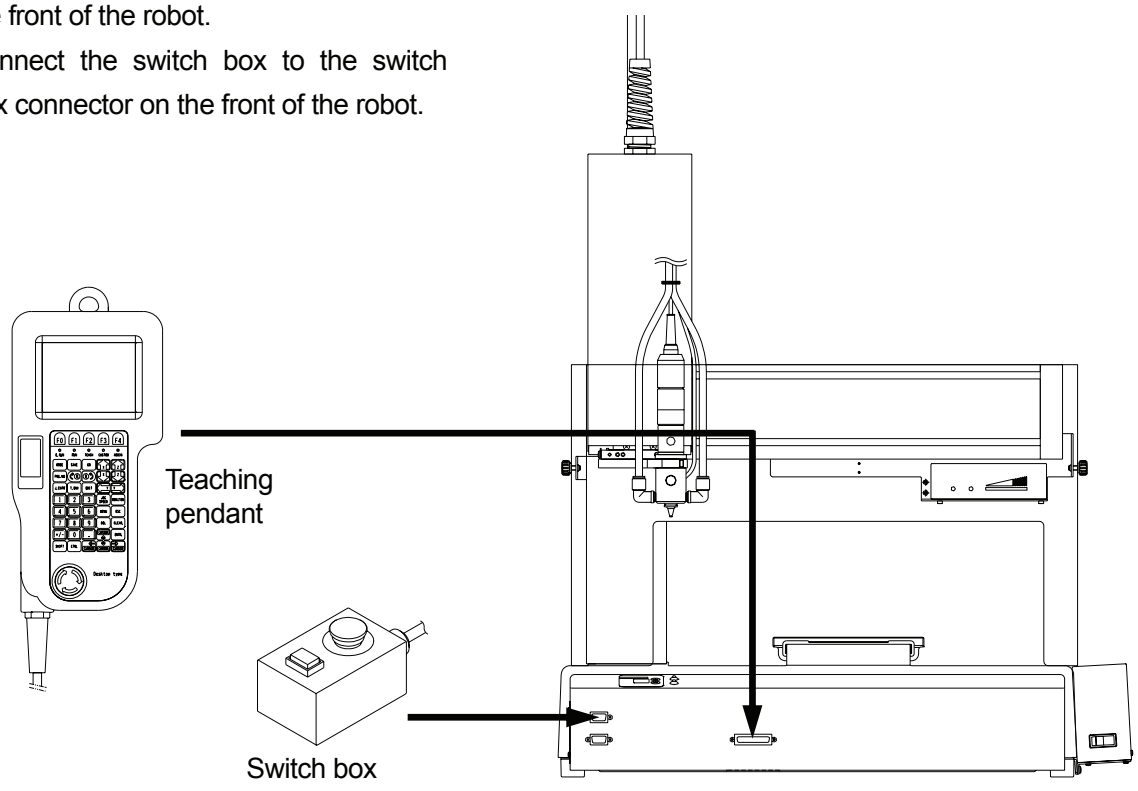
I/O Cable

Connect one end of the I/O cable to the unit box, and then connect the other ends of the cable to the indicator and I/O-SYS on the back of the robot as illustrated to the right.



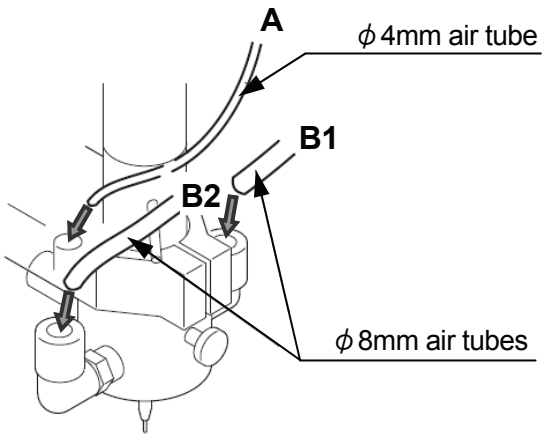
Switch Box and Teaching Pendant

Connect the teaching pendant to the teaching pendant connector (TPU) on the front of the robot.
Connect the switch box to the switch box connector on the front of the robot.

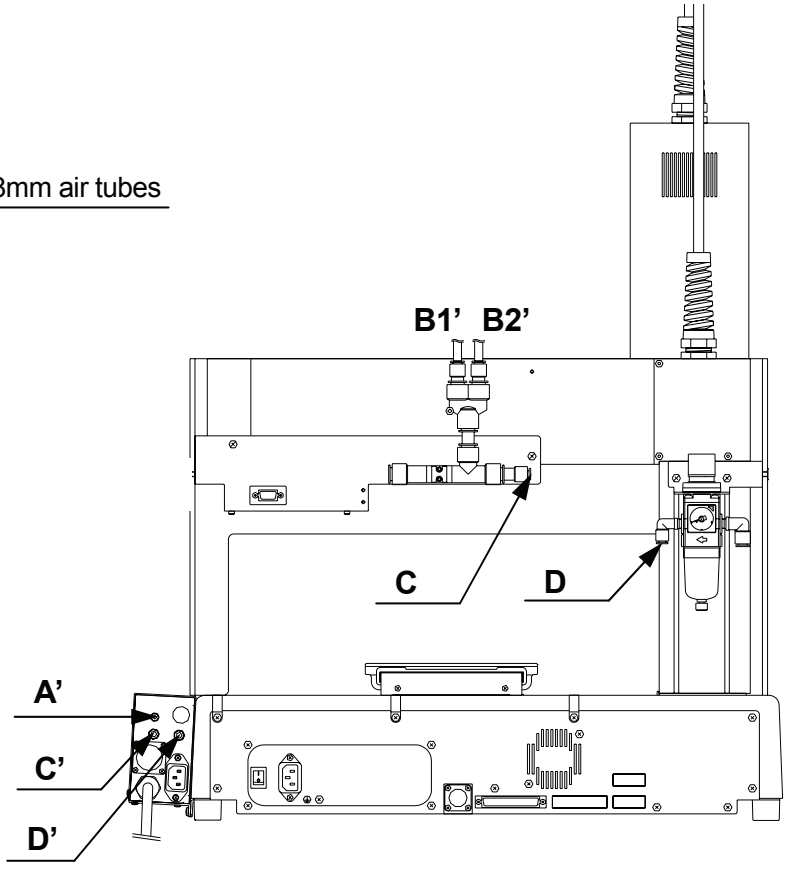


Air Tube

Connect parts A and A', C and C', and D and D' (indicated in the illustrations below) using the air tubes.
One ends of the air tubes have already been connected to the parts A, C, and D before shipment. Connect the other ends of the tubes to the corresponding parts A', C', and D' on the unit box.
Parts B1 – B1' and B2 – B2' have already been connected with the air tubes before shipment.
(A: ϕ4mm, B: ϕ8mm, C and D: ϕ6mm)



Spindle motor

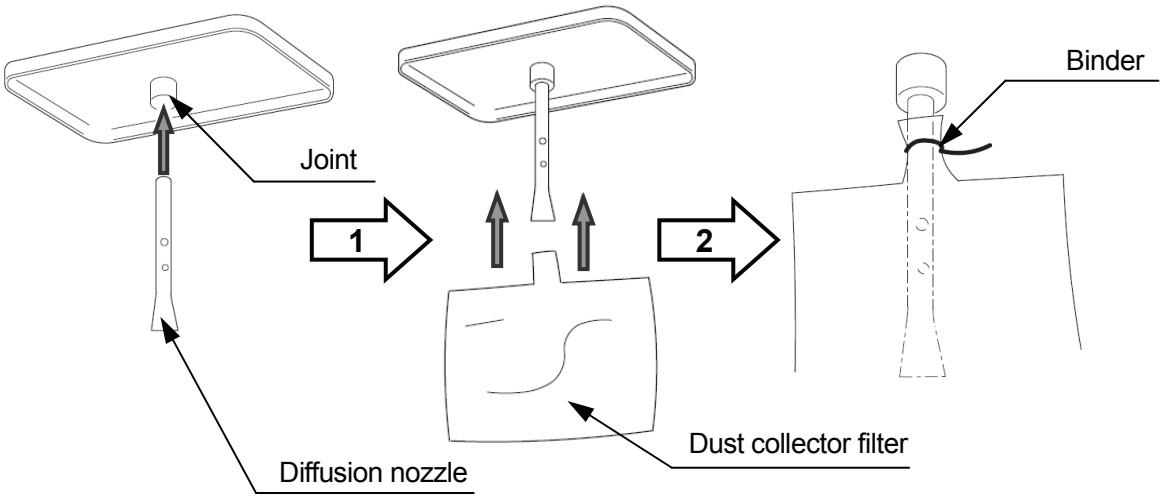


Filter Box

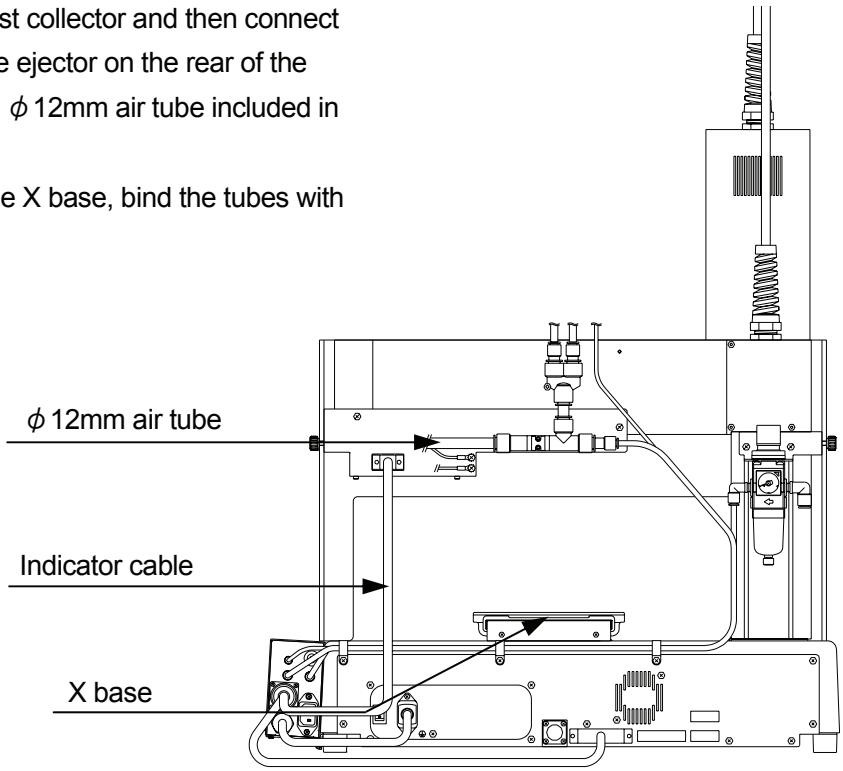
Caution

- Be sure to ground the robot to prevent dust explosion.
- Do not cut materials which may cause a dust exprosion.

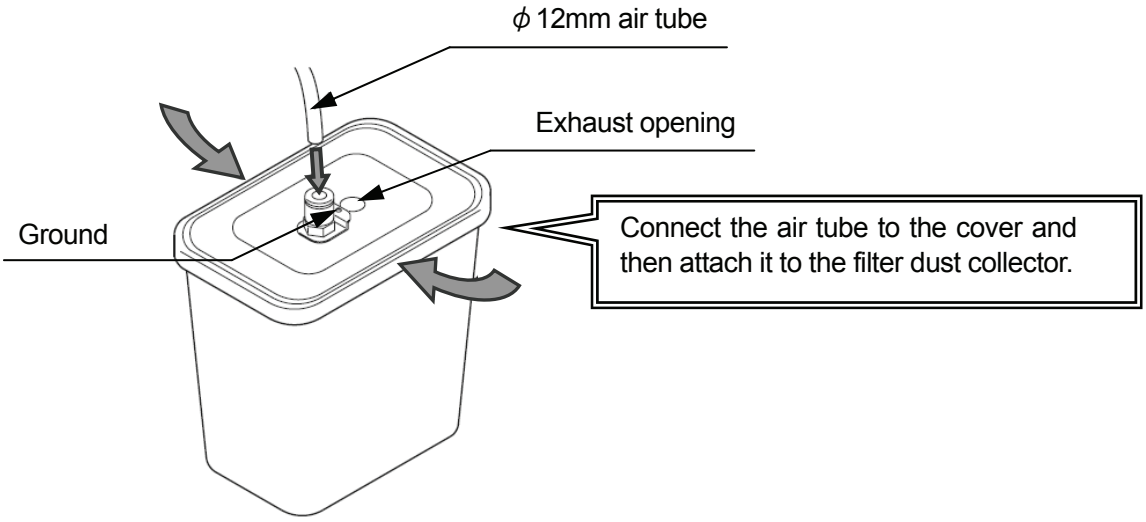
Connect the diffusion nozzle to the joint on the rear surface of the filter dust collector cover. Then insert the diffusion nozzle into the dust collector filter and secure the filter with the binder.



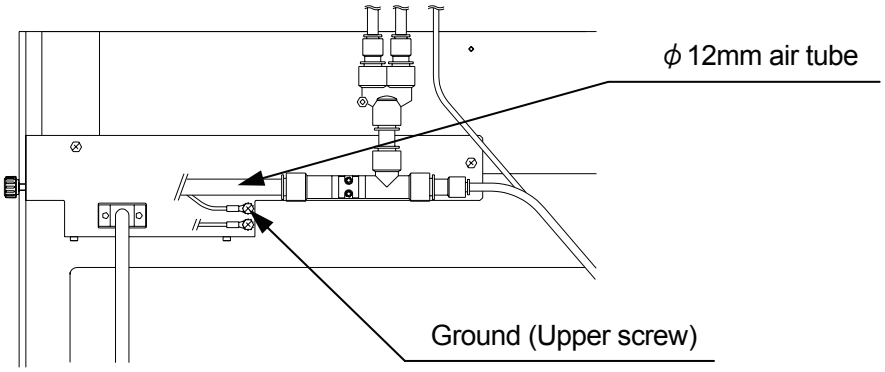
Put the cover on the filter dust collector and then connect the joint on the cover and the ejector on the rear of the Y-Axis of the robot using the ϕ12mm air tube included in the package.
If the air tubes collide with the X base, bind the tubes with the indicator cable.



Connect the grounding wire assembled on the ϕ12mm air tube with the grounding screws on the top surface of the filter dust collector cover and the back of the robot.
A toothed washer comes with each grounding screw. Insert the grounding wire end between the washer and the screw, and then tighten them to the cover and the robot.
Do not block the exhaust opening on the filter dust collector cover. Otherwise, efficient dust collection cannot be ensured.



(Filter dust collector)



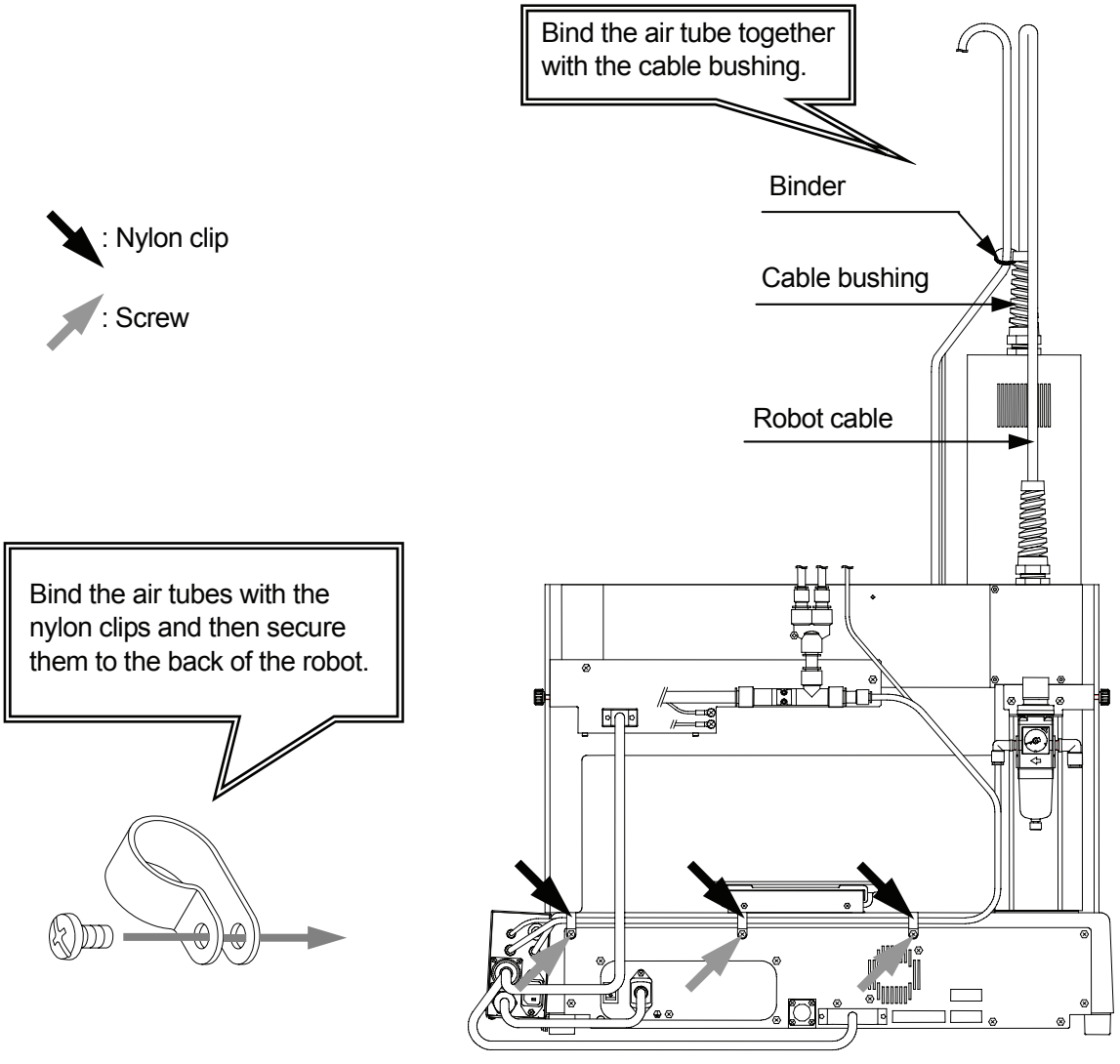
(Robot)

Nylon Clip

> **Caution**
>
> Be careful not to pinch or bend the air tube by binding it too tightly. A pinched or bent tube creates suction that is insufficient to capture dust and may lead to malfunction.

