

AUTO-SOLDERING SYSTEM HU-200 Instruction Manual



Thank you very much for purchasing the HAKKO HU-200.

The HAKKO HU-200 is a soldering robot system.
This manual explains how to use the HAKKO HU-200 and the software.
Be sure to read this manual before operating the HAKKO HU-200.

Keep this manual readily accessible for reference.



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1. Set Components

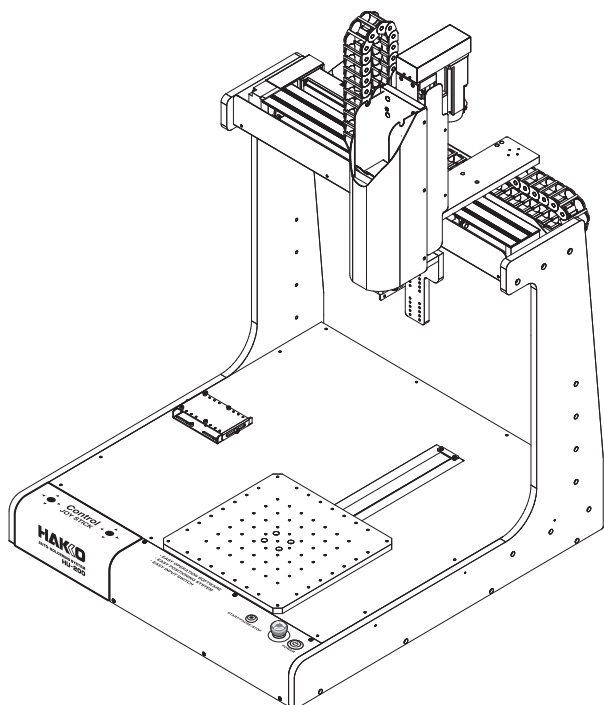
1-1 Packing List

Product Name	Product Number	Configuration Information
HAKKO HU-200 (robot)	—	p. 2
Power cord	—	p. 2
USB cable	BX1062	p. 2
Cleaner	CX1003	p. 3
HAKKO FU-601	—	p. 3
Soldering unit mount	CX5004	p. 4
Soldering unit fixture base	CX5002*1	p. 4
Cleaner base	CX5003*1	p. 4
Feeder unit	CX5005	p. 4
Solder reel support shaft	—	p. 2
Feeder cable: 4 m	BX1045*1	p. 2
Tube unit Φ 0.3 – 1.0	BX1055	p. 2
Tube unit Φ 1.2 – 1.6	BX1042	p. 2
Tube unit B Φ 0.3	BX1054	p. 2
Tube unit B Φ 0.5 – 1.0	BX1052	p. 2
Tube unit B Φ 1.2 – 1.6	BX1053	p. 2
PC	—	p. 4
Attachment holder (for tablet PC)	—*1	p. 2
Display arm (for tablet PC)	—*1	p. 2
Instruction manual (CD-ROM)	—	p. 2
Quick manual (Installation and Connection)	—	p. 2
Quick user guide (PC software)	—	p. 2
I/O cable (for cleaner)	—	p. 2
Relay cord (1.5 m)	—	p. 2

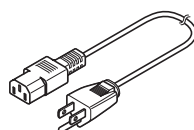
1. Set Components (continued)

1-2 HAKKO HU-200

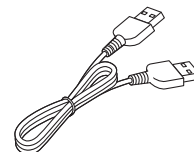
HAKKO HU-200 (robot)	1	Instruction manual (CD-ROM)	1
Power cord	1	Quick manual (Installation and Connection)	1
USB cable (BX1062)	1	Quick user guide (PC software)	1
Solder reel support shaft	1	I/O cable (for cleaner)	1
Feeder cable 4 m (BX1045)*1	1	Attachment holder*1	1
Tube unit Φ 0.3 – 1.0 mm (BX1055)	1	Display arm*1	1
Tube unit Φ 1.2 – 1.6 mm (BX1042)	1	Relay cord 1.5m	1
Tube unit B Φ 0.3 mm (BX1054)	1		
Tube unit B Φ 0.5 – 1.0 mm (BX1052)	1		
Tube unit B Φ 1.2 – 1.6 mm (BX1053)	1		



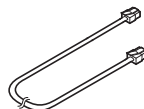
HAKKO HU-200
(robot)



Power cord



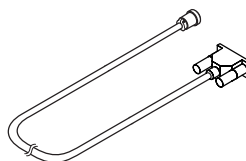
USB cable
(BX1062)



Relay cord 1.5m



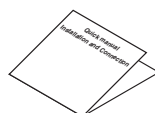
I/O cable
(for cleaner)



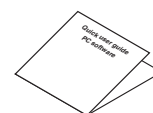
Feeder cable 4 m
(BX1045)



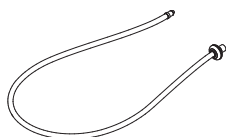
Solder reel support shaft



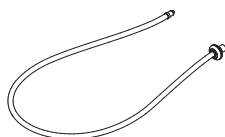
Quick manual
Installation and Connection



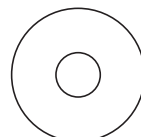
Quick user guide
PC software



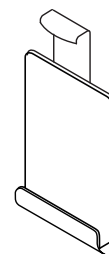
Tube unit
 Φ 0.3 – 1.0 mm
(BX1055)



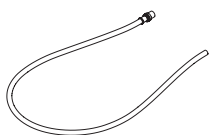
Tube unit
 Φ 1.2 – 1.6 mm
(BX1042)



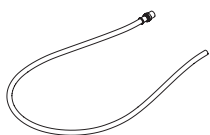
Instruction manual
(CD-ROM)



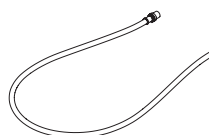
Attachment holder
(for tablet PC)



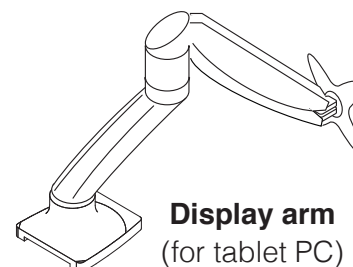
Tube unit B
 Φ 0.3 mm
(BX1054)



Tube unit B
 Φ 0.5 – 1.0 mm
(BX1052)



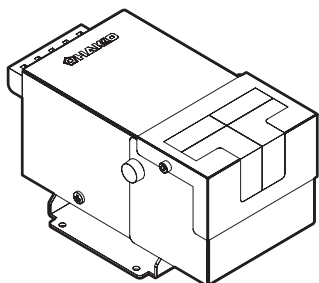
Tube unit B
 Φ 1.2 – 1.6 mm
(BX1053)



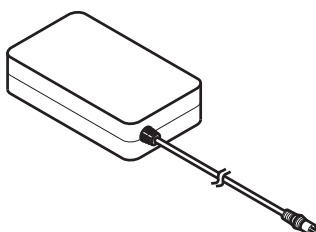
Display arm
(for tablet PC)

1-3 Cleaner (CX1003)

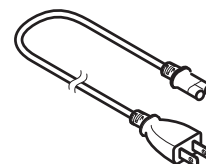
Cleaner (CX1003).....	1	Power cord (for cleaner)	1
AC adapter	1	Instruction manual (for cleaner).....	1



**Cleaner
(CX1003)**



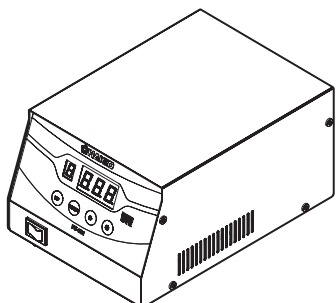
AC adapter



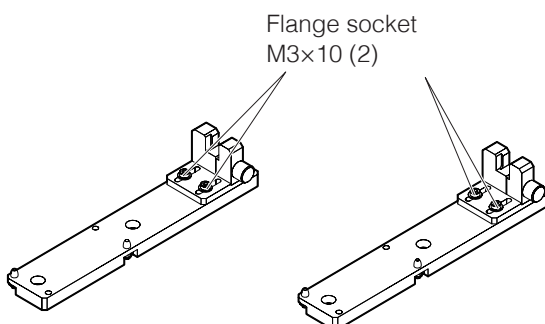
**Power cord
(for cleaner)**

1-4 HAKKO FU-601

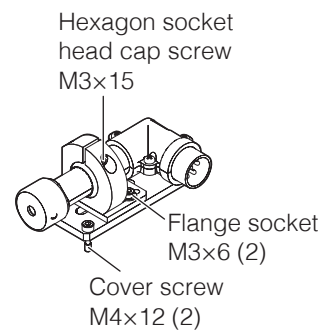
HAKKO FU-601 ^{*2}	1	Feeder unit attachment screw	1
HAKKO FU-6002 (FU6002-01X).....	1	Soldering iron cable 5 m (BX1033) ^{*1}	1
Spatter prevention cover (BX1027).....	1	Relay cord (BX1056).....	1
Soldering unit fixture base (CX5019).....	1	Power cord	1
Tip adjustment jig unit For TX1 series tips (CX5017)	1	Heat-resistant pad	1
For TX2 series tips (CX5018)	1	Instruction manual	1



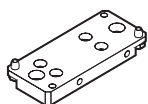
HAKKO FU-601



For TX1 series tips (CX5017) For TX2 series tips (CX5018)
Tip adjustment jig unit



**HAKKO FU-6002
(FU6002-01X)**



**Soldering unit fixture base
(CX5019)**

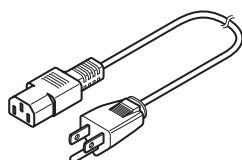


**Spatter prevention cover
(BX1027)**

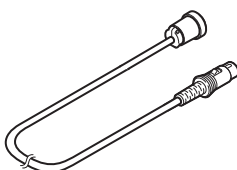


Feeder unit attachment screw

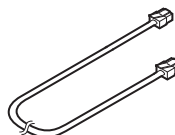
Hexagon socket head cap screw M3 x 30 (2)



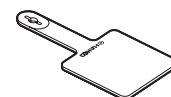
**Power cord
(for HAKKO FU-601)**



**Soldering iron cable 5 m
(BX1033)**



**Relay cord
(BX1056)**

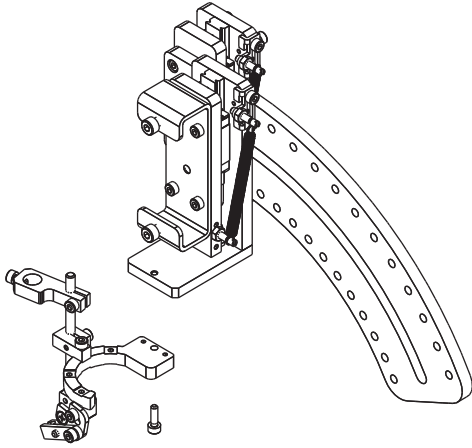


Heat-resistant pad

1. Set Components (continued)

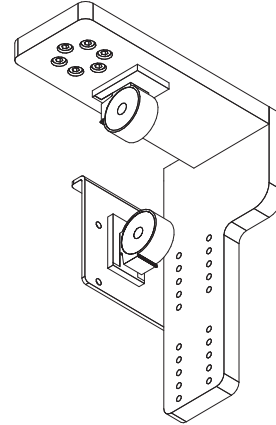
1-5 Soldering Unit Mount (CX5004)

Soldering unit mount (CX5004) 1



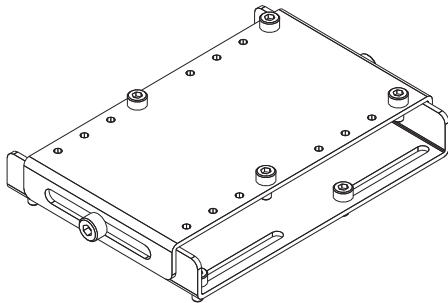
1-6 Soldering Unit Fixture Base (CX5002)

Soldering unit fixture base (CX5002)*1 1



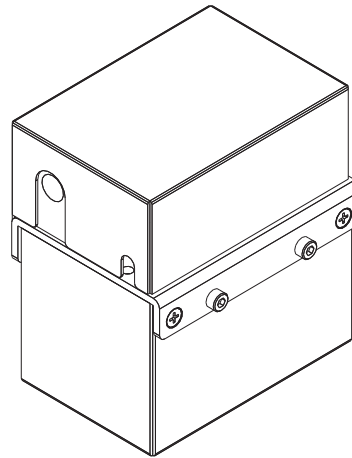
1-7 Cleaner Base (CX5003)

Cleaner base (CX5003)*1 1



1-8 Feeder Unit (CX5005)

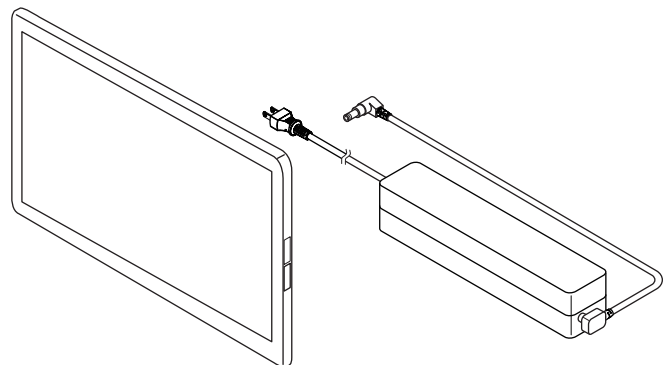
Feeder unit (CX5005)*3 1



1-9 PC

Tablet PC (Windows 10 Professional) 1

Power cord 1



*1 This system is shipped with it attached to the robot main body.

*2 Tips are sold separately. Refer to "11. Parts List" (p. 136) in this manual or to "Tip Types" in the instruction manual of HAKKO FU-601.

*3 Solder feed pulley units, solder feed guide sets and Teflon tubes are sold separately. For further details, refer to "11. Parts List" (p. 136).

2. Specifications

2-1 Specifications for Each Model

2-1-1 Robot

Power supply	AC100 – 240V 50/60Hz	
Power consumption	300W	
Movable range (stroke)	X	400 mm
	Y	300 mm
	Z	200 mm
	θ	$\pm 200^\circ$
Drive system (motor type)	X	Servo motor
	Y	
	Z	
	θ	
	Solder feed	Stepping motor
Position detection method	Absolute encoder	
Payload capacity	Y (workpiece)	20kg
Speed	X	1 – 800 mm/s
	Y	
	Z	
	θ	1 – 800°/s
Repeatable position accuracy	X	± 0.01 mm
	Y	
	Z	
	θ	$\pm 0.01^\circ$
Allowable voltage range	AC100 – 240V 50/60Hz $\pm 5\%$	
Noise level	56dB	
Operating environment	Ambient temperature range	0 – 40 °C (No condensation or freezing)
	Ambient humidity range	85% RH or less (No condensation or freezing)
	Use atmosphere	No corrosive or combustible gas No excessive dust
Outside dimensions	600 (W) × 910 (H) × 650 (D) mm	
Weight	50 kg	
External I/O	Input: 20	
	Output: 12 (NPN type) (including 2 for cleaner)	
External interface	USB × 4 (including one port for PC)	
Z axis solenoid brake release button	Provided on left side of Z axis	

2. Specifications (continued)

2-1-2 HAKKO FU-601

Station	
Power supply	AC 100V 50/60 Hz
Power consumption	300 W
Settable temperature range^{*1}	50 – 500 °C
Temperature Stability	Unloaded condition ± 5 °C at idle
Output	AC 29 V
Outside dimensions	145 (W) × 107 (H) × 211 (D) mm
Weight	4 kg
Soldering Iron Unit (HAKKO FU-6002)	
Power consumption	260 W (29V)
Tip to ground resistance	< 2 Ω
Leakage voltage	< 2 mV
Cord length	5 m
Overall length^{*2, *3}	168 mm
Weight^{*2}	134 g (173 g including soldering unit fixture base)

*1 Displayed temperatures are temperatures measured using HAKKO FG-101.

*2 When used with tip 4XD

*3 Dimension can be adjusted within a ± 5 mm range.

This product is protected against electrostatic discharge.

Settable ranges for solder feed^{*2-4}

Number of solder feed programs	Maximum of 250 programs
Solder feed length	0.1 – 99.9 mm
Solder feed speed	0.1 – 99.9 mm/s ^{*1}
Solder back feed length	0 – 20.0 mm
Solder back feed speed	0 – 99.9 mm
Heat time	0.1 – 9.9 sec

*1 Depending on the type of solder, it may not be possible to feed solder normally at high speed. In such cases, contact the dealer where you purchased the product.

*2 The values in the table above are for primary soldering.

*3 For secondary and tertiary soldering, all values can be set starting from 0. If no feed speed is set for secondary soldering, that operation will be canceled. For other values, setting any of the values to 0 or blank will skip all subsequent operations.

*4 For DS (drag soldering), if a condition in which the secondary feed length is set is selected, the secondary feed length setting will be ignored.

2-1-3 Feeder Unit (CX5005)

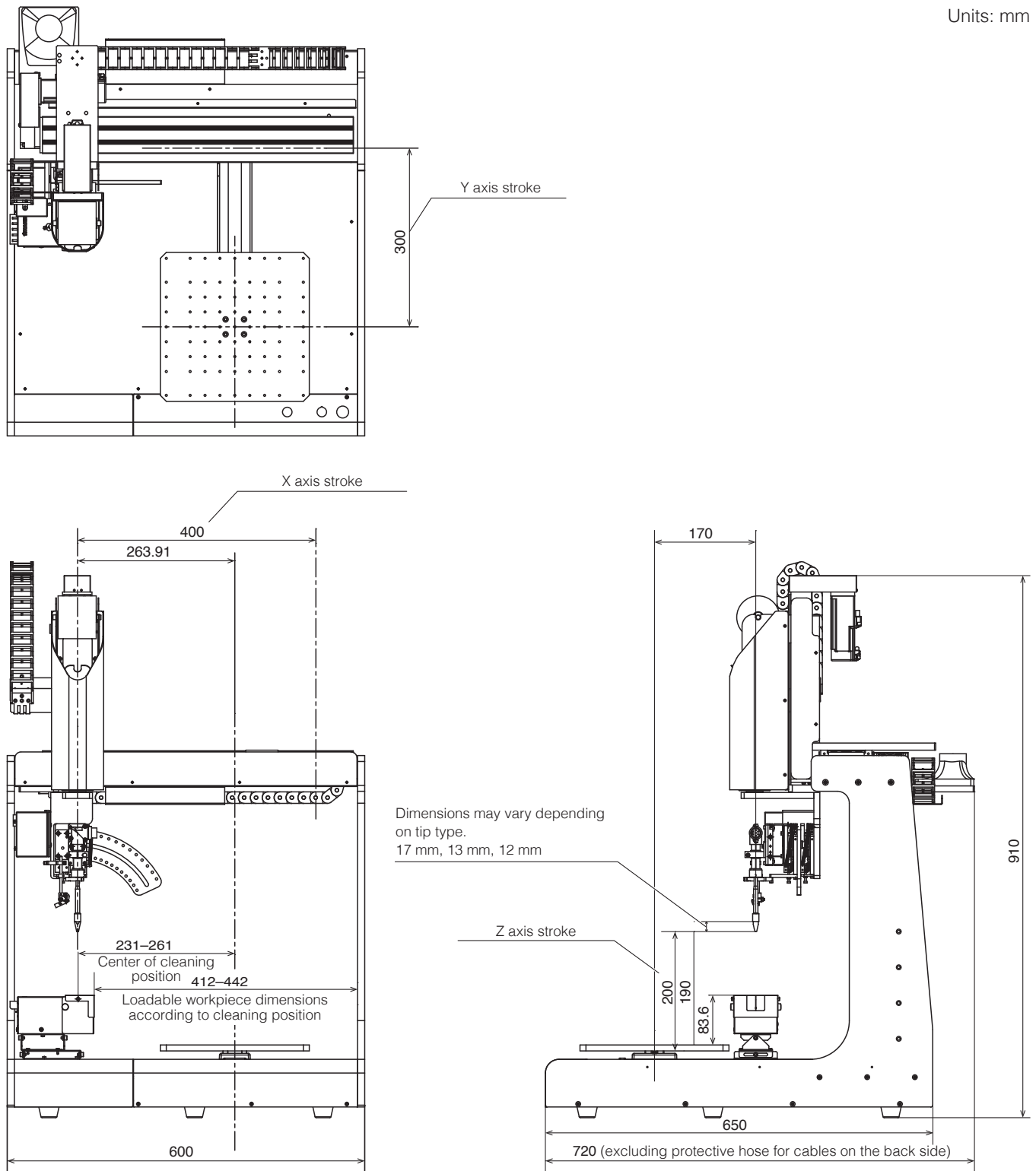
Usable solder wire diameter	0.3, 0.5, 0.6 (0.65), 0.8, 1.0, 1.2, 1.6 mm
------------------------------------	---

- A spool of up to 1 kg of solder can be installed.
- A solder feed pulley unit, solder feed guide set, and Teflon tube are necessary for use. These are sold separately and should be purchased according to the diameter of the solder which will be used.

2-2 Part Dimensions

2-2-1 Robot

Units: mm

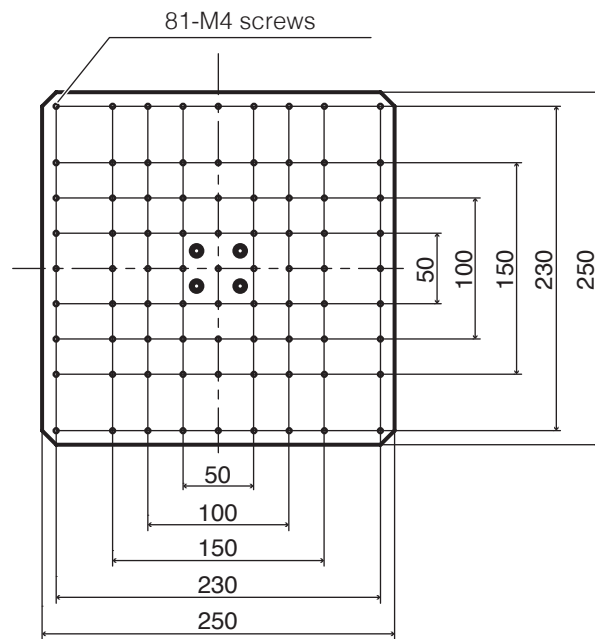


— Note —

Specifications and design are subject to change without notice.

2. Specifications (continued)

2-2-2 Jig Table



3. Warnings, Cautions and Notes

⚠ WARNING

In this manual, items requiring caution are classified into 2 categories, “WARNINGS” and “CAUTIONS”, as defined below. Please make sure to understand these items before reading the main text.

⚠ WARNING: Failure to comply with a WARNING may result in serious injury or death.

⚠ CAUTION: Failure to comply with a CAUTION may result in injury to the operator, or damage to the objects involved.

Note: Indicates important steps or items in the procedure being explained.

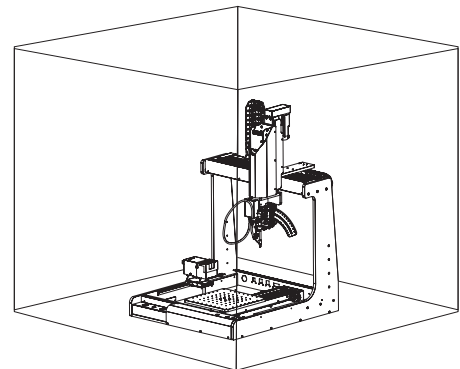
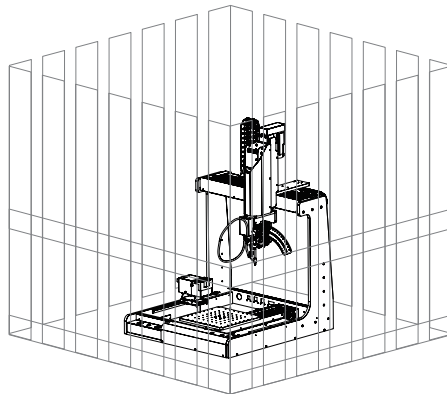
In Article 59 of the Industrial Safety and Health Act, Article 36 of the Labor Safety and Health Regulations, and related laws, special training for safety and health must be given to workers who direct, inspect, or adjust industrial robots. Be sure that such special training is provided to the workers involved in such activities.

⚠ WARNING

During operation

There is a risk of death or injury if a person comes in contact with the robot while it is operating. Take safety measures (such as installation of a safety enclosure) to prevent workers from entering the robot’s range of movement during operation.

Safety enclosure: If there is no safety enclosure, indicate the robot’s range of movement and take necessary safety measures.



Installation/transportation

- When transporting the robot, it should be carried by at least 2 people, or a cart, hand truck, etc. should be used.
- When performing work involving 2 or more people, be sure that the relationship between the leader and subordinates is clear, and perform work while giving voice instructions to each other to ensure safety and prevent dangerous contact or falls.
- Install the robot on a flat surface and secure it in place to prevent the robot from tipping over or falling.
- Do not climb on top of the robot or use it as a step.
- When moving the robot, be sure to secure its movable parts before moving.
- Be sure that the main power supply is switched off when installing the robot and performing wiring, and check that wiring has been performed properly.
- When using externally connected devices such as emergency stop equipment, etc., check that they operate correctly before use.

3. Warnings, Cautions and Notes (continued)

WARNING

During automatic operation

- Check the safety of the surrounding area before starting operation.
- Provide indications that the robot is in operation and be careful that no one enters the safety enclosure during operation.
- When workers have entered the safety enclosure, take measures to enable emergency stopping.

During work

- When performing work inside the safety enclosure, notify nearby workers that work is being performed and display a “Working” sign, etc. in an easily visible location.
- When work will be performed inside the safety enclosure, before starting work check whether or not external wires are equipped with insulation or shielding, whether or not there are abnormalities in the operation of moving sections, and that there are no abnormalities in the operation of emergency stop equipment, etc.
- When training work, inspection, etc. is being performed, be sure that workers perform the work thoroughly.
- To enable operation to be immediately stopped in the event of a dangerous condition, perform work within reach of an emergency stop button, or install emergency stop devices close at hand.
- If a dangerous situation occurs, press the emergency stop button (button of emergency stop device) immediately.
- When work is being performed by multiple workers, perform work while giving voice instructions to each other and while checking safety to prevent other workers from performing careless operations during the work.
- When inspecting or replacing parts that do not require operation, switch off the main power supply before performing such work.

Other

- Do not use near flammable, inflammable, explosive, or corrosive gases or materials.
- If the product will not be used for a long period of time, unplug the power plug.
- Do not touch metal parts near the tip while the tip is at high temperatures.
- Since there is a danger of fingers getting pinched, keep your fingers away from moving sections (X, Y, Z, and θ axes).
- When performing repairs or replacing parts, be sure to unplug the power plug and wait for the soldering iron to cool down before performing such work.
- Do not allow disassembly or repair to be performed by workers other than qualified repair technicians. Also, do not modify the product.

CAUTION

- Since the door (cover) of the JOY STICKS may become detached, be careful not to hold onto the door (cover).
- When transporting the product, be careful not to hold it by the X axis section. Doing so may result in damage to the product.
- Be sure to ground the product during use.
- Attach only HAKKO-specified accessories to the robot, and do not use this product for applications other than soldering.
- Ensure safety by wearing a helmet, protective gloves, safety glasses, and safety shoes when necessary.
- Do not subject the product to strong impact.
- Product should be installed so that sufficient working space to safely perform preventive maintenance, etc. can be secured.
- Be sure to ground the product during use.
- Be sure to provide sufficient illumination to perform work safely. (JIS Z9110 specifies 300 to 750 lux.)
- Be sure to use the product only in the specified use environment. Use in high-temperature high-humidity regions or in cold high-altitude regions may not provide sufficient performance.
- Do not touch the product with wet hands or use the product when the main body or cords are wet.
- If the product becomes abnormally hot or emits smoke, abnormal odors, or abnormal noise, stop use immediately and set the power switch to off.
- When use is interrupted or completed, set power switch to off.
- Always hold the power plug when plugging it in or unplugging it.
- Do not place the cord close to heat, oil, or objects with protruding corners.
- Do not forcibly bend, pull on, or twist the cord.
- Do not use the cord if the plug is damaged or if it is loose in the electrical outlet.
- The cutting blade has a sharp edge. Be careful not to cut your hands, etc. on it.
- If cut flux-containing solder is not used for a long time, the flux characteristics may deteriorate.
- Since the flux characteristics of cut solder inside the guide pipe may deteriorate due to the heat of the soldering iron, it should be used quickly.
- Do not bend the guide pipe or forcibly turn it. Doing so may cause it to break.
- Do not fold the tube or bend it at a sharp angle. Doing so may cause it to become clogged with solder.
- If solder or flux sticks to the cutting blade or pulley, use a brush, etc. to remove it.
- Periodically remove the guide pipe and Teflon tube and clean off any flux that is stuck on.

3. Warnings, Cautions and Notes (continued)

About Batteries (for backup AX1004)

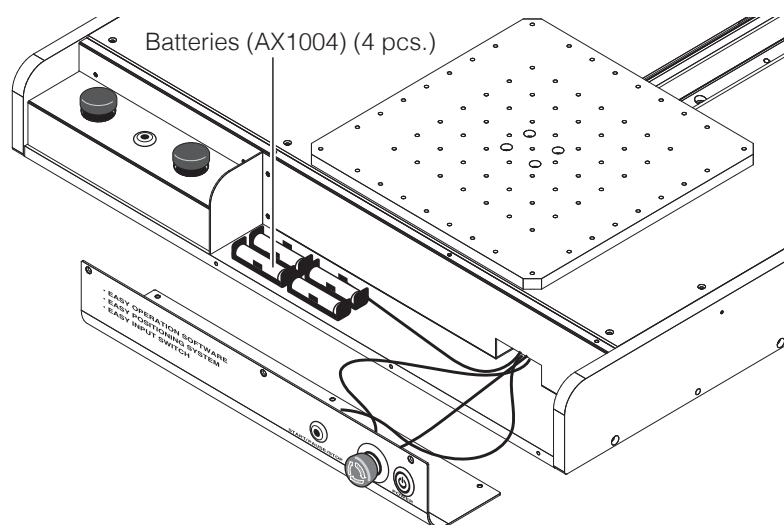
Please be sure to replace batteries (AX1004) before end of service life.

The battery (AX1004) will be depleted when all power supply is turned off or the main supply on the back side is turned on and the power supply button on the front panel is turned off.

Battery (AX1004) life Approx. 6500 hours (approx. 9 months)

Use the above information as a reference for the service life of the battery (AX1004).

However, the duration of the charge varies depending on the use environment and ambient temperature.



⚠ CAUTION

If the battery (AX1004) runs out, the position information for each axis will be lost and the product will not operate normally.

Always be sure to have a new battery (AX1004) on hand and replace the battery (AX1004) before it runs out.

If battery (AX1004) has run out:

If the battery (AX1004) has run out, please consult the sales office or distributor since it will be necessary to set the position information again from the start.

Refer to “8-4 How to replace batteries (for backup AX1004)” (p. 131) for the procedure for replacing batteries (AX1004).

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3. Warnings, Cautions and Notes (continued)

4. Disclaimer

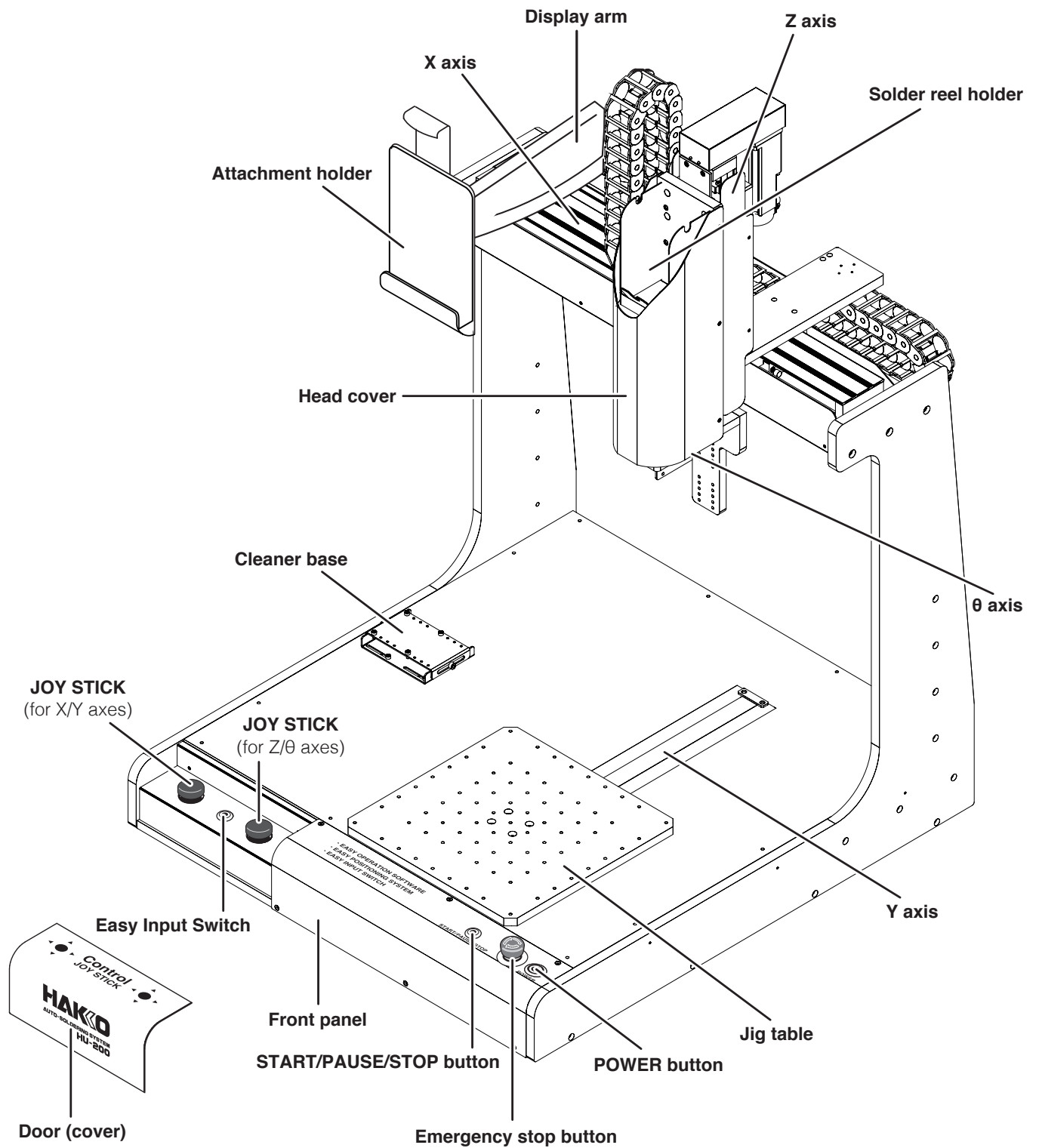
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5. Miscellaneous

This Agreement shall be governed by the laws of Japan, and Osaka District Court shall have exclusive primary jurisdiction with respect to all disputes arising out of this Agreement.

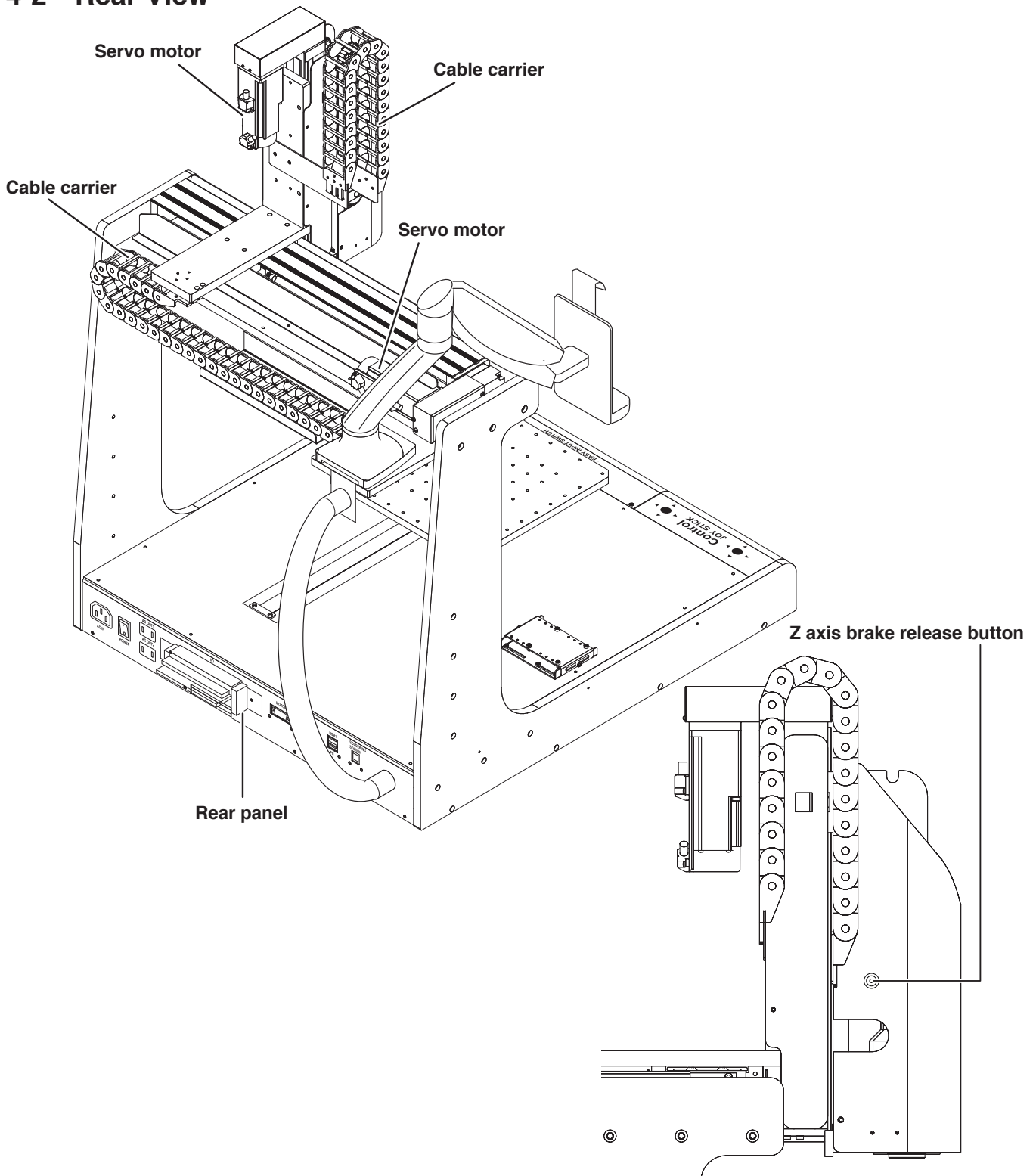
4. Part Names

4-1 Front View



4. Part Names (continued)

4-2 Rear View



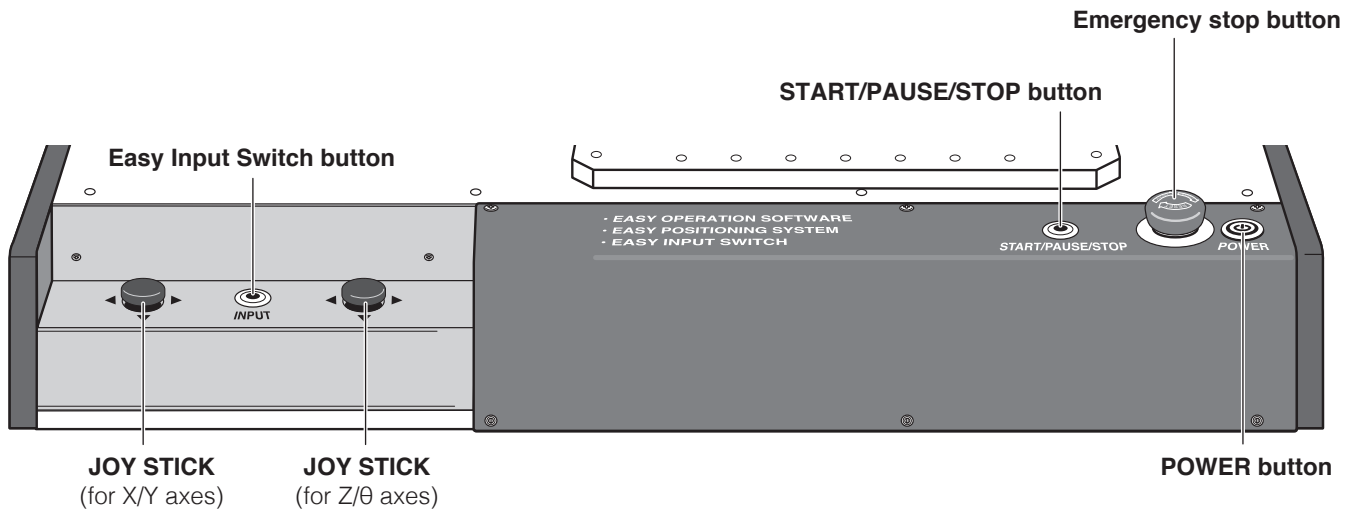
Z axis brake release button

If the **Z axis brake release button** is pressed while the equipment is in emergency stop condition while the application is running, the solenoid brake will be set to off.

