

JANOME DESKTOP ROBOT

JR3000 Series

Operation Manual

Depaneling Specifications

Thank you for purchasing this Janome Robot.

- Before using your robot, read this manual thoroughly and always make sure you use the robot correctly. In particular, be sure to thoroughly read “For Your Safety” as it contains important safety information.
- After having read this manual, store in a safe place that can be easily accessed at any time by the operator.

Original Instructions

JANOME

PREFACE

The Janome Desktop Robot JR3000 Series are new, low-cost, high-performance robots. With these robots we succeeded in reducing the price while maintaining functionality. The combined use of stepping motors and specialized micro step driving circuits saves both energy and installation space. There are several manuals pertaining to these robots.

This manual describes depaneling specifications for the JR3000 Series. Other than this *Depaneling Specifications* operation manual, there are also operation manuals with common sections relevant to all robots in this series. Refer also to these manuals when operating this robot.

JR3000 Series

For Your Safety	This is important safety information. Make sure you read this before using the robot.
Setup	Explains how to set up the robot. <ul style="list-style-type: none"> ■ Make sure you read this manual when installing the robot ■ NOTE: This manual is designed for people who have received safety and installation training regarding the robot.
Maintenance	Explains maintenance procedures for the robot. <ul style="list-style-type: none"> ■ Make sure you read this manual when performing maintenance ■ NOTE: This manual is designed for people who have received safety and maintenance training regarding the robot.
Basic Instructions	Provides part names, data configurations, and the basic knowledge necessary to operate the robot.
Quick Start	Explains the actual operation of the robot by creating and running simple programs.
Teaching Pendant Operation	Explains how to operate the robot via the teaching pendant.
Functions I	Explains point teaching.
Functions II	Explains commands, variables, and functions.
Functions III	Explains functions such as All Program Common Settings and PLC programs.
Functions IV	Explains Customizing Functions.
External Control I (I/O / Fieldbus)	Explains I/O and Fieldbus. Refer to this manual if you are using Fieldbus.
Communication Control (COM/LAN)	Explains COM 1 – 3 and LAN communication control.
Camera & Sensor Functions	Explains the functions of the attachable camera and Z position sensor.
Specifications	Outlines general specifications such as the robot's operating range, mass, etc.
Auxiliary Axis Functions	Explains the auxiliary axis functions.
PC Operation	Explains how to use the PC software JR C-Points II.
Depaneling Specifications	Explains the specialized depaneling application functions.

Note: The content of this manual may differ from the robot in your possession due to updates to the product specifications.

For information regarding optional additions for this robot, refer to “24. Specifications” in the operation manual *Specifications*. The notation "optional" is not used in the main text of this manual except for diagrams.

Attention

To make full use of the machine's functions and capabilities, make sure that you use the robot according to the correct handling/operation procedures that are written in the manuals pertaining to this robot.

Attention

If you turn OFF the power after making changes to robot's settings or data without saving, those changes are lost and the robot will revert to its original settings. Make sure that you save any changes to data and/or settings.

Attention

Before using this robot for the first time, make sure you back up robot data and save the individual configuration information. Individual configuration information is needed when replacing internal circuit boards.



Warning

Always **make sure the machine is grounded through the power cord. Do not use the machine when it is not grounded.**

Improper grounding causes electric shocks, fires, malfunction, and unit breakdown.



Warning

Make sure that the machine power supply is OFF before connecting the power cord.

Failure to do so could cause electric shock and/or injury.



Warning

Do not handle or operate the robot in ways not covered in the manuals pertaining to this robot. Contact Janome (listed on the back page of this manual) for repairs.

Failure to do so can cause electric shock and/or injury.

Note: The operation methods described in this manual are indicated as follows:



Operation via the teaching pendant



Operation via PC (JR C-Points II)

■ Compatibility with EC/EU Directives

This robot includes a declaration to the EC/EU directives.

We implement conformity testing through a third certification authority for each of the EMC, LVD, MD directives.

The applicable requirements of the MD and EMC Directives vary depending on the machine settings and systems. We conduct general confirmation tests using a proxy setup.

In accordance, we request that you perform a final compatibility test and risk assessment using your own complete setup of machines and devices.

NOTE: Only the JR3203ERT, JR3303ERT, and JR3403ERT models conform to the EC/EU directives.

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FOR YOUR SAFETY




The safety notes outlined below are provided in order to ensure safe and correct usage of the product in addition to preventing injury to the operator, other people and damage to property as well.

..... Be sure to follow the safety guidelines detailed here











Symbols are also listed alongside the safety note explanations. Refer to the list below for an explanation of these symbols.

- Symbols that indicate the level of danger and/or damage.

The level of danger or damage that could occur as a result of ignoring these safety guidelines and misusing the robot are classified by the following symbols.

	Danger	This symbol indicates an imminent risk of serious injury or death.
	Warning	This symbol indicates a risk of serious injury or death.
	Caution	This symbol indicates the possibility of serious injury or damage to property.

- The following symbols list the nature of the danger and any necessary safety methods to be taken.

	Indicates caution must be taken
	Take Caution (General Precaution)
	Indicates a forbidden action
	Never do this (General Prohibition)
	Do not disassemble, modify or repair.
	Do not touch (Contact Prohibition)
	Indicates a required action
	Be sure to follow instructions (General Requirement)
	Be sure to unplug the power cord
	Make sure the machine is grounded

FOR YOUR SAFETY



If using auxiliary axis functions to operate a motor, such as a servo motor, that produces feedback and/or a motor with high output etc., or when using auxiliary axes in the robot setup etc., we ask that you perform a risk assessment on your side and take any necessary safety measures.

If Using Auxiliary Axis Functions in a Way that Require Safety Measures

Danger

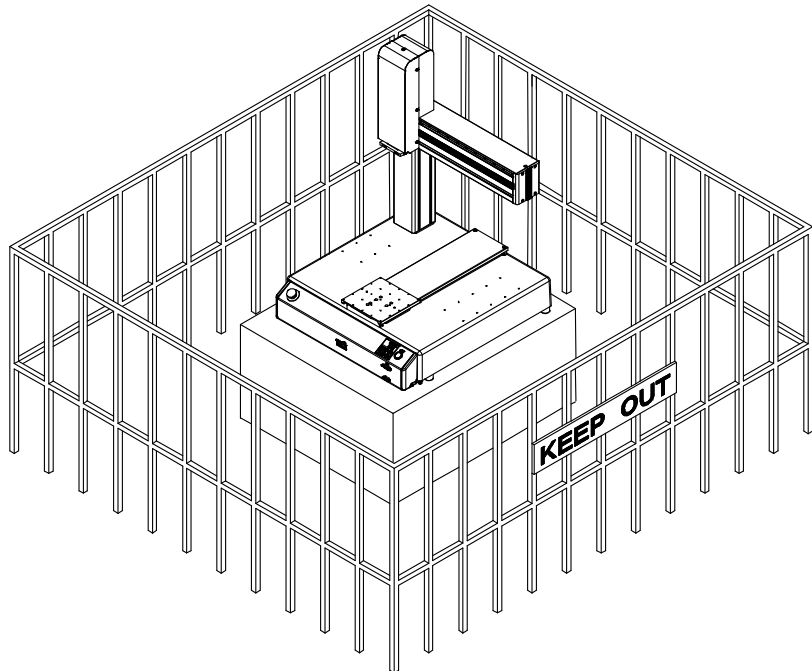


Always set up safety guards around the robot or the auxiliary axes so the moveable parts cannot be touched.

Anyone within the maximum reach of the robot and the auxiliary axes being controlled by the robot may be injured. Set up an **emergency stop interlock device that cuts off the motor power to the auxiliary axes when the entrance to the safety guard is opened** and make sure this entrance is the only way to access the machine.

NOTE: A stop made via a device connected to the I/O-S connector is a category 2 stop. Make sure to perform a separate risk assessment of the interlock device. Furthermore, put up a “**No Entry**” or “**Do Not Operate**” warning sign in a clearly visible place.

Example:



FOR YOUR SAFETY

If Using Auxiliary Axis Functions in a Way that Require Safety Measures

Danger



When power to the robot is ON, never enter the safety guard or put your face, hands, or any part of your body inside.

Entering the safety guard could result in injury.



When entering the safety guard due to something wrong with the robot or a peripheral device, or to inspect or lubricate the machine etc., **with both the power supply breaker and the robot switched OFF, make sure to lockout and tagout and confirm there is no electricity flowing to the robot.**

Failure to do so can cause electric shock or injury.

Warning



When creating a robot system using auxiliary axis functions, if the system can be categorized as an industrial robot, make sure to use the robot in accordance with the laws and guidelines of the country where it is used.



Before performing a run or operation, always check the following:

- **Obstacles:** Make sure there are no obstacles or people within the safety guard.
- **Installation:** Make sure the robot is installed properly, that there are no abnormalities with the robot and the surrounding devices, and that the teaching pendant and tools are in the appropriate places.
- **Emergency Stop Switch:** Make sure the I/O-S circuit (interlock) and emergency stop switch(es) are functioning properly.

It is potentially dangerous to operate the robot without making these checks first.

FOR YOUR SAFETY

If Using Auxiliary Axis Functions in a Way that Require Safety Measures

Warning



Construct safety guards that are strong enough to protect the operator against such dangers as the tool or workpiece splintering, etc.

When working within the safety guard, use protective gear such as a helmet, protective gloves, protective goggles, and safety shoes.

Failure to follow these safety measures can result in injury.



If objects that the robot grasps have a risk of falling or being projected, **take into account the size, weight, and chemical composition of the objects for the required safety precautions.**

Failure to do so can result in injury or unit breakdown.



When working within the safety guard, make sure not to come within the maximum range of the robot.

Failure to do so can cause injury.



When starting a run, first confirm there are **no people inside of the safety guard and there are no obstacles that could interfere with the run.**

Failure to do so can cause injury or unit breakdown.

FOR YOUR SAFETY

Danger



Do not use where flammable or corrosive gas is present.
Leaked gas accumulating around the unit causes explosions and fire.

Warning



Make sure that you securely install the unit in a place that can fully withstand both the unit's weight and its usage. Install the robot and switchbox on a workbench 60cm or higher above floor level, and install the robot in the center of the workbench. In addition, **for units with a cooling fan on the back, allow for 30cm or more clearance between the back of the unit and the wall.** If installation is inadequate, the unit can drop or fall over causing injury and unit breakdown. Also, inadequate installation causes overheating and fire.



Make sure to power the unit within its rated current range.
Failure to do so causes electric shocks, fires, and unit breakdown.



Plug the power cord into the power outlet firmly.
Failure to do so causes the plug to heat up resulting in fire.



Be sure to use the unit within its indicated voltage range.
Failure to do so causes fires and unit malfunction.



When replacing fuses, or inspecting or lubricating the unit, unplug the power cord from the power outlet, then remove the cord from the main unit and make sure there is no electrical current. Also, do not touch any of the power inlet pins within 5 seconds of removing the power cord. Failure to follow these steps causes electric shocks and injury.

FOR YOUR SAFETY

Warning



Always make sure the machine is grounded through the power cord. Do not use the machine when it is not grounded.
Improper grounding causes electric shocks, fires, malfunction, and unit breakdown.



Wipe the power plug with a clean, dry cloth periodically to eliminate dust.
Dust accumulation deteriorates the electrical insulation and causes fires.



Be sure to unplug the power cord from the power outlet when the unit is not in use for long periods of time.
Dust accumulation causes fires.



Be sure to turn OFF the unit before inserting or removing cords and cables such as the teaching pendant cable or LAN cable.
Failure to do so causes electric shock, data loss, unit breakdown, and malfunction.



If connecting a tool not included with the robot, make sure to perform a risk assessment and take the necessary safety precautions.
Failure to do so can cause injury and unit breakdown.



Do not attempt to disassemble or modify the unit.
Disassembly or modification causes electric shocks and unit breakdown.



Do not allow water or oil to come in contact with the unit or the power cord.
Contact with water or oil causes electric shock, fire, and unit breakdown.
IP Protection Rating: IP20.



If anything unusual occurs, such as a burning smell or unusual sound, stop operation and unplug the power cord immediately. Contact the dealer from whom you purchased the robot or the office listed on the last page of this manual. Continuing to use the robot without addressing the problem causes electric shock, fire, or unit breakdown.

FOR YOUR SAFETY

Caution



Do not drop or jar the unit during transport and/or installation.

This causes injuries or damages the unit.



Before performing any operation, ensure there is no imminent danger to any of the operators. Failure to do so causes injury.



Use the unit in an environment between 0 and 40°C, with a humidity level of 20 – 90%, and without condensation.

Use outside of these conditions can cause unit breakdown.



Use the unit in an environment where no electrical noise is present.

Failure to do so causes unit malfunction or breakdown.



For models with I/O-S circuits*, when installing the unit, take safety measures such as setting up area sensors and safety guards.

If there are no safety measures in place and someone enters the area of operation when the robot is running, they may be injured.



Keep the emergency stop switch within reach of the operator when running or operating the robot.

If the robot is operated when the emergency switch is not within reach, it may not be possible to stop the robot immediately and safely. This is potentially dangerous.



Make sure that you regularly perform a function check of the emergency stop switch(es). Also, for models with I/O-S circuits*, regularly perform an I/O-S circuit function check.

If the robot is operated without making these checks, it may not be possible to stop the robot immediately and safely in an emergency. This is potentially dangerous.

* A stop made via a device connected to the I/O-S connector is a category 2 stop. Make sure to perform a separate risk assessment of the interlock device.

FOR YOUR SAFETY

Caution



When attaching tools such as the spindle motor and USB camera, etc., make sure they are securely fitted before running the robot.

Failure to do so causes injury or breakdown.



Make sure the collet chuck on the spindle motor is secure.

A loose chuck can cause the cutter to fall, resulting in injury or breakdown.

If the collet chuck is loose, refer to “10.4 Replacing the Collet Chuck” and secure the collet chuck.



Check that the chuck is clear of dust and swarf before inserting the router bit.

Clean the collet chuck regularly.

An unclean collet chuck can cause the router bit to fall, resulting in injury or breakdown.

Refer to “10.4 Replacing the Collet Chuck” for details on how to clean the collet chuck.



Check the chuck casing has not stretched.

The chuck casing used to secure the collet chuck may stretch from prolonged use of the spindle motor. If this happens, the spindle motor needs servicing.

A stretched chuck can cause the router bit to fall, resulting in injury or breakdown.










Always make sure to turn the spindle motor lever to the S (locking) position before running the robot. Running the robot without locking the spindle motor can cause the cutter to fall, resulting in injury or breakdown.



Make sure the nozzle base clamp knob is firmly tightened.

A loose clamp knob can cause the nozzle base to fall, resulting in injury or breakdown.

FOR YOUR SAFETY

 Caution	
	When using the machine for extended periods of time, check and make sure none of the main unit's mounting screws are loose, and perform a routine inspection every 3 months. Failure to do so causes injury or breakdown.
	Be sure to check the connections of the cords and cables to the main unit. Improper wiring causes unit malfunction or breakdown.
	Secure the movable parts of the unit before transportation. Failure to do so causes injury or breakdown.
	Use the unit in an environment that is not exposed to direct sunlight. Direct sunlight causes unit malfunction or breakdown.
	Individual Configuration Information varies for each individual unit even if they are the same model. Do not use backup data with a different robot. The robot cannot function normally with backup data from a different robot.
	Always tighten to the specified torque when indicated. Tightening to a torque other than the one specified can cause malfunction of electrical components, such as the ones in the terminal block, and/or unit breakdown due to mechanical components overheating. Additionally, when tightening screws that do not have a tightening torque indicated, tighten using the recommended torque listed below.

Recommended Tightening Torque

Screw Type	Nominal Diameter	Standard Tightening Torque (Nm)		
Screw types (Strength classification: 4.8) Head shapes: pan, round, flat fillister, binding, countersunk, raised countersunk, truss, sems	M3	0.54	–	0.83
	M3.5	0.88	–	1.32
	M4	1.27	–	1.96
	M5	1.96	–	3.92
Hex socket bolts (Strength classification: 12.9)	M4	2.37	–	3.57
	M5	4.69	–	7.05

NOTE: When tightening screws to secure printed circuit boards, batteries, and fans we recommend tightening them to the standard tightening torque × 0.5 (Nm).

FOR YOUR SAFETY

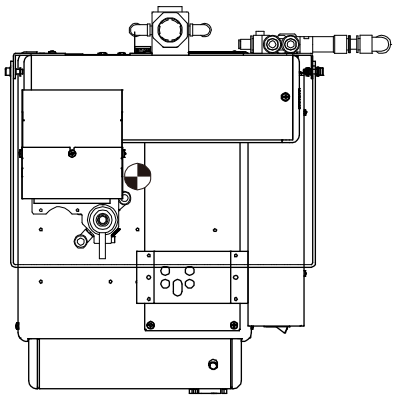
Caution




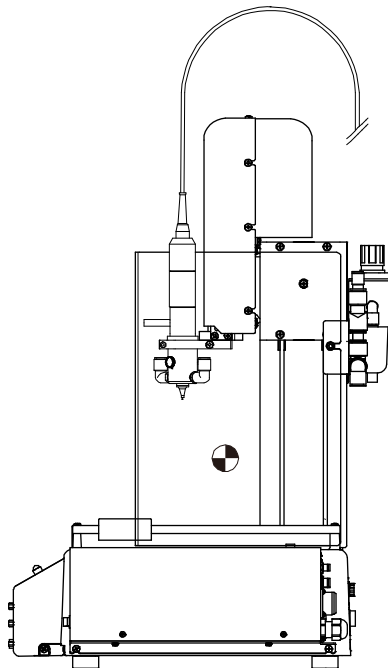
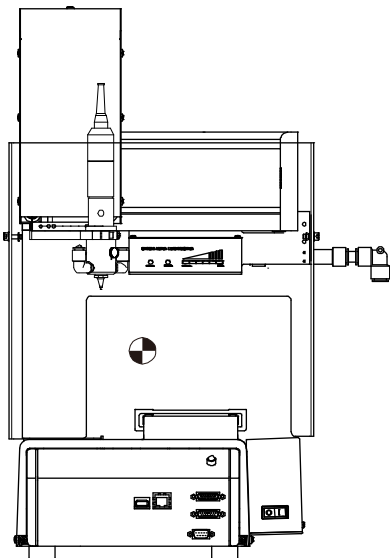
After confirming the unit's approximate center of gravity with the diagrams below, transport the unit using at least two people.

The center point of gravity varies depending on the model.

■ JR3203ERT



 : Center of Gravity



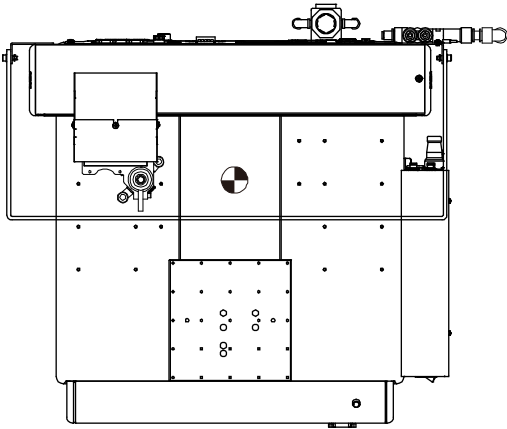
FOR YOUR SAFETY




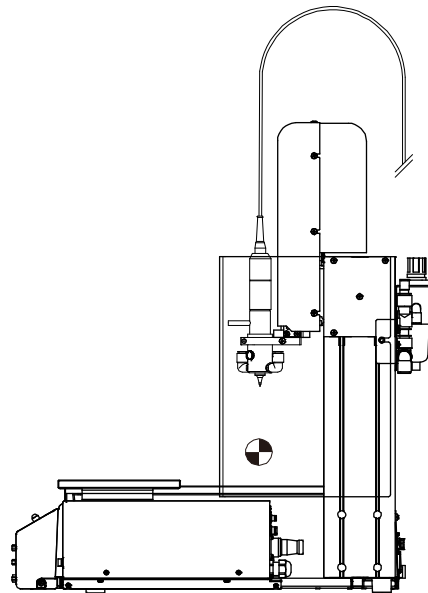
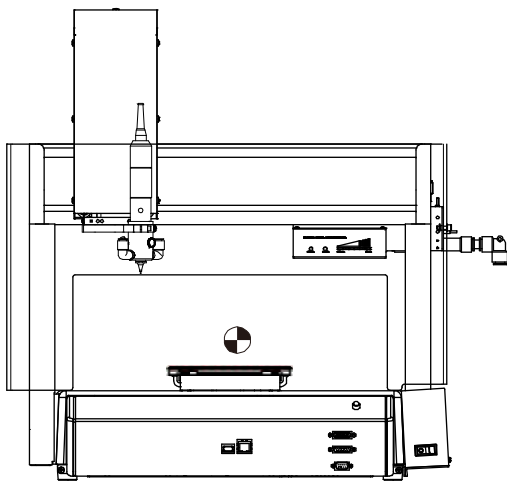
After confirming the unit's approximate center of gravity with the diagrams below, transport the unit with a lifter or at least two people.

The center point of gravity varies depending on the model.

■ JR3303ERT



 : Center of Gravity



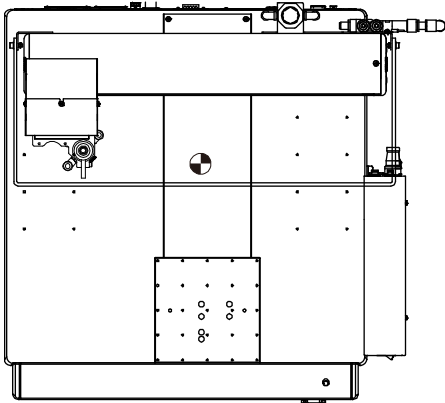
FOR YOUR SAFETY




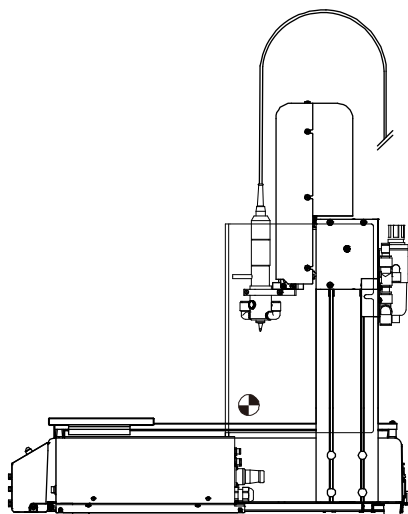
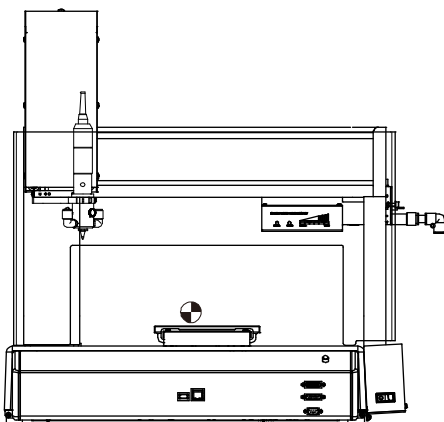
After confirming the unit's approximate center of gravity with the diagrams below, transport the unit with a lifter or at least two people.

The center point of gravity varies depending on the model.

■ JR3403ERT



 : Center of Gravity



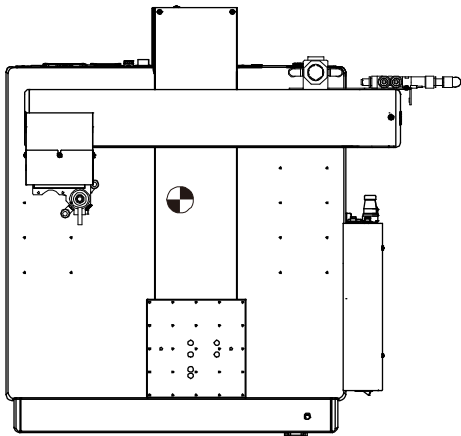
FOR YOUR SAFETY



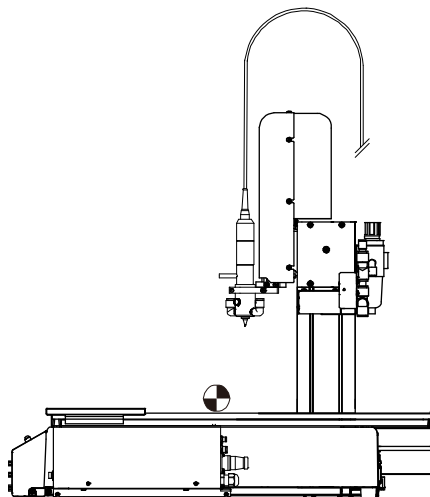
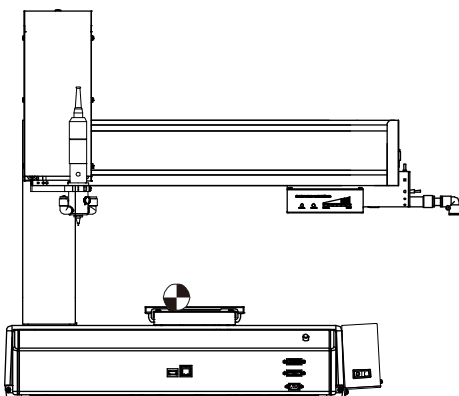
After confirming the unit's approximate center of gravity with the diagrams below, transport the unit with a lifter or at least two people.

The center point of gravity varies depending on the model.

■ JR3503ERT



● : Center of Gravity



FOR YOUR SAFETY

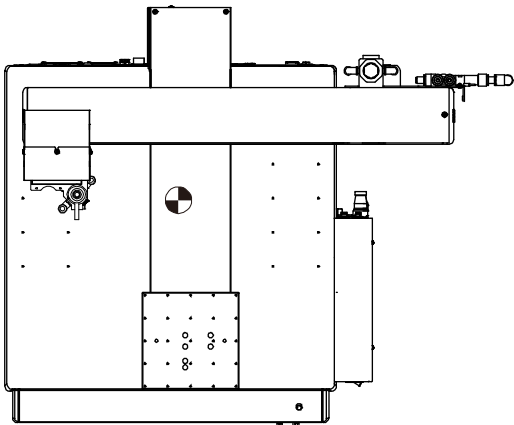
Caution




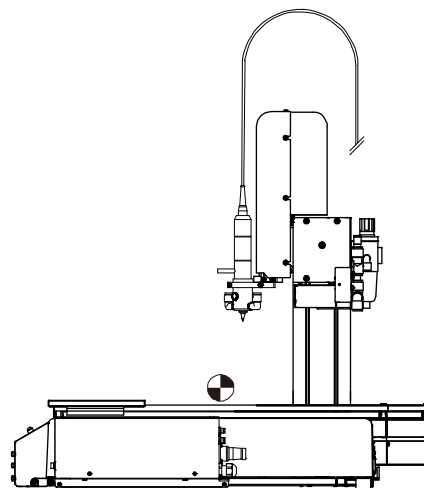
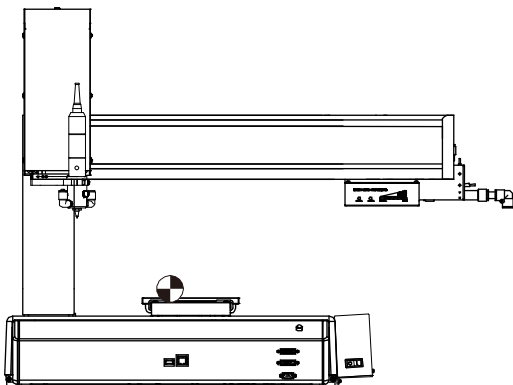
After confirming the unit's approximate center of gravity with the diagrams below, transport the unit with a lifter or at least two people.

The center point of gravity varies depending on the model.

■ JR3603ERT



 : Center of Gravity



1. PACKAGE CONTENTS

■ Exclusive to Depaneling Models

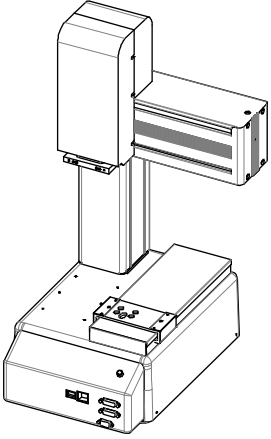
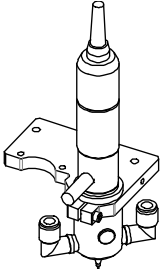
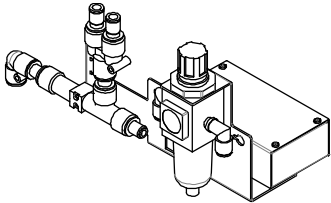
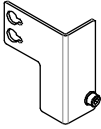
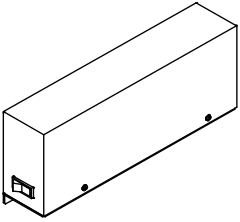
Illustration	Name	Q'ty	
		JR3203ERT	JR3303ERT JR3403ERT JR3503ERT JR3603ERT
 <p>Example: JR3203ERT</p>	Robot unit	1	1
	Spindle motor (unit) [170918011]	1	1
	Indicator/ejector (assembly) [170917009]	1	1
	Safety cover Mounting plate (unit) [170905004]	1	1 JR3303ERT/ JR3403ERT
	Unit box (unit)	[170906005] 1	[170906108] 1

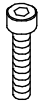

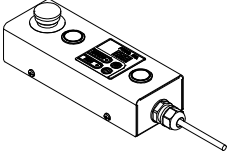
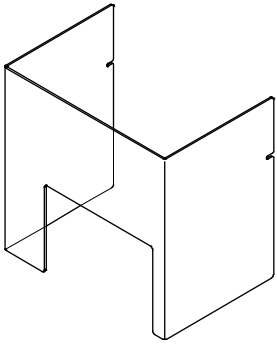
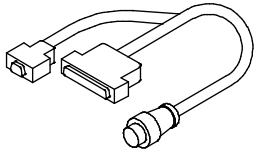
Illustration	Name	Q'ty	
		JR3203ERT	JR3303ERT JR3403ERT JR3503ERT JR3603ERT
	Hex socket bolt (M5 x 10) (for attaching the spindle motor) [000083524]	2	2
	Phillips/slotted binding head screw (M4 x 6) (for attaching indicator/ejector) [000101426]	1	1
	Phillips/Slotted Binding Head Screw (M4 x 6) (for attaching safety cover) [000101426]	2	2 (JR3303ERT / JR3403ERT only)
	Phillips/Slotted Binding Head Screw (M4 x 6) (for attaching unit box) [000101426]	-	2
	Switchbox 2 (unit) with replace bit switch (LED) [170630407]	1	1
	Safety cover	1 [963088004]	1 [971097007] (JR3303ERT/ JR3403ERT only)
	I/O Cable (unit) [963556019]	1	1


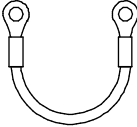



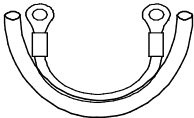
Illustration	Name	Q'ty	
		JR3203ERT	JR3303ERT JR3403ERT JR3503ERT JR3603ERT
	Cable ties (for fixing air tubes) [000053008]	12	12
	Grounding wire [963557308]	1	1
	Air tube ø4 mm	1 [996902038]	1 [996902049] (JR3303ERT JR3403ERT)
			1 [996902050] (JR3503ERT JR3603ERT)
	Air tube ø6mm	2 [995088003]	2 [995088900]
	Air Tube ø8mm	2 [996903501]	2 [996903202] (JR3303ERT)
			2 [996903707] (JR3403ERT)
			2 [996903615] (JR3503ERT JR3603ERT)
	Air Tube ø12 mm (with grounding wire) [996633208]	1	1

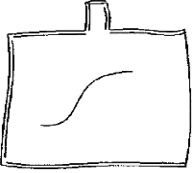

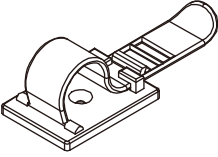

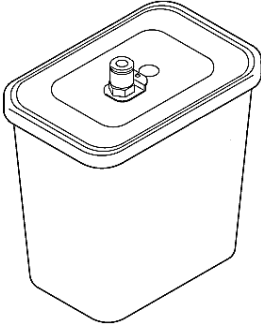
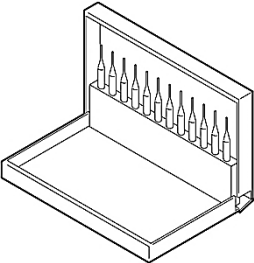
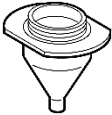
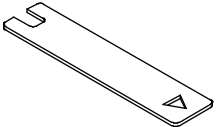
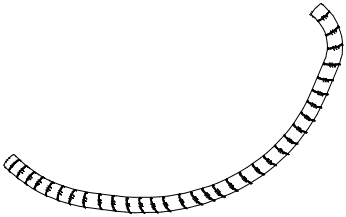



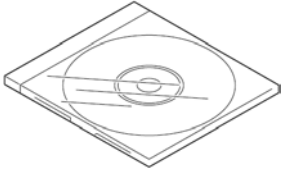


Illustration	Name	Q'ty	
		JR3203ERT	JR3303ERT JR3403ERT JR3503ERT JR3603ERT
	Dust Filter [996120001]	3	3
	Cable ties (for the dust filter) [000053008]	3	3
	UL clamp [000186207]	1	1
	Diffusion Nozzle [996122003]	1	1
	Filter Box [996469004]	1	1

Illustration	Name	Q'ty	
		JR3203ERT	JR3303ERT JR3403ERT JR3503ERT JR3603ERT
	Router bit (cutter) (× 10) [996445005]	1	1
	Vacuum nozzle (spare) [996091002]	1	1
	Wrench [996418009]	1	1
	Spiral tube [171440102]	1	1

■ Common to all models

Illustration	Name	Q'ty	
		JR3203ERT	JR3303ERT JR3403ERT JR3503ERT JR3603ERT
	Hex socket bolt M4 x 14 (for belt adjustment) [000099109]	2	2
	Self adhesive tie mount 8000272407]	4	4
	Grease (unit) (for robot cable) [170662006]	1	1

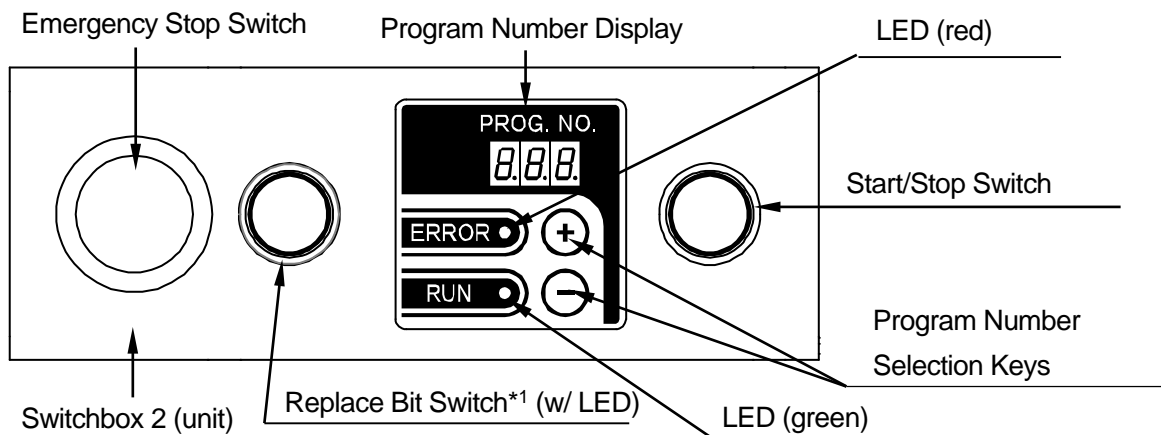
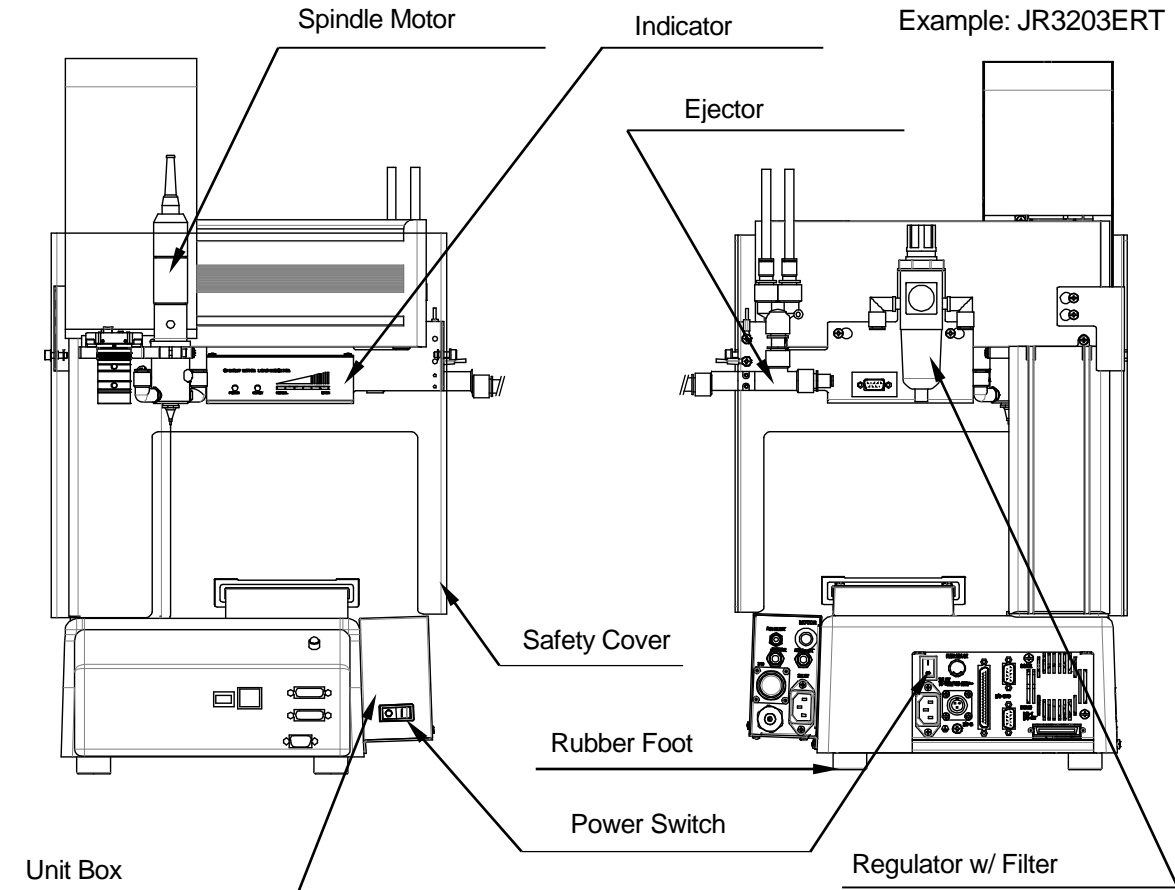
■ Manuals

Illustration	Name	Q'ty	
		JR3203ERT	JR3303ERT JR3403ERT JR3503ERT JR3603ERT
	CD-ROM (Operation manuals) [170819701]	1	1
	For Your Safety [170802000]	1	1
	Operation Manual Depaneling Specifications (this manual) [170834104]	1	1

2. PART NAMES

2.1 Parts Common to the JR3000ERT Series

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



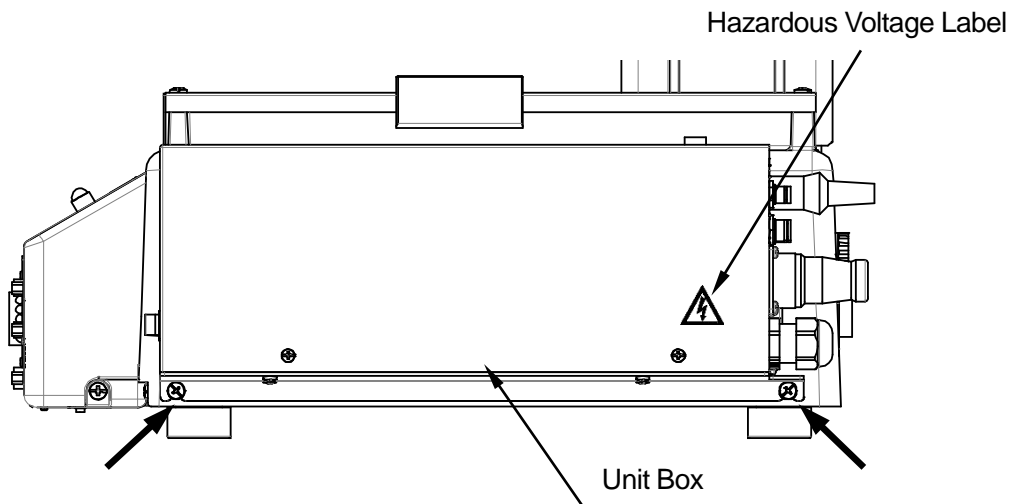
*1 [Option Switch 1] in Diagnostic Mode refers to the replace bit switch for depaneling robots.

3. INSTALLATION (ASSEMBLY)

3.1 Unit Box (Unit)

■ JR3203ERT

Loosen the two Phillips/slotted binding head M4x10 screws on the side of the robot, indicated by the black arrows. Slide the unit box (unit) over the loosened screws until the screws fit all the way into the slits on the bottom of the unit box. Tighten the screws.

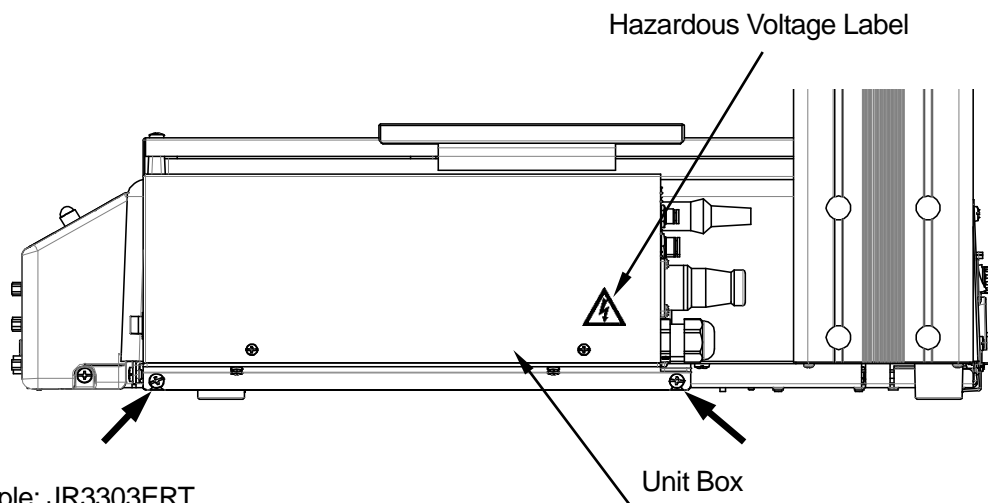


Example: JR3203ERT

■ JR3303ERT, JR3403ERT, JR3503ERT, JR3603ERT

Loosely tighten the two binding head M4x6 screws included into the side of the robot in the locations indicated by the black arrows.