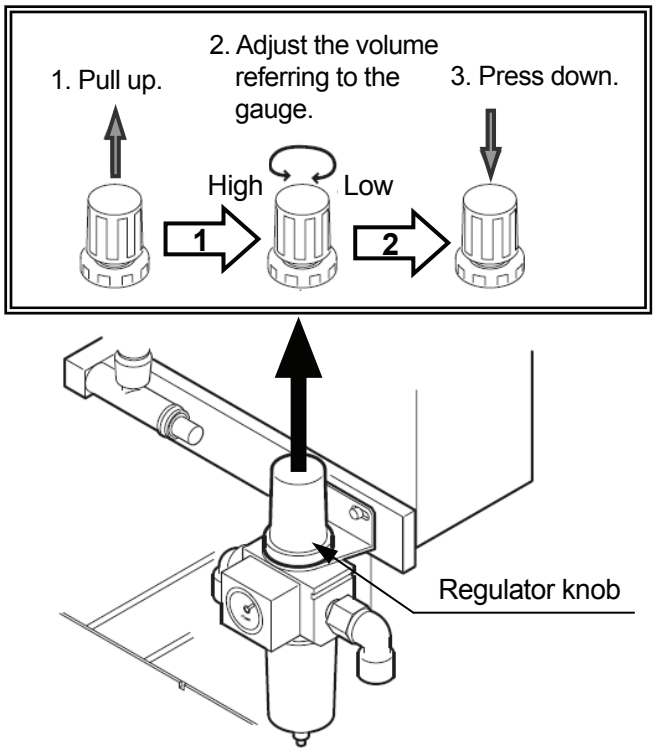
> **Caution**
>
> Do not bind the robot cable with air tubes and grounding wire. Doing so may damage the robot cable and may lead to malfunction.

First, bind the air tubes together with the cable busing (see the illustration below) with the binder included in the package so as to prevent interfering operation.
Next, bind the air tubes with the nylon clips included in the package. Remove the screws on the back of the robot, and then secure the clips at the three positions using the screws as illustrated below.



Air Flow Adjustment

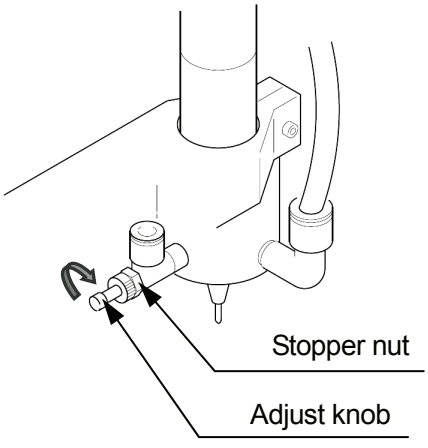
To adjust supply air, turn the regulator knob to set supply air pressure the standard setting (0.5MPa {5kgf/cm^2}).



Caution

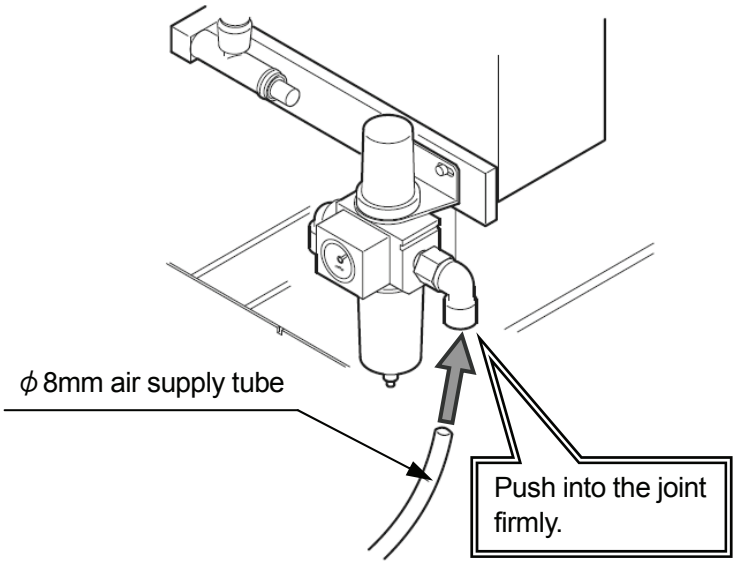
- Set the air pressure regulator to 0.5MPa so as to maintain the dust collection efficiency.
- Insufficient air supply may result in pressure failure while vacuuming.
- Use dry air contains no oil and water.

To reduce exhaust air, turn the adjust knob on the bottom of the spindle motor to the right.
After the adjustment, tighten the stopper nut to secure the knob.



Air Supply Tube

Connect the ϕ8mm air supply tube to the joint on the right side of the regulator.

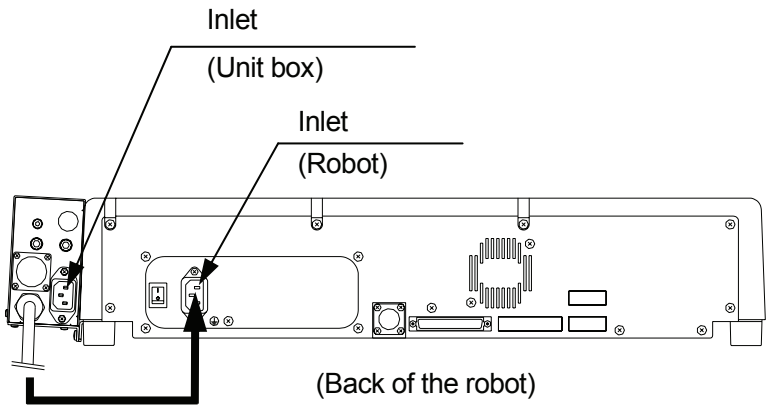


Caution

- For your safety, install the manual air supply shut off mechanism (e.g. hand valve) to each unit.
- The air joint is manufactured by SMC Corporation. We recommend you to use the air supply tube manufactured by SMC Corporation or equivalent.

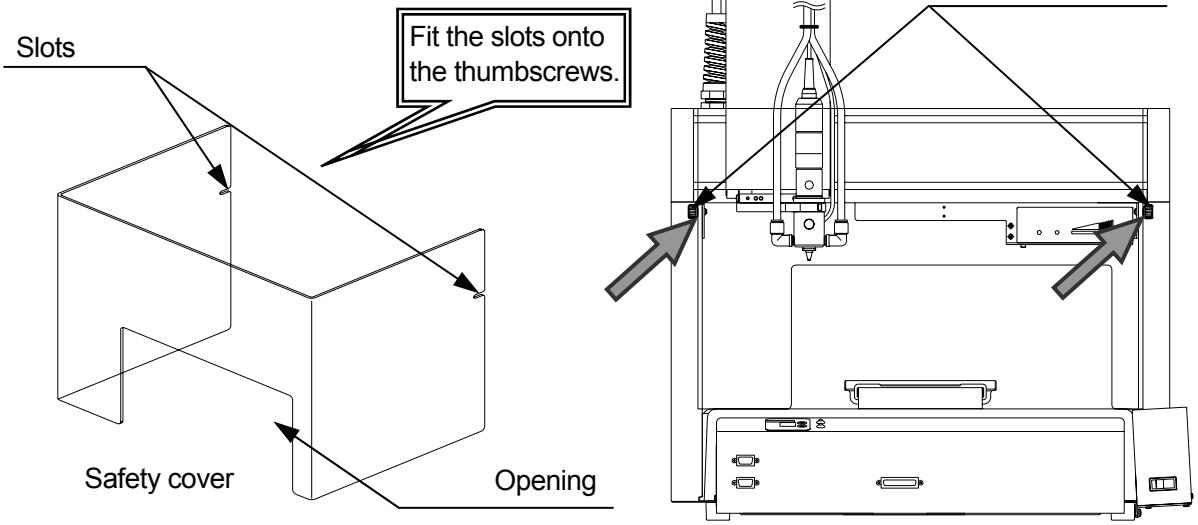
Power Cable

Connect the unit box power cable to the power inlet on the robot, and then connect the power cable included in the package to the power inlet on the unit box and the power supply.



Safety Cover

Screw the thumbscrews into both sides of the ejector and the filter regulator loosely, and then fit the slots on the safety cover onto the thumbscrews.
Tighten the thumbscrews firmly to secure the safety cover.

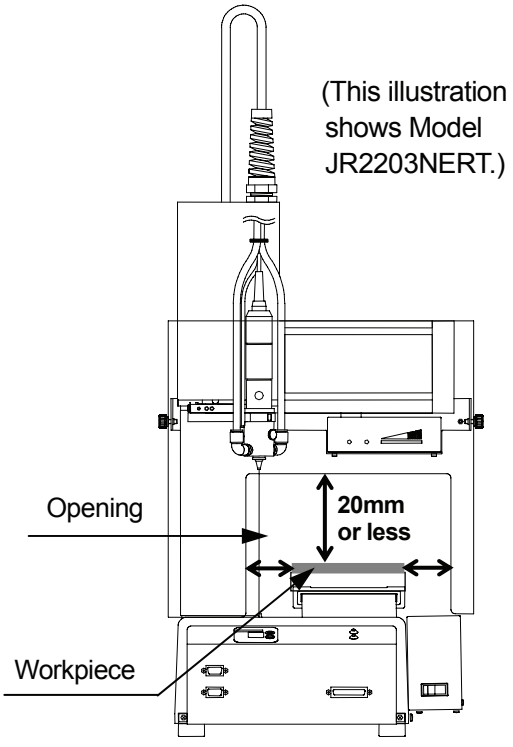


Caution

- Make sure that cables and air tubes do not contact with the safety cover or other instruments, such as covers and jigs, installed additionally.
- The safety cover included in the package may not be strong enough depending on the jigs or applications you have prepared. For your safety, replace it with a new safety cover* according to ISO13857**.

*: The left, right, upper, or lower side distance between the opening of the safety cover and the workpiece should be 20mm or less, so as not to enter your hands within 120mm of the cutter.

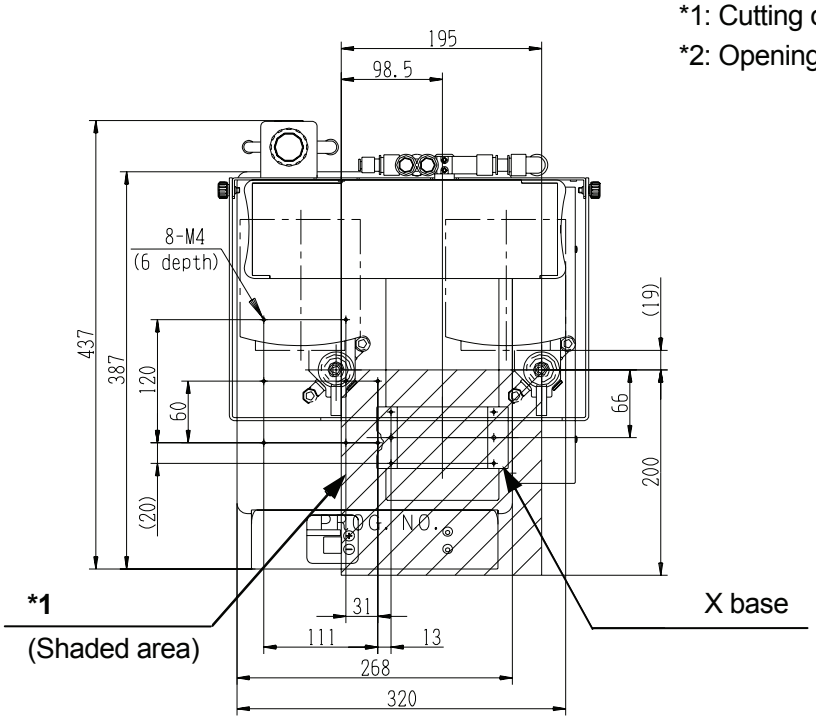
**: ISO13857: Safety of machinery – Safety distances to prevent hazard zones being reached by the upper and lower limbs

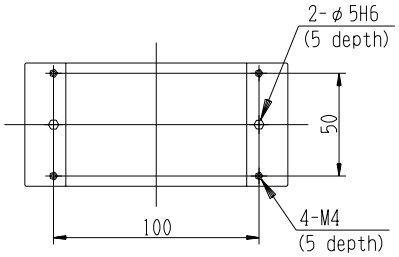


EXTERNAL DIMENSIONS

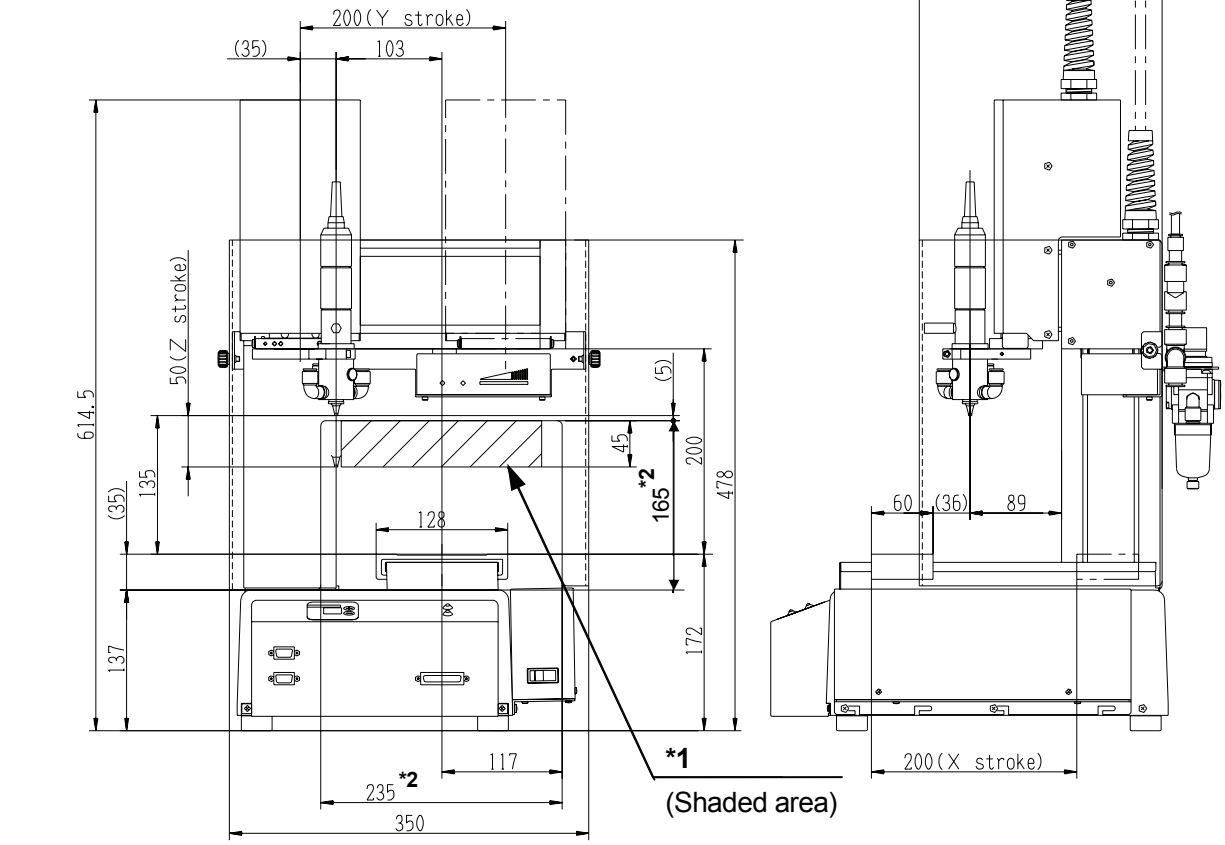
Model JR2203NERT

*1: Cutting operation range
*2: Opening of the safety cover



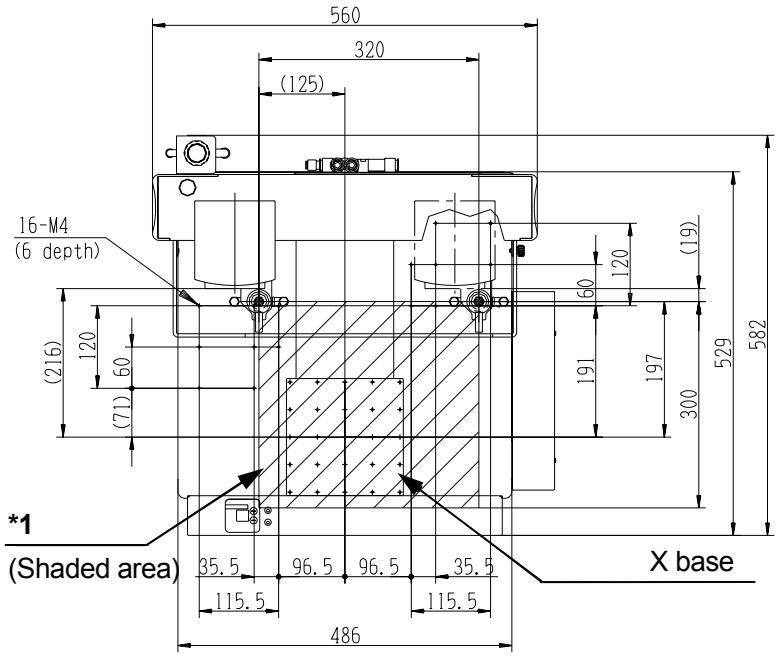


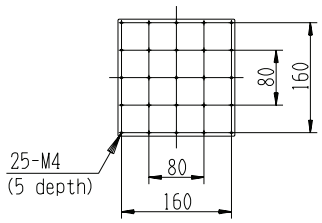
X Base Dimensions (1:5)