⚠ CAUTION

**There is a danger of the Z axis dropping when the solenoid brake is set to off.
Be sure to support the Z axis before setting the solenoid brake to OFF.**

4-3 Front Panel



JOY STICK (for X/Y axes)

Moves the X axis and Y axis manually. For movement direction, refer to the diagram. For operation details, see “7-2 JOG Operation” (p. 57).

JOY STICK (for Z/θ axes)

Moves the Z axis and θ axis manually. For movement direction, refer to the diagram. For operation details, see “7-2 JOG Operation” (p. 57).

Easy Input Switch button

Pressing the Easy Input Switch will set the current coordinates as the soldering start point or end point. For operation details, see “7-4 Solder Installation and Solder Feed Settings” (p. 69).

START/PAUSE/STOP button

Runs, pauses, and stops the program. For operation details, see “7-6 Running a Program” (p. 93).

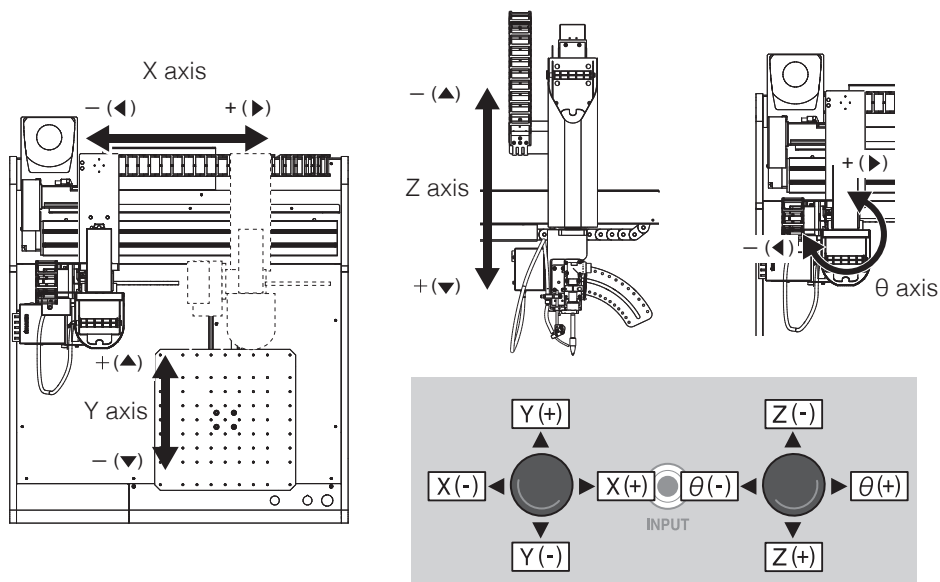
Emergency stop button

Sets the equipment to emergency stop condition. Turn clockwise to cancel this condition.

POWER button

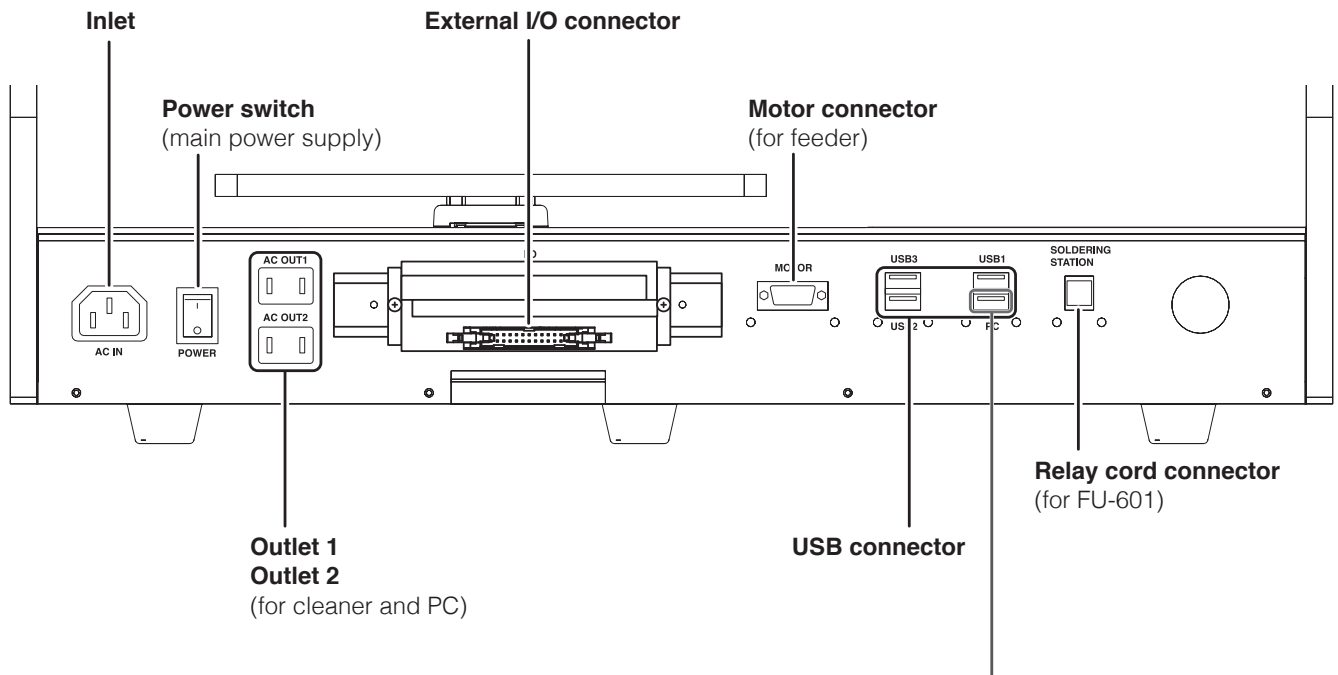
Button to switch the secondary-side power on and off.

JOY STICK operation and axis movement directions



4. Part Names (continued)

4-4 Rear Panel



⚠ CAUTION

Even if the cable is plugged into a USB connector other than the USB connector for PC (lower right), connection between the PC and robot will not be achieved.

5. Installation

5-1 Cautions on Installation

Install the robot on a level surface.

⚠ WARNING

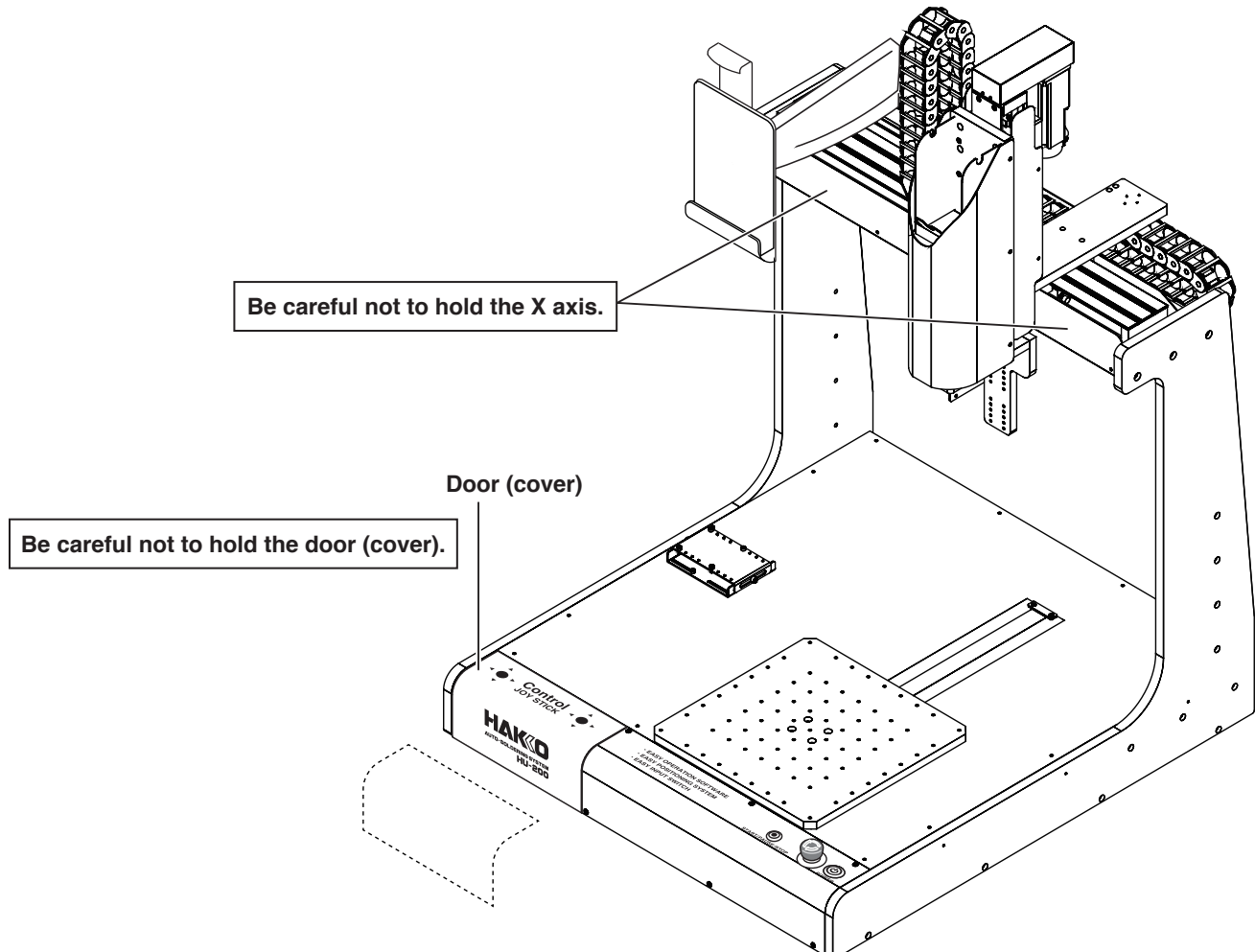
- When transporting the robot, it should be carried by at least 2 people, or a cart, hand truck, etc. should be used.
- When performing work involving 2 or more people, be sure that the relationship between the leader and subordinates is clear, and perform work while giving voice instructions to each other to ensure safety and prevent dangerous contact or falls.
- Secure the robot in place to prevent the robot from tipping over or falling.

⚠ CAUTION

- Since the door (cover) of the JOY STICKS may become detached, be careful not to hold onto the door (cover).
- When transporting the product, be careful not to hold it by the X axis section. Doing so may result in damage to the product.

5-2 Attaching Accessories to the Robot

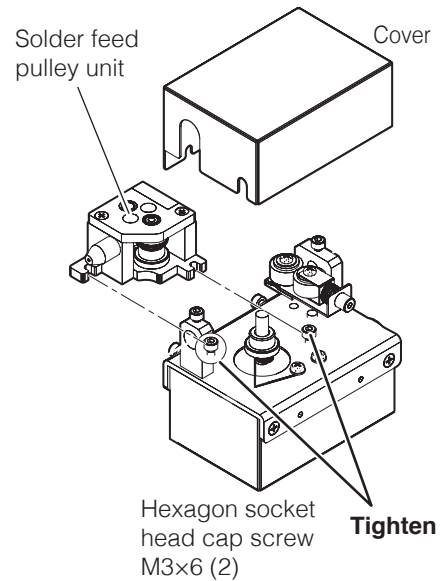
At the time of shipment, the robot is as shown below.



5. Installation (continued)

5-2-1 Attaching the Feeder Unit (CX5005)

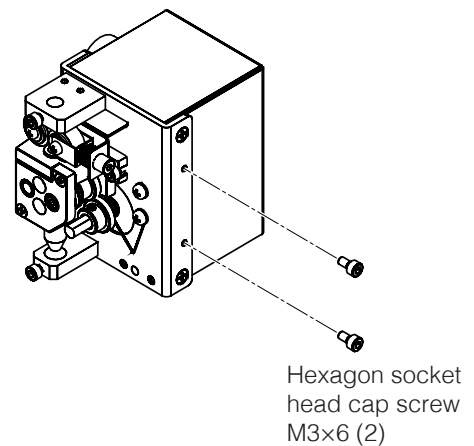
1. Open the cover of the feeder unit (CX5005), attach the solder feed pulley unit to the feeder unit (CX5005), and tighten the screws indicated in the diagram.



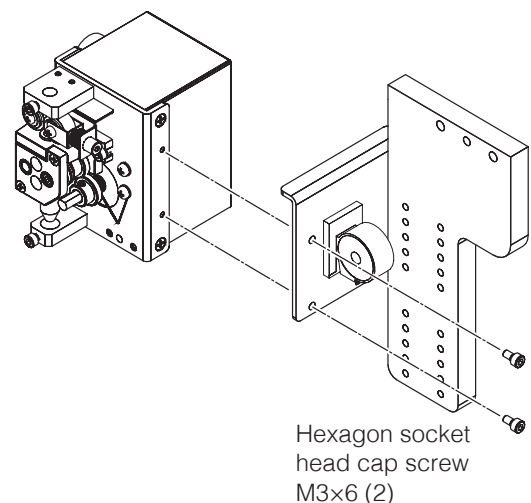
⚠ CAUTION

Do not touch any hexagon socket head cap screw other than those indicated in this manual. Also, be careful not to overtighten the screws. The attachment method of the solder feed pulley unit for $\Phi 0.3$ mm solder (BX1000) is different. Refer to “Solder setting method” included with the BX1000.

2. Remove the hexagon socket head cap screws of the feeder unit (CX5005).

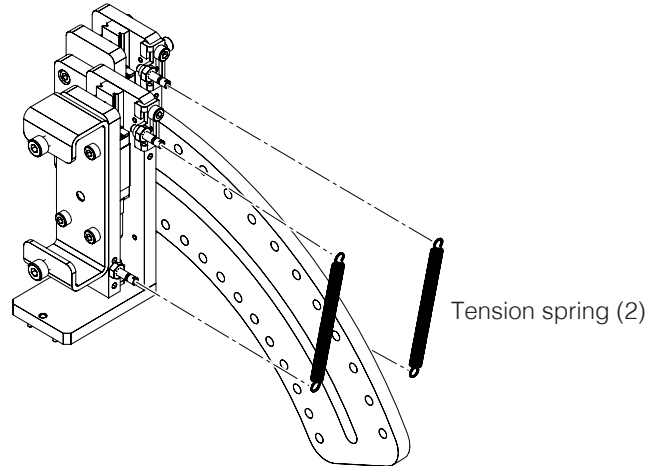


3. Use the removed hexagon socket head cap screws to attach the feeder unit (CX5005) to the soldering unit fixture base.

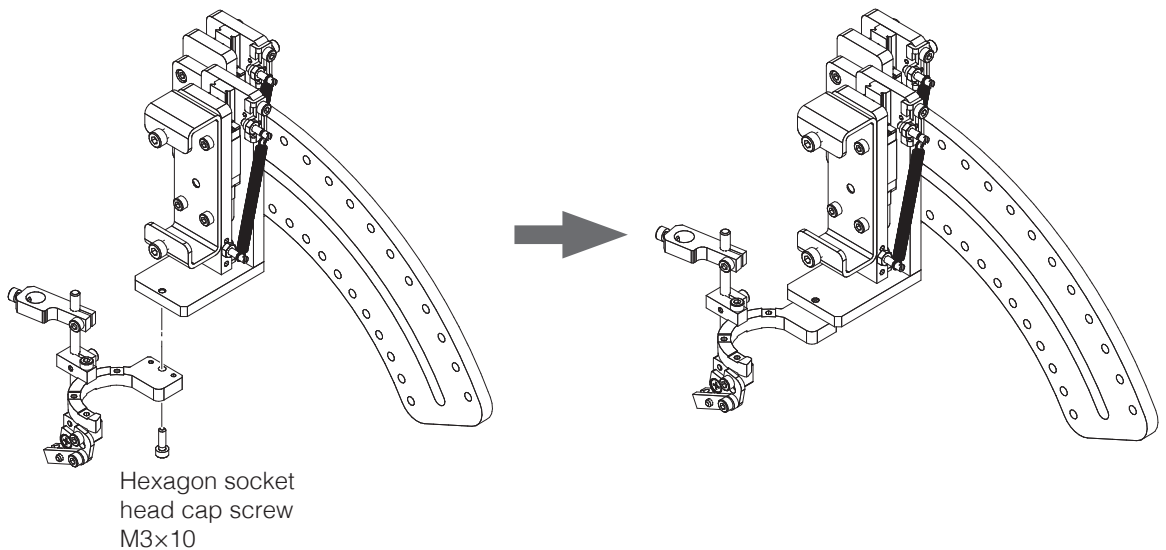


5-2-2 Attaching the Soldering Iron Unit

1. Attach the tension springs included with the soldering unit mount (CX5004) to the soldering unit mount.



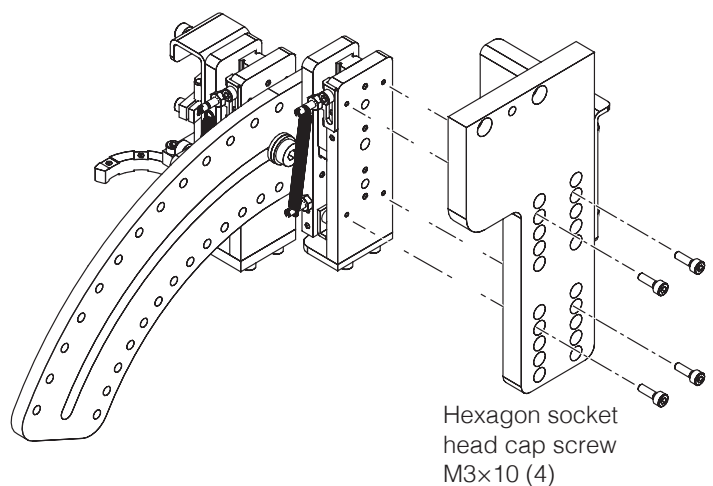
2. Assemble the soldering unit mount (CX5004) using 1 of the hexagon socket head cap screws included with the soldering unit mount.



3. Attach the soldering unit mount (CX5004) to the soldering unit fixture base (CX5002) using 4 of the hexagon socket head cap screws included with the soldering unit mount.

The mounting angle can be set with the soldering unit mount.

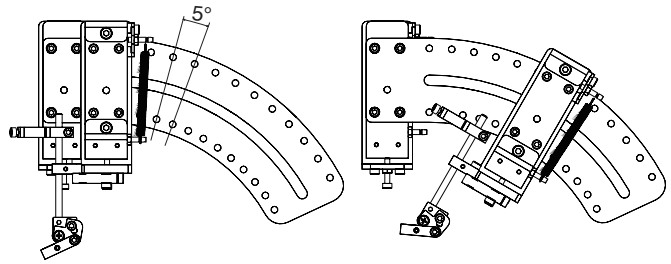
For details, refer to "About the Soldering Unit Mount (CX5004)" (p. 22).



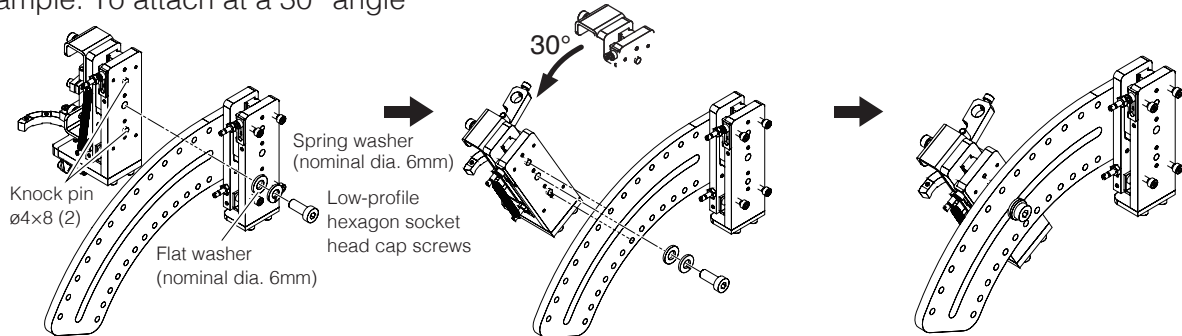
5. Installation (continued)

About the Soldering Unit Mount (CX5004)

The angle of the soldering unit mount (CX5004) for attaching the HAKKO FU-6002 and feeder unit (CX5005) can be changed in 5° intervals.



Example: To attach at a 30° angle



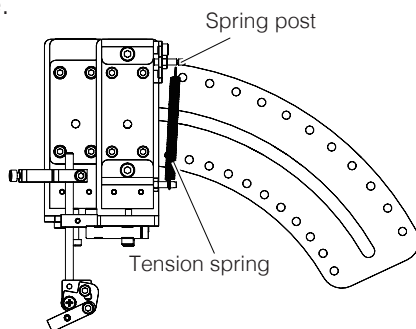
⚠ CAUTION

When changing the angle, be sure that the 2 knock pins are securely in the mounting holes.

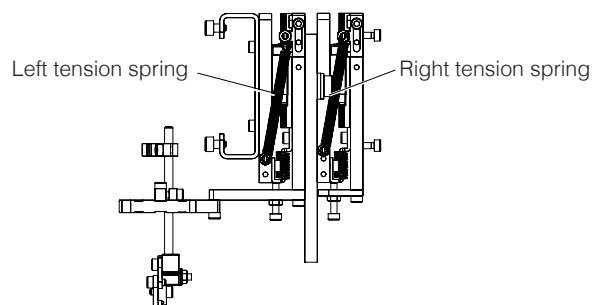
Setting the tension spring positions

Tension springs are included with the soldering unit mount (CX5004).

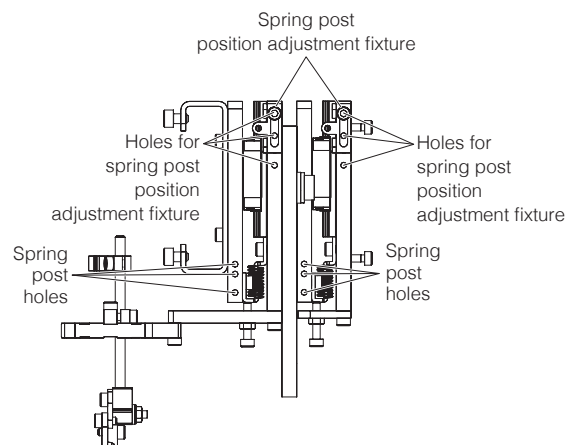
When the angle is changed when attaching the HAKKO FU-6002 and feeder unit (CX5005), change the tension spring attachment positions and adjust the pressure of the tip when it touches the workpiece.



Right-side view of soldering unit mount



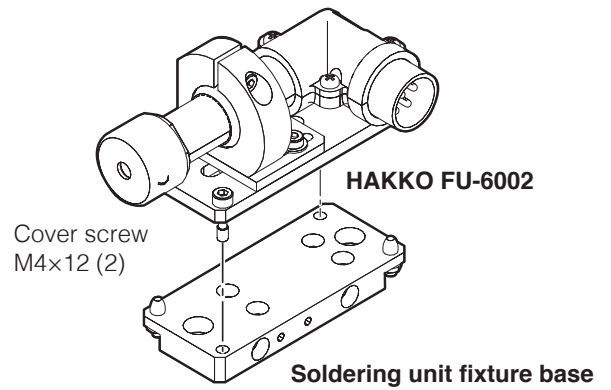
In the right-side view of the soldering unit mount, the right tension spring supports the soldering unit mount (CX5004), feeder unit (CX5005), and HAKKO FU-6002, and the left tension spring supports the feeder unit (CX5005) and HAKKO FU-6002. Insert the spring posts into the spring post holes and attach the tension springs to the spring posts.



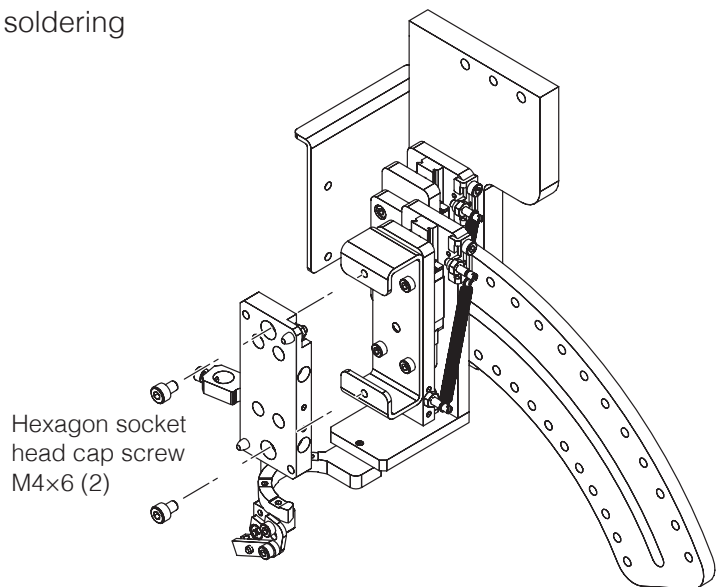
— Note —

The spring post position adjustment fixture can be attached for finely adjusting the pressure of the tip when it touches the workpiece.

4. Remove the soldering unit fixture base included with the HAKKO FU-601 from the HAKKO FU-6002.

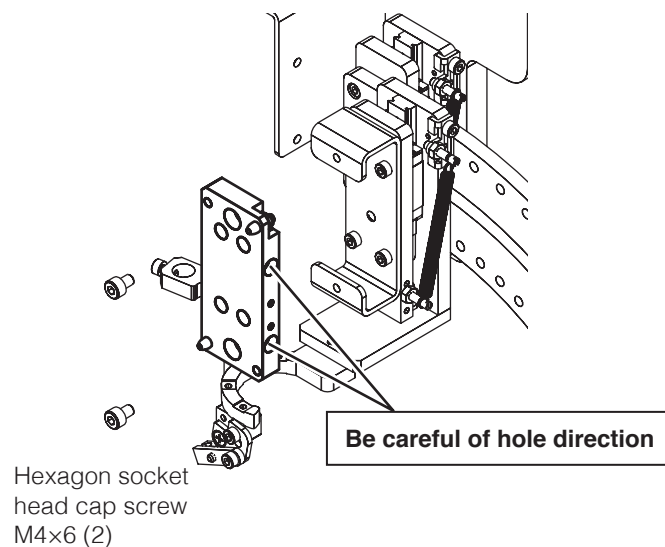


5. Attach the soldering unit fixture base to the soldering unit mount (CX5004).



⚠ CAUTION

Be sure to attach the soldering unit fixture base in the proper orientation. Attach in the orientation shown in the following diagram while paying attention to the hexagon socket head cap screw mounting holes, etc.



5. Installation (continued)

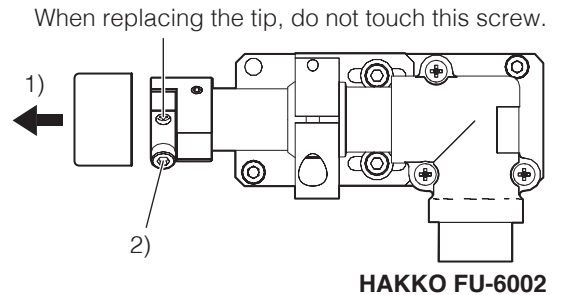
6. Attach the tip (sold separately) to the HAKKO FU-6002 included with the HAKKO FU-601.

⚠ CAUTION

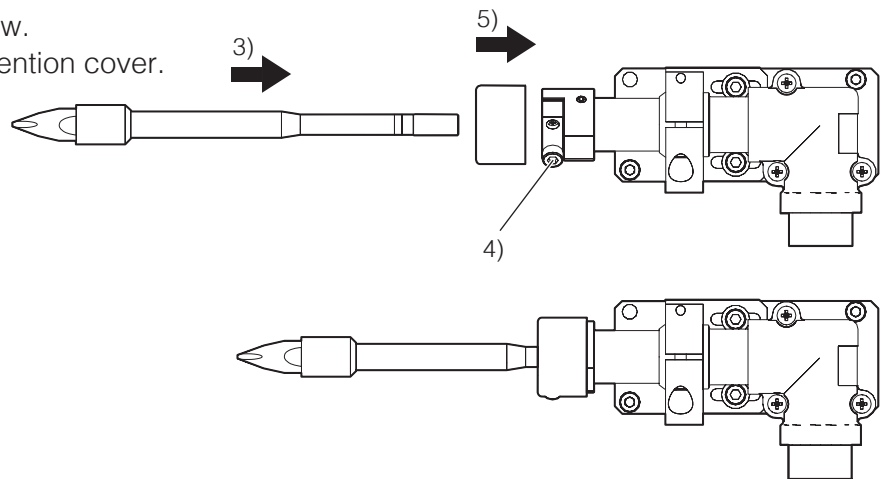
Allow the tip to cool before replacing it.

When replacing the tip while it is still hot, be sure to use the heat-resistant pad.

- 1) Slide the spatter prevention cover forward.
- 2) Loosen the tip holding screw (M3 × 10).



- 3) Insert the tip.
- 4) Tighten the tip holding screw.
- 5) Cover with the spatter prevention cover.



⚠ CAUTION

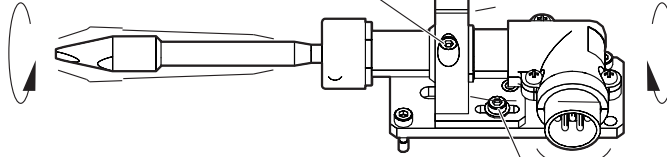
- Check that there are no gaps between the tip and the spatter prevention cover.
- When attaching a new tip, it is necessary to perform tip position adjustment.

How to Adjust the Tip Position

- When the tip position adjustment screws are loosened, axis rotation **(a)** and left/right movement **(b)** can be performed. Move the tip relative to the target workpiece, and after determining the tip position, tighten the screws.

Tip position adjustment screw (a): Axis rotation

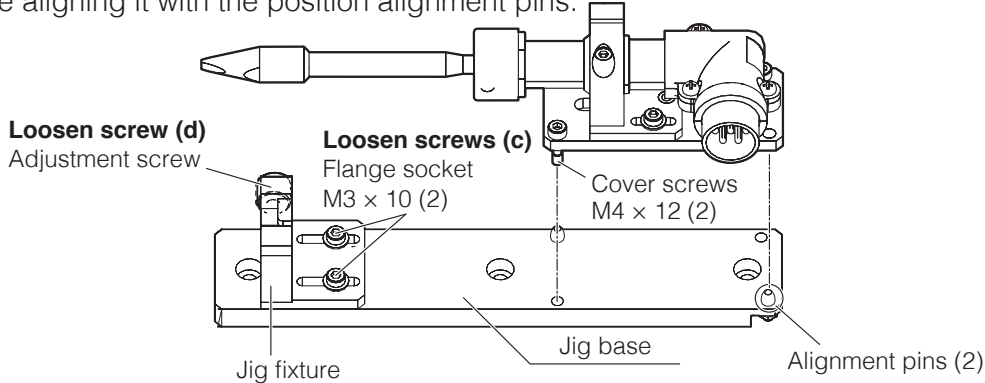
Hexagon socket head cap screw M3 × 15



Tip position adjustment screw (b): Left/right movement

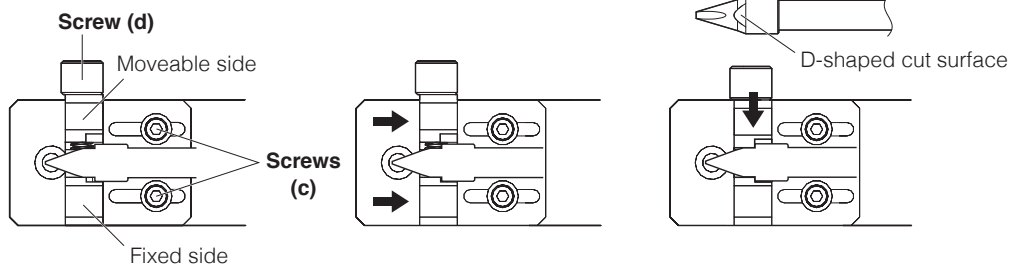
Flange socket M3 × 6 (2)

- Loosen screws **(c)** and **(d)**, and place the HAKKO FU-6002 on the tip adjustment jig unit while aligning it with the position alignment pins.



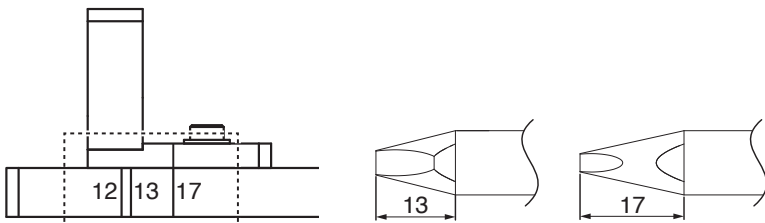
- Align the D-shaped cut surface of the tip with the indentation in the jig fixture and move the jig fixture so that the tip fits into the fixture exactly. This position will be the standard point, so retighten the 2 screws **(c)**.

Then, to make sure that the tip does not lift up, hold it down while tightening screw **(d)**. Unless the workpiece changes, do not move the jig fixture other than the moveable side. After setting the standard point, remove the tip from the tip adjustment jig unit.



— Note —

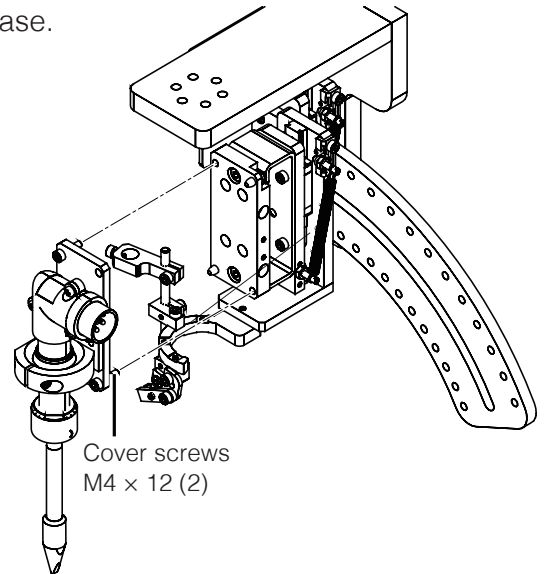
There are markings on the side of the tip adjustment jig unit. They are for tip end dimensions of 12 mm, 13 mm, and 17 mm. Use these markings as guides when adjusting the position of the jig fixture.



12 mm: —
 13 mm: TX2-XD4, TX2-XD6, TX2-XBCR4,
 TX2-XBCR6, TX2-XDR4,
 TX2-XDR6, TX2-XRK
 17 mm: TX2-XD3, TX2-XBCR3, TX2-XDR3

5. Installation (continued)

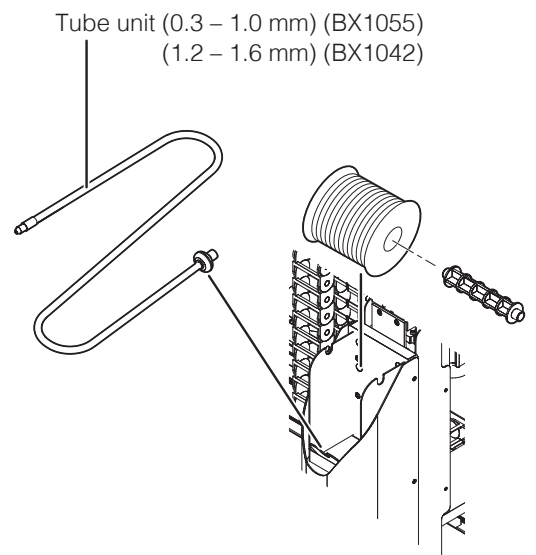
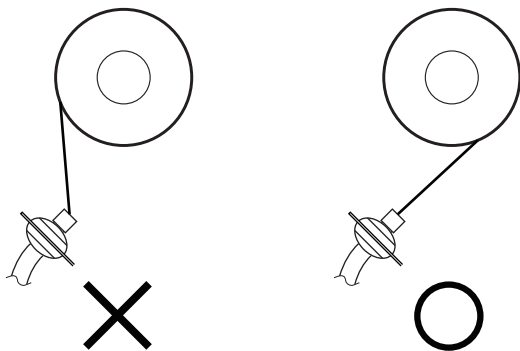
7. Attach the HAKKO FU-6002 to the soldering unit fixture base.



5-2-3 Attaching Tube Units

1. Install the tube unit and solder bobbin on the HU-200 (robot). Install the solder bobbin while paying attention to the solder feed direction.