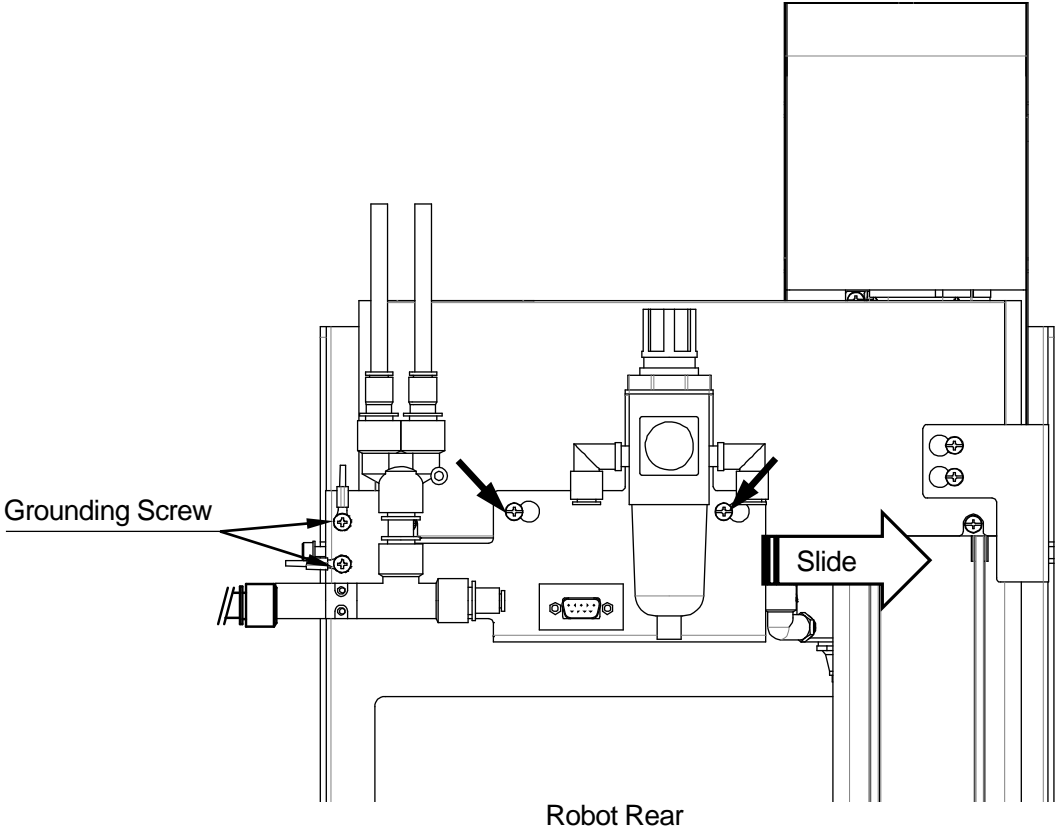
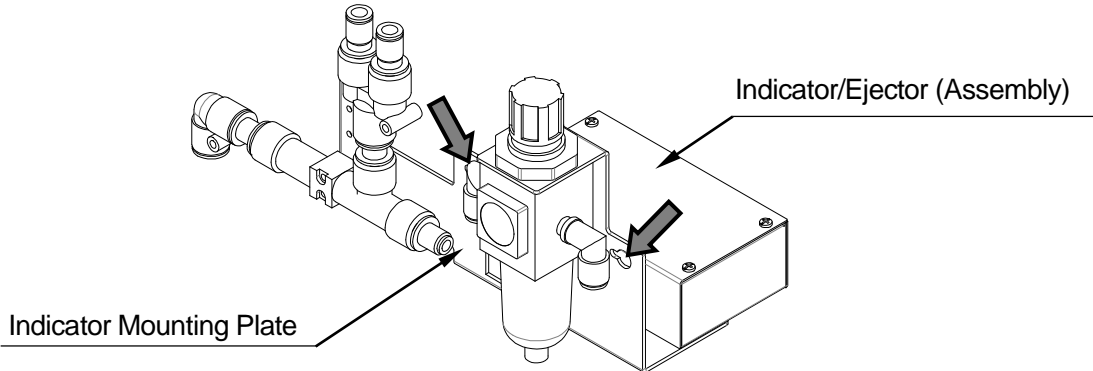
Slide the unit box (unit) over the loosely tightened screws until the screws fit all the way into the slits on the bottom of the unit box. Tighten the screws.



Example: JR3303ERT

3.2 Indicator/Ejector (Assembly)

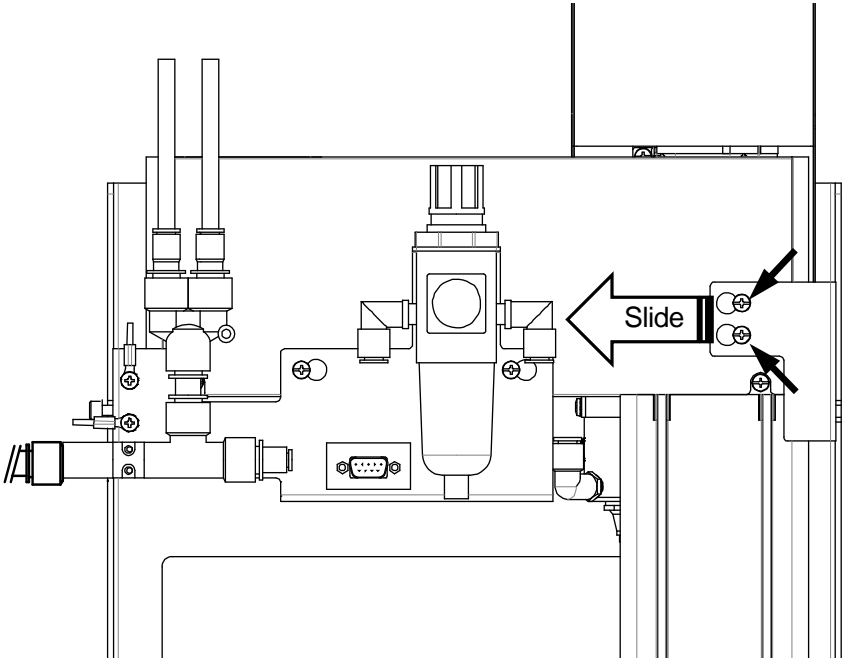
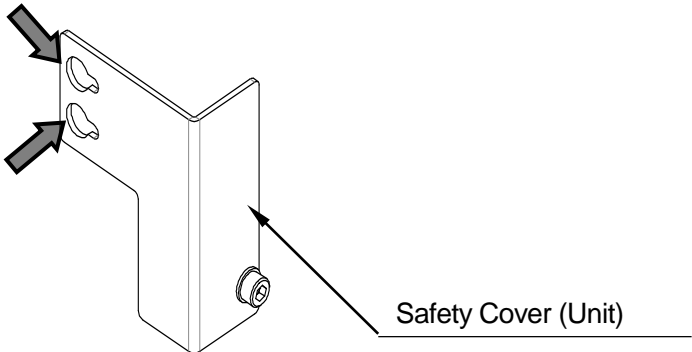
1. Attach the indicator/ejector (assembly) to the back of the robot.
Loosely tighten two Phillips/slotted binding head M4x6 screws (included) to the back of the robot, in the locations indicated by the black arrows.
2. Hook the loosely tightened screw heads into the screw holes indicated by the gray arrows on the indicator mounting plate. Slide the mounting plate to the right and tighten the screws down to secure the indicator/ejector (assembly).



Example: JR3203ERT

3.3 Safety Cover (Unit)

- 1. Attach the safety cover mounting plate (unit) to the back of the robot.
Loosely tighten two Phillips/slotted binding head M4x6 screws to the back of the robot, in the locations indicated by the black arrows.
- 2. Hook the loosely tightened screw heads into the screw holes indicated by the gray arrows on the safety cover mounting plate (unit). Slide the safety cover mounting plate (unit) to the left and tighten the screws down to secure it.

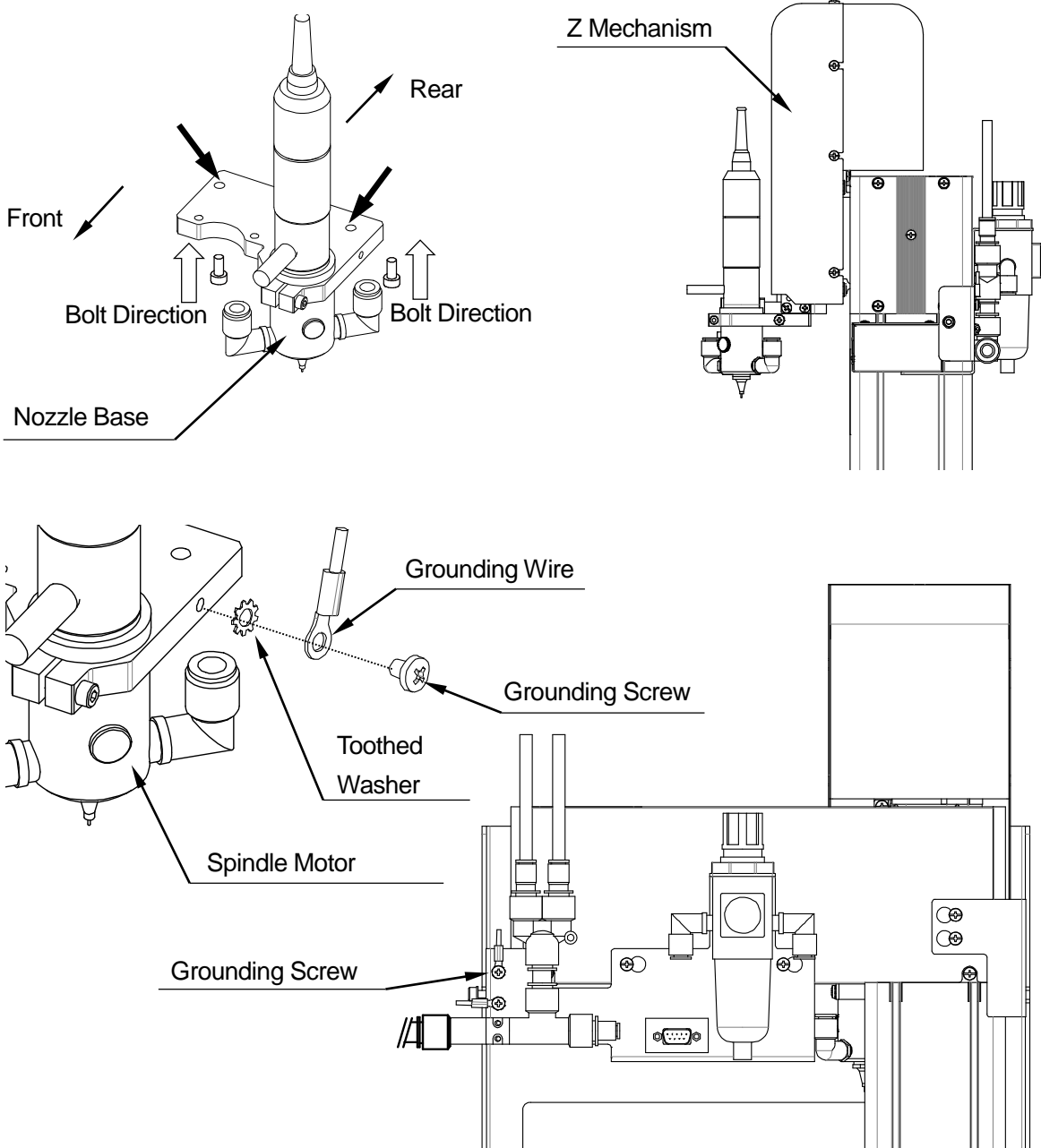


Robot Rear

Example: JR3203ERT

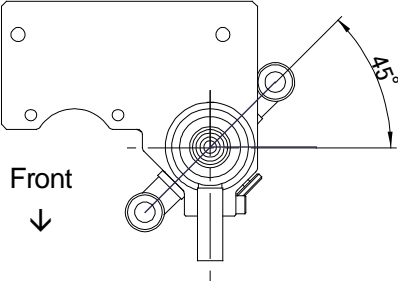
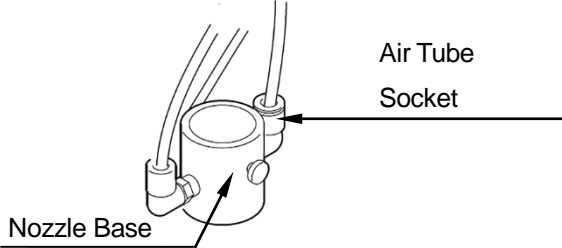
3.4 Spindle Motor (Unit)

1. Attach the spindle motor to the bottom of the Z mechanism on the robot using the two hex socket M5x10 bolts included. (Tightening torque: 7 N/m)
3. Use the screw on the side of the spindle motor and the screw on the back of the robot to connect the grounding wire included.
4. Each of the screws is securing a toothed washer. Remove the screw and attach the grounding wire in this order: washer < grounding wire < screw.



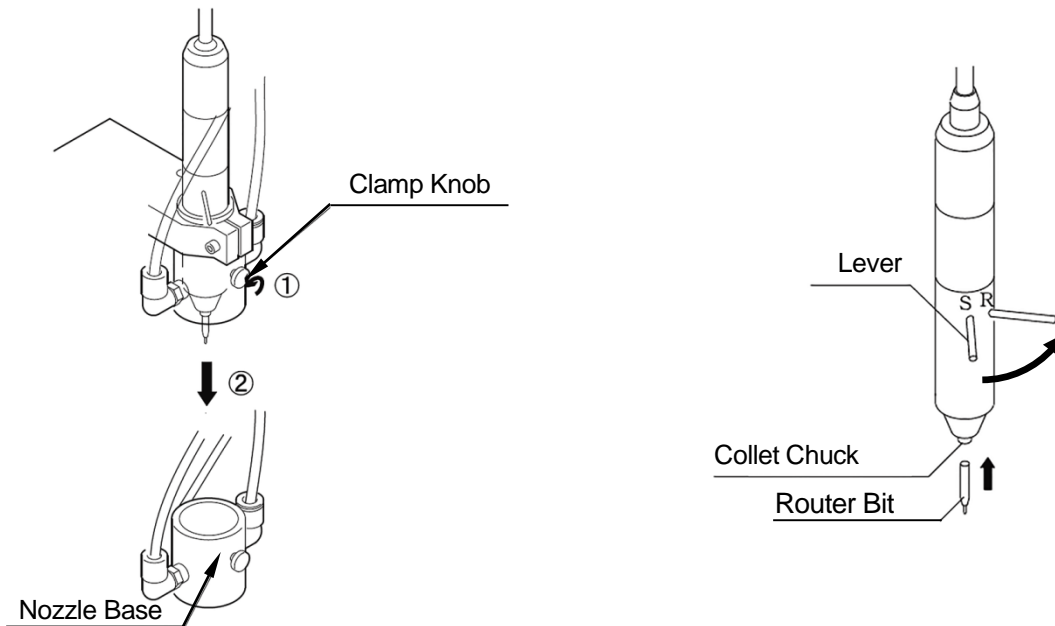
Example: JR3203ERT

- 5. Attach the nozzle base so that the air tube sockets come in at a 45 degree angle to the robot. Otherwise, the air tube sockets will hit the safety cover depending on the position of the Z mechanism.



3.5 Router Bit (Cutter)

1. Loosen the clamp knob, pull the nozzle base straight down and remove it from the spindle motor.



2. Turn the lever on the spindle motor to the R position to release the collet chuck.
3. Insert the router bit into the collet chuck as far as it will go and then turn the lever back to the S position to secure it.
4. Reattach the nozzle base and tighten the clamp knob. Be careful not to damage the router bit.



Caution

- The router bit is secured using a three-toothed collet chuck. Check that the chuck is clear of dust and swarf before inserting the router bit. Clean the collet chuck regularly. A dirty or loose chuck can cause the cutter to fall, resulting in injury or breakdown.
- Firmly push the nozzle base all the way up. If the nozzle is loose, vacuum efficiency may be reduced resulting in airborne dust and swarf.
Inhalation of dust and swarf can be harmful to your health.



Caution

Always make sure to turn the spindle motor lever to the S (locking) position before running the robot. Running the robot without locking the spindle motor can cause the cutter to fall, resulting in injury or breakdown.

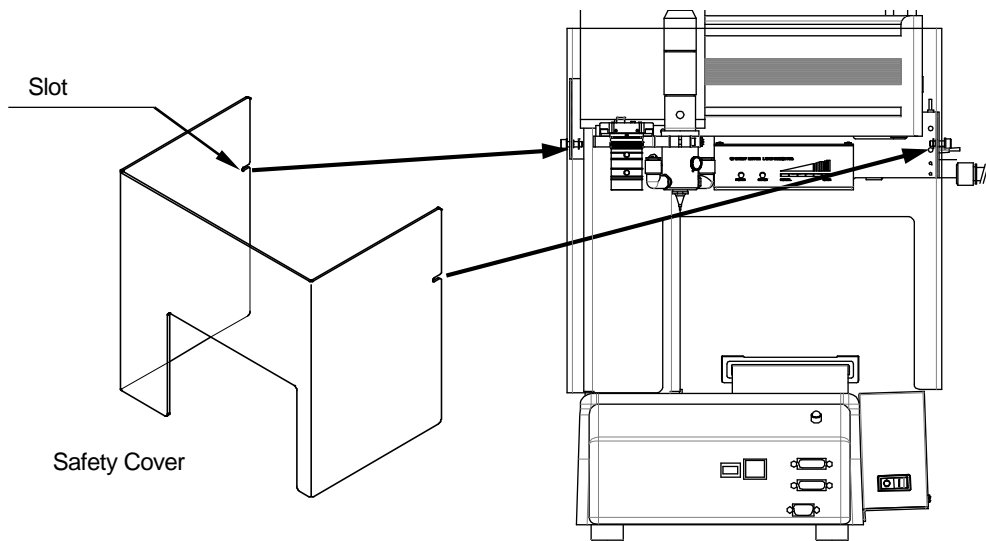
3.6 Safety Cover

A safety cover is included with JR3203ERT, JR3303ERT, and JR3403ERT models.

For JR3503ERT and JR3603ERT models, you need to prepare a safety cover on your side.

The indicator/ejector (assembly) is fitted with hex socket bolts for attaching the safety cover. Loosen the hex socket bolts a few turns and place the safety cover with its slots over the bolt threads. Tighten the hex socket bolts to secure the safety cover.

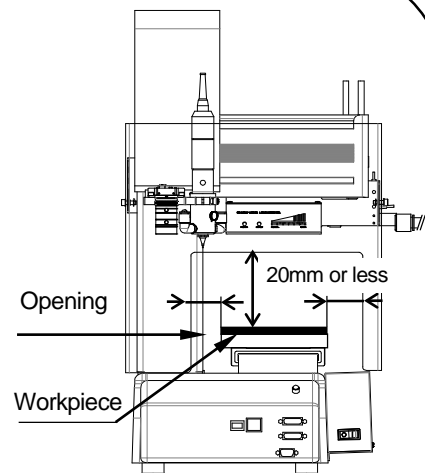
NOTE: Do not over loosen the hex socket bolts as this can dislodge the bolt retainers (E ring).



Example: JR3203ERT


Caution

- Make sure that cables and the air tubes do not touch the safety cover, or any other fixtures or covers you may have installed.
- The safety cover included with the robot is simple and it may cause breakdown or not be safe for operators depending on the methods of use or fixtures you have prepared. Based on ISO13857 and in consideration for operator health and safety, take any necessary safety precautions such as replacing and installing a new safety cover.
- If the gaps (top, bottom, left and right sides) between the workpiece and the safety cover are more than 20 mm, install a safety cover so that your hand cannot come within 120 mm of the router bit. (ISO13857)



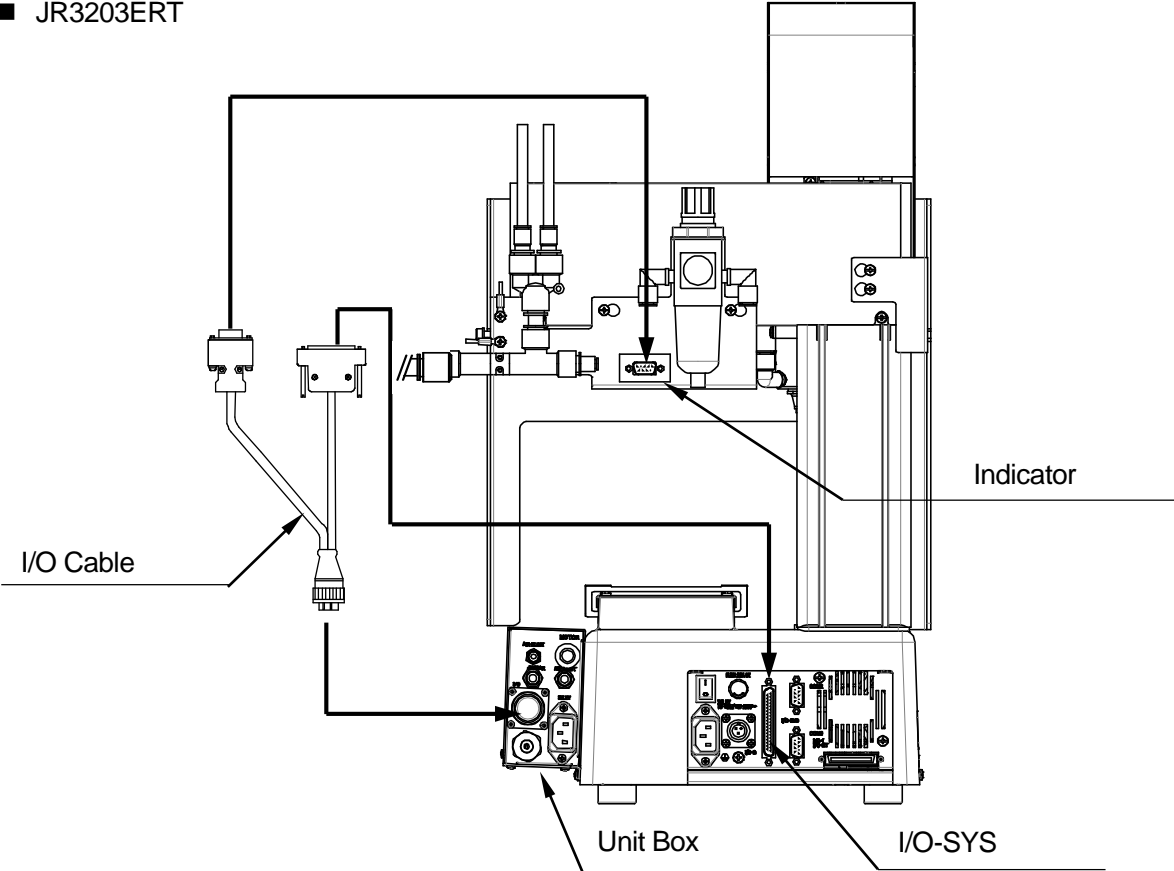
Example: JR3203ERT

3.7 Cable Wiring

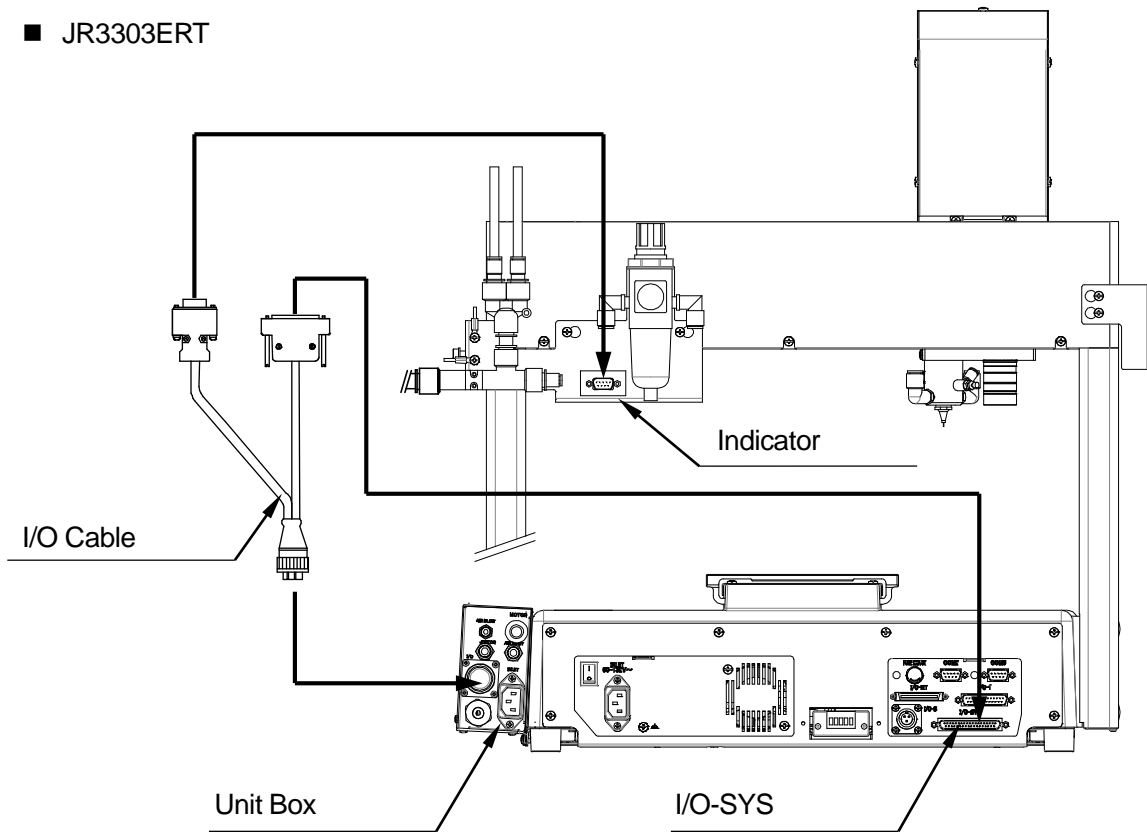
 **Caution** Firmly connect all cords and cables to the robot and devices. Improper wiring may result in unit malfunction or breakdown.

Connect the I/O cable as follows:

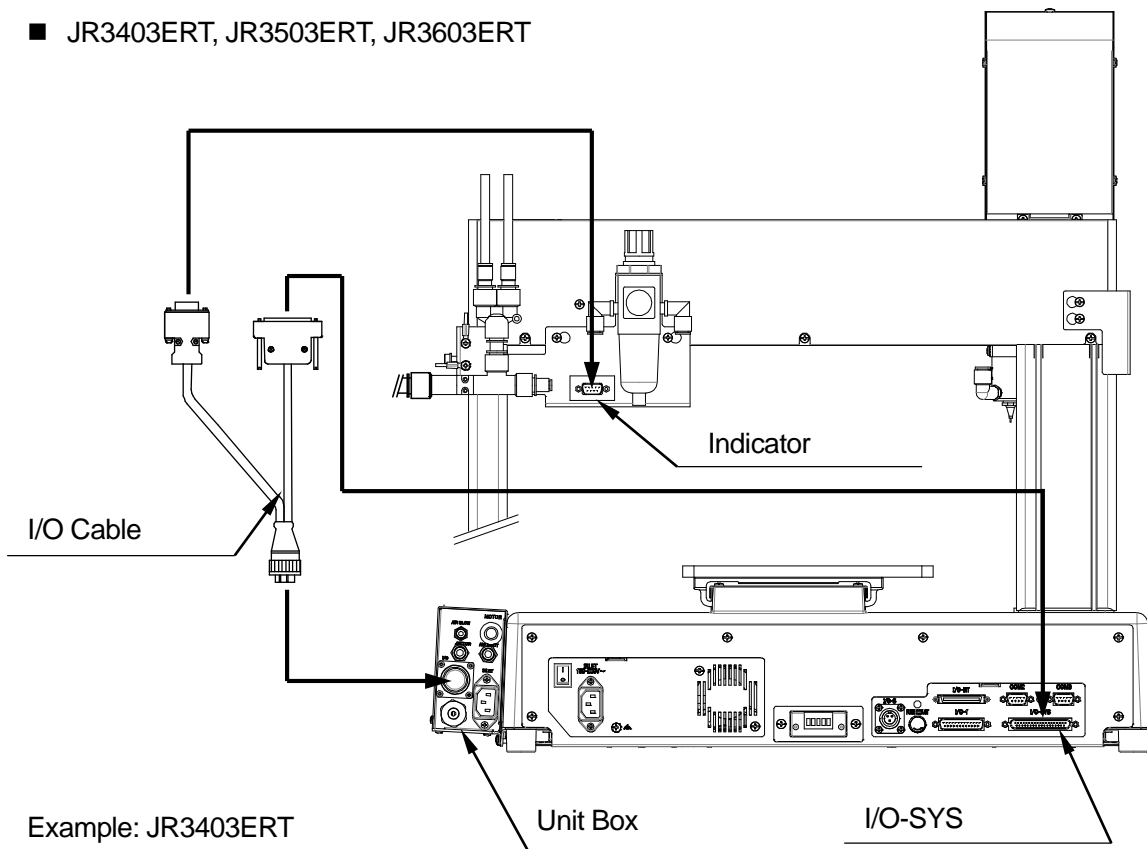
■ JR3203ERT



■ JR3303ERT

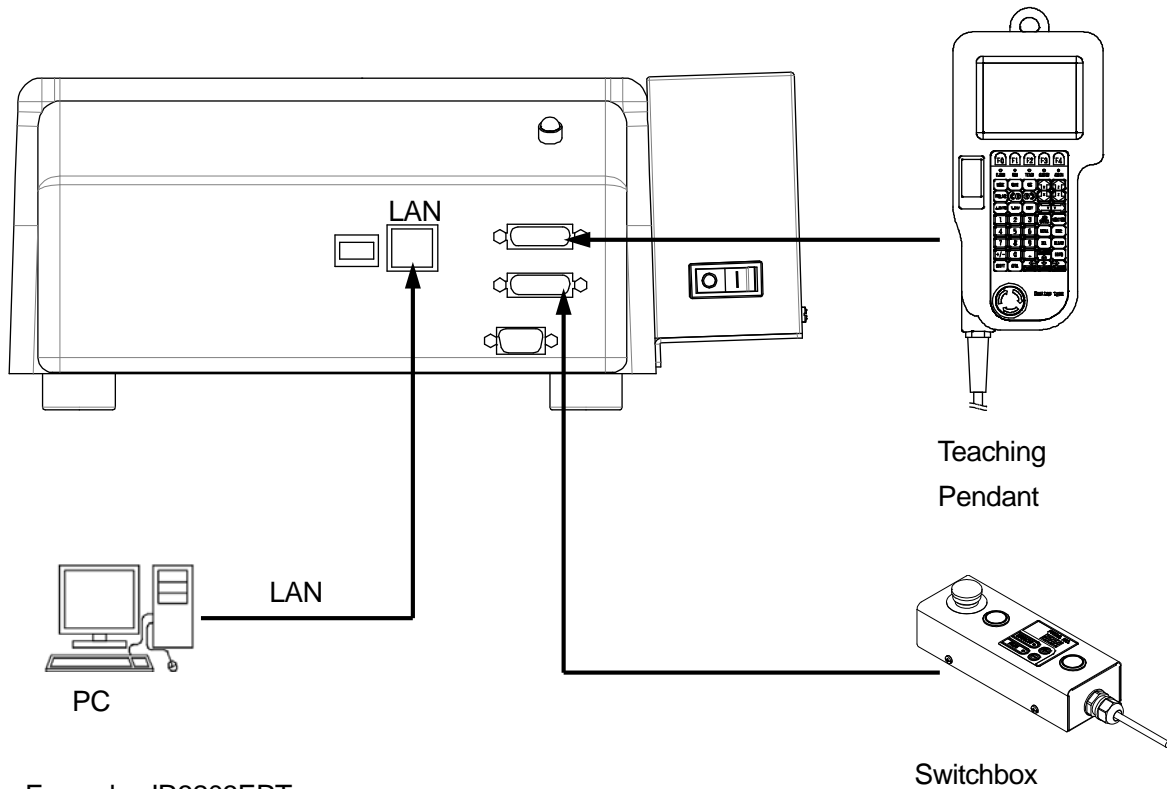


■ JR3403ERT, JR3503ERT, JR3603ERT



3.8 Connecting Devices to the Front of the Robot

Connect the teaching pendant to the TPU connector, the switchbox to the switchbox connector, and a PC to the LAN connector using a LAN cable on the front of the robot.



Example: JR3203ERT



Caution

Do not lift or hold the teaching pendant or switchbox by the cable. Holding the unit by the cable can damage it.



Caution

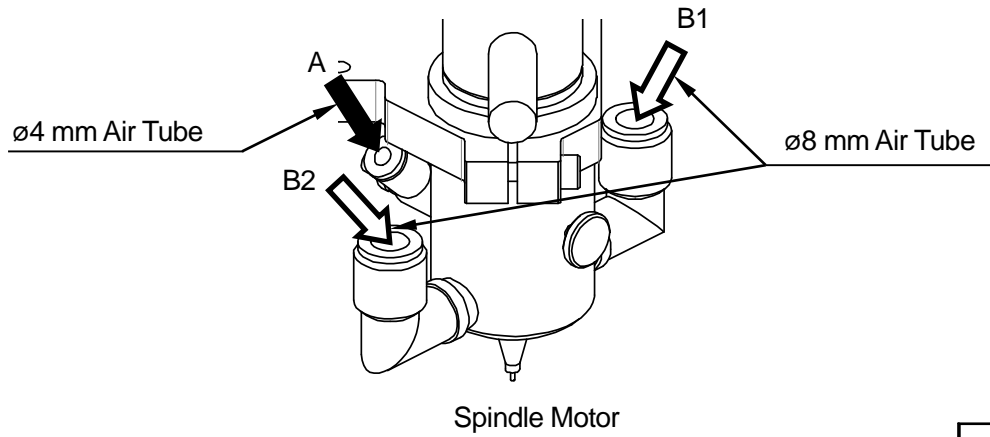
After connecting the teaching pendant and/or switchbox to the robot, secure the connectors by tightening the connector screws firmly. An unsecure connector may cause malfunction or breakdown.



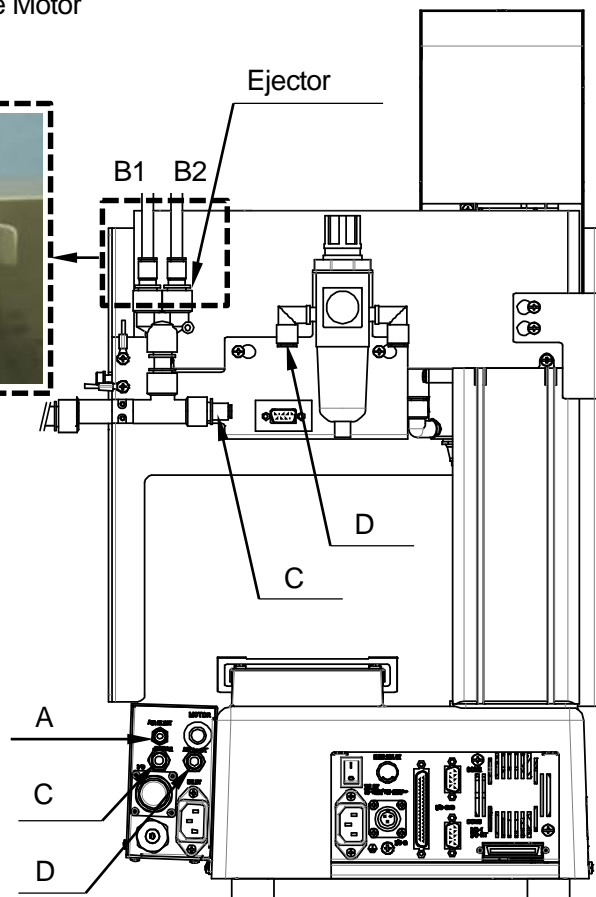
Caution

Do not drop the teaching pendant or switchbox. Store the teaching pendant and switchbox in a secure location and take measures to make sure they cannot fall. Failure to do so may result in breakage.

3.9 Air Tubes



Attach the included UL clamp to the upper left corner on the back of the robot. Connect the two $\varnothing 8$ mm air tubes to the ejector. Bundle the 2 air tubes with the UL clamp and bind the air tubes to the UL clamp with the included cable tie as shown to the right.



Example: JR3203ERT

Referring to the diagram, connect A to A, B1 to B1, B2 to B2, C to C, and D to D using the air tubes included.

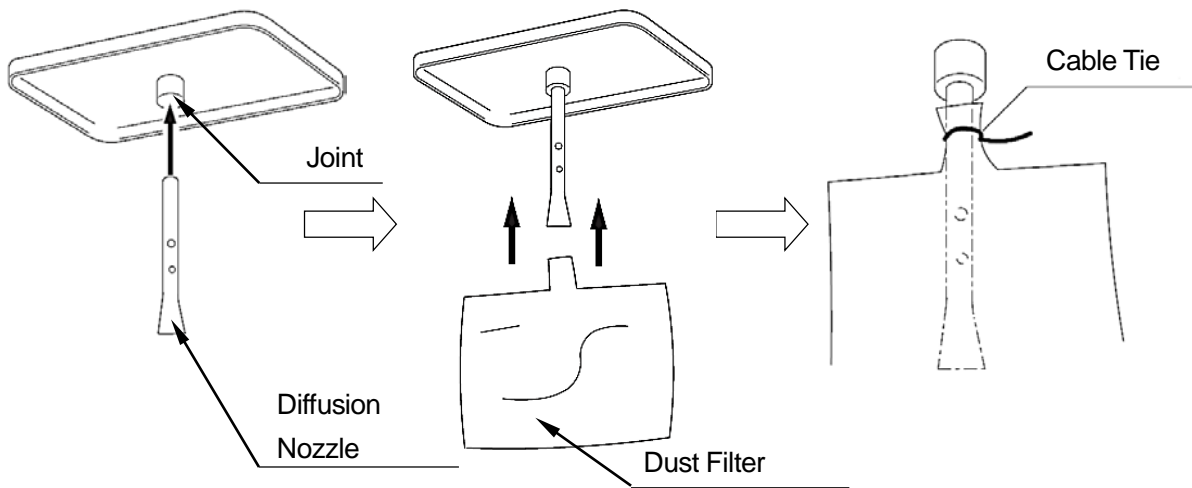
(A: $\varnothing 4$ mm, B: $\varnothing 8$ mm, C and D: $\varnothing 6$ mm)

3.10 Filter Box

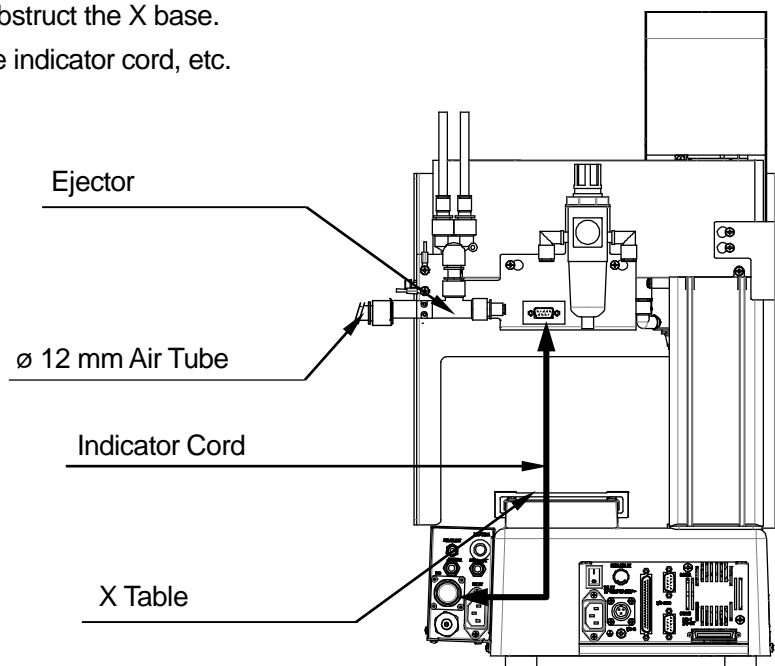


- Always ground the filter box as static electricity may cause an explosion of swarf depending on the work material.
- Do not process materials which may cause the filter box to explode. Failure to do so may cause injury or fire.

1. Connect the diffusion nozzle to joint on the underside of the filter box cover. Then insert the diffusion nozzle into the dust filter and secure the filter with a cable tie.



2. Put the cover on the filter box and connect the \varnothing 12 mm air tube to the joint attached to the cover and the ejector on the rear of the robot Y axis. Make sure the air tubes do not obstruct the X base. If necessary bind the tubes to the indicator cord, etc.



Example: JR3203ERT

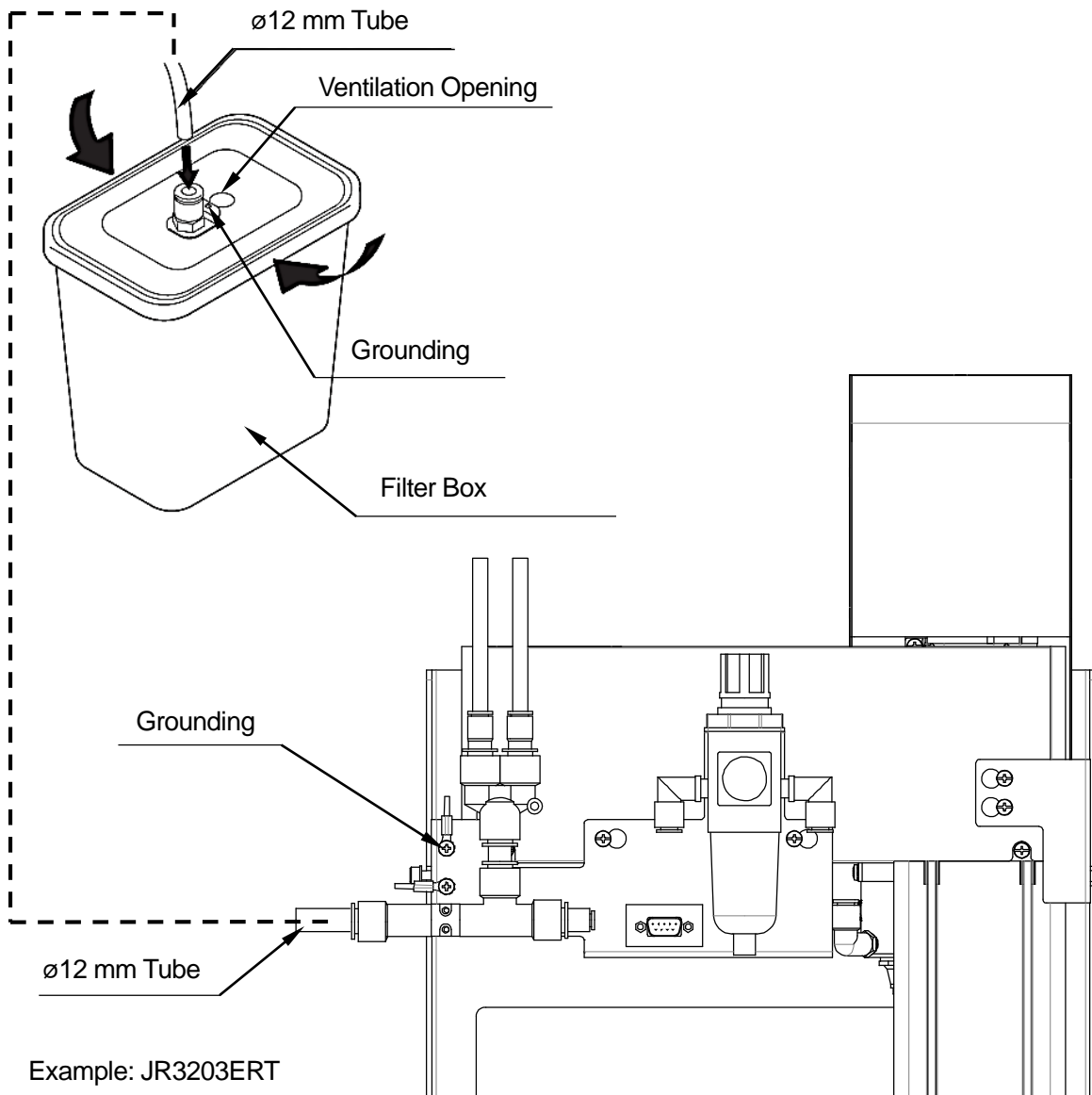
3. Connect the grounding wire attached to the $\varnothing 12$ mm air tube using the screws attached to the filter box cover and the rear of the robot (refer to the diagram below). Each grounding screw is provided with a toothed washer.

Remove the screw and attach the grounding wire in this order: washer < grounding wire < screw. Also make sure that the filter box ventilation opening is not blocked. If it is blocked, the vacuum efficiency is reduced.



Caution

Place the filter box on a work table at the same height as the robot; 60 cm or higher above the ground. If it is inevitable to place the filter box at a height different to the robot, make sure to perform a risk assessment so that the air tube and the grounding wire cannot trip up workers. Failure to do so may cause injury.