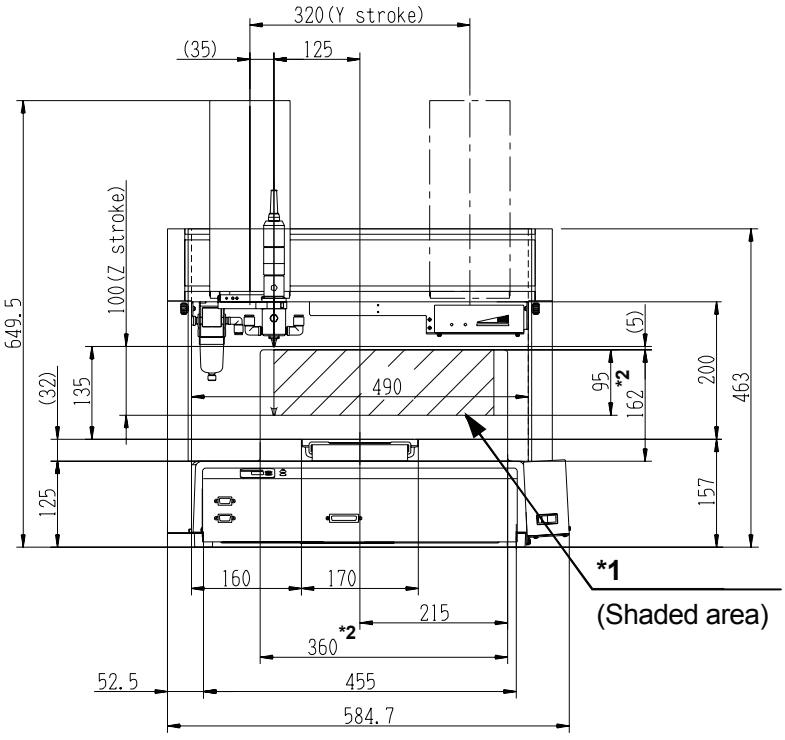
Model JR2303NERT

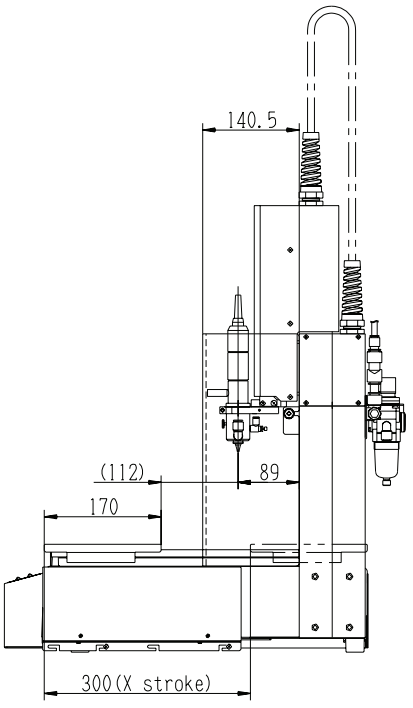
*1: Cutting operation range
*2: Opening of the safety cover





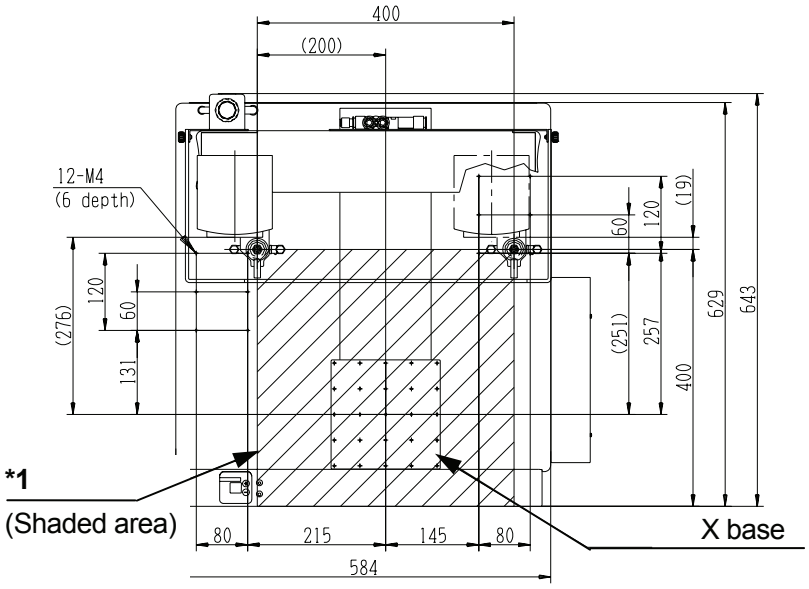
X Base Dimensions (1:5)

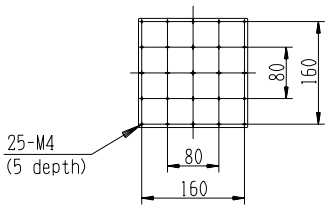




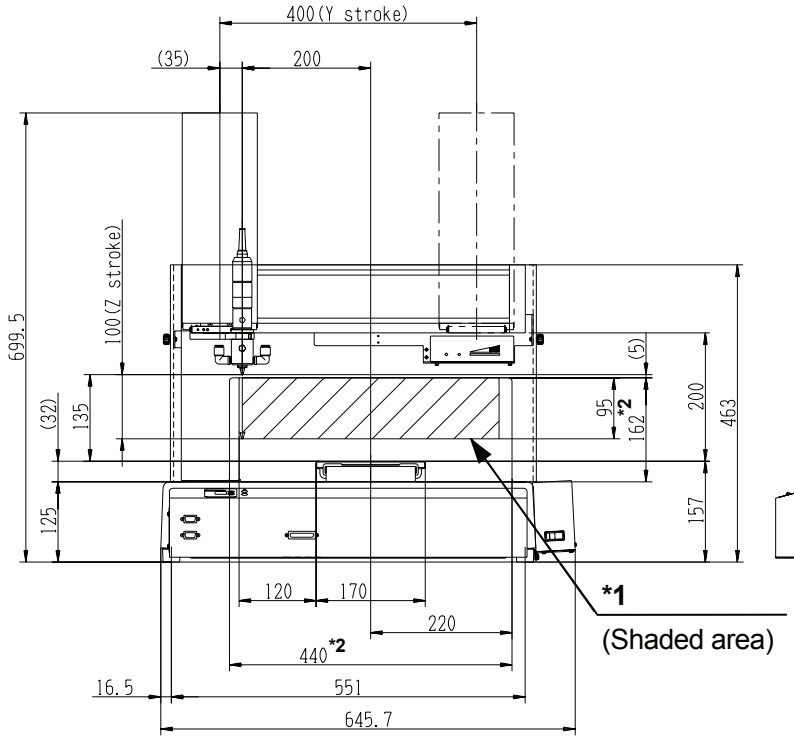
Model JR2403NERT

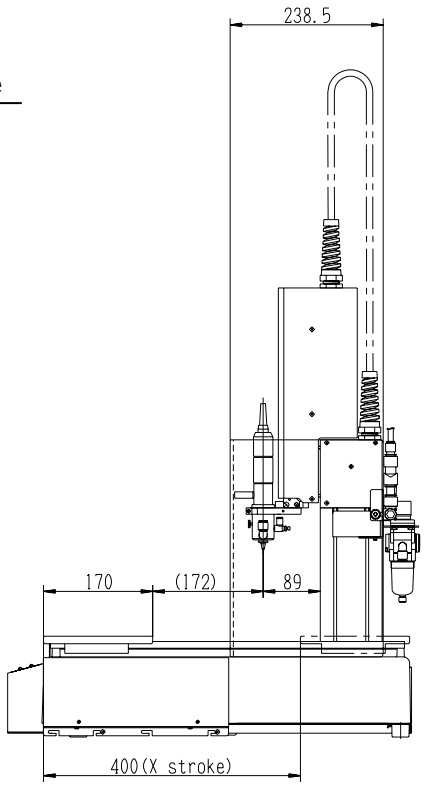
*1: Cutting operation range
*2: Opening of the safety cover



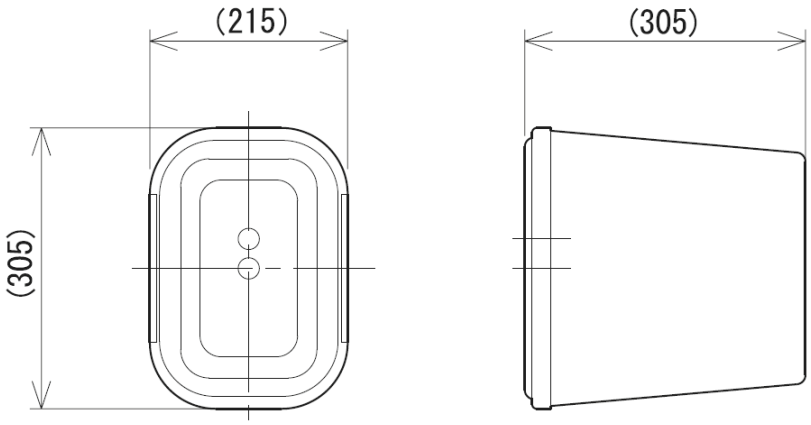


X Base Dimensions (1:5)

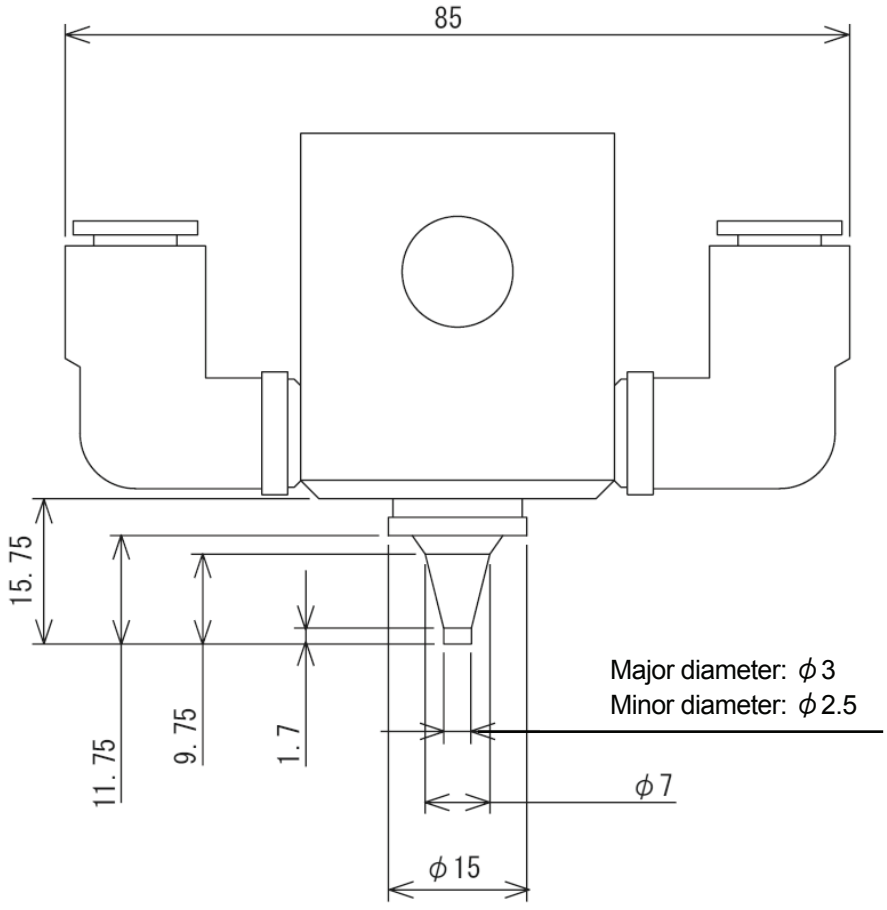




Filter Dust Collector



Nozzle Base



PRECAUTIONS FOR OPERAITNG THE PCB CUTTING APPLICATIONS MODELS: PART 1

- To activate the PCB cutting applications, customizing data for the PCB cutting applications (e.g. dedicated point types such as [Cut Start Point] and the program data [Board Cut Condition]) has been added to the standard robot system software.
  Therefore, if you select [Version Information] from the [Administration] menu, the [Use] line (third line from the top) will indicate [Standard].

- After having transmitted C & T data from the PC to the robot, the preset I/O settings will be deactivated. Be sure to turn on the robot again.

- After having changed the I/O function assignments, the ON/OFF settings may not be changed accordingly. To activate the changes, turn on the robot again for initialization.

- For the PCB cutting applications, the I/O type has been set to A (I/O-A). If B (I/O-B) has been selected, the robot will not work properly. In this case, change the I/O-type following the procedures on the next page.

I/O FUNCTIONS

Switching I/O Types

There are two I/O types: A (I/O-A) and B (I/O-B). They differ in terms of the I/O-SYS function assignment.
For the PCB cutting applications, the I/O type has been set to A (I/O-A). If B (I/O-B) has been selected, the robot will not work properly. In this case, change the I/O-type following the procedures below.

Important

If the I/O type is set to I/O-B, the operation mode can only be changed via the I/O-SYS. **Note that the operation mode cannot be changed using the teaching pendant after the unit has been set to I/O-B.**

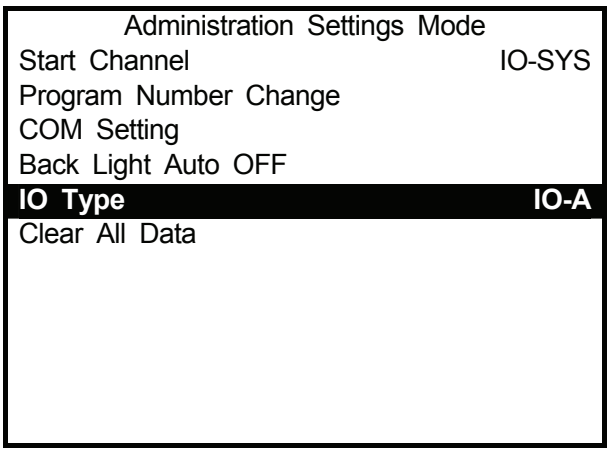
How to Switch between I/O Types

TP MODE [Administration]
[Administration Settings Mode]
[IO Type]

PC **The I/O type of the robot cannot be changed via a PC.**

Select [IO-B] using the teaching pendant to switch the I/O type from A to B.

To switch the I/O type from B to A, turn on the robot before connecting anything to the I/O-SYS. The robot will start in the Administration mode.
Then select [IO-A] following the above selection procedure.
Be sure to turn off the robot to connect the teaching pendant cable to the I/O-SYS. Then, turn on the robot.



I/O-SYS Function Assignments A (I/O-A)

		Name	Function	Pin No.
Input	Ext	sysIn1	Start	1
	PCB	sysIn2	Spindle Error	2
		sysIn3	Program Number LOAD	3
		sysIn4	Program Number bit0 2^0=1	4
		sysIn5	Program Number bit1 2^1=2	5
		sysIn6	Program Number bit2 2^2=4	6
		sysIn7	Program Number bit3 2^3=8	7
		sysIn8	Program Number bit4 2^4=16	8
		sysIn9	Program Number bit5 2^5=32	9
		sysIn10	Program Number bit6 2^6=64	10
		sysIn11	Last Work/Error Reset Program Number bit7 2^7=128	11
		sysIn12	Temporary Stop	12
		sysIn13	Free	13
		sysIn14	Free/Start Inhibition/Stop-Start Inhibition/Soft Lock/ Emergency Stop	14
		sysIn15	Free	15
		sysIn16	Free	16
Output	Ext	sysOut1	Ready for Start	17
		sysOut2	Robot Stopping	18
		sysOut3	Program Number ACK	19
		sysOut4	Program Number Error	20
		sysOut5	Running	21
		sysOut6	Error	22
		sysOut7	Emergency Stop	23
		sysOut8	Position Error	24
	PCB	sysOut9	Spindle	25
	PCB	sysOut10	Vacuum	26
	PCB	sysOut11	Air Blow	27
	PCB	sysOut12	Finish Initialize (Connect to the power supply relay on the unit box.)	28
		sysOut13	Free	29
		sysOut14	Free	30
		sysOut15	Free	31
		sysOut16	Free	32
		–	No Connection	33
Others		COM+	DC24V	34
		COM-	GND	35
		COM–	GND	36
		COM-	GND	37

Ext: Activated only in the External Run mode.

PCB: For the PCB cutting applications only: Do not change the functions.

Input

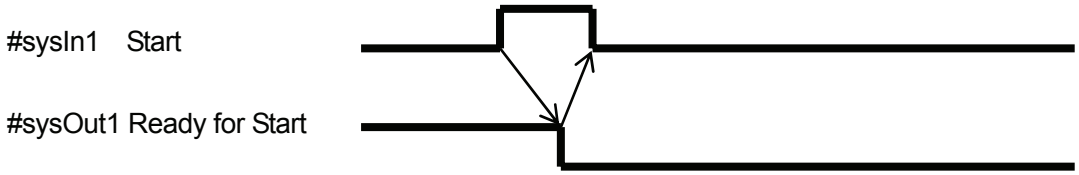
Start (#sysIn1): Turn on this signal to start or restart a program in the External Run Mode. This signal is also used to start mechanical initialization when turning the power on as well as when moving the Robot Axes to the coordinates of the work home position.
This signal is activated when the Ready for Start (#sysOut1) signal is on.

The #sysIn1 Start signal will perform mechanical initialization or start (restart) running programs **when the IO-S input is on and the #sysIn14 Start Inhibition signal is off in the External Run Mode**, and in any of the following conditions:

1. The robot is ready for mechanical initialization if the power is turned on.
2. The robot is ready for mechanical initialization after the emergency stop has been released.
3. The robot is ready to start a program at the work home position.
4. The robot has been stopped using a temporary stop.
5. The robot is stopped and is standing by for restart at a wait start point.
6. The robot has received a waitStart command and is standing by to restart.

A #sysIn1 Start signal of less than a 20msec pulse is regarded as invalid in order to eliminate electric noise.
The valid pulse width of the #sysIn1 Start signal is 30msec or wider; however, it is recommended that you set the #sysIn1 Start signal to turn off when the acknowledgement signal #sysOut1 Ready for Start is turned off, instead of setting the pulse width to 30msec or wider.

The #sysOut1 Ready for Start signal turns on when the robot is standing by to start in the above cases.
The #sysOut1 Ready for Start will turn off if the #sysIn1 Start turns ON.



Spindle Error (#sysIn2): This signal is turned off when the overcurrent of the spindle motor is detected during operation.
If this signal is turned off between [Cut Start Point] and [Cut End Point], the robot will be stopped immediately and the message [Spindle Motor Overload Error] will be displayed on the LCD.
This signal is used for the PCB cutting applications only. Do not change the function.

Program Number LOAD: (#sysIn3)

Use this signal to load the program numbers. Turning this signal on will load the #sysIn4 – 10 Program Number bit signals.
This signal is valid when [Program Number Change] in the [Administration Settings Mode] menu is set to [I/O-SYS] and [Program Number Changing Way] in the [Run Mode Parameter] menu is set to [LOAD/ACK Handshake].

Program Number bit 0 – 6: (#sysIn4 – #sysIn10)

Turning on these signals will assign program numbers.
For example, if you want to assign the program number 67, turn the #sysIn10, #sysIn5, and #sysIn4 signals on.

67 = 64 (#sysIn10) + 2 (#sysIn5) + 1 (#sysIn4)

These signals are valid when [I/O-SYS] in the [Program Number Change] ([Administration Settings Mode] menu) is set to [Valid].
If [Program Number Changing Way] in the [Run Mode Parameter] menu is set to [Loading at Start], start the program after assigning the program number using this signal.