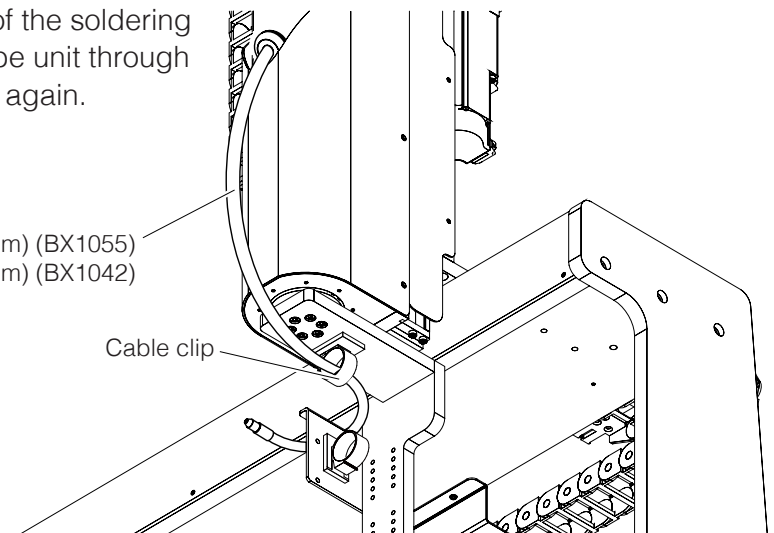
Solder feed direction



2. Open the cable clip on the upper part of the soldering unit fixture base (CX5002), pass the tube unit through the cable clip, and close the cable clip again.

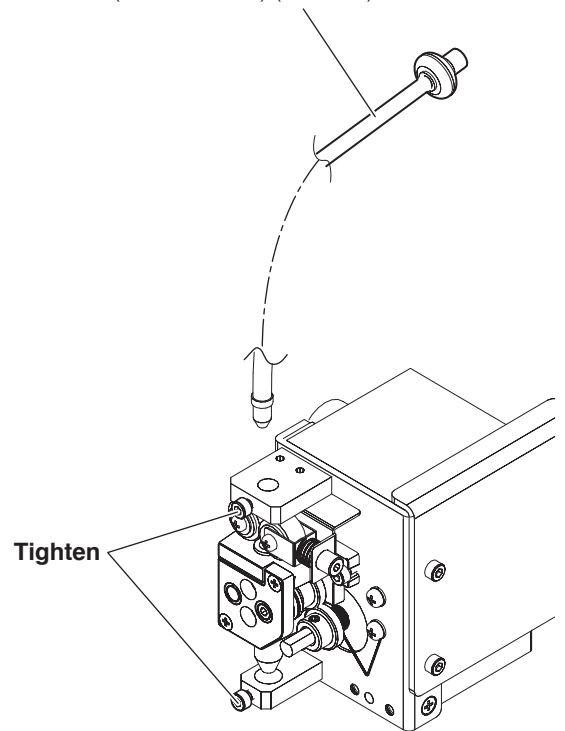
Tube unit (0.3 - 1.0 mm) (BX1055)
(1.2 - 1.6 mm) (BX1042)

Cable clip

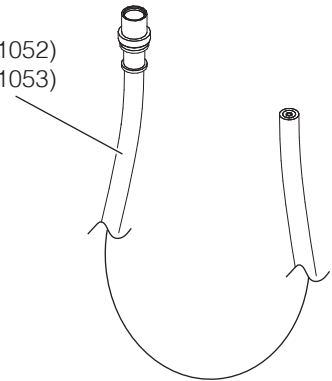


- 3.** Attach tube unit and tube unit B to the feeder unit (CX5005) and tighten the screws indicated in the diagram.

Tube unit (0.3 – 1.0 mm) (BX1055)
(1.2 – 1.6 mm) (BX1042)

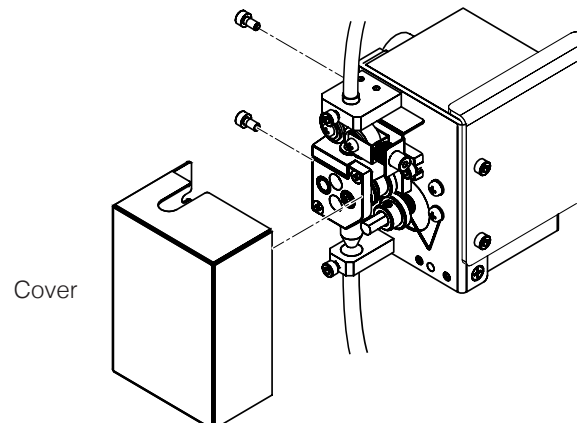


Tube unit B (0.3 mm) (BX1054)
(0.5 – 1.0 mm) (BX1052)
(1.2 – 1.6 mm) (BX1053)



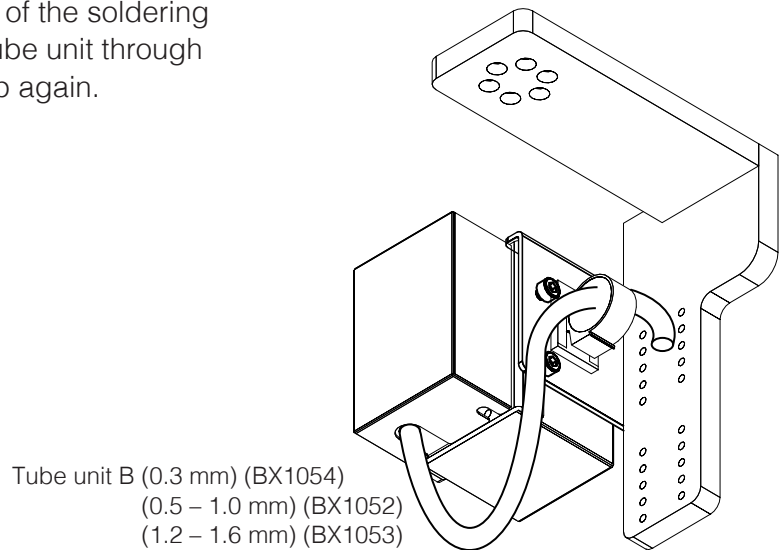
- 4.** Close the feeder unit cover.

Hexagon socket
head cap screw
M3x6 (2)

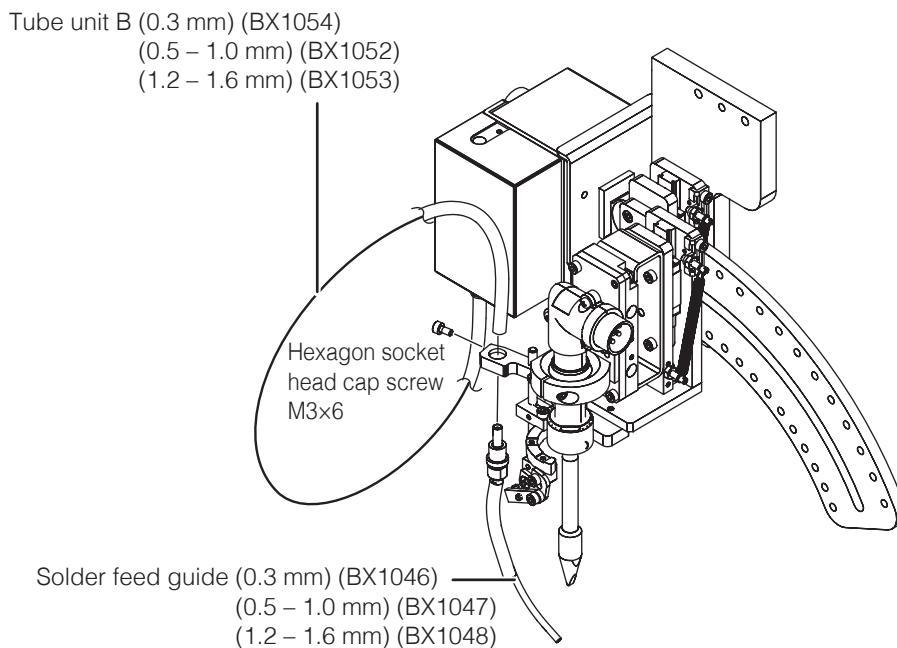


5. Installation (continued)

5. Open the cable clip on the upper part of the soldering unit fixture base (CX5002), pass the tube unit through the cable clip, and close the cable clip again.



6. Attach tube unit B and the solder feed guide to the soldering unit mount.

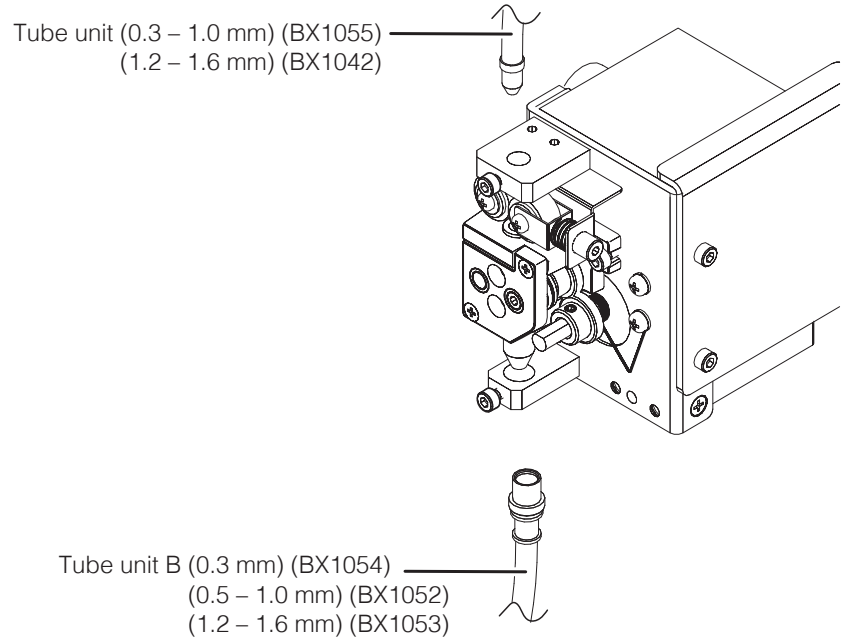


— Note —

It is necessary to adjust the solder feed position of the solder feed guide and the Teflon tube attachment method.
For adjustment method details, refer to “7-4-1 Solder Installation and Solder Feed Position Adjustment” (p. 69).

— Note —

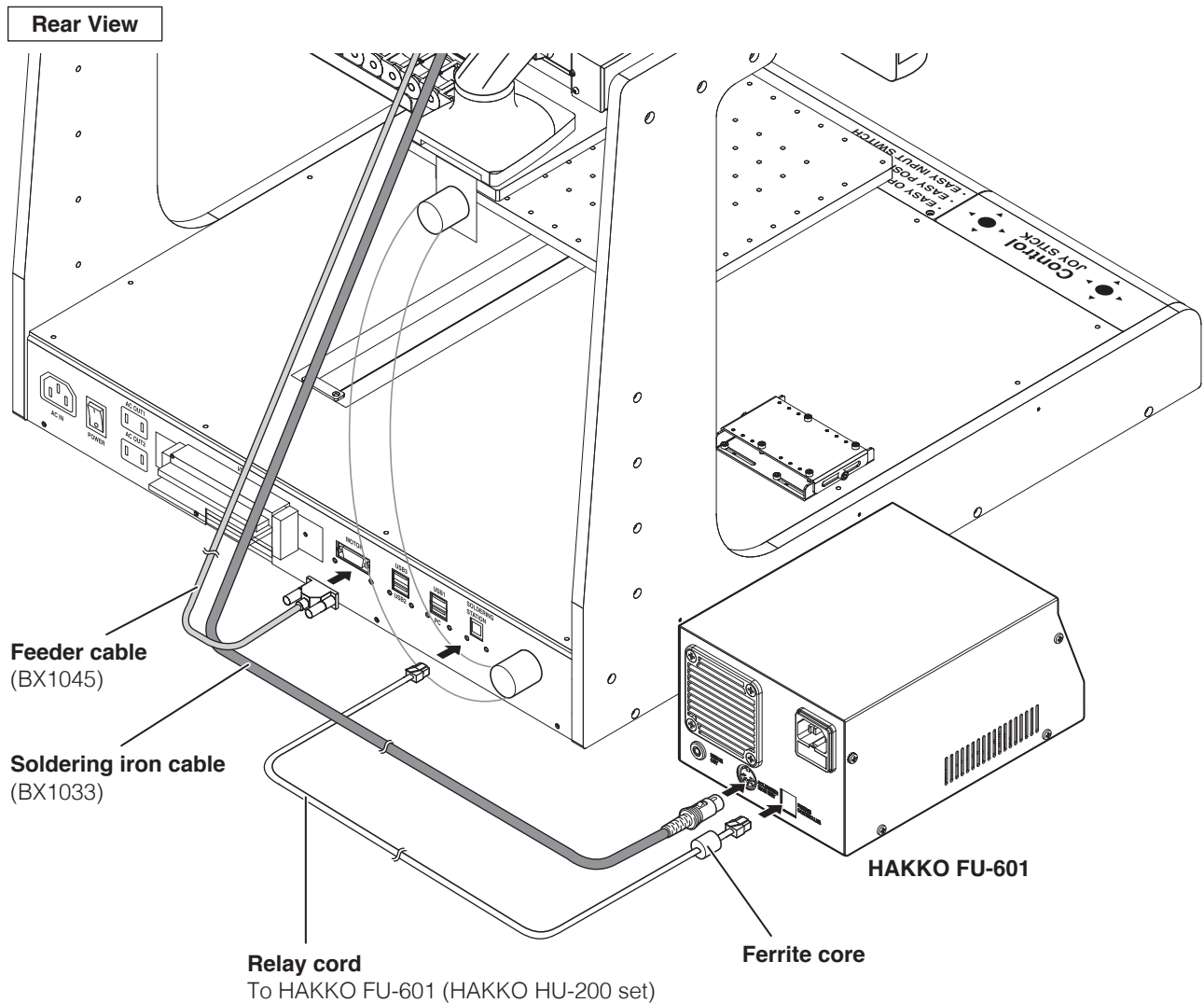
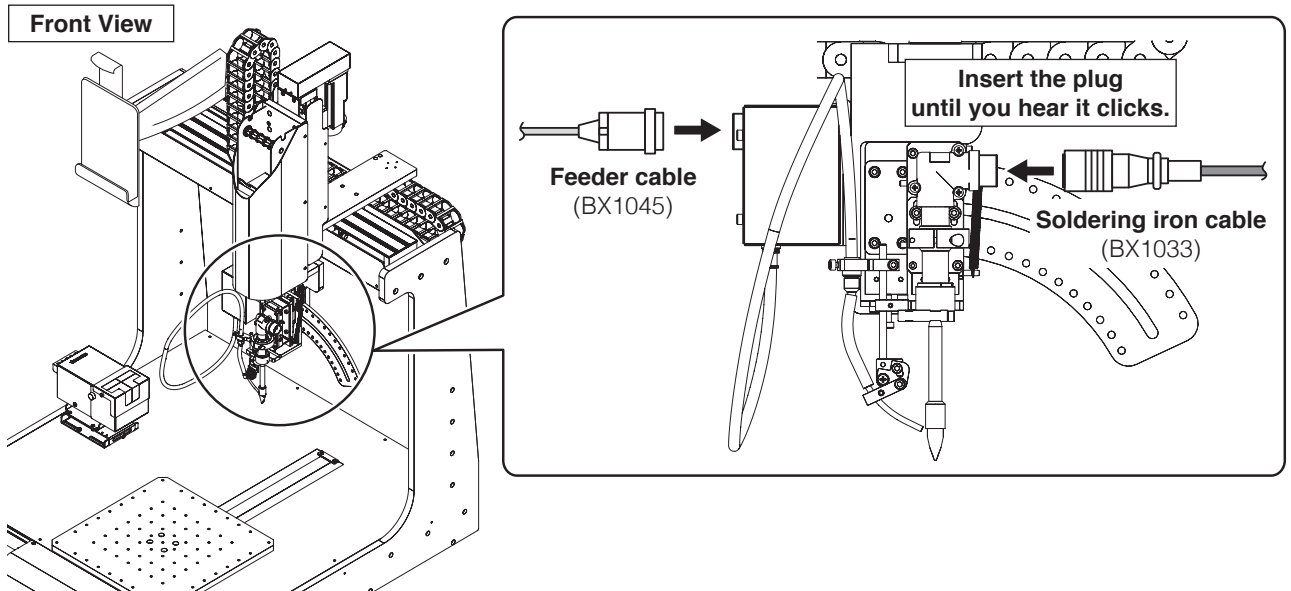
There are 2 kinds of tube units: The tube unit attached between the HAKKO HU-200 (robot) and the feeder unit, and tube unit B attached between the feeder unit and the solder feed guide. There are different models of each kind according to the solder diameter.



5. Installation (continued)

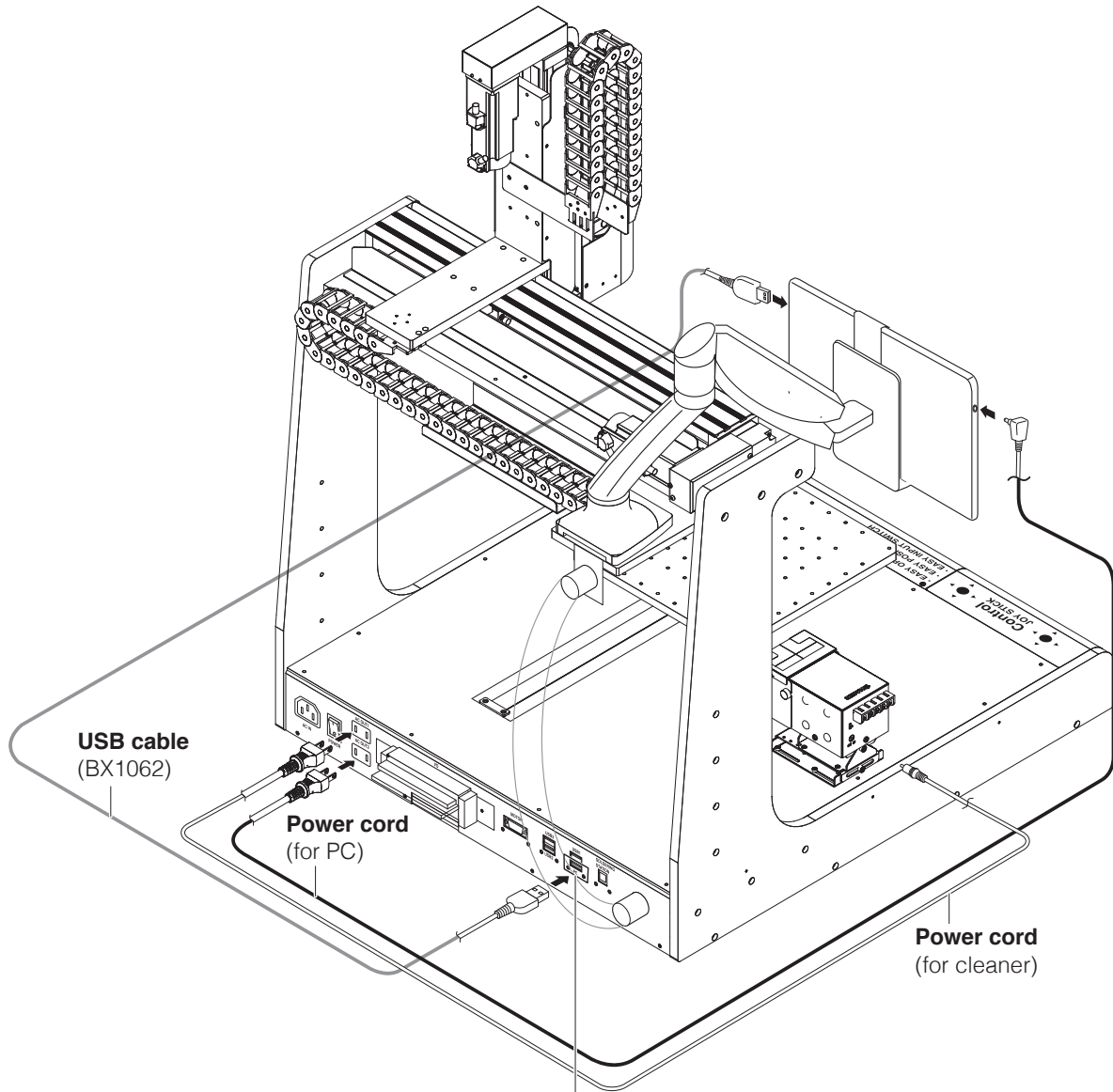
5-2-4 Connecting Cables and Cords

1. Connect the feeder cable (BX1045) between the robot and feeder unit (CX1010), and connect the relay cord (HAKKO HU-200 set) between the HAKKO FU-601 and robot.
2. Connect the soldering iron cable (BX1033) between the HAKKO FU-601 and HAKKO FU-6002.



5-2-5 Mounting and Connecting the PC

1. Lift up the top part of the tablet, slide the PC in, and secure it in the tablet holder.
2. Connect the PC and robot with the USB cable (BX1062) and power cord.

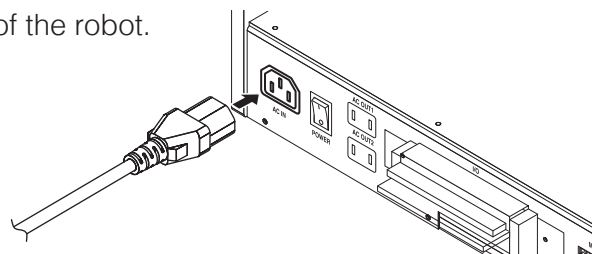


⚠ CAUTION

Even if the cable is plugged into a USB connector other than the USB connector for PC (lower right), connection between the PC and robot will not be achieved.

5-2-6 Connecting the Power Cord (for robot)

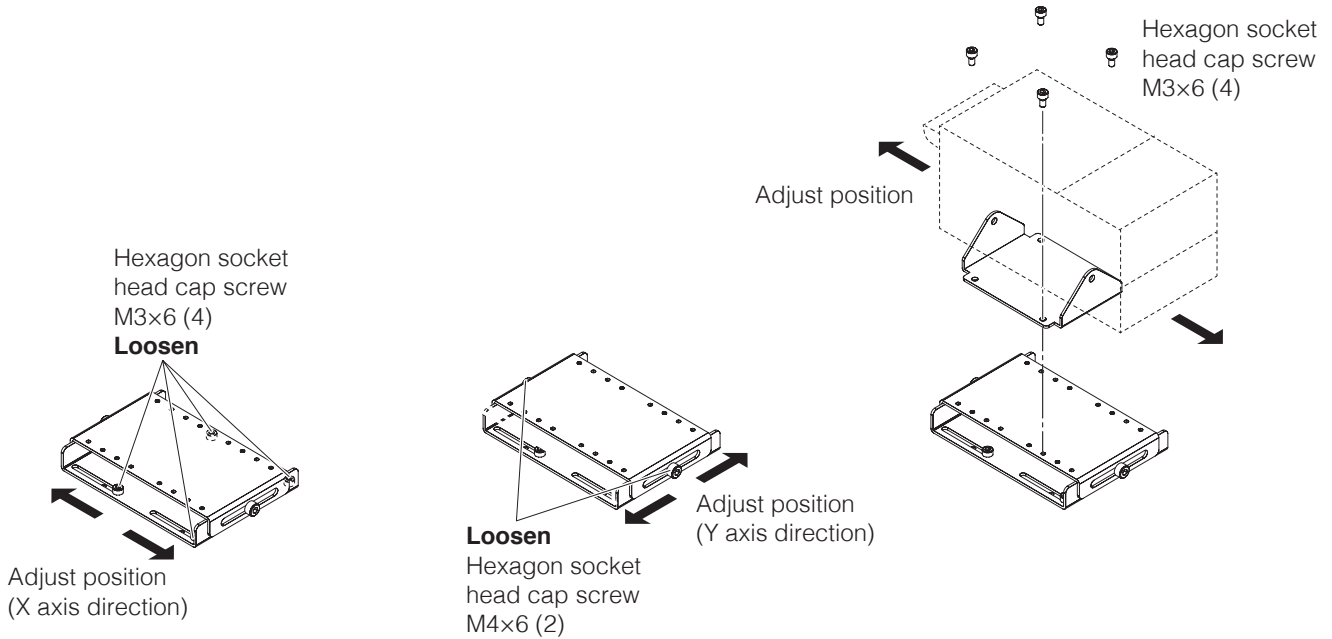
Insert the power cord (for robot) into “AC IN” at the back of the robot.



5. Installation (continued)

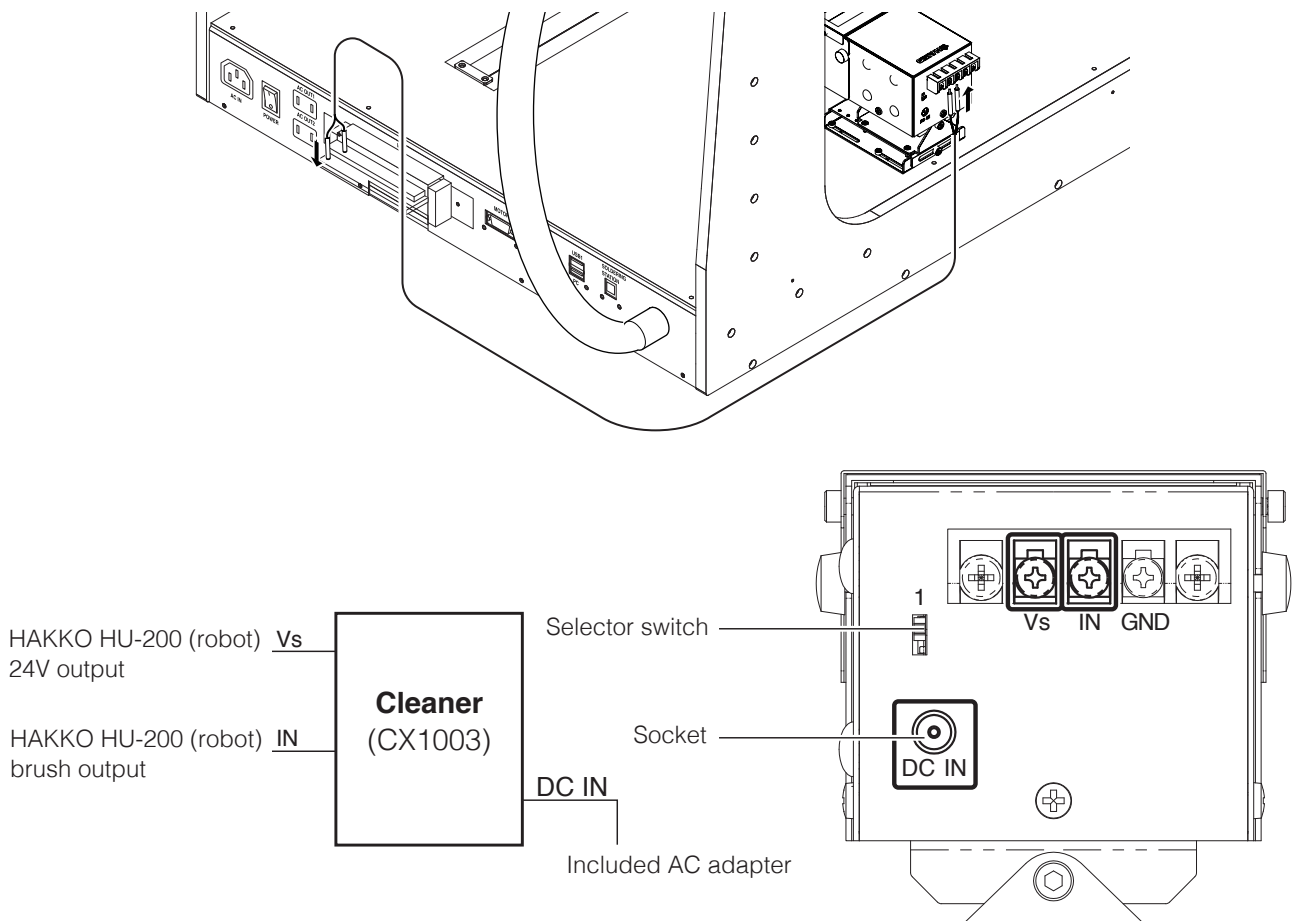
5-2-7 Attaching the Cleaner (CX1003)

1. Attach the cleaner (CX1003) to the cleaner base (CX5003).



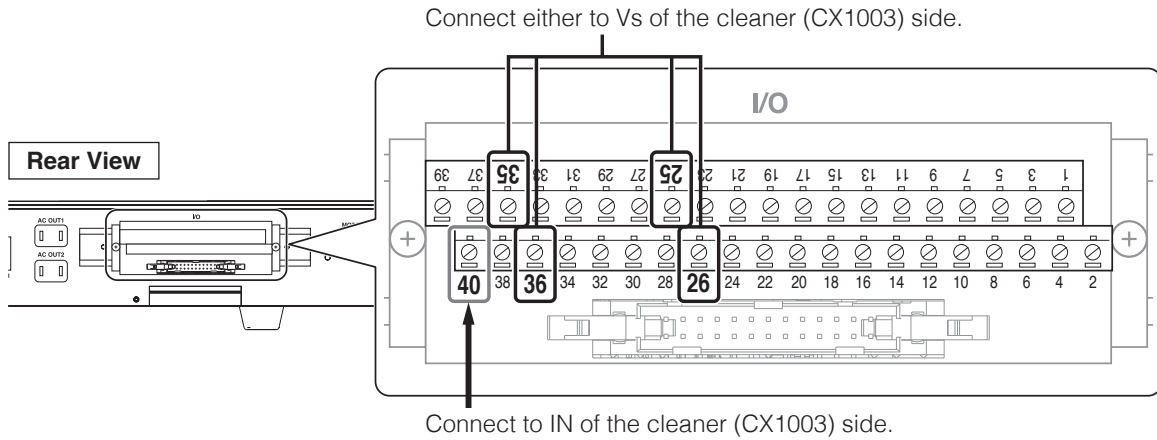
— Note —

When the cleaner is connected to the robot, set the selector switch to “1” and connect as shown in the diagram below.
For information on how to use the cleaner (CX1003), refer to the cleaner instruction manual.





5-2-8 Wiring of the cleaner (CX1003)


The cleaner wires it like the diagram below.



— Connecting of the lead —

 Loosen the screw

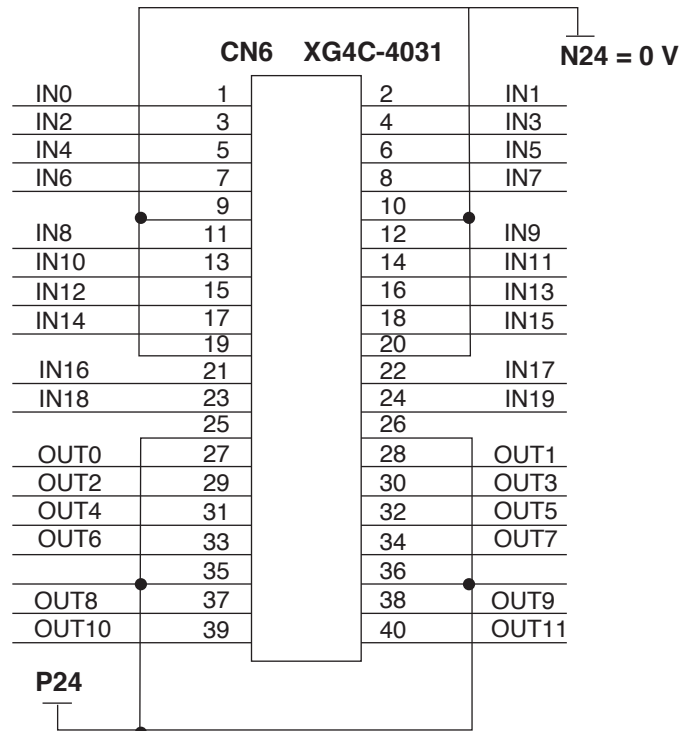
 Insert the lead

 Tighten the screw

Pull the lead, and confirm that it is not pulled out.

5-3 External I/O Pin Layout

This is the I/O pin layout for input/output with external devices. It is used when assigning input signals and output signals for use when running soldering programs or for external emergency stop circuits. Connection is performed using the connector on the back of the robot. (The pins for OUT10 and OUT11 are exclusively for connection to the cleaner.) Wiring should be performed using stranded wire with a diameter of 0.5mm² (equivalent to AWG20).




⚠ CAUTION

To prevent electrical shock, be sure to ground the product during use.

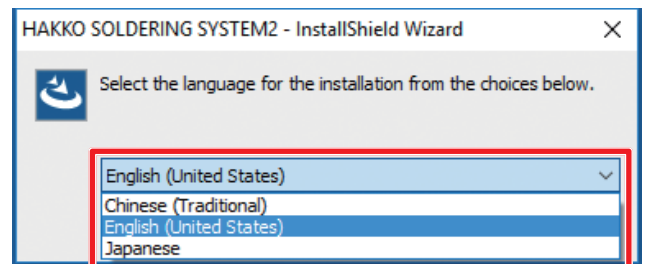
6. Installation

You must be logged into the computer with Administrator user rights in order to install the software.

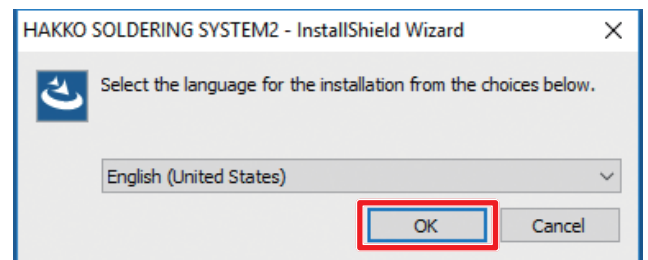
6-1 Performing a New Installation of the Software

1. Double-tap on  HAKKO SOLDERING SYSTEM2 Ver.** Setup.exe.

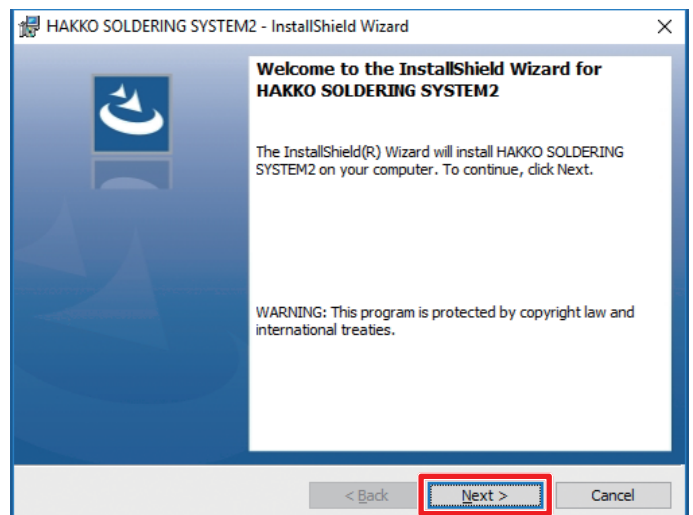
2. Select the language to be used for the installation.



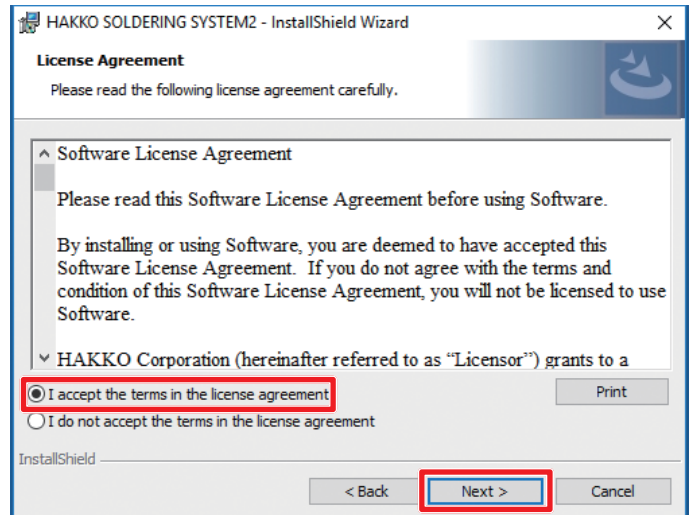
3. After selecting the language, tap **[OK]** to proceed to the installation screen.



4. When the installation screen is displayed, tap **[Next]**.



5. The End User's License Agreement will appear. Read the terms of the license agreement carefully and if you agree to the terms, select **"I accept the terms in the license agreement"** and tap **[Next]**.

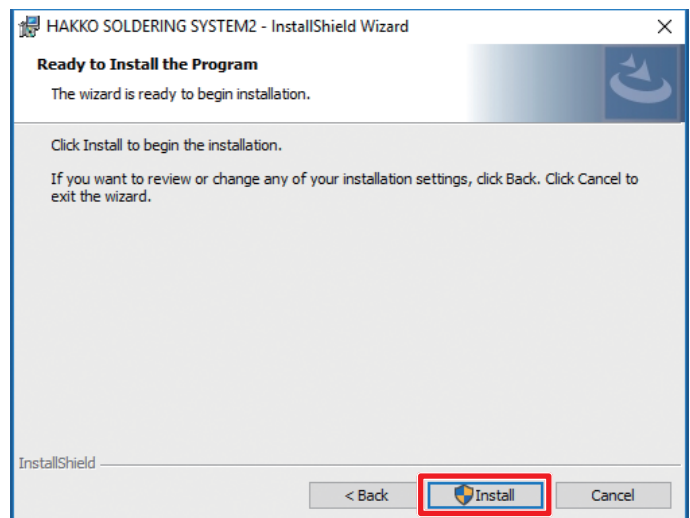


⚠ CAUTION

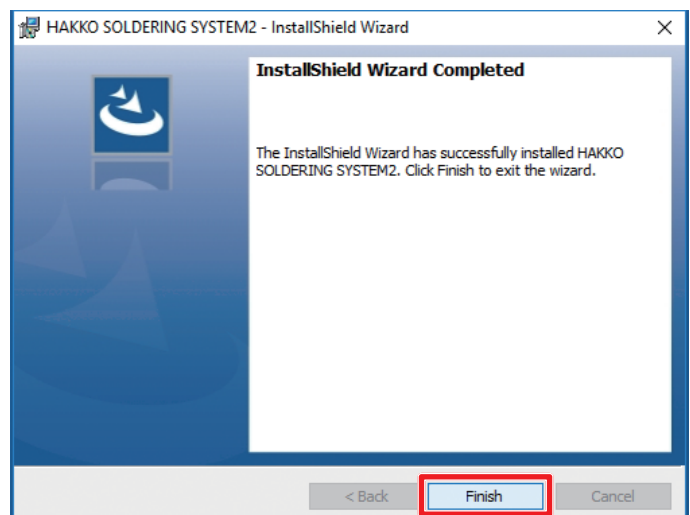
Installation and use of this software can be performed only by agreeing to this **"Software License Agreement"**.