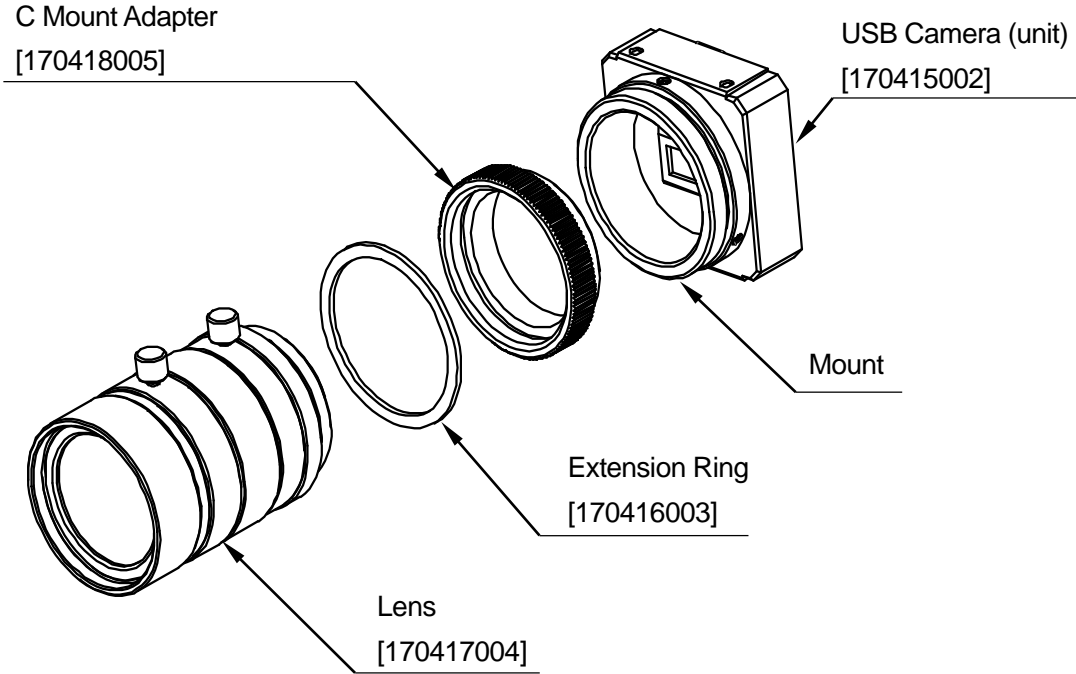


3.11 Attaching the USB Camera (Unit) (Optional)

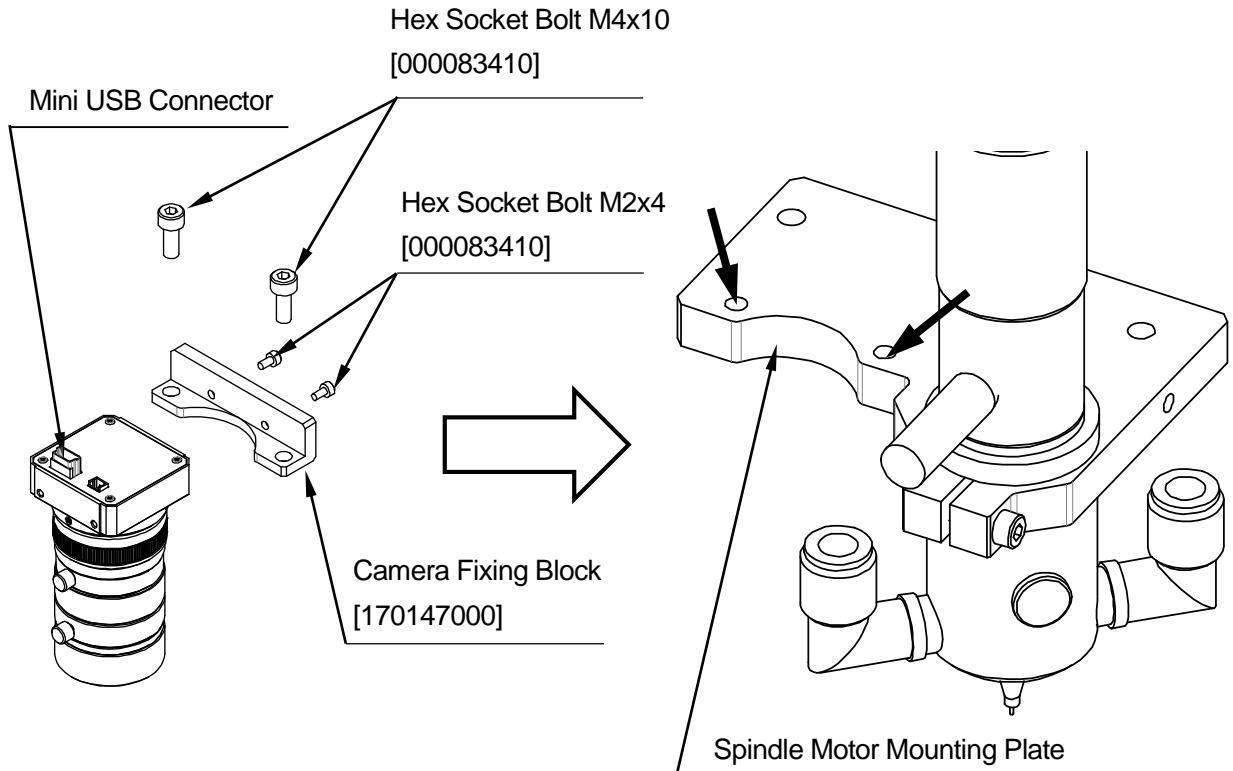


Do not touch the imaging area of the lens mount or the lens with your fingers.
Clean the lens to remove any dust or stains.
A dirty lens may cause malfunction.

1. Assemble the camera in the order shown below. (Note that all parts except for the extension ring screw together.)



2. Attach the camera to the camera fixing block using the two hex socket M2x4 bolts.
3. Secure the assembled USB camera (unit) to the spindle motor mounting plate as indicated by the black arrows, using the two hex socket M4x10 bolts.



Caution

Use the camera for teaching only. Make sure to remove the camera and USB cable when running the robot.

The USB cable is not designed for dynamic motion and may get damaged if not removed during runs. Swarf may also get inside the lens and deteriorate camera imaging if the robot is run with the camera attached.

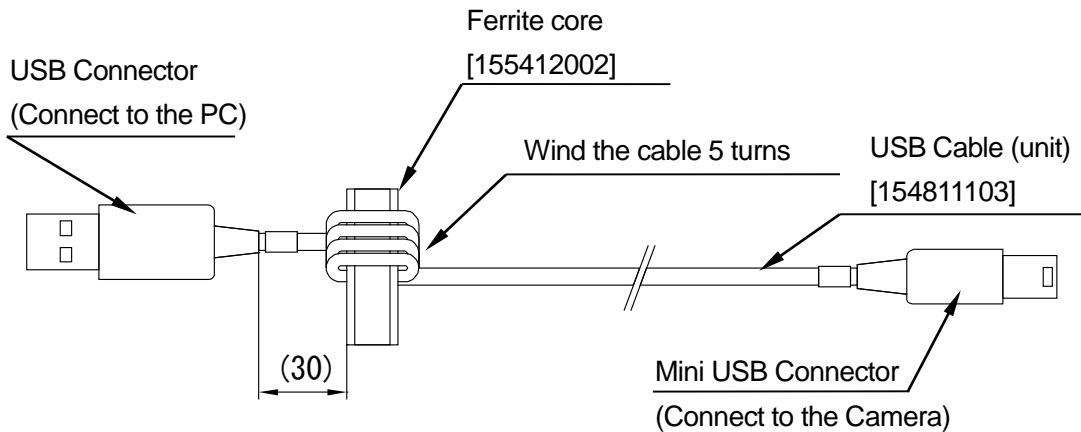
NOTE: The USB camera and its accessories are optional items. Some of them are not necessary for assembly.

3.12 Connecting the USB Cable (Optional)

Connect the USB camera to the USB port on the PC (not the robot) using the USB cable.

Use the ferrite core included if you are required to conform to the EC/EU directives, or you experience problems with imaging such as the display freezing, etc.

Refer to the operation manual *PC Operation* for details regarding USB camera settings and usage.



Wind the cable 5 turns around the ferrite core.

1. Run the cable through the center of the ferrite core. (1st turn)
2. Wind the cable around the outside of the ferrite core and through the center once again. (2nd turn)
3. Repeat step 2 three times. (5 turns in total)



Caution

Pull the cable to tighten it and make sure it is wound close to the ferrite core.

Also make sure that the wound part of the cable is not overlapping.

Failure to do so can cause malfunction.

3.13 Air Tube and Cable Arrangement



Caution

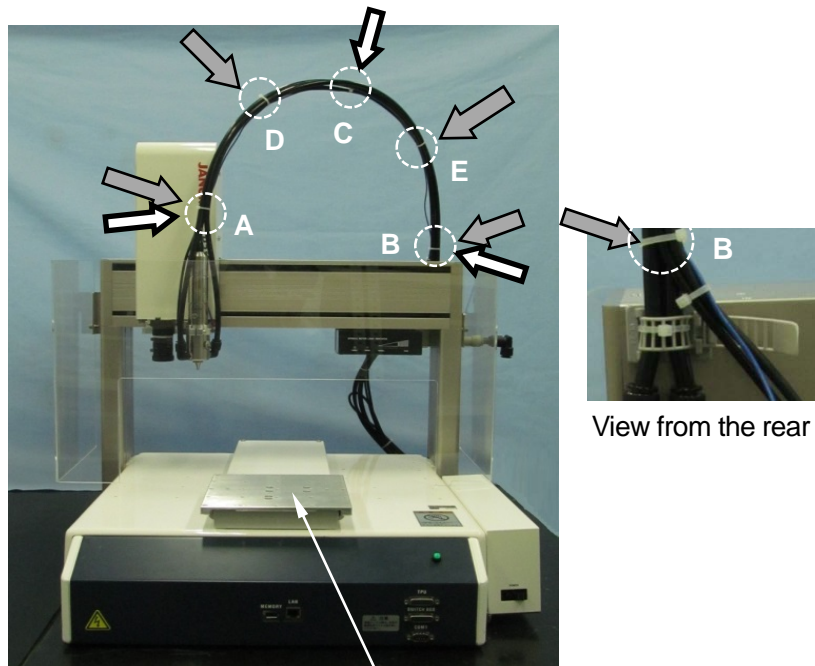
When securing the air tubes, be careful not to bend or pinch them by binding them too tightly.

If a tube is pinched or bent, the robot will not be able to vacuum swarf. Swarf accumulation may cause breakdown and is harmful to your health if inhaled.

Use the cable ties included to bind the air tubes and spindle motor cable in several places as shown below so as not to obstruct robot movements. When doing so, take care with the following:

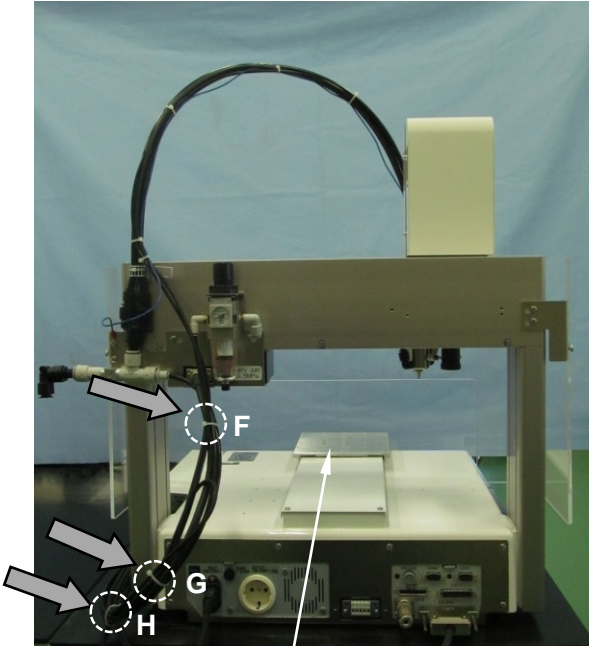
- Make sure the cable ties are tightened so there is no play in between the tubes and cables; however, do not overly tighten them and crush the air tubes.
 - Be extra careful that the air tubes and cables do not interfere with the X table.
1. Bundle the $\varnothing 4$ mm air tube, grounding wire and spindle motor cable together. Tie them with the included cable ties at the following 3 places indicated by the white arrows.
 - A: Directly above the spindle motor
 - B: Directly above the UL clamp
 - C: In between A and B
 2. Bind the 2 $\varnothing 8$ mm air tubes to the air tube/cables bound in step 1 and tie them together with the included cable ties at the following 4 places indicated by the gray arrows.
 - A: Directly above the spindle motor
 - B: Directly above the UL clamp (refer to “3.9 Air Tubes” for the UL clamp placement)
 - D, E: In between A and B at equal intervals

NOTE: If the optional USB camera is attached to the robot, use the 2 cable ties included to secure the USB cable to the bundled air tubes/cables.



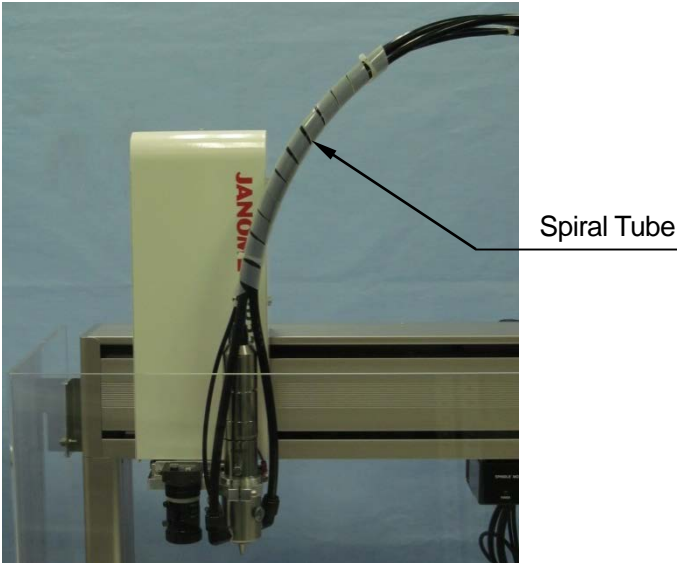
X-table


- 3. Bundle the spindle motor cable, indicator cable, $\varnothing 4$ mm, $\varnothing 6$ mm and $\varnothing 8$ mm air tubes, and tie them together with the included cable ties at the 3 places (F, G, and H) indicated by the gray arrows.



X-table

- 4. Place the included spiral tube over the bound tubes/cables as shown below.





Caution

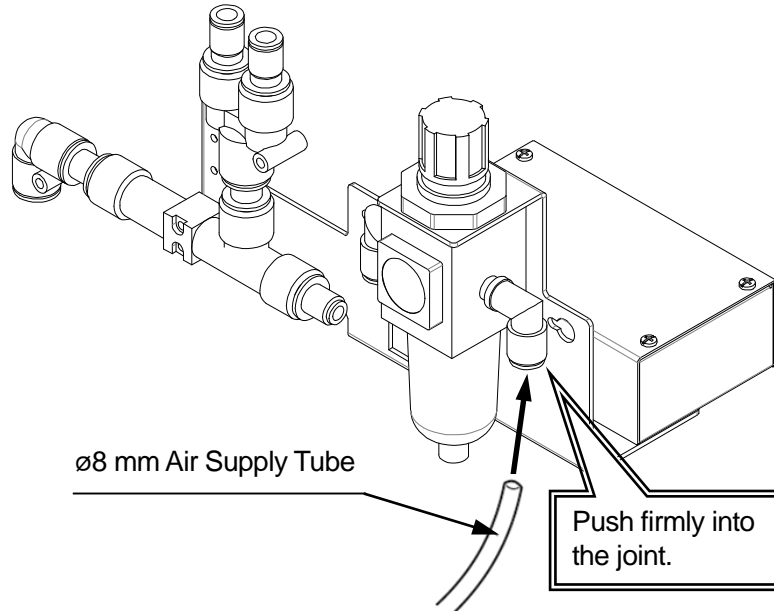
Use the camera for teaching only. Make sure to remove the camera and USB cable when running the robot.

The USB cable is not designed for dynamic motion and may get damaged if not removed during runs. Swarf may also get inside the lens and deteriorate camera imaging if the robot is run with the camera attached.

NOTE: The USB cable is not shown in the illustrations above.

3.14 Air Supply

Connect an air supply tube to the joint on the right side of the regulator on the robot.
(use the $\varnothing 8$ mm tube)



Caution

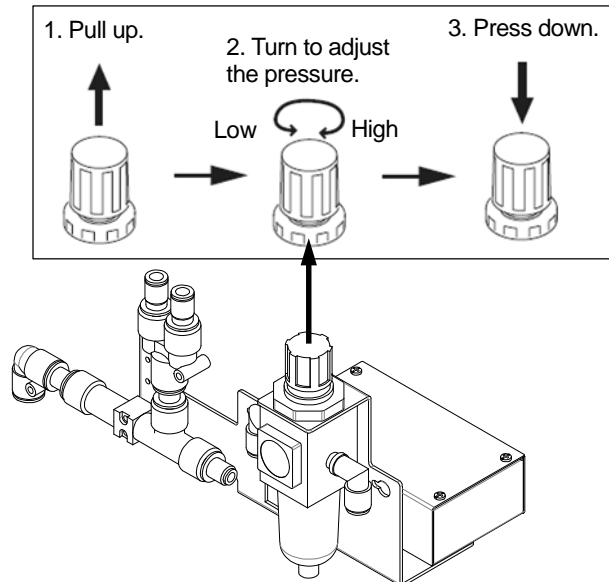
- For safety reasons, install a manual air supply shut off device (e.g. hand valve) for each robot. Over pressure may damage the regulator.
- Use an air tube manufactured by SMC Corporation, the same manufacturer as the air joint. Other air supply tubes may not fit into the air joint securely and can reduce the vacuum pressure. Inhalation of dust and swarf can be harmful to your health.

3.14.1 Airflow Adjustment

■ Adjusting the air supply

Turn the regulator knob to adjust the air supply pressure. Turn the knob clockwise to increase the pressure, or counterclockwise to reduce the pressure.

Adjust the pressure to 0.5 MPa (5kgf/cm²) by referring to the pressure gauge.



Caution

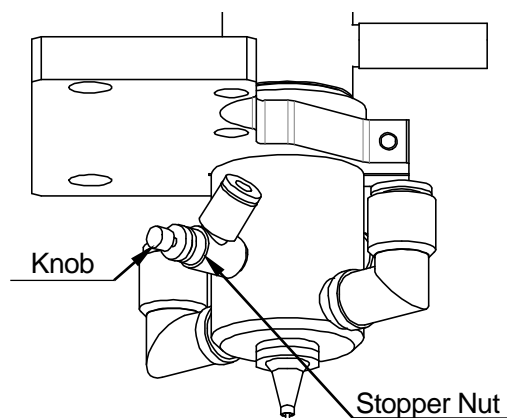
- Set the supply air pressure to 0.5 MPa. Low air pressure reduces the vacuum efficiency.
- Insufficient air flow may also reduce pressure while vacuuming.
- Use dry air containing no oil or moisture. Damp dust or swarf may clog the air system and reduce the vacuum pressure. Inhalation of dust and swarf can be harmful to your health.

■ Adjusting the Air Flow

Turn the knob on the bottom of the spindle motor (as shown below) to adjust the air flow.

Turn the knob clockwise to open the valve or counterclockwise to close the valve.

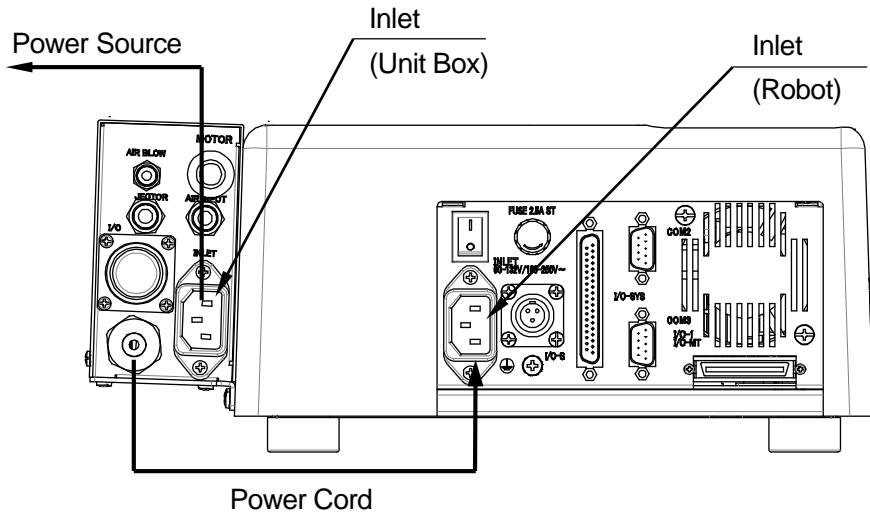
After adjusting the air flow, tighten the stopper nut to secure the knob.



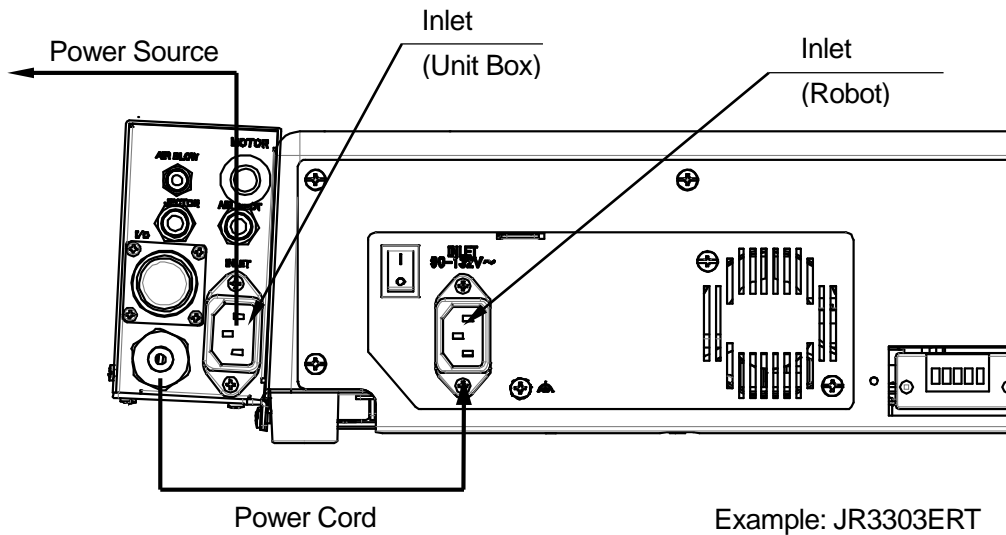
3.15 Power Cords

Connect the power cord from the unit box to the power inlet on the rear of the robot, and then connect the power cord supplied with the robot to the power inlet on the unit box and the power source.

■ JR3203ERT



■ JR3303ERT, JR3403ERT, JR3503ERT, JR3603ERT



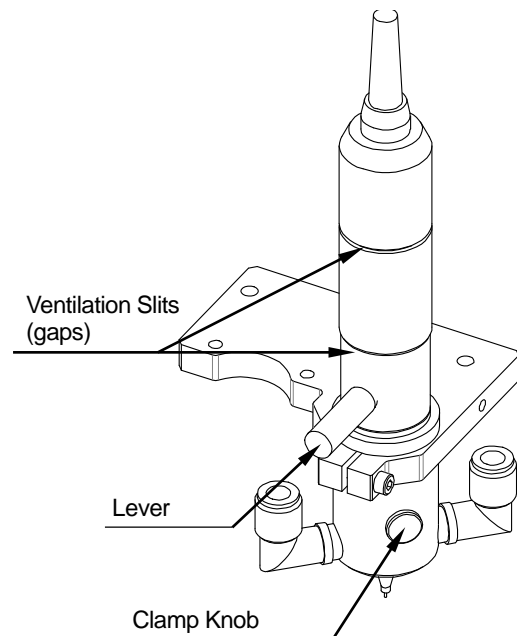
4. USAGE PRECAUTIONS

Check the following items before turning ON the power to the robot:

- The grounding wires and cords are connected correctly.
- The air tubes are firmly secured in the appropriate locations.
- The regulator pressure is set appropriately. (0.5 MPa (5kgf/cm²))
- The safety cover is secured properly.

Check the following items before running or teaching programs with the robot:

- Nothing is blocking the two ventilation slits on the spindle motor. (necessary for cooling the motor)
- The clamp knob on the nozzle base is firmly tightened.
- The spindle motor lever is set to the S position.
- The router bit is firmly and correctly set in place.
- The dust filter is not full.
- The installed fixtures are suitable for the workpiece.



Warning

Install the switchbox in a stable place. Refer to “11.6 Switchbox” for details regarding the external dimensions. Placing the switchbox in an unstable location or near moving parts may prohibit you from being able to stop the robot immediately in the event of an emergency, resulting in operator injury.



Caution

Check that the cables and air tubes do not come in contact with the robot or any jigs you may have installed during operation.

Prolonged use may cause malfunction or air to leak.

Air leaks can reduce the filter efficiency, resulting in inhalation of dust or swarf and can be harmful to your health.

The motor area may get hot. Touching the motor can cause burns.



Caution

Our dust collection system developed exclusively for depaneling is highly efficient at collecting dust and swarf; however 100 % dust collection is not guaranteed and dust and particles may be expelled into the air around the unit.

Operators who are near the unit for extended periods of time should wear an anti-dust mask to prevent inhalation of dust or swarf.

Also, make sure to sufficiently ventilate the work area during operations.

Inhalation of dust and swarf can be harmful to your health.

5. CALIBRATION OF THE USB CAMERA (OPTIONAL)



Caution

Use the camera for teaching only. Make sure to remove the camera and USB cable when running the robot.

The USB cable is not designed for dynamic motion and may get damaged if not removed during runs. Swarf may also get inside the lens and deteriorate camera imaging if the robot is run with the camera attached.

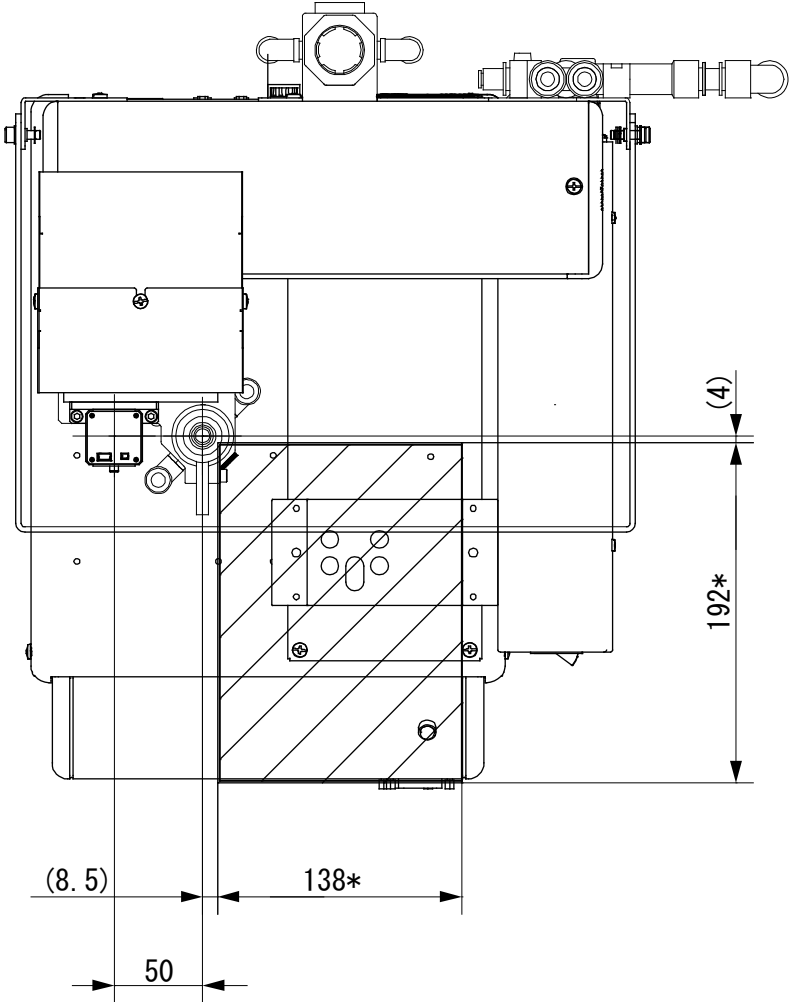
Calibration is required before using the USB camera (optional) to teach.

5.1 Calibrating the USB Camera

5.1.1 PCB Cutting Range when Using the USB Camera

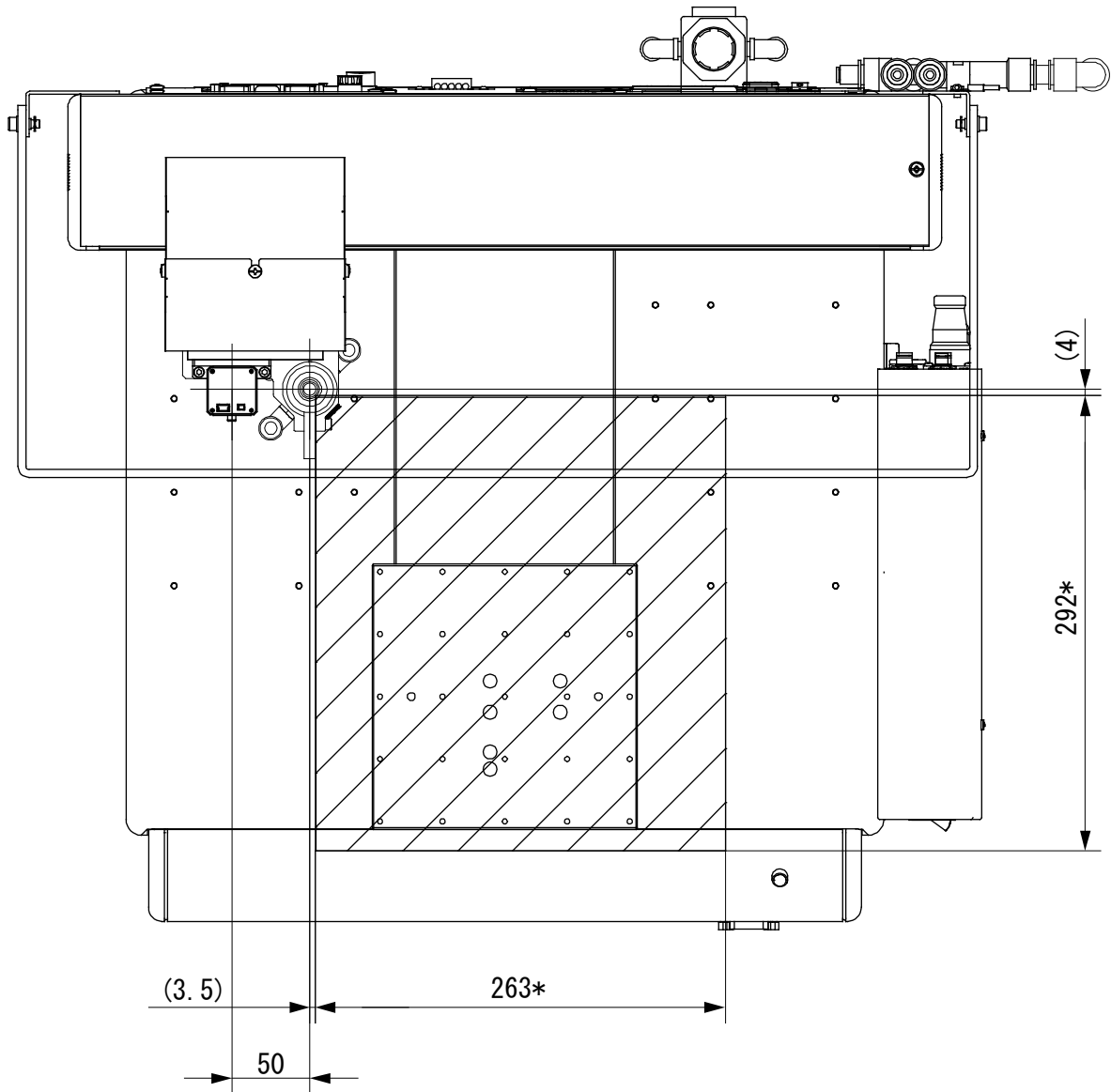
The cutting range of the robot when using the USB camera is as shown below.

- JR3203ERT



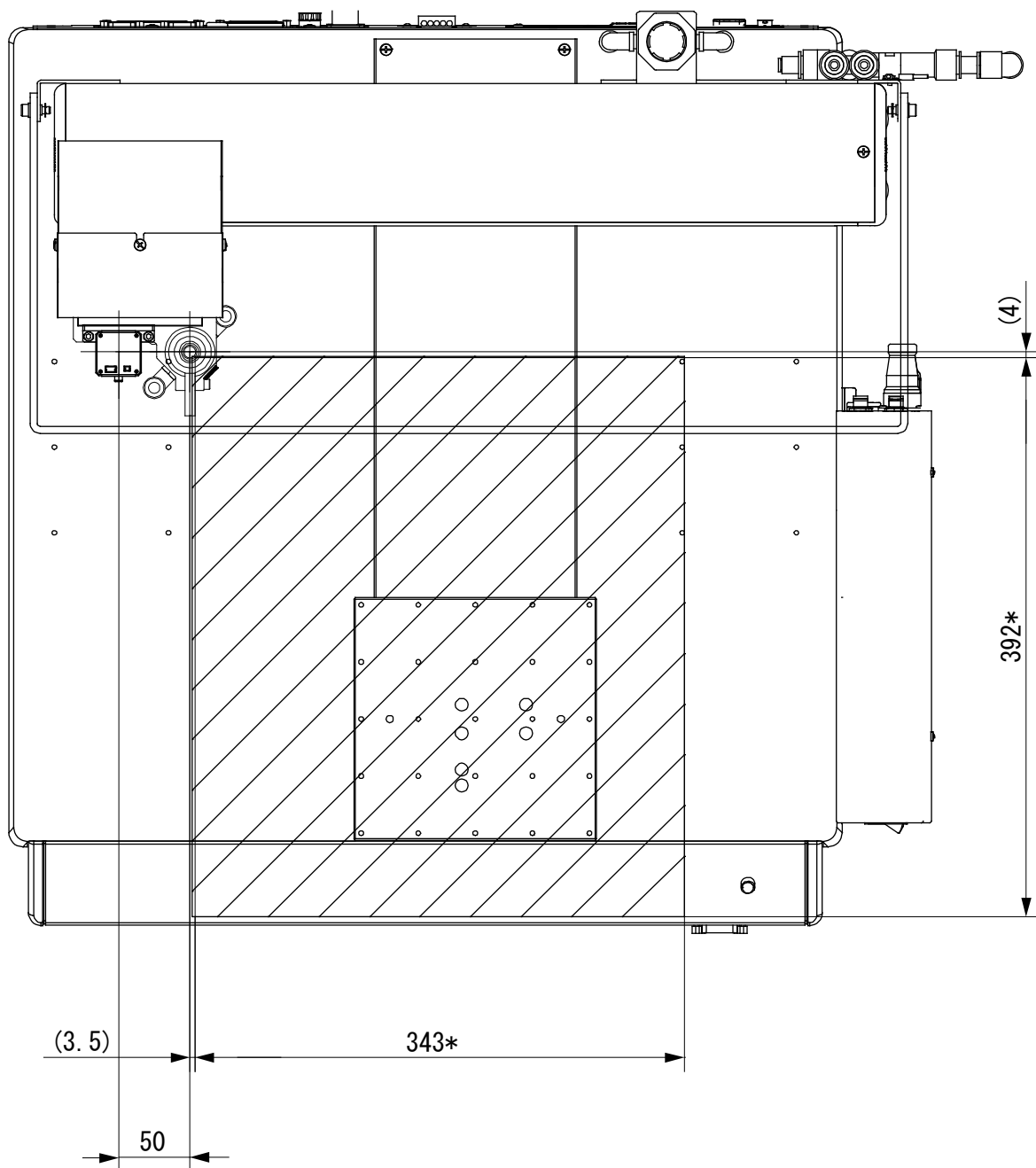
*  : Cutting Range

■ JR3303ERT



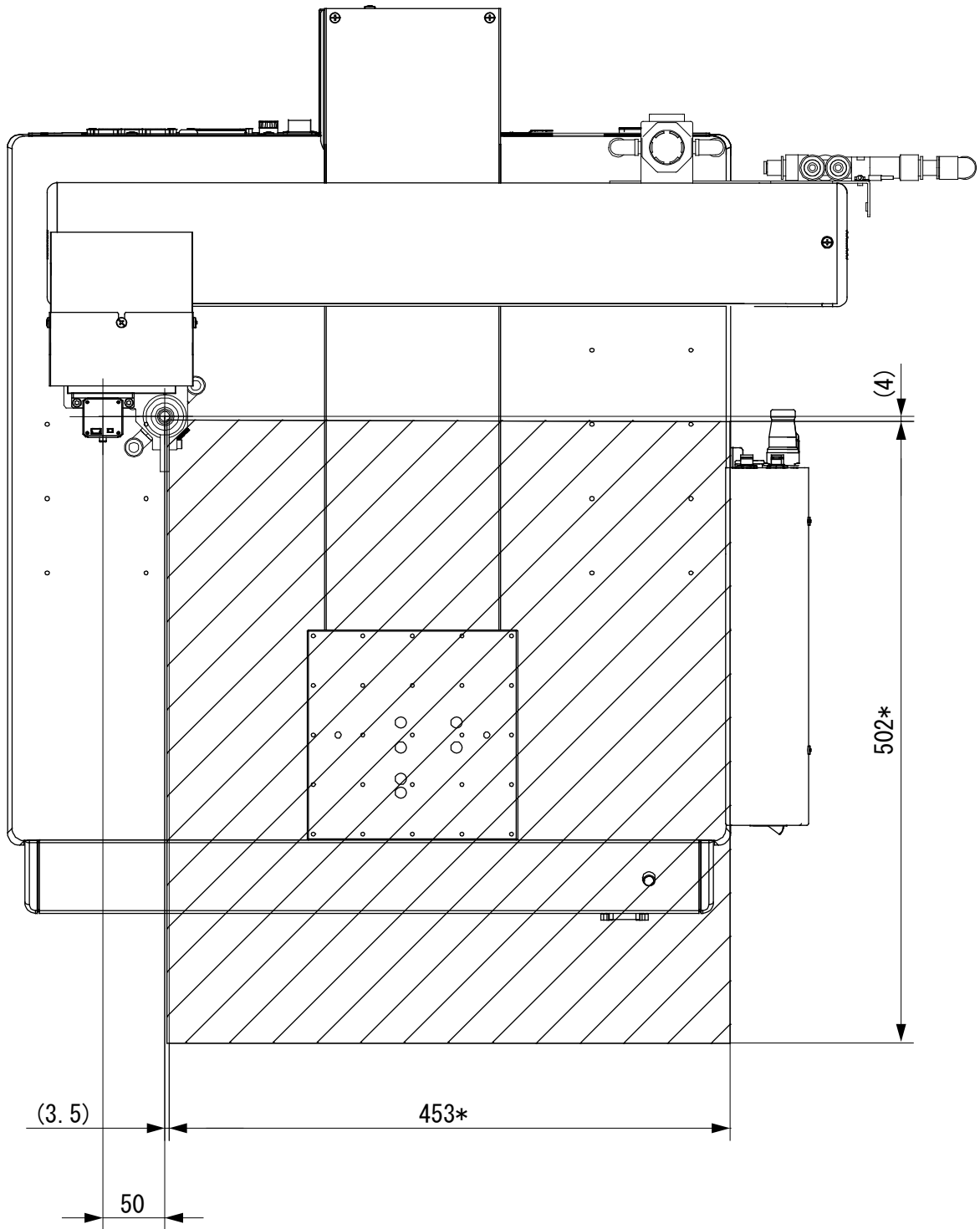
*  : Cutting Range

■ JR3403ERT



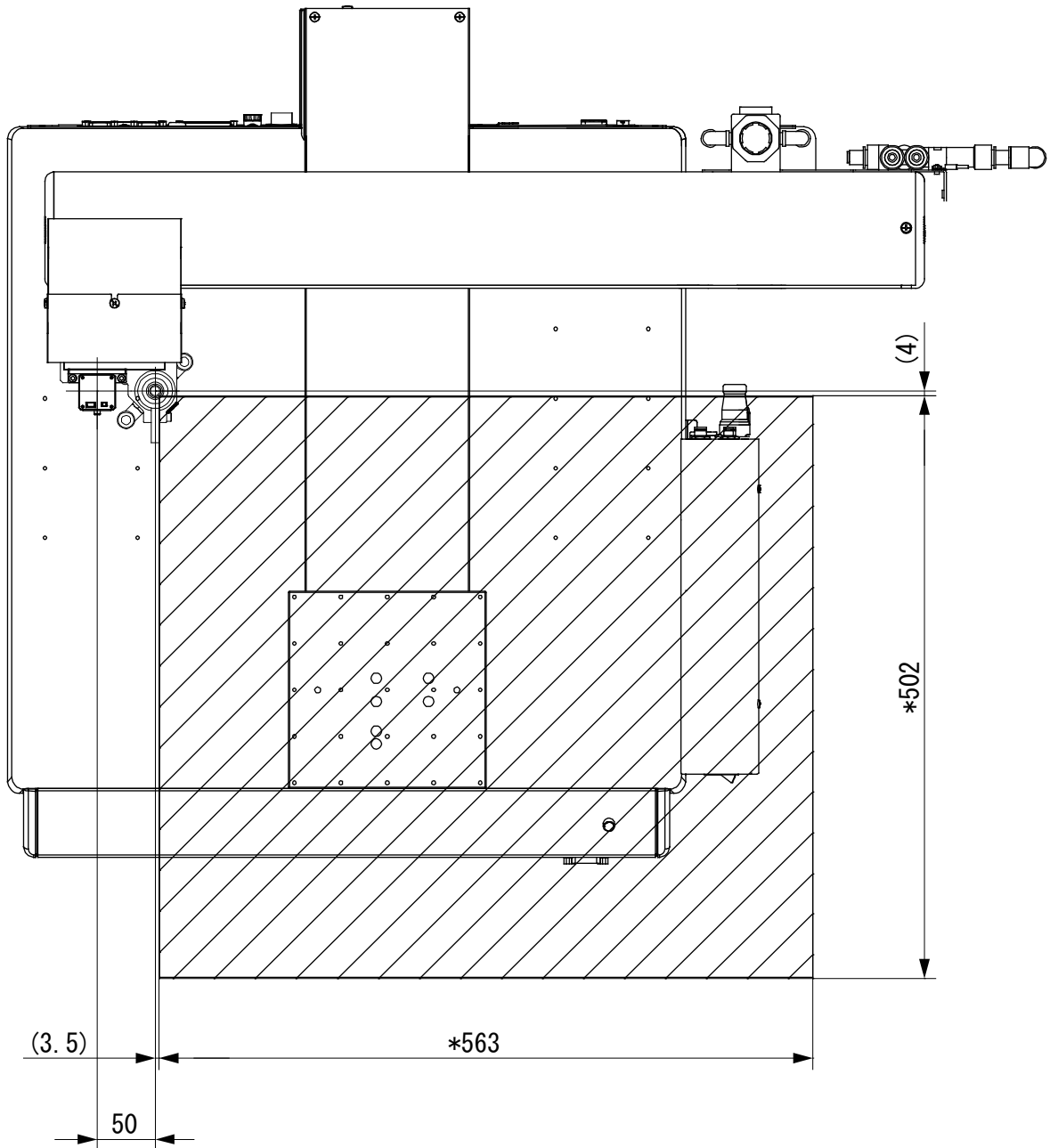
*  : Cutting Range

■ JR3503ERT



*  : Cutting Range

■ JR3603ERT



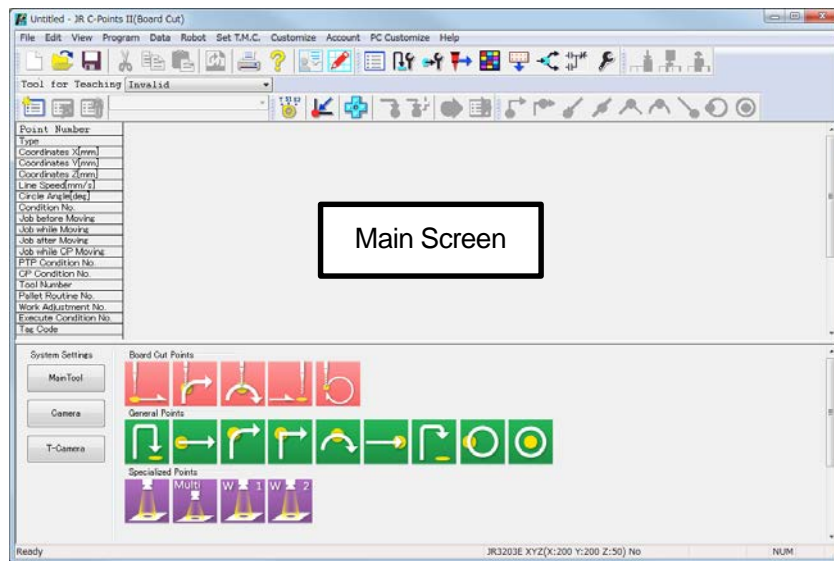
*  : Cutting Range

5.1.2 Preparation

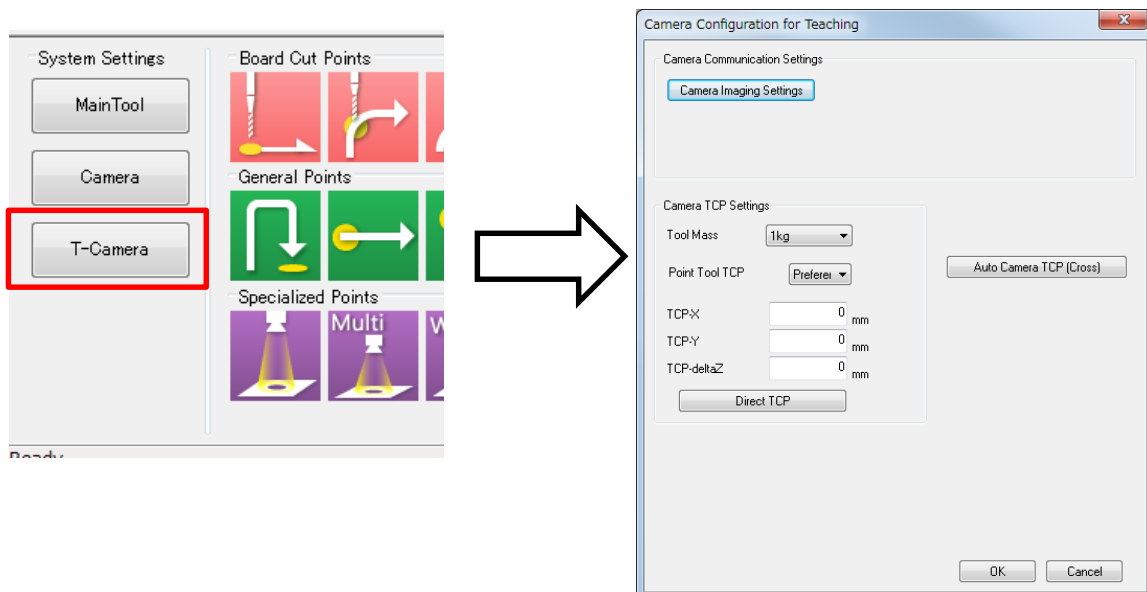
Prepare a robot equipped with a router bit and a USB camera. Refer to “3.8 Connecting Devices to the Front of the Robot” and connect the robot to a PC using a LAN cable.