Last Work (#sysIn11):

If [Cycle Mode] is set to [Continuous Playback], the robot Axes will move to Point 01 and repeat the operation after running the last point. Setting point job data that terminates the program, or turning this signal on will stop the robot.
This signal is valid only when the robot completes running the last point (before moving to Point 1). This signal cannot stop the robot in the middle of the program.

Error Reset (#sysIn11):

This signal resets operation if an operation error has occurred. After the error reset, the program (operation) is immediately terminated.
When this signal is turned on, the sysOut6 Error signal turns off. This enables you to use the sysOut6 Error signal as the ACK signal for the sysIn11 Error Reset signal.
This signal can terminate a program if the robot:

1. has been stopped by a sysIn12 Temporary Stop signal and is waiting for a start signal.
2. has been stopped at a [Wait Start Point] and is waiting for a start signal.
3. has received a point job *waitStart* command and is standing by to restart.

If this signal is turned on while the robot is stopped temporarily or while the sysOut1 Ready for Start signal is on, program execution will be reset and the program will terminate immediately.

Program Number bit 7: (#sysIn11)

The highest bit number of the #sysIn4 – #sysIn10 Program Number bit 0 – 6 signals. Turn on this signal to designate a program number larger than 128.

Temporary Stop (#sysIn12): Turning on this signal will temporarily halt the process in the middle of a program. This signal is invalid if the robot is running the CP points. It is valid only when the robot is running the PTP points.
The start will be disabled if this signal is on.

Start Inhibition (#sysIn14): Setting the #sysIn14 signal to [Start Inhibition] in the [IO-SYS Function Assignment] will disable start. This signal will function when it is turned off. (Active-Low signal)
When the #sysOut2 Robot Stopping signal is on (the robot is stopped), start can be disabled by turning this signal off. The robot will not move even if the #sysIn1 Start signal is turned on.
This signal is invalid if the #sysOut2 Robot Stopping signal is off (the robot is running).

Stop-Start Inhibition: (#sysIn14) Setting the #sysIn14 signal to [Stop-Start Inhibition] in the [IO-SYS Function Assignment] will stop the robot temporarily or disable start. This signal will function when it is turned off. (Active-Low signal)
When the #sysOut2 Robot Stopping signal is on (the robot is stopped), start can be disabled by turning this signal off. The robot will not move if the #sysIn1 Start signal turns on.
Turning this signal off when the #sysOut2 Robot Stopping signal is off will move the robot Axes to a PTP drive breakpoint and stop the robot temporarily. To restart it, first turn on this signal, and then the start signal.

Soft Lock (#sysIn14): Setting the #sysIn14 signal to [Soft Lock] in the [IO-SYS Function Assignment] will stop operation immediately or disable start. This signal will function when it is turned off. (Active-Low signal)
When the #sysOut2 Robot Stopping signal is on (the robot is stopped), start can be disabled by turning this signal off. The robot will not move if the #sysIn1 Start signal turns on.
Turning this signal off when the #sysOut2 Robot Stopping signal is off will stop the robot immediately.

Emergency Stop (#sysIn14): Setting the #sysIn14 signal to [Emergency Stop] in the [IO-SYS Function Assignment] will stop the robot immediately. This signal works when it turns off. (Active-Low signal)
The robot will stop immediately if this signal turns off in the External Run Mode or the Switch Run Mode.

Output

Ready for Start (#sysOut1): When the #sysIn1 Start signal is valid in the External Run Mode, this signal will turn on in the following cases:

- The robot is ready for mechanical initialization after the power is turned on.
- The robot is ready to move to the work home position.
- The robot is ready to start running.
- The robot has been stopped temporarily and is ready to restart operation.

The #sysOut1 Ready for Start signal will turn on **when the IO-S input is on and the #sysIn14 Start Inhibition signal is off in the External Run Mode**, and in any of the following conditions:

1. The robot is ready for mechanical initialization after the power is turned on.
2. The robot is ready for mechanical initialization after the emergency stop has been released.
3. The robot is ready to start a program at the work home position.
4. The robot has been stopped by a temporary stop.
5. The robot is stopped and is standing by to restart at a wait start point.
6. The robot has received a *waitStart* command and is standing by to restart.

If the #sysOut5 Running is off, the robot's status is either 1, 2, or 3.
Signals cannot identify the robot's statuses 4, 5, and 6.

Whenever the #sysOut1 Ready for Start signal is on, the #sysOut2 Robot Stopping is always on. However, the #sysOut1 Ready for Start will not turn on when the robot is stopped and will wait for a start signal. The #sysOut2 Robot Stopping signal will turn on instead.

Robot Stopping (#sysOut2): When the robot is stopped, this signal is on. When the robot is running, this signal is off.
If this signal is on (the robot is stopped), start will be disabled when the #sysIn14 Soft Lock signal is turned off. The robot will not move even if the #sysIn1 Start signal is turned on.
If this signal is off (the robot is running), the robot will stop immediately when the #sysIn14 Soft Lock signal is turned off.

Program Number ACK: (#sysOut3) This is the acknowledgement signal for the #sysIn3 Program Number LOAD signal.
When the #sysIn3 Program Number LOAD signal turns on, the #sysIn4 – #sysIn10 Program Number bit signals will be loaded and then this signal will turn on. This signal will turn off if the #sysIn3 Program Number LOAD signal turns off.

Program Number Error: (#sysOut4) This signal turns on when an unregistered program number is selected in the Switch Run Mode and the External Run Mode.

Running (#sysOut5):	This signal turns on when the robot starts running a program. This signal turns off when the robot finishes running a program.
Error (#sysOut6):	This signal turns on when an error has occurred.
Emergency Stop (#sysOut7):	This signal turns on when an emergency stop error has occurred. (e.g. the emergency stop button has been pressed.) When this signal turns on, the #sysOut6 Error signal turns on at the same time.
Position Error (#sysOut8):	If [Position Error Check] in the [Other Parameter] menu ([Run Mode Parameter]) is set to [Valid], the position sensor will check the position error just before the robot finishes running (returns to the work home position.) This signal turns on if a position error is detected.
Spindle (#sysOut9):	Turn on this signal to rotate the spindle motor. Turn off this signal to stop the spindle motor. **This signal is used for the PCB cutting applications only. Do not change the function.**
Vacuum (#sysOut10):	Turn on this signal to start vacuuming. Turn off this signal to stop vacuuming. **This signal is used for the PCB cutting applications only. Do not change the function.**
Air Blow (#sysOut11):	Turn on this signal to start blowing air. Turn off this signal to stop blowing air. **This signal is used for the PCB cutting applications only. Do not change the function.**
Finish Initialize (#sysOut12):	This signal is turned on when initialization is completed. This signal is being turned on unless you need to perform initialization again in case of the emergency stop, for example. For the PCB cutting applications, this signal pin is connected to the power supply relay on the unit box. Accordingly, the unit box is on while this signal is on. When this signal is turned off, the unit box is also turned off. **This signal is used for the PCB cutting applications only. Do not change the function.**

OTHERS

COM+ (DC24V): If the I/O-SYS Internal/External power selector switch is set to [EXT], connect the COM+ pin to the plus pole of the external power supply (DC24V).
If the I/O-SYS Internal/External power selector switch is set to [IN], DC24V (+) will be output.

Do not connect the COM+ pin to the external power supply when [I/O-SYS] is set to [Internal]. Doing so may cause unit malfunction.

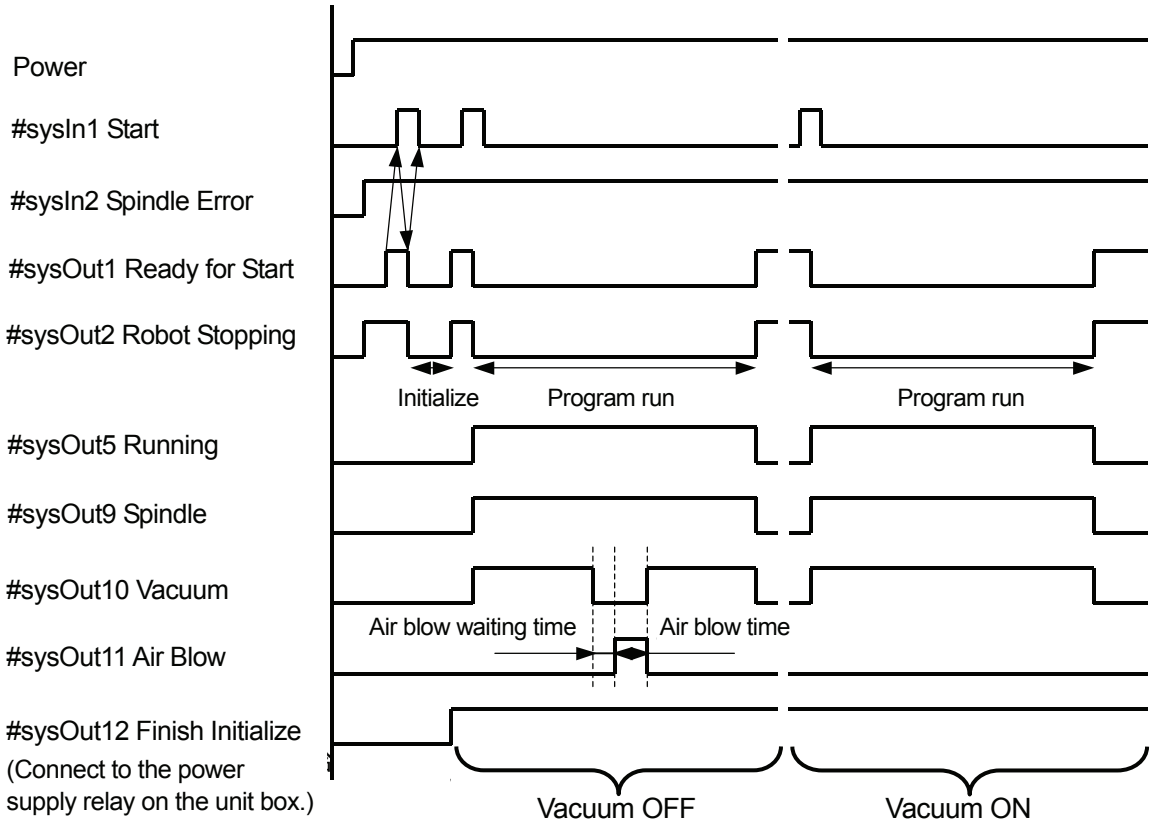
COM- (GND): If the I/O-SYS Internal/External power selector switch is set to [EXT], connect the COM- pin to the ground of the external power supply.
If the I/O-SYS Internal/External power selector switch is set to [IN], use the pin as a common ground.

I/O-1 Function Assignment A (I/O-A)

	Name	Function	Pin No.	Color of Insulator	Spiral Mark
Input	genIn1	Free	1	Blue	
	genIn2	Free	2	Orange	
	genIn3	Free	3	Green	
	genIn4	Free	4	Brown	
	genIn5	Free	5	Grey	
	genIn6	Free	6	Red	
	genIn7	Free	7	Black	
	genIn8	Free	8	Yellow	
Output	genOut1	Free	9	Pink	
			10	Purple	
	genOut2	Free	11	White	
			12	Blue	Red
	genOut3	Free	13	Orange	White
			14	Green	White
	genOut4	Free	15	Brown	White
			16	Grey	White
	genOut5	Free	17	Red	White
	genOut6	Free	18	Black	White
	genOut7	Free	19	Yellow	Black
	genOut8	Free	20	Pink	Black
Others	COM+	DC24V	21	Purple	White
	COM+	DC24V	22	White	Blue
	COM-	GND	23	Blue	Red
	COM-	GND	24	Orange	White

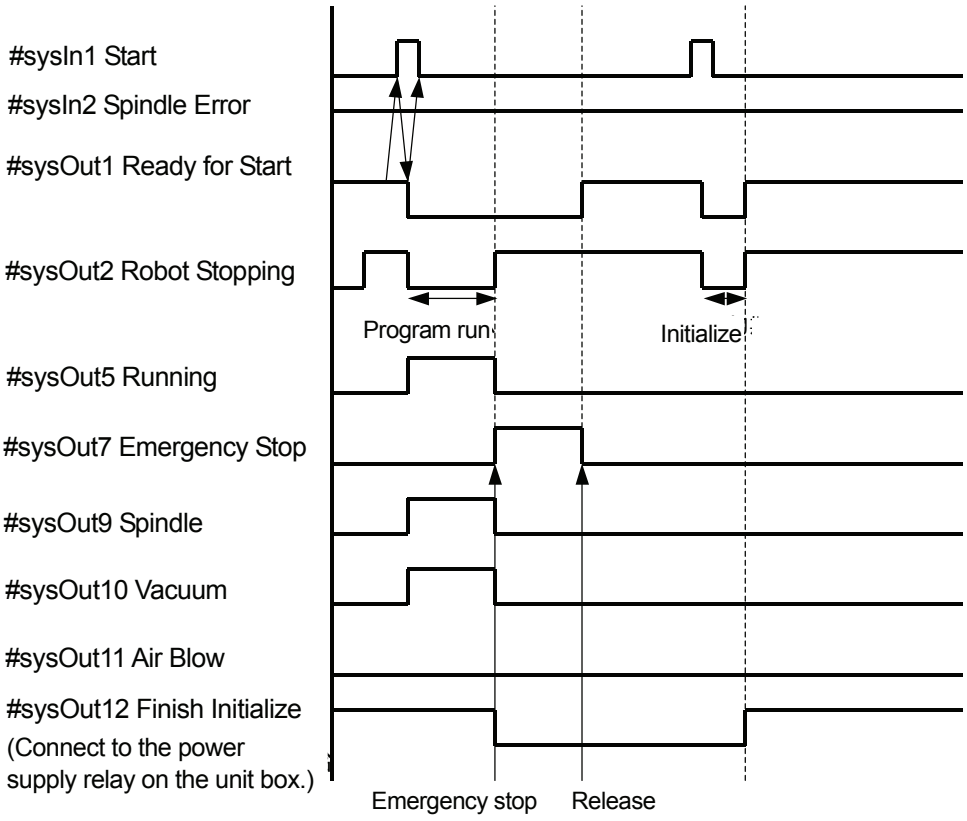
TIMING CHART

1. PCB Cutting (I/O-A)



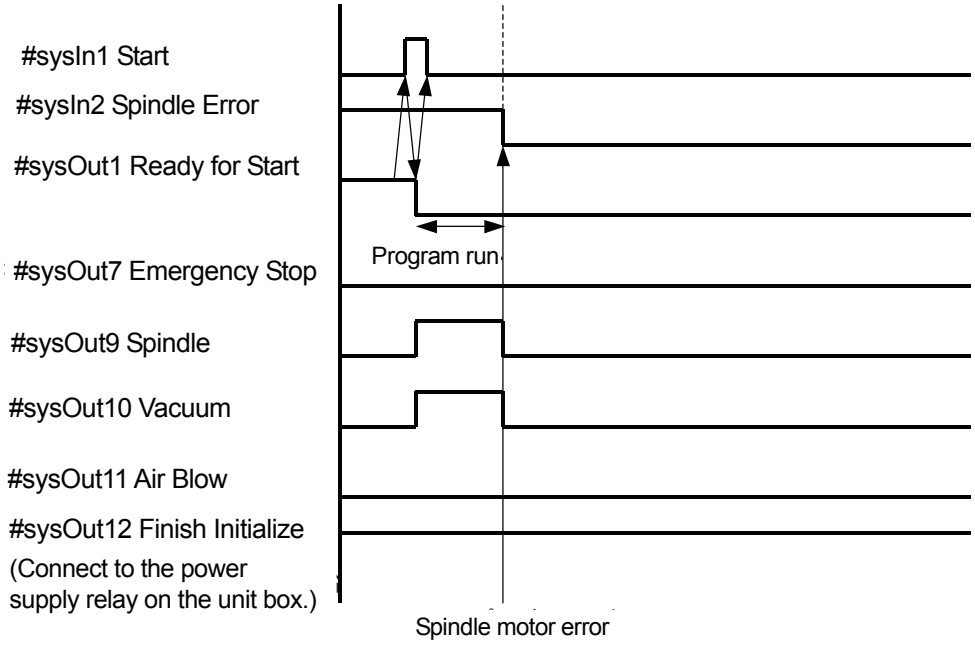
- This timing chart shows an example when running a program that includes the PCB cutting point types [Cut Start Point] and [Cut End Point].

2. Emergency Stop (I/O-A)



- This timing chart shows an example when running a program that includes the PCB cutting point types [Cut Start Point] and [Cut End Point].

3. Spindle Error (I/O-A)



- This timing chart shows an example when running a program that includes the PCB cutting point types [Cut Start Point] and [Cut End Point].

PRECAUTIONS FOR OPERAITNG THE PCB CUTTING APPLICATIONS MODELS: PART 2

Data created in the Customizing mode is referred to as *customizing data*.
To activate the PCB cutting applications, add customizing data for the PCB cutting applications (e.g. dedicated point types such as [Cut Start Point] and the program data [Board Cut Condition]) to the standard robot system software.
If the account [JSMC_BC] is deleted in the Customizing mode, all other customizing data for the PCB cutting applications will be deleted. In this case, you need to repeat point teaching again.

If you are using the JR C-Points software (optional), select [Open] from the [File] pull-down menu, then open the PCB applications C & T data file [JR2*03NERT_xxx.cps] (included on the operation manual CD-ROM) to create a new C & T data file.
Note that C & T data opened by selecting [New] from the [File] pull-down menu does not include the PCB applications customizing data. If you send the C & T data to the robot, the PCB applications customizing data stored in the robot will be overwritten (deleted).
If the PCB cutting applications customizing data stored in the robot is deleted, follow the instructions on page 75 (“If the PCB Cutting Applications C & T Data Is Deleted”) to restore the data.

Cautions

If customizing data for the PCB cutting applications (account name: [JSMC_BC]) is deleted, the PCB cutting applications will not be activated. Do not operate the robot.

Cautions for Operating the Robot

- If [Clear All Data] ([Administration Settings Mode] menu) is performed, all the customizing data for the PCB cutting applications will be deleted. To delete only the teaching data collectively, select the items [MENU] → [Teaching Data Copy, Delete, Conversion] → [Delete All Teaching Data] in order.

- If you wish to change the point job numbers set under [Job and Sequencer on Run Mode], be sure to read “Precaution for Changing the Point Job Numbers Set under [Job and Sequencer on Run Mode]” on page 53, and then perform a test run.
  After having changed the point job numbers set under [Job and Sequencer on Run Mode], the spindle motor may not stop rotating even after the robot is stopped.

- Always pay attention to the spindle motor rotation when performing a point run in the Teaching mode.