If agreement to the End User's License Agreement is not given, this software cannot be used.

6. Tap **[Install]**.



7. After installation has been completed, tap **[Finish]**.



6. Installation (continued)

6-2 Performing a Software Update

6-2-1 Backing up Data

Back up the data before Updating the software.
The backup procedure is as follows:

1. Tap the “This PC” icon on the desktop and open the C: drive.
Next, open the HakkoCorporation folder and then open the HAKKO SOLDERING SYSTEM2 folder.
2. Create new folders on the desktop and copy the following two folders as backup data.
 - “**Program**” folder (containing soldering program data)
 - “**System**” folder (containing cleaning setting data)

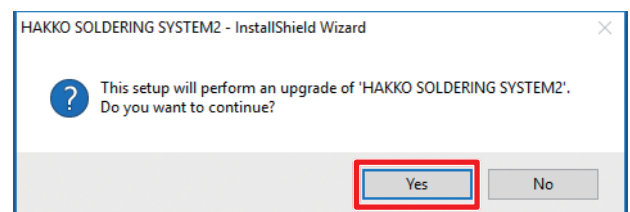
For information on backing up soldering conditions, refer to “7-4-2-2 Reading/Writing Soldering Conditions” (p. 73).

System setting and main screen setting information cannot be backed up. Be sure to keep a record of any changed setting values, etc.

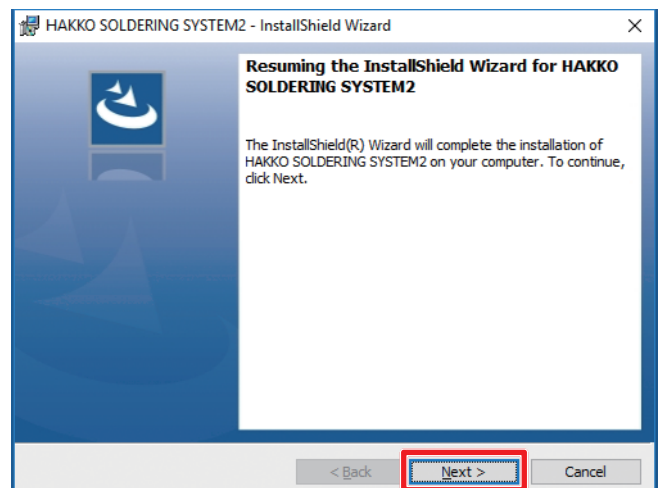
6-2-2 Updating Software

1. Double-tap on  HAKKO SOLDERING SYSTEM2 Ver.*.**Setup.exe.

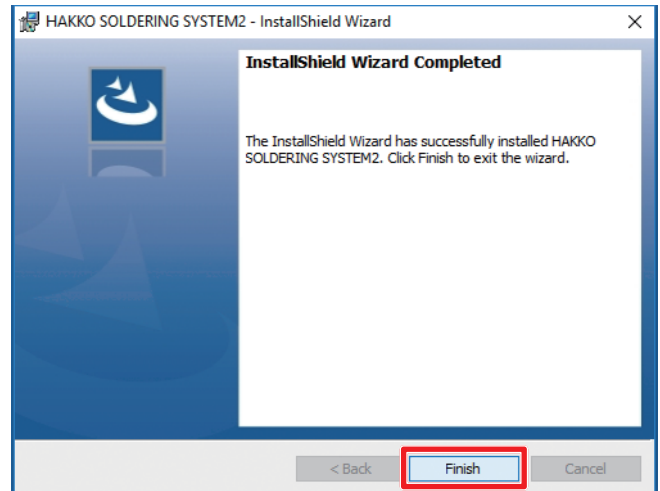
2. When the update screen is displayed, tap **[Yes]**.



3. When the installation screen is displayed, tap **[Next]**.



4. After installation has been completed, tap **[Finish]**.



6-2-3 After Installation Has Been Completed

- **“Program” folder**

After updating, check that there is a “Program” folder under the C:\Hakko Corporation\HAKKO SOLDERING SYSTEM2 folder.

If the “Program” folder has been deleted, copy the backup “Program” folder to that location.

- **“System” folder**

Copy the backup “System” folder to under C:\Hakko Corporation\HAKKO SOLDERING SYSTEM2 and overwrite the existing “System” folder.

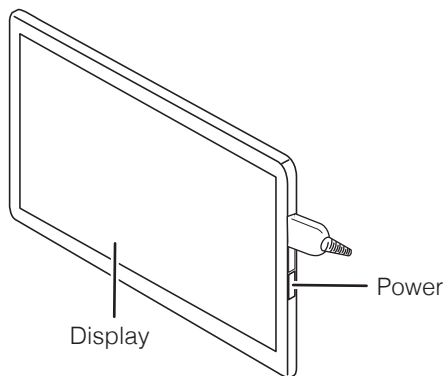
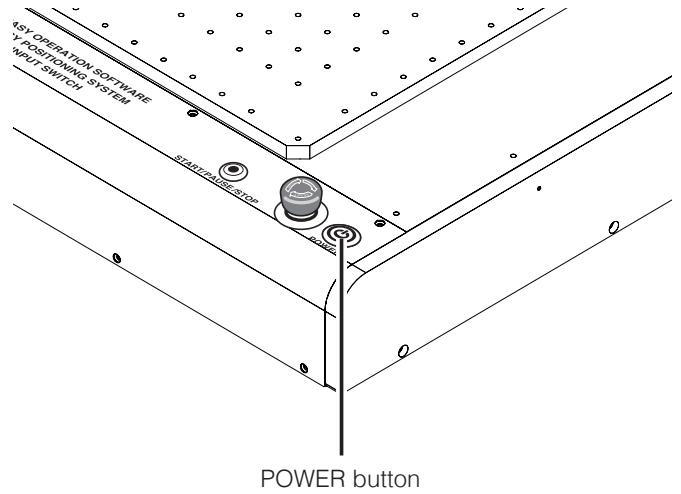
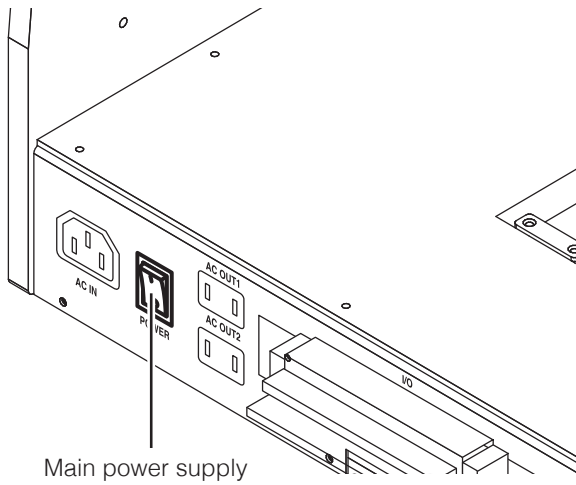
If the existing folder is not overwritten with the backup copy, cleaning settings will be the initial settings.

For soldering conditions, refer to “7-4-2-2 Reading/Writing Soldering Conditions” (p. 73) and read the files.

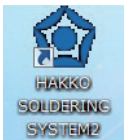
For system setting and main screen setting information, modify the changed values, etc. to the values recorded before updating the software.

7. Operation

First, check that all connections in “5. Installation” have been performed, and then switch on the main power supply and POWER button of the HAKKO HU-200 (robot) and switch on the power of the PC.

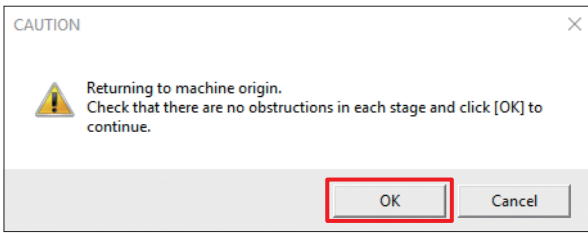


When the PC is switched on, the sign in screen will appear. When first shipped from the factory, it is possible to proceed without inputting anything. Next, double-tap on the HAKKO SOLDERING SYSTEM2 icon to start HAKKO SOLDERING SYSTEM2.

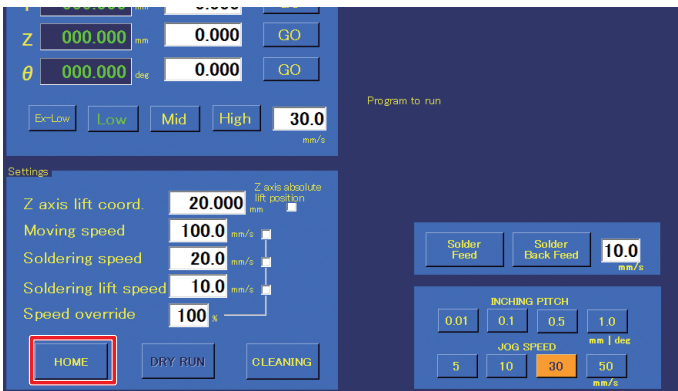


When the software is started, a window asking whether to return to origin will appear (refer to the diagram below).

Tap **[OK]** to execute return to origin.

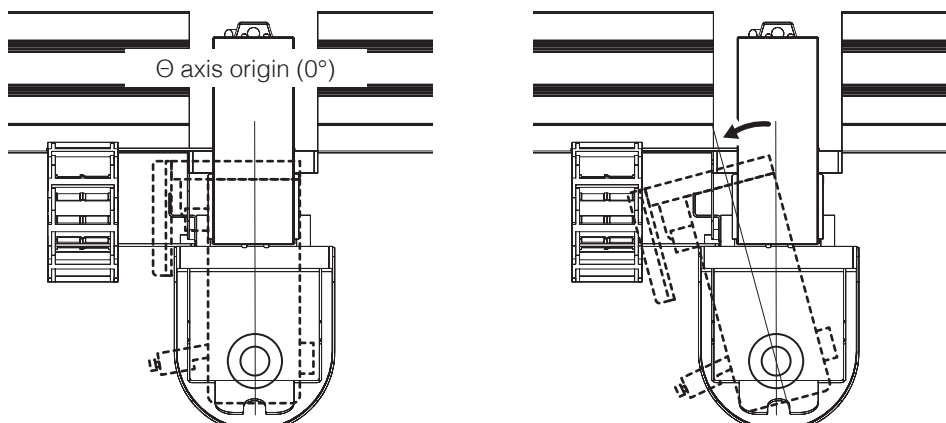


When **[Cancel]** is selected, be sure to execute return to origin from **[HOME]** of the software's top screen.



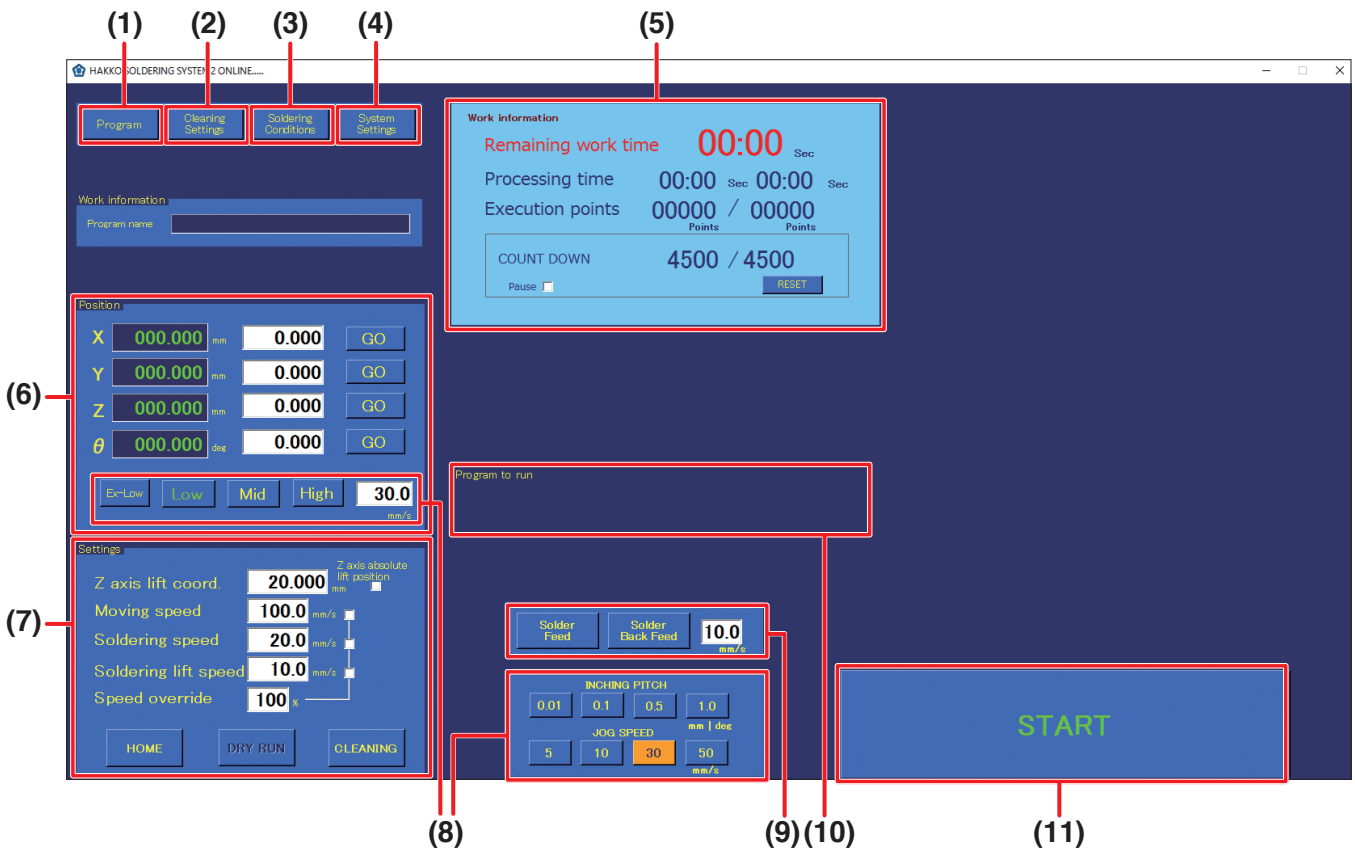
⚠ CAUTION

- **First, check that all equipment have been connected properly and that there is no danger in the surrounding area.**
When HAKKO SOLDERING SYSTEM2 starts, each axis will move as the robot returns to the origin. Be careful to stay out of the way of the robot as it moves.
- **When the θ axis rotates while returning to the origin, there is a danger of cables wrapping around the robot.**
If it seems like there is a danger of cables wrapping around, press the emergency stop button immediately, turn the θ axis slightly counterclockwise from the origin (0°) when viewed from above the soldering unit fixture base, and then tap **[HOME]** again.



7. Operation (continued)

7-1 Explanation of Software Screen

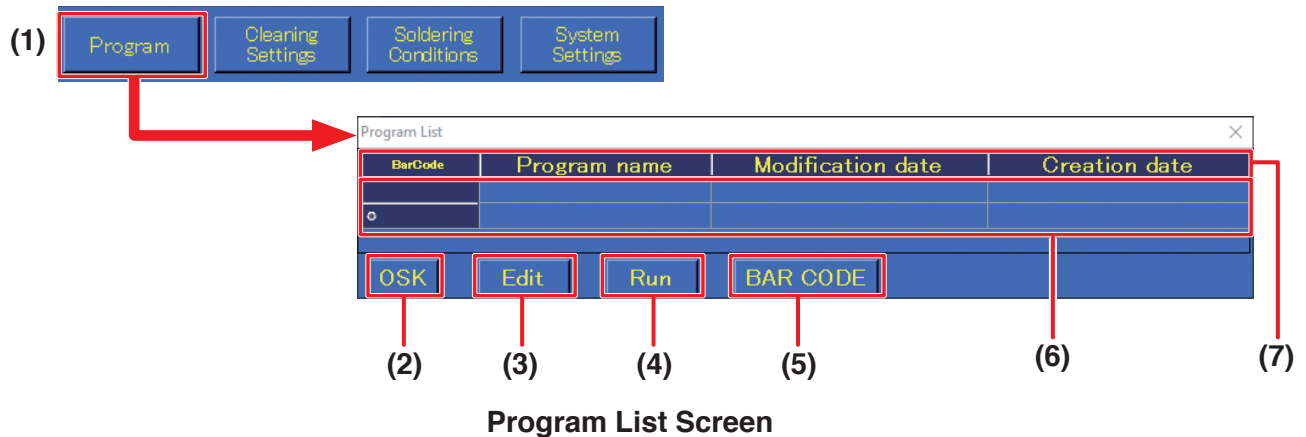


Software Top Screen (Admin mode)

When the software starts up, the top screen including the following information will be shown.

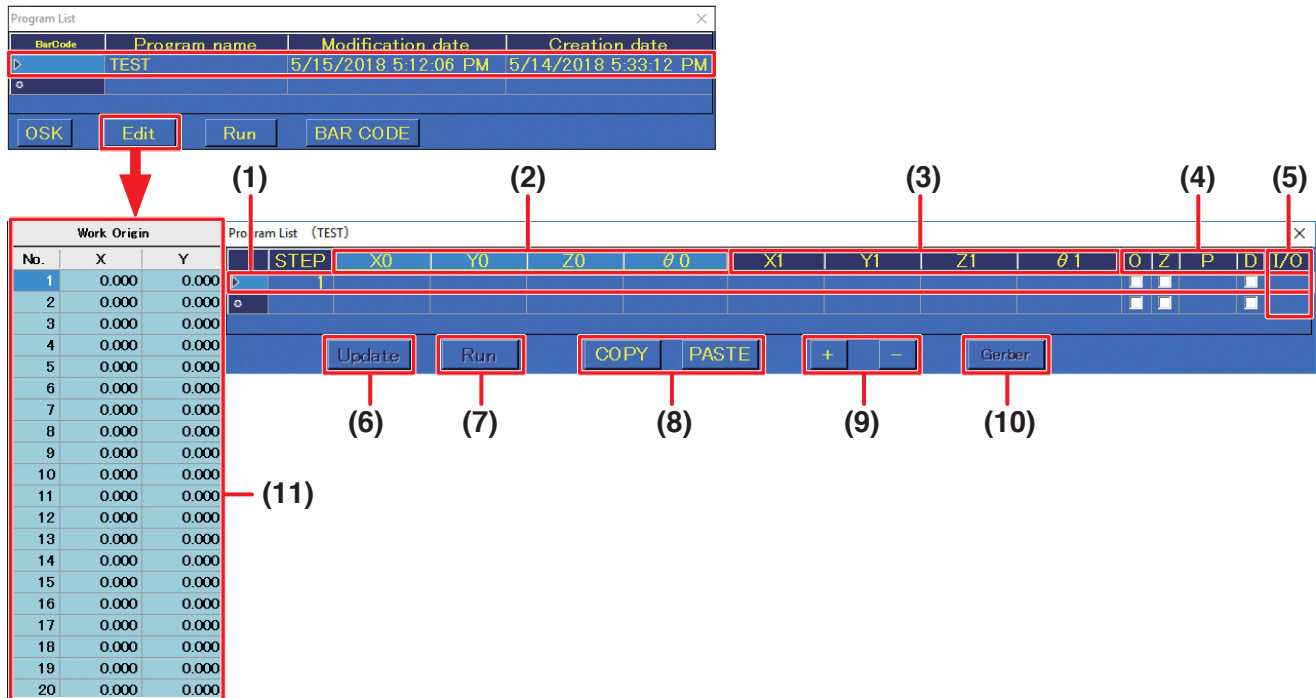
- | | |
|--------------------------|----------------------------------|
| (1) Program | (7) Settings |
| (2) Cleaning Settings | (8) JOG operation settings |
| (3) Soldering Conditions | (9) Solder Feed/Solder Back Feed |
| (4) System Settings | (10) Program to run |
| (5) Work information | (11) Start button |
| (6) Position | |

7-1-1 Program



- (1) **Program** (top screen)
Used for selecting, editing, or newly creating a work program.
- (2) **OSK**
Calls up the on-screen keyboard for inputting the program name.
- (3) **Edit**
Calls up the Program Edit Screen (refer to next page) for the selected program.
For details on the Program Edit Screen, refer to "7-5 Creating a Soldering Program" (p. 74).
- (4) **Run**
Selects the program to run. The selected program will be shown in the running programs area of the top screen.
- (5) **BAR CODE**
Calls up the Bar Code Setting Screen. The PWB to be worked on and the created program can be linked.
For details on the Bar Code Setting Screen, refer to "7-7-3 Calling up a Program Using a Bar Code or I/O" (p. 106).
→ A commercially available USB type bar code reader is necessary to use bar codes.
- (6) The bar code, program name, modification date, and creation date of the created program will be shown.
(If a bar code for calling up the program has been linked, a simplified bar code will be shown.)
- (7) **Program name, Modification date, Creation date**
Tapping each of the items will cause the list to be ordered by that item.

7. Operation (continued)



Program Edit Screen

The start point and end point cells and checkboxes can be set directly in the Program Edit Screen. More detailed settings can be performed in the Point Edit Screen which can be called up by double-tapping in the first column or in the STEP column.

- (1) Each horizontal row shows information for a single point.
- (2) **X0, Y0, Z0, θ0**
Shows the information for the soldering start point.
- (3) **X1, Y1, Z1, θ1**
Shows the information for the soldering end point.
- (4) **O:** If checked, indicates that the start point is an offset.
Z: Checked when "Return to" is set to Z lift position.
P: Shows the solder feed soldering condition number.
D: If checked, indicates that the soldering mode is DS (drag soldering).
- (5) Shows indications for when I/O settings or individual point settings have been set. If all settings have been set, **[IO CZSP]** will be shown. If no setting has been made for the corresponding section, the character for that section will be replaced by **[*]**.
 - I:** Input setting
 - O:** Output setting
 - C:** Cleaning setting
 - Z:** Individual point Z axis lift setting
 - S:** Individual point speed setting
 - P:** Palletizing setting
- (6) **Update**
Applies the changes to the program and saves it.

(7) Run

Selecting the desired program and tapping **[Run]** will cause the selected program to be shown in the running programs area of the top screen.

Error checking will be performed at the same time. If an error such as input of a value outside the range, etc. is found, an error screen will be shown. When the problem has been solved, the program can be run.

Outside range • STEP 1: X, Y axis start point and end point
 • STEP 3: X axis start point and end point
 • STEP 4: Y axis start point and end point
 →Settable ranges: X axis: 0 – 400 mm, Y axis: 0 – 300 mm

Error screen showing values outside range

2018/01/31 13:49:13 FILE = test

Solder Points: 4 / Total Steps: 4

STEP	SP	EP	ORG00	(0.000, 0.000)	X= 405.063, Y= -4.935	Z= 166.131, θ = 44.263, SPEED= (800.0, 20.0, 10.0), SNo = 1
STEP 1:	SP	EP	ORG00	(0.000, 0.000)	X= 405.063, Y= -4.935	Z= 166.131, θ = 44.263, SPEED= (800.0, 20.0, 10.0), SNo = 1
STEP 3:	SP	EP	ORG00	(0.000, 0.000)	X= 400.106, Y= 82.671	Z= 166.131, θ = -0.491, SPEED= (800.0, 20.0, 10.0), SNo = 1
STEP 4:	SP	EP	ORG00	(0.000, 0.000)	X= 351.907, Y= 305.642	Z= 158.927, θ = -89.413, SPEED= (800.0, 20.0, 10.0), SNo = 1

Procedure for Correcting Errors

1. Close the error screen.

2. Open the Point Edit Screen for the step to be corrected in the program list.

3. Input proper values in the start point and end point boxes.

4. When correction has been finished, tap **[Exit]**.

5. Correct STEP 3 and STEP 4 in the same way.

6. After all problems have been corrected, tap **[Update]** in the Program Edit Screen.
 After that, tap **[Run]**.

For details on the Point Edit Screen, refer to Point Edit Screen on the next page.

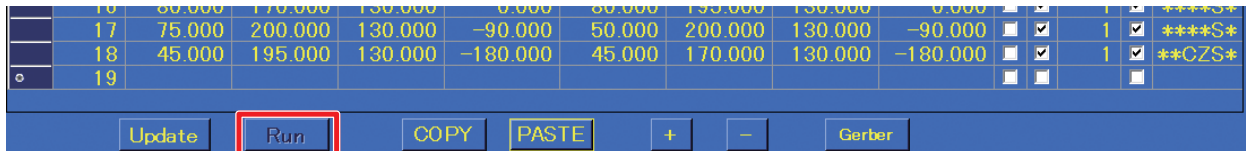
7. Operation (continued)

Attention at the time of error-checking

When reading a soldering program to be run, error-checking is performed.

At this time, if the emergency stop button is pressed during error-checking, error-checking will be ended.

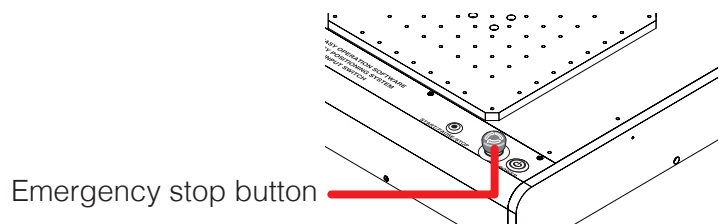
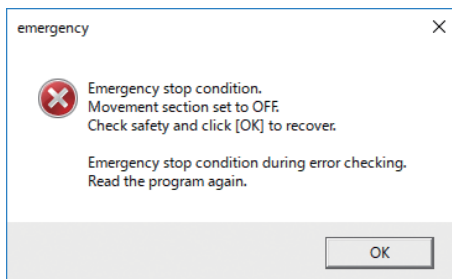
1. Follow the procedure in “7-6-1 Calling up and Running a Program” (p. 93) in the detailed instruction manual. In **Step 3**, select **[Work]**.



2. The execution program will be displayed. Error-checking will be performed at the same time as displaying the program.

STEP	X0	Y0	Z0	θ0	X1	Y1	Z1	θ1	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000			1		**C***
2	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000			1		
3	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000			1		***S*
4	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000			1		***Z**
5	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000			1		**C***

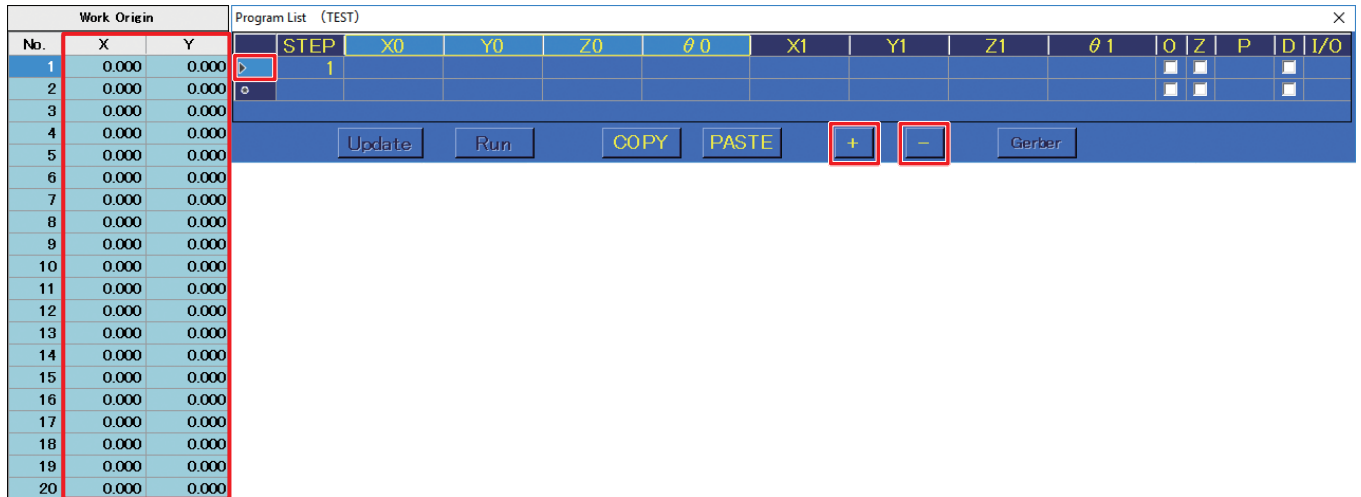
3. If the **[emergency stop button]** is pressed before error-checking has been completed, the warning message shown below will be shown and error-checking will be stopped. If the warning message has been displayed, just resetting the **[emergency stop button]** will not continue operation.



4. If the above error message has been displayed, after resetting the **[emergency stop button]**, the program can be run by calling up the program list screen again, selecting **[Work]**, and performing error-checking again.

(8) COPY: Copies point data. Select the beginning of the row to be copied and tap **[COPY]**. The data for a single point row will be copied. To select multiple rows, tap and drag on the beginning of the rows.

PASTE: Pastes the copied data. Select the beginning of the row to paste data into and tap **[PASTE]**. When **[PASTE]** is tapped, existing data in the selected row will be overwritten. To add data, add a new row before performing paste. When pasting, it is necessary to input the work origin. Set the post-copy workpiece origin in advance, and select the X axis and Y axis values for the set work origin.



(9) As shown in the above figure, tapping the beginning of a row will cause the entire row to be selected. In this condition, tapping **[+]** or **[-]** will cause a row to be added or deleted respectively.

- [+]:** Adds a row below the selected row.
- [-]:** Deletes the selected row.

(10) Gerber

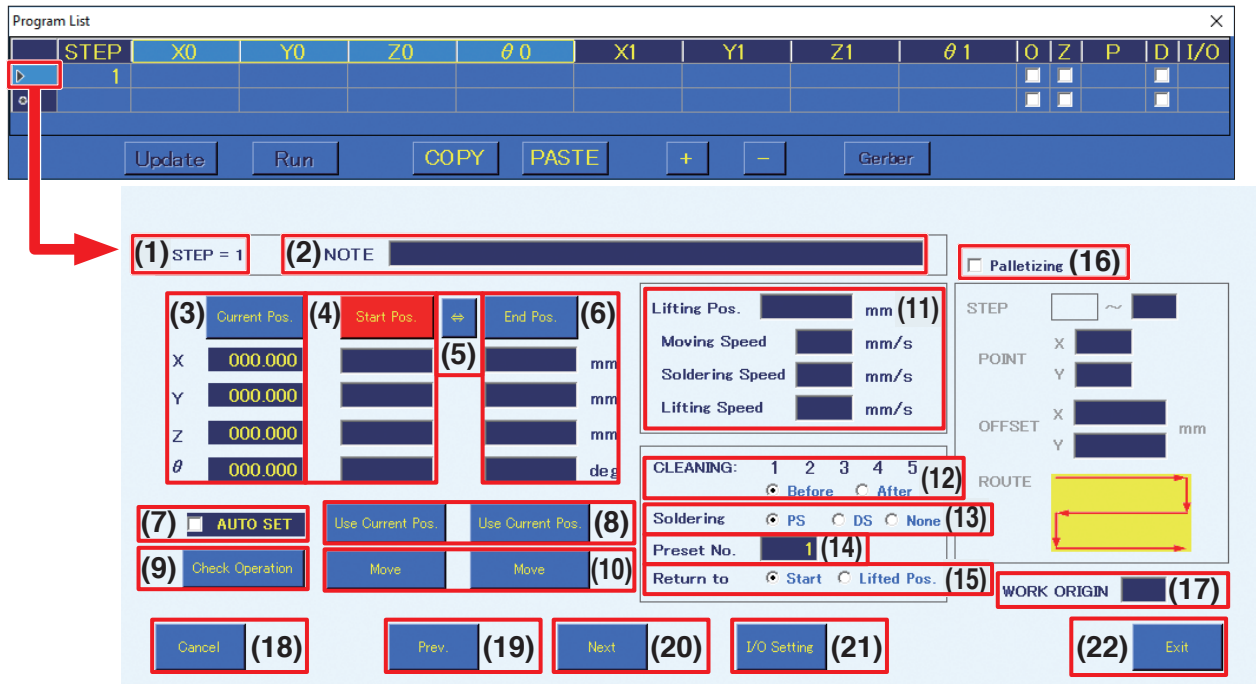
Calls up a screen for inputting coordinates for the aperture specification of Gerber data used in circuit design creation.

(11) Work Origin

When the Program Edit Screen is opened, the Work Origin screen will be shown on the left side of that screen.


Work origins can be set in this screen (up to 20 points).

7. Operation (continued)

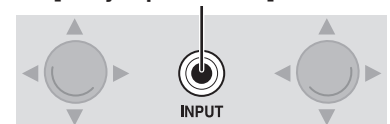


Point Edit Screen

Detailed point settings are performed in the Point Edit Screen.

- (1) **STEP = 1** (number)
1 (number) indicates the solder point number.
- (2) **NOTE**
Comments, memos, etc. for each point can be input.
- (3) **Current Pos.**
Shows the current tip position.
- (4) **Start Pos./OFFSET**
Sets the coordinates or offset amount of the start point.
When **[Start Pos.]** is shown, tapping **[Start Pos.]** will switch to **[OFFSET]**, and when **[OFFSET]** is shown, tapping **[OFFSET]** will switch to **[Start Pos.]**.
- (5) 
Switches between setting the coordinates read using the robot's **[Easy Input Switch]** button or **[Use Current Pos.]** as the start point/offset or end point.
- (6) **End Pos.**
Sets the coordinates of the end point.
- (7) **AUTO SET**
Reads coordinates using the robot's **[Easy Input Switch]** button.
When checked, the setting destination will be automatically switched each time the robot's **[Easy Input Switch]** button is pressed.
Soldering mode*1
For PS mode: End point → Start point → Next point
For DS mode: Start point → End point → Next point
For None: Start point → Next point
For PS mode (Offset): End point (Automatic offset input*2) → Next point
- (8) **Use Current Pos.**
Sets the current coordinates as the start point or end point.
When the start point is an offset, sets the offset value of the System Settings Screen.
- (9) **Check Operation**
The operation of the steps set in this screen will be simulated.

[Easy Input Switch] button



*1 For details about soldering mode, refer to "(13) Soldering" on the next page.

*2 The automatically input offset amount is set in the System Settings Screen.

For details about system settings, refer to "7-1-4 System Settings" (p. 50).

(10) Move

Moves to the set Start Pos./OFFSET or end point coordinates. If the value is blank, no movement will be performed.

If the end point is blank when the start point is an offset, no movement will be performed even if **[Move]** on the start point side is tapped because calculation cannot be performed.

(11) Individual point settings

Sets the Lifting Pos., Moving Speed, Soldering Speed, and Lifting Speed for individual points.

If a value is blank, the values in the top screen will be applied. When numerical values are input for the Lifting Pos., those values will be used even if Z axis absolute lift position is not checked in the top screen.

(12) CLEANING settings

Select from the cleaning numbers **[1] – [5]** set in the Cleaning Settings Screen. The cleaning timing can be set as before or after soldering of that point. For details on cleaning settings, refer to “7-1-2 Cleaning Settings” (p. 48).

(13) Soldering

Select from PS (point soldering), DS (drag soldering), or None (movement only)

(14) Preset No.

Sets the soldering conditions number. Settable range: 1 – 250

(15) Return to

Sets the movement destination for after solder completion. For start point, movement will be to the start point or offset destination; for Z lift position, movement will be vertically to the Z axis lift position.

(16) Palletizing

When checked, palletizing settings can be performed. Palletizing is used when the settings for a created point will be repeated multiple times.

(17) WORK ORIGIN

Sets the WORK ORIGIN number in the **Work Origin** screen.

When blank, X=0.000, Y=0.000 will be used as the Work Origin.

Work Origin		
No.	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
5	0.000	0.000
6	0.000	0.000
7	0.000	0.000
8	0.000	0.000
9	0.000	0.000
10	0.000	0.000
11	0.000	0.000
12	0.000	0.000
13	0.000	0.000
14	0.000	0.000
15	0.000	0.000
16	0.000	0.000
17	0.000	0.000
18	0.000	0.000
19	0.000	0.000
20	0.000	0.000

(18) Cancel

Discards the points currently being edited and closes the screen.

(19) Prev.

Moves to the previous point.

(20) Next

Moves to the next point.

— Note —

If the necessary settings for start point coordinates, end point coordinates, and soldering conditions have not been set, a setting error will be shown and movement to the next Point Edit Screen will not be performed. If the next point is a new point, it will inherit the start point/offset display and soldering conditions.

(21) I/O Settings

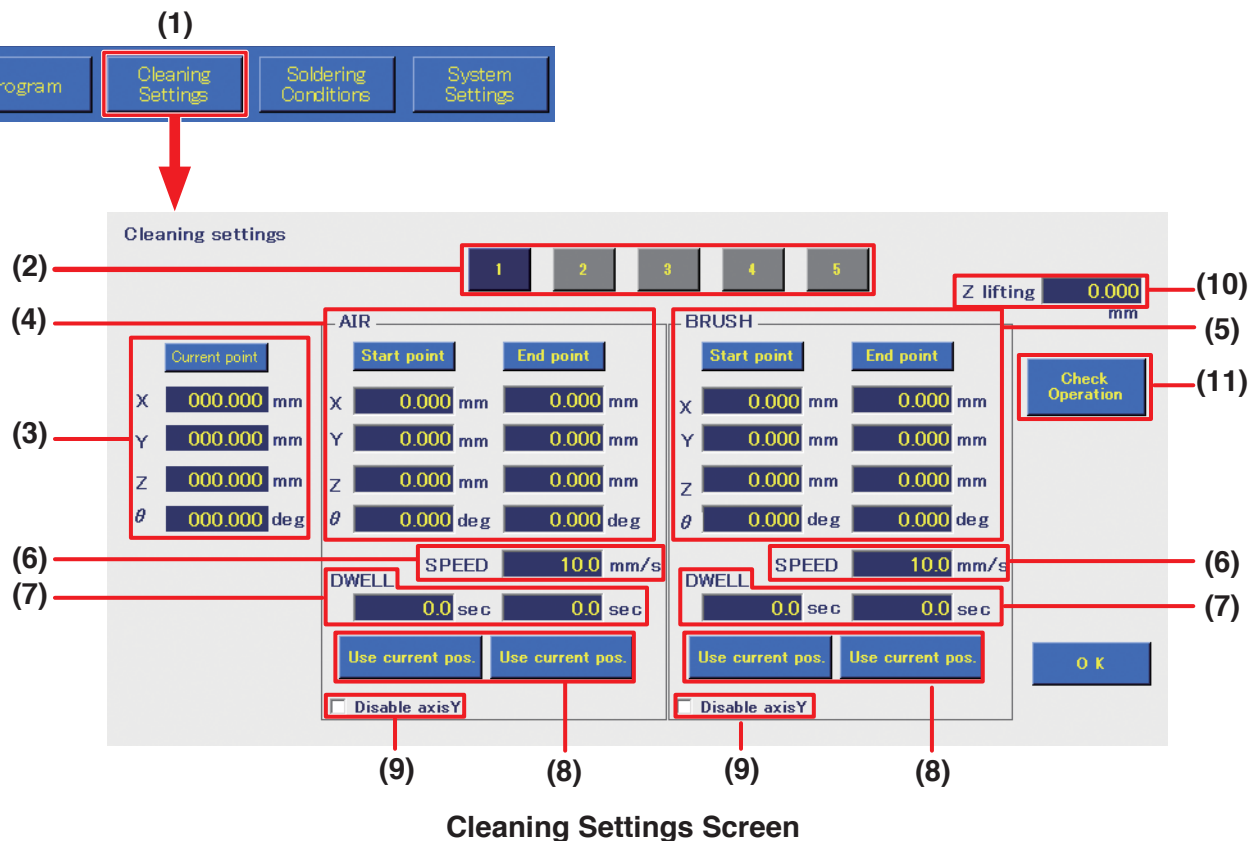
Opens the point I/O Settings Screen. For details on the I/O Settings Screen, refer to “7-7-4 I/O Settings” (p. 110).