Connect the cable from the USB camera to a USB port on the PC.

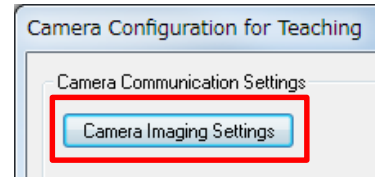
1. Start up the PC software to display the main screen.
(For details on starting up the PC software, refer to the operation manual *PC Operation*.)



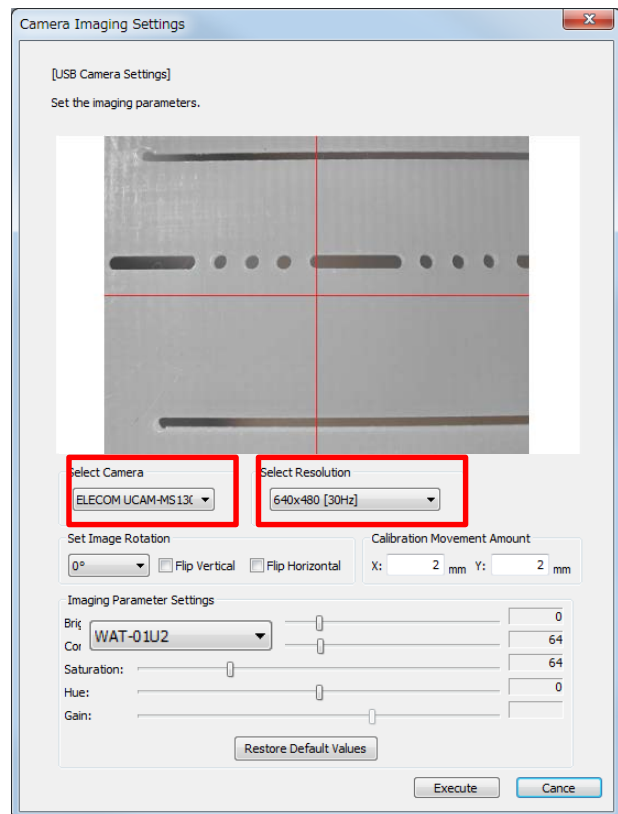
2. Click [Teaching Camera] on the bottom left of the main screen to display the Camera Configuration for Teaching screen.



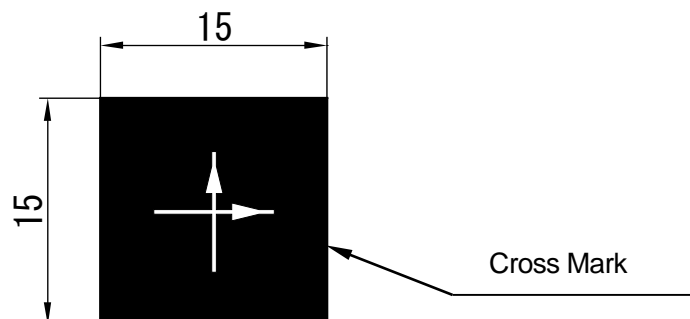
- Click [Camera Imaging Settings] to display the Camera Imaging Settings screen.



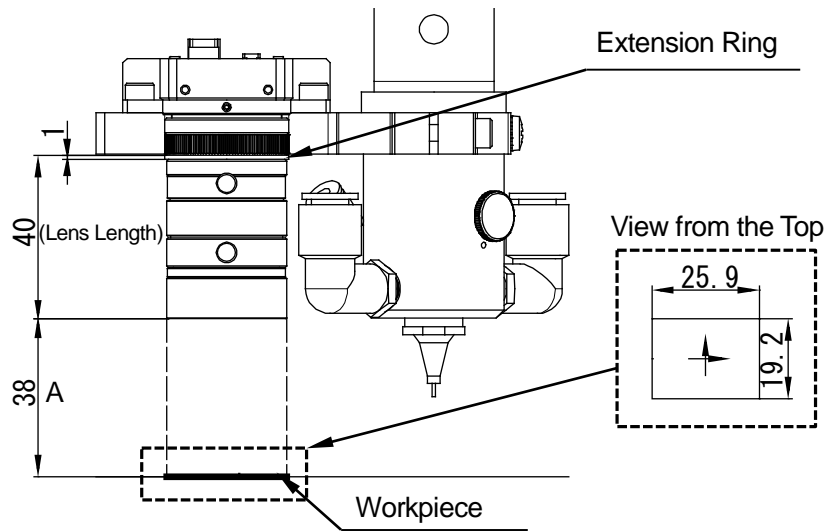
- Select the camera and resolution as follows:
 Camera: WAT-01U2
 Resolution: 640 × 480 (30 Hz)
 Click the [Execute] button to enable the selection.



- Place the cross mark (part number: 170145A01) included in the camera accessories used for calibration on the workpiece.



- Adjust the distance (A) between the camera and the cross mark (workpiece) so that the workpiece is displayed in focus using the Camera for Teaching settings in JOG Mode.



When using the 1 mm extension ring with the lens positioned 38 mm from the cross mark (workpiece) and with the focus ring set to 0.15, the field of view is 25.99 mm × 19.2 mm.

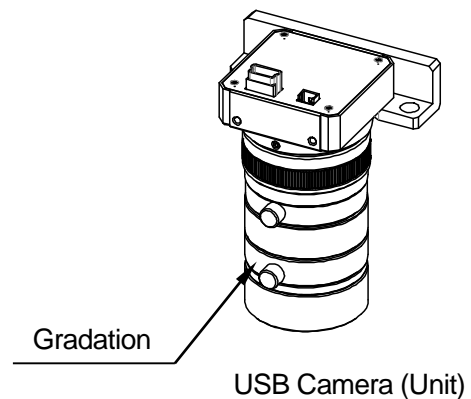
The further the camera is positioned from the workpiece, the wider the field of view. However this reduces the magnification and the teaching precision.

Aim to set the camera 38 mm from the cross mark (workpiece). However, make sure the distance you set the camera at is a distance where the router bit will not come in contact with the workpiece.

Turn the focus ring to adjust the focus, and the aperture ring to adjust the light exposure.

NOTE: After completing the adjustments, do not alter the settings.

If any of the settings are modified, you will need to calibrate the camera again.

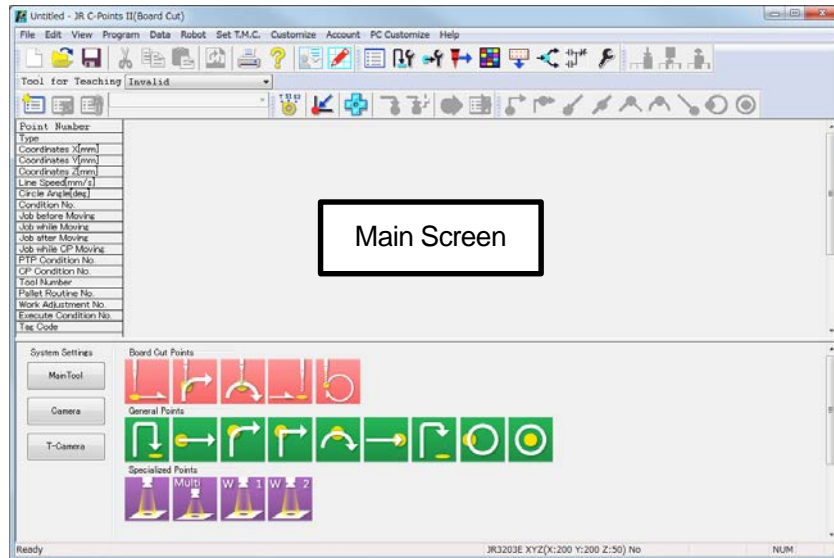


5.1.3 Calibration

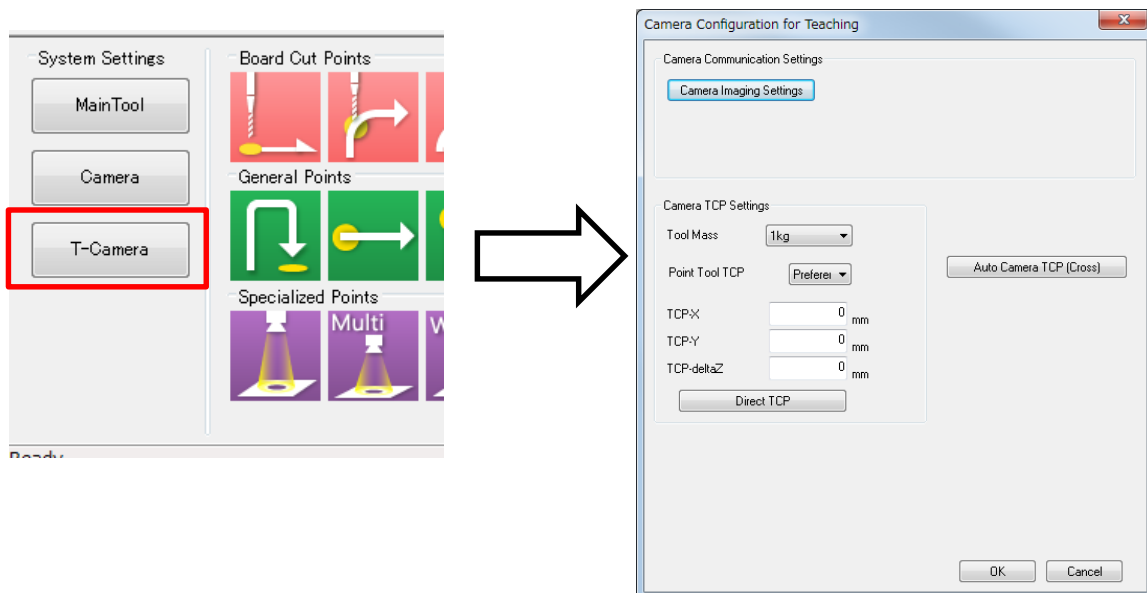
The optional PC software [JR C-Points II (Board Cut)] is required for calibration. Calibrate the USB camera using the following procedure:

1. Start up the PC software to display the main screen.

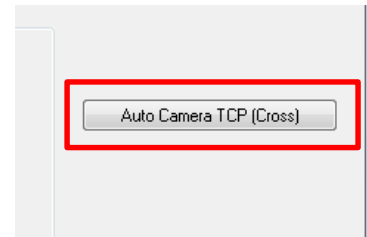
(For details on starting up the PC software, refer to the operation manual *PC Operation*.)



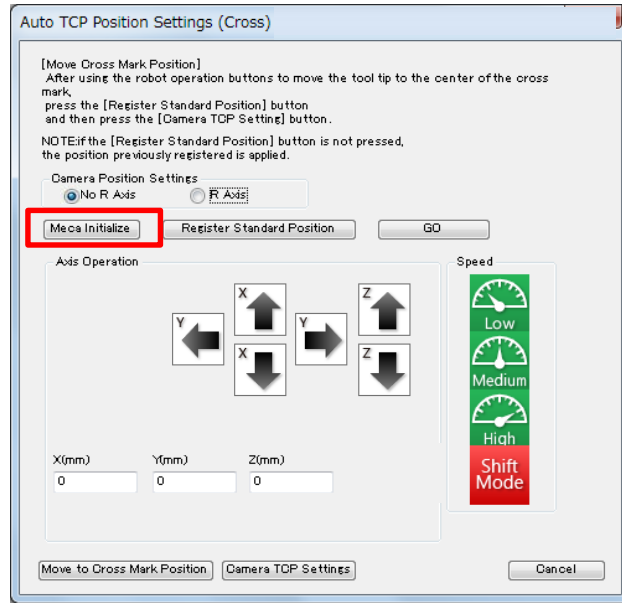
2. Click [Teaching Camera] on the bottom left of the main screen to display the Camera Configuration for Teaching screen.



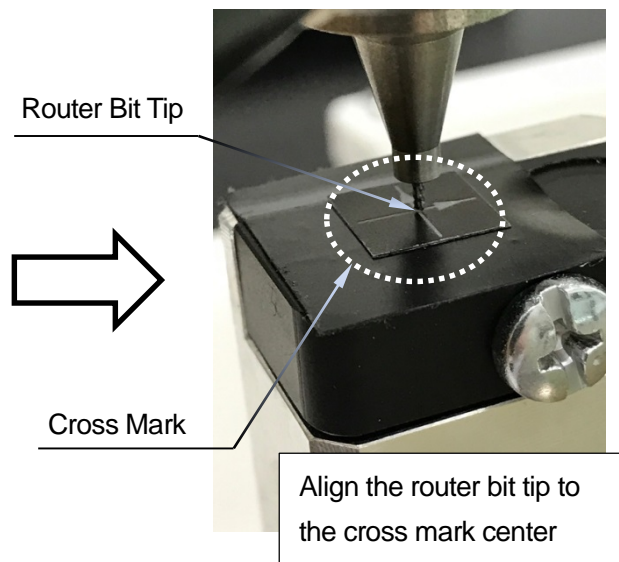
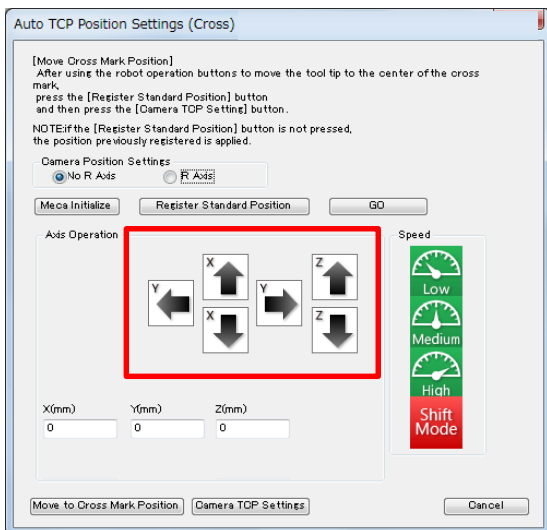
- Click the [Auto Camera TCP (Cross Mark)] button on the right of the Camera for Teaching Configuration screen. The Auto TCP Position Settings (Cross Mark) screen appears.



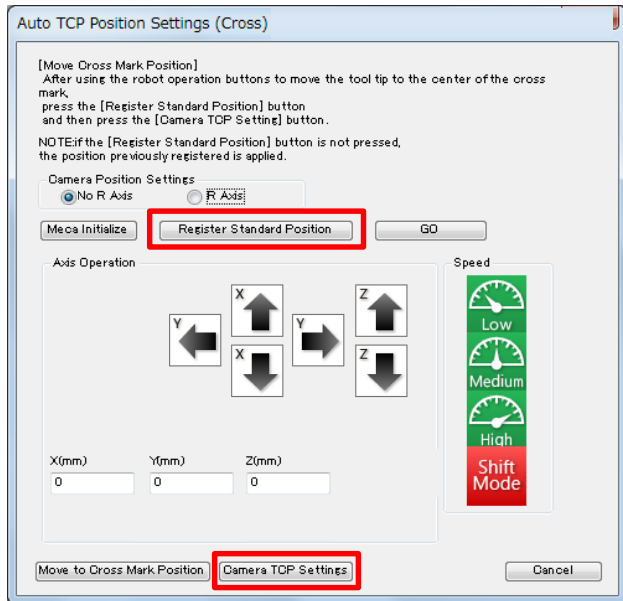
- Click [Meca Initialize] to mechanically initialize the robot.



- Use the arrow buttons to align the router bit tip to the center of the cross mark on the workpiece.

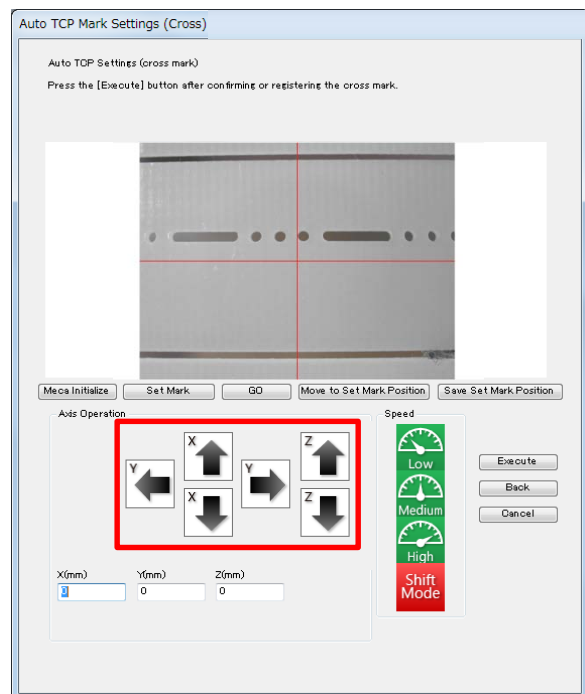


- After aligning the router bit tip to the cross mark center, click the [Register Standard Position] to register the router bit standard position.

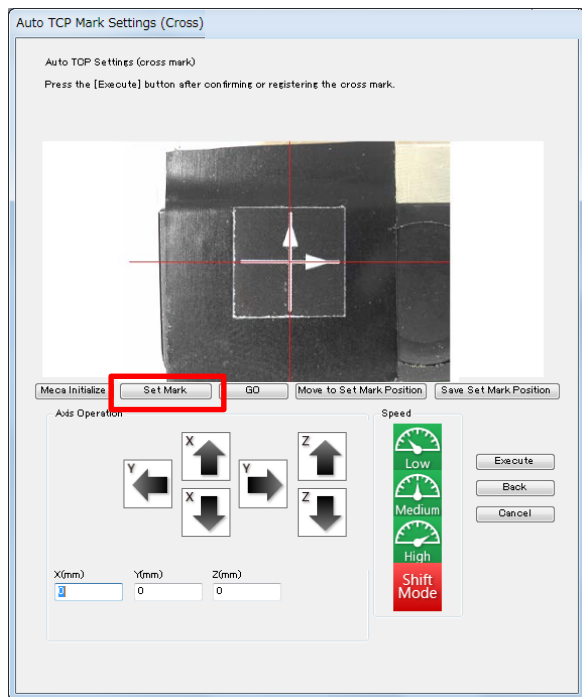


- Click the [Camera TCP Settings] button. The Auto TCP Mark Settings screen appears.

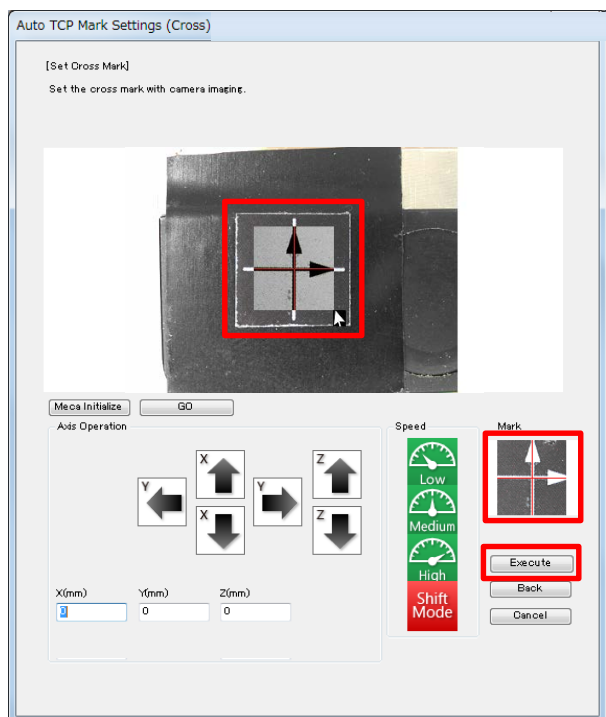
- Use the arrow buttons to display the cross mark on the screen.



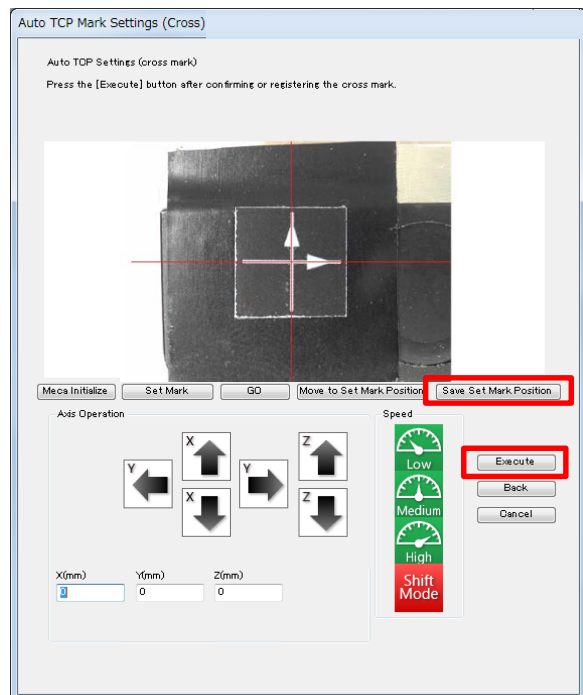
- Click the [Set Mark] button to display the Mark Registration screen.



- Drag the mouse cursor over the cross mark to select it. Confirm the cross mark is displayed in the [Mark] display area. Click the [Execute] button to register the mark and return to the previous screen.

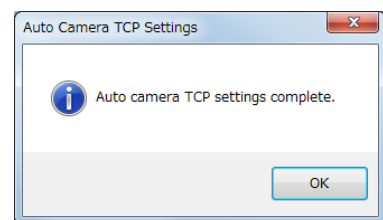


11. Click the [Save Mark Setting Value] button to save the set mark position.

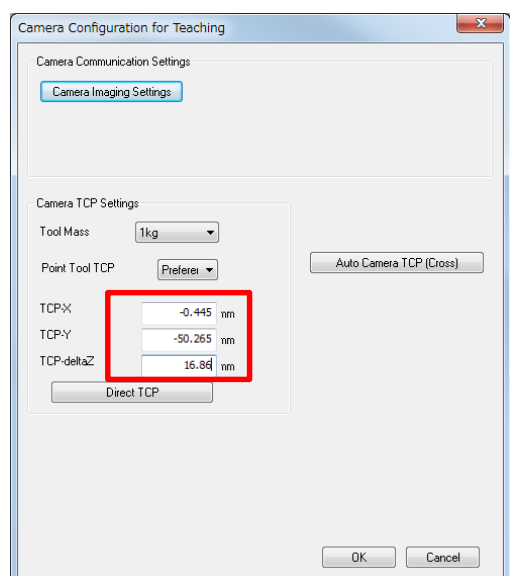


12. Click the [Execute] button to calibrate the camera.

13. After the camera is calibrated, a confirmation screen is displayed. Click OK.



You are returned to the Camera Configuration for Teaching screen, where the TCP results are displayed.



6. TEACHING

The 6 point types from [Cut Start Point] to [Cut Circle Center Point] are used for CP movements during PCB cutting. You can also modify the [Board Cut Conditions] for these point types to suit your needs.

This section explains how to teach a new program.

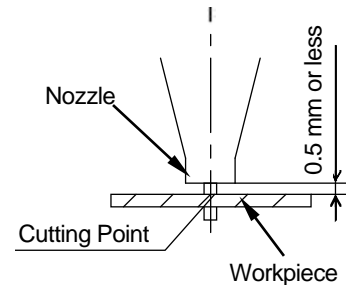


Caution

Register the cutting job point so that the distance between the workpiece and the nozzle is 0.5 mm or less. (The vacuuming efficiency changes depending on the distance between the nozzle and the workpiece.)

Note that if the registered point is too low, the nozzle may damage the workpiece and cause the pulse motor to step out. Also note that the nozzle tip can easily warp. Do not apply a strong force to it.

Damaging the nozzle or workpiece can cause injury or breakdown.



6.1 Point Types

These are the point types used for PCB cutting.

Other than the standard point types, depaneling robots use the following 6 point types for PCB cutting:

1. Cut Start Point



Set this point type to the point where you want to start cutting the PCB; the robot switches from PTP movement to CP movement. At this point, the robot can standby for the exact time set in [Start Wait Time]. The robot also detects spindle errors from this point to the next point.

2. Cut Relay Point



This point type is used to change the cutting direction during PCB cutting. At this point, the robot can standby for the exact time set in [Line Stop Time]. The robot also detects spindle errors from this point to the next point.

3. Cut Arc Point



This point type is used to define the arc when cutting in an arc motion. The robot also detects spindle errors from this point to the next point.

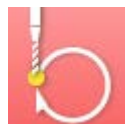
4. Cut End Point



Set this point type to where you want to finish cutting the PCB. The vacuum can be set ON or OFF at this point.

- Vacuum OFF
The robot halts vacuuming (air suction), stands by for the [Air Blow Wait Time] and then blows air for the time specified in [Air Blow Time]. Next, the robot starts vacuuming again and makes a PTP movement to the next point.
- Vacuum ON
The robot makes a PTP movement to the next point while continuing to vacuum, without standing by at the [Cut End Point].

5. Cut Circle Start Point



This point type is used in conjunction with the [Cut Circle Center Point] to define the circle when cutting in a circle motion. Set [Cut Circle Center Point] after setting this point type. The robot detects spindle errors during this movement.

6. Cut Circle Center Point



This point type is used in conjunction with the [Cut Circle Start Point] to define the circle when cutting in a circle motion. The vacuum can be set ON or OFF at the end of the circle motion.

- Vacuum OFF

The robot halts vacuuming (air suction), stands by for the [Air Blow Wait Time] and then blows air for the time specified in [Air Blow Time].

Next, the robot starts vacuuming again and makes a PTP movement to the next point.

- Vacuum ON

The robot makes a PTP movement to the next point while continuing to vacuum, without standing by at the [Cut End Point].

NOTE:

- Always make sure to use these 6 CP movement point types (from [Cut Start Point] to [Cut Circle Center Point]) to cut PCBs. Otherwise, the spindle motor, vacuuming, and air blowing cannot be controlled properly.
- Even if any of the 6 PCB cutting point types are not set, the spindle motor starts running when starting to run.

For information regarding the other standard point types, refer to the operation manual *Basic Instructions*.

The items that can be set to a given point vary depending on the point type, as shown below.

(✓: Settable, blank: not settable)

Point Job Additional Function Data	Line Speed	Job before Moving*1	Job while Moving*1	Job after Moving*1	Job while CP Moving*1	PTP Condition	CP Condition	Tool Data	Pallet Routine	Workpiece Adjustment	Execute Condition	Tag Code	Vacuum	Circle Angle
Point Types														
Cut Start Point*2	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Cut Relay Point*2	✓			✓	✓		✓			✓	✓	✓		
Cut Arc Point*2	✓			✓						✓	✓	✓		
Cut End Point*2				✓		✓				✓	✓	✓	✓	
Cut Circle Start Point*2	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Cut Circle Center Point*2					✓	✓					✓	✓	✓	✓
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					✓	✓					✓	✓		✓
Single Camera Shoot Point			✓	✓	✓		✓		✓	✓	✓	✓		
Multi Camera Shoot Point			✓	✓	✓		✓		✓	✓	✓	✓		
Double Camera Shoot Point 1			✓	✓	✓		✓		✓	✓	✓	✓		
Double Camera Shoot Point 2			✓	✓	✓		✓		✓	✓	✓	✓		

*1: [Job before Moving], [Job while Moving], [Job after Moving], and [Job while CP Moving] are referred to as “point jobs.” If a point job is set to one of the point types from [Cut Start Point] to [Circle Center Point], operations attached to that point type are not executed. For example, the setting [Start Wait Time] is attached to Cut Start Points. This is a wait time for the robot before it starts cutting at Cut Start Points. You specify this wait time when you setting a Cut Start Point to a program (or you can specify it as a [Board Cut Condition]). However, if an optional point job is also set to the Cut Start Point, the robot will not wait for this time. If you want to set a point job, etc., to these points and also want the robot to do the operations included with those point types, use the callBase command.

*2: Spindle error detection is only performed when the axes are moved using these point types. If a spindle error occurs with any other point type, the error detection lamp comes ON, but the spindle error is not displayed.

6.2 Selecting a Point Type

TP

When teaching a new point, enter the coordinates to display the point type selection screen (as shown to the right).

For PCB cutting, select one of the top 6 point types.

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

Point Type Selection Screen

PC

If teaching points using the PC software JR C-Points II (Board Cut), click a point icon from the basic operations area to add that point type to the end of the program.

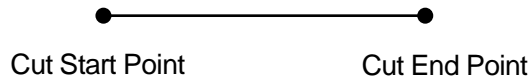
For PCB cutting, select one of the icons within the dotted line below.

Refer to the operation manual *PC Operation* for further details.

Point Number	1	2	3	4	5
Type	Cut Start Point	Cut Relay Point	Cut Relay Point	Cut End Point	Cut End Point
Coordinates X(mm)	17.875	69.455	69.345	16.810	17.905
Coordinates Y(mm)	146.450	147.540	154.025	154.140	146.435
Coordinates Z(mm)	50.000	50.000	50.000	50.000	50.000
Line Speed(mm/s)	10.0	10.0	10.0	10.0	--
Circle Angle(deg)	--	--	--	--	--
Condition No.	--	--	--	--	--
Job before Moving	--	--	--	--	--
Job while Moving	--	--	--	--	--
Job after Moving	--	--	--	--	--
Job while CP Moving	--	--	--	--	--
PTP Condition No.	--	--	--	--	--
CP Condition No.	--	--	--	--	--
Tool Number	--	--	--	--	--
Palet Routine No.	--	--	--	--	--
Work Adjustment No.	--	--	--	--	--
Execute Condition No.	--	--	--	--	--
Tool Code	--	--	--	--	--

6.3 Straight Cutting

Register the two points [Cut Start Point] and [Cut End Point] to cut in a straight line.



Select [Cut Start Point] and enter the line speed.

Register the [Cut End Point] at the location where you want to finish cutting.

NOTE

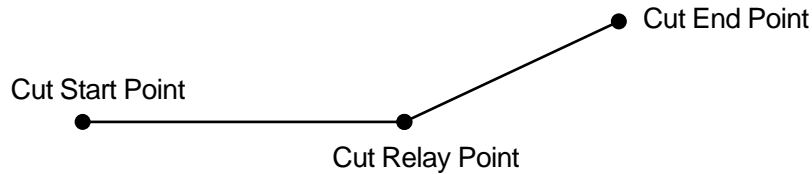
- The robot waits at the Cut Start Point for the time set in [Start Wait Time] (Individual Program Settings > Board Cut Condition). [Start Wait Time] is only valid at Cut Start Points.
- The robot waits at the Cut End Point for the time set in [Air Blow Wait Time] (Individual Program Settings > Board Cut Condition). After this, the robot blows air for the exact time set in [Air Blow Time].

Attention

The recommended cutting speed is approximately 10 mm/s. Make further adjustments to this speed by referring to the green LED on the indicator. The cutting speed can greatly reduce the operating life of the router bit. Set the cutting speed as slow as possible.

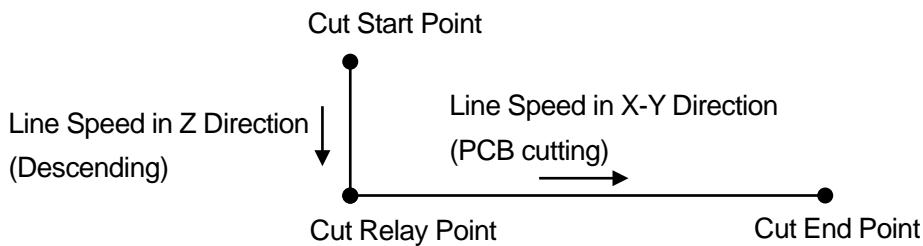
6.4 Zigzag Cutting

Register [Cut Relay Point] between [Cut Start Point] and [Cut End Point] to cut along a polygonal line as shown below.



Call up the settings screen (base screen) for the Cut End Point and insert a point between [Cut Start Point] and [Cut End Point] by entering the coordinate of the point where you want to bend the line. Register the coordinate and the point type selection screen appears. Select [Cut Relay Point]. A screen for entering the line speed is displayed. Enter and register the line speed (CP movement speed).

Zigzag cutting can be used to change the line speeds for boring and PCB cutting.



Set [Cut Start Point] to where you want to start cutting, but set its Z coordinate at a height above the workpiece. Enter the desired descending speed as a line speed.

Insert [Cut Relay Point] at the same X-Y coordinates as that of [Cut Start Point] with Z coordinate at the PCB cutting height. Enter the desired speed in the X-Y directions as a line speed.

In the example above, the unit descends and bores using the (CP) line speed set to the Cut Start Point. The robot then moves in the X-Y directions using the (CP) line speed set to the Cut Relay Point for the rest of the cutting operation.

Attention

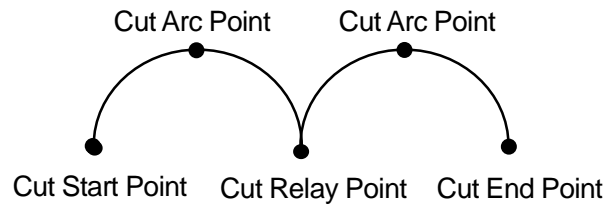
The recommended cutting speed is approximately 10 mm/s. Make further adjustments to this speed by referring to the green LED on the indicator. The line speed can greatly affect the operating life of the router bit. Set the line speed as slow as possible.

6.5 Arc Cutting

You can cut in an arc using the point types described below.

Consecutively register the following three points in this order to cut in an arc: [Cut Start Point] > [Cut Arc Point] > [Cut End Point].

You can continuously cut another arc shape if you set [Cut Relay Point] instead of [Cut End Point] as shown below.

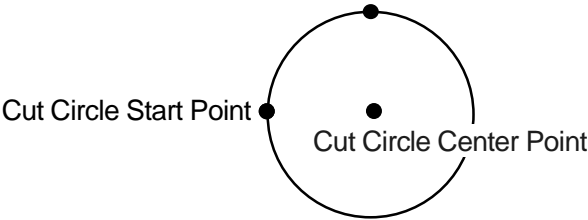


Attention

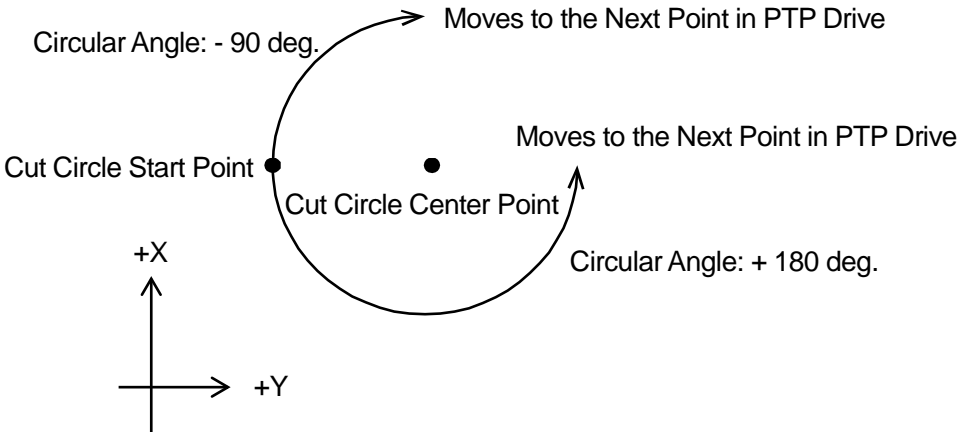
The recommended cutting speed is approximately 10 mm/s. Make further adjustments to this speed by referring to the green LED on the indicator. The line speed can greatly affect the operating life of the router bit. Set the line speed as slow as possible.

6.6 Circle Cutting

You can cut in a circle using the point types described below.
 Consecutively register the following points: [Cut Circle Start Point] > [Cut Circle Center Point].
 The robot cuts in an arc shape according to the angle set for the [Cut Circle Center Point]. Set the circle angle to 360° to cut a complete circle.



Set the line speed for [Circle Start Point] and set the circular angle for [Circle Center Point].
 The circular angle can be entered up to ±9999.999 degrees at 0.001 degree increments. The robot cuts a circle in a clockwise direction (when viewed from the front of the robot) if a positive angle is entered, and cuts counterclockwise if a negative angle is entered.



Attention

The recommended cutting speed is approximately 10 mm/s. Make further adjustments to this speed by referring to the green LED on the indicator.
 The line speed can greatly affect the operating life of the router bit. Set the line speed as slow as possible.

6.7 Board Cutting Condition Settings

The following 4 board cutting conditions are available in [Board Cut Condition] from [Individual Program Settings]. These board cutting conditions can be set to each program individually and the robot runs in accordance with the individually set condition when each program is executed.

1. Start Wait Time

After the Z axis is lowered, the robot waits for this set time at the Cut Start Point before starting the cutting operation. For example, when the router bit is lowered to cut a hole etc., the workpiece may vibrate when the router bit first comes in contact with it. [Start Wait Time] can be used to make the robot wait until the workpiece has stabilized. The greater the setting value, the longer the robot waits.

2. Line Stop Time

At Cut Relay Points, the burden on the router bit substantially increases. To reduce the burden on the router bit, the robot waits at the Cut Relay Point according to the exact time set in Line Stop Time.

3. Air Blow Wait Time

To prevent the router bit from clogging, the robot can blow air at Cut End Points. However, to make sure the workpiece remains stable, a waiting time can be set before blowing air. If the vacuum is set to OFF at a Cut End Point, the robot stops vacuuming, stands by for the time specified in [Air Blow Wait Time], and then blows air.

4. Air Blow Time

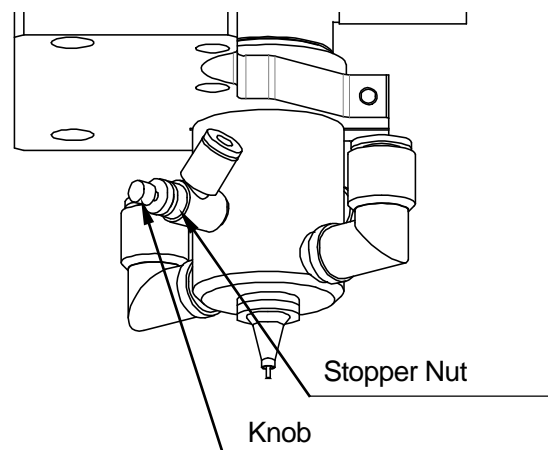
To prevent the router bit from clogging, the robot blows air at Cut End Points. If the vacuum is set to OFF at a Cut End Point, the robot stops vacuuming, stands by for the time specified in [Air Blow Wait Time], and then blows air for the time specified in [Air Blow Time]. If the vacuum is set to ON, the robot continues vacuuming and moves to the next point without blowing air.

■ Airflow Adjustment

Turn the knob on the bottom of the spindle motor (as shown to the right) to adjust the air flow.

Turn the knob clockwise to open the valve or counterclockwise to close the valve.

After adjusting the air flow, tighten the stopper nut to secure the knob.



■ How to set the board cutting conditions

TP  **MENU** [Individual Program Settings] > [Board Cut Condition]

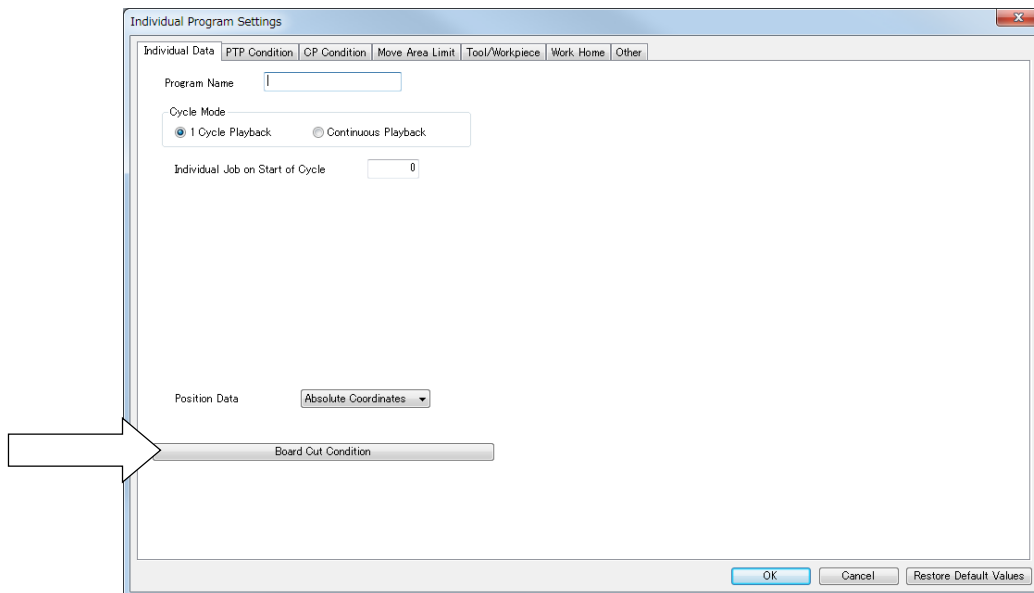
PC  [Program] > [Individual Program Settings] > [Individual Data] > [Board Cut Condition]

You can set the following values for the board cutting conditions:

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

NOTE: [Air Blow Wait Time] and [Air Blow Time] are valid only at Cut End Points when [Vacuum] is set to [OFF].

If you are using a PC, click [Board Cut Condition] from the Individual Program Settings dialog box.



The Board Cut Condition edit screen shown below appears.

Click the [Value] cell and enter the value you want.