TP When performing a point run in the Teaching mode, press the [1] key on the point settings screen ([Manual Job Number Setting]) to rotate the spindle motor (Spindle ON) and to start vacuuming (Vacuum ON). To stop the spindle motor rotation (Spindle OFF), press the [0] key on the point settings screen ([Manual Job Number Setting]). Under the [Manual Job Number Setting], the spindle motor will not stop when the point run is completed.

To run the point job at the end of cycle, set the [Job on End of Cycle (while P.EXEC)] to [Valid] and press the [F4] (P.EXEC) key after a point run is performed at the last point in a program.

The robot will return to the work home position and run the point job set there if the [Cycle Mode] ([Program Data Settings] item) is set to [Continuous Playback] and the sysIn11 ([Last Work]) signal is on.

Note that the [Job on End of Cycle (while P.EXEC)] is one of the [Job Sequencer on Teaching Mode] settings ([Teaching Mode Customizing] menu) in the Customizing mode.

PC When performing a point run via the PC, enter [101]*1 in the [Point Job] cell in the [JOG] dialog box to rotate the spindle motor (Spindle ON) and to start vacuuming (Vacuum ON). To stop the spindle motor rotation (Spindle OFF), enter [102]*2 in the [Point Job] cell in the [JOG] dialog box. Under this condition, the spindle motor will not stop when the point run is completed.

To run the point job at the end of cycle, set the [Job on End of Cycle (while P.EXEC)] to [Valid] and select [Program Data] → [WorkHome] from the menu bar then click *3 after a point run is performed at the last point in a program.

The robot will return to the work home position and run the point job set there if the [Cycle Mode] ([Program Data Settings] item) is set to [Continuous Playback] and the sysIn11 ([Last Work]) signal is on.

*1: Point job data 101: Preparation for PCB cutting (Spindle ON, Vacuum ON, Air OFF)

*2: Point job data 102: Post-processing for PCB cutting (Spindle OFF, Vacuum OFF, Air OFF)

*3: This function is only available on JR C-Points software newer than Ver. 9.14.

TEACHING DATA

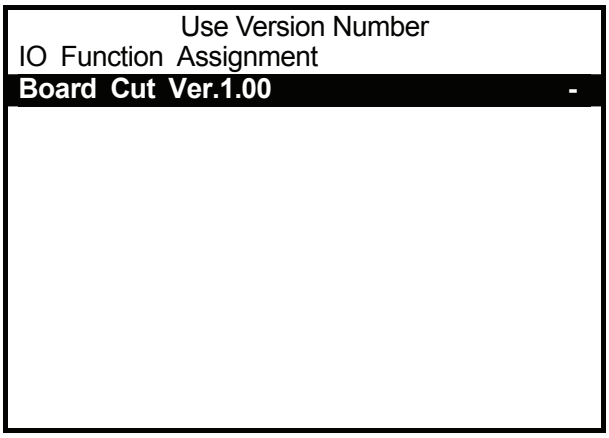
How to Confirm the Application Version Number

Customizing data for the PCB cutting applications (e.g. dedicated point types such as [Cut Start Point] and the program data [Board Cut Condition]) has been added to the standard robot system software. Confirm the customizing data version number following the procedures below.

TP MENU → [Use Version Number]

PC [Data] → [Use Version Number]

If the application version number will not be displayed properly or the dedicated point types (e.g. [Cut Start Point]) cannot be selected, it is possible that the customizing data for the PCB cutting applications is deleted.
In this case, referring to page 75 (“If the PCB Cutting Applications C & T Data Is Deleted”), send C & T data [JR2x03NERT_xxx.cps] (included on the operation manual CD-ROM) from the PC to the robot, and then perform point teaching.



Point Types

There are four point types for the PCB cutting applications.

1. Cut Start Point
   Set this point type to the point where the PCB cutting is started. The unit switches from the PTP drive to the CP drive. After the spindle motor is turned on, the unit stands by for the [Start Wait Time] specified in [Board Cut Condition] and detects the spindle error at this point.

2. Cut Relay Point
   Set this point type to the point where the unit changes the direction of the CP drive between the [Cut Start Point] and [Cut End Point] points. The unit stands by for the [Line Stop Time] specified in [Board Cut Condition] and detects the spindle error at this point.

3. Cut Arc Point

Set this point type to the point used to specify an arc in the CP drive drawn by the unit between the [Cut Start Point] and [Cut End Point] points. The unit continues to detect the spindle error after having passed through this point.

4. Cut End Point

Set this point type to the point where the PCB cutting is completed. At this point, the vacuum can be set to turn on or off.

- Vacuum OFF:

  The unit stops vacuuming, stands by for the [Air Blow Wait Time] specified in [Board Cut Condition], and blows air for the [Air Blow Time] specified in [Board Cut Condition]. Then the unit starts vacuuming again and moves to the next point in the PTP drive.

- Vacuum ON:

  The unit continues vacuuming and moves to the next point in the PTP drive, without standing by at this point.

- If you wish to perform PCB cutting in the CP drive, be sure to set all the four PCB cutting point types to job points. Otherwise, operations such as vacuuming, blowing air, and rotating the spindle motor will not function properly.

- The spindle motor will rotate when a program run is started, even though any or all of the four PCB cutting point types are not set to job point.

- Refer to the general operation manuals pertaining to this robot for explanations of the standard point types.

Depending on the point type set to each point, some types of data cannot be set. Refer to the table below for details.

(○: Can be set, ×: Cannot be set)

Point Job Data/ Additional Function Data / Point Type	Line Speed	Job before Moving*1	Job while Moving*1	Point Job*1	Job while CP Driving*1	PTP Condition	CP Condition	Tool Data	Pallet Routine	Work Adjustment	Execute Condition	Tag Code
Cut Start Point	○	○	○	○	○	×	○	○	○	○	○	○
Cut Relay Point	○	×	×	○	○	×	○	×	×	○	○	○
Cut Arc Point	○	×	×	○	×	×	×	×	×	○	○	○
Cut End Point	×	×	×	○	×	○	×	×	×	○	○	○
PTP Point	×	○	○	○	×	○	×	○	○	○	○	○
CP Start Point	○	○	○	○	○	×	○	○	○	○	○	○
CP Passing Point	○	×	×	○	×	×	×	×	×	○	○	○
CP Stop Point	○	×	×	○	○	×	○	×	×	○	○	○
CP Arc Point	○	×	×	○	×	×	×	×	×	○	○	○
CP End Point	×	×	×	○	×	○	×	×	×	○	○	○
PTP Evasion Point	×	×	×	×	×	○	×	×	○	×	○	×
Circle Start Point	○	○	○	○	○	×	○	○	○	○	○	○
Circle Center Point	×	×	×	×	○	○	×	×	×	△	○	○

△: The [Work Adjustment] data cannot be se to the [Circle Center Point], however the data set to the [Circle Start Point] will also be applied to the [Circle Center Point].

***1**: If you add [Job before Moving], [Job while Moving], [Point Job], or [Job while CP Moving] to any of the following points: [Cut Start Point], [Cut Relay Point], [Cut Arc Point], or [Cut End Point], the job originally set to the point will be ignored, (e.g. the unit will not stand by until the start switch is pressed, or a start signal will come on at the [Cut Start Point]) and the newly added job will be performed instead. If you wish to perform both jobs, execute the *callBase* command in the newly added job. The originally set job will be called and performed.

If you use Move commands (e.g. *lineMove*) between the [Cut Start Point] and [Cut End Point] points, the unit cannot detect the spindle error while executing the Move command.

Board Cut Condition (Program Data)

[Board Cut Condition] is included in the program data of each program and is only activated for the program in which it is contained.

There are 4 board cut conditions.

1. Start Wait Time

   The unit lowers the Z-Axis at the [Cut Start Point] point and stands by for starting cutting operation for the [Start Wait Time] specified in [Board Cut Condition] at the [Cut Start Point].

   The cutter and/or the workpiece may vibrate while the cutter drives a hole at the [Cut Start Point]. Set the [Start Wait Time] enough to stabilize the cutter and workpiece.

2. Line Stop Time

   Load on the cutter increases rapidly at the [Cut Relay Point]. To reduce load on the cutter, the unit stops for the [Line Stop Time] specified in [Board Cut Condition] at the [Cut Relay Point].

3. Air Blow Wait Time

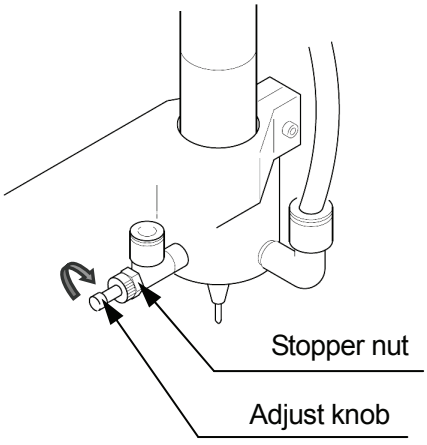
   To prevent the cutter getting stuck in the PCB, the unit blows air at the [Cut End Point] point if [Vacuum OFF] is set to the [Cut End Point]. To stabilize the cutter and workpiece the unit can stand by before blowing air at the [Cut End Point]. The unit stops vacuuming, stands by for the [Air Blow Wait Time] specified in [Board Cut Condition], and blows air for the [Air Blow Time] specified in [Board Cut Condition].

4. Air Blow Wait Time

   To prevent the cutter getting stuck in the PCB, the unit blows air at the [Cut End Point] point. If [Vacuum OFF] is selected, the unit stops vacuuming, stands by for the [Air Blow Wait Time] specified in [Board Cut Condition], and blows air for the [Air Blow Time] specified in [Board Cut Condition]. If [Vacuum ON] is selected, the unit continues vacuuming and moves to the next point in the PTP drive, without blowing air.

To reduce exhaust air, turn the adjust knob on the bottom of the spindle motor to the right.

After the adjustment, tighten the stopper nut to secure the knob.



Job and Sequencer on Run Mode

The following point job for the PCB cutting applications can be set under [Job and Sequencer on Run Mode]:

Point job number	Point job name	Function
101	CutStart	Preparation for PCB cutting (Spindle ON, Vacuum ON, Air OFF)
102	CutEnd	Post-processing for PCB cutting (Spindle OFF, Vacuum OFF, Air OFF)

Confirm the point job numbers set under [Job and Sequencer on Run Mode] following the procedures below.

TP MENU → [Run Mode Parameter] → [Job and Sequencer on Run Mode]

PC [Data] → [Run Mode Parameter]

Precaution for Changing the Point Job Numbers Set under [Job and Sequencer on Run Mode]

The default point jobs originally set to the point job numbers 101 and 102 under the [Job and Sequencer on Run Mode] menu. (See the table on the next page for details)
These point job numbers can be changed following the above procedure.

Job and Sequencer on Run Mode	1/2
Job on Power ON	0
Job after Initialize	**102**
Job on Emergency Stop	102
Job on Playback Error	102
Job on System Error	102
Job on Start of Run Mode	0
Job on Start of Cycle	101
Job on End of Cycle	102
Job on Stopping	0
Job on Starting	0
Job while Stopping (Cycle Top)	0
Job while Stopping (In Cycle)	0

If you have changed the default point job number 101 or 102, execute the *callJob* command under the new point job number.
The default point jobs will be called and performed.
If you have changed the default point job number 101 or 102 and have not executed the *callJob* command under the new point job number, the preparation and post-processing for the PCB cutting (e.g. turning the spindle motor on and off) will not be performed.

Caution

If you wish to change the point job numbers set under [Job and Sequencer on Run Mode], be sure to read the above precaution and then perform a test run.
After having changed the point job numbers set under [Job and Sequencer on Run Mode], the spindle motor may not stop rotating even after the robot is stopped.

For example, write the command [callJob 101] to call the default point job set to the point job number 101.

- For details on the [Job and Sequencer on Run Mode], see the *Features III* operation manual.
- For details on the point job commands (e.g. [callJob]), see the *Features II* operation manual.

The table below shows the point jobs originally set under [Job and Sequencer on Run Mode] need to be called and performed.

Point job	Point job name	Default point job number	Possible error occurs if you have changed the default point job number and have not executed the *callJob* command under the new point job number
Job on Emergency Stop	CutEnd	102	The spindle motor will not stop rotating even after the emergency stop switch is pressed and the robot is stopped.
Job on Playback Error	CutEnd	102	The spindle motor will not stop rotating even after the spindle error has occurred and the robot is stopped.
Job on System Error	CutEnd	102	The spindle motor will not stop rotating even after the system error has occurred and the robot is stopped.
Job on Start of Cycle	CutStart	101	The spindle motor will not start rotating even after the operation is stated.
Job on End of Cycle	CutEnd	102	The spindle motor will not stop rotating even after a cycle of operation is completed and the robot is stopped.
Job after Initialize	CutEnd	102	The spindle motor will not be reset even when mechanical initialization is performed after turning on the power or releasing the emergency stop.

Follow the procedures below to reset the parameters in the Run mode.

TP MENU → [Teaching Data Copy, Delete, Conversion] → [Reset Run Mode Parameter]

PC [Data] → [Run Mode Parameter] → Press the [Back Default Value] button.

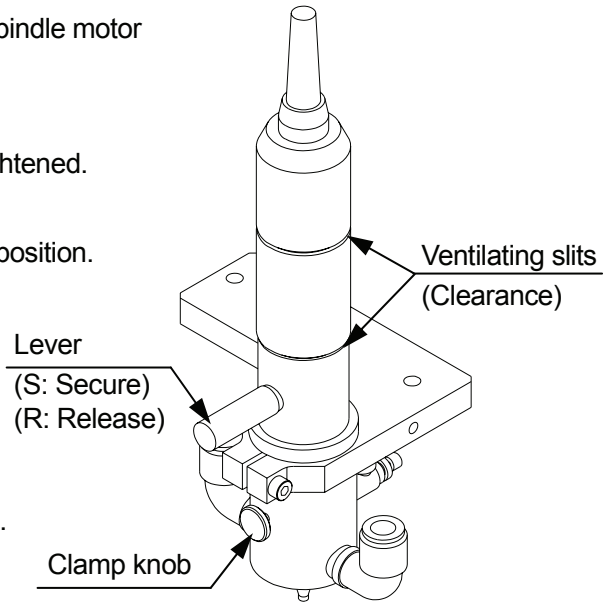
PRECAUTIONS FOR OPERATION

Check the following before turning on the unit:

- All the grounding wires and the connecting cable are connected properly.
- All the air tubes are connected to the appropriate positions properly.
- The air pressure regulator is set to the standard setting (0.5MPa {5kgf/cm^2}).
- The safety cover is secured properly.

Check the following before teaching and running points:

- Nothing blocks the two ventilating slits on the spindle motor (necessary for cooling the motor).
- The clamp knob on the nozzle base is firmly tightened.
- The lever on the spindle motor is set at the [S] position.
- The collet chuck holds the cutter firmly.
- The dust collect filter is not full.
- The attached jigs are suitable for the workpiece.



Caution

- Place the switch box on a stable surface. Placing it on an unstable surface or near the operating range of the unit is dangerous since it may not be possible to stop the unit immediately and safely. This could result in operator injury.
- Check that the connecting cables and the air tubes do not collide with the unit or the jigs during operation. Colliding with the unit and the jigs may lead unit malfunction or air leakage.
- Note that the spindle motor is highly-heated before and after operation.

Caution

Janome original high efficient dust collection system does not ensure 100% dust collection.
To prevent from inhaling dust or chips, operators should wear a dust mask and ventilate the work area during PCB cutting operation.

TEACHING

To perform PCB cutting operation in the CP drive, it is necessary to set the four PCB cutting point types [Cut Start Point], [Cut Relay Point], [Cut Arc Point], and [Cut End Point] to job points. The settings can be changed under the [Board Cut Condition].

The following is an example when registering a new program.

Program and Points

First, select a program number to register.
If you are using the PC, open C & T data [JR2x03NERT_xxx.cps], including the customizing data for the PCB cutting applications, first.

TP PROG.NO → Enter a program number.

Press the SHIFT + ESC keys to return to the base condition, and then press the PROG.NO key. The Program Number entry screen will appear.
Enter a program number you wish to register. The settings screen for Point 1 will appear.

PC

1. First, double-click the following C & T data (included on the operation manual CD-ROM) to be sent to the robot.

   - For Model JR2203NERT: JR2203NERT_xxx.cps
   - For Model JR2303NERT: JR2303NERT_xxx.cps
   - For Model JR2403NERT: JR2403NERT_xxx.cps

   ([xxx] indicates the customizing data version number.)

- Save the file onto the PC with a different file name.
- This step is not necessary if you receive the above C & T data from the robot using [Receive C&T Data] ([Robot] menu).

2. [Program] → [Add Program] → Enter a program number.

Straight Cutting

Enter the point where PCB cutting operation is started.

If you register a new point, the Point Type selection screen shown to the right will appear after having entered the coordinates.

Select [Cut Start Point] to display the Line Speed entry screen. Then enter the desired value.

Select Point Type	1/2
Cut Start Point	
Cut Relay Point	
Cut Arc Point	
Cut End Point	
PTP Point	
PTP Evasion Point	
Circle Start Point	
Circle Center Point	
CP Start Point	
CP Passing Point	
CP Stop Point	
CP Arc Point	

Point Type Selection Screen

- If you register points using the PC (JR C-Points software), a [PTP Point] will be added to the end of the program by clicking the icon once. Then change the point type to [Cut Start Point].

Register the [Cut End Point] point where PCB cutting operation is completed.

- At the [Cut Start Point] point, the unit stands by for the [Start Wait Time] set under [Board Cut Condition] in [Program Data Settings] menu. The [Start Wait Time] is activated only at the [Cut Start Point] point.
- At the [Cut End Point] point, the unit stands by for the [Air Blow Wait Time] set under [Board Cut Condition] in the [Program Data Settings] menu, and then blows air for the [Air Blow Time] set under [Board Cut Condition] in the [Program Data Settings] menu.

Caution

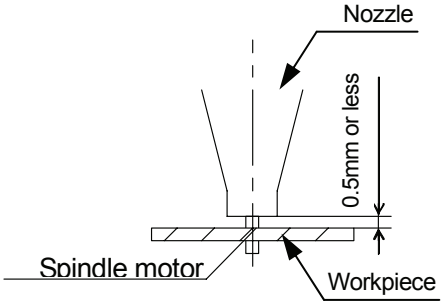
The faster the line speed is, the shorter the life of the cutter becomes.
Set the line speed approx. 10mm/sec so that the green LED lights up.

Caution

Register the cutting job point so that the distance between the workpiece and the nozzle is 0.5mm or less. (The wider the distance is, the less dust collection efficiency becomes.)