(22) Exit

Finishes the settings and closes the current Point Edit Screen. If the necessary settings for start point coordinates, end point coordinates, and soldering conditions have not been set, a setting error will be shown and the screen cannot be closed. However, if movement to a new row has been performed using **AUTO SET** or **[Next]** and all coordinate values are blank, the point currently being edited will be discarded and the screen will close.

7. Operation (continued)

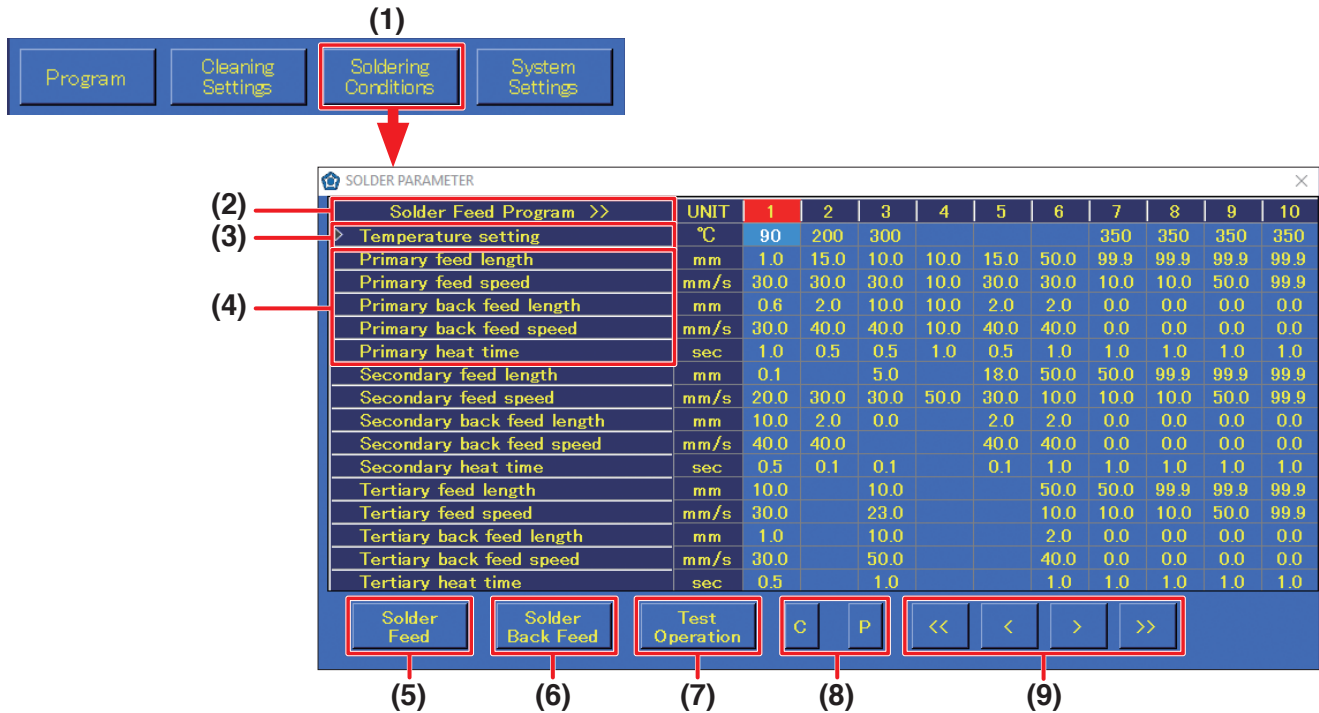
7-1-2 Cleaning Settings



Cleaning Settings Screen

- (1) **Cleaning Settings** (top screen)
Button for setting cleaning settings. Up to 5 settings can be set.
- (2) **Cleaning number**
Cleaning program number. Up to 5 cleaning programs can be set.
- (3) **Current point**
Shows the current tip position.
- (4) **AIR**
Sets air cleaning settings.
- (5) **BRUSH**
Sets brush cleaning settings.
- (6) **SPEED**
Sets the movement speed when moving the tip from Start point → End point → Start point.
- (7) **DWELL**
Sets the respective cleaning times while waiting at the start point and end point during cleaning. (Settable range: 0.0 – 60.0 sec.)
- (8) **Use current pos.**
Sets the current coordinates as the start point or end point.
- (9) **Disable axis Y**
When checked, forces the Y axis to not move during cleaning regardless of the input coordinate values.
- (10) **Z lifting**
The Z axis lift coordinates to be used during cleaning. These values will be given priority during cleaning regardless of the **Z axis lift coord.** set in the top screen. For details on Z axis lift behavior, refer to “7-2-2 Z Axis Lift” (p. 61).
- (11) **Check operation**
Checks the operation of the set cleaning behavior.

7-1-3 Soldering Conditions



Solder Feed Parameter Setting Screen

- (1) **Soldering Conditions** (top screen) Solder feed programs are created in the Solder Feed Parameter Setting Screen. A maximum of 250 solder feed programs can be set.
- (2) **Soldering Feed Program** Solder feed program numbers. A single vertical column is a single program.
- (3) **Temperature setting** Input the temperature setting. (Settable range: 50 – 500°C)
- (4) **Feed length, feed speed, back feed length, back feed speed, heat time** These are the solder feed settings. The settable range for each item are as shown in the table below. For primary soldering, the settings are for the start point position. For both secondary and tertiary soldering, the settings are for the end point position.

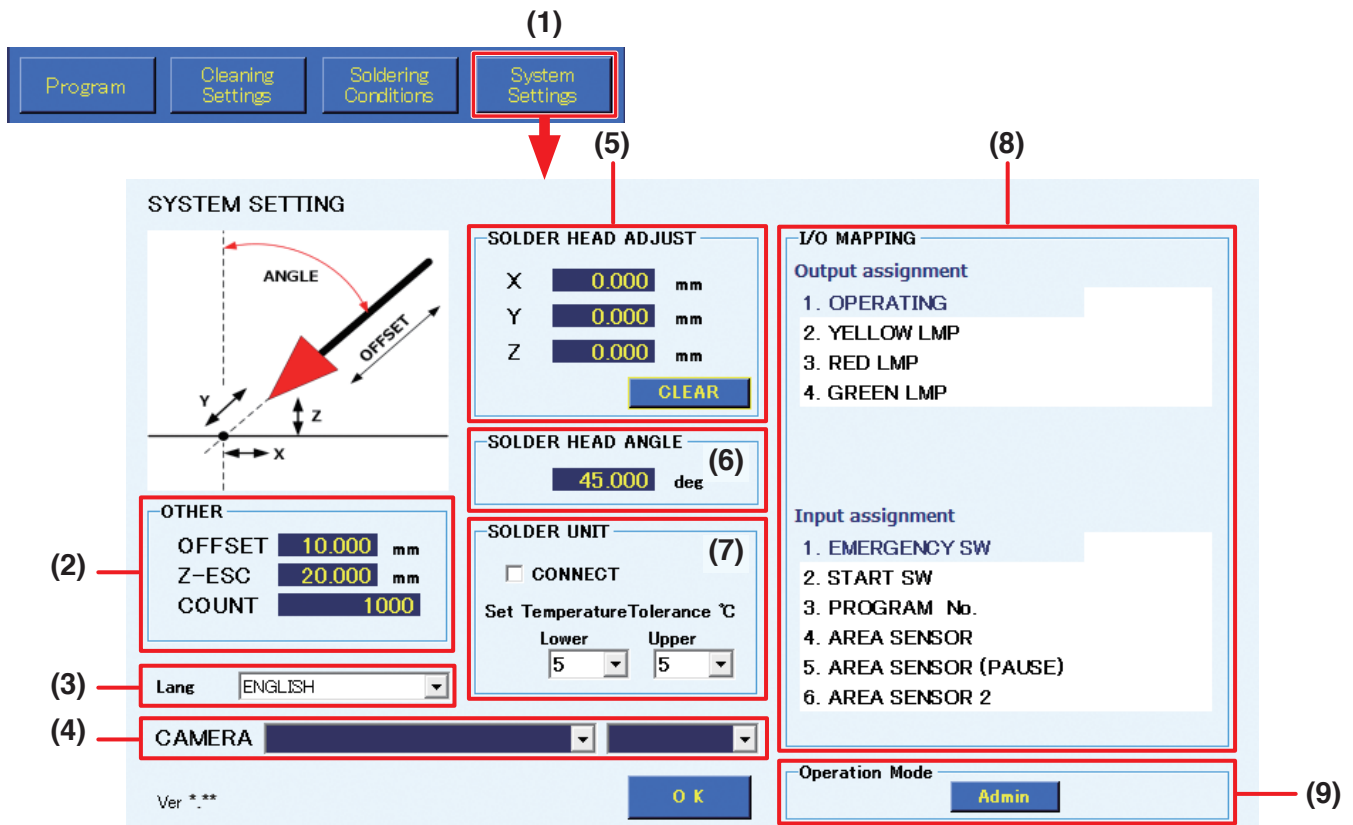
Setting item	Range*1
Solder feed length	0.1 – 99.9 mm
Solder feed speed	0.1 – 99.9 mm/s
Solder back feed length	0 – 20.0 mm
Solder back feed speed	0 – 99.9 mm
Heat time	0.1 – 9.9 sec

*1 For secondary and tertiary soldering, all values can be set starting from 0.

- (5) **Solder Feed** Button for manually feeding solder. When tapped, it will be set to on and solder will be fed. Tapping it again will set it to off. (Solder feeding, solder retraction, and solder feed speed settings can also be performed from the top screen.)
- (6) **Solder Back Feed** Button for manually retracting solder. When tapped, it will be set to on and solder will be retracted. Tapping it again will set it to off. (Solder feeding, solder retraction, and solder feed speed settings can also be performed from the top screen.)
- (7) **Test Operation** The program for the soldering conditions number for the selected column will be run.
- (8) **C:** Copies the soldering conditions in the selected column.
P: Pastes the copied soldering conditions into the selected column.
- (9) **<< / >>:** Moves to the previous or next soldering conditions page (1 page = 10 columns)
- < / >:** To switch between pages (columns 1 – 10 ⇔ columns 11 – 20), tap << or >>. Selects the previous or next column of conditions.

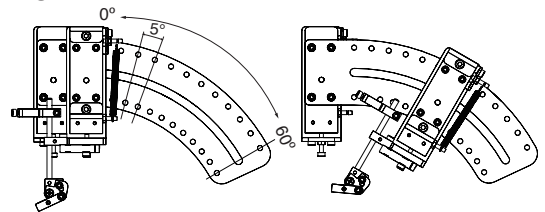
7. Operation (continued)

7-1-4 System Settings

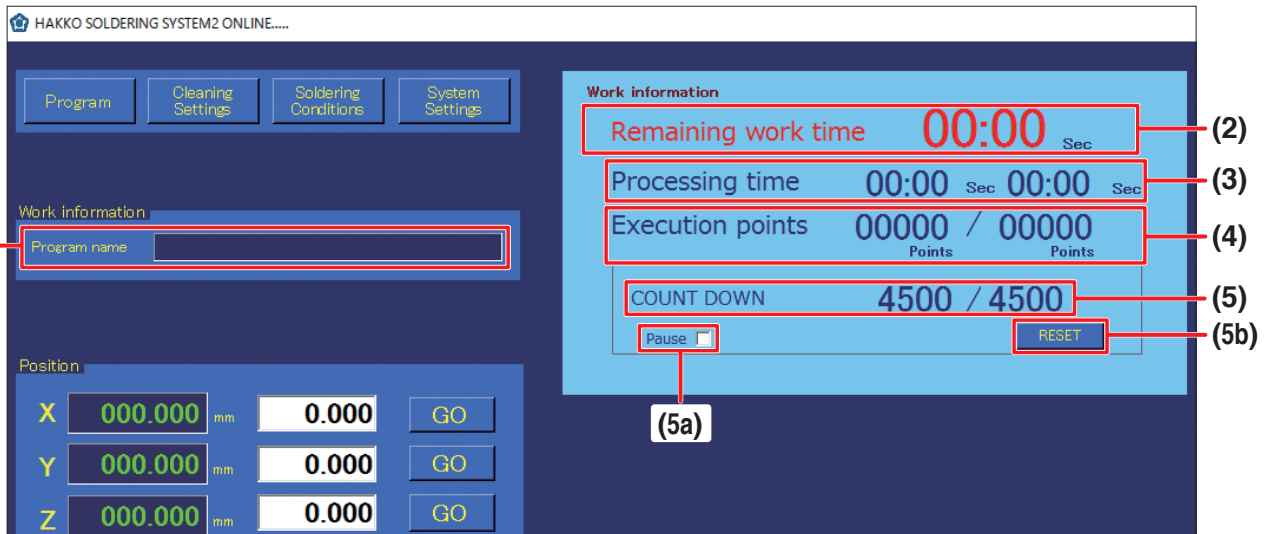


System Settings Screen (Admin mode)

- (1) **System Settings** (top screen)
Used for setting more detailed settings. For details, refer to “7-7 Performing Detailed Settings” (p. 95).
- (2) **OTHER**
OFFSET: Sets the offset when using AUTO SET.
Z-ESC: Sets the Z axis lift amount when an error occurs in the HAKKO FU-601 solder feed.
COUNT: Sets the numerical value for COUNT DOWN shown in work information in the top screen.
- (3) **Lang**
Select the language.
- (4) **CAMERA**
Selects the camera to be used by the system.
- (5) **SOLDER HEAD ADJUST**
Corrects the tip position for tips whose dimension has changed due to wear.
- (6) **SOLDER HEAD ANGLE**
Set the angle matching the mounting angle of the soldering iron unit.
The tip angle can be changed between 0° and 60° and mounted. (Refer to diagram at right.)
- (7) **SOLDER UNIT**
Connects to the HAKKO FU-601 and sets the upper limit temperature and lower limit temperature for the temperature tolerance standard.
- (8) **I/O MAPPING**
Sets the I/O connections for external peripheral equipment such as an emergency stop device, etc.
- (9) **Operation Mode**
Switches the mode to either Admin mode or Operator mode. In Admin mode, all operations can be performed. In Operator mode, program editing or settings such as cleaning settings, soldering conditions, etc. cannot be performed. For details on switching modes, refer to “7-7-5-7 Operation Mode” (p. 117).



7-1-5 Work Information



(1) Program name

Displays the name of the selected program. When a program name is displayed, the Program Edit Screen for the program corresponding to the name can be opened by double-tapping on the program name.

(2) Remaining work time

For a program which has been run to the end at least once already, the remaining work time will be shown when the program is run a second or later time. Even if the program has been changed, the remaining time for the program before the change will be shown.

(3) Processing time

Left value: Shows the elapsed time for the program currently being run.

Right value: Shows the time for a single program.

The program times are shown only for programs which have been run to the end at least once. In addition, even if the program has been changed, the work time for the program before the change will be shown.

(4) Execution points

Left value: Shows the number of points for which work has been completed.

Right value: Shows the total number of points for the program being run.

(5) COUNT DOWN

Left value:

Shows the value equal to the set value minus the number of executed points. When the count reaches 0, the program will pause even if the program is in the middle of running. At that time, a pause dialog will be shown. It can be used for tip life management, maintenance timing management, etc.

When the program is paused, **[START]** will change to **[PAUSE]**.

When **[PAUSE]** is tapped, operation will restart from the point at which it was paused.

(Refer to "7-1-11-1 Flowchart (Screen Button Operation)" (p. 55)).

When performing operation using the robot buttons, press the **[START/PAUSE/STOP]** button.

(Refer to "7-1-11-2 Flowchart (Robot Button Operation)" (p. 56)).

Right value:

Shows any desired value set in the COUNT box for OTHER in systems settings.

(5a) Pause

Check it to temporarily pause the COUNT DOWN function.

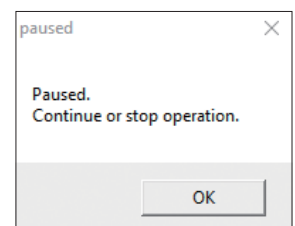
While checked, the count (left value) is stopped even if soldering is performed.

(5b) RESET

Resets the COUNT DOWN value.

If it is reset, the count (left value) will return to the same as the original value at right.

When this button is tapped after setting a value in the COUNT box for OTHER in systems settings, the value will be updated in this screen.

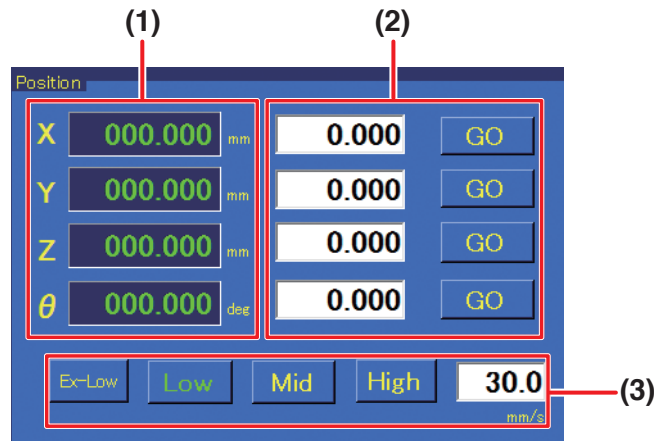


Press button.



7. Operation (continued)

7-1-6 Position



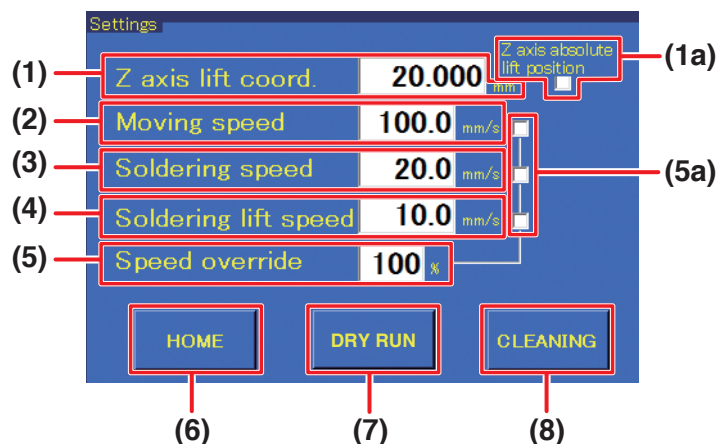
Used for checking the current coordinates of the robot or for performing coordinate movement of the robot.

- (1) Shows the current coordinate of the robot for each axis.
- (2) When the coordinates to move to are known, input the coordinates.
When **[GO]** is tapped, the corresponding axes will move to the specified coordinates.
(Settable range: X: 0 – 400 mm; Y: 0 – 300 mm; Z: 0 – 200 mm; θ : $\pm 200^\circ$)
- (3) Selects the speed for movement to the coordinates specified in (2).
Ex-Low: 5 mm/sec.; **Low:** 30 mm/sec.
Mid: 100 mm/sec.; **High:** 200 mm/sec.
Free setting range: 1 – 800 mm/sec. can be input.

— Note —

When the movement distance is long, select Mid or High while being careful to avoid contact.
When the movement distance is short, use Ex-Low or set a low value for the free setting.

7-1-7 Settings



Sets movement speed, etc. When individual settings are not performed, these values are used when running the program.

- (1) **Z axis lift coord.**
Sets the value for the Z axis lift when the robot is moving to coordinates. This coordinate is set to avoid contact with protruding objects on the workpiece. (Settable range: 0.000 – 200.000 mm)
For details on Z axis lift, refer to “7-2-2 Z Axis Lift” (p. 61)

(1a) Z axis absolute lift position (checkbox)

Sets the Z axis lift coordinate on and off. Normally, this checkbox is checked.

(2) Moving speed

Sets the movement speed of each axis for movement between points while the program is being run. (Settable range: 1 – 800 mm/sec.)

(3) Soldering speed

Sets the soldering moving speed between primary soldering and secondary soldering (from start point to end point).

(Settable range: 1 – 800 mm/sec.)

(4) Soldering lift speed

Sets the speed for movement after the end point to the movement destination (start point or Z lift position).

(Settable range: 1 – 800 mm/sec.)

(5) Speed override

The speeds for moving speed, soldering speed, and soldering lift speed can be adjusted as percentages. This can be used for adjusting the speed of completed programs.

(Settable range: 1 – 100%)

(5a) Speed override (checkbox)

Sets the items for adjustment using speed override on and off.

(6) HOME

Returns the robot to the origin point. The Z axis will be moved first, and then the X, Y, and θ axes will be moved in that order.

(7) DRY RUN

Performs the robot motion of the selected program without adjusting the soldering iron temperature or performing solder feed. This operation is used to check the position information of the program.

— Note —

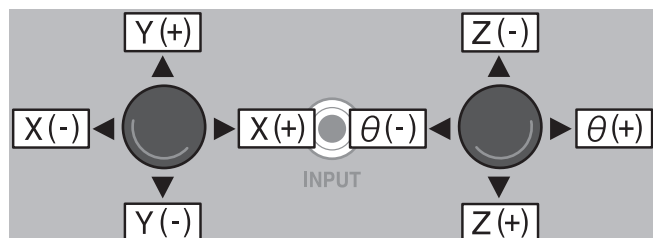
COUNT DOWN is also performed when using DRY RUN.

For details on COUNT DOWN, refer to “7-1-5 Work Information” (p. 51).

(8) CLEANING

Performs cleaning. Used to perform cleaning at any desired time. Cannot be used while a program is running. Only cleaning program 1 can be performed.

7-1-8 INCHING PITCH/JOG SPEED



Used for axis movement of the robot. There are 2 ways of moving. Fine adjustments can be performed by using either of the 2 methods according to the application.

(1) INCHING PITCH

When a numerical value is selected, operating the robot's JOY STICK will move the robot only by the selected amount.

Since movement will not continue even if the JOY STICK continues to be tilted, this is suitable for movements by small degrees.

(2) JOG SPEED

When a speed is selected, movement will be performed at the selected speed for as long as the robot's JOY STICK is kept tilted.

7. Operation (continued)

7-1-9 Solder feeding / Solder retraction

Buttons for feeding and retracting solder when in manual. The solder feed speed can also be set. For details, refer to “7-1-3 Soldering Conditions” (p. 49), and for operations refer to “7-4 Solder Installation and Solder Feed Settings” (p. 69).

7-1-10 Running Program

Running program													
STEP	X0	Y0	Z0	θ 0	X1	Y1	Z1	θ 1	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	■	■	1	■	**C***
2	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000	■	■	1	■	
3	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000	■	■	1	■	***S*
4	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	■	■	1	■	***Z**
5	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	■	■	1	■	**C***

While a program is running, the STEP (row) currently being performed will be highlighted, and the rows will scroll.

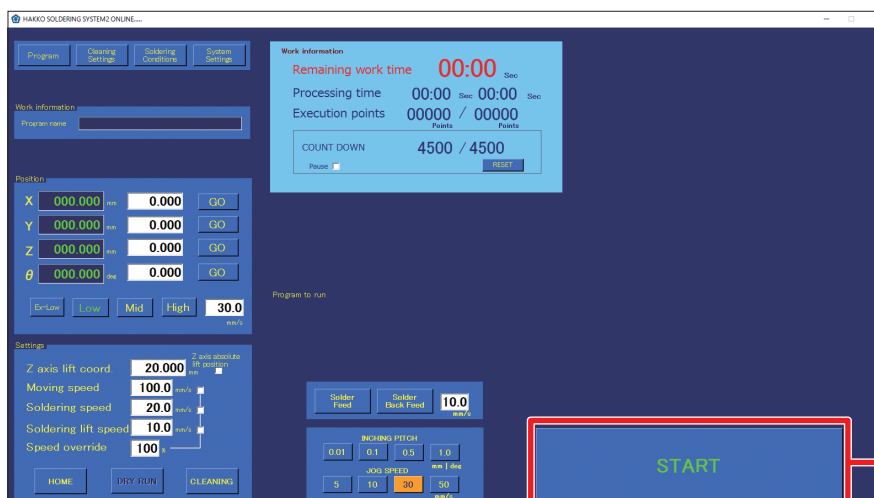
A maximum of 5 rows of the program which was called up will be shown. While the program is running, the screen will automatically scroll with the STEP currently being executed. This section is for display only, and setting changes, etc. cannot be performed here.

For details on programs, refer to “7-5 Creating a Soldering Program” (p. 74).

7-1-11 Start Button

Program start, pause, stop, and restart operations can be performed using the **[START/PAUSE/STOP]** button on the robot’s front panel or the **[START]** button on the software’s top screen.

For details, refer to “7-1-11-1 Flowchart (Screen Button Operation)” (p. 55) or “7-1-11-2 Flowchart (Robot Button Operation)” (p. 56).



Top screen of software

List of button displays

All displays are blinking displays.

STOP

PAUSE

Screen button operation

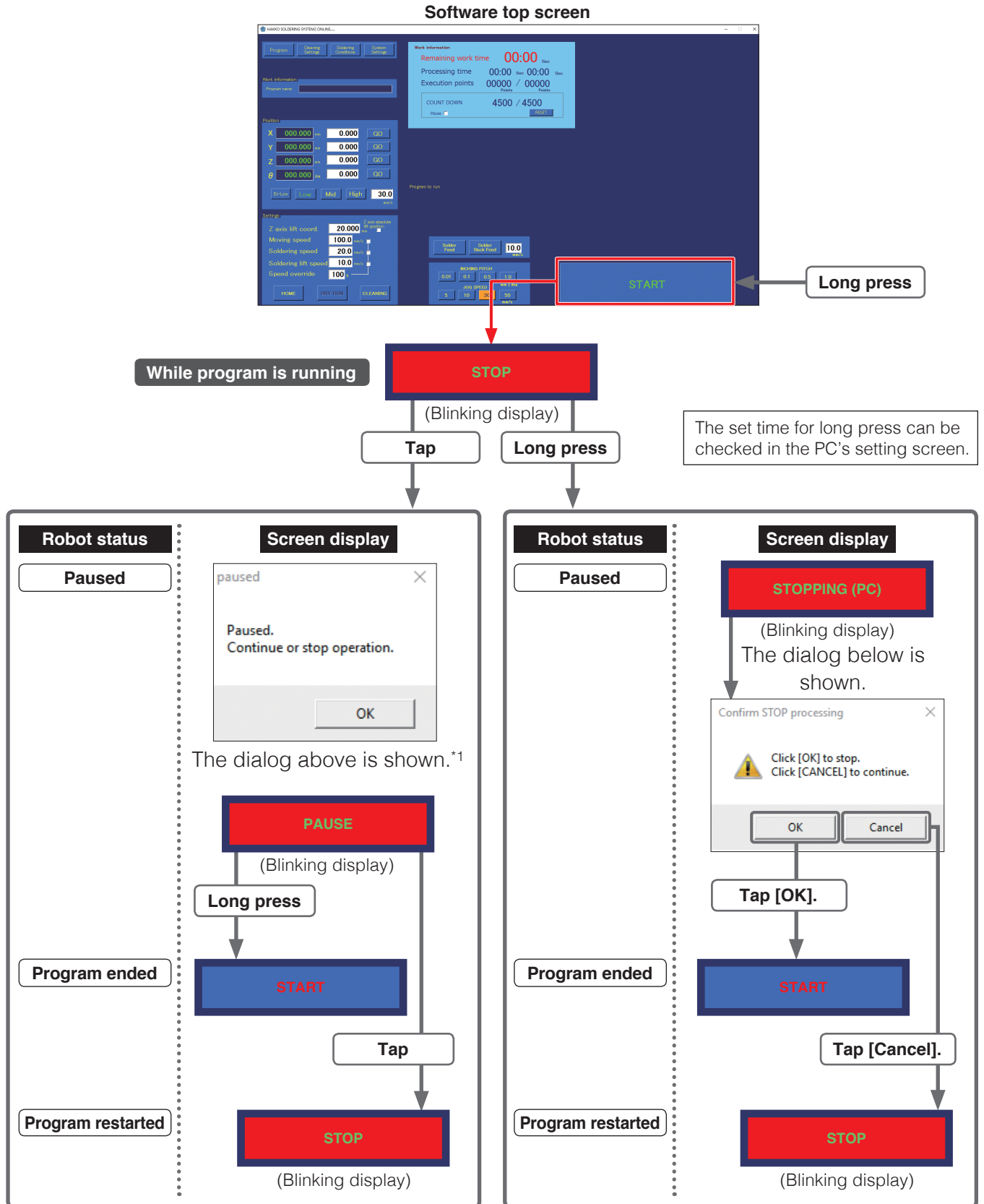
STOPPING (PC)

Robot button operation

STOPPING (SW)

7-1-11-1 Flowchart (Screen Button Operation)

The diagram below shows the flow of program pause, stop, and restart operations using the screen buttons after a program has been started.

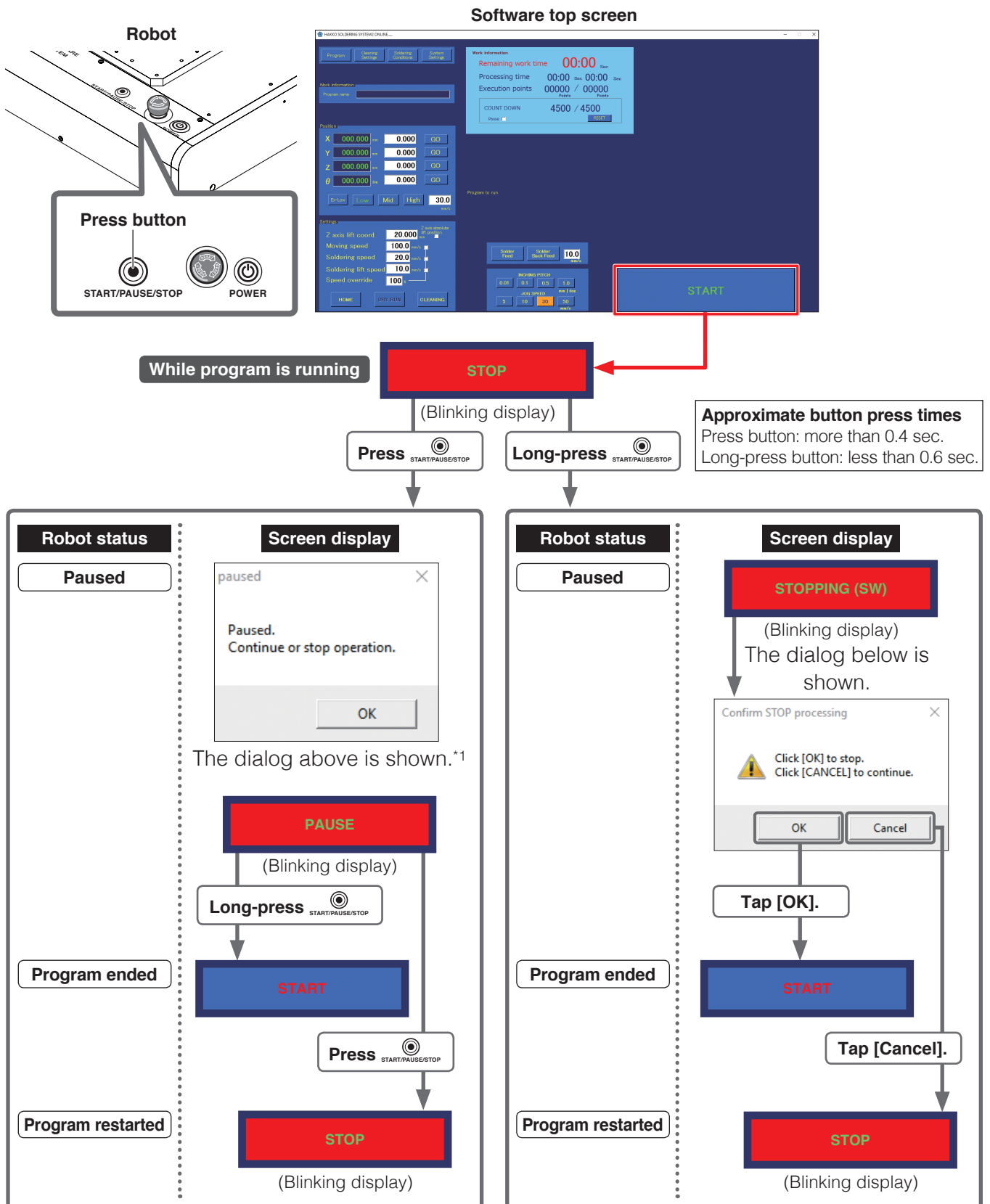


*1 During PAUSE, even if [OK] is tapped in the dialog, the same display will be shown again. If [PAUSE] is long-pressed (end program) or tapped (restart program) the display will automatically disappear.

7. Operation (continued)

7-1-11-2 Flowchart (Robot Button Operation)

The diagram below shows the flow of program pause, stop, and restart operations using the robot button after a program has been started.



*1 During PAUSE, even if [OK] is tapped in the dialog, the same display will be shown again.
 If [PAUSE] is long-pressed (end program) or tapped (restart program) the display will automatically disappear.

7-2 JOG Operation

⚠ CAUTION

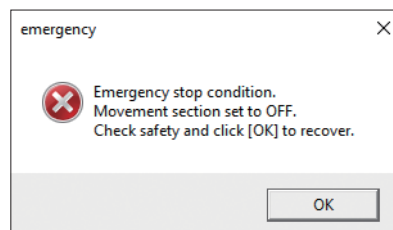
When the robot will be operated, notify nearby workers that work is being performed and perform work while checking safety.

To enable operation to be immediately stopped in the event of a dangerous condition, perform work within reach of an emergency stop button.

When an emergency stop condition has been entered by pressing the emergency stop button, the display below will be shown on the screen.

After removing the cause of the emergency stop, turn the robot's emergency stop button clockwise to return it to its normal position.

Then, tap **[OK]** in the message window.



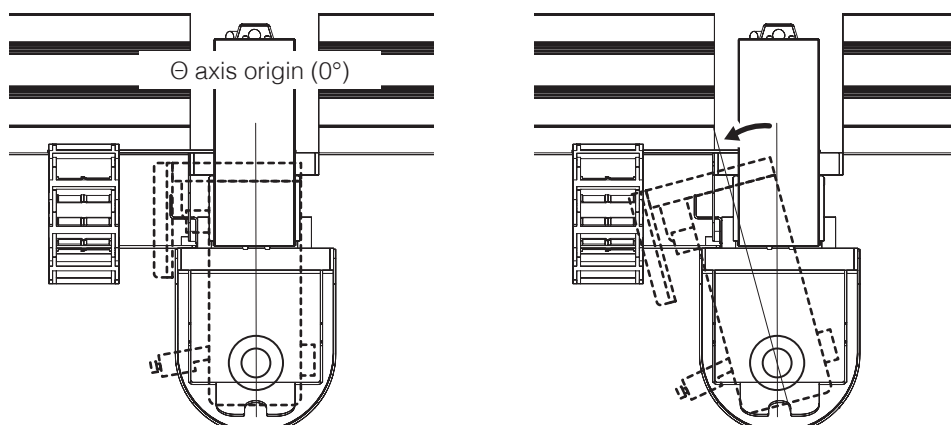
— Note —

- Even if **[OK]** is tapped before the emergency stop button has been returned to its normal position, the same display will appear again. Perform the emergency stop button operation first.
- After recovering from an emergency stop condition, be sure to tap **[HOME]** in the top screen to return the robot to the origin point. The Z axis will be moved first, and then the X, Y, and θ axes will be moved in that order.

⚠ CAUTION

When the θ axis rotates while returning to the origin, there is a danger of cables wrapping around the robot.

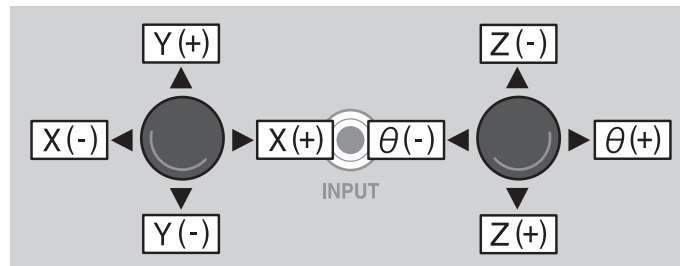
If it seems like there is a danger of cables wrapping around, press the emergency stop button immediately, turn the θ axis slightly counterclockwise from the origin (0°) when viewed from above the soldering unit fixture base, and then tap **[HOME] again.**



7. Operation (continued)

7-2-1 Basic Operations for JOG Operation

7-2-1-1 Movement Direction Using JOY STICKS



7-2-1-2 Axis Movement by Direct Coordinate Input

If the rough coordinates are known, input the coordinate directly in the top screen and move the robot.

1. Select Ex-Low, Low, etc. speed.

Ex-Low: 5 mm/sec.; **Low:** 30 mm/sec.
Mid: 100 mm/sec.; **High:** 200 mm/sec.

Free speed setting (1 – 800 mm/sec.) can also be set by inputting.

— Note —

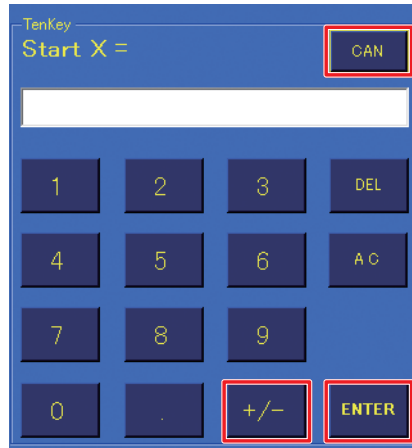
Select Ex-Low, Low, etc. speed first and be careful of contact.



2. Input the X, Y, Z, and θ coordinates to move to into the respective spaces.
(Settable range: X: 0 – 400 mm; Y: 0 – 300 mm; Z: 0 – 200 mm; θ : $\pm 200^\circ$)
3. Tapping **[GO]** next to each axis will cause the corresponding axis to move to the input coordinate. **[GO]** for the moving axis will be shown in red, and if **[GO]** for the moving axis is tapped again or if **[GO]** for a different axis is tapped, movement will be interrupted.
Input values within the movement range for each axis.
(If the input value is outside the range or if the value is blank, the input space will be shown in red.)