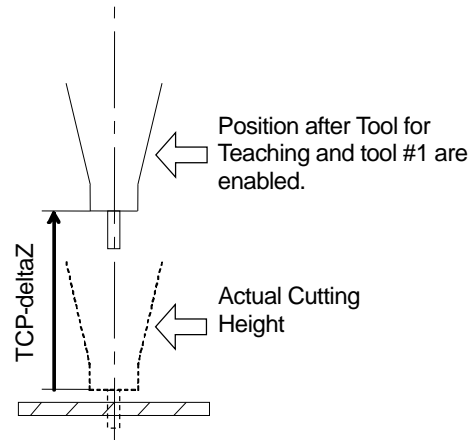
	Value	Unit
Start Wait Time	0.2	sec
Line Stop Time	0.2	sec
Air Blow Wait Time	0.5	sec
Air Blow Time	0.5	sec

6.8 Setting the Z Height for Point Teaching

Using the Tool for Teaching function, you can check the point position from a different Z axis height.

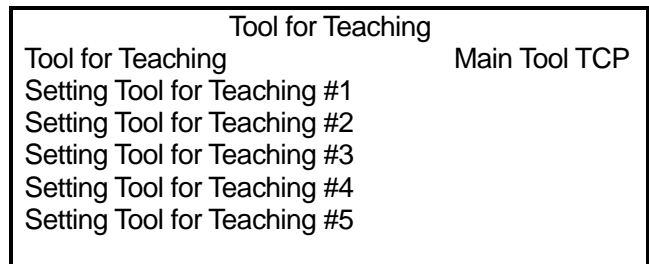
This allows you to teach without the router bit coming in contact with the workpiece.

Example: Setting the Z axis position 10 mm above the registered position.



This example explains how to use Tool for Teaching #1 to check the point position from a different Z axis height.

1. Press the **SHIFT** + **UTILITY** keys to display the Tool for Teaching settings screen.
(This screen can also be displayed if you press the **UTILITY** key, select Teaching Environment Setting and then select [Tool for Teaching])



Tool for Teaching Screen

Tool for Teaching Setting Items

UTILITY

[Teaching Environment Setting]

[Tool for Teaching]

[Tool for Teaching]

Invalid, Main Tool TCP, Camera TCP, ZeroTCP, Camera for Teaching,

Tool #1 Valid – Tool #5 Valid

[Setting Tool for Teaching #1]

...

[Setting Tool for Teaching #5]

2. Set [Tool for Teaching] to [Tool #1 Valid].

Tool for Teaching	
Invalid	
Camera TCP	
Main Tool TCP	
zeroTCP	
Camera for Teaching	
Tool #1 Valid	
Tool #2 Valid	
Tool #3 Valid	
Tool #4 Valid	
Tool #5 Valid	

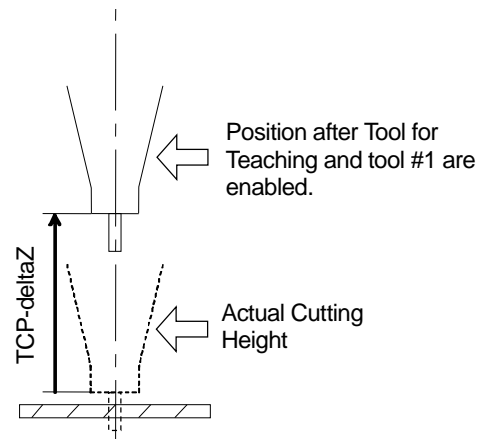
3. Set each item in the [Setting Tool for Teaching #1] to the following values:

- TCP-X, TCP-Y: 0 mm
- TCP-deltaZ: 10 mm

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

4. Keep pressing the **ESC** key until you reach the Teaching Mode base screen.

5. Press the **GO** key to move the axes 10 mm higher than the cutting operation and check the location of the axes.



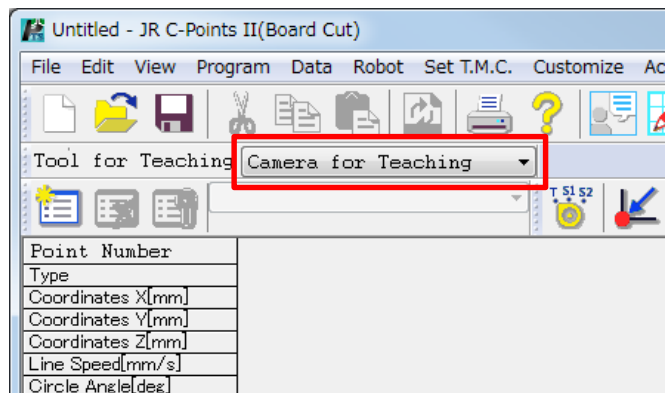
NOTE: After setting the [Setting Tool for Teaching], switch to [Tool #1 Valid] or [Main Tool TCP] in [Tool for Teaching] to check the point locations as necessary.

Except for test runs and point runs (P.EXEC), [Setting Tool for Teaching] is valid only in Teaching Mode.

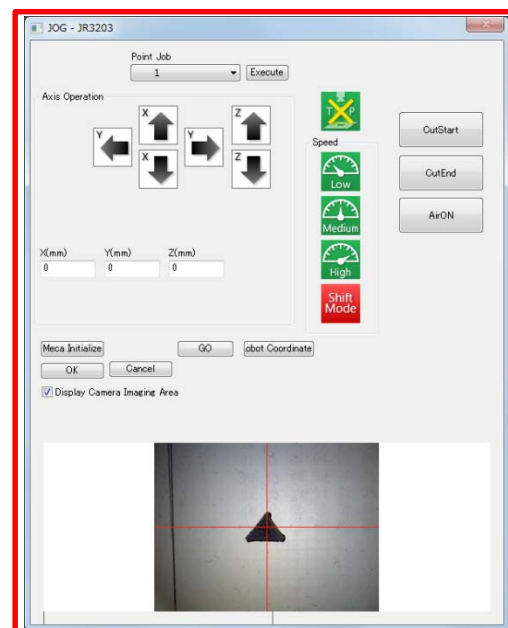
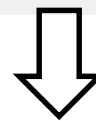
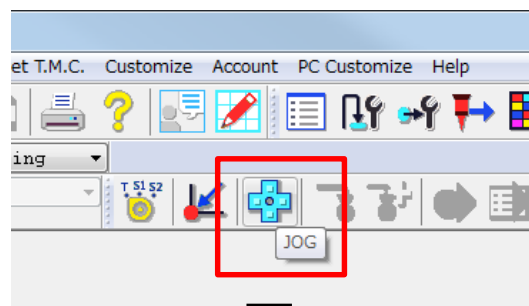
■ Setting the Teaching Height Using JR C-Points II (Board Cut)

Follow the procedure hereafter to set the teaching height.

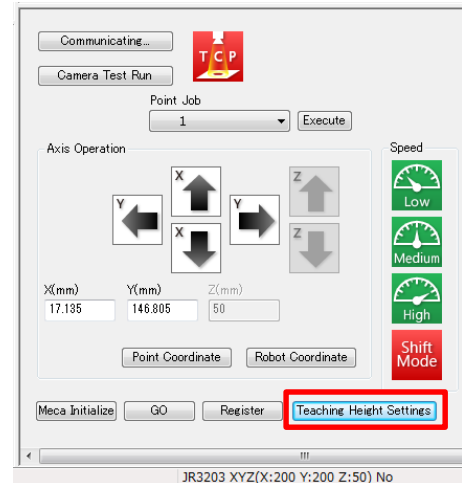
1. Select [Camera for Teaching] as the [Tool for Teaching].



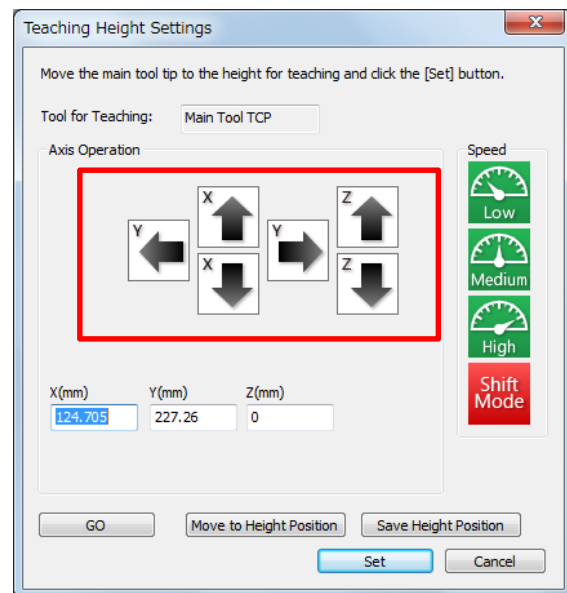
2. Click the JOG icon to display the JOG screen.



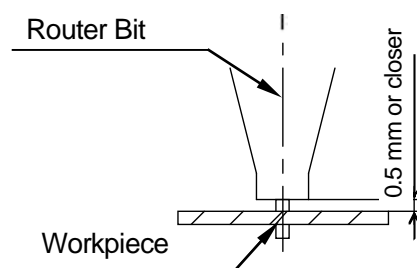
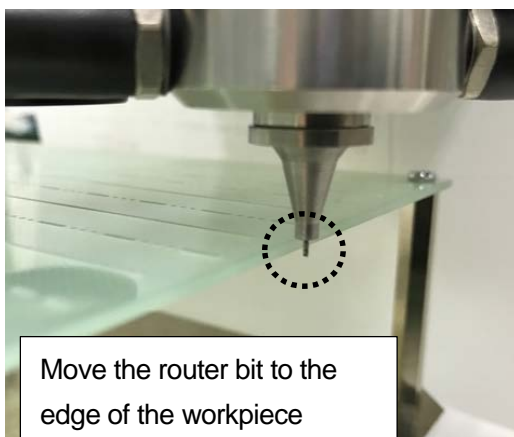
- Click the [Set Teaching Height] button to display the Set Teaching Height screen.



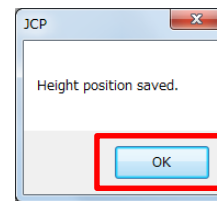
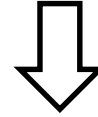
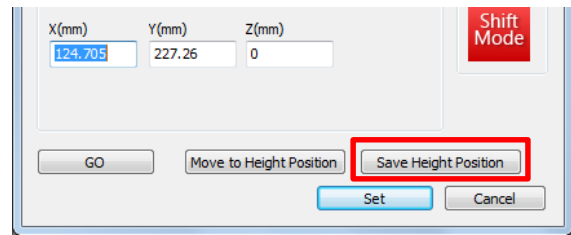
- Use the arrow buttons to align the router bit 0.5 mm or closer to the workpiece. The X and Y coordinates can be set freely as they have no relevance to this operation.



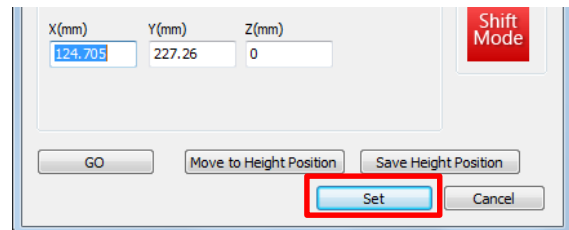
Move the router bit to the edge of the workpiece, as shown below, and set the router bit at the height where it would pierce the workpiece during cutting operations.



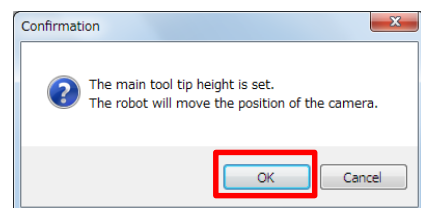
5. After finalizing the router bit height, click the [Save Height Position]. The height is saved and a confirmation pop-up appears. Click [OK].



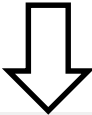
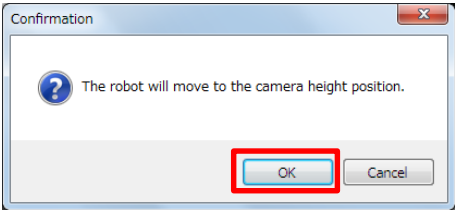
6. After all the settings are complete, click the [Set] button. A confirmation that the settings are complete is displayed.



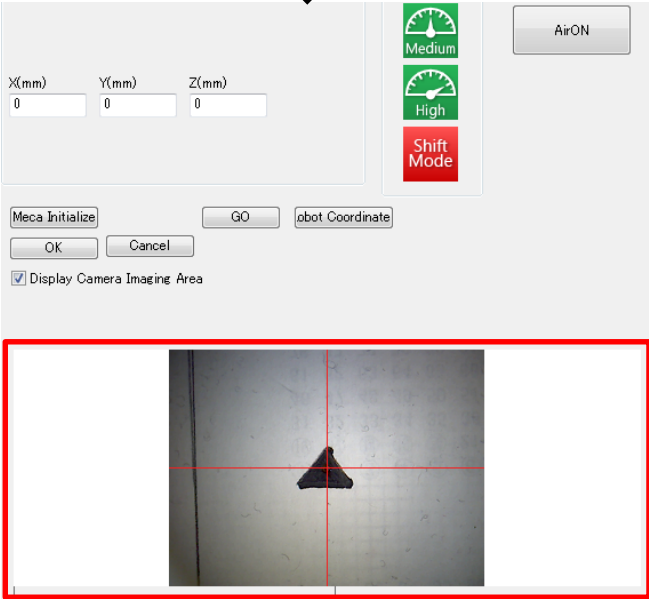
7. Click the [OK] button.



8. A confirmation that the robot will move to the camera height position appears. Click [OK] to move the camera (tool) to the set height coordinates.



Completing these settings allows you to teach while viewing camera imaging.



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

The spindle and vacuuming functions stay ON even after the last point is performed in a program point run. After finishing a program run, turn OFF the spindle and vacuuming functions by pressing the **0** key on the teaching pendant or clicking the **CutEnd** button in JR C-Points II (Board Cut).

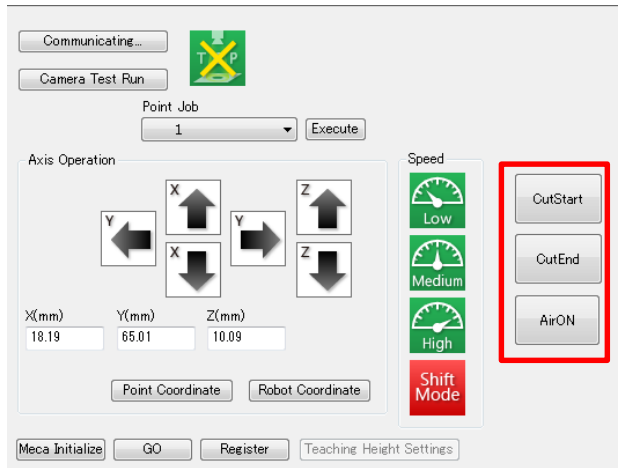
TP

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

Program 1		P2	
X+5	Y+60	Z+20	
Type	Cut Relay Point		
Line Speed	50mm/s		
S.MARK		E.MARK	J.EXEC P.EXEC

Point Setting Screen

- 0** Key Spindle OFF, Vacuum OFF, Air OFF
 Stops the spindle motor, vacuum, and air blowing.
 This is the same process used at the end of PCB cutting.
 Use this key to manually stop the spindle motor and air blowing when not cutting PCBs.
- 1** Key Spindle ON, Vacuum ON, Air OFF
 Starts the spindle motor and vacuum. This is the same process used before PCB cutting. Use this key to manually start PCB cutting preparation.
- 2** Key Spindle OFF, Vacuum OFF, Air ON
 Press this key to manually blow air when adjusting the air flow valve, etc.
 Press the **0** key to stop blowing air.



CutEnd Button Spindle OFF, Vacuum OFF, Air OFF
Stops the spindle motor, vacuum, and air blowing.
This is the same process used at the end of PCB cutting.
Use this button to manually stop the spindle motor and air blowing when not cutting PCBs.

CutStart Button Spindle ON, Vacuum ON, Air OFF
Starts the spindle motor and vacuum. This is the same process used before PCB cutting. Use this button to manually start PCB cutting preparation.

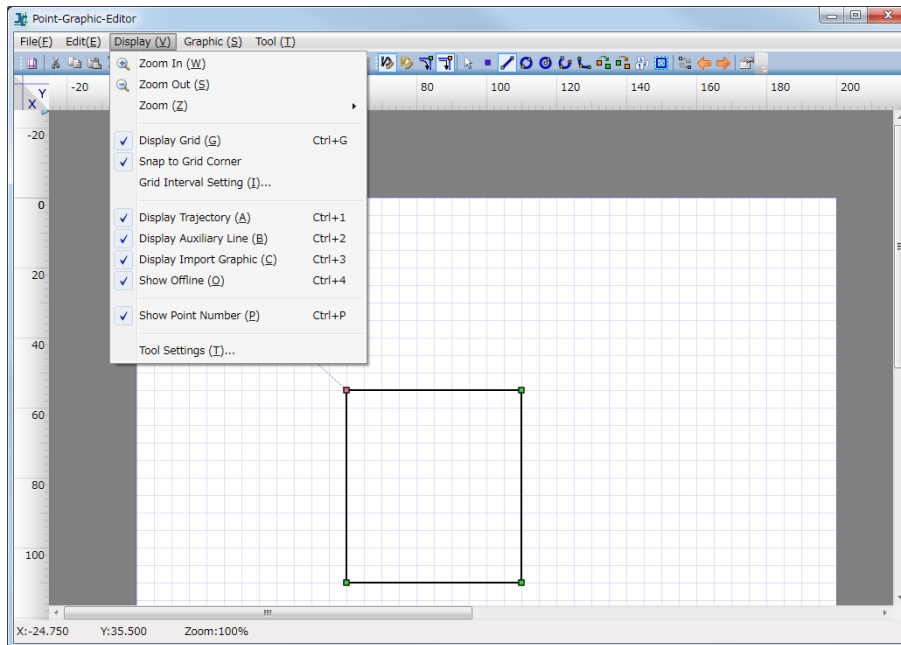
AirOn Button Spindle OFF, Vacuum OFF, Air ON
Click this button to manually blow air when adjusting the air flow valve, etc. Click the **CutEnd** button to stop blowing air.

6.10 Tool Offset Function in Point-Graphic-Editor with the PC Software

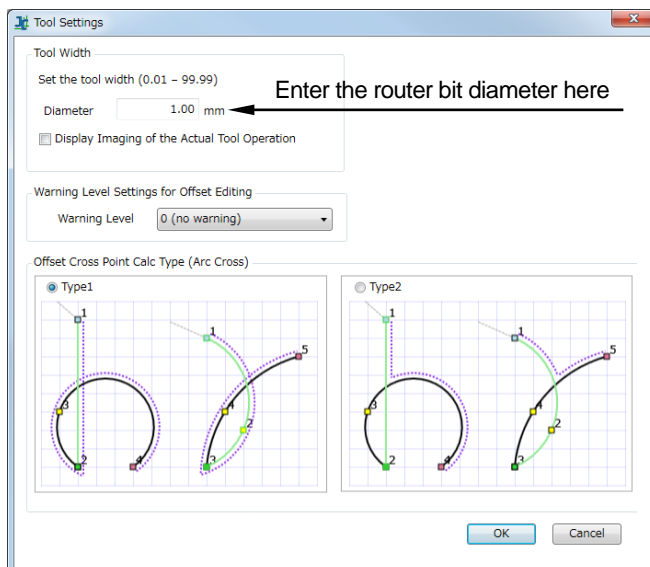
When editing point graphics, you can easily offset the tool radius on the point graphic editing screen by presetting the tool width in Point Graphic Editor. Set the router bit width as the tool width to display the actual cutting width and range of the tool. Offset the point positions as necessary.

■ Setting the Router Bit Width

Click [Display (V)] tab to open the dropdown list



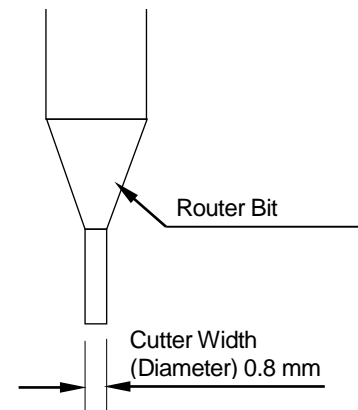
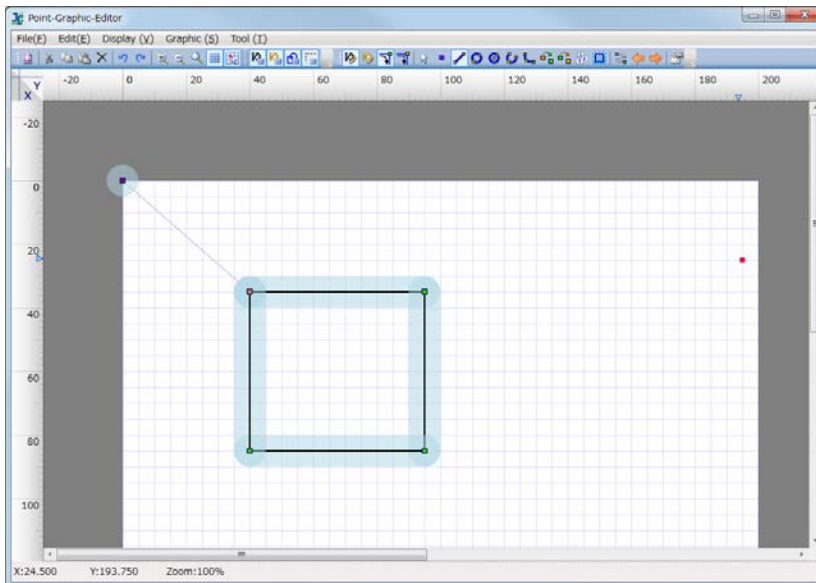
Click [Tool Settings] to open the Tool Settings dialog box and enter the router bit diameter into [Diameter].



Put a check in “Display Imaging of the Actual Tool Operation” to show the diameter (0.8 mm) of the cutter on the router bit and its path.

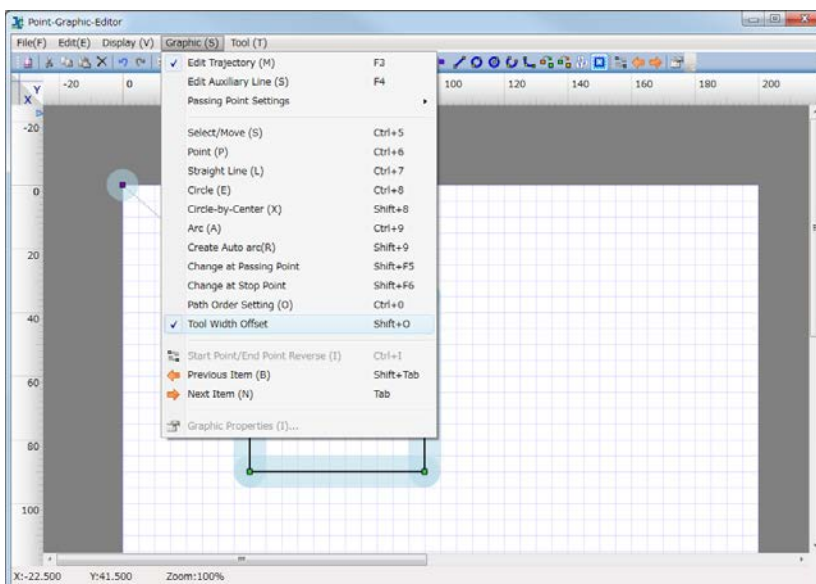
You can set the warning level using the [Warning Level Settings for Offset Editing] settings (set to “0 (no warning)” by default).

After the above settings are made, the tool path appears as shown below.

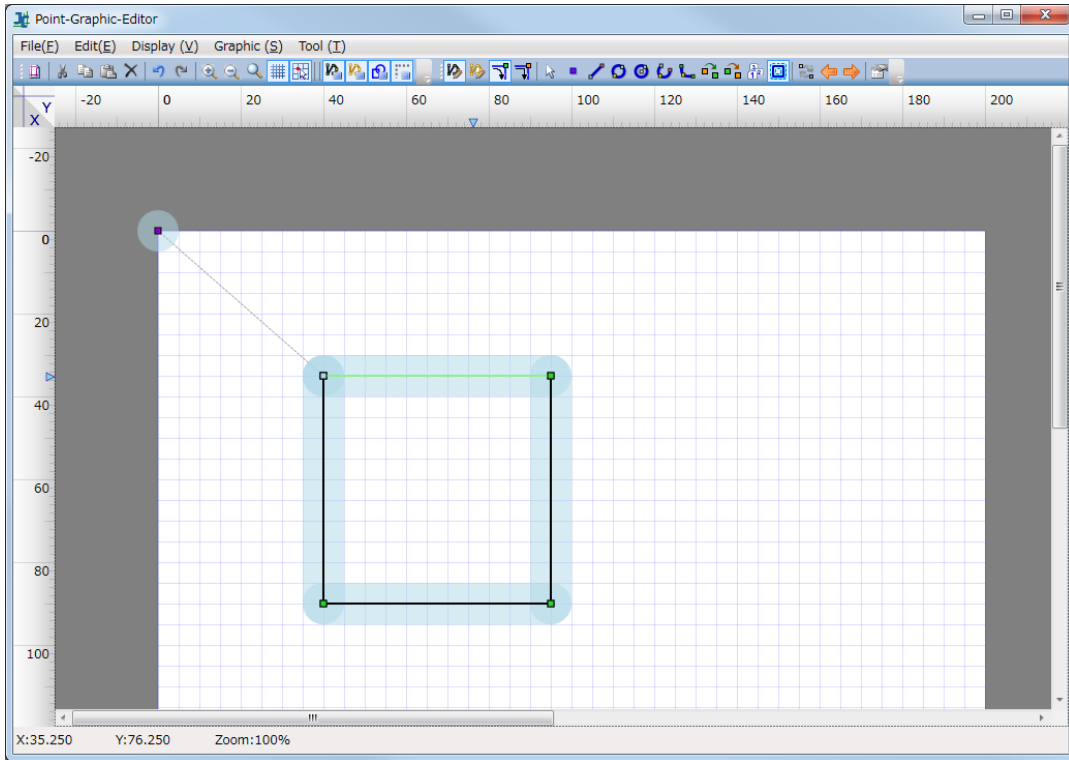


The black line indicates the center of the cutting path and the blue area indicates the gap cut with the router bit.

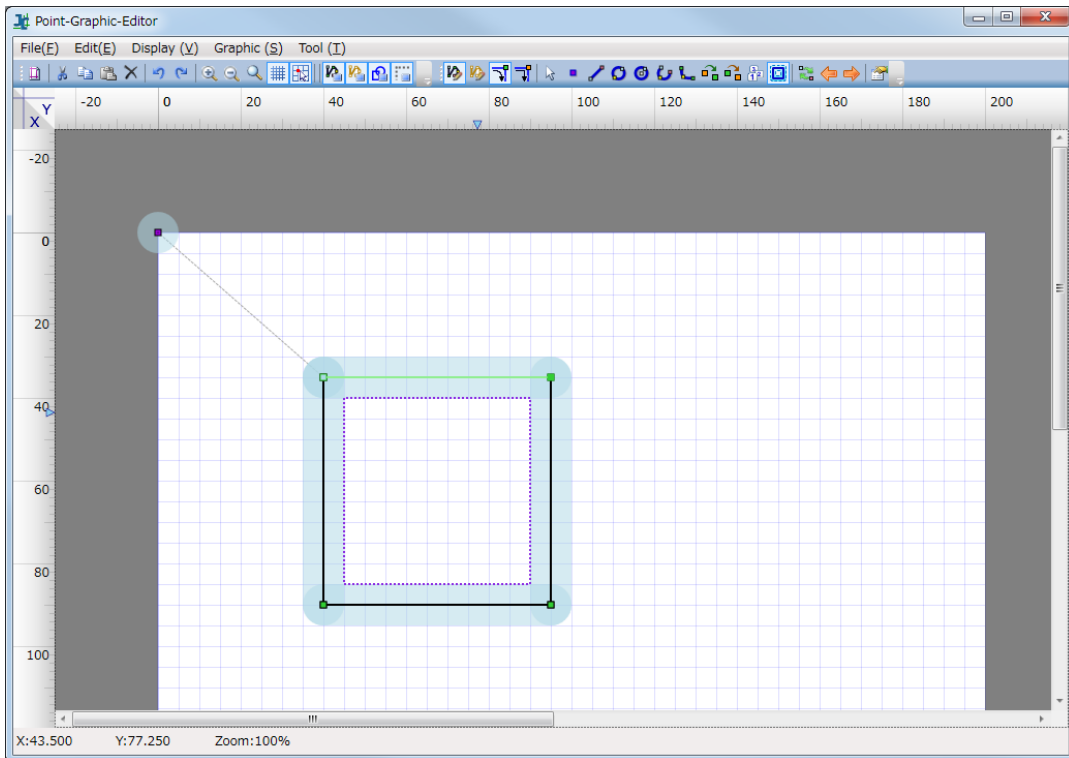
If you use the [Tool Width Offset] function, you can offset the position of the router bit outward or inward by a half width of the router bit. Select [Tool Width Offset] from [Graphics (S)] pull down menu.



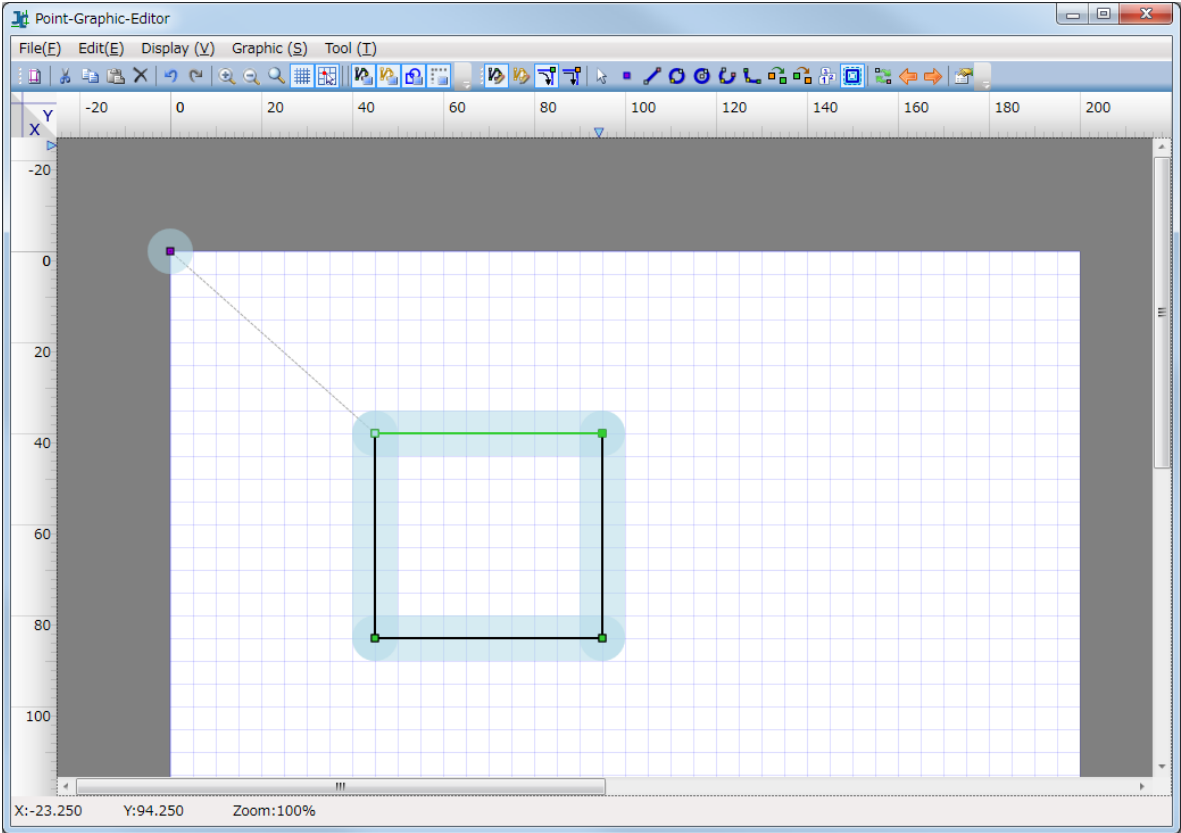
Select one side of the cutting path with the mouse pointer. The selected side of the cutting path turns green.



Drag the selected side of the cutting path inward or outward. A purple dotted line appears at the edge of the gap to show the cutting path after offset. The illustration below shows an example when dragging the cutting path inward.

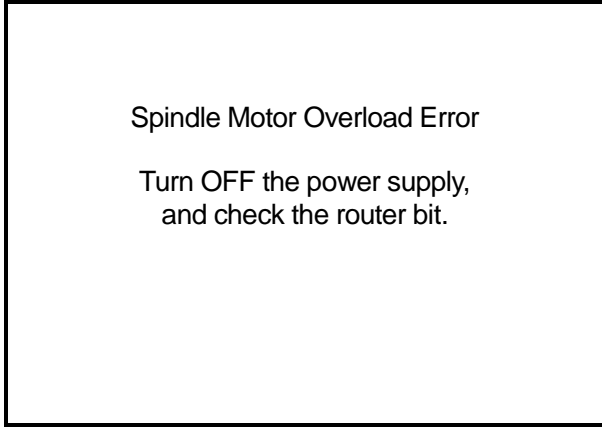


The black cutting path is offset to where the purple dotted line was when the mouse button is released. You can undo this operation by pressing CTRL + Z on the keyboard.



7. WHAT TO DO WHEN THERE IS A SPINDLE ERROR

As the router bit dulls, the current to the spindle motor increases. The indicator LEDs turn on one by one from Green, Yellow to Red as the current increases. If the red LED on the far right is on for 2 seconds, the Spindle Motor Overload Error message appears.



Spindle Motor Overload Error Message

If a spindle error is detected between a Cut Start Point and a Cut End Point, the robot stops immediately. The spindle motor, vacuum, and air blowing all stop, and the Spindle Motor Overload Error is displayed.

If this happens, turn OFF the robot and check the router bit. Note that a spindle error may occur if the router bit is not firmly secured in the collet chuck. Re-attach the router bit or replace as necessary.

NOTE: When a spindle error occurs, the message [Ur] and the error No. are displayed alternately on the program number display on the switchbox.

Error No.	TP Message	Handling
01	Spindle Motor Overload Error	This error occurs when there is an excessive load on the spindle motor causing it to overload. Turn OFF the robot and check the router bit. If this error frequently occurs when only the green LED indicator is ON, there is likely a problem with the spindle motor. Contact the office listed on the back of this manual or your local dealer.

If a spindle motor error occurs, you need to power cycle the robot. However, if you have created or modified any data or settings and you turn OFF the robot without saving, the changes made are lost. If a spindle error occurs before saving any changes, perform the procedure below, and then turn OFF the robot and check the router bit.

1. Press the emergency stop switch.
2. Disengage the emergency stop switch by turning it clockwise.
3. Mechanically initialize the robot. (F4 key)
4. Save the C&T data. (SAVE key)
5. Turn OFF the robot.

8. I/O FUNCTIONS

8.1 I/O-SYS Function Assignment

	Name	Function	Pin No.
Input	Ext sysIn1	Start / Free	1
	PCB sysIn2	Spindle Error	2
	sysIn3	Program Number Load / Free	3
	sysIn4	Program Number 1 / Free	4
	sysIn5	Program Number 2 / Free	5
	sysIn6	Program Number 4 / Free	6
	sysIn7	Program Number 8 / Free	7
	sysIn8	Program Number 16 / Free	8
	sysIn9	Program Number 32 / Free	9
	sysIn10	Program Number 64 / Free	10
	sysIn11	Last Work / Program Number 128 / Error Reset / Free	11
	sysIn12	Temporary Stop / Program Number 256 / Speed Limit / Free	12
	sysIn13	Reset Replace Bit / Program Number 512 / Free	13
	sysIn14	Free / (A) Start Inhibition / (A) Stop - Start Inhibition / (A) Software Interlock / (A) Urgent Stop / (B) Start Inhibition / (B) Stop - Start Inhibition / (B) Software Interlock / (B) Urgent Stop	14
	sysIn15	Free / Last Work / Error Reset	15
	sysIn16	Free / Temporary Stop	16
Output	Ext sysOut1	Ready for Start / Free	17
	sysOut2	Robot Stopped / Free	18
	sysOut3	Program Number ACK / Free	19
	sysOut4	Program Number Error / Free	20
	sysOut5	Running / Free	21
	sysOut6	Error / Free	22
	sysOut7	Emergency Stop / Free	23
	sysOut8	Position Error / Free	24
	PCB sysOut9	Spindle	25
	PCB sysOut10	Vacuum	26
	PCB sysOut11	Air Blow	27
	PCB sysOut12	Finish Initialize (connect to the unit box power supply relay)	28
	sysOut13	Replace Bit / Free	29
	sysOut14	Free	30
	sysOut15	Free	31
	sysOut16	Free	32
Other	-	Not in use	33
	COM+	DC24V	34
	COM-	GND	35
	COM-	GND	36
	COM-	GND	37

Ext: Functions only in External Run Mode.

PCB: Specialized signals for depaneling robots. Do not change the function assignments.

8.1.1 Input

- Start (#sysIn1)

Turn ON this signal when you want to start or restart a program in External Run Mode. In addition, this signal is also used for moving to the work home position coordinates.

This signal is enabled when Ready for Start (#sysOut1) is ON.

When in External Run Mode and starts are not prohibited by the Start Inhibition (#sysIn14) signal, the Start (#sysIn1) signal starts or restarts running programs with the robot under any of the following conditions when the I/O-S input is ON:

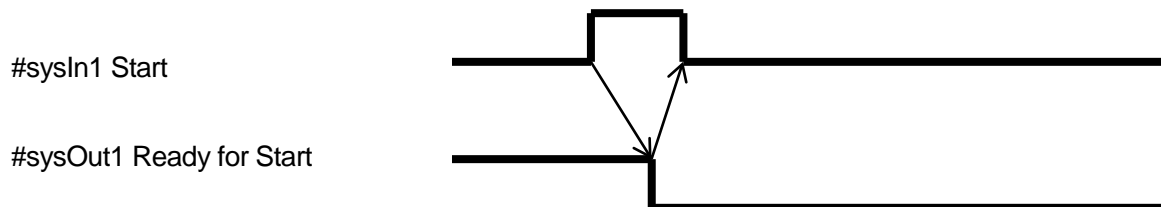
1. Waiting for program start at the work home position.
2. Waiting for restart after a temporary stop.
3. Waiting for restart after stopping at the wait start stop point.
4. Waiting for start according to a point job *waitStart* command.

A Start (#sysIn1) signal with a pulse of 20msec or less is invalid due to noise elimination.

A pulse width of 30msec or wider is useable, however, rather than using pulse width to acknowledge the signal, we recommend using the OFF edge of the Ready for Start (#sysIn1) signal as an acknowledgment signal (ACK signal).

When waiting to start as described above, the Ready for Start signal (#sysOut1) is ON.

The Ready for Start (#sysOut1) turns OFF when the Start (#sysIn1) turns ON.



- Spindle Error (#sysIn2)

This signal is ON when the robot is operating normally and turns OFF when a current overload is detected. If a spindle error is detected between a Cut Start Point and a Cut End Point, the robot stops immediately and the message "Spindle Motor Overload Error" is displayed on the LCD.

NOTE: This is a specialized signal for depaneling models. Do not change this function assignment.

- Program Number Load (#sysIn3)

This signal directs the loading of program numbers. When this signal goes ON, Program Number (#sysIn 4 – 10) is loaded. This function is enabled when [Administration Settings Mode] > [Change Program Number] > [I/O-SYS] is set to [Valid] and the Teaching Mode menu [All Program Common Settings] > [I/O Settings] > [Program Number Switching Method] is set to [LOAD/ACK Handshake].
- Program Number 1 – 512 (#sysIn4 – #sysIn13) (I/O-SYS)

You can specify program numbers by turning ON this signal.

Example: If you want to specify program number [67]:

$$67 = 64 (\#sysIn10) + 2 (\#sysIn5) + 1 (\#sysIn4) = \text{Turn ON signals } \#sysIn10, \#sysIn5 \text{ and } \#sysIn4.$$

This function is enabled when [Administration Settings Mode] > [Change Program Number] > [I/O-SYS] is set to [Valid]. If the Teaching Mode menu [All Program Common Settings] > [I/O Settings] > [Program Number Switching Method] is set to [Load at Start (I/O-SYS)], start the program after specifying the program number with this signal.

If [Program Number Reading Format] is set to [Binary Code], specify the program number in binary code to this register.

If [Program Number Reading Format] is set to [BCD (Binary Coded Decimal)], specify the program number in BCD to this register. For further information, refer to “8.2.2 Program Number Reading Format” in the operation manual *Setup*.
- Last Work (#sysIn11, #sysIn15)

When the Teaching Mode menu [Individual Program Settings] > [Cycle Mode] is set to [Continuous Playback], after finishing the last point, the robot moves to point 01 and repeats the operation. To end this repeated operation, end the program using a point job or turn this signal ON. This function is only valid at the point when the last point is finished (before moving). You cannot use this signal in the middle of a program.
- Error Reset (#sysIn11, #sysIn15)

If an error occurs when the robot is running programs, turn this signal ON to reset the error. The program (run) is then terminated on the spot.

In addition, the Error (#sysOut6) signal turns OFF when this signal is turned ON, so you can use Error (#sysOut6) as an ACK signal for this signal.

Another way to use this signal is when the robot is holding or the Ready for Start (#sysOut1) signal is output and the robot is waiting to start, you can turn ON this signal to reset the program's execution and terminate the program on the spot.

Program termination via this signal is enabled in the following situations:

 1. Waiting for restart after an error occurs.
 2. Waiting for restart after a temporary stop.
 3. Waiting for restart after stopping at the wait start stop point.
 4. Waiting for start according to a point job *waitStart* command.

- Program Number 128 (#sysIn11)
When ON, this signal enables you to specify program numbers 128 and above.
- Program Number 256 (#sysIn12)
When ON, this signal enables you to specify program numbers 256 and above.
- Temporary Stop (#sysIn12, 16)
You can temporarily stop running programs by turning ON this signal. However, you cannot stop a CP movement while it is running. You can only temporarily stop at PTP points.
Also, when this signal is ON, start is inhibited.
- Speed Limit (#sys12)
You can limit the speed of the robot to 250 mm/s (safe speed) when in External Run Mode or Switch Run Mode by turning this signal ON.
- Reset Replace Bit (#sysIn13)
When the Replace Bit (#sysOut13) signal is ON, turn ON the Reset Replace Bit signal for 1 or more seconds to turn OFF the Replace Bit signal output.
- Free (#sysIn14 – 16)
The default for the #sysIn14 – 16 signals is Free. These signals are useable as free signals unless their functions are changed in [I/O Function Assignment].
- Start Inhibition (#sysIn14)
This signal becomes a function to inhibit starts when Start Inhibition (#sysIn14) is set in [I/O-SYS Function Assignment]. You can select either type A or type B for this signal.
“(A) Start Inhibition” (#sysIn14) works when it is ON (positive logic), and “(B) Start Inhibition” (#sysIn14) works when it is OFF (negative logic). For example, starts are inhibited if “(A) Start Inhibition” (#sysIn14) is ON and the Robot Stopped (#sysOut2) signal is ON (when the robot is stopped). Even if you try to start the robot, it will not move. When the Robot Stopped (#sysOut2) signal is OFF (when the robot is moving), this signal is invalid.

- Stop – Start Inhibition (#sysIn14)

This signal becomes a function to temporarily stop operation or inhibit start when Stop/Start Inhibition (#sysIn14) is set in [I/O-SYS Function Assignment].

You can select either type A or type B for this signal.

“(A) Stop - Start Inhibition” (#sysIn14) works when it is ON (positive logic), and “(B) Stop - Start Inhibition” (#sysIn14) works when it is OFF (negative logic).

For example, start is inhibited if “(A) Stop - Start Inhibition” (#sysIn14) is ON and the Robot Stopped (#sysOut2) signal is ON (the robot is stopped). Even if you try to start the robot, it will not move.

If you turn this signal ON when the Robot Stopped (#sysOut2) signal is OFF (when the robot is moving), the robot completes its current PTP movement and then holds.

To restart, input a start signal after turning OFF this signal.