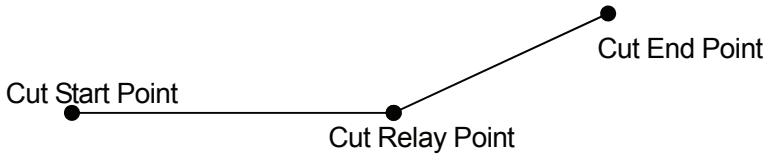
Note that if the registered point is too low, the nozzle may damage the workpiece and the pulse motor error will be returned.

Also note that the nozzle tip can be bent easily. Do not apply a hard shock to it.



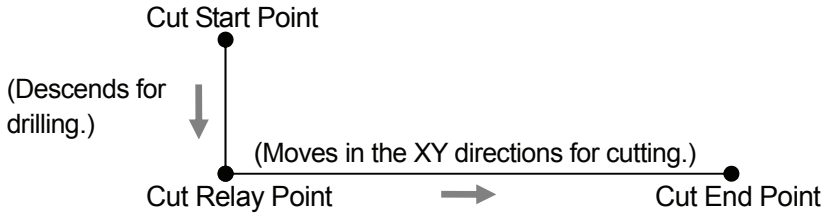
Zigzag Cutting

Register the [Cut Relay Point] between the [Cut Start Point] and [Cut End Point] points to bend a straight line as shown below.



Display the settings screen (also referred to as *base condition* in the operation manuals) for the [Cut End Point]. Then press the EDIT key and select [Insert a Point]. The new position entry screen will appear. Select the second line and enter the coordinates of the point to be inserted.
The Point Type selection screen will appear. Then select [Cut Relay Point].
The Line Speed entry screen will appear. Enter the desired (CP) line speed and fix it.

If you set the [Cut Relay Point] to the starting point in X-Y direction for cutting and set the [Cut Start Point] above the [Cut Relay Point], the unit drives a hole at the [Cut Relay Point], then moves while cutting the workpiece.



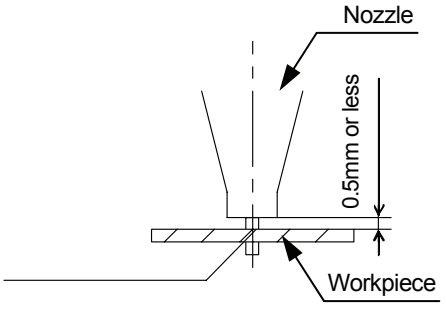
In the example above, the unit descends for drilling at the (CP) line speed set to the [Cut Start Point] and moves in the XY directions at the (CP) line speed set to the [Cut Relay Point] while cutting the workpiece.

Caution

The faster the line speed is, the shorter the life of the cutter becomes.
Set the line speed approx. 10mm/sec so that the green LED lights up.

Caution

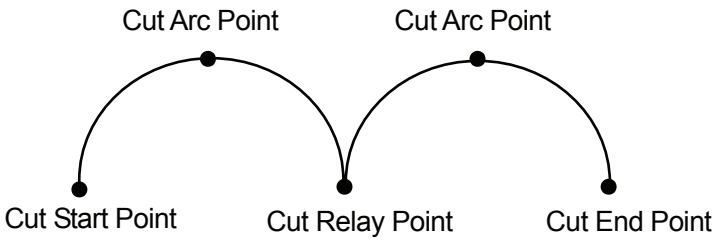
Register the cutting job point so that the distance between the workpiece and the nozzle is 0.5mm or less. (The wider the distance is, the less dust collection efficiency becomes.)
Note that if the registered point is too low, the nozzle may damage the workpiece and the pulse motor error will be returned.
Also note that the nozzle tip can be bent easily. Do not apply a hard shock to it.



Arch Cutting

To perform cutting operation in an arc, register the [Cut Start Point] first, [Cut Arc Point] next, and then [Cut End Point] to three consecutive points to draw an arc as illustrated below.

By registering [Cut Relay Point] instead of [Cut End Point], you can repeat an arc motion.



If you register points using the PC (JR C-Points software), a [PTP Point] will be added to the end of the program by clicking the icon once. Then change the point type to the [Cut Start Point], [Cut Arc Point], [Cut End Point], or [Cut Relay Point].

Caution

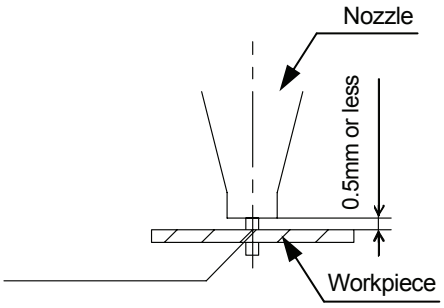
The faster the line speed is, the shorter the life of the cutter becomes.
Set the line speed approx. 10mm/sec so that the green LED lights up.

Caution

Register the cutting job point so that the distance between the workpiece and the nozzle is 0.5mm or less. (The wider the distance is, the less dust collection efficiency becomes.)

Note that if the registered point is too low, the nozzle may damage the workpiece and the pulse motor error will be returned.

Also note that the nozzle tip can be bent easily. Do not apply a hard shock to it.



Board Cut Condition

TP MENU → [Program Data Settings]
→ [Board Cut Condition]

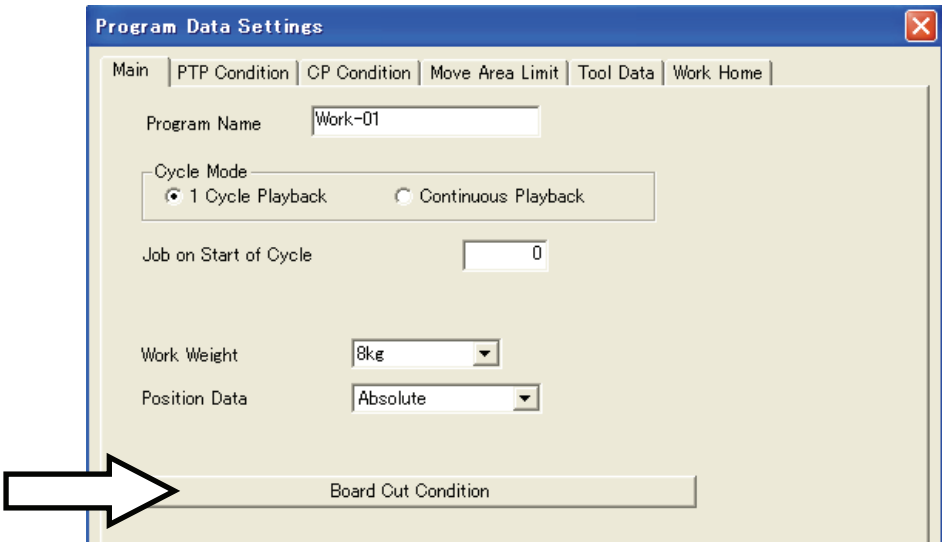
PC [Program] → [Program Data Settings] → [Board Cut Condition]

Set the following item under the [Board Cut Condition]:

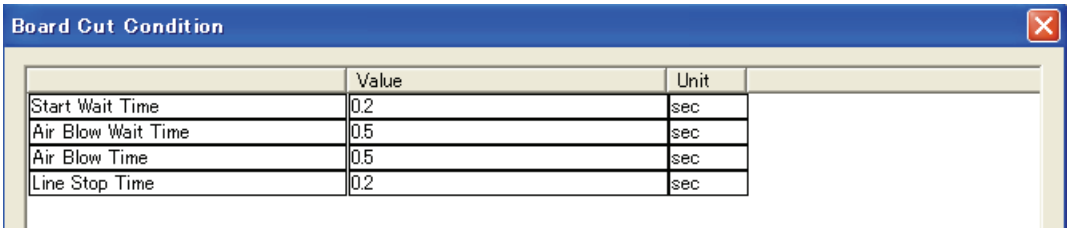
1. Start Wait Time (Setting range: 0 – 10sec, default: 0.2sec)
2. Line Stop Time (Setting range: 0 – 10sec, default: 0.5sec)
3. Air Blow Wait Time (Setting range: 0 – 10sec, default: 0.5sec)
4. Air Blow Time (Setting range: 0 – 10sec, default: 0.2sec)

- The [Air Blow Wait Time] and [Air Blow Time] set under the [Board Cut Condition] are activated at the [Cut End Point] only when [Vacuum] is set to [OFF].

If you are using the PC, press the [Board Cut Condition] button in the Program Data Settings dialog box. The Board Cut Condition edit screen shown below will appear.

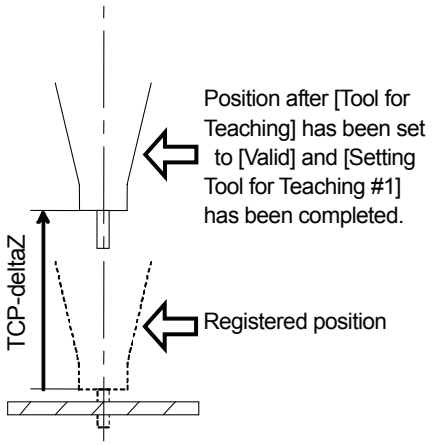


Click the [Value] cell and enter the desired values.



Z-Axis Position Adjustment for Checking the Point Position

Using the [Tool for Teaching] function, you can check the job point position from a different Z-Axis position to prevent the cutter from colliding with the PCB due to a position error.



For example, follow the procedures below if you wish to set the Z-Axis position 10mm above the registered position:

1. Press the SHIFT + T.ENV keys to display the Tool for Teaching settings screen. This screen can be displayed if you press the T.ENV key and then select [Tool for Teaching].

   There are two [Tool for Teaching] menu options:

   - [Tool for Teaching] ([Invalid] or [Valid])
   - [Setting Tool for Teaching] (#1 – #5)

2. Set the [Tool for Teaching] to [Valid].

3. Press the SHIFT + ESC keys to return to the Tool for Teaching settings screen, and then select [Setting Tool for Teaching #1].

4. Set each item in the [Setting Tool for Teaching] to the following value:

   - [TCP-X] and [TCP-Y]: 0mm
   - [TCP-deltaZ]: 10mm

5. Press the SHIFT + ESC keys to return to the Tool for Teaching settings screen, and then press the GO key.
   Each Axis will ascend 10mm from the position coordinates displayed on the LCD. After the ascent, the current position coordinates will be displayed on the LCD.

Tool for Teaching	
Tool for Teaching	Invalid
Setting Tool for Teaching #1	
Setting Tool for Teaching #2	
Setting Tool for Teaching #3	
Setting Tool for Teaching #4	
Setting Tool for Teaching #5	

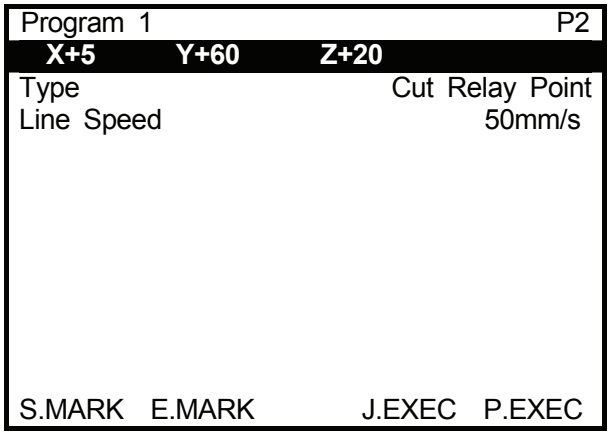
Setting Tool for Teaching	
Tool Weight	3.5kg
TCP-X	0mm
TCP-Y	0mm
TCP-deltaZ	10mm
Direct TCP-XY Setting	

- After the [Setting Tool for Teaching] settings (Step 4 above) have been completed, you can change the Z-Axis position by pressing the GO key on the Tool for Teaching settings screen if [Tool for Teaching] is set to [Valid].
- The [Setting Tool for Teaching] settings are activated only in the Teaching mode, except a test run and point run. (Press the F4 ([P.EXEC]) key to perform a point run.)

TEACHING PENDANT OPERATION

How to Control the Spindle Motor, Vacuum, and Air Flow Manually

You can control the spindle motor, vacuum, and air flow by pressing the following key on the point settings screen:



Point Settings Screen

[0] key: Spindle OFF, Vacuum OFF, Air OFF

Turns off the spindle motor, vacuum, and air blow: Equal to the post-processing for PCB cutting (point job number 102 described on page 51)

Press this key to turn off the functions when PCB cutting is not performed.

[1] key: Spindle ON, Vacuum ON, Air OFF

Turns on the spindle motor and vacuum: Equal to the preparation for PCB cutting (point job number 101 described on page 51)

[2] key: Vacuum OFF, Air ON

Press this key to exhaust air when adjusting the air flow manually.

Press the [0] key to stop exhaust air.

Caution

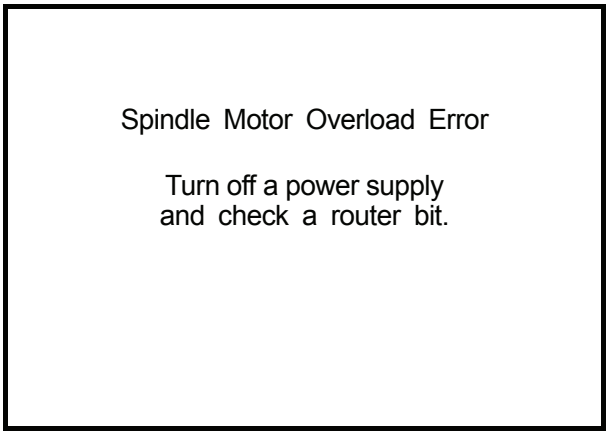
The above functions are assigned to the [0], [1], and [2] keys under [Manual Job Number Setting] ([Teaching Environment] menu).

These functions will be deactivated if the point job numbers assigned under [Manual Job Number Setting] have been changed or customizing data for the PCB cutting applications (account name: [JSMC_BC]) has been deleted.

REQUIRED ACTION UPON A SPINDLE ERROR

If the cutter is blunt, the current to the spindle motor will increase and the indicator will light up in order of Green → Yellow → Red.
If the red LED is on for 2 seconds, a spindle error will be returned.

If a spindle error is detected between [Cut Start Point] and [Cut End Point] points, the unit will be stopped immediately, then the spindle motor, vacuuming, and air suction will be turned off and the message shown to the right will be displayed on the LCD.



Spindle Motor Overload Error Message

The spindle error may be returned if the cutter is not secured to the collet chuck.
Turn off the power switch of the unit box and check that the cutter is not loose or damaged.

- When the spindle error has occurred, the message [Ur] and the error No. [01] will be displayed on the program number display on the front of the robot.

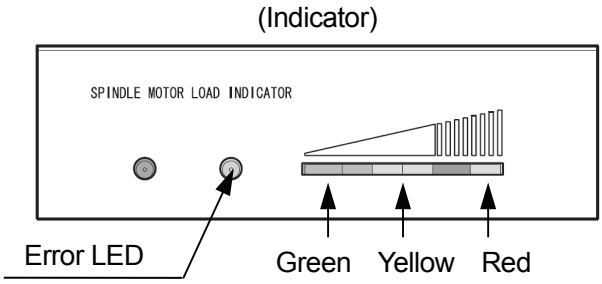
No.	Message	Countermeasure
01	Spindle Motor Overload Error	This error will be returned due to overload of motor, for example, when the current to the spindle motor increases. Turn off the unit and check that the cutter is not loose or damaged.

If you have changed any settings or data stored in the robot, be sure to save it in the robot. Otherwise, changes will not be saved when the robot is turned off.
If the spindle error has occurred before saving the changes, follow the procedures below, and then turn off the unit and check the cutter.

1. Press the emergency stop switch.
2. Turn the emergency stop switch counterclockwise to release emergency stop state.
3. Perform initialization. (Press the F4 key.)
4. Save C & T data. (Press the SAVE key.)
5. Turn off the robot.

MAINTENANCE

The LEDs on the indicator will light up depending on the current through the spindle motor.
If the cutter is blunt, the current to the spindle motor will increase and the LEDs will light up in order of Green → Yellow → Red.



Green LED: Both the cutter and feed speed are proper for PCB cutting.

Yellow LED: Either the cutter or feed speed is not proper for PCB cutting. Check that the cutter is not damaged or reduce the feed speed.

Red LED: If the red LED is on for 2 seconds, the spindle error will be returned and the robot will be stopped. Both the error and red LEDs will be on. Check that the cutter is not damaged. If the cutter is damaged, replace it referring to "How to Replace the Cutter" on the next page.

Caution

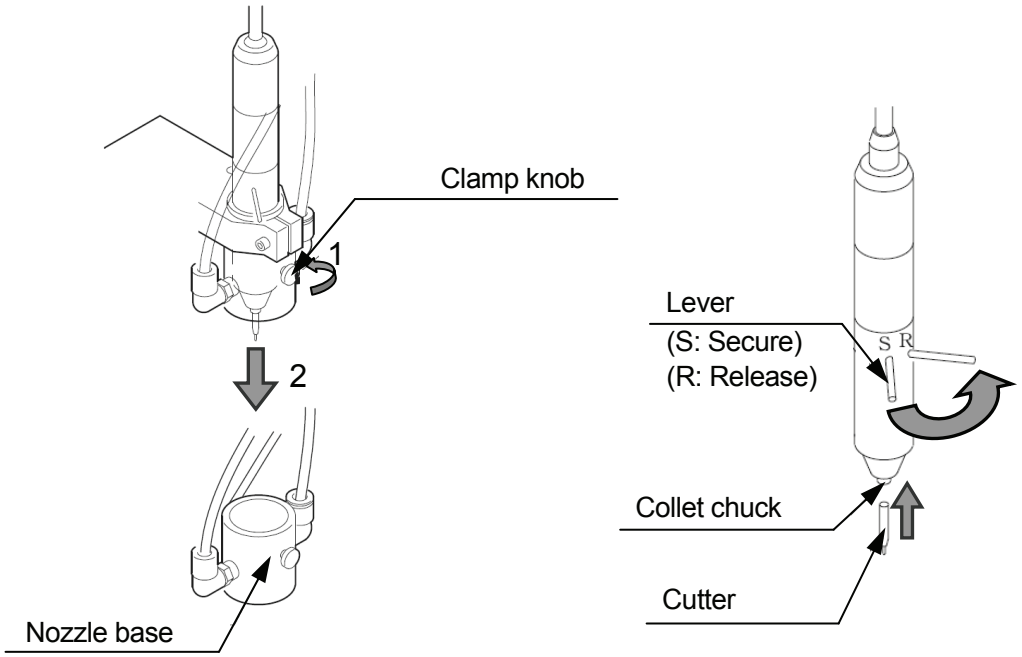
- The error LED flashes once and will be turned off when the unit is turned on.
- The green, yellow and red LEDs will light up once when the spindle motor starts rotating, but the yellow and red LEDs will be turned off soon.
- When the unit is stopped due to a servomotor error, raise the Z-Axis before turning the power off. Otherwise, the PCB may be damaged since the PCB clamp will be released when the power is turned off and each Axis will move a small amount when the servomotor is turned on.
- If the yellow or red LED light up after replacing the cutter, the feed speed is high or any of the spindle motor parts are damaged. If the LEDs still light up after reducing the feeding speed, contact the dealer from whom you purchased the robot or the office listed on the last page of this manual to overhaul the motor.