Inputting Values

Tapping each input space will cause a numerical keypad window to be shown. (Refer to the diagram below.) After inputting the value using the numerical keypad, tapping **[ENTER]** will cause the input value to be reflected in the input space. To cancel the numerical keypad window, tap on **[CAN]** at the upper right. To input negative values, after inputting the number tap **+/-**.

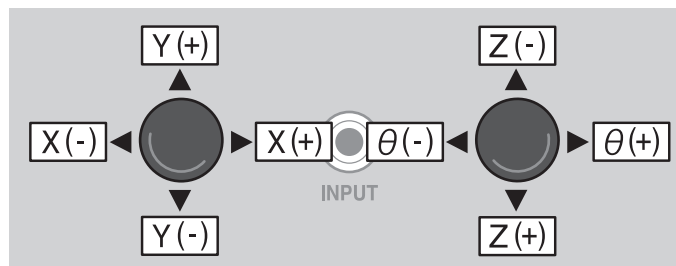


7-2-1-3 Axis Movement at Selected Speed (JOY STICK operation)

If the coordinates are unknown or if you want to move the robot freely, movement of axes can be performed using the JOY STICKS inside the door (cover) of the robot.



1. Select the desired **JOG SPEED** (5 mm/sec, 10 mm/sec, 30 mm/sec, or 50 mm/sec) in the top screen.
2. Tilt the JOY STICK inside the robot door (cover) in the desired direction. Refer to the diagram below for JOY STICK movement directions. Movement will be performed at the selected speed while the JOY STICK is tilted.



3. Move the axis close to the desired position while watching the robot movement. Letting go of the JOY STICK will stop movement.

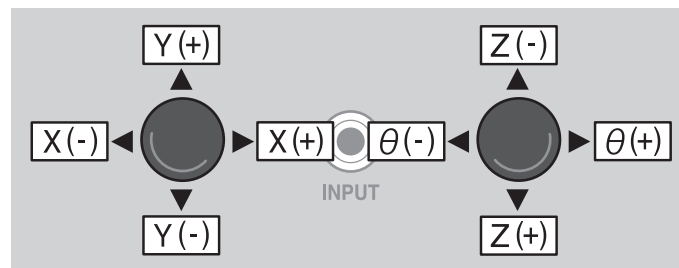
7. Operation (continued)

7-2-1-4 Axis Movement by Inching (JOY STICK operation)

To move the axis in fine increments or to perform fine adjustments when adjusting tip position, etc., the axis can be moved using the inching function. (Refer to diagram below.)

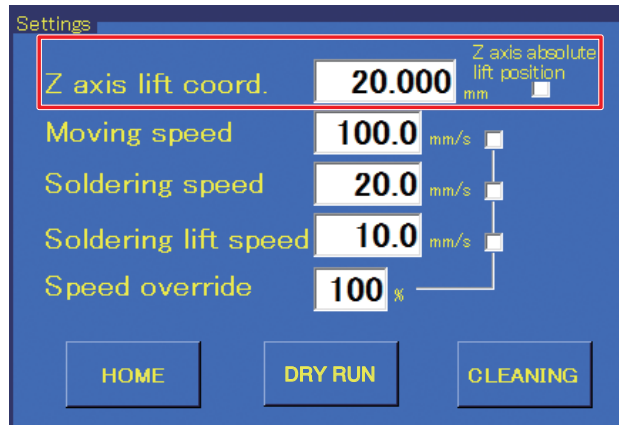


1. Select the desired **INCHING PITCH** (0.01 mm/deg, 0.1 mm/deg, 0.5 mm/deg, or 1.0 mm/deg) in the top screen.
2. Tilt the JOY STICK inside the robot's door (cover) in the desired direction. The robot will move only one unit of the selected pitch in the direction of the JOY STICK tilt.



3. Repeat **Step 2** as necessary to move the axis to the desired position.

7-2-2 Z Axis Lift



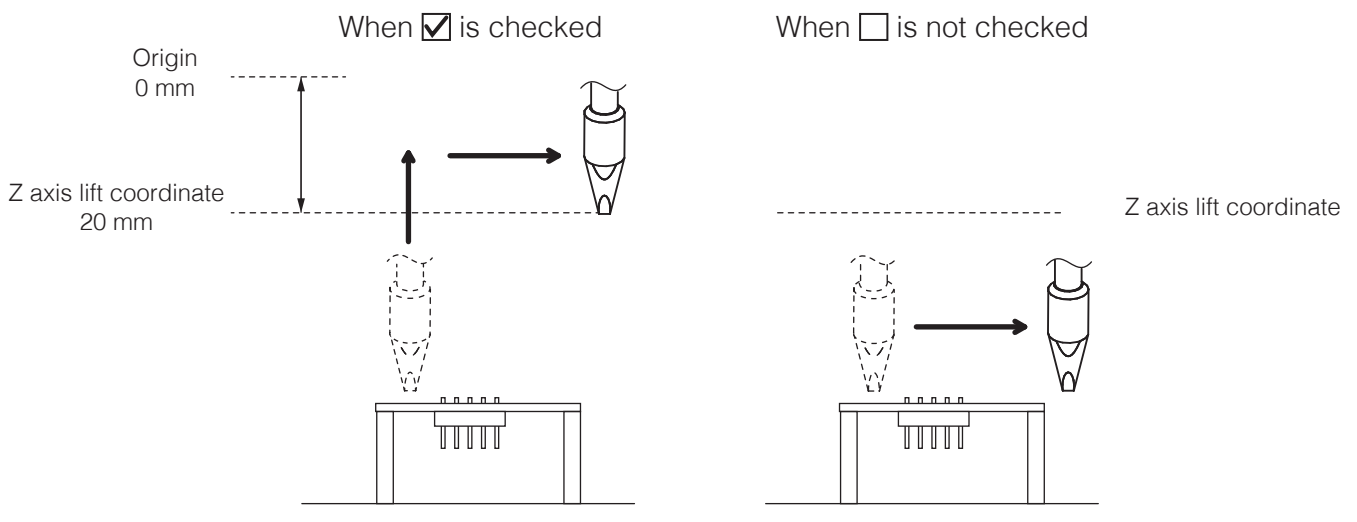
Z axis lift is a function for avoiding danger and unexpected damage to the PWB and areas around where soldering is performed.

The Z axis lift coordinate is a coordinate setting for avoiding contact with protruding objects on the workpiece during horizontal movement.

This operates both while a program is running and also during manual JOG operation.

When **Z axis absolute lift position** is checked in the top screen **Settings** and movement of an axis is performed, the Z axis will move to the lift coordinate before movement of the other axes is performed. The lift coordinate is set by inputting the **Z axis lift coord..** (Refer to diagram above.)

Ex.) When moving to the right by JOG operation



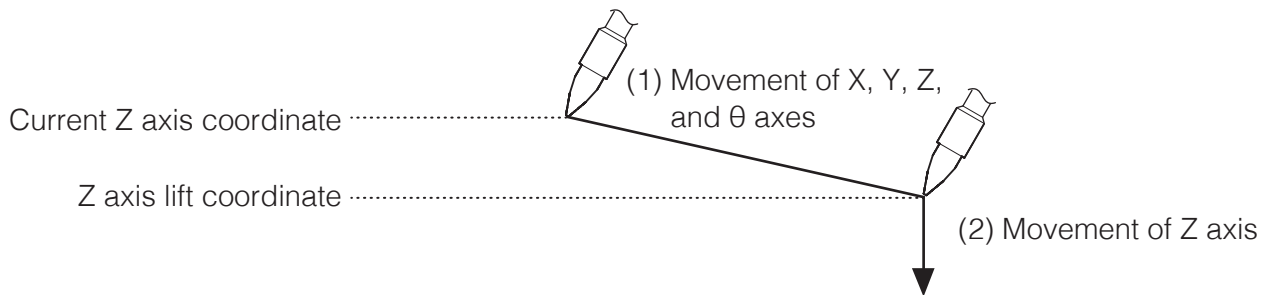
⚠ CAUTION

However, when fine adjustments such as setting tip position are necessary, if Z axis lift is performed each time the axis is moved, work becomes difficult. In such cases, uncheck the checkbox and use extra care to avoid contact with surrounding parts while moving. After work has been completed, be sure to check the checkbox again.

7. Operation (continued)

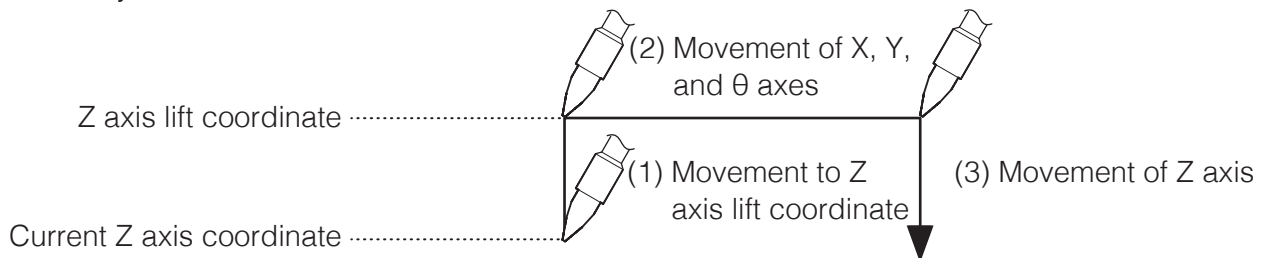
- **When current Z axis coordinate is higher than the Z axis lift coordinate**

Movement of the Z axis to the Z axis lift coordinate is performed after movement of the X, Y, Z, and θ axes.



- **When current Z axis coordinate is lower than Z axis lift coordinate**

Movement to the Z axis lift coordinate is performed, followed by movement of the X, Y, and θ axes, and finally the Z axis.



— Note —

If the Z axis before movement is at the same height as the Z axis lift coordinate, movement of the X, Y, and θ axes will be performed without moving the Z axis.

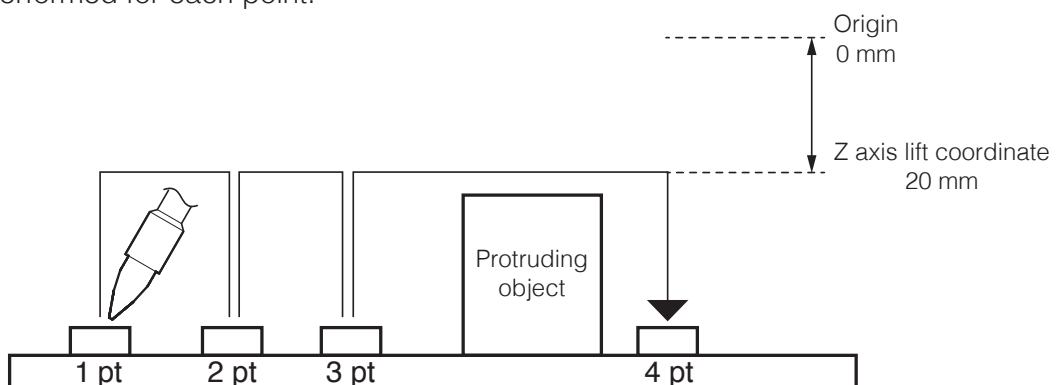
If movement of only the Z axis is performed without changing the X, Y, and θ axes, Z axis lift will not be performed.

When performing axis movement of the X, Y, and θ axes using the JOY STICKS, Z axis lift will be performed at the point when the JOY STICK is tilted, and movement cannot be interrupted until the Z axis lift coordinate has been reached.

During JOG operation, the Z axis lift operating speed will be the speed set for position in the top screen (refer to "7-1-6 Position" (p. 52)). The **JOG SPEED** is not applied.

When axis movement of the X/Y and θ /Z axes is performed simultaneously using the JOY STICKS, X, Y, and θ axis movement will be stopped at the point where the Z axis is moved from a position higher than the Z axis lift coordinate to a position lower than the Z axis lift coordinate.

While a program is running, if the **Z axis absolute lift position** in the top screen **Settings** is checked, Z axis lift will be performed for each point.



In addition, the height can be changed and a Z axis lift coordinate can be set only for specific points.

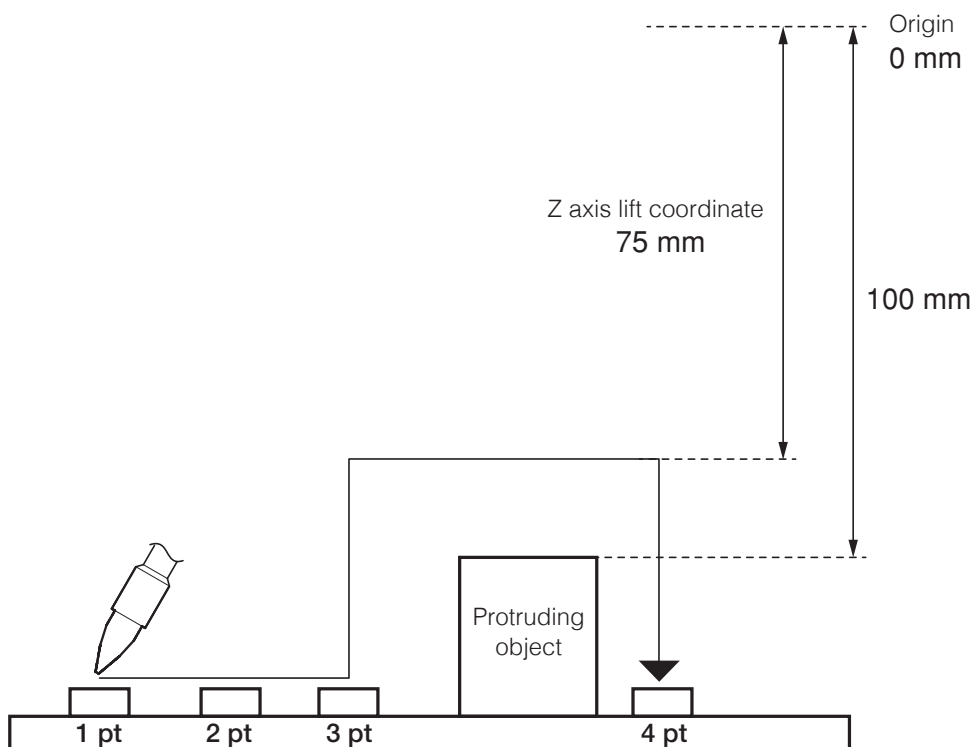


Ex.) When there is a protruding object between the 3rd point and the 4th point

- No Z axis lift is set up to the 3rd point.
 - In order to avoid the protruding object when moving from the 3rd point to the 4th point, the **Lifting Pos.** is set to 75 mm in the Point Edit Screen of the 4th point.
- Z axis lift is performed from the 3rd point to the 4th point.

— Note —

- If Z axis lift values are set in both the top screen and the Point Edit Screen, the Z axis lift coordinate set in the Point Edit Screen will be given priority and be applied.
- To avoid a protruding object between the 3rd point and the 4th point, input a value for the Z axis lift coordinate of the 4th point.



7. Operation (continued)

7-3 Cleaner (CX1003) Settings

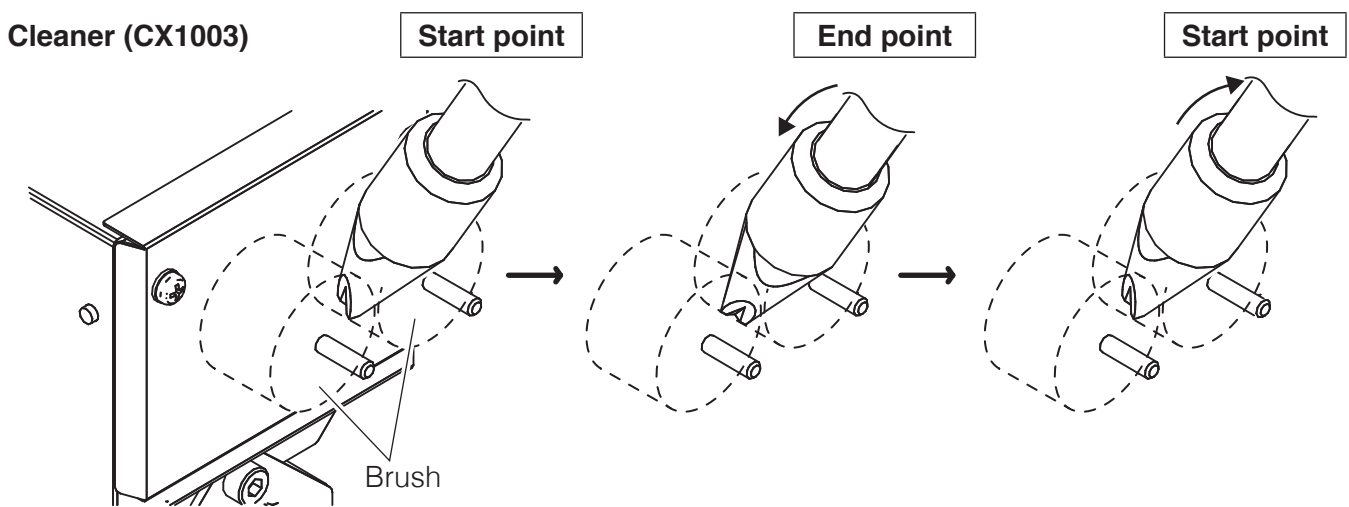
⚠ CAUTION

After performing JOG operation learning, be sure to set the cleaning position settings first.

7-3-1 Brush Cleaning Coordinate Settings

Determining the cleaning position of the installed cleaner (CX1003) will be performed.

To make it possible for the cleaner (CX1003) to perform cleaning and make the tip solder clean, the start point → end point → start point, movement to the cleaning process, and the angle can be set.



Tap **[Cleaning Settings]** in the top screen and input the settings.

1. Move the tip to a position where cleaning can be performed using the brushes of the cleaner (CX1003) by using the robot's JOY STICKS or specifying coordinates in the top screen. Adjust the cleaning position while selecting the appropriate **JOG SPEED** or **INCHING PITCH**.

— Note —

Since the Y axis coordinate is for jig table movement, it is not directly related to cleaning operation. If movement of the jig table is not desired, check the **Disable axis Y** checkbox.



2. Open the Cleaning Settings Screen (diagram above) from the top screen.
3. Up to 5 cleaning settings can be set. Select the number to be set by tapping the corresponding button (1).
4. Settings are started by setting the start point first. (Refer to table below.) The coordinates for the position adjusted to in **Step 1** are shown as the **[Current point]** (2).

X axis	30.000 mm
Y axis	250.000 mm
Z axis	120.000 mm
θ axis	0°
Movement speed	100 mm/sec
Cleaning time	1.0 sec

5. Check that the position is one where the tip is in contact with the brushes and cleaning can be performed, and tap **[Use current pos.]** on the **BRUSH** start point side (3). The coordinates of the current position will be reflected in the **[Start point]** space (4). Note that direct input of values can also be performed.

— Note —

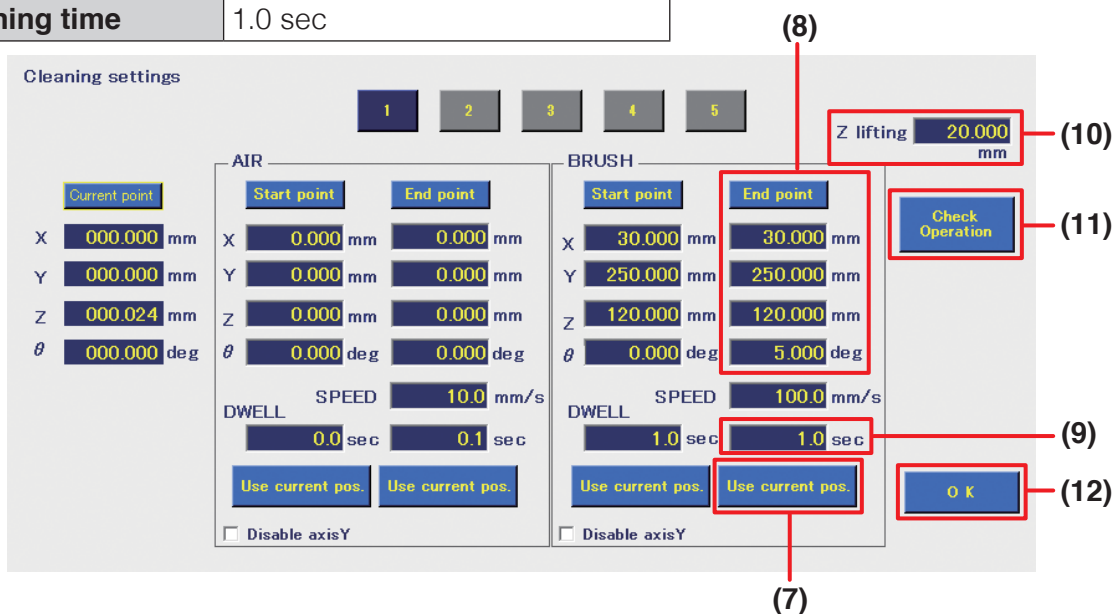
Input values within the movable range for each axis.
 For the movable range for each axis, refer to “2-1-1 Robot” in “2. Specifications” (p. 5).
 (If the input value is outside the range or if the value is left blank, the input space will be red.)

6. Set the time to stay at the start point position as the **DWELL** time (5). In the example, cleaning will be performed for 1 second at the start point coordinates. If this space is set to “0” or is left blank, this process will be skipped.
7. Set the movement speed during cleaning as the **SPEED** (6).
 In the example, it is set to 100 mm/sec. (Settable range: 1 – 800 mm/sec.)

7. Operation (continued)

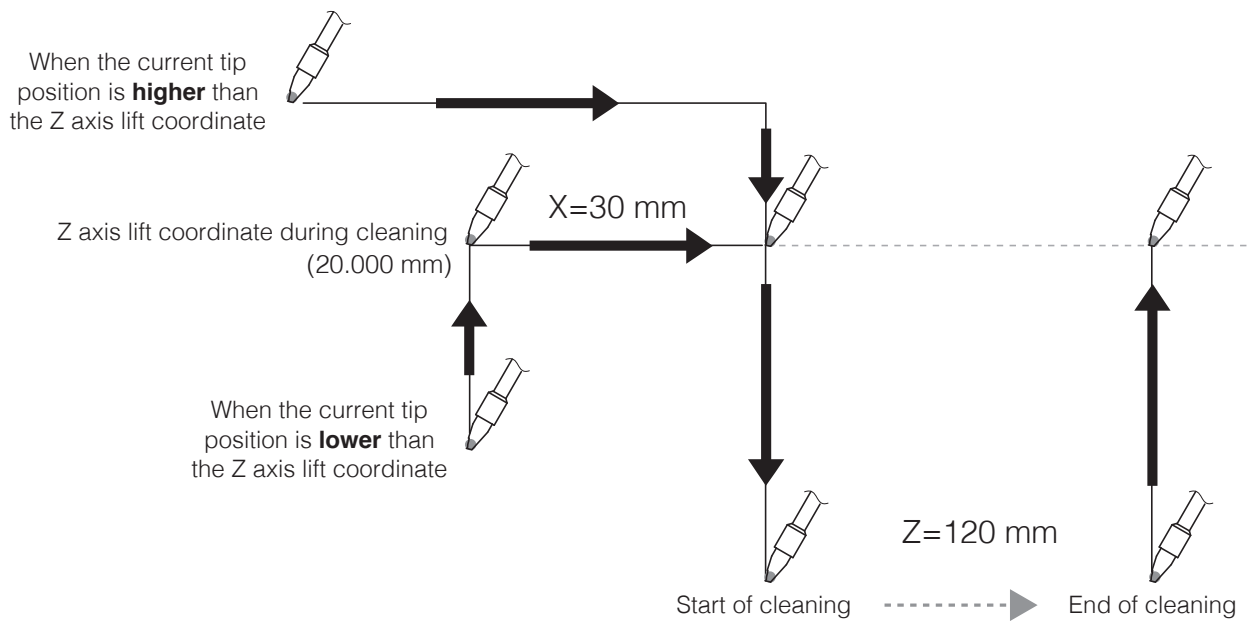
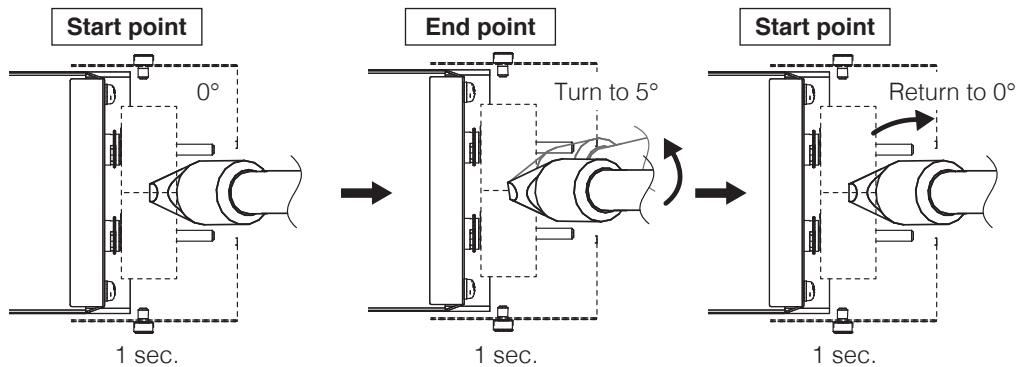
8. Next, set the end point (refer to table below). The end point coordinates for cleaning are coordinates that are set to enable cleaning of areas that cannot be cleaned at the start point coordinates.
Adjust the cleaning position using the robot's JOY STICKS or by specifying coordinates in the top screen.
In the example the Y coordinate and Z coordinate are the same as those of the start point, and only the θ has been changed.

X axis	30.000 mm
Y axis	250.000 mm
Z axis	120.000 mm
θ axis	5°
Movement speed	100 mm/sec
Cleaning time	1.0 sec

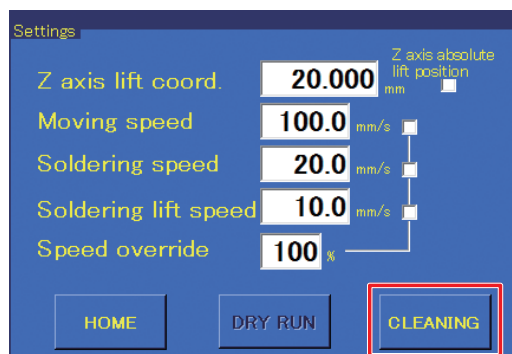


9. Tap **[Use current pos.]** on the **BRUSH** end point side (7). The coordinates of the current position will be reflected in the **[End point]** space (8).
10. Set the time to stay at the end point position as the **DWELL** time (9). In the example, cleaning will be performed for 1 second at the end point coordinates. (Settable range: 0.0 – 60.0 sec.) If this space is set to “0” or is left blank, this process will be skipped.
11. Finally, set the Z axis lift coordinate before cleaning or after cleaning as the **Z lifting** (10). These values will be given priority when performing cleaning regardless of the **Z axis lift coord.** set in the top screen.
For the movement during cleaning, refer to the next page.
In the example, it is set to 20.000 mm. (Settable range: 0.000 – 200.000 mm)

The cleaning movement which has been set can be checked by tapping **[Check operation] (11)**. When cleaning is performed according to the settings set in **Steps 4 to 11**, brush cleaning will be performed as shown in the diagram below.



12. Tap **[OK] (12)** to save the settings.



To perform cleaning manually, tap **[CLEANING]** in the top screen.

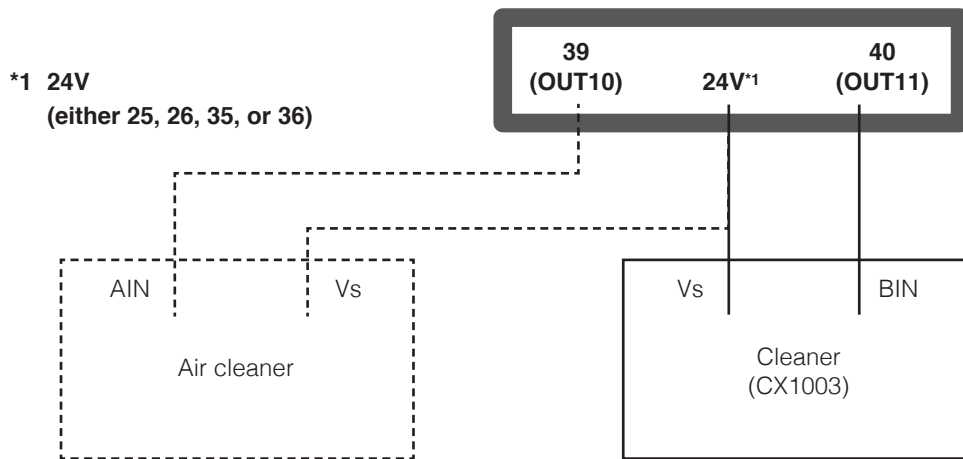
In this case, cleaning will be performed according to setting 1. This button cannot be used while the robot has accepted another operation. To specify the cleaning timing in a soldering program, refer to "7-5 Creating a Soldering Program" (p. 74).

The order of cleaning is air cleaning → brush cleaning

7. Operation (continued)

7-3-2 Connecting an Air Cleaner

Cleaner (CX1003) included in the set is a brush cleaner. In addition to this, an air cleaner can also be set. The method for setting cleaning settings is the same as when using a **BRUSH** cleaner. Wiring of an air cleaner can be performed as shown in the diagram below.



If the connections to AIN and BIN are reversed, brush cleaning will be performed using the air cleaning settings, and air cleaning will be performed using the brush cleaning settings.

7-3-3 Selecting Cleaner Type

To use both air cleaning and brush cleaning

When values have been input for both **AIR** and **BRUSH**, cleaning is performed in the order air cleaning → brush cleaning.

To use either air cleaning or brush cleaning

— Note —

If the **DWELL** time for both start point and end point are set to 0, that cleaning will be canceled.

Ex.) To use air cleaning

If the **AIR DWELL** time is set to 0 sec. for the start point and 0.1 sec. for the end point, air cleaning will be performed for 0.1 sec. at the end point coordinates.

Cleaning settings

1 2 3 4 5

Z lifting 20.000 mm

	AIR		BRUSH	
	Start point	End point	Start point	End point
X	0.000 mm	0.000 mm	30.000 mm	30.000 mm
Y	0.000 mm	0.000 mm	250.000 mm	250.000 mm
Z	0.000 mm	0.000 mm	120.000 mm	120.000 mm
θ	0.000 deg	0.000 deg	0.000 deg	5.000 deg
	SPEED 10.0 mm/s		SPEED 100.0 mm/s	
DWELL	0.0 sec	0.1 sec	1.0 sec	1.0 sec
	Use current pos.	Use current pos.	Use current pos.	Use current pos.
	<input type="checkbox"/> Disable axisY		<input type="checkbox"/> Disable axisY	

Check Operation

OK

7-4 Solder Installation and Solder Feed Settings

7-4-1 Solder Installation and Solder Feed Position Adjustment

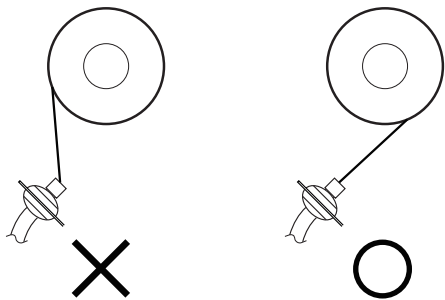
Check that the feeder unit and soldering unit mount are firmly assembled. For details on assembling and attaching them, refer to “5-2-1 Attaching the Feeder Unit (CX5005)” (p. 20) and “5-2-2 Attaching the Soldering Iron Unit” (p. 21).

7-4-1-1 Solder Installation

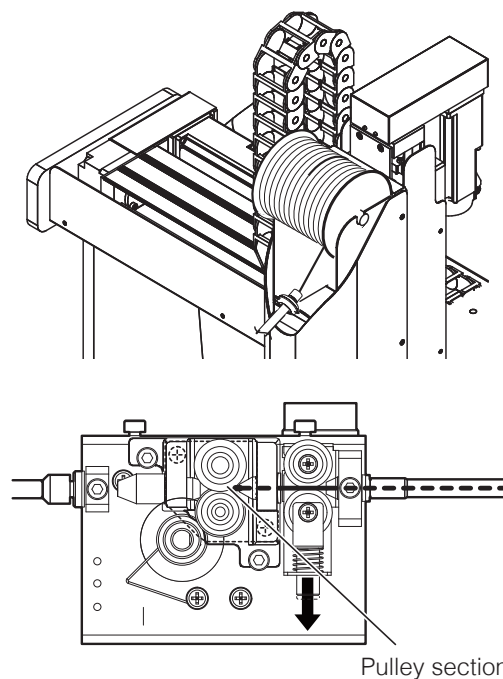
— Note —

A 2.5mm hexagonal wrench is used for adjusting the feeder unit and soldering unit mount.

1. Set the solder in the solder reel holder.
Set the solder orientation so that the solder will be fed from the rear side.

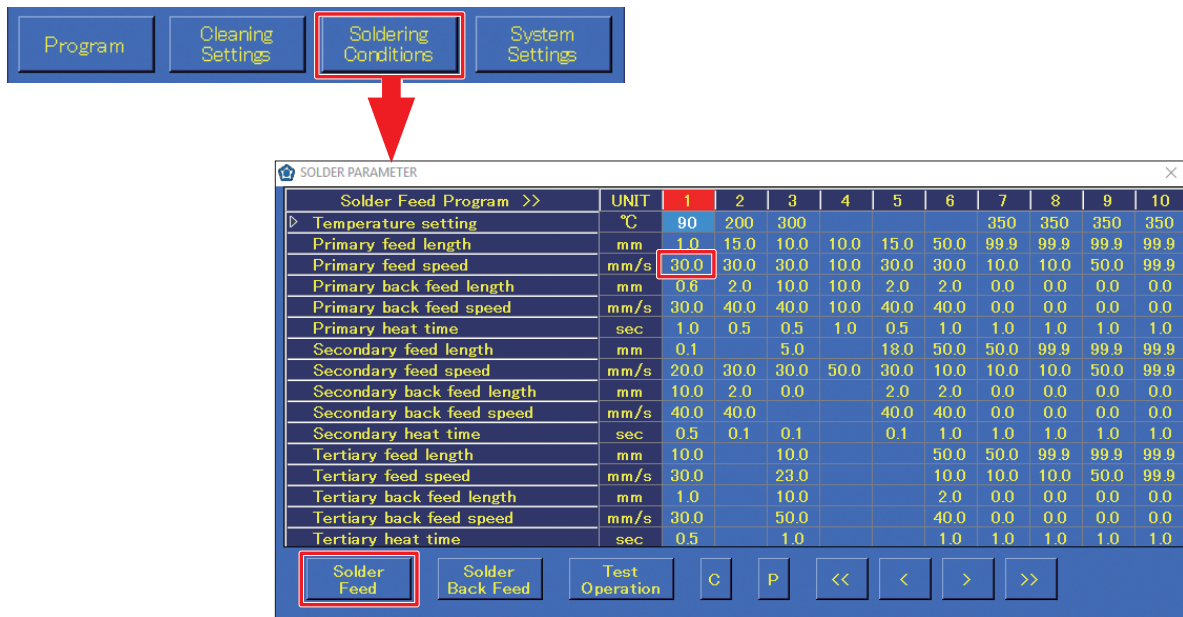


2. While turning the solder bobbin, pass the solder through the tube unit so that it pushes against the pulley section of the solder feed pulley unit.
To prevent solder feed problems, the bending radius of the tube unit should be kept to 10 cm or more.



7. Operation (continued)

- Tap **[Soldering Conditions]** in the top screen to open the Solder Feed Parameter Setting Screen.



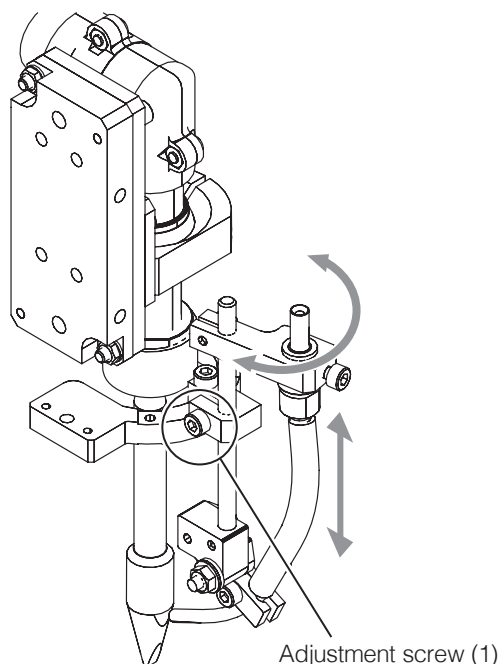
- When **[Solder Feed]** in the Solder Feed Parameter Setting Screen is tapped, solder will be fed. Tapping it again will cause solder feed to stop. Feed solder until solder comes out of the end of the Teflon tube.

— Note —

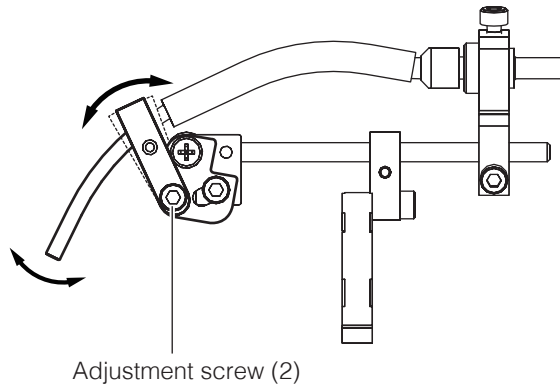
The solder feed speed will be the primary feed speed for the column of the selected soldering conditions number.

7-4-1-2 Solder Feed Position Adjustment

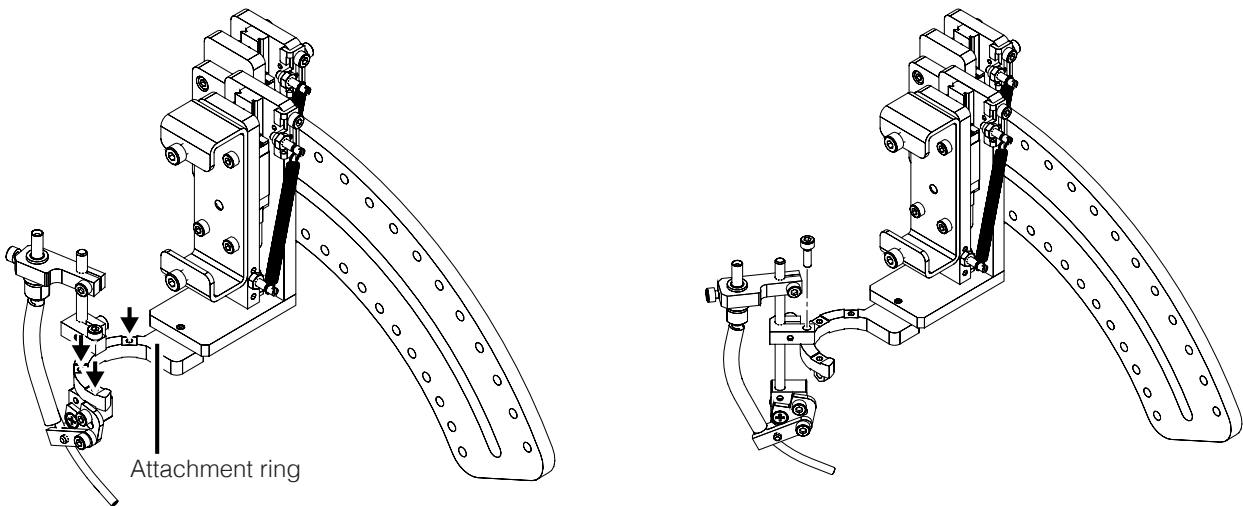
- When adjustment screw (1) of the soldering unit mount is loosened, the entire feed guide set can be moved as shown in the diagram below. Adjust the rod length and direction (rotation direction) and move the tip of the feed guide set to the soldering iron tip position.