- Software Interlock (#sysIn14)

If Software Interlock (#sysIn14) is set in [I/O-SYS Function Assignment], this becomes a function to inhibit starts and make urgent stops during operation. You can select either type A or type B for this signal. “(A) Software Interlock” (#sysIn14) works when it is ON (positive logic), and “(B) Software Interlock” (#sysIn14) works when it is OFF (negative logic). For example, starts are inhibited if “(A) Software Interlock” (#sysIn14) is ON and the Robot Stopped (#sysOut2) signal is ON (the robot is stopped). Even if you try to start the robot, it will not move.

If this signal is turned ON when the Robot Stopped (#sysOut2) signal is OFF (the robot is moving), the robot makes an urgent stop.

- Urgent Stop (#sysIn14)

When Urgent Stop (#sysIn14) is set in [I/O-SYS Function Assignment], this becomes a function for making urgent stops. You can select either type A or type B for this signal.

“(A) Urgent Stop” (#sysIn14) works when it is ON (positive logic), and “(B) Urgent Stop” (#sysIn14) works when it is OFF (negative logic).

For example, the robot makes an urgent stop if “(A) Urgent Stop” (#sysIn14) is ON in Run Mode.

8.1.2 Output

- Ready for Start (#sysOut1)

When the Start (#sysIn1) signal is enabled, this signal comes ON. This occurs in the following situations:

1. Waiting for mechanical initialization after turning the power ON.
2. Waiting for mechanical initialization after releasing an emergency stop.
3. Waiting for program start at the work home position.
4. Waiting for restart after a temporary stop.
5. Waiting for restart after stopping at the wait start stop point.
6. Waiting for start according to a point job *waitStart* command.

If the Running (#sysOut5) signal is OFF, the robot is under conditions 1, 2 or 3.

Also, when the Ready for Start (#sysOut1) signal is ON, the Robot Stopped (#sysOut2) signal is always also ON. However, this is not so for the reverse. If the robot is stopped because it is waiting for a signal, then the Robot Stopped (#sysOut2) signal is ON, but the Ready for Start (#sysOut1) signal will not come ON.

- Robot Stopped (#sysOut2)

When the robot is stopped this signal is ON, when the robot is moving, it is OFF. If you turn the “(A) Software Interlock” (#sysIn14) signal ON when this signal is ON (the robot is stopped), start is inhibited. Even if you try to start the robot, it will not move. If you turn the “(A) Software Interlock” (#sysIn14) signal ON when this signal is OFF (the robot is moving), it will make an urgent stop.

- Program Number ACK (#sysOut3)

This is a response signal for Program Number Load (#sysIn3).

When you turn Program Number Load (#sysIn3) ON, this signal comes ON after Program Number (#sysIn4 – #sysIn13) is loaded.

If Program Number Load (#sysIn3) goes OFF, this signal also goes OFF.

- Program Number Error (#sysOut4)

This signal goes ON when you specify an unregistered program number in Switch Run/External Run Mode.

- Running (#sysOut5)

When you start to run a program this signal goes ON. When the program finishes it goes OFF.

- Error (#sysOut6)

This signal comes ON when an error occurs.

- **Emergency Stop (#sysOut7)**
This signal comes ON when an “Emergency Stop Error” occurs (due to the emergency stop switch being pushed, etc.). When this signal is ON, the Error (#sysOut6) signal comes ON at the same time.
- **Position Error (#sysOut8)**
If the Teaching Mode menu [All Program Common Settings] > [Other Parameters] > [Position Error Check] is set to [Valid], the position sensor checks the position error just before the robot completes a run (before returning to the work home position). This signal turns ON if a position error is detected.
- **Spindle (#sysOut9)**
This is a signal to start rotating the spindle motor. Turn ON this signal to start rotating the spindle motor and turn it OFF to stop.
NOTE: This is a specialized signal for depaneling models. Do not change this function assignment.
- **Vacuum (#sysOut10)**
This is a signal to start vacuuming. Turn ON this signal to start vacuuming (suction).
Turn OFF this signal to stop vacuuming.
NOTE: This is a specialized signal for depaneling models. Do not change this function assignment.
- **Air Blow (#sysOut11)**
This is a signal to start blowing air. Turn ON this signal to start blowing air. Turn OFF this signal to stop blowing air.
NOTE: This is a specialized signal for depaneling models. Do not change this function assignment.
- **Free (#sys14 – 16)**
The default for the #sysOut14 – 16 signals is Free. These signals are useable as free signals unless their functions are changed in [I/O Function Assignment].
- **Finish Initialize (#sysOut12)**
This signal comes ON when initialization is complete. This signal is always ON unless you need to perform mechanical initialization due to an emergency stop, etc.
For depaneling models, this signal is connected to the power supply relay on the unit box. Accordingly, when this signal comes ON, the unit box turns ON. When this signal is turned OFF, the unit box is also turned OFF.
NOTE: This is a specialized signal for depaneling models. Do not change this function assignment.

- Replace Bit (#sysOut13)

This signal comes ON and a message is displayed on the teaching pendant when the router bit is due for replacement. You can reset this signal by pressing the Replace Bit switch on the switchbox for 3 seconds after replacing the router bit. You can also input the Reset Replace Bit (#sysIn13) signal to reset this signal.

8.1.3 Other

- COM+ (DC24V)

If I/O-SYS is set to use an external power supply, connect the COM+ pin to the plus pole of the external power supply (DC24V).

If I/O-SYS is using an internal power supply, DC24V (+) is output.



Caution

When I/O-SYS is set to [Internal], do not connect the robot to an external power supply. Doing so causes unit breakdown.

- COM- (GND)

If I/O-SYS is set to use an external power supply, connect the COM- pin to the external power supply grounding.

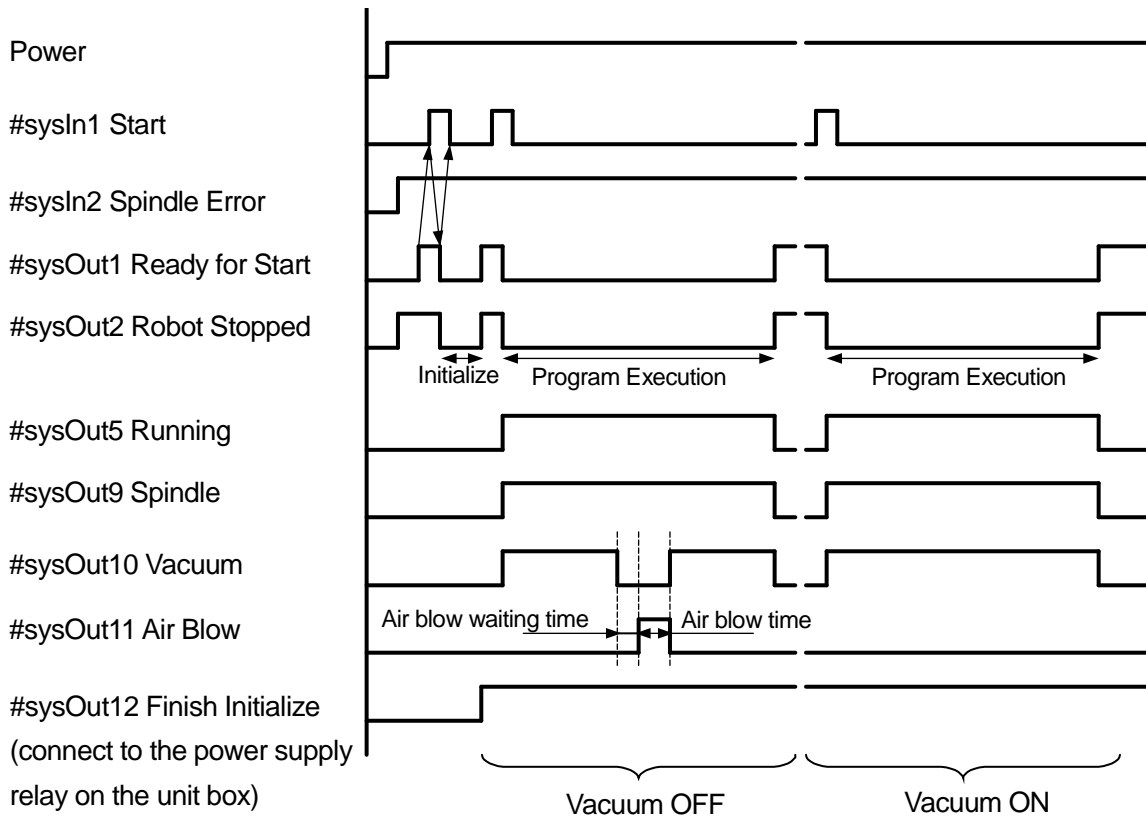
If I/O-SYS is using an internal supply, use the pin as a common grounding.

8.2 I/O-1 Function Assignment

	Name	Function	Pin No.	Insulator Color	Spiral Marking
Input	genIn1	Free	1	Blue	
	genIn2	Free	2	Orange	
	genIn3	Free	3	Green	
	genIn4	Free	4	Brown	
	genIn5	Free	5	Gray	
	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	Gray	White
genOut5	Free	17	Red	White	
genOut6	Free	18	Black	White	
genOut7	Free	19	Yellow	Black	
genOut8	Free	20	Pink	Black	
Other	COM+	DC 24 V	21	Purple	White
	COM+	DC 24 V	22	White	Blue
	COM-	GND	23	Blue	Red
	COM-	GND	24	Orange	White

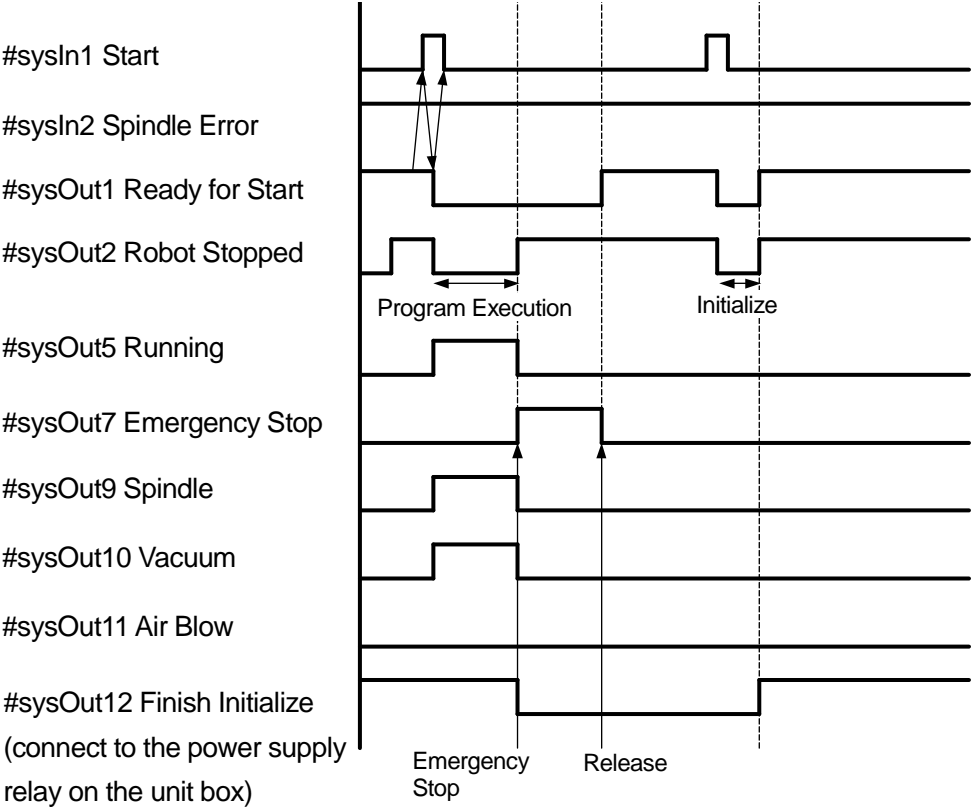
9. TIMING CHARTS

9.1 PCB Cutting



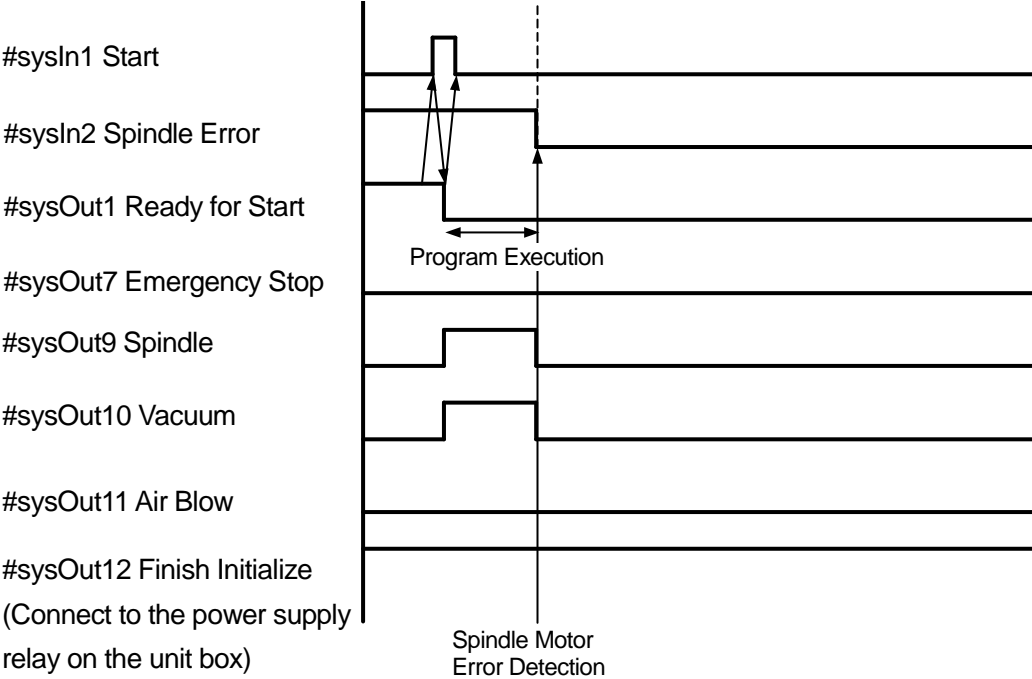
NOTE: This chart shows an example when running a program that uses the PCB cutting point types Cut Start Point – Cut End Point.

9.2 Emergency Stop



NOTE: This chart shows an example when running a program that uses the PCB cutting point types Cut Start Point – Cut End Point.

9.3 Spindle Error



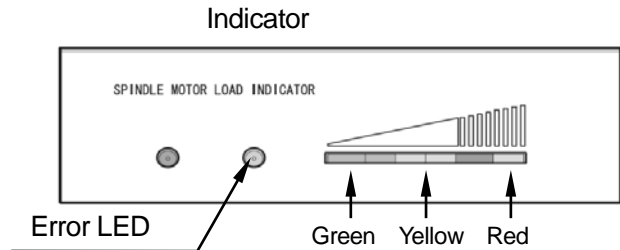
NOTE: This chart shows an example when running a program that uses the PCB cutting point types Cut Start Point – Cut End Point.

10. MAINTENANCE

■ Indicator Information

The LEDs on the indicator indicate the amount of electrical current supplied to the spindle motor.

If the router bit is blunt, the current to the spindle motor increases. The LEDs light up Green > Yellow > Red according to the amount of current received by the spindle motor.



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

Yellow LED: Either the cutter is blunt or feed speed is too high for PCB cutting. Replace the cutter or reduce the feed speed.

Red LED: If the far right red LED is on for 2 seconds, a spindle error occurs and the robot stops. Refer to “10.1 Replacing the Router Bit (Cutter)” and replace the router bit.

NOTE: If a spindle motor overload frequently occurs when only the green LED indicator is ON, there is likely a problem with the spindle motor.



Caution

- After the robot stops due to an error, be sure to raise the Z axis before power cycling the robot. Each robot axis moves a small amount when the power is turned ON again. Also, when the robot is turned OFF, the PCB clamp signal is cut, so the PCB is no longer fixed in place. For this reason, raise the Z axis before turning ON the robot, otherwise the PCB may be damaged.
- If the yellow or red LEDs light up even after replacing the router bit, the feed speed is too high or some of the spindle motor parts are worn. If the LEDs still light up after reducing the speed, you need to overhaul the spindle motor. Contact the office listed on the back of this manual or your local dealer.

Attention

The error LED lights up momentarily when the power is turned ON. This is normal.

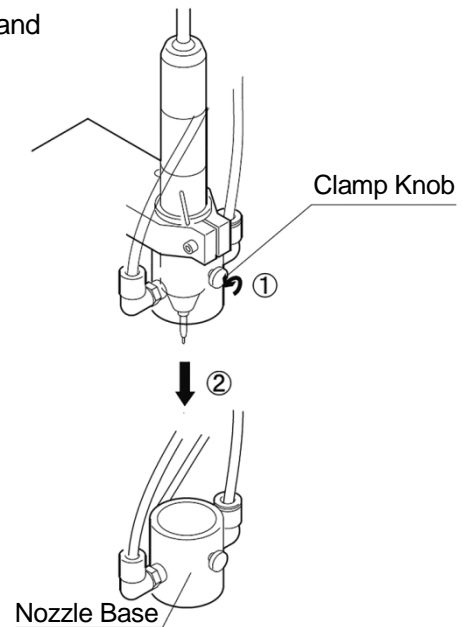
When the spindle motor starts, all LEDs light up momentarily.

Replacement Parts List

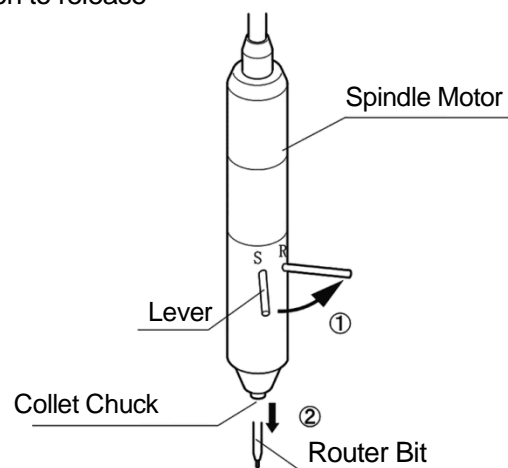
Name		Q'ty	Number
Router bit		1 (10pc set)	996445005
Vacuum nozzle		1	996091002
Filter set	Dust filter	3	996667005
	Cable ties	3	
	Ejector	1	
Spindle motor JR3203ERT, JR3303ERT, JR3403ERT		1	996516008
JR3503ERT, JR3603ERT		1	996516101
Nozzle base bulkhead (protector)		1	996111009

10.1 Replacing the Router Bit (Cutter)

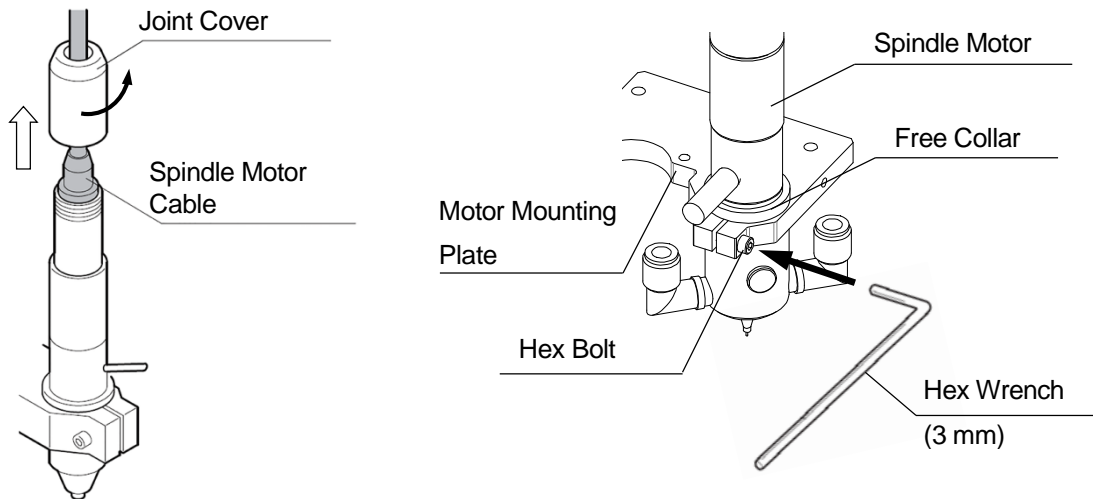
1. Turn OFF the robot and then unplug the power cable from the outlet.
2. Loosen the clamp knob, pull the nozzle base straight down and remove the router bit from the spindle motor. Be careful not to damage the router bit.



3. Turn the lever on the spindle motor to the R position to release the collet chuck, and then pull out the router bit.



4. Loosen the spindle motor joint cover.
5. Remove the joint cover and unplug the spindle motor cable.
6. Use a 3mm hex key to loosen the hex bolts on the motor mounting plate, and remove the spindle motor. Leave the free collar on top of the mounting plate. Also note that the free collar is not secured, so take care not to lose it.

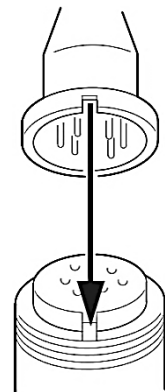


7. Refer to “10.4 Replacing the Collet Chuck” and remove the collet chuck.
8. Clean the area of insertion for the collet chuck as well as the removed collet chuck itself. The collet chuck can be difficult to tighten on, especially if the slit on the collet chuck is filled with dust etc., and can cause the router bit to fall off. Clean the collet chuck whenever you replace the router bit.
9. After cleaning, check that the collet chuck slit is not filled with dust and reattach the collet chuck to its original position following the procedure used to remove it in reverse.
10. Secure the spindle motor by tightening the hex bolt with a 3mm hex key at a 0.8 Nm (8 kgfcm) tightening torque.

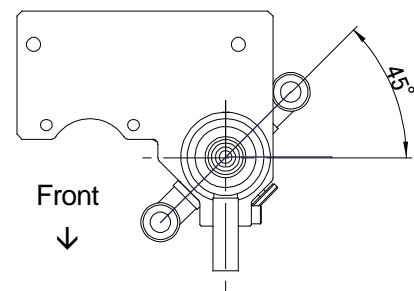
11. Line up the notches and connect the cable as shown in the diagram to the right.

12. Reattach the joint cover to its original position.

13. Insert the new router bit into the collet chuck as far as it will go and then turn the lever back to the S position to secure it. When inserting the router bit, make sure that no dust, etc., gets inside.



14. Reattach the nozzle base to its original position, and then tighten the clamp knob. Make sure that the angle of the nozzle base is 45 degrees to the robot as shown. Take care not to damage the router bit.



Caution

- The router bit is secured with a three-toothed collet chuck. Check that the chuck is free of dust and swarf before inserting the router bit. Clean the collet chuck regularly. A dirty or loose chuck can cause the cutter to fall, resulting in injury or damage to the robot.
- Firmly push the nozzle base all the way up. If the nozzle is loose, vacuum efficiency may be reduced resulting in airborne dust and swarf.
Dust and swarf may damage the workpiece. Inhalation of dust and swarf can be harmful to your health.



Caution

- Check the chuck casing has not stretched and fits securely to the head unit of the spindle motor. The chuck casing used to secure the collet chuck may stretch from prolonged use of the spindle motor. If this happens, the spindle motor needs servicing. A loose chuck can cause the cutter to fall, resulting in injury or damage to the robot.
- Always make sure to turn the spindle motor lever to the S (locking) position before running the robot. Running the robot without locking the spindle motor can cause the cutter to fall, resulting in injury or damage to the robot.

10.1.1 When to Replace the Router Bit (Cutter)

The robot is equipped with a function to notify when the router bit is due for replacement.


The [Router Bit Usage] and [Time Until Bit Replacement] is displayed on the teaching pendant screen while in Run Mode. The router bit replacement period can be set at your discretion. The robot then performs the following to notify you when the robot run time exceeds this period:

1. Displays a notification on the teaching pendant LCD. (Run Mode only)
2. Turns ON the Replace Bit switch LED on the switchbox.
3. Turns ON the Replace Bit (#sysIn13) signal.

Reset the notification by pressing the Replace Bit switch on the switchbox for 3 seconds after replacing the router bit.

■ Setting the Time Until Bit Replacement

You can set the router bit replacement time using the teaching pendant or the PC software JR C-Points II (Board Cut). The replacement time can be set from 0 to 999 hours. If you set this to 0, this function is disabled and the [Router Bit Usage] and [Time Until Bit Replacement] notifications are not be displayed.

TP  MENU > Board Cut Tool Setting > Time Until Bit Replacement

PC  Data > Board Cut Tool Setting > Router Replacement Time

10.2 Cleaning and Replacing the Vacuum Nozzle



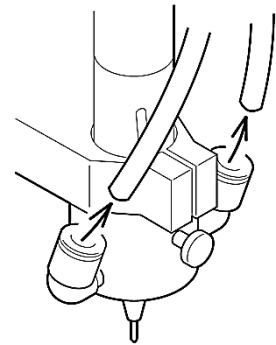
Caution

Take care not to damage the router bit when attaching or removing the vacuum nozzle. A broken router bit can cause injury and breakdown.

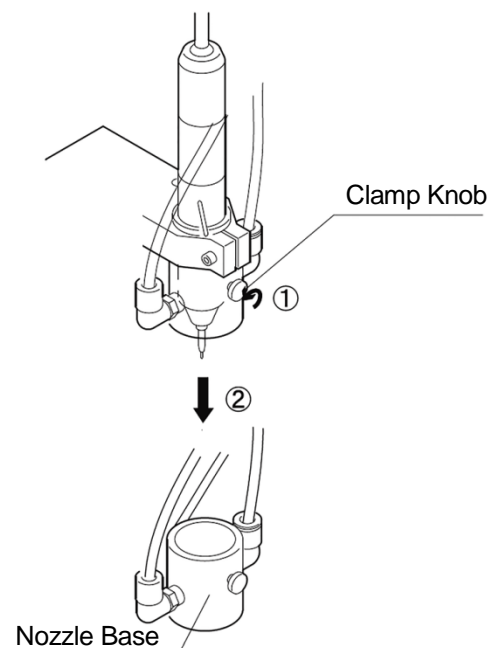
With long term use, the vacuum nozzle clogs up, reducing dust collection efficiency. Make sure to clean the vacuum nozzle regularly.

If the router bit breaks, it may cut into the vacuum nozzle and damage it. If this happens, replace the vacuum nozzle with the spare one included with the robot.

1. Turn OFF the robot and then unplug the power cable from the outlet.
2. Remove the air tubes from the nozzle base.

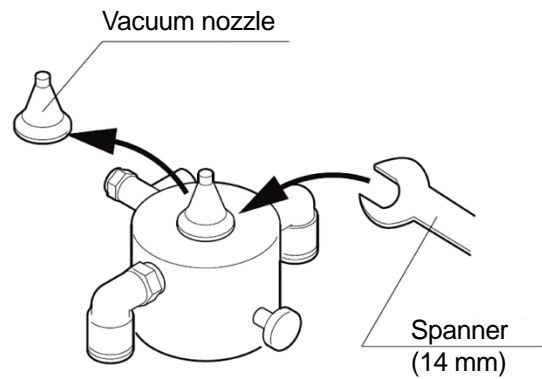


3. Loosen the clamp knob and remove the nozzle base.



- Loosen the vacuum nozzle using a 14 mm spanner, and remove it from the nozzle base.

NOTE: If the vacuum nozzle is damaged, replace it with the spare nozzle included with the robot.

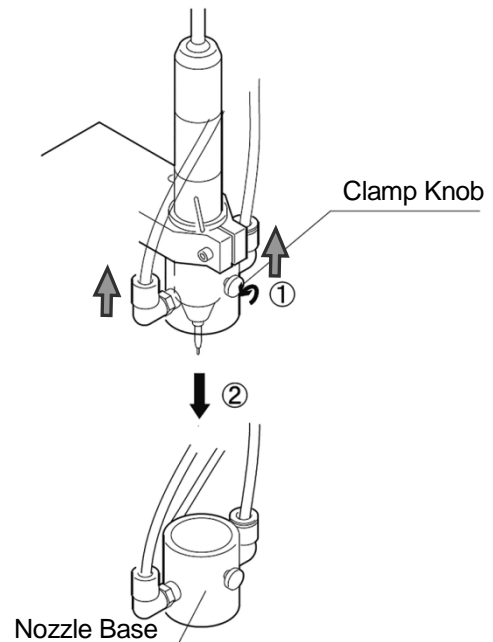


- Use a long, thin stick (skewer, etc.,) to remove swarf stuck in the nozzle.
- Screw the vacuum nozzle into the nozzle base, and then tighten it with a 14 mm spanner.



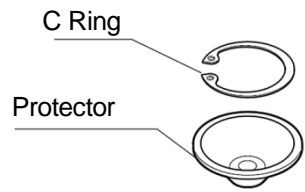
10.3 Replacing the Nozzle Base Bulkhead (Protector)

- Turn OFF the robot and then unplug the power cable from the outlet.
- Disconnect the air tubes from the nozzle base, and then loosen the clamp knob to remove the nozzle base.

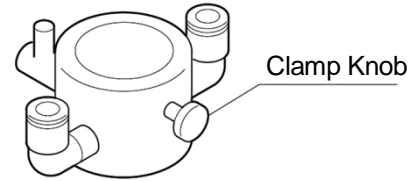


3. Remove the C ring using a specialized tool (as recommended below).

Recommended Tool: Snap Ring Pliers
 Product No.: SOCP-130
 (manufactured by KTC)



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

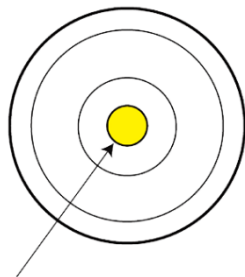


- Replace the bulkhead before it is worn as it affects the service life of the spindle motor.
- Regularly check the wear of the bulkhead (protector). Our highly efficient dust collection system blasts swarf and dust through the bulkhead, which causes it to gradually wear out.

Attention

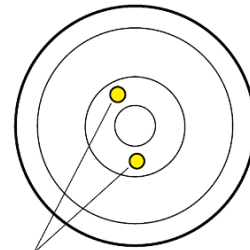
Worn bulkheads, as illustrated below, may decrease the dust collection efficiency and can damage the spindle motor. Bulkhead wear greatly depends on cutting conditions, PCB materials, and the rate of work; however, we recommend replacing the bulkhead once every 6 – 12 months.

■ Enlarged Inner Diameter



Larger than \varnothing 3.7 mm
 (Nominal inner diameter: \varnothing 3.4 mm)

■ Holes

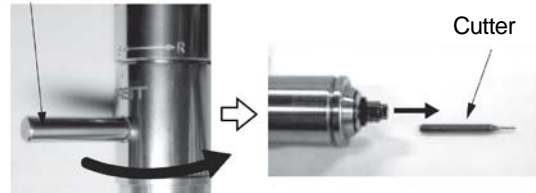


Holes

10.4 Replacing the Collet Chuck

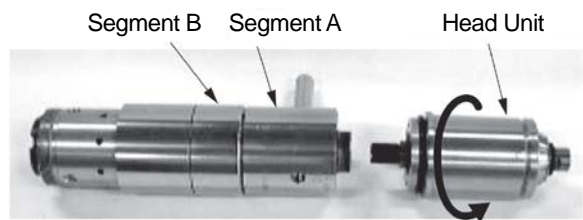
1. Turn the chuck release lever to the R position (release position) and remove the router bit. After removing the router bit, return the lever to the S position (set position).

Chuck Release Lever



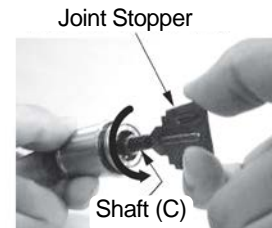
NOTE: Make sure to return the lever to the S position so that you can easily push out the collet chuck in step 4.

2. Wrap the head unit of the spindle motor in a rubber sheet or equivalent. Hold segment A and turn the head unit counterclockwise to detach it.

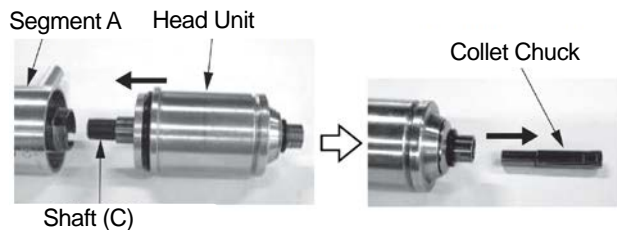


NOTE: Do not untighten segment A and segment B when you loosen the head unit.

3. Fit a spanner to the grooves on the top of the head unit and insert the joint stopper into the shaft (C) on the other end of the head unit. Hold the spanner and turn the joint stopper counterclockwise. Keep loosening the screw inside the shaft until the shaft (C) becomes detached. (Do not remove the shaft (C) from the head unit)



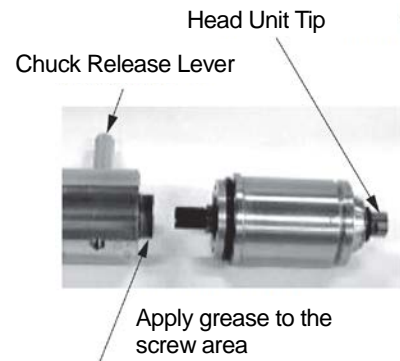
4. Push out the collet chuck by pushing the shaft (C) end of the head unit into segment A. This should push out the collet chuck from the other end. Grasp the collet chuck and pull it out.



5. After removing the collet chuck, clean the collet chuck sheath with a cotton swab moistened with alcohol.



6. After cleaning the collet chuck sheath, attach a new collet chuck and assemble the head unit by reversing the disassembly procedure.



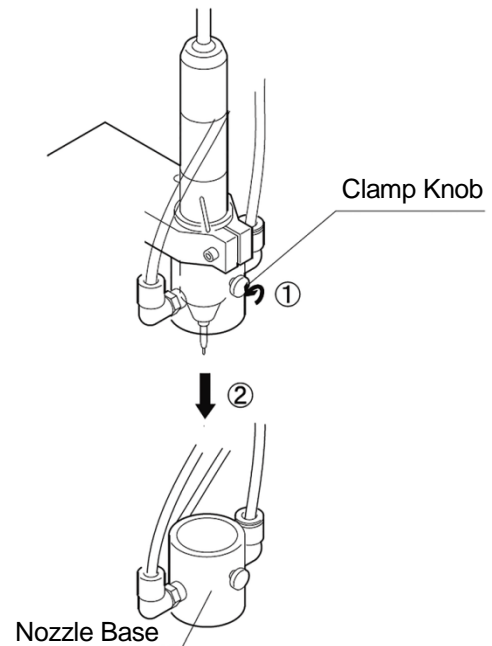
Attention

- When attaching the new collet chuck, tighten the screw inside the shaft until the joint stopper is hard to turn. (Tighten the screw inside the shaft until the collet chuck turns with the joint stopper.)
- Apply an appropriate amount of grease to the screw area of the motor segment.
- When screwing the head unit onto the motor segment, use a rubber sheet or equivalent so as to completely tighten the head unit. (Check that it cannot be easily loosened)
- After assembling the spindle motor, turn the tip of the head unit with your hands and move the chuck release lever left and right to check there are no issues.

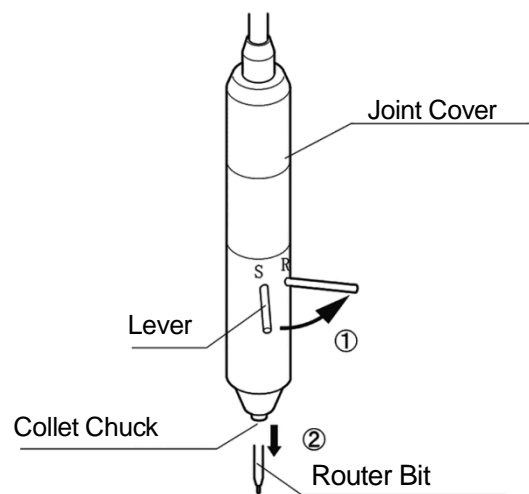
10.5 Replacing the Spindle Motor

Replace the spindle motor (part number: 996516008) if it is damaged.

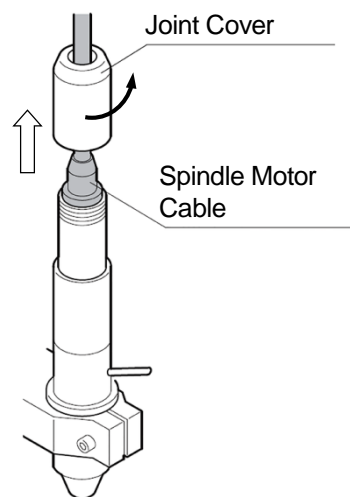
1. Turn OFF the robot and then unplug the power cable from the outlet.
2. Loosen the clamp knob, pull the nozzle base straight down and remove the router bit from the spindle motor. Be careful not to damage the router bit.



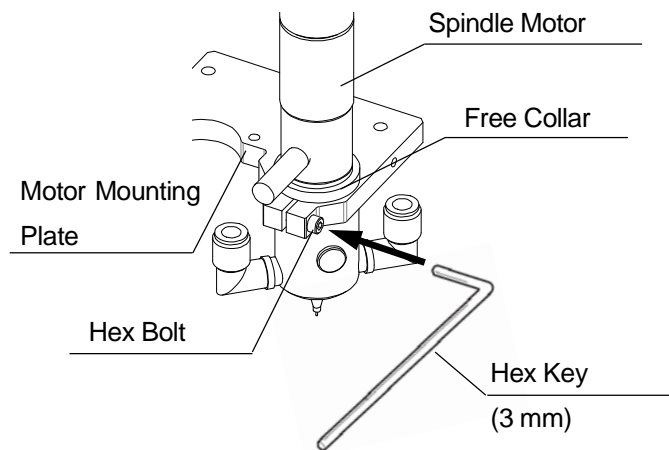
3. Turn the lever on the spindle motor to the R position to release the collet chuck, and then pull out the router bit.
4. Loosen the spindle motor joint cover.



5. Remove the joint cover and unplug the spindle motor cable.



- Use a 3mm hex key to loosen the hex bolts on the motor mounting plate, and remove the spindle motor. Leave the free collar on top of the mounting plate. Also note that the free collar is not secured, so take care not to lose it.



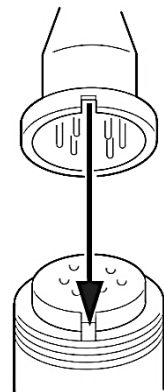
- Replace the old spindle motor with a new one. Attach the new spindle motor by inserting it into the free collar.

- Secure the spindle motor by tightening the hex bolt with a 3mm hex key at a 0.8 Nm (8 kgfcm) tightening torque.

- Line up the notches and connect the cable as shown in the diagram to the right.

- Reattach the joint cover to its original position.

- Insert the router bit into the collet chuck as far as it will go and then turn the lever back to the S position to secure it. When inserting the router bit, make sure that no dust, etc., gets inside.



- Reattach the nozzle base to its original position, and then tighten the clamp knob. Take care not to damage the router bit.

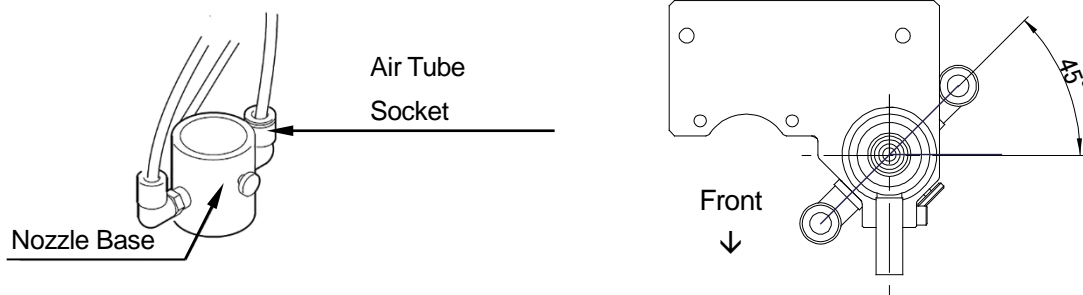
Attention

We recommend servicing the spindle motor once every 6 months regardless of condition.

Contact the office listed on the back of this manual or your local dealer for the maintenance and replacement parts.

With the JR3203ERT model, attach the nozzle base so that the air tube sockets come in at a 45 degree angle to the robot. Otherwise, the air tube sockets will hit the safety cover depending on the robot coordinates.

With the JR3303ERT, JR3403ERT, JR3503ERT, and JR3603ERT models, attach the nozzle base at an angle so that the air tubes do not come in contact with the spindle motor lever.



10.6 Replacing the Spindle Motor Bearing

The service life of the spindle motor bearing is approximately 2,000 hours, but it varies depending on the work environment and the PCB material. Contact the office listed on the back of this manual or your local dealer for bearing replacement.



Caution

Refer to the indicator LEDs as a guide to determine when the bearing needs to be replaced.

We recommend earlier replacement of the bearing to prevent the motor stalling due to a worn bearing.

If the motor stalls, the workpiece may be damaged.

Contact the office listed on the back of this manual or your local dealer for details regarding bearing replacement.

10.7 Replacing the Ejector

Large amounts of swarf passing through the diffuser inside the ejector at a high speed may damage or clog the diffuser and may reduce the dust collection efficiency.

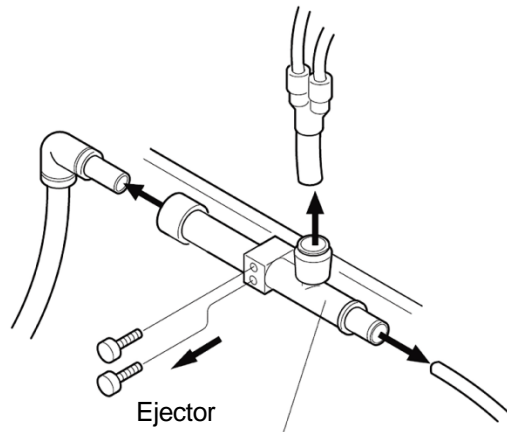
To maintain optimal ejector performance, replace it every three times you replace the dust filter.



Caution

Replace the ejector regularly. Failure to do so reduces the dust collection efficiency. Dust and swarf may damage the workpiece. Inhalation of dust and swarf can be harmful to your health.

1. Turn OFF the robot and then unplug the power cable from the outlet.
2. Remove the three air tubes from the ejector.
3. Remove the two screws attaching the ejector to the rear of the robot. Remove the ejector.
4. Follow the above procedure in reverse and attach a new ejector at a tightening torque of 1.5 Nm (15 kgfcm).



10.8 Replacing the Dust Filter

Swarf from PCB cutting is collected in the dust filter inside the filter box, via the air tube connected to the vacuum nozzle and the ejector attached to the rear of the robot. Replace the dust filter frequently as dust collection efficiency decrease if the dust collector filter is full.



Caution

- The replacement frequency varies depending on your conditions of use. Regularly check the filter visually and manually.
- Be sure to wear a dust mask or other such protector when replacing the dust filter. Inhalation of dust and swarf can be harmful to your health.

Replace the filter when the dust volume reaches approximately 6,000 cm³.

The rate of dust accumulation in the filter varies depending on the type and thickness of the PCB, and the width of the router bit; in the example below, there is 5 cm³ of dust for every 1m cut.