Replacement Parts List

Name		Q'ty	Number
Cutter		1 (10pc set)	996445005
Vacuum nozzle		1	996091002
Dust collector unit	Dust collector filter	3	996667005
	Binder	3	
	Ejector	1	
Spindle motor		1	996516008
Nozzle base bulkhead (Protector)		1	996111009

How to Replace the Cutter

1. Turn off the unit and then remove the power cable from the wall outlet.
2. Loosen the clamp knob to draw the nozzle base vertically from the spindle motor. Be careful not to damage the cutter with the nozzle base.
3. Turn the lever on the spindle motor to the [R] position to release the collet chuck, and then pull out the cutter.



4. Insert a cotton swab soaked with alcohol into the collet chuck to clean the inside.
5. Insert the cutter into the collet chuck as far as it will go, and then turn back the lever to the [S] position to secure the cutter.
6. Reattach the nozzle base, and then tighten the clamp knob. Be careful not to damage the cutter.

Caution

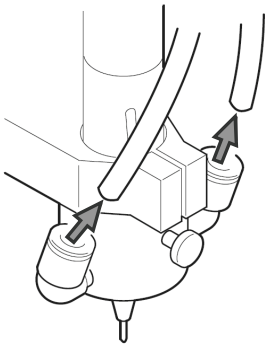
- Be sure to turn the lever to the [S] (locking) position before starting the unit. Otherwise, the spindle motor will be broken.
- The cutter is secured with a three-jaw collet chuck. Check that the chuck is clean before inserting the cutter. The chuck cannot hold the cutter firmly if chips or dust got inside the chuck.
- Clean the collet chuck regularly.
- When reattaching the nozzle base, push it back firmly. A loose nozzle cannot collect dust efficiently.

How to Clean and Replace the Vacuum Nozzle

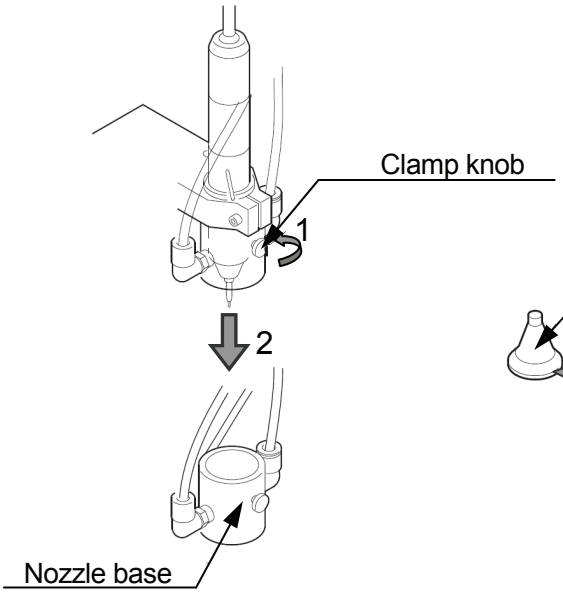
> **Caution** When attaching or removing the vacuum nozzle, be careful not to damage the cutter.

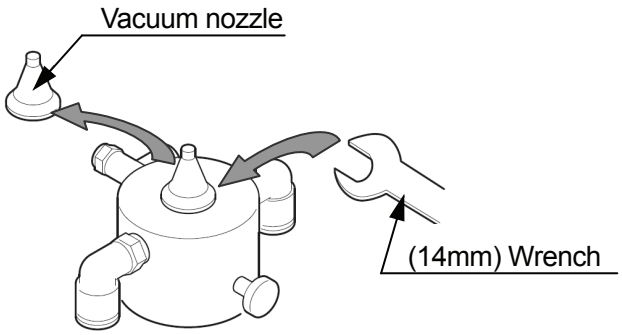
During the prolonged use, collect dust efficiency will be reduced with chips got inside the vacuum nozzle. Clean the vacuum nozzle regularly.
If the cutter collides with the nozzle tip, the vacuum nozzle may be damaged. Replace it with a spare vacuum nozzle included in the package.

1. Turn off the unit and then remove the power cable from the wall outlet.
2. Remove the air tubes from the nozzle base.

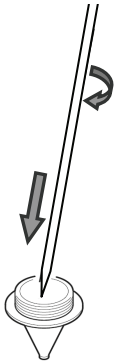


3. Loosen the clamp knob to remove the nozzle base.





4. Loosen the vacuum nozzle using a 14mm wrench, and then remove it from the nozzle base.
   If the vacuum nozzle has been damaged, replace it with a spare nozzle included in the package.
5. Remove chips from inside the nozzle using a wooden stick with a fine point.
6. Screw the vacuum nozzle into the nozzle base, and then tighten it with a 14mm wrench.

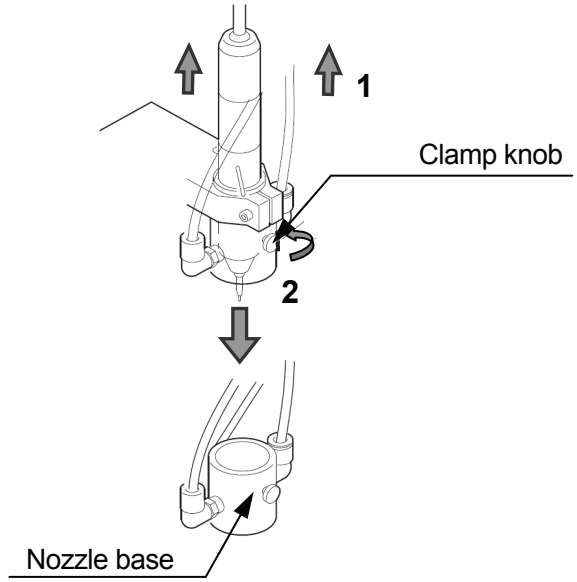


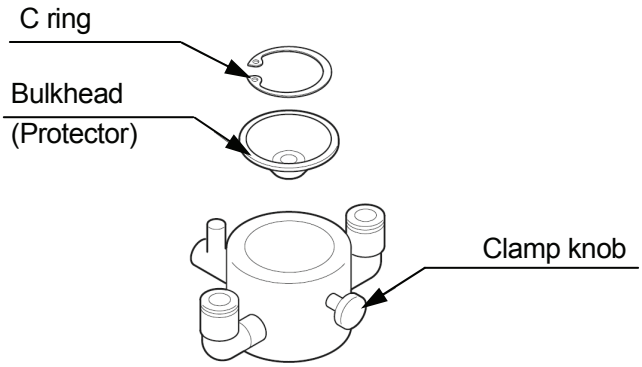
How to Replace the Nozzle Base Bulkhead (Protrector)

1. Turn off the unit and then remove the power cable from the wall outlet.

2. Remove the air tubes from the nozzle base, and then loosen the clamp knob to remove the nozzle base.

3. Remove the C ring using the dedicated tool (Snap ring plier: S0CP-130 manufactured by Kyoto Tool Co., Ltd.).



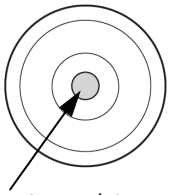


4. Replace the bulkhead (protector) if it is damaged.

⚠ Caution

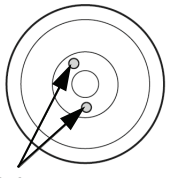
- Replace the bulkhead (protector) if damaged to prolong the spindle motor life.
- Check whether the bulkhead (protector) is damaged regularly, approx. every 6 to 12 months, depending on the working environments such as the materials of the PCB or unit utilization.
  The bulkhead (protector) will be damaged with chips passing through it. The damaged bulkhead (protector) illustrated below may decrease dust collect efficiency and result in malfunction of the motor.

- **Inner diameter becomes large**



Larger than ϕ3.7mm
(Standard inner diameter: ϕ3.4mm)

- **Holes in unwanted places**

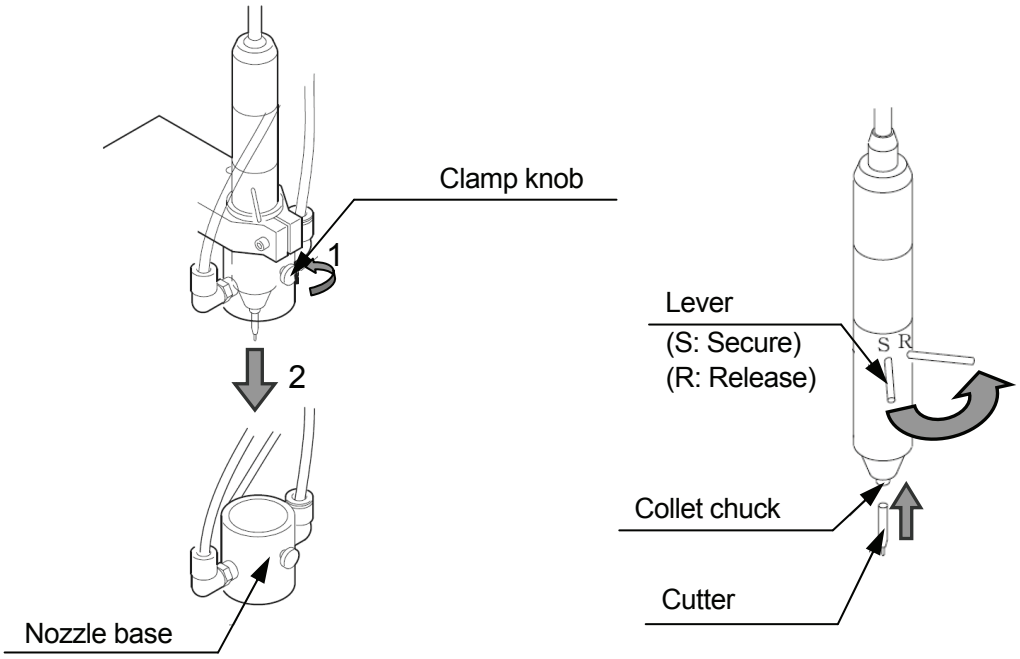


Holes

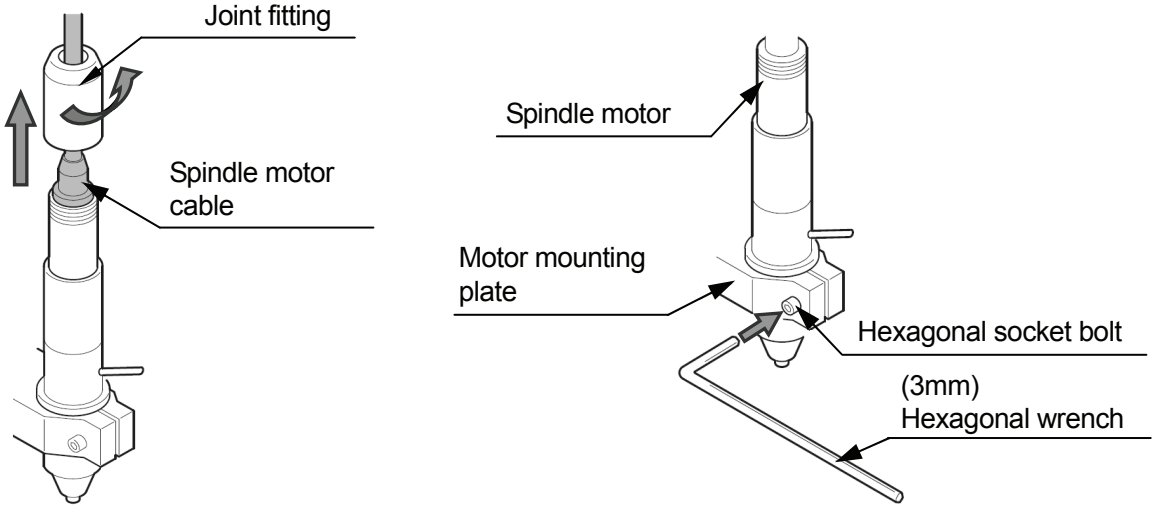
How to Replace the Spindle Motor

Replace the spindle motor if it is damaged.

1. Turn off the unit and then remove the power cable from the wall outlet.
2. Loosen the clamp knob to draw the nozzle base vertically from the spindle motor. Be careful not to damage the cutter with the nozzle base.
3. Turn the lever on the spindle motor to the [R] position to release the collet chuck, and then pull out the cutter.

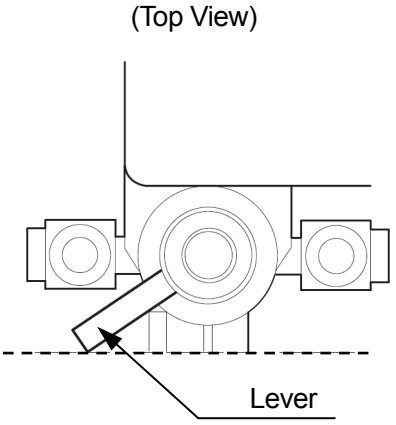


4. Loosen the joint fitting on the spindle motor.
5. Remove the joint fitting from the spindle motor to remove the spindle motor cable.
6. Loosen the hexagonal socket bolt on the motor mounting plate using a 3mm hexagonal wrench to remove the spindle motor.
7. Replace the spindle motor with a new one.



8. Turn the lever on the spindle motor to the [S] position, and then set the motor within the right side of the tool holder (indicated by the dotted line).

9. Tighten the hexagonal socket bolt to the tool holder using a 3mm hexagonal wrench at a 0.8Nm (8kgfcm) tightening torque.

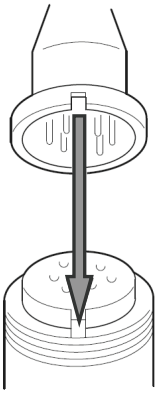


10. Fit the notches to connect the spindle motor cable to the spindle motor.

11. Reattach the joint fitting.

12. Insert the cutter into the collet chuck as far as it will go, and then turn back the lever to the [S] position to secure the cutter.
    Check that the chuck is clean before inserting the cutter. The chuck cannot hold the cutter firmly if chips or dust got inside the chuck.

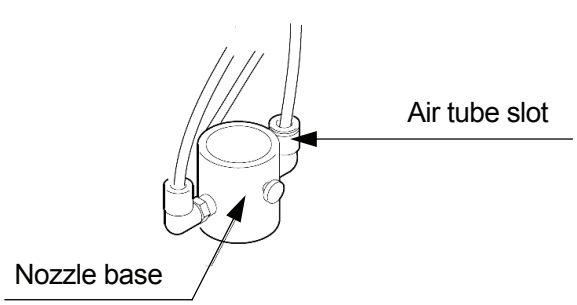
13. Reattach the nozzle base, and then tighten the clamp knob. Be careful not to damage the cutter.

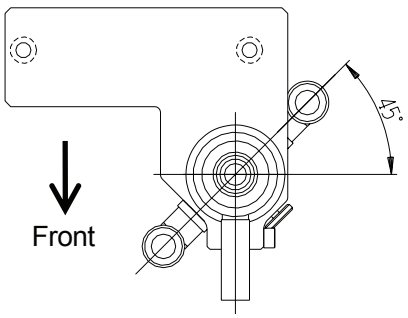


Caution

The guarantee period of the spindle motor is 6 months.
If there is no trouble with the motor, it is advisable to perform maintenance once every 6 months.
For maintenance or replacement, contact the dealer from whom you purchased the robot or the office listed on the last page of this manual.

- If you are using Model JR2203NERT, adjust the nozzle base so that the air tube slots come at a 45-degree angle to the robot. Otherwise, the air tube slot will hit the safety cover when the Y-Axis moves.
  If you are using Models JR2303NERT and JR2403NERT, adjust the nozzle base so that the air tubes do not hit the spindle motor lever.





How to Replace the Spindle Motor Bearing

The spindle motor bearing life varies depending on the working environments such as the materials of the PCB or unit utilization.

It is advisable to replace the bearing after 2,000 hours of use.

Caution

Refer to the LEDs on the indicator for the time of replacement.
If the spindle motor bearing is damaged, the motor will be stopped during operation.
For replacement, contact the dealer from whom you purchased the robot or the office listed on the last page of this manual.

How to Replace the Ejector

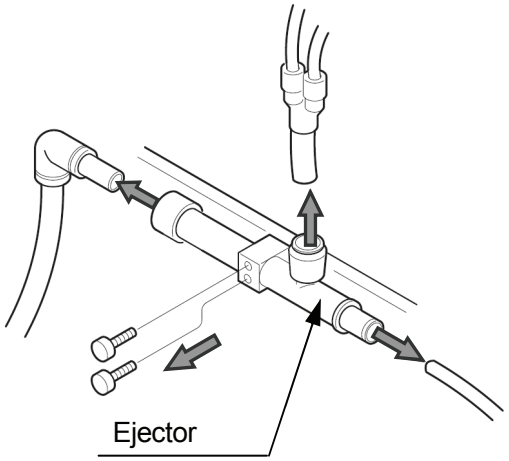
Many chips passing through the diffuser inside the ejector at a high speed may damage the diffuser and may decrease dust collection efficiency.

To maximize the ejector performance, it is advisable to replace the ejector when you have replaced the dust collector filter three times.

Caution

Replace the ejector regularly.
Failure to do so may decrease dust collection efficiency.

1. Turn off the unit and then remove the power cable from the wall outlet.
2. Remove the three air tubes from the ejector.
3. Remove the two screws attaching the ejector to the rear of the robot.
4. Reverse the above procedures to attach a new ejector at a 1.5Nm (15kgfcm) tightening torque.



How to Replace the Dust Collector Filter

The chips from the PCB pass through the air tube connected to the vacuum nozzle and the ejector attached to the rear of the robot, and then accumulates in the dust collector filter inside the filter dust collector.
Accumulated chips in the dust collector filter may decrease dust collection efficiency.
Replace the filter frequently.

Caution

- Time for replacement varies depending on the working environments such as the materials of the PCB or unit utilization.
  Frequently see or touch the dust collector filter to check the amount of the chips accumulated in it.
- Wear a dust mask when replacing the dust collector filter.