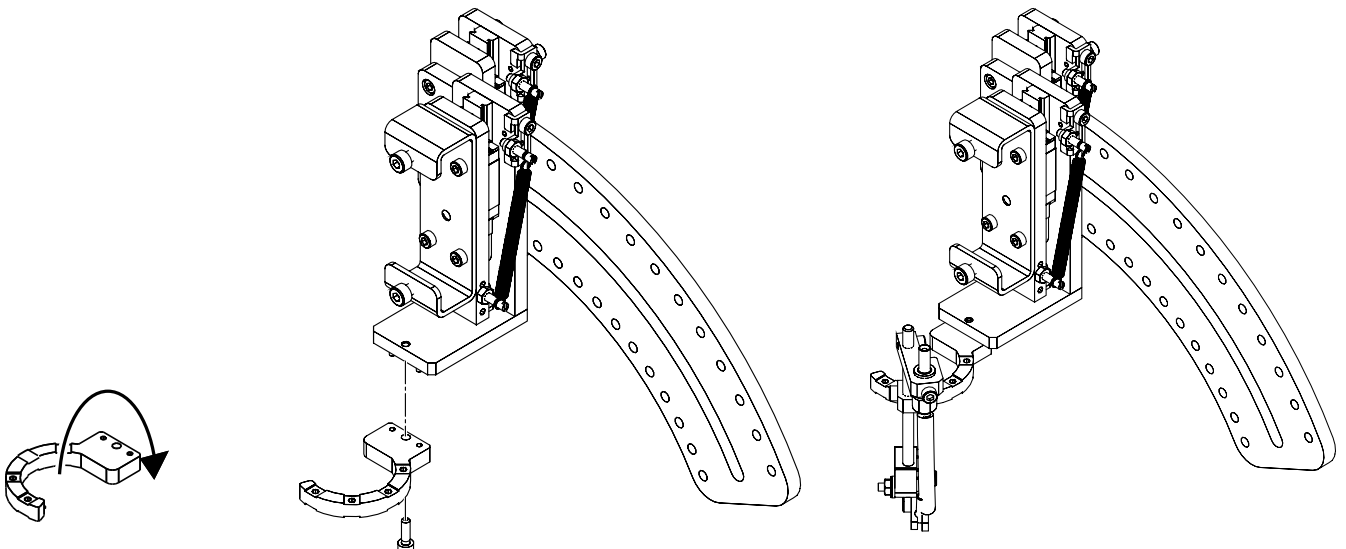
2. When adjustment screw (2) is loosened, the guide pipe can be moved as shown in the diagram below. Adjust it to a position where the solder will come in contact with the soldering iron tip.



3. The attachment ring has holes in 4 locations. The feed guide set angle can be adjusted by changing the attachment ring hole position.



4. Changing the attachment orientation of the attachment ring will make it possible to attach the feed guide set at the opposite angle.

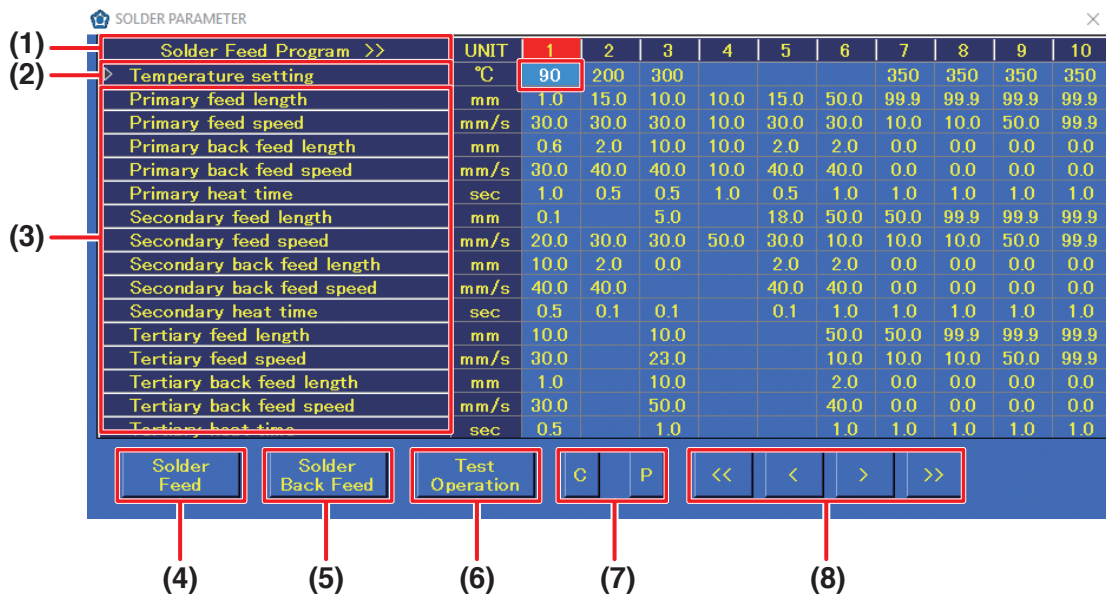


7. Operation (continued)

7-4-2 Solder Feed Settings

7-4-2-1 Creating a Solder Feed Program (Solder Feed Parameter Setting Screen)

Tap **[Soldering Conditions]** in the top screen to open the Solder Feed Parameter Setting Screen. Set the solder feed settings in this settings screen.



(1) Soldering Feed Program

This is the solder feed program number. Up to 250 programs can be set. A single vertical column is a single program.

(2) Temperature setting

Input the temperature setting if it is desired to change the temperature setting to match the soldering conditions from the robot.

If the space is blank, the HAKKO FU-601 temperature setting will be applied.

(3) Feed length, feed speed, back feed length, back feed speed, heat time

These are the solder feed parameter settings. The settable range for each item are as shown in the table below. For primary soldering, the settings are for the start point. For both secondary and tertiary soldering, the settings are for the end point.

Setting item	Range*1 - *4
Solder feed length	0.1 – 99.9 mm
Solder feed speed	0.1 – 99.9 mm/s
Solder back feed length	0 – 20.0 mm
Solder back feed speed	0 – 99.9 mm
Heat time	0.1 – 9.9 sec

*1 Depending on the type of solder, it may not be possible to feed solder normally at high speed. In such cases, contact the dealer where you purchased the product.

*2 The values in the table above are for primary soldering.

*3 For secondary and tertiary soldering, all values can be set starting from 0. If no feed speed is set for secondary soldering, that operation will be canceled. For other values, setting any of the values to 0 or blank will skip all subsequent operations.

*4 If the back feed length or back feed speed is set to 0, the corresponding back feed operation will be skipped.

— Note —

- The conditions for both PS (point soldering) and DS (drag soldering) can be set in the Solder Feed Parameter Setting Screen.
- When setting conditions for DS (drag soldering), set the secondary feed speed.

For DS (drag soldering), if a condition in which the secondary feed length is set is selected, the secondary feed length setting will be ignored.

(4) Solder feed

Used to feed solder at any desired timing. Tapping it once will start solder feed.

Tapping it again will stop solder feed. The solder feed speed will be the primary feed speed in the column for the selected soldering conditions number. (Solder feeding, solder retraction, and solder feed speed settings can also be performed from the top screen.)

(5) Solder back feed

Used to retract solder at any desired timing. Tapping it once will start solder back feed. Tapping it again will stop solder back feed.

The solder feed speed will be the primary feed speed in the column for the selected soldering conditions number. (Solder feeding, solder retraction, and solder feed speed settings can also be performed from the top screen.)

(6) Operation test

The program operations for the selected soldering conditions number will be performed. To select the soldering conditions number, select the top of the corresponding column.

(7) C: Copies the soldering conditions in the selected column.

P: Pastes the copied soldering conditions into the selected column.

(8) << / >>: Moves to the previous or next soldering conditions page (1 page = 10 columns)

< / >: Selects the previous or next column of conditions.

7-4-2-2 Reading/Writing Soldering Conditions

Soldering conditions can be read and written in CSV format.

1. Long-press anywhere in the Solder Feed Parameter Setting Screen.

Solder Feed Program >>	UNIT	1	2	3	4	5	6	7	8	9	10
Temperature setting	°C	90	200	300				350	350	350	350
Primary feed length	mm	1.0	15.0	10.0	10.0	15.0	50.0	99.9	99.9	99.9	99.9
Primary feed speed	mm/s	300	300	300	100	300	300	100	100	500	99.9
Primary back feed length	mm	0.6	2.0	10.0	10.0	2.0	2.0	0.0	0.0	0.0	0.0
Primary back feed speed	mm/s	300	400	400	100	400	400	0.0	0.0	0.0	0.0
Primary heat time	sec	1.0	0.5	0.5	1.0	0.5	1.0	1.0	1.0	1.0	1.0
Secondary feed length	mm	0.1		5.0		18.0	50.0	50.0	99.9	99.9	99.9
Secondary feed speed	mm/s	200	300	300	500	300	100	100	100	500	99.9
Secondary back feed length	mm	100	2.0	0.0		2.0	2.0	0.0	0.0	0.0	0.0
Secondary back feed speed	mm/s	400	400			400	400	0.0	0.0	0.0	0.0
Secondary heat time	sec	0.5	0.1	0.1		0.1	1.0	1.0	1.0	1.0	1.0
Tertiary feed length	mm	100		100			50.0	50.0	99.9	99.9	99.9
Tertiary feed speed	mm/s	300		23.0							
Tertiary back feed length	mm	1.0		10.0							
Tertiary back feed speed	mm/s	300		500				400	0.0	0.0	0.0
Tertiary heat time	sec	0.5		1.0				1.0	1.0	1.0	1.0

2. As shown in the diagram above, the Export Solder Conditions Table/Import Solder Conditions Table selection screen will appear.

To write solder conditions to a file, select Export Solder Conditions Table; to read solder conditions from a file, select Import Solder Conditions Table. This function reads and writes all soldering conditions.

Reading or writing of individual soldering conditions cannot be performed.

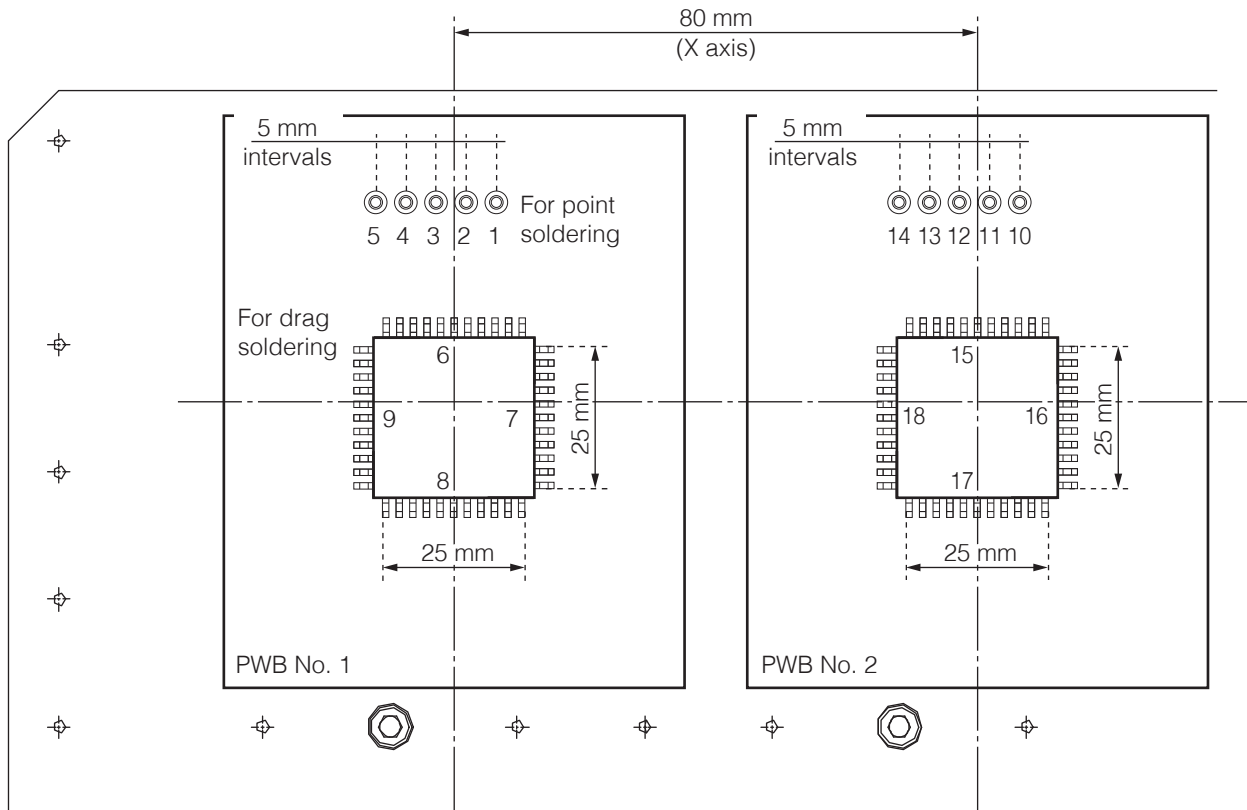
— Note —

Since importing will overwrite the current conditions, the current conditions will be lost. To retain the current conditions, export them and save them to a file first.

3. Perform reading or writing of a file according to the Windows OS screen.

7. Operation (continued)

7-5 Creating a Soldering Program



Performing order	Type of soldering	PWB No.
1	PS (point soldering)	1
2	PS (point soldering)	1
3	PS (point soldering)	1
4	PS (point soldering)	1
5	PS (point soldering)	1
6	DS (drag soldering)	1
7	DS (drag soldering)	1
8	DS (drag soldering)	1
9	DS (drag soldering)	1
10	PS (point soldering)	2
11	PS (point soldering)	2
12	PS (point soldering)	2
13	PS (point soldering)	2
14	PS (point soldering)	2
15	DS (drag soldering)	2
16	DS (drag soldering)	2
17	DS (drag soldering)	2
18	DS (drag soldering)	2
19	Removal	—

A soldering program will be created in the order shown in the table on the previous page using the PWB shown in the diagram on the previous page.

7-5-1 PS (Point Soldering) Settings

First, check that all equipment is connected properly, and that the power is switched on. For connection details, refer to “5. Installation” (p. 19).

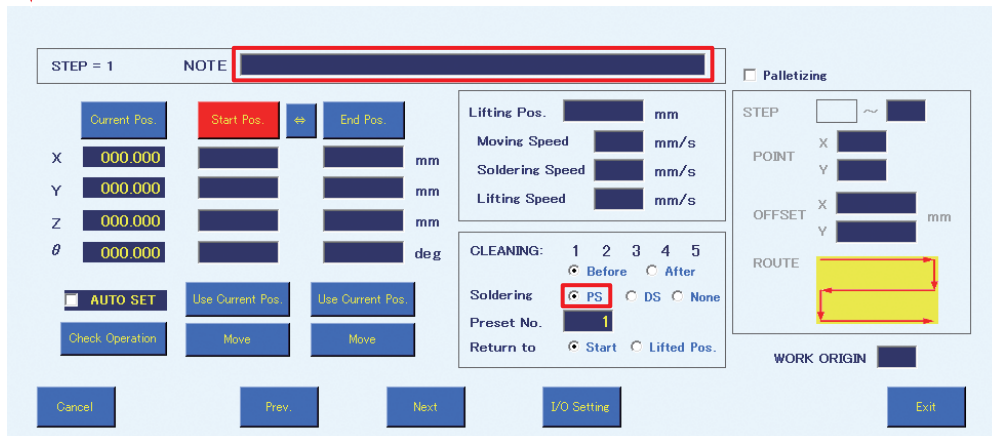
Switch on the tablet power and start the software (HAKKO SOLDERING SYSTEM2).

Since a window asking whether to return to origin will appear, perform return to origin.

Setting the End Point and Start Point of the 1st Point (PS)



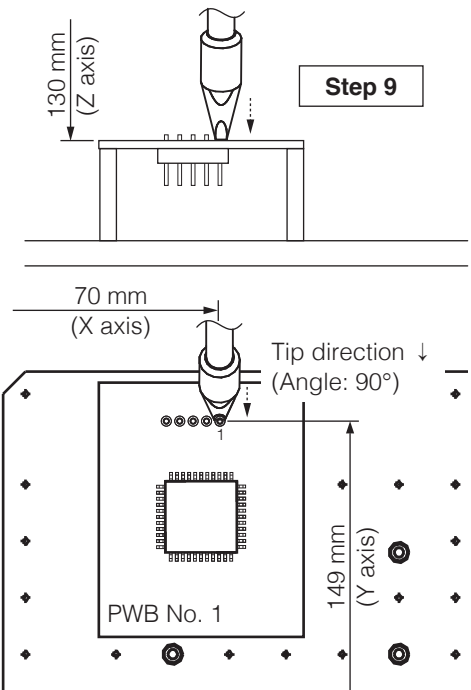
1. Tap **[Program]** in the top screen. The program list will open.
2. Tap the beginning of a row to select the entire row.
3. Tap the **Program name**, select a cell, and then tap it again to enter the condition for inputting characters. (The cursor will blink.)
4. If the OSK does not appear, tap **[OSK]** to open the on-screen keyboard and input the program name.
5. Tap **[Edit]** to open the Program Edit Screen.
6. Double-tap **STEP 1** and open the Point Edit Screen as shown in the diagram below.
7. Input the name of the product to be soldered in the **NOTE** space.



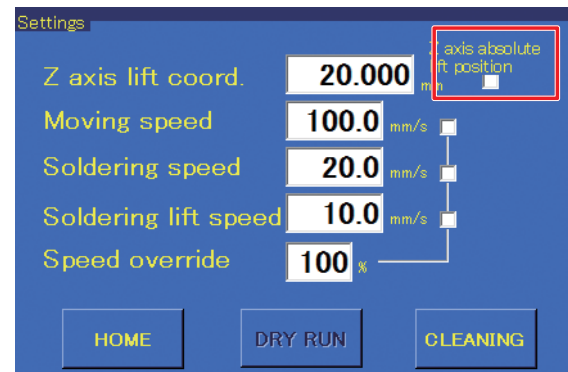
8. Select **PS** as the soldering mode.

7. Operation (continued)

9. Determining the position of the end point coordinates for the 1st point will be performed.
 (The end point coordinates for PS mode will be the position of the point to be soldered.)
 Move the tip to the position on the workpiece (refer to the figure at right) where point soldering will be performed.



- 1) Use the JOY STICKS or directly input the coordinates in the top screen to move the tip close to the point to be soldered.
- 2) To perform fine adjustment such as determining the tip position, etc., uncheck **Z axis absolute lift position** in the top screen.
 For details on Z axis lift behavior, refer to “7-2-2 Z Axis Lift” (p. 61).



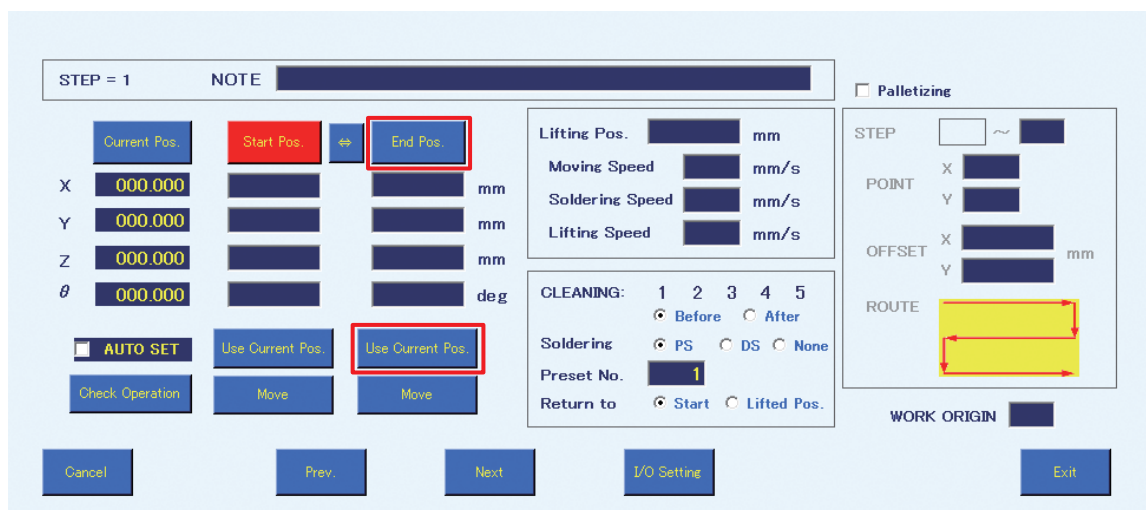
10. Perform fine adjustment and align the tip with the point to be soldered.

Selecting any of the **INCHING PITCH** buttons in the top screen will cause the robot to move only that amount when the JOY STICK is tilted once.

Use this to perform fine adjustment. The movement speed will be the speed set in the top screen's **Position** area.



Tap **[Use Current Pos.]** on the end point side.
 The coordinates can also be input by pressing the robot's **[Easy Input Switch]** button.

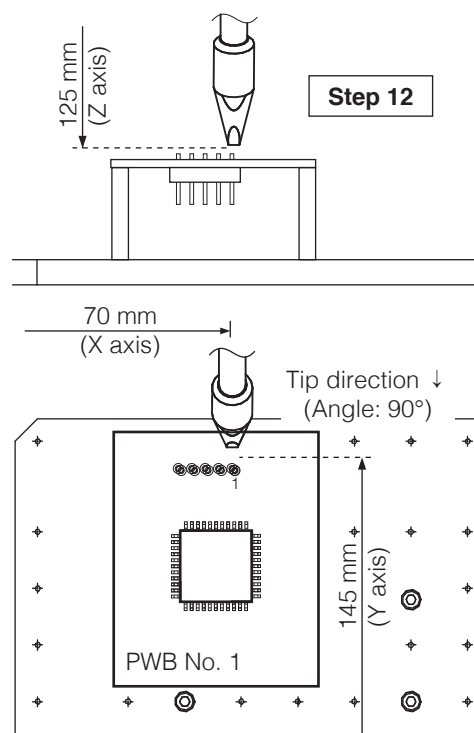


11. This completes the input of the coordinates determined by the positioning operation in **Step 10** as the end point coordinates.

12. Determining the position of the start point coordinates for the 1st point will be performed.
 (The start point coordinates for PS mode is the pre-soldering position).

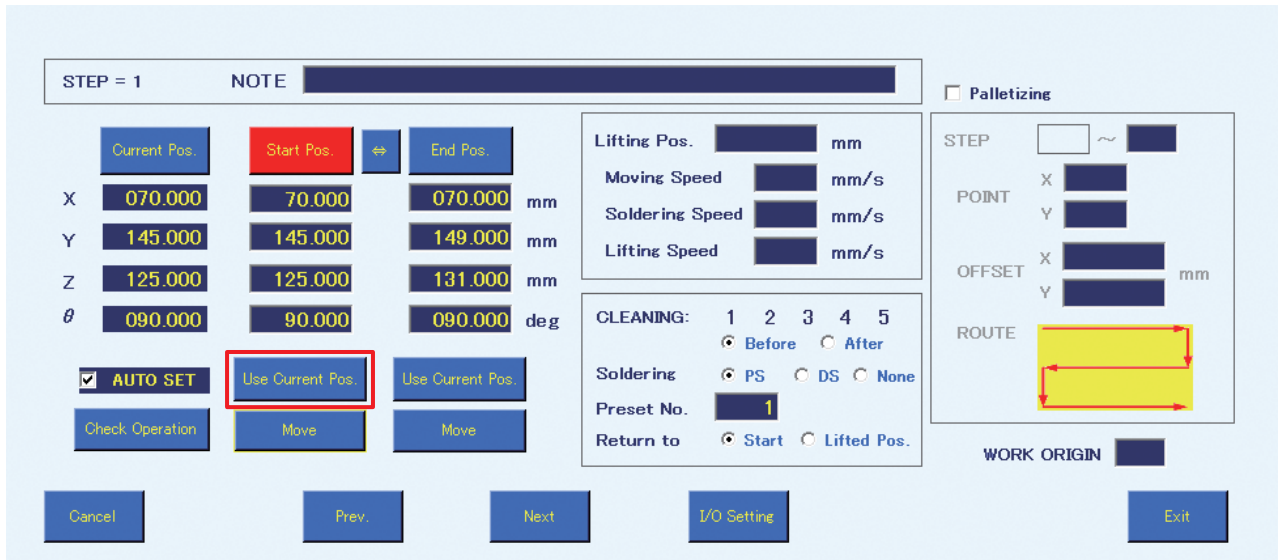
To avoid deterioration of the flux or solder, pre-soldering should be set to a position as close as possible to the point to be soldered.

- 1) With the **Z axis absolute lift position** checkbox in the top screen still unchecked from when the end point coordinates were set, continue with fine adjustment.
- 2) Align the tip with the pre-soldering position.



7. Operation (continued)

13. Tap **[Use Current Pos.]** on the start point side. In the same way as for setting the end point, input can also be performed using the robot's **[Easy Input Switch]** button.
14. This completes input of the coordinates determined by the positioning operation in **Step 12** as the start point coordinates.



If the offset screen is shown, tap **[OFFSET]** to switch to **[Start Pos.]**.



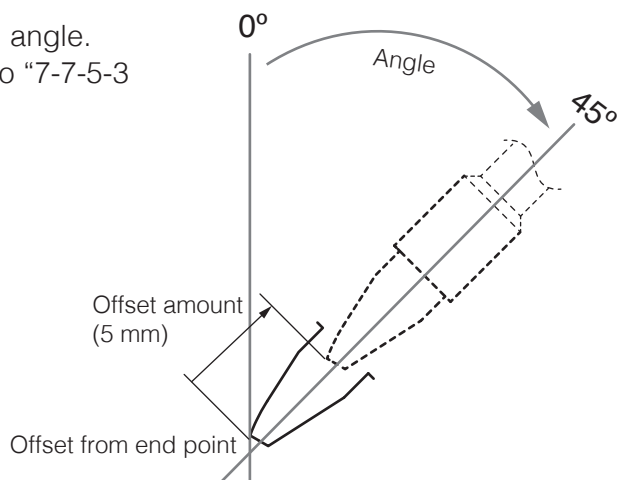
Another Way of Setting the Start Point: Offset

The offset amount is a function that enables setting the start point by inputting the value of the distance from the end point.

1. Tap **[Start Pos.]** so that the button display changes to **[OFFSET]**.
2. Determining the position of the end point coordinates will be performed.
The coordinates set in "Setting the End Point and Start Point of the 1st Point (PS)" (p. 75) will be used as an example.
3. Input the value for the offset from the end point in **[OFFSET]**.
Ex.) 5mm is input as the offset amount. The position shown in the diagram will be the start point.



The offset amount can be set according to the tip angle.
For information on how to set the tip angle, refer to "7-7-5-3 SOLDER HEAD ANGLE Function" (p. 114).



— Note —

In the Point Edit Screen, the offset amount is the movement distance from the end point. If there are many nearby components and the tip might hit them, switch to coordinate input. In coordinate input mode, fine positioning can be set by inputting the X, Y, Z, and θ values.

⚠ CAUTION

Offset can only be set for PS (point soldering) mode.

7. Operation (continued)

15. Select the CLEANING number and timing for performing cleaning.

A cleaning condition from [1] – [5] can be selected. The conditions can be set in the Cleaning Settings Screen.

The selected number will be highlighted. Tapping it again will cancel the selection. For the cleaning timing, before or after the point being edited can be selected.

If cleaning will not be performed, skip this process.



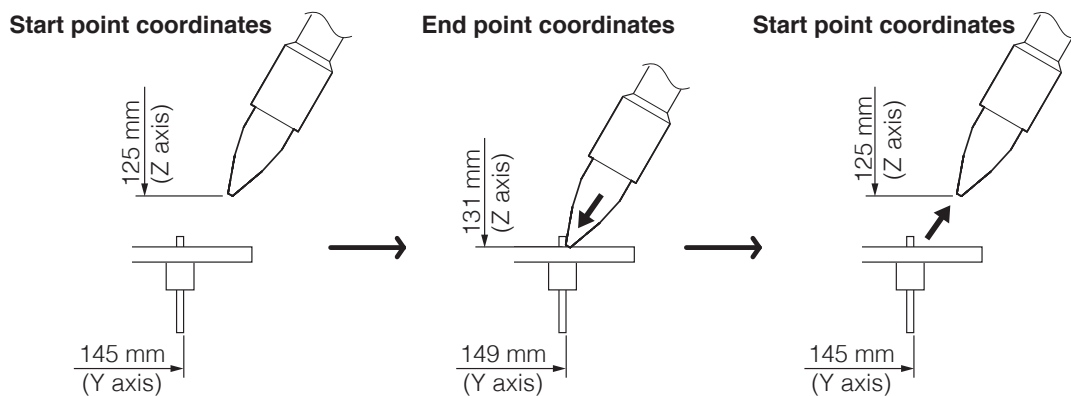
16. Select the soldering conditions (solder feed program number). (Input range: 1 – 250)

In this example, soldering condition 1 is selected. For details on soldering conditions settings, refer to “7-1-3 Soldering Conditions” (p. 49).

17. Set the destination after completion of soldering. Select settings for Return to.

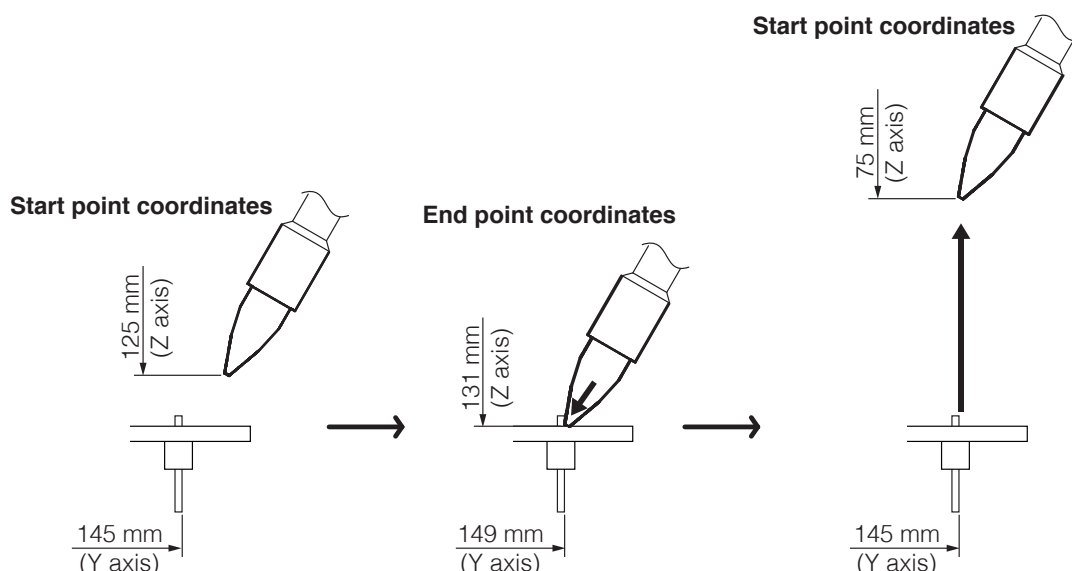
Ex.) When the start point was selected

When the start point is selected, the tip will move to the start point coordinates after soldering has been completed.



Ex.) When the Z lift position was selected

When the Z lift position is selected, the tip will move to the Z axis lift coordinate in the top screen.



Ex.) When individual settings are performed

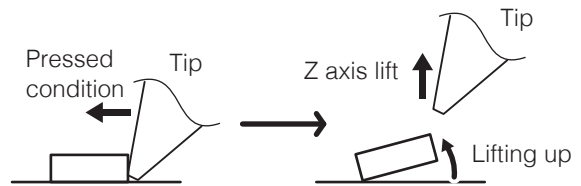
When a value is input for the Z lift position in the Point Edit Screen, Z axis lift will be performed to the coordinates input for that point in the Point Edit Screen.

When a value has been input for Z axis lift coordinate in the Point Edit Screen, that value will be given priority and Z axis lift will be performed to the input point.

In this example, the start point will be set.

⚠ CAUTION

- When the Z axis lift position checkbox in the top screen is unchecked, it may be dangerous because Z axis lift will not be performed. When a soldering program will be run, be sure that the Z axis lift position checkbox is checked.
- Since the tip presses against the point to be soldered, damage may be caused depending on the shape of the part. Select suitable Z axis lift and start point coordinates for the end point movement destination.



18. Set the **Lifting Pos.**, **Moving Speed**, **Soldering Speed**, and **Lifting Speed**. If values are not input, the values in the top screen will be applied. The values input here will have priority over the values in the top screen.

When values have been input for **Lifting Pos.**, **Moving Speed**, **Soldering Speed**, or **Lifting Speed** in the Point Edit Screen, the Point Edit Screen settings will have priority over the top screen settings. For details on the top screen settings, refer to “7-1-7 Settings” (p. 52).

Lift Pos.

This coordinate is set to avoid contact with the workpiece or jigs when moving horizontally.

Moving Speed

Sets the movement speed of each axis for movement between points while running a program.

Soldering Speed

Sets the solder movement speed between primary soldering and secondary soldering.

Lifting Speed

Sets the movement speed after soldering has been completed.

Lifting Pos.	<input type="text"/>	mm
Moving Speed	<input type="text"/>	mm/s
Soldering Speed	<input type="text"/>	mm/s
Lifting Speed	<input type="text"/>	mm/s

CLEANING:	1	2	3	4	5
	<input checked="" type="radio"/> Before	<input type="radio"/> After			
Soldering	<input checked="" type="radio"/> PS	<input type="radio"/> DS	<input type="radio"/> None		
Preset No.	<input type="text" value="1"/>				
Return to	<input checked="" type="radio"/> Start	<input type="radio"/> Lifted Pos.			

19. Set the **WORK ORIGIN**. In this example, 1 is input. If it is left blank, X=0.000, Y=0.000 will be used as the **WORK ORIGIN**.

For details on WORK ORIGIN, refer to “Using the WORK ORIGIN” (p. 89).

<input type="text"/>	mm
<input type="text"/>	mm/s
<input type="text"/>	mm/s
<input type="text"/>	mm/s

1	2	3	4	5
<input checked="" type="radio"/> Before	<input type="radio"/> After			
<input checked="" type="radio"/> PS	<input type="radio"/> DS	<input type="radio"/> None		
<input type="text" value="1"/>				
<input checked="" type="radio"/> Start	<input type="radio"/> Lifted Pos.			

STEP	<input type="text"/>	~	<input type="text"/>
POINT	X	<input type="text"/>	
	Y	<input type="text"/>	
OFFSET	X	<input type="text"/>	mm
	Y	<input type="text"/>	
ROUTE			
WORK ORIGIN	<input type="text" value="1"/>		

Setting Exit

7. Operation (continued)

20. Tap **[Exit]** to finish the settings for the 1st point. To cancel settings, tap **[Cancel]**.
To continue with setting the next point, tap **[Next]**.

Settings for the 2nd to 5th points

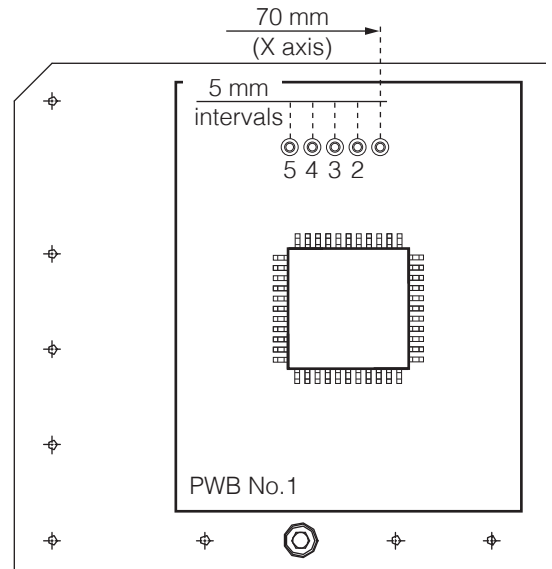
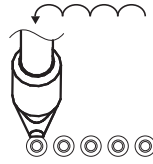
The screenshot shows the 'Point Edit Screen' for 'STEP = 1'. It features a grid for position settings (X, Y, Z, θ) with 'Current Pos.', 'Start Pos.', and 'End Pos.' columns. The 'End Pos.' column is highlighted in red. To the right, there are settings for 'Lifting Pos.', 'Moving Speed', 'Soldering Speed', and 'Lifting Speed'. Below that is a 'CLEANING' section with options for 'Before' and 'After', and 'Soldering' options (PS, DS, None). A 'Preset No.' field is set to '1', and 'Return to' is set to 'Start'. On the far right, a 'Palletizing' section includes 'STEP', 'POINT', 'OFFSET', and 'ROUTE' settings. At the bottom, there are navigation buttons: 'Cancel', 'Prev.', 'Next' (highlighted with a red box), 'I/O Setting', and 'Exit' (highlighted with a red box).

21. When the Point Edit Screen has been closed once, select STEP 1 in the Program Edit Screen and tap **[+]** to add a row. Then double-tap on the added row to edit STEP 2.
Create the soldering program for the 2nd to 5th points in the same way as for the 1st point.

STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
2									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	

At the bottom of the table, there are buttons: 'Update', 'Run', 'COPY', 'PASTE', '+', '-', and 'Gerber'. The '+' button is highlighted with a red box.