Use the following formula to calculate the dust accumulation in the filter for every 1 m of PCB cut:

$$\text{Dust Volume (cm}^3\text{/m)} = 10 \times \frac{\text{PCB Thickness (mm)} \times \text{Router Bit Diameter}^2 \text{ (mm)}}{1.024}$$

Example: Cutting an 0.8mm thick PCB with a 0.8 mm wide router bit

$$10 \times \frac{0.8 \text{ (mm)} \times \varnothing 0.8^2 \text{ (mm)}}{1.024} = 5 \text{ (cm}^3\text{/m)}$$

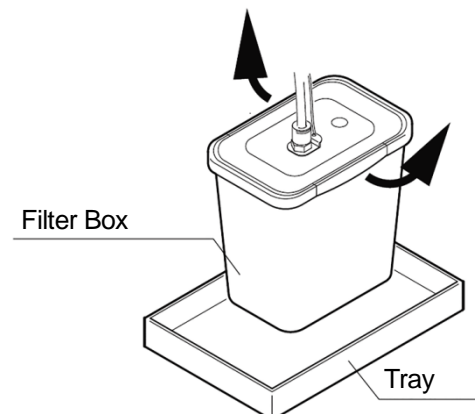
There is 5 cm³ of dust for every 1mm cut.

$$6000 \text{ (cm}^3\text{)} \div 5 \text{ (cm}^3\text{/m)} = 1200 \text{ (m)}$$

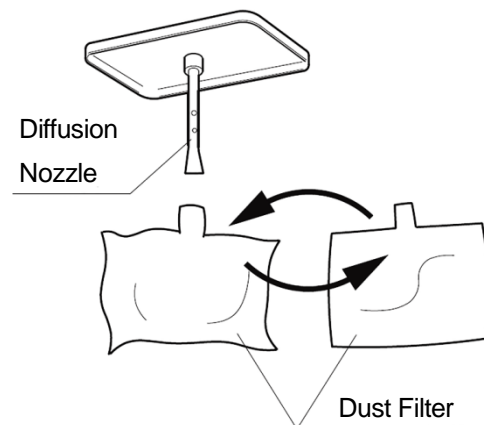
Accordingly, in this example, the filter needs to be replaced every 1,200 m of PCB cutting.

To maintain a high dust collection efficiency, replace the dust filter frequently.

When replacing the filter, put a tray under the filter box so as to catch any airborne particles.



1. Turn OFF the robot and then unplug the power cable from the outlet.
2. Wear a dust mask, etc., and remove the filter box cover.
Gently remove the dust collector filter from the diffusion nozzle. If the filter cannot be removed, cut the cable tie to release it.



Caution

Dust particles may get stuck inside the diffusion nozzle. If this happens, do not squeeze the dust filter. Squeezing the filter can cause dust and swarf to become airborne. Inhalation of dust and swarf can be harmful to your health.

3. Close and seal the neck of the dust filter with a cable tie, etc., and then dispose of it according to the relevant national and/or regional legislation and your corporation's disposal policy.
4. Insert the diffusion nozzle into the neck of a new filter, until the joint of the diffusion nozzle reaches the neck of the dust filter. Secure the filter with a cable tie. If the inside of the filter box is dirty, wipe with a rag moistened with alcohol or equivalent.



Danger

Check that the grounding wire is properly connected to the filter box. Static electricity can cause the filter to explode, which may result in injury or fire.



Caution

- The filter collects dust and swarf from cut PCBs. When replacing the filter, always make sure to wear a dust mask or other such protector.
 - Make sure that the filter box ventilation opening is not blocked.
 - Do not reuse the dust filter. (100 % polyester)
- Inhalation of dust and swarf can be harmful to your health.

10.9 Replacing the Cable Ties

The cable ties may deteriorate and split with age.

Check that the cable ties are not damaged, loose, or broken before running the robot.

Replace any cable ties as required.



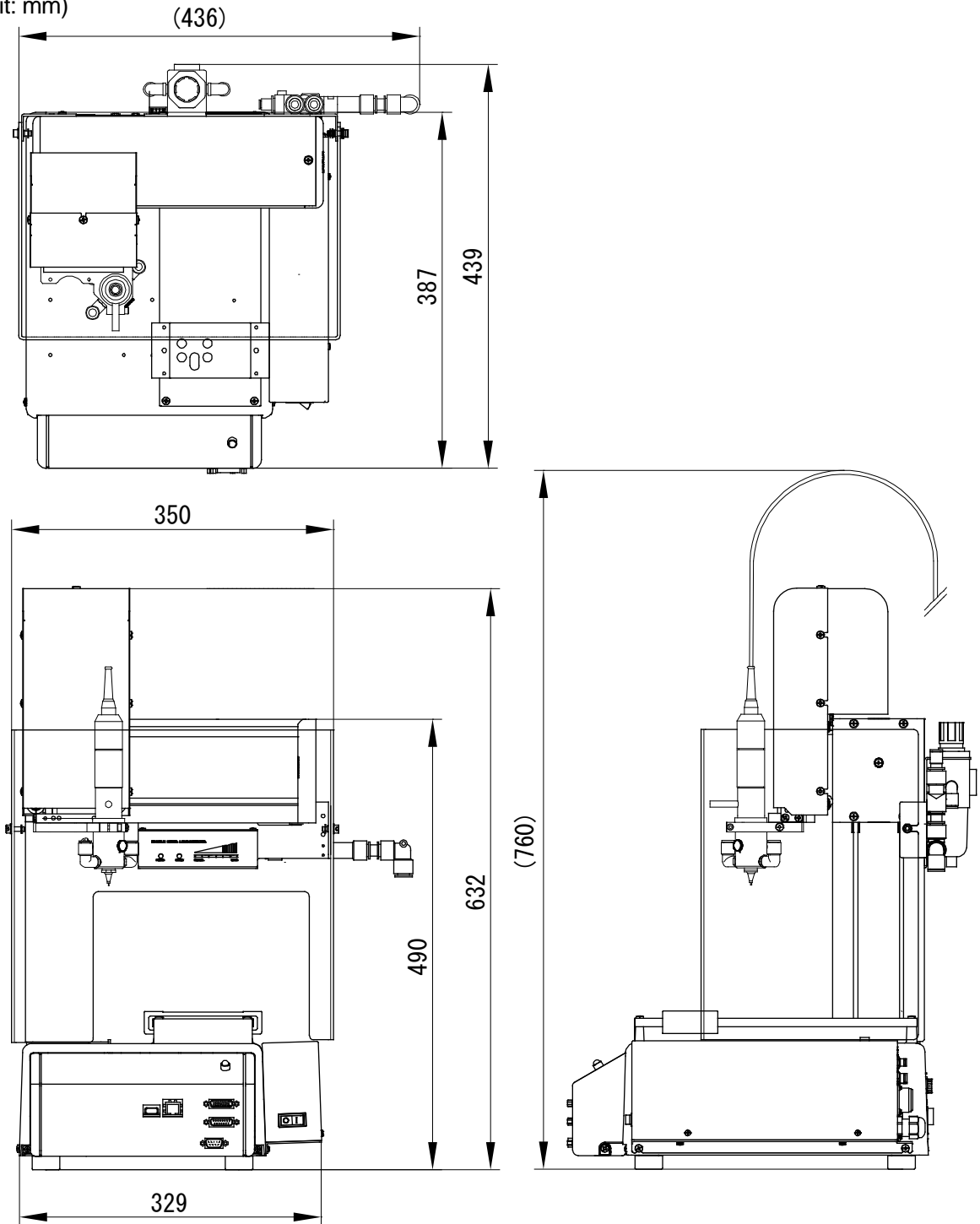
Caution

Always perform daily checks on the robot. Make sure there are no abnormalities with the robot and peripheral devices before running the robot. Running the robot without making these checks can cause damage and unit breakdown.

11. EXTERNAL DIMENSIONS

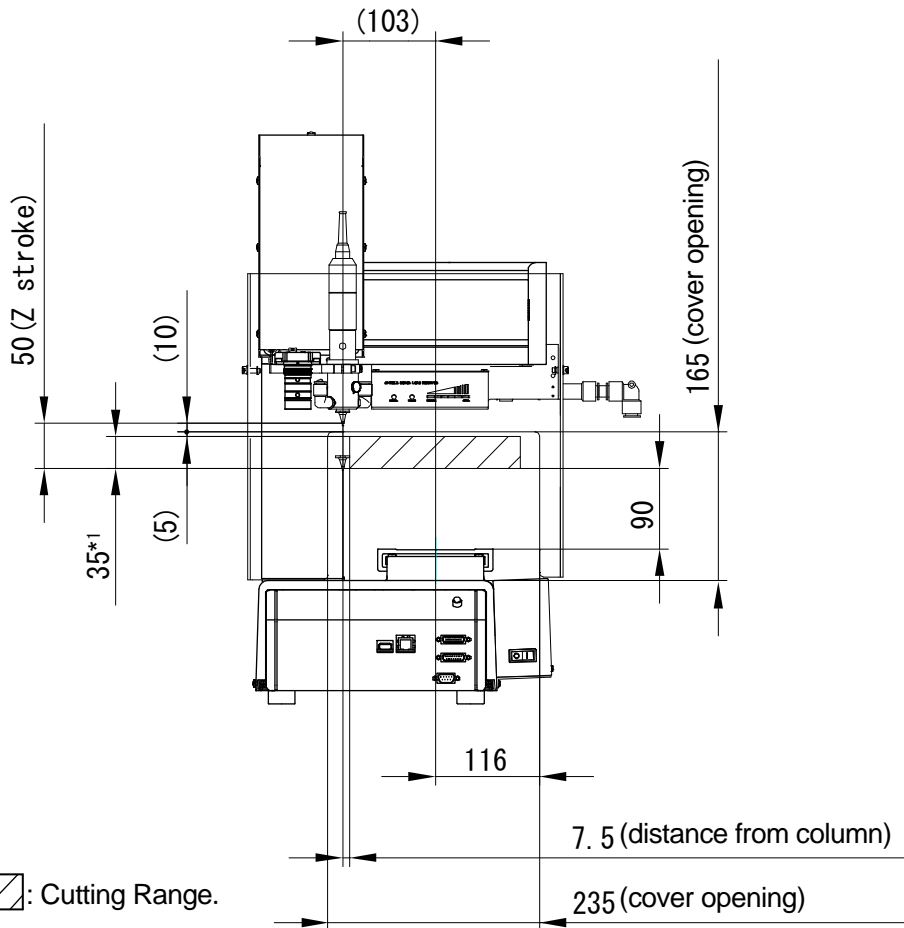
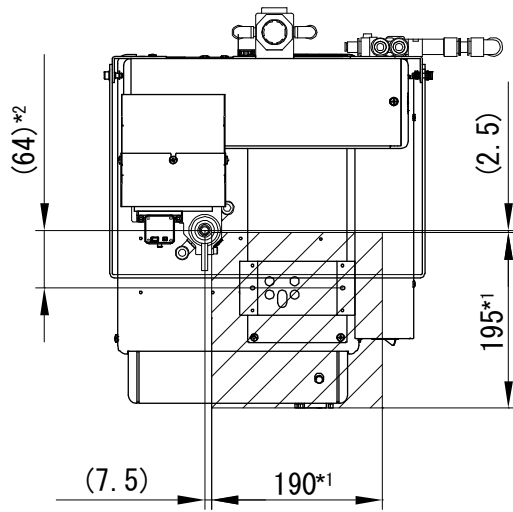
11.1 JR3203ERT


(unit: mm)



For details regarding other robot dimensions, refer to the external dimensions in the operation manual *Specifications*.

■ Cutting Range
(unit: mm)



*1 : Cutting Range.

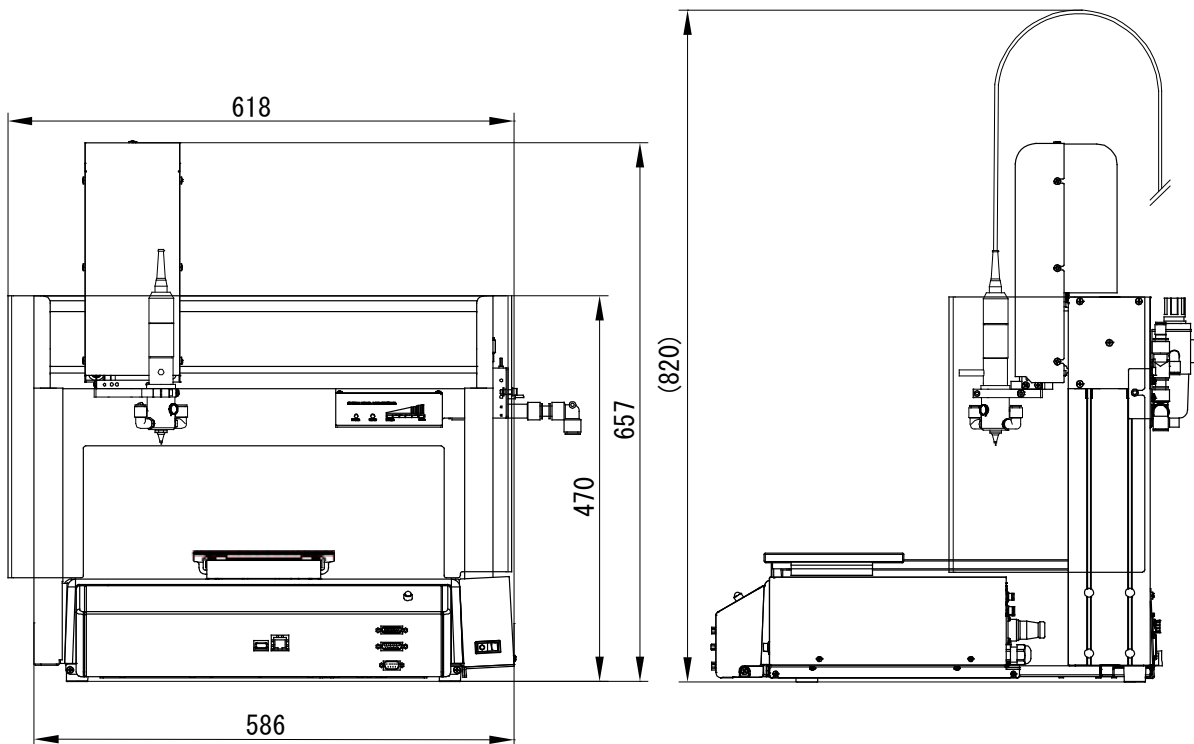
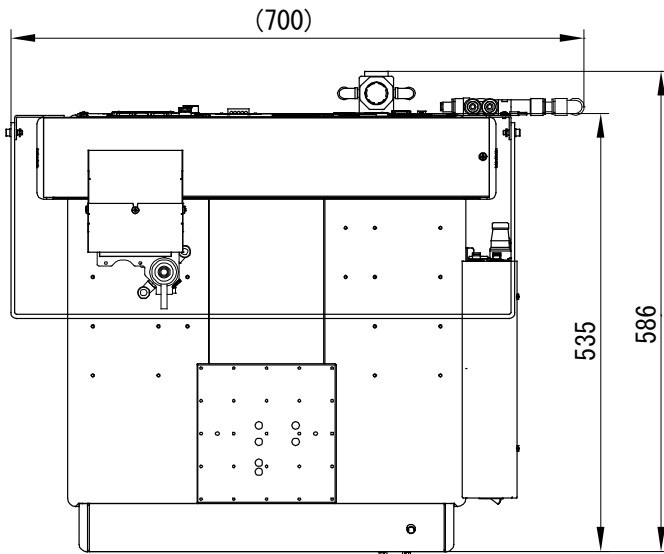
*2 With JR3203ERT models, the X direction distance in relation to the spindle center and the X-table center is 64 mm and with JR2203NERT models, it is 66 mm. Make sure to modify teaching data accordingly if transferring data. Failure to do so can damage the workpiece.



Caution

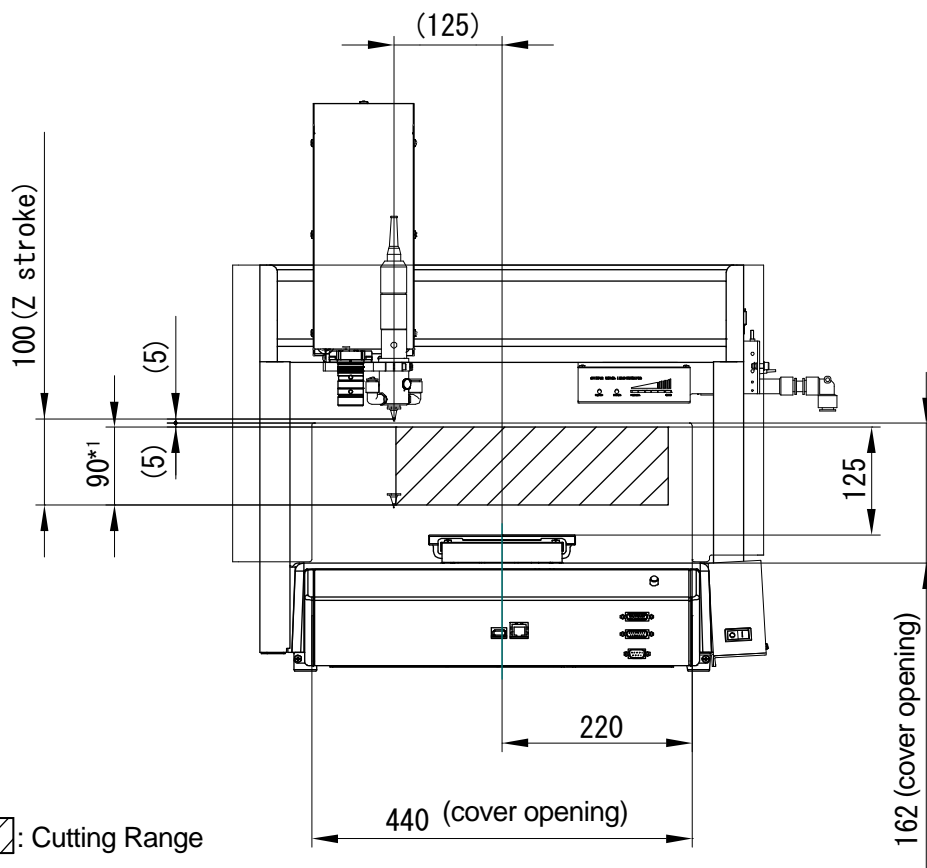
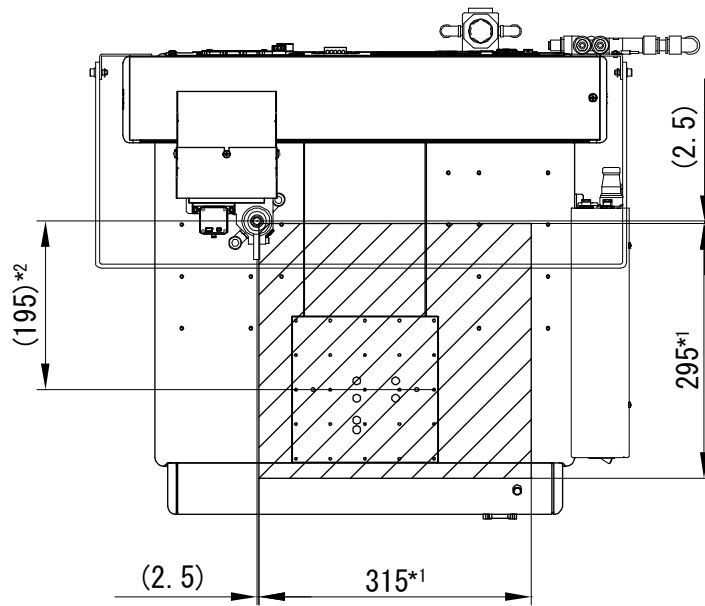
11.2 JR3303ERT

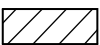
(unit: mm)



For details regarding other robot dimensions, refer to the external dimensions in the operation manual *Specifications*.

■ Cutting Range
(unit: mm)



*1  : Cutting Range

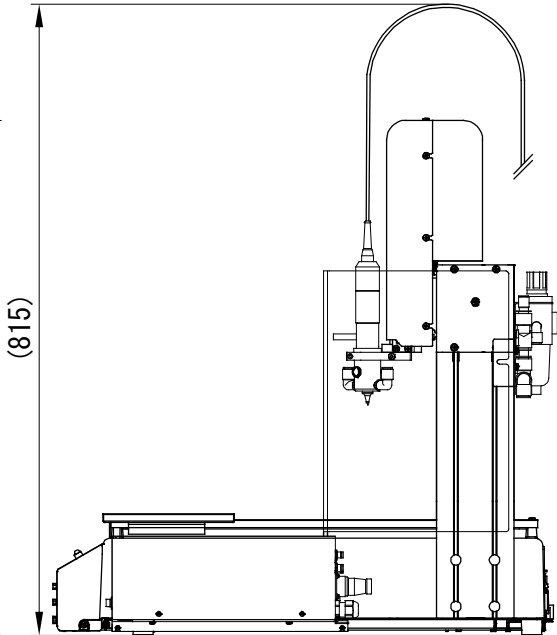
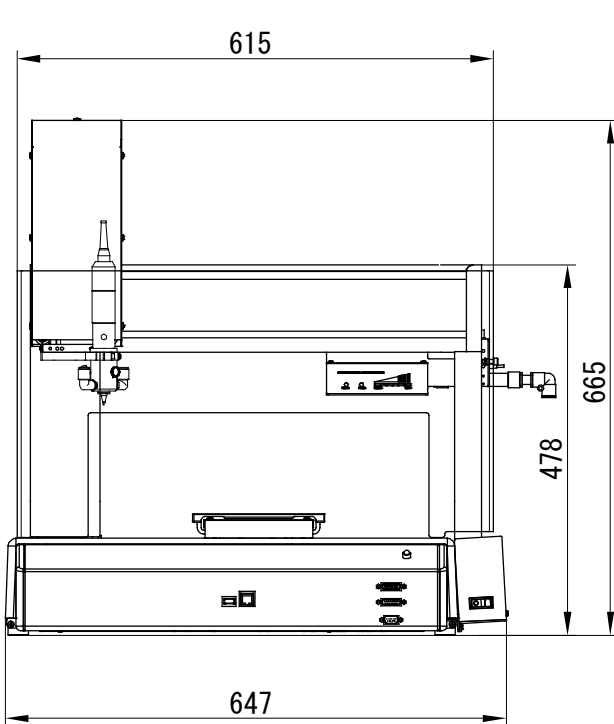
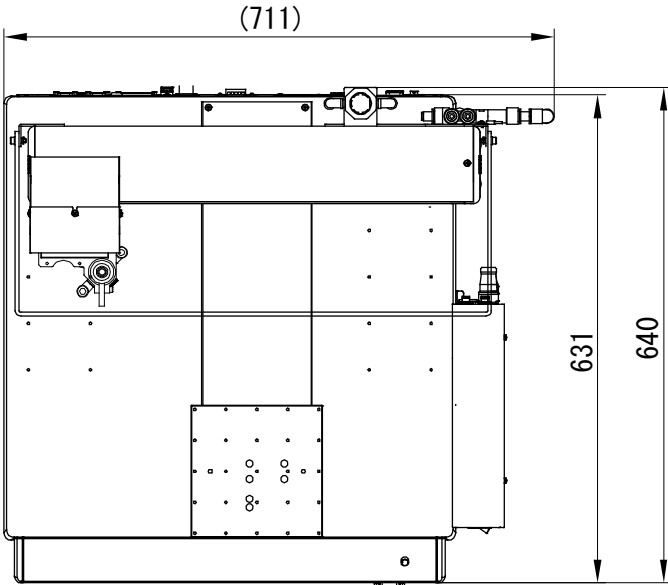
*2 With JR3303ERT models, the X direction distance in relation to the spindle center and the X-table center is 195 mm and with JR2303NERT models, it is 197 mm. Make sure to modify teaching data accordingly if transferring data. Failure to do so can damage the workpiece.



Caution

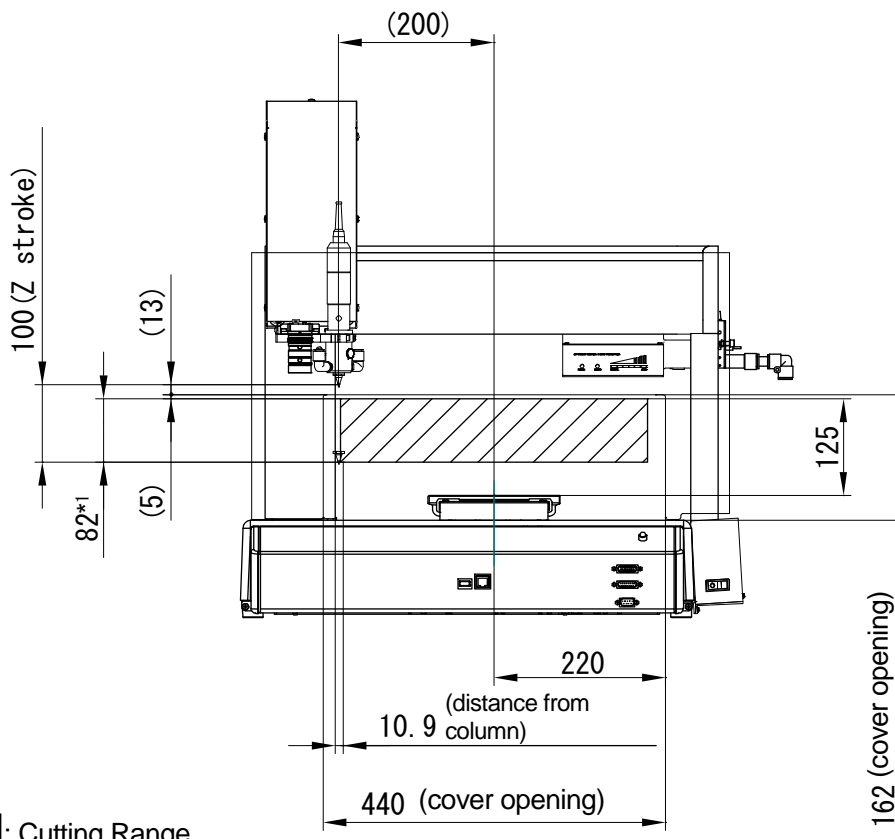
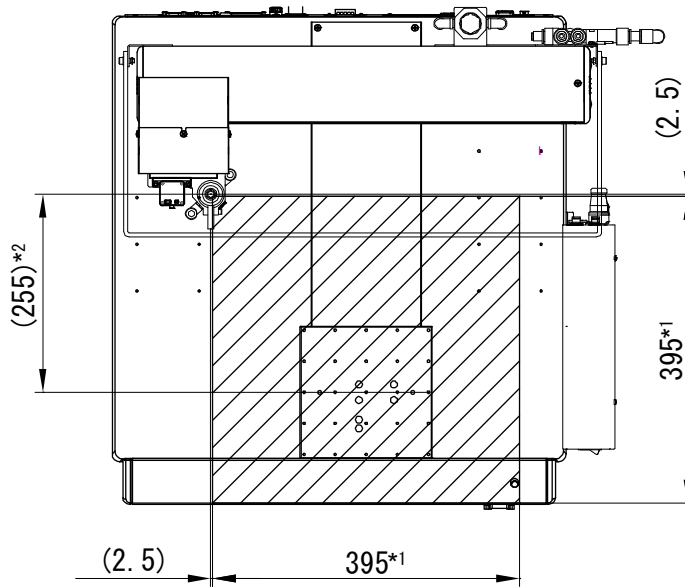
11.3 JR3403ERT


(unit: mm)



For details regarding other robot dimensions, refer to the external dimensions in the operation manual *Specifications*.

■ Cutting Range
(unit: mm)



*1  : Cutting Range

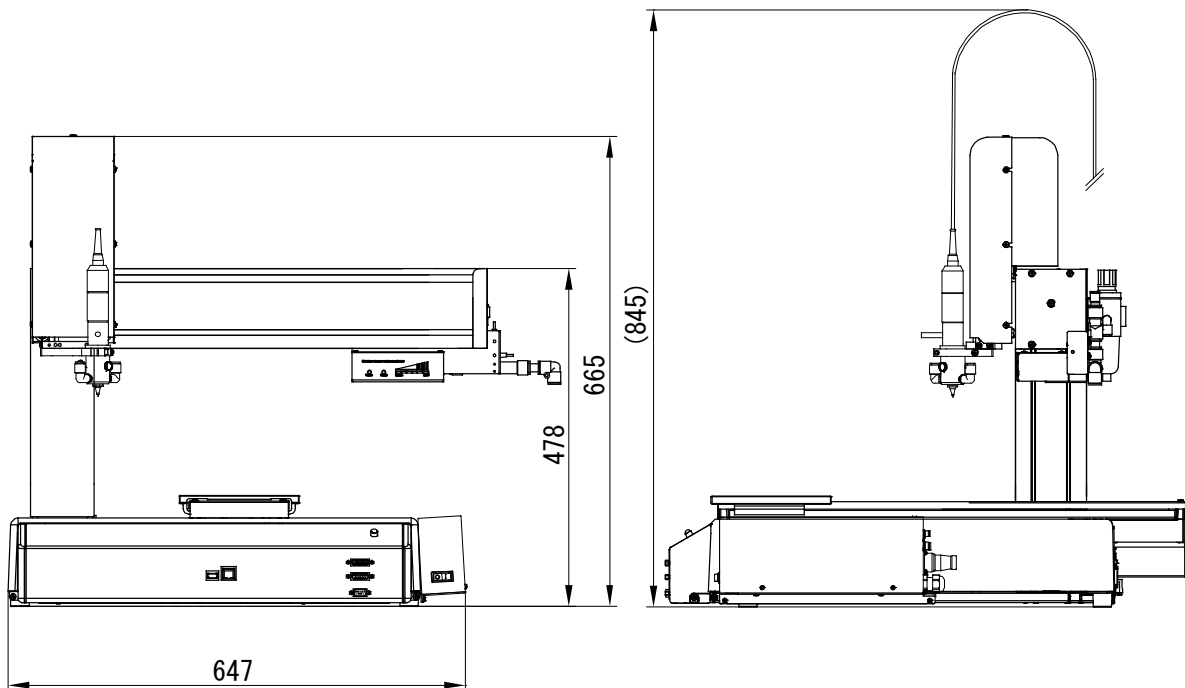
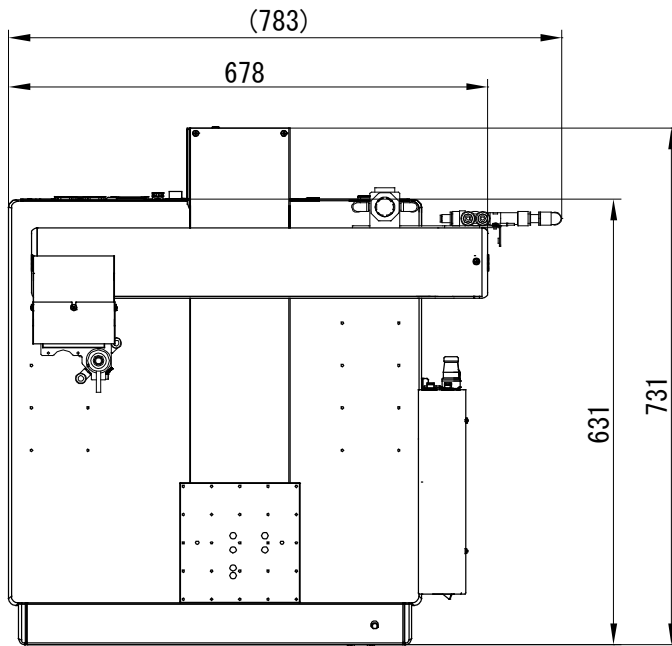


Caution

*2 With JR3403ERT models, the X direction distance in relation to the spindle center and the X-table center is 255 mm and with JR2403NERT models, it is 257 mm. Make sure to modify teaching data accordingly if transferring data. Failure to do so can damage the workpiece.

11.4 JR3503ERT

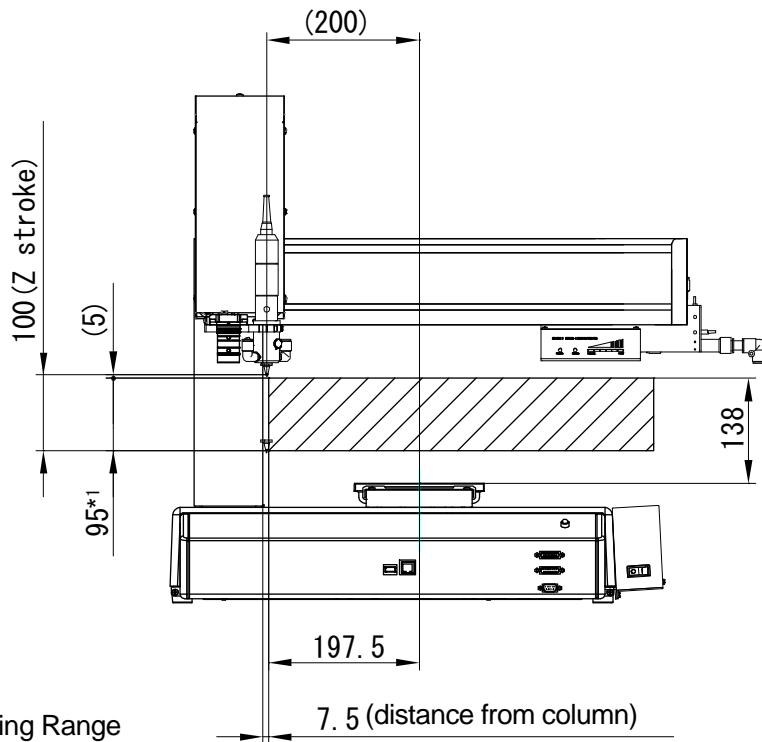
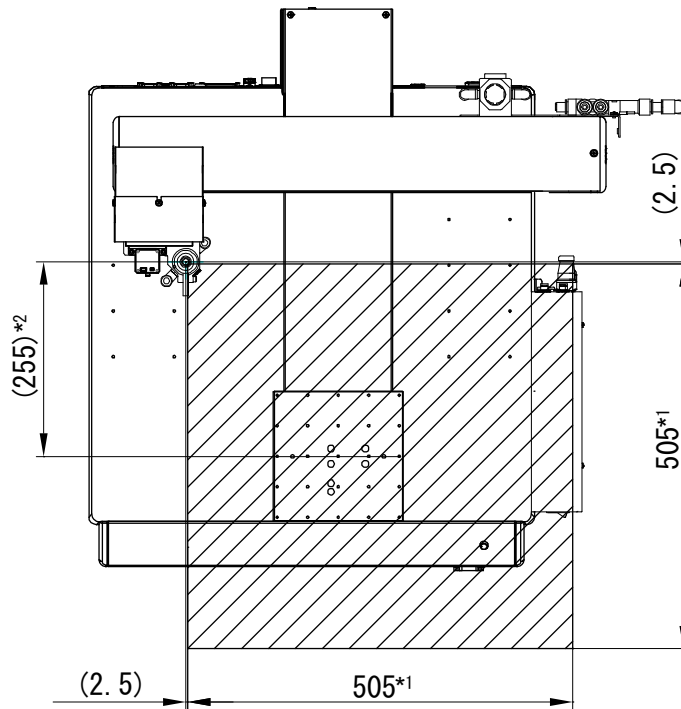
(unit: mm)




NOTE: There is no safety cover supplied for the JR3503ERT and JR3603ERT models.
Please prepare on your side.

For details regarding other robot dimensions, refer to the external dimensions in the operation manual *Specifications*.

■ Cutting Range
(unit: mm)



*1  : Cutting Range

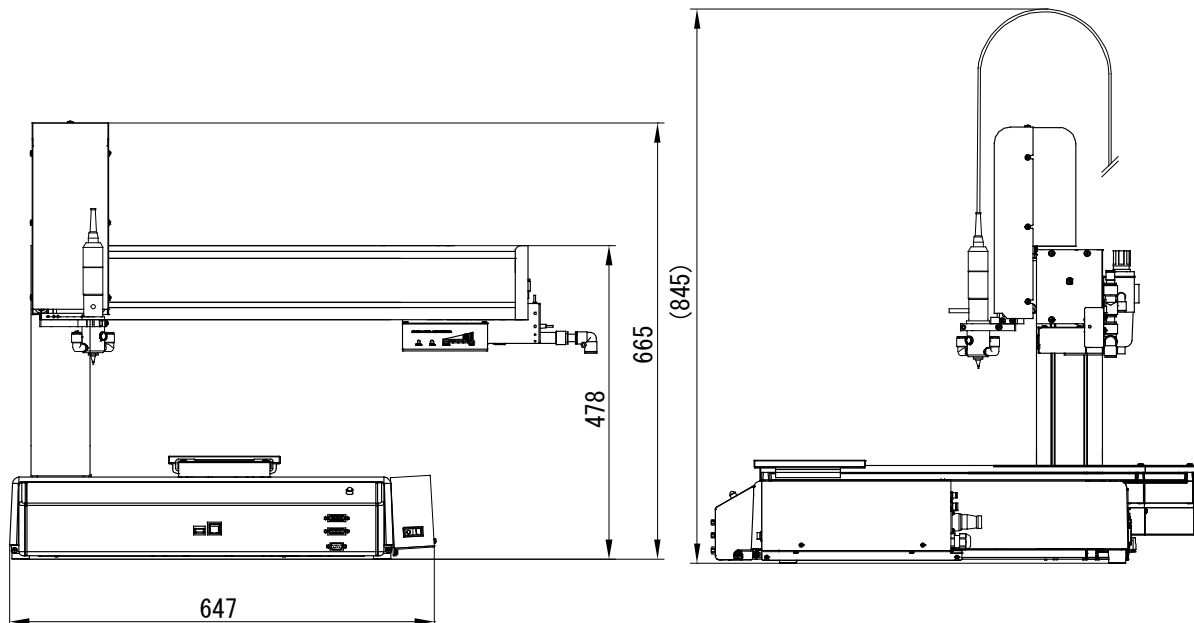
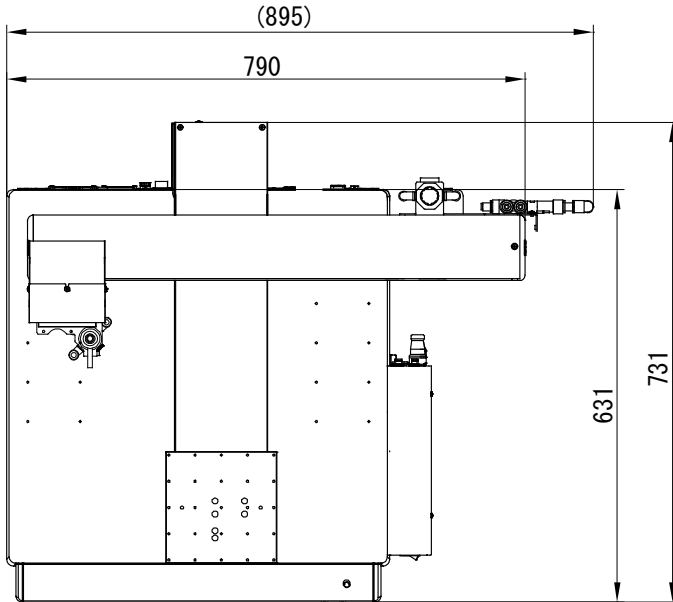
*2 With JR3503ERT models, the X direction distance in relation to the spindle center and the X-table center is 255 mm and with JR2503NERT models, it is 257 mm. Make sure to modify teaching data accordingly if transferring data. Failure to do so can damage the workpiece.



Caution

11.5 JR3603ERT

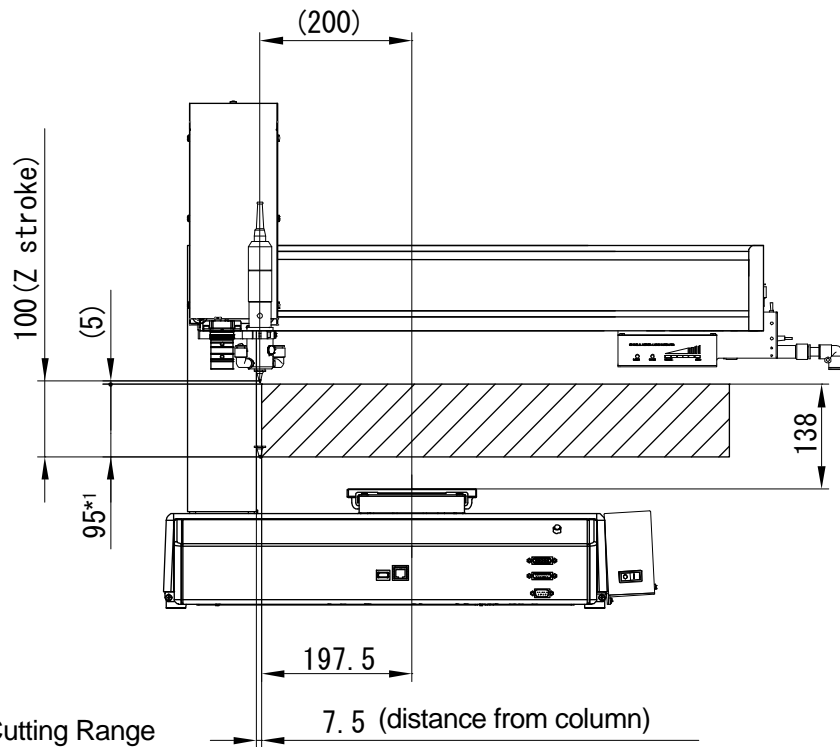
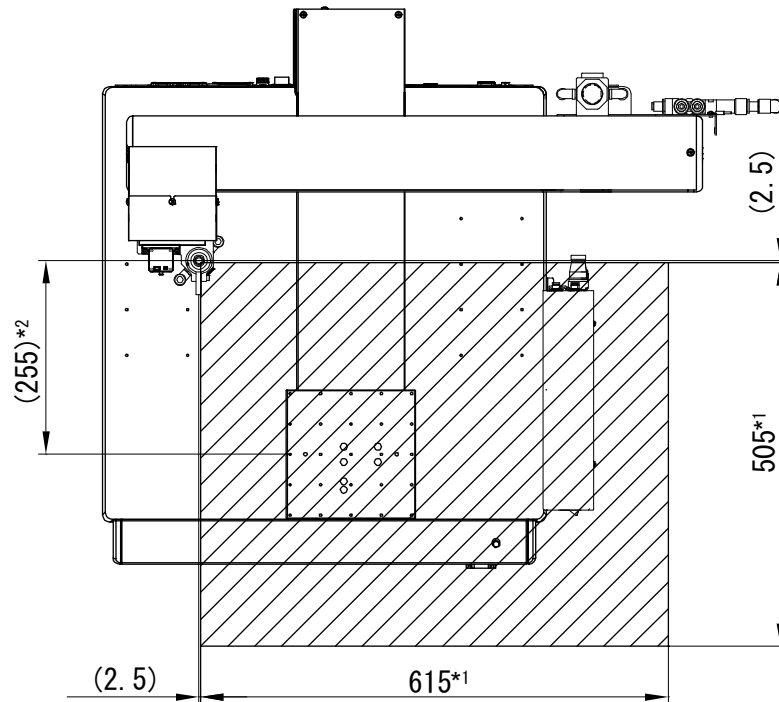
(unit: mm)

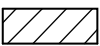


NOTE: No safety cover supplied for the JR3503ERT and JR3603ERT models.
Please prepare on your side.

For details regarding other robot dimensions, refer to the external dimensions in the operation manual *Specifications*.