It is advisable to replace the dust collector filter when the amount of the chips reaches a volume of approx. 6,000cm^3.
The amount of the chips accumulated in the filter varies depending on the materials of the PCB or the cutter diameter.
Use the following formula to calculate the amount of the chips accumulated in the filter each time the PCB is cut 1mm (A cm^3/m):

$$A\ (cm^3/m) = 10 \times \frac{\text{PCB thickness (mm)} \times \text{Square of the cutter diameter (mm)}}{1.024}$$

For example, when a 0.8mm thick PCB is cut with a ϕ0.8mm cutter, [A] will be:

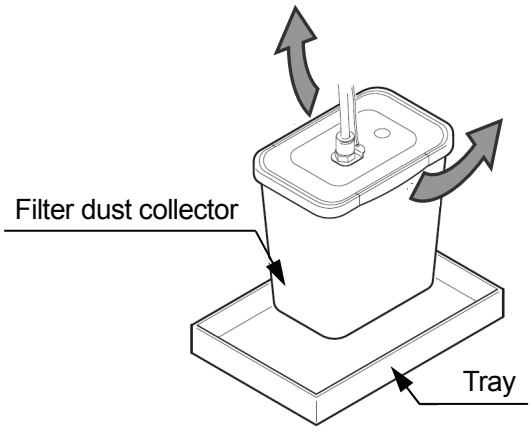
$$10 \times \frac{0.8\ (mm) \times 0.8\ (mm)\ squared}{1.024} = 5\ (cm^3/m)$$

Accordingly, the optimal cut length for replacement will be:

$$6000\ (cm^3) / 5\ (cm^3/m) = 1200\ (m)$$

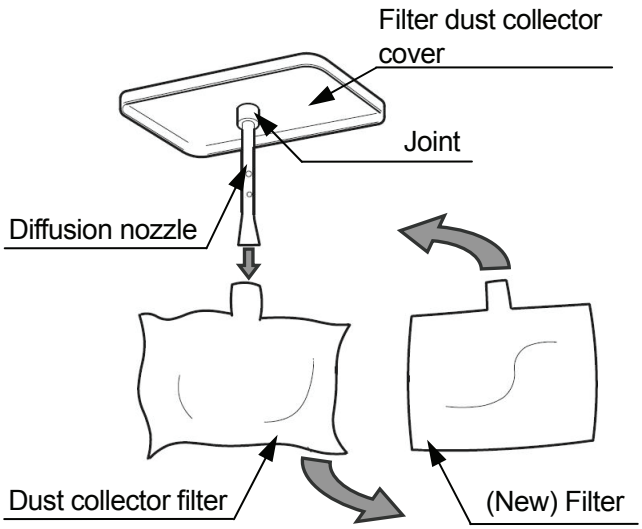
Replace the filter each time the PCB is cut approx. 1,200m.

For high dust collection efficiency, replace the dust collector filter frequently.
When replacing the filter, put a tray under the filter dust collector so as to catch the chips come from the filter.



1. Turn off the unit and then remove the power cable from the wall outlet.

2. Wear a dust mask, and then remove the filter dust collector cover.
   Gently remove the dust collector filter from the diffusion nozzle. If the filter cannot be removed, cut the binder to release it.



Caution

- Check that no chip gets jammed in the diffusion nozzle.
- Do not push the dust collector filter hard. Otherwise, chips are pushed out of the filter and may splatter around.

3. Bind the top of the filter with a binder, and then dispose it according to the guidelines for separating trashes in your area.

4. Insert the diffusion nozzle into the top of a new filter, and then secure the filter with the binder.
   Insert the diffusion nozzle so that the top of the filter covers the base of the nozzle (joint).
   If inside of the filter dust collector is dirty, wipe with a waste cloth soaked with alcohol.

Caution

- Chips from the PCB are accumulated inside the dust collector filter. When replacing the filter, wear a dust mask so as not to inhale the chips.
- Do not Do not block the exhaust opening on the filter dust collector cover.
- Check that the grounding wire is properly connected to the filter dust collector.
- The dust collector filter is disposable and cannot be reused. Dispose it according to the guidelines for separating trashes in your area. (Filter material: 100% polyester)

If the PCB Cutting Applications C & T Data Is Deleted

If the [Use Version Number] is not displayed properly or the PCB cutting point types cannot be selected, PCB cutting applications customizing data may have been deleted.
The PCB cutting applications customizing data will be deleted if:

1. You are using the JR C-Points software (optional) and open C & T data by selecting [New] from the [File] pull-down menu, then send the data to the robot.
2. You select [Clear All Data] in the [Administration Settings Mode] menu.

In this case, start up the JR C-Points Limited Edition software (included on the operation manual CD-ROM) or the JR C-Points software (optional) and then send the PCB cutting applications C & T data to the robot.

If backup of the PCB cutting applications C & T data is available, send the backup file to the robot following the procedures below.

How to Send the Backup File from the PC to the Robot

Start up the JR C-Points Limited Edition software (included on the operation manual CD-ROM).
Click [Robot] on the menu bar and then click [Send C & T Data] on the pull-down menu.
After having transmitted C & T data from the PC to the robot, all the C & T data set stored in the robot will be deleted.
(For details on the backup data, see “HOW TO BACK UP THE C & T DATA” of the *Maintenance* operation manual.)

- After having transmitted C & T data from the PC to the robot, the preset I/O settings will be deactivated. Be sure to turn on the robot again.

- If the backup data version is older than the deleted customizing data, you need to update the customizing data again.

If backup of the PCB cutting applications C & T data is not available, follow the procedures on the next page.

How to Reset the Robot Settings to the Factory Default

If backup of the PCB cutting application C & T data is not available, send the PCB cutting applications C & T data included on the operation manual CD-ROM to the robot.
All the C & T data set stored in the robot will be deleted and the robot settings will reset to the factory default.

1. Start up the JR C-Points Limited Edition software (included on the operation manual CD-ROM). Click [Robot] on the menu bar and then click [Send C & T Data] on the pull-down menu to transmit the C & T data corresponding to the model you are using.

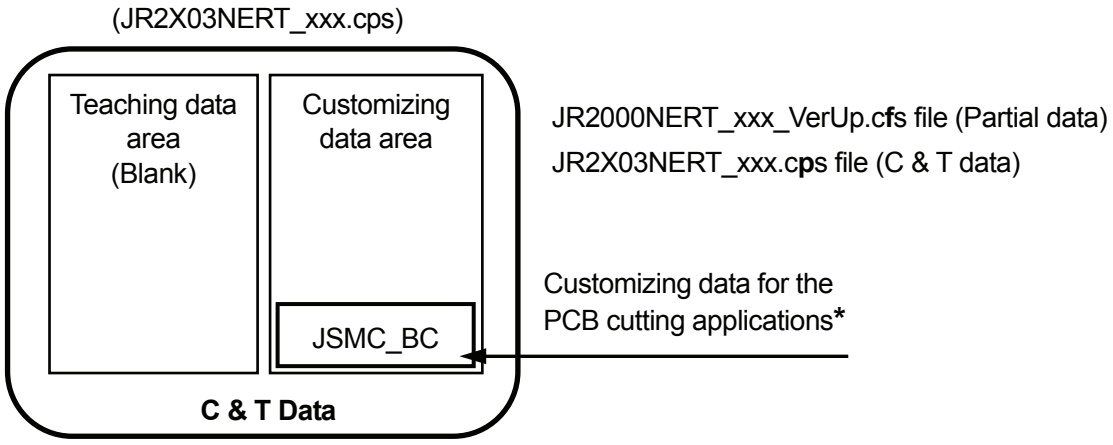
   JR2203NERT_xxx_cps: PCB cutting applications C & T data for Model JR2203NERT
   JR2303NERT_xxx_cps: PCB cutting applications C & T data for Model JR2303NERT
   JR2403NERT_xxx_cps: PCB cutting applications C & T data for Model JR2403NERT

   These C & T data files are included on the operation manual CD-ROM. (See page 5 for details)
   [xxx] indicates the customizing data version number.

- After having transmitted C & T data from the PC to the robot, the preset I/O settings will be deactivated. Be sure to turn on the robot again.

- If the C & T data includes the newer PCB cutting applications than that in the C & T data included on the operation manual CD-ROM is available, send the newer one to the robot.

- To reset the robot settings to the factory default, send C & T data [JR2X03NERT_xxx.cps] (included on the operation manual CD-ROM) from the PC to the robot.



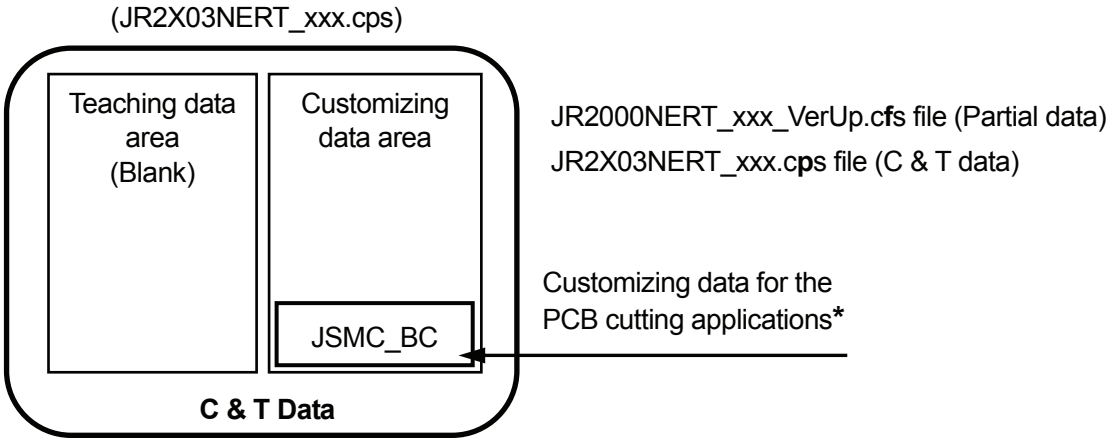
*: The contents of [JR2000NERT_xxx_VerUp.cfs] is the same as those of [JSMC_BC]. ([JSMC_BC] has been saved partially.)

- [xxx] indicates the customizing data version number.
- [X] varies depending on the models (2, 3, or 4).

How to Update Customizing Data for the PCB Cutting Applications

Caution

To update customizing data for the PCB cutting applications, send the JR2000NERT_xxx_VerUp.c**f**s file (partial data) to the robot.
If the JR2X03NERT_xxx.c**p**s file (C & T data) is transmitted to the robot, all teaching data and customizing data for the PCB cutting applications will be deleted.



*: The contents of [JR2000NERT_xxx_VerUp.cfs] is the same as those of [JSMC_BC]. ([JSMC_BC] has been saved partially.)

- [xxx] indicates the customizing data version number.
- [X] varies depending on the models (2, 3, or 4).

Follow the procedures below to update customizing data for the PCB cutting applications (account name: [JSMC_BC]).

1. Receive C & T data from the robot using the JR C-Points software (optional).
2. Select [Open Piece Data] from the [File] pull-down menu on the menu bar to open JR2000NERT_xxx_VerUp.cfs (partial data).
3. Check the [Overwrite Data From Now] box in the [Data Duplication] dialog box to overwrite data.
4. Send C & T data to the robot.
5. Turn off the robot and then turn it on again.

- Refer to the *Maintenance* operation manual on how to update the robot system software.
  To activate the PCB cutting applications, customizing data for the PCB cutting applications (e.g. dedicated point types such as [Cut Start Point] and the program data [Board Cut Condition]) is add to the standard robot system software.

SPECIFICATIONS

JR2200N(E) Series

Model 2203NERT		
Specifications		Description
Axis Type		3 (synchronous control)
Operating Range	X-Axis	200mm
	Y-Axis	200mm
	Z-Axis	50mm
Cutting Operation Range (Limit)	X-Axis	200mm
	Y-Axis	195mm
	Z-Axis	45mm
Portable Weight	Workpiece	7kg
	Tool	2.5kg
Acceptable Moment of Inertia		–
Maximum Speed[*1] (PTP Drive)	X- and Y-Axes	700mm/sec (7 – 700mm/sec)[*2]
	Z-Axis	250mm/sec (2.5 – 250mm/sec)[*2]
Maximum Speed[*1] (CP Drive)	X-, Y-, and Z-Axes (Combined)	500mm/sec (0.1 – 500mm/sec)[*2]
Repeatability	X- and Y-Axes	±0.006mm
	Z-Axis	±0.006mm
Supply Air Pressure[*3]		0.5Mpa (5kgf/cm^2)
Air Consumption		200Nl/min[*4]
External Dimensions (excluding cables and protrusions)	W x D x H (mm)	350 x 436 x 615
Weight (Robot)		26kg

*1: Maximum speed may vary depending on drive conditions.

*2: Speed range

*3: Use dry air contains no oil and water to prevent malfunction of the devices.

*4: Set the supply air to 200Nl/min or higher so as to maintain the dust collection efficiency. Insufficient air supply may result in pressure failure while vacuuming.

JR2300N(E) Series

Model 2303NERT		
Specifications		Description
Axis Type		3 (synchronous control)
Operating Range	X-Axis	300mm
	Y-Axis	320mm
	Z-Axis	100mm
Cutting Operation Range (Limit)	X-Axis	300mm
	Y-Axis	320mm
	Z-Axis	95mm
Portable Weight	Workpiece	11kg
	Tool	5kg
Acceptable Moment of Inertia		–
Maximum Speed*1 (PTP Drive)	X- and Y-Axes	800mm/sec (8 – 800mm/sec)*2
	Z-Axis	320mm/sec (3.2 – 320mm/sec)*2
Maximum Speed*1 (CP Drive)	X-, Y-, and Z-Axes (Combined)	800mm/sec (0.1 – 800mm/sec)*2
Repeatability	X- and Y-Axes	±0.007mm
	Z-Axis	±0.007mm
Supply Air Pressure*3		0.5Mpa (5kgf/cm^2)
Air Consumption		200Nl/min*4
External Dimensions (excluding cables and protrusions)	W x D x H (mm)	585 x 580 x 650
Weight (Robot)		39kg

*1: Maximum speed may vary depending on drive conditions.

*2: Speed range

*3: Use dry air contains no oil and water to prevent malfunction of the devices.

*4: Set the supply air to 200Nl/min or higher so as to maintain the dust collection efficiency. Insufficient air supply may result in pressure failure while vacuuming.

JR2400N(E) Series

Model 2403NERT		
Specifications		Description
Axis Type		3 (synchronous control)
Operating Range	X-Axis	400mm
	Y-Axis	400mm
	Z-Axis	100mm
Cutting Operation Range (Limit)	X-Axis	400mm
	Y-Axis	400mm
	Z-Axis	95mm
Portable Weight	Workpiece	11kg
	Tool	5kg
Acceptable Moment of Inertia		–
Maximum Speed*1 (PTP Drive)	X- and Y-Axes	800mm/sec (8 – 800mm/sec)*2
	Z-Axis	320mm/sec (3.2 – 320mm/sec)*2
Maximum Speed*1 (CP Drive)	X-, Y-, and Z-Axes (Combined)	800mm/sec (0.1 – 800mm/sec)*2
Repeatability	X- and Y-Axes	±0.007mm
	Z-Axis	±0.007mm
Supply Air Pressure*3		0.5Mpa (5kgf/cm^2)
Air Consumption		200Nl/min*4
External Dimensions (excluding cables and protrusions)	W x D x H (mm)	646 x 641 x 650
Weight (Robot)		47kg

*1: Maximum speed may vary depending on drive conditions.

*2: Speed range

*3: Use dry air contains no oil and water to prevent malfunction of the devices.

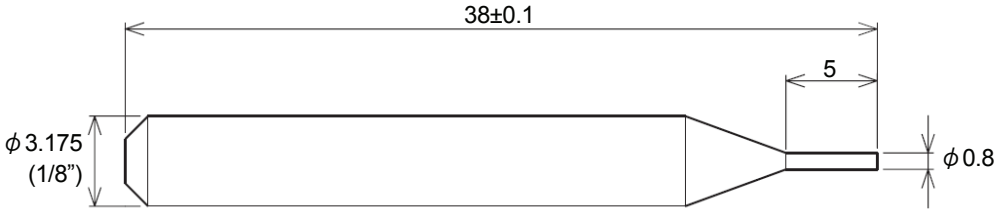
*4: Set the supply air to 200Nl/min or higher so as to maintain the dust collection efficiency. Insufficient air supply may result in pressure failure while vacuuming.

Tools

Specifications		Description
Spindle Motor	Drive System	DC brushless motor
	Rated Capacity	21W
	Rated Speed	40,000r/min
	Chuck	Collet chuck (ϕ3.175mm)[*1]
Cutter Diameter		ϕ0.8mm[*2]
Dust Collection System	Vacuum	Ejector
	Exhaust Air	Can be adjusted by the speed controller.
		Air blow time: 0 – 10 (sec)[*3]
	Filter Volume	6,000cm^3 (Disposable)
Maximum PCB Size		155 × 195 × 1.6 (mm)
Suitable PCB Material		Glass epoxy, phenolic paper
Cutting Path Error[*4]		0.2mm (for reference only)

*1: The single action chuck, requires no special tools

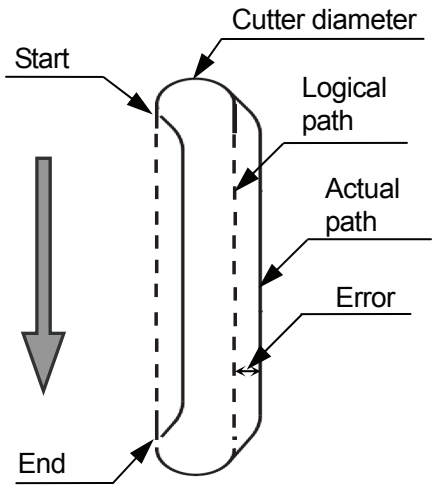
*2: See below for detailed specifications for the cutter. (Size: mm)



- The (left-handed) chips from PCB are ejected downward.
- The cutter (router bit) is expendable and is not covered under the warranty.
- Use the recommended cutter (included in the package).

*3: The air blow time can be changed under [Program Data Settings]. (See page 61 “Board Cut Condition” for details)

*4: See below for detailed explanation of the cutting path error.



Caution

- The cutting position error varies depending on the working environments, such as the material or thickness of PCB, cutter diameter, and cutting speed.
- The cutting position error is the average value measured under the following conditions:
  - Cutter diameter: ϕ0.8mm
  - Cutting speed: 10mm/s
  - PCB material: Glass epoxy resin
  - PCB thickness: 1.6mm
- The actual path slips to the left of the moving direction.

MEMO

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The specifications of the robot or the contents of this manual may be modified without prior notice in order to improve its quality.

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Original Instructions

963813109 as of 2009-03

March 2009