■ Cutting Range
(unit: mm)



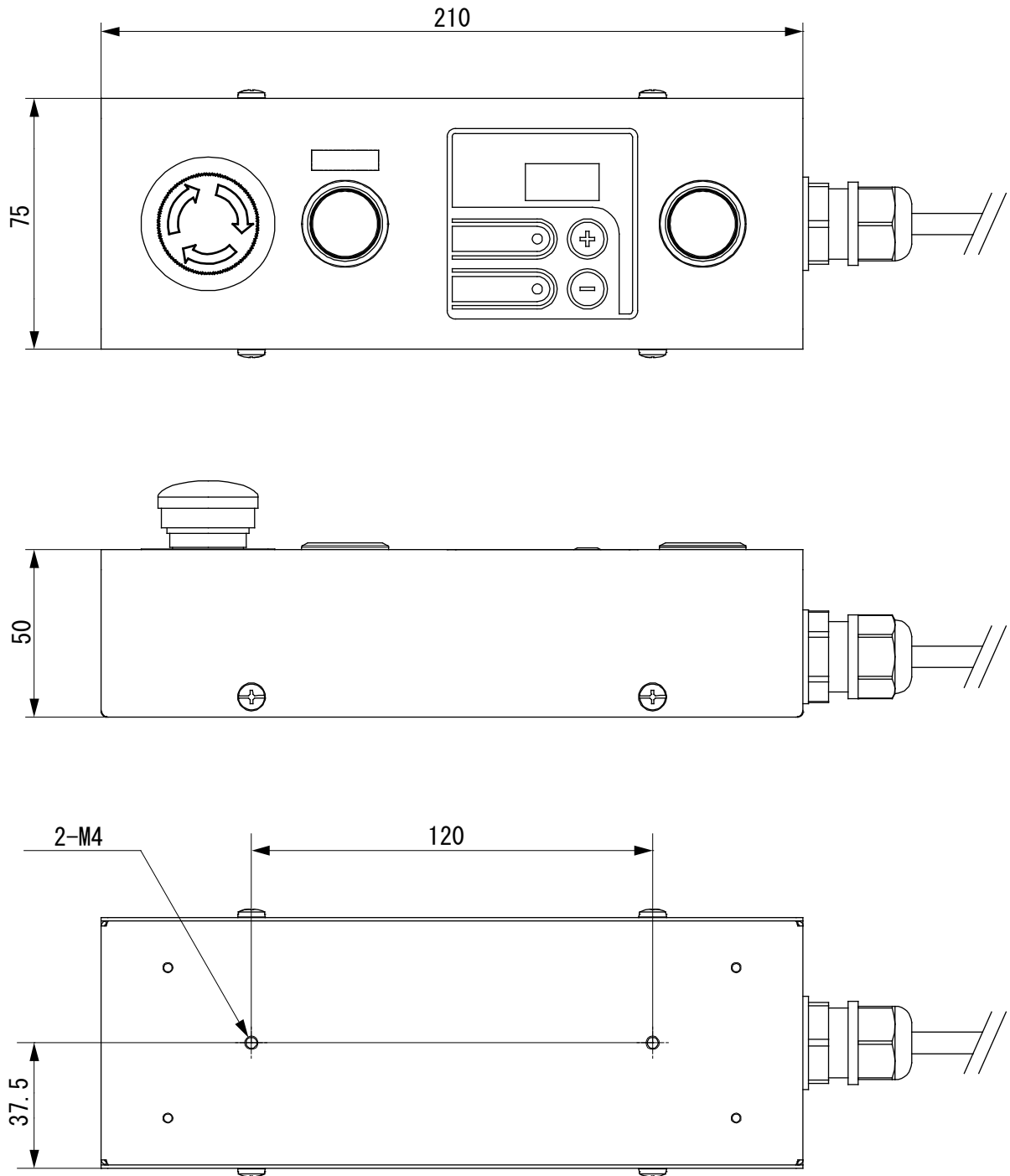
*1 : Cutting Range

*2 With JR3603ERT models, the X direction distance in relation to the spindle center and the X-table center is 255 mm and with JR2603NERT models, it is 257 mm. Make sure to modify teaching data accordingly if transferring data. Failure to do so can damage the workpiece.

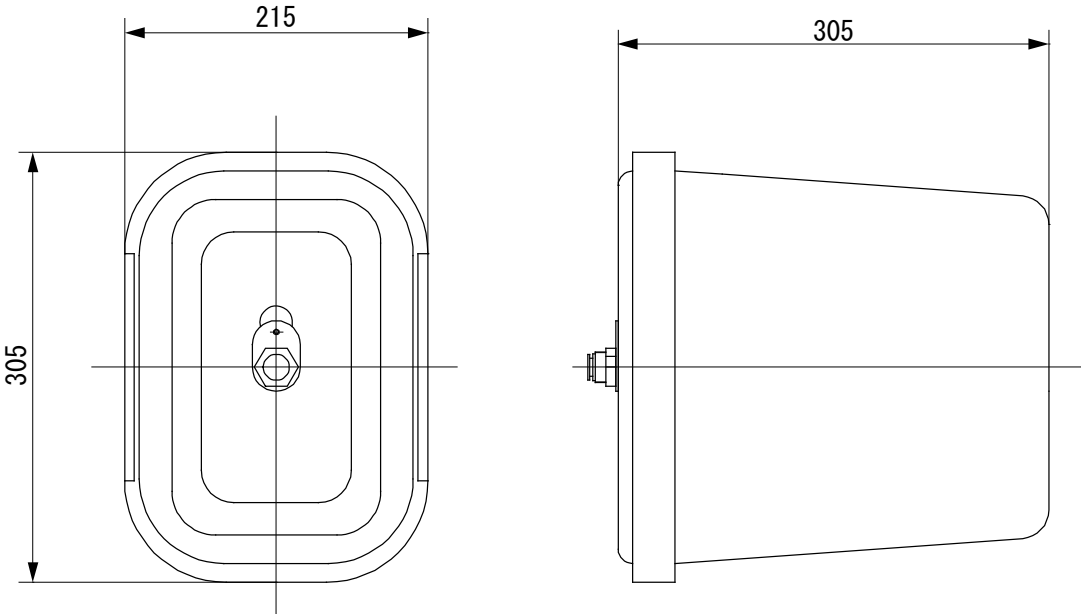


Caution

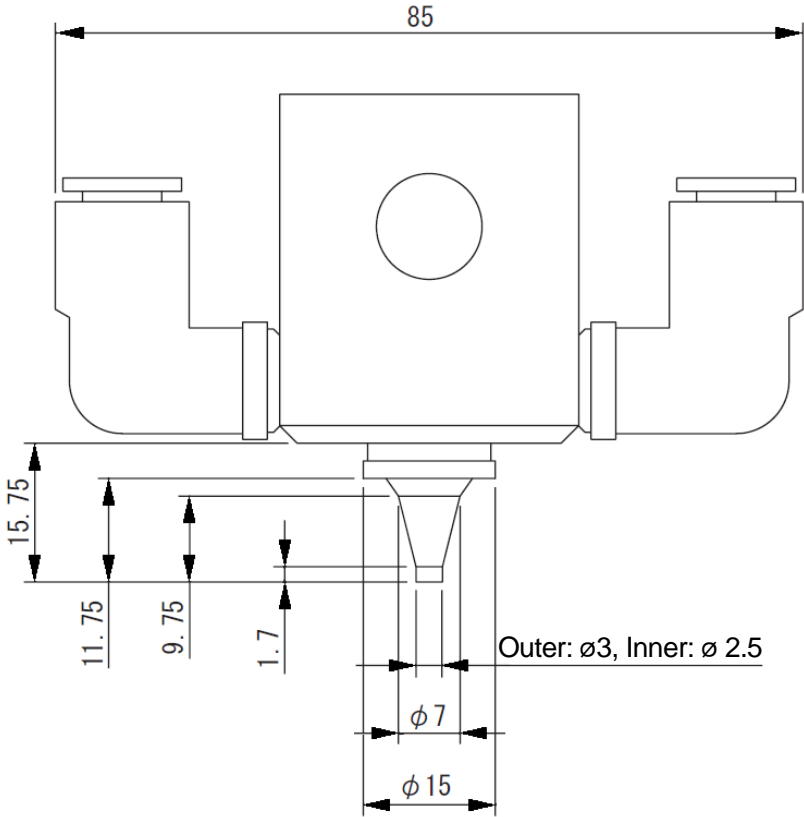
11.6 Switchbox



11.7 Filter Box



11.8 Nozzle Base



12. SPECIFICATIONS

■ Specialized for Depaneling Models

Item	Model	JR3203ERT
Number of Axes		3 (synchronous control)
Operating Range	X axis	200 mm
	Y axis	200 mm
	Z axis	50 mm
Cutting Range (Limit)	X axis	195 mm
	Y axis	190 mm
	Z axis	35 mm
Operating Range when using USB Camera	X axis	192 mm
	Y axis	138 mm
	Z axis	35 mm
Portable Mass	Workpiece	7 kg
	Tool	2.5 kg
Maximum Speed* ¹ (PTP Movement)	X and Y axes	700 mm/sec (7 to 700 mm/sec)* ²
	Z axis	250 mm/sec (2.5 to 250 mm/sec)* ²
Maximum Speed* ¹ (CP Speed)	X, Y, Z axes (combined)	600 mm/sec (0.1 to 600 mm/sec)* ²
Repeatability	X and Y axes	± 0.006 mm
	Z axis	± 0.006 mm
Supplied Air Pressure		0.5 Mpa (5kgf/cm ²) dry air* ³
Air Consumption		200 NI/min* ⁴
External Dimensions (mm) (excluding cables and protrusions)	W × D × H	350 × 439 × 632
Mass (robot)		26 kg

*1 Maximum speed may vary depending on operating conditions.

*2 Speed range

*3 Use dry air containing no oil or water to prevent problems with the pneumatic system.

*4 Provide an air supply of 200 NI/min or higher so as to maintain dust collection efficiency. Insufficient air supply may cause pressure failure during vacuuming.

Item		Model	JR3303ERT
Number of Axes		3 (synchronous control)	
Operating Range	X axis	300 mm	
	Y axis	320 mm	
	Z axis	100 mm	
Cutting Range (Limit)	X axis	295 mm	
	Y axis	315 mm	
	Z axis	90 mm	
Operating Range when using USB Camera	X axis	292 mm	
	Y axis	263 mm	
	Z axis	90 mm	
Portable Mass	Workpiece	15 kg	
	Tool	6 kg	
Maximum Speed* ¹ (PTP Movement)	X and Y axes	900 mm/sec (9 to 900 mm/sec)* ²	
	Z axis	400 mm/sec (4 to 400 mm/sec)* ²	
Maximum Speed* ¹ (CP Speed)	X, Y, Z axes (combined)	850 mm/sec (0.1 to 850 mm/sec)* ²	
Repeatability	X and Y axes	± 0.007 mm	
	Z axis	± 0.007 mm	
Supplied Air Pressure		0.5 Mpa (5kgf/cm ²) dry air* ³	
Air Consumption		200 NI/min* ⁴	
External Dimensions (mm) (excluding cables and protrusions)	W x D x H	618 x 586 x 657	
Mass (robot)		42 kg	

*1 Maximum speed may vary depending on operating conditions.

*2 Speed range

*3 Use dry air containing no oil or water to prevent problems with the pneumatic system.

*4 Provide an air supply of 200 NI/min or higher so as to maintain dust collection efficiency. Insufficient air supply may cause pressure failure during vacuuming.

Item		Model	JR3403ERT (double column model only)
Number of Axes			3 (synchronous control)
Operating Range	X axis		400 mm
	Y axis		400 mm
	Z axis		100 mm
Cutting Range (Limit)	X axis		395 mm
	Y axis		395 mm
	Z axis		82 mm
Operating Range when using USB Camera	X axis		392 mm
	Y axis		343 mm
	Z axis		82 mm
Portable Mass	Workpiece		15 kg
	Tool		6 kg
Maximum Speed*1 (PTP Movement)	X and Y axes		900 mm/sec (9 to 900 mm/sec)*2
	Z axis		400 mm/sec (4 to 400 mm/sec)*2
Maximum Speed*1 (CP Speed)	X, Y, Z axes (combined)		850 mm/sec (0.1 to 850 mm/sec)*2
Repeatability	X and Y axes		± 0.007 mm
	Z axis		± 0.007 mm
Supplied Air Pressure			0.5 Mpa (5kgf/cm ²) dry air*3
Air Consumption			200 Nl/min*4
External Dimensions (mm) (excluding cables and protrusions)	W × D × H		647 × 640 × 665
Mass (robot)			51 kg

*1 Maximum speed may vary depending on operating conditions.

*2 Speed range

*3 Use dry air containing no oil or water to prevent problems with the pneumatic system.

*4 Provide an air supply of 200 Nl/min or higher so as to maintain dust collection efficiency. Insufficient air supply may cause pressure failure during vacuuming.

Item		Model	JR3503ERT
Number of Axes		3 (synchronous control)	
Operating Range	X axis	510 mm	
	Y axis	510 mm	
	Z axis	100 mm	
Cutting Range (Limit)	X axis	505 mm	
	Y axis	505 mm	
	Z axis	95 mm	
Operating Range when using USB Camera	X axis	502 mm	
	Y axis	453 mm	
	Z axis	95 mm	
Portable Mass	Workpiece	15 kg	
	Tool	6 kg	
Maximum Speed* ¹ (PTP Movement)	X and Y axes	900 mm/sec (9 to 900 mm/sec)* ²	
	Z axis	400 mm/sec (4 to 400 mm/sec)* ²	
Maximum Speed* ¹ (CP Speed)	X, Y, Z axes (combined)	850 mm/sec (0.1 to 850 mm/sec)* ²	
Repeatability	X and Y axes	± 0.008 mm	
	Z axis	± 0.008 mm	
Supplied Air Pressure		0.5 Mpa (5kgf/cm ²) dry air* ³	
Air Consumption		200 NI/min* ⁴	
External Dimensions (mm) (excluding cables and protrusions)	W x D x H	678 x 731 x 665	
Mass (robot)		48 kg	

NOTE: This model only conforms to the EMC directive for the EC/EU directives.

*1 Maximum speed may vary depending on operating conditions.

*2 Speed range

*3 Use dry air containing no oil or water to prevent problems with the pneumatic system.

*4 Provide an air supply of 200 NI/min or higher so as to maintain dust collection efficiency. Insufficient air supply may cause pressure failure during vacuuming.

Item		Model	JR3603ERT
Number of Axes		3 (synchronous control)	
Operating Range	X axis	510 mm	
	Y axis	620 mm	
	Z axis	100 mm	
Cutting Range (Limit)	X axis	505 mm	
	Y axis	615 mm	
	Z axis	95 mm	
Operating Range when using USB Camera	X axis	502 mm	
	Y axis	563 mm	
	Z axis	95 mm	
Portable Mass	Workpiece	15 kg	
	Tool	6 kg	
Maximum Speed* ¹ (PTP Movement)	X and Y axes	900 mm/sec (9 to 900 mm/sec)* ²	
	Z axis	400 mm/sec (4 to 400 mm/sec)* ²	
Maximum Speed* ¹ (CP Speed)	X, Y, Z axes (combined)	850 mm/sec (0.1 to 850 mm/sec)* ²	
Repeatability	X axis	± 0.008 mm	
	Y axis	± 0.01 mm	
	Z axis	± 0.008 mm	
Supplied Air Pressure		0.5 Mpa (5kgf/cm ²) dry air* ³	
Air Consumption		200 NI/min* ⁴	
External Dimensions (mm) (excluding cables and protrusions)	W x D x H	790 x 731 x 665	
Mass (robot)		49 kg	

NOTE: This model only conforms to the EMC directive for the EC/EU directives.

*1 Maximum speed may vary depending on operating conditions.

*2 Speed range

*3 Use dry air containing no oil or water to prevent problems with the pneumatic system.

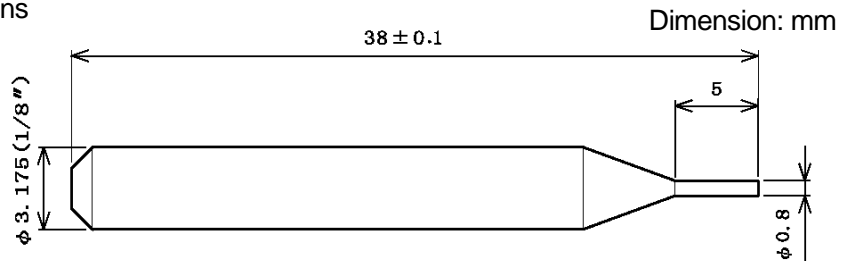
*4 Provide an air supply of 200 NI/min or higher so as to maintain dust collection efficiency. Insufficient air supply may cause pressure failure during vacuuming.

■ Tool Specifications

Item		Details
Spindle Motor	Drive System	DC brushless motor
	Rated Capacity	21 W
	Rated Speed	40,000 r/min
	Chuck	Collet Chuck (ϕ 3.175 mm) ^{*1}
Cutter Diameter		ϕ 0.8 mm ^{*2}
Dust Collection System	Vacuum	Ejector
	Air Blower	Can be adjusted using the speed controller. Air blow time: 0 to 10 (sec) ^{*3}
	Filter Volume	6,000 cm ³ (Disposable)
Maximum PCB Size		1.6 mm
Suitable PCB Material		Glass epoxy, phenolic paper, etc.
Cutting Position Error ^{*4}		0.2 mm (reference value)
Tool Unit Mass	Without USB Camera	0.91 kg
	With USB Camera	1.02kg

*1 No tool required for replacing the router bit. The single-action lever type chuck allows easy replacement.

*2 Router Bit Specifications

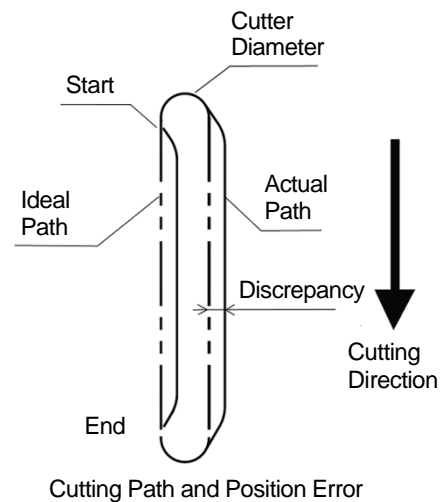


- Swarf from PCB cutting is ejected downward (left-handed).
- The router bit is consumable.
- Use the recommended router bit.

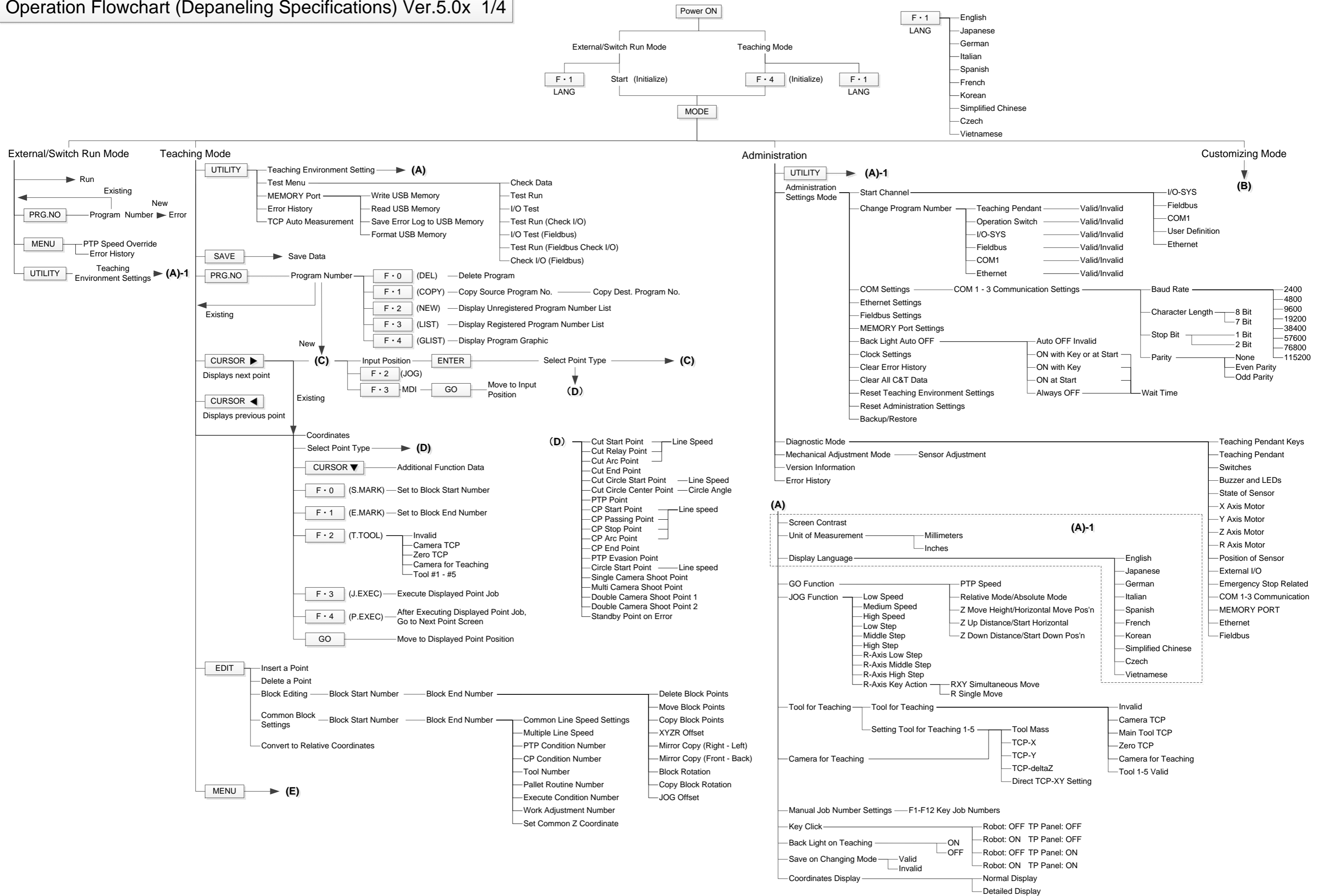
*3 The air blow time is adjustable. (Refer to “6.7 Board Cutting Condition Settings” for details)

*4 Cutting position error refers to the discrepancy between optimal taught line and the actual cutting line (path) between the start and end points. The diagram below shows the cutting position error.

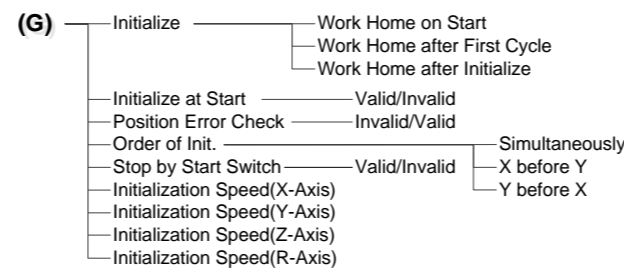
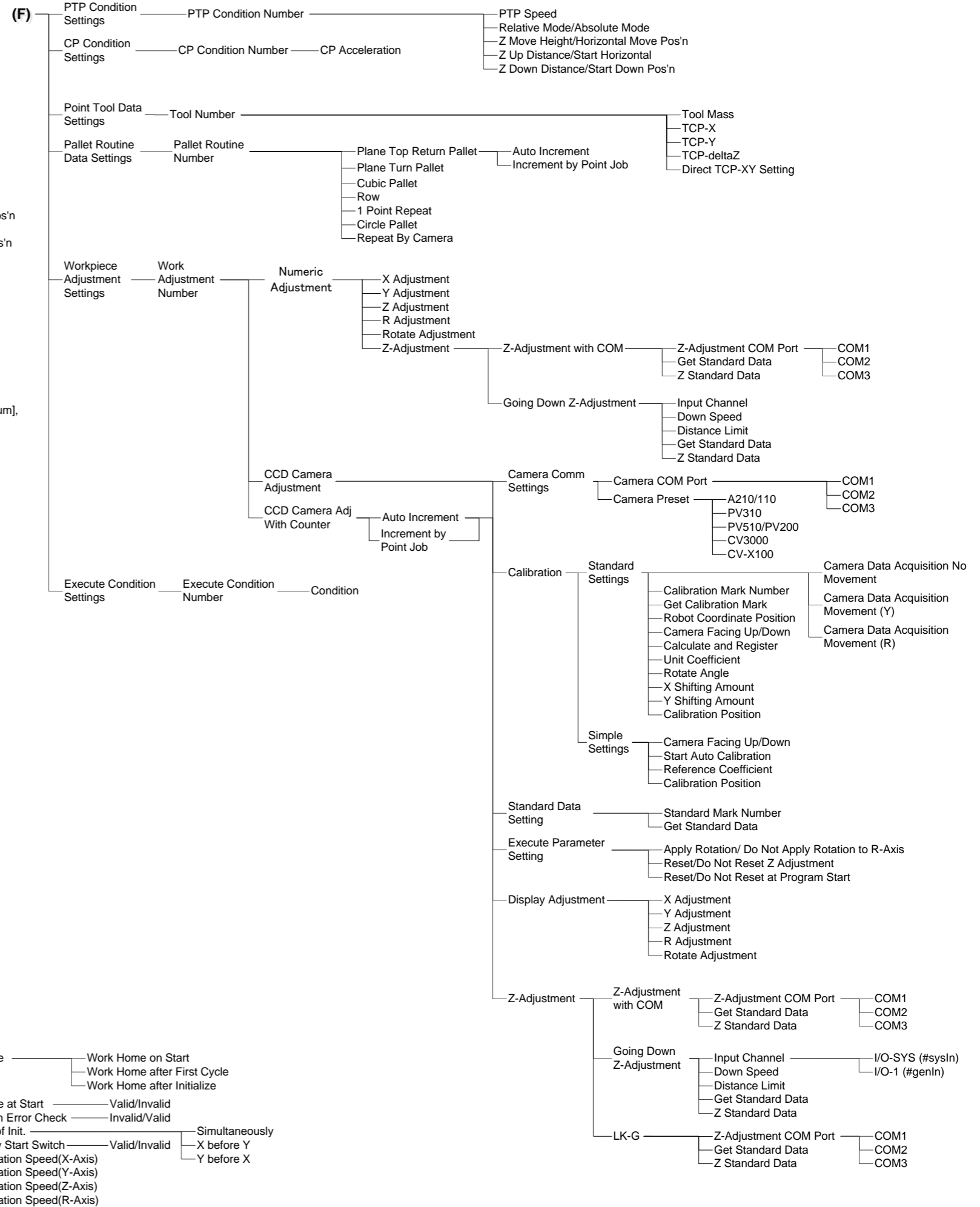
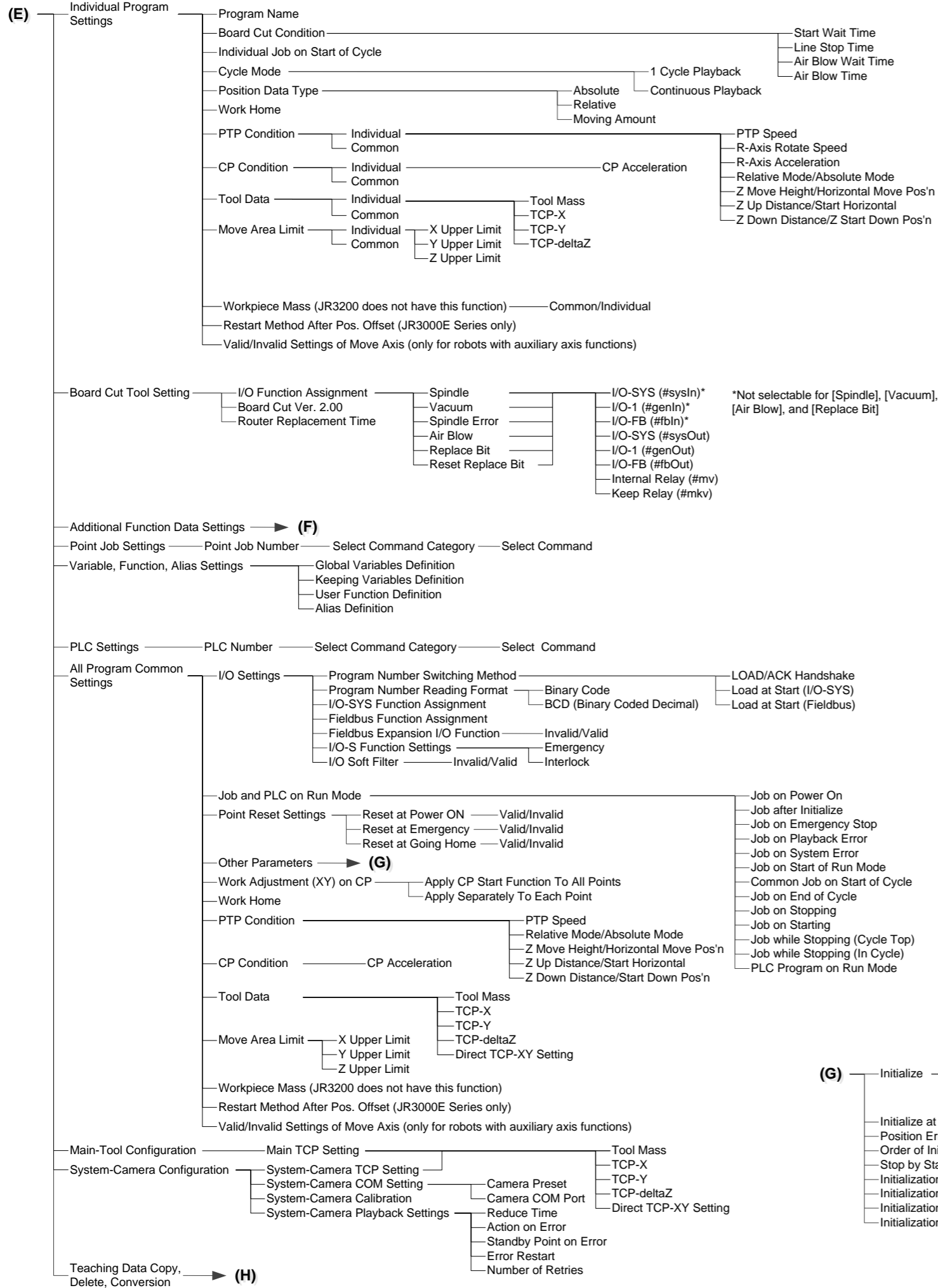
- Accuracy cannot be guaranteed as the value depends on the PCB material, thickness, size of the cutter, line speed and other such conditions.
- The cutting position error value in the table above, is the average value measured under the following conditions:
Cutter diameter: ϕ 0.8 mm
Line speed: 10 mm/s
PCB material: Glass epoxy resin
PCB thickness: 1.6 mm
- The position error occurs on the left side of the cutting direction.



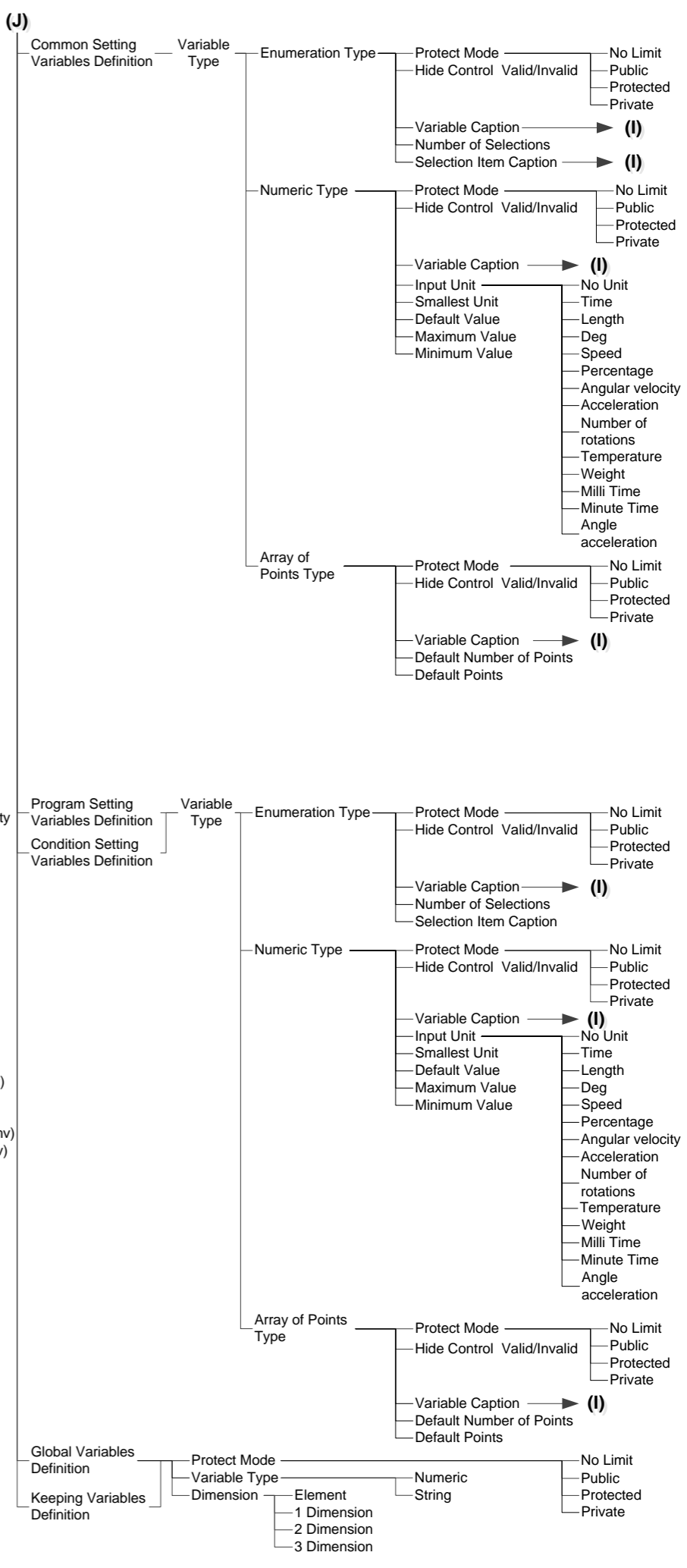
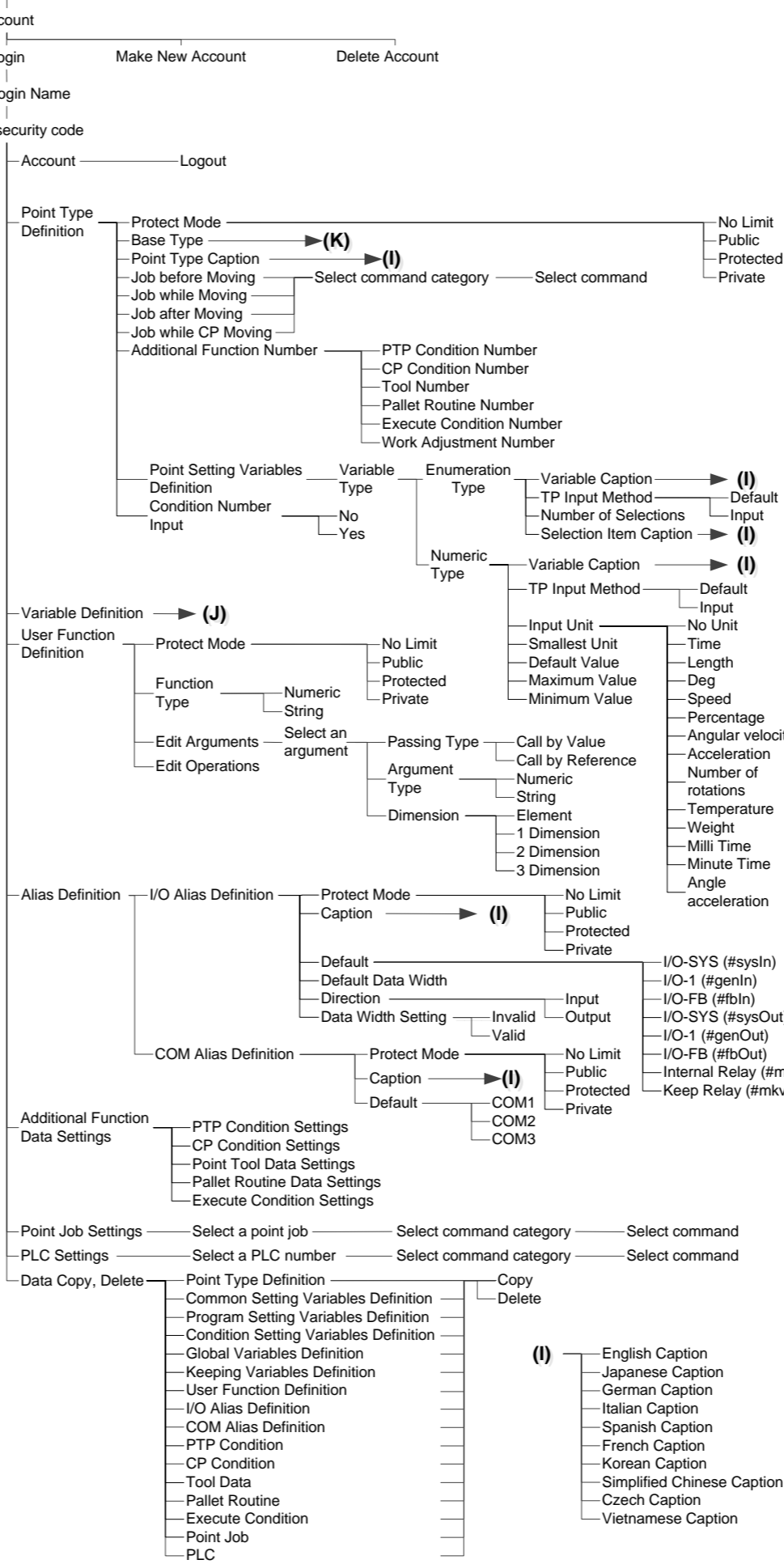
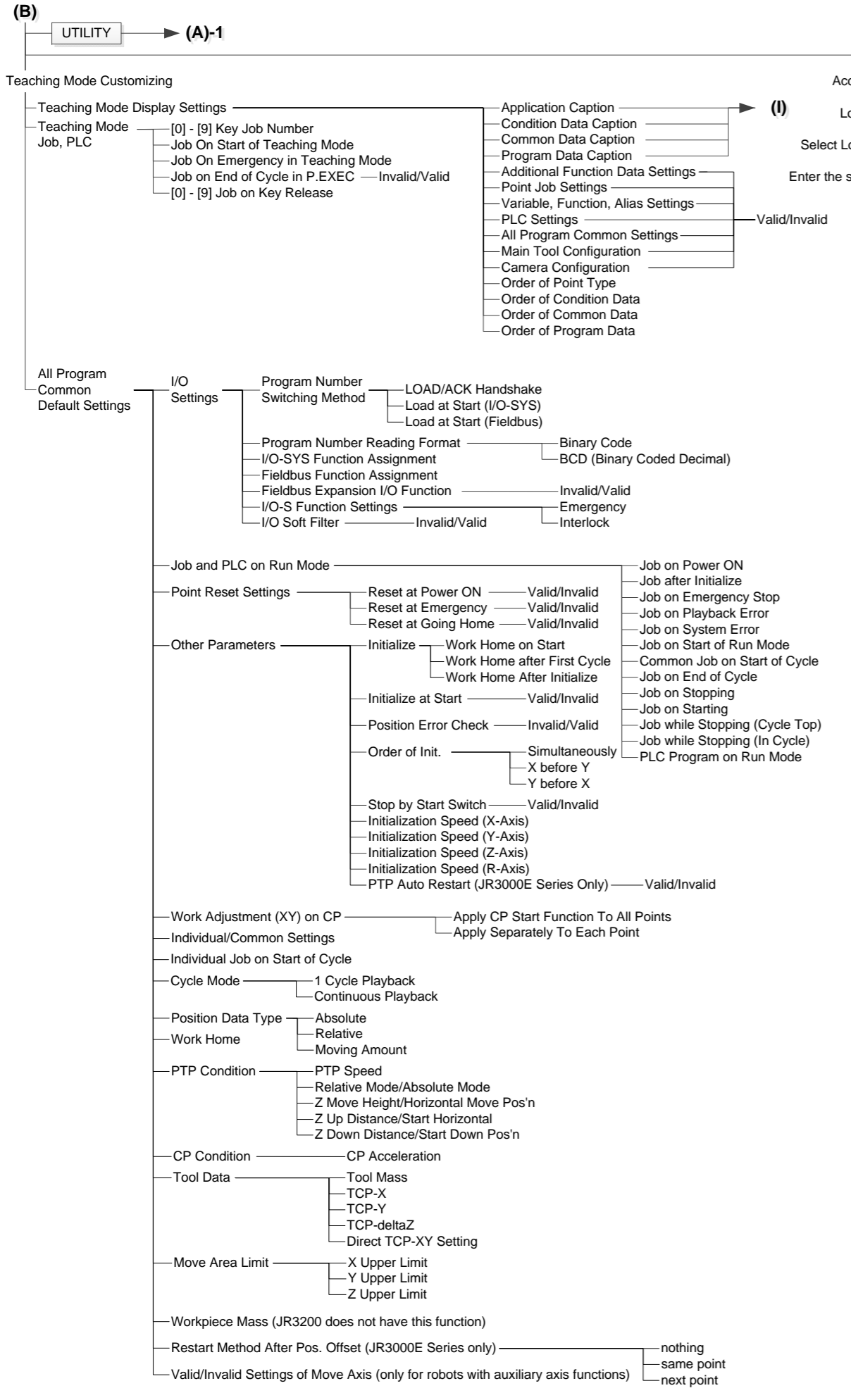
Operation Flowchart (Depaneling Specifications) Ver.5.0x 1/4



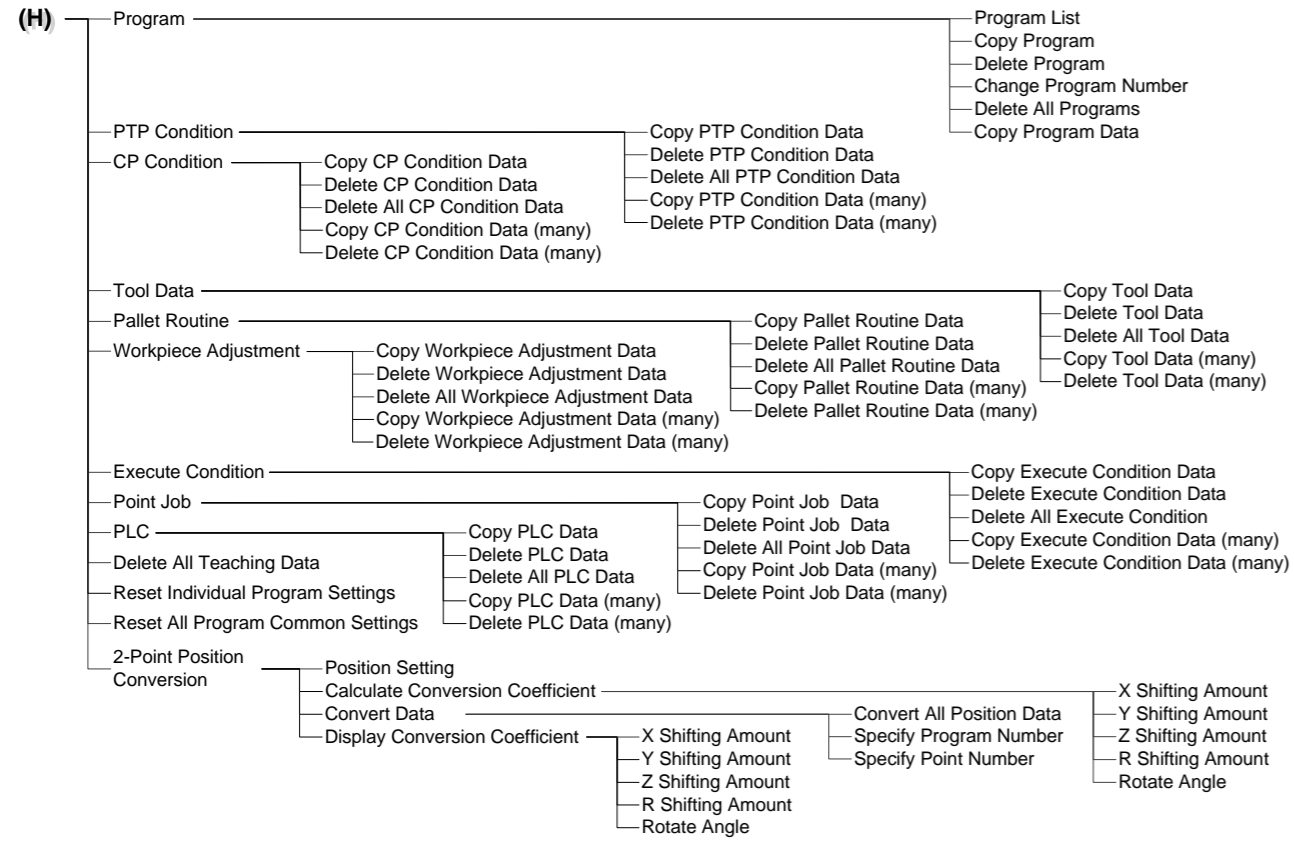
Operation Flowchart (Depaneling Specifications) Ver.5.0x 2/4



Operation Flowchart (Depaneling Specifications) Ver.5.0x 3/4



Operation Flowchart (Depaneling Specifications) Ver.5.0x 4/4



- (K)**
- Cut Start Point
 - Cut Relay Point
 - Cut Arc Point
 - Cut End Point
 - Cut Circle Start Point
 - Cut Circle Center Point
 - PTP Point
 - CP Start Point
 - CP Passing Point
 - CP Stop Point
 - CP Arc Point
 - CP End Point
 - PTP Evasion Point
 - Circle Start Point
 - Single Camera Shoot Point
 - Multi Camera Shoot Point
 - Double Camera Shoot Point 1
 - Double Camera Shoot Point 2
 - Standby Point on Error

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170834104 as of 2017-04

Japanese Ver. 2017-04