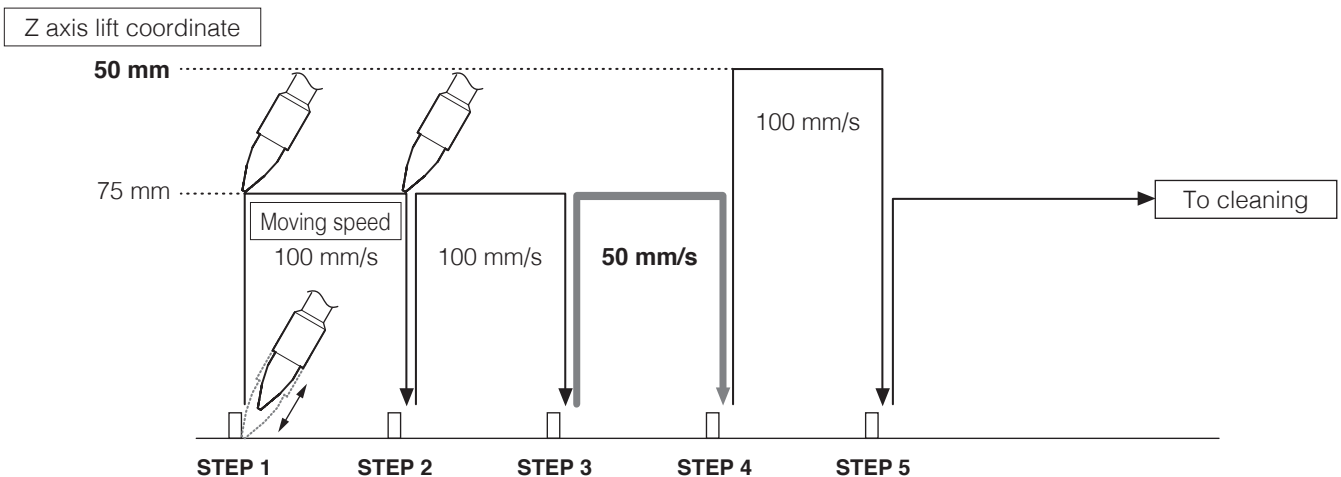
In this example, the movement speed for the 3rd point is set to 50 mm/sec., the Z axis lift coordinate for the 4th point is set to 50.000 mm, and brush cleaning is set to be performed after soldering of the 5th point. (The cleaning number is 1.)



STEP	1	2	3	4	5
X0 Start point (mm)	70	65	60	55	50
Y0 Start point (mm)	145	145	145	145	145
Z0 Start point (mm)	125	125	125	125	125
θ0 Start point (°)	90	90	90	90	90
X1 End point (mm)	70	65	60	55	50
Y1 End point (mm)	149	149	149	149	149
Z1 End point (mm)	131	131	131	131	131
θ1 End point (°)	90	90	90	90	90
Moving speed (mm/s) ^{*1}	100	100	50^{*2}	100	100
Soldering speed (mm/s) ^{*1}	30	30	30	30	30
Soldering conditions	1	1	1	1	1
PS/DS	PS	PS	PS	PS	PS
WORK ORIGIN	1	1	1	1	1
Z lift position (mm) ^{*1}	75.000	75.000	75.000	50.000^{*2}	75.000
Cleaning number	1	—	—	—	1
Cleaning	Previous	—	—	—	Next

*1 If a value was not input in the Point Edit Screen, the top screen value will be shown.

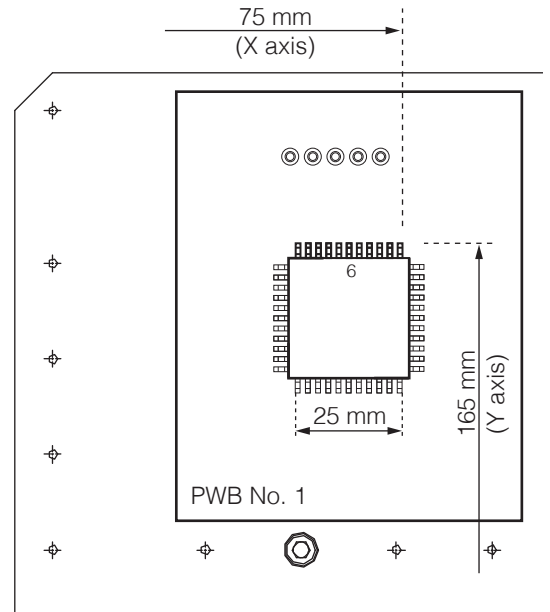
*2 If a value was input in the Point Edit Screen, the Point Edit Screen value will be shown.



7. Operation (continued)

7-5-2 DS (Drag Soldering) Settings

Programs up to Program No. 5 have been completed by point soldering settings. Next, set the soldering program for Program No. 6 (for the 6th point, which is the 1st point for drag soldering).



When continuing setting after PS settings, continue by performing settings from the Program Edit Screen.

1. Double-tap on **STEP 6**. The Point Edit Screen as shown in the diagram below will appear.

STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
2	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	
3	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***S*
4	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***Z**
5	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
6									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
7									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	

2. Input the name of the part to be soldered in the **NOTE** space.
3. Select **DS** for the soldering mode. In DS mode, **[Start Pos.]** cannot be set using **[OFFSET]** mode.

STEP = 6 NOTE

Current Pos. Start Pos. ⇄ End Pos.

X 070.000 mm

Y 149.000 mm

Z 131.000 mm

θ 090.000 deg

AUTO SET Use Current Pos. Use Current Pos.

Check Operation Move Move

Lifting Pos. mm

Moving Speed mm/s

Soldering Speed mm/s

Lifting Speed mm/s

CLEANING: 1 2 3 4 5

Before After

Soldering PS DS None

Preset No. 1

Return to Start Lifted Pos.

Palletizing

STEP ~

POINT X

 Y

OFFSET X mm

 Y

ROUTE

WORK ORIGIN

Cancel

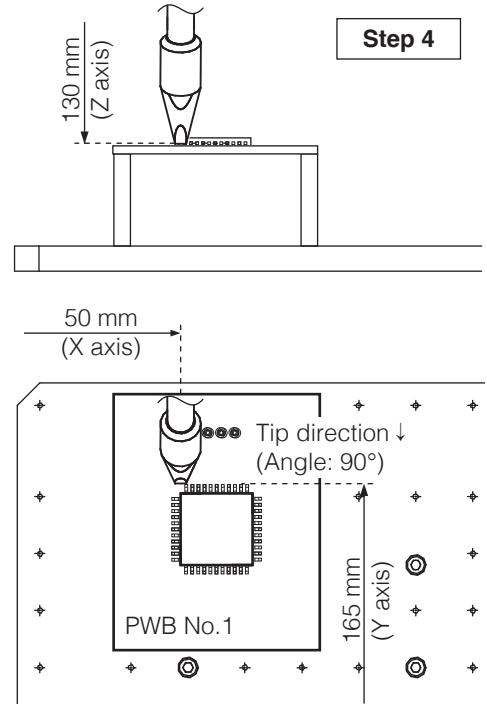
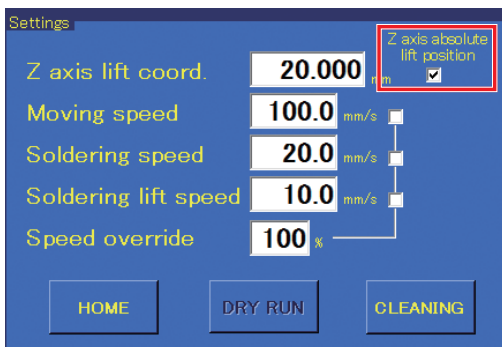
Prev.

Next

I/O Setting

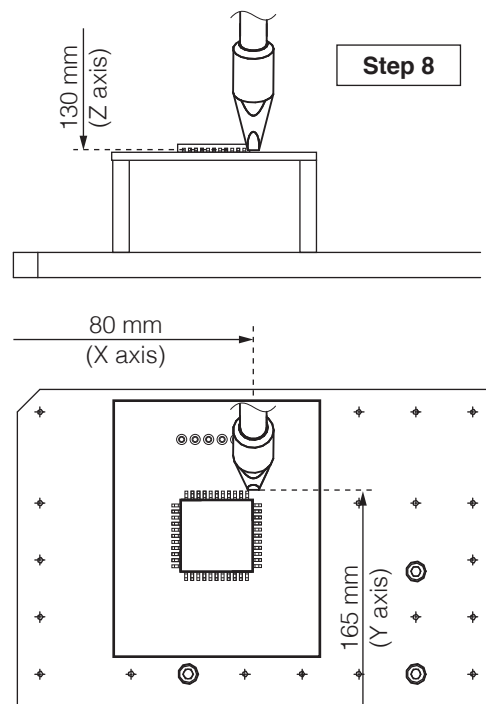
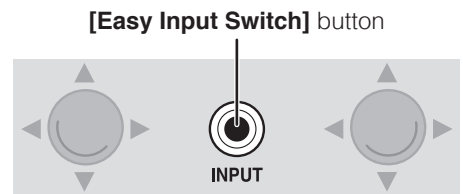
Exit

4. Determining the start point coordinates of the 6th point will be performed.
 (In DS mode, the start point coordinates will be the starting position of the drag soldering point.) Use JOG operation to move the tip to the drag soldering starting position on the workpiece (diagram at right), and align the soldering iron tip.
- 1) Move to the drag soldering starting position using the JOY STICKS or direct input of coordinates.
 - 2) To perform fine adjustment such as determining the tip position, etc., uncheck **Z axis absolute lift position** in the top screen.
- For details on Z axis lift behavior, refer to “7-2-2 Z Axis Lift” (p. 61).



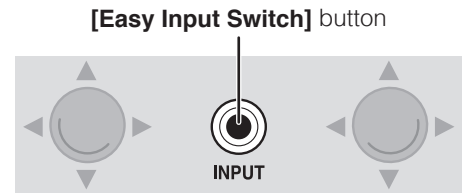
5. Perform fine adjustment using the top screen's **INCHING PITCH** function, etc. to align the soldering iron tip with the point to be soldered.
6. Tap **[Use Current Pos.]** on the start point side (refer to the screenshot on the next page). When performing operations from the robot, press the **[Easy Input Switch]** button.
7. This completes input of the coordinates determined by the positioning operation in **Step 4** as the start point coordinates.
8. Determining the end point coordinates of the 6th point will be performed. In DS mode, the end point coordinates are the final position of the drag soldering point. Use JOG operation to align the soldering iron tip with the drag soldering end position on the workpiece.

Use JOG operation to align the soldering iron tip with the soldering end position.
 With the **Z axis absolute lift position** checkbox in the top screen still unchecked from when the end point coordinates were set, continue with fine adjustment.
 Use JOG operation to align the soldering iron tip with the drag soldering end position.



7. Operation (continued)

9. Tap **[Use Current Pos.]** on the end point side (refer to the screenshot below). When performing operations from the robot, press the **[Easy Input Switch]** button.



10. This completes input of the coordinates determined by the positioning operation in **Step 6** as the end point coordinates.



11. The CLEANING number and timing for performing cleaning will be selected in the same way as for “PS (point soldering) settings”. For DS (drag soldering) as well, cleaning will be set to be performed before soldering of the 6th point (refer to screenshot above).

12. Select the soldering conditions (solder feed program number). (Input range: 1 – 250)
In this example, soldering condition 1 is selected.
Unlike for point soldering, in drag soldering the Start Pos. corresponds to the start point. The primary solder is performed at a point (the sky of the start point) where only the Z-axis coordinate of the origin became the Lifting Pos., and a solder is sent at forwarding speed set to a second solder.
If a condition in which the secondary feed length is set is selected for DS (drag soldering), that setting will be ignored.

13. When **DS** is selected for the **Soldering**, only **Lifting Pos.** will be selected for **Return to**, regardless of whether or not Z axis lift is checked. If **Lifting Pos.** in the Point Edit Screen is blank, movement will be to the top screen **Z axis lift coord.**
For drag soldering, the value input for the **Z axis lift coord.** will be the primary solder feed position.

14. Set the **Lifting Pos.**, **Moving Speed**, **Soldering Speed**, and **Lifting Speed**. If values are not input, the values in the top screen will be applied. When values have been input for **Lifting Pos.**, **Moving Speed**, **Soldering Speed**, or **Lifting Speed** in the Point Edit Screen, the Point Edit Screen settings will have priority over the top screen settings (“7-1-7 Settings” (p. 52)).



Lifting Pos.

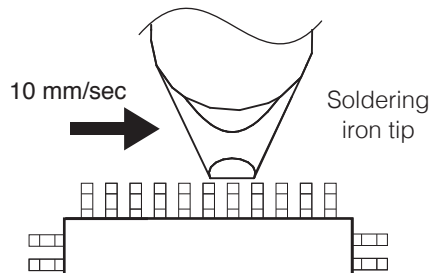
This coordinate is set to avoid contact with protruding objects on the workpiece when moving horizontally.

Moving Speed

Sets the movement speed of each axis for movement between points.

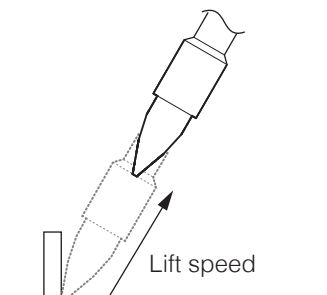
Soldering Speed

Sets the solder movement speed between primary soldering and secondary soldering. The standard **Soldering speed** for drag soldering can be set as the soldering speed in the top screen. To change the drag soldering speed for each point, input values for **Soldering Speed** in the Point Edit Screen. In this example, it is set to 10 mm/sec.



Lifting Speed

Sets the movement speed after soldering has been completed.



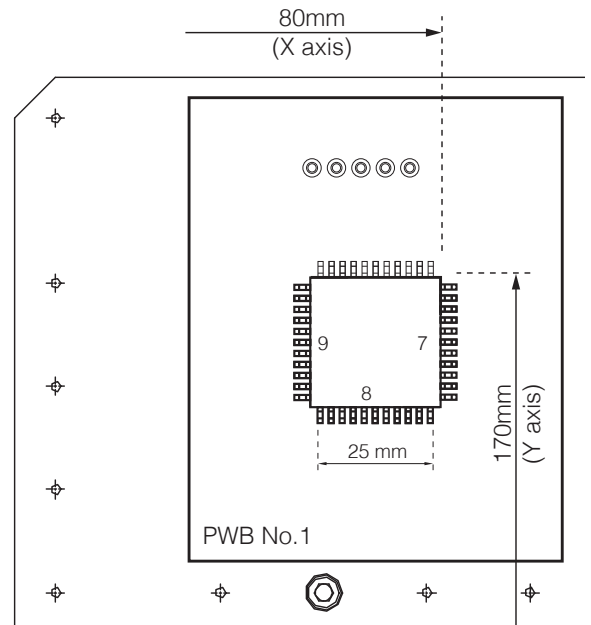
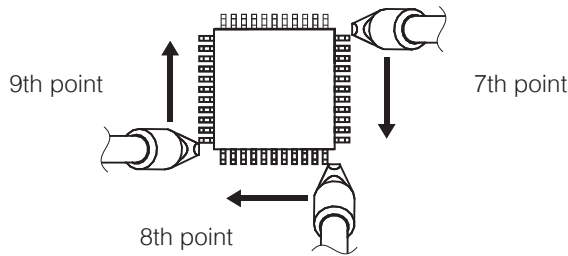
15. Set the **WORK ORIGIN**. In this example, 1 is input in the same way as for “PS (point soldering) settings”. For details on **WORK ORIGIN**, refer to “Using the WORK ORIGIN” (p. 89).

16. Tap **[Exit]** to finish 1 of the settings of the DS (drag soldering) settings for the 6th point. To cancel settings, tap **[Cancel]**.

7. Operation (continued)

Settings (DS) for the 7th to 9th points

Create the soldering programs for the 7th to 9th points in the same way as for the 6th point.

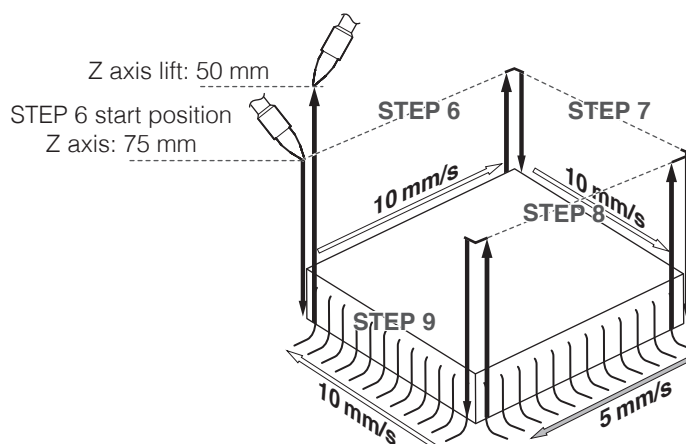


In this example, the soldering speed for the 8th point is set to 5 mm/sec., the Z axis lift coordinate for the 9th point is set to 50.000 mm, and brush cleaning is set to be performed after soldering of the 9th point. (The cleaning number is set to 1.)

STEP	6	7	8	9
X0 Start point (mm)	50	80	75	45
Y0 Start point (mm)	165	170	200	195
Z0 Start point (mm)	130	130	130	130
θ0 Start point (°)	90	0	-90	-180
X1 End point (mm)	75	80	50	45
Y1 End point (mm)	165	195	200	170
Z1 End point (mm)	130	130	130	130
θ1 End point (°)	90	0	-90	-180
Moving speed (mm/s) ^{*1}	100	100	100	100
Soldering speed (mm/s) ^{*1}	10^{*2}	10^{*2}	5^{*2}	10^{*2}
Soldering conditions	1	1	1	1
PS/DS	DS	DS	DS	DS
WORK ORIGIN	1	1	1	1
Z lift position (mm) ^{*1}	75.000	75.000	75.000	50.000^{*2}
Cleaning number	1	—	—	1
Cleaning	Previous	—	—	Next

*1 If a value was not input in the Point Edit Screen, the top screen value will be used.

*2 If a value was input in the Point Edit Screen, the Point Edit Screen value will be used.



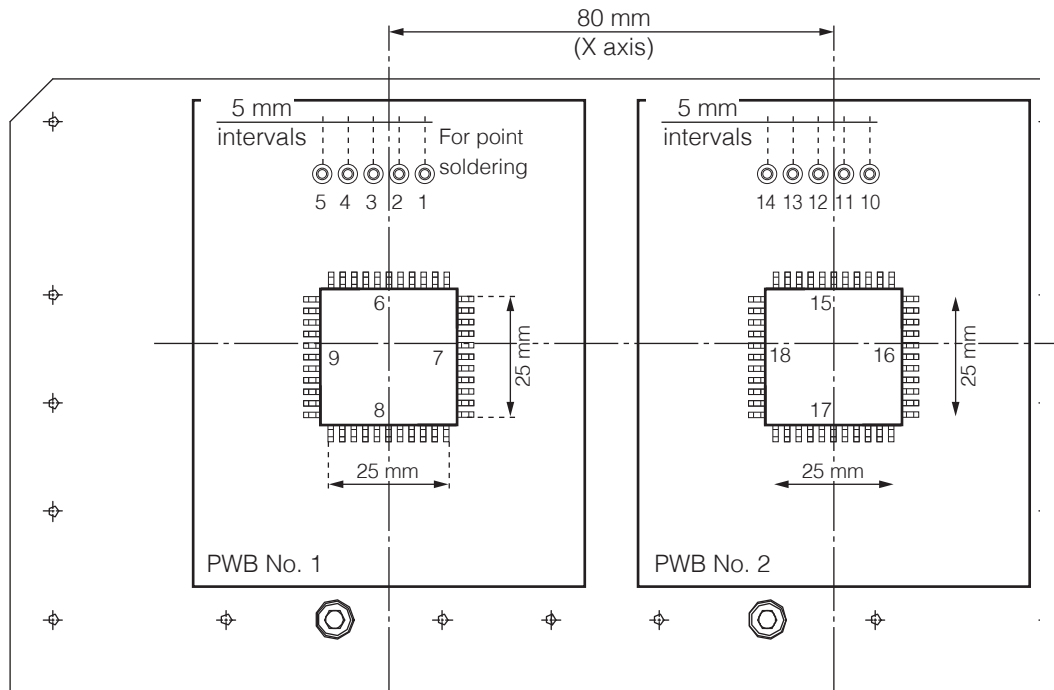
7-5-3 Copying Soldering Programs

When the same soldering program will be applied to multiple PWB's.

Using the WORK ORIGIN

The same soldering program can be run for multiple PWBs using the robot's work origin as the standard point.

When 2 of the same PWBs are lined up as shown in the diagram below, the soldering program for PWB No. 1 will be applied for PWB No. 2.

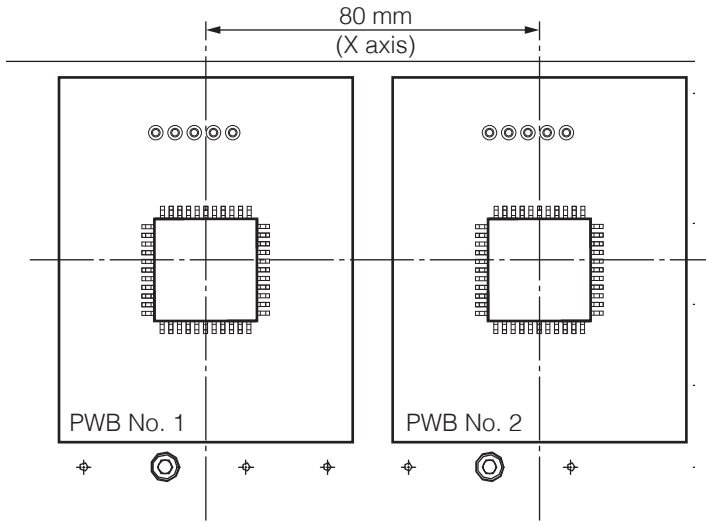


1. Set the work origins. For PWB No. 1, the work origin is 1 (X coordinate: 0, Y coordinate: 0).

Work Origin		
No.	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
5	0.000	0.000
6	0.000	0.000
7	0.000	0.000
8	0.000	0.000
9	0.000	0.000
10	0.000	0.000
11	0.000	0.000
12	0.000	0.000
13	0.000	0.000
14	0.000	0.000
15	0.000	0.000
16	0.000	0.000
17	0.000	0.000
18	0.000	0.000
19	0.000	0.000
20	0.000	0.000

7. Operation (continued)

- The distance between PWB No. 1 and PWB No. 2 is 80 mm in the X axis direction and 0mm in the Y axis direction. These values will be input as work origin 2.



Work Origin		
No.	X	Y
1	0.000	0.000
2	80.000	0.000
3	0.000	0.000
4	0.000	0.000
5	0.000	0.000
6	0.000	0.000
7	0.000	0.000
8	0.000	0.000
9	0.000	0.000
10	0.000	0.000
11	0.000	0.000
12	0.000	0.000
13	0.000	0.000
14	0.000	0.000
15	0.000	0.000
16	0.000	0.000
17	0.000	0.000
18	0.000	0.000
19	0.000	0.000
20	0.000	0.000

- Select rows 1 to 9. (Tap and drag to select down to row 9.)
- Tap [COPY].

1. With this area tapped

STEP	X0	Y0	Z0	θ 0	X1	Y1	Z1	θ 1	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C**
2	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	
3	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***S*
4	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***Z**
5	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C**
6	50.000	165.000	130.000	90.000	75.000	165.000	130.000	90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C*S*
7	80.000	170.000	130.000	0.000	80.000	195.000	130.000	0.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	***S*
8	75.000	200.000	130.000	-90.000	50.000	200.000	130.000	-90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	***S*
9	45.000	195.000	130.000	-180.000	45.000	170.000	130.000	-180.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**CZS*
10									<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	
11									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
12									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
13									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
14									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
15									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
16									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
17									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
18									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
19									<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	

Update Run COPY PASTE + - Gerber

5. Tap row 10.

6. Tap [PASTE].

Program List (TEST02) X

STEP	X0	Y0	Z0	θ0	X1	Y1	Z1	θ1	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
2	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	
3	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	****S*
4	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***Z**
5	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
6	50.000	165.000	130.000	90.000	75.000	165.000	130.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C*S*
7	80.000	170.000	130.000	0.000	80.000	195.000	130.000	0.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	****S*
8	75.000	200.000	130.000	-90.000	50.000	200.000	130.000	-90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	****S*
9	45.000	195.000	130.000	-180.000	45.000	170.000	130.000	-180.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**CZS*
▷ 10	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
11	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	
12	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	****S*
13	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***Z**
14	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
15	50.000	165.000	130.000	90.000	75.000	165.000	130.000	90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C*S*
16	80.000	170.000	130.000	0.000	80.000	195.000	130.000	0.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	****S*
17	75.000	200.000	130.000	-90.000	50.000	200.000	130.000	-90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	****S*
18	45.000	195.000	130.000	-180.000	45.000	170.000	130.000	-180.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**CZS*
○ 19									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	

7. Tapping on the values in the work origin screen and tapping [Work origin 2] which will be used this time will complete the copying process.
The copied data will use the selected origin point.

Work Origin		
Nb.	X	Y
1	0.000	0.000
2	80.000	0.000
3	80.000	100.000
4	0.000	0.000
5	0.000	0.000
6	0.000	0.000
7	0.000	0.000
8	0.000	0.000
9	0.000	0.000
10	0.000	0.000
11	0.000	0.000
12	0.000	0.000
13	0.000	0.000
14	0.000	0.000
15	0.000	0.000
16	0.000	0.000
17	0.000	0.000
18	0.000	0.000
19	0.000	0.000
20	0.000	0.000

Set the work origin

Same as source

Work origin 2

Cancel

Tap here in advance.

8. This completes the soldering program settings for sample PWBs No. 1 and No. 2.

7. Operation (continued)

7-5-4 None (PWB Removal Position) Settings

Settings to move the jig table out in front for removing the PWB will be performed. For safe removal, the settings in this example will return all axes to their origin points.

1. Select row 19 and tap **[+]**.
2. The Point Edit Screen for row 19 will open.
3. Set the soldering mode to **None**.
4. Determining the coordinates for removing the PWB will be performed. Use the JOY STICKS to move the PWB to the removal position. (The coordinates can also be input directly without moving the PWB.) In this example, the **[Start Pos.]** X, Y, Z and θ values will be set as shown in the diagram below.

The screenshot displays the 'Point Edit Screen' for STEP = 19. It features several input fields and control buttons. The 'Current Pos.' section shows X, Y, Z, and θ coordinates, all set to 0.000. The 'Start Pos.' section also shows X, Y, Z, and θ coordinates, all set to 0.000. The 'End Pos.' section is currently empty. The 'Soldering' mode is set to 'None'. The 'Use Current Pos.' button is highlighted with a red box. The 'CLEANING' section shows options for 'Before' and 'After' soldering. The 'Soldering' section shows options for 'PS', 'DS', and 'None'. The 'Return to' section shows options for 'Start' and 'Lifted Pos.'. The 'ROUTE' section shows a yellow rectangular area with red arrows indicating the path. The 'WORK ORIGIN' is set to the origin point.

5. Tap **[Use Current Pos.]**.
6. This completes input of the PWB removal position. (When the soldering mode is set to **None**, input of soldering conditions is not necessary.)
7. Tap **[Exit]** to complete the settings for **None** (PWB removal position). To cancel settings, tap **[Cancel]**.

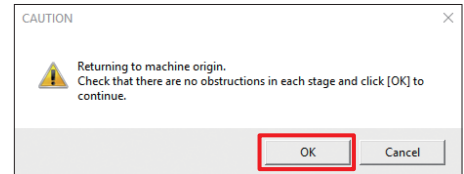
This completes creation of the soldering program for sample PWBs No.1 and No.2 from point soldering to drag soldering and PWB removal.

7-6 Running a Program

7-6-1 Calling up and Running a Program

First, check that all equipment is connected properly, and that the power is switched on. For connection details, refer to “5. Installation” (p. 19). Start HAKKO SOLDERING SYSTEM2.

1. Tap **[HOME]** in the top screen to return the robot to the origin.
A confirmation dialog will appear. Tap **[OK]**.



⚠ CAUTION

When the θ axis rotates while returning to the origin, there is a danger of cables wrapping around the robot.

If it seems like there is a danger of cables wrapping around, press the emergency stop button immediately, turn the θ axis slightly counterclockwise from the origin (0°) when viewed from above the soldering unit fixture base, and then tap **[HOME] again.**

2. Tap **[Program]** in the top screen. The Program List Screen will open.
3. Select the program to be run, open the Program Edit Screen, and tap **[Run]**.

— Note —

When a program is read, a check of whether or not the speed and coordinate settings of the selected program are within the settable range will be performed. If a value is outside the settable range, the program will not be read. Judgement of whether or not values are within range include the values for offset, palletizing, and tip correction.

Running program													
STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***C***
2	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	
3	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***S*
4	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***Z**
5	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***C***

A maximum of 5 rows of the program which was called up will be shown.

While the program is running, the screen will automatically scroll with the point currently being executed.

STEP: Shows the consecutive number of the point

X0, Y0, Z0, $\theta 0$: Shows the start point coordinates of the point

X1, Y1, Z1, $\theta 1$: Shows the end point coordinates of the point

O: Checked when the start point is offset.

Z: Checked when **Return to** is set to Z lift position.
When not checked, **Return to** will be the start point.

P: Shows the solder feed program number.

D: Checked when the soldering mode is DS mode.

I/O: Shows indications for when I/O settings or individual point settings have been set. If all settings have been set, “**IO CZ SP**” will be shown. If no setting has been made for the corresponding section, the character for that section will be replaced by “*”.

I: Input setting

O: Output setting

C: Cleaning setting

Z: Individual point Z axis lift setting

S: Individual point speed setting

P: Palletizing setting

7. Operation (continued)

Display of the top screen running program section

While a soldering program is being run, the section for displaying **Running program** during waiting is shown as follows:

Running program													
STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
2	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	
3	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***S*
4	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***Z**
5	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***

Displayed information	Displayed status
Cleaning tip	Moving to end point after moving to cleaning coordinates.
Moving to start point	Moving from previous point to start point.
Waiting for command to lower tip	When there is an input setting.
Moving to soldering point	Moving from start point to end point
Waiting for soldering completion	Waiting for completion of solder feed (after primary heating)
Soldering completed. Returning to start point	After completion of soldering, moving from end point to start point.
Waiting for soldering READY	Waiting for HAKKO FU-601 Ready signal.
Moving to drag soldering position	Moving from drag soldering start point to end point

4. Tap **[DRY RUN]** in the top screen to check positions. By performing only the robot motion of the selected program without adjusting the soldering iron temperature or performing solder feed, the soldering positions of the program can be checked.

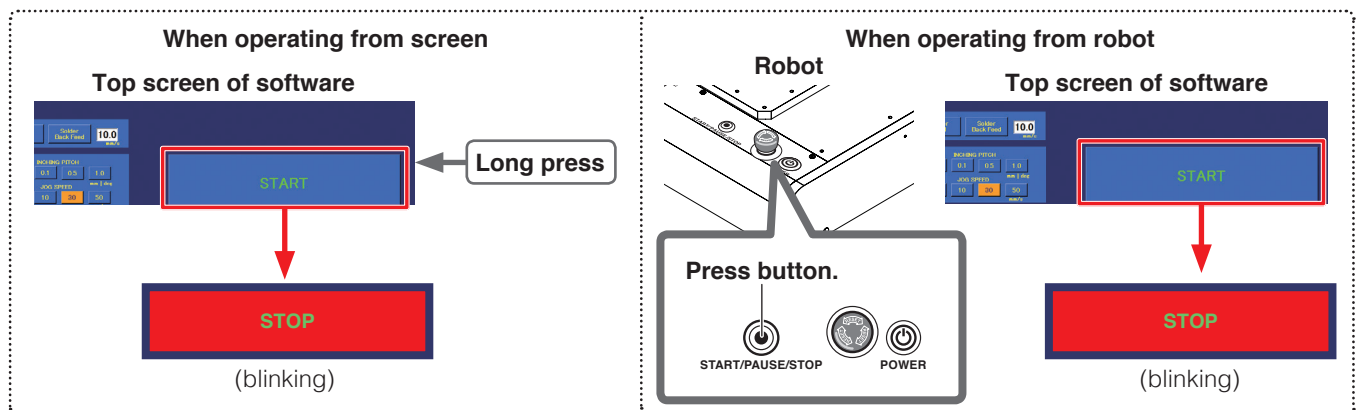
COUNT DOWN in the top screen (refer to diagram at right) is also performed when using **[DRY RUN]**.

To exclude **[DRY RUN]** from the count, check PAUSE.

For details on COUNT DOWN, refer to “7-1-5 Work Information” (p. 51).



5. Long-pressing **[START]** will run the program. The button will become red, and the display will change to a blinking **[STOP]**. The program can also be run using the robot's **[START/PAUSE/STOP]** button or start input from I/O. For details on screen operation or robot operation while a program is running, refer to “7-1-11-1 Flowchart (Screen Button Operation)” (p. 55) or “7-1-11-2 Flowchart (Robot Button Operation)” (p. 56).



6. Screen highlighting of the running program rows will move together with the progress of the running program. When the entire program has been completed, the screen highlight will return to the first row.

Running program			
STEP	X0	Y0	Z0
1	70.000	145.000	125.000
2	65.000	145.000	125.000
3	60.000	145.000	125.000

7-7 Performing Detailed Settings

There are several functions for performing detailed settings.

By using these functions, more detailed soldering program settings can be performed.

7-7-1 Other Inputting Methods of Coordinates

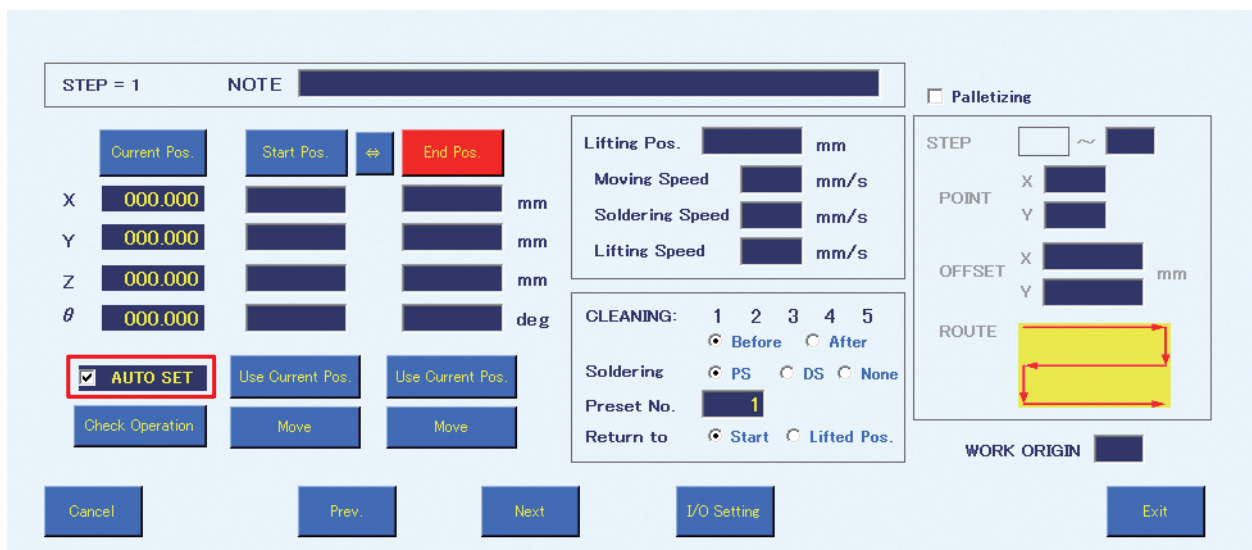
7-7-1-1 Using "AUTO SET"

When **AUTO SET** in the Point Edit Screen is checked, input can be performed easily using the robot's **[Easy Input Switch]** button without using **[Use Current Pos.]**.

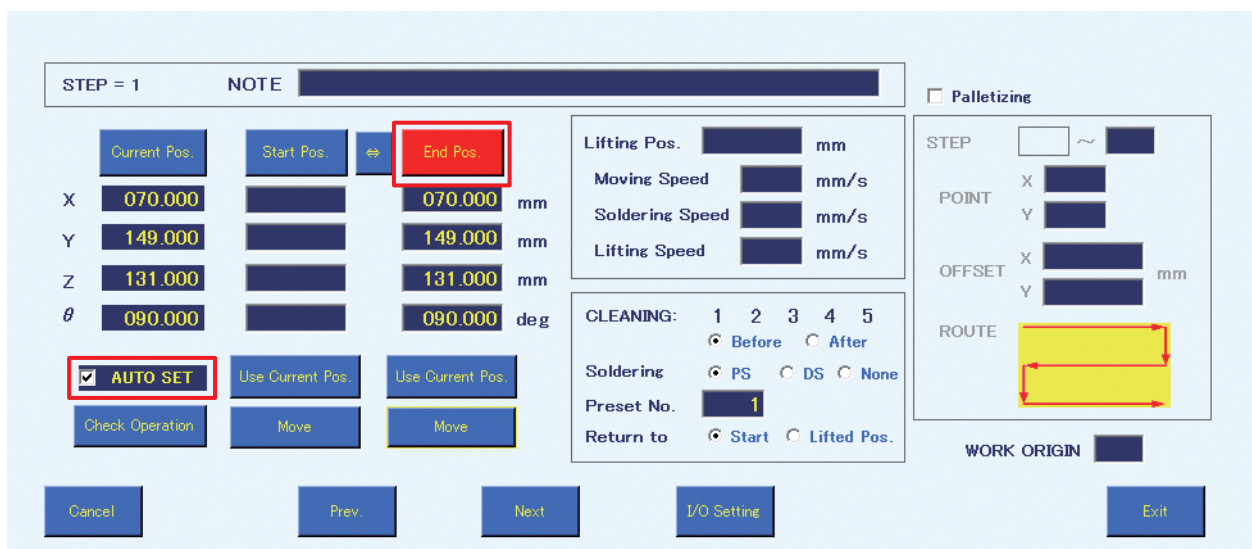
Each time the **[Easy Input Switch]** button is pressed, the input position switches automatically from End point → Start point → End point of next point.

In **DS** mode, the input position switches from Start point → End point → Start point of next point.

For **None**, the input position switches from Start point → Start point of next point.



1. Check the **AUTO SET** checkbox.
2. Use the JOY STICKS to align the tip with the end point position.



7. Operation (continued)

- When the robot's **[Easy Input Switch]** button is pressed, input of the coordinates determined by the operation in **Step 2** as the end point coordinates will be completed. The input position will automatically change to the start point side. Use the JOY STICKS to align the tip with the start point position.
- When the robot's **[Easy Input Switch]** button is pressed, input of the coordinates determined by the operation in **Step 3** as the start point coordinates will be completed. The input position will automatically switch to the end point of the next point.

The screenshot displays a control interface for a robot, specifically for Step 1. The interface is organized into several sections:

- STEP = 1**: A header indicating the current step.
- NOTE**: A dark blue bar for displaying notes.
- Coordinate Input Table**: A table with columns for 'Current Pos.', 'Start Pos.', and 'End Pos.', and rows for X, Y, Z, and θ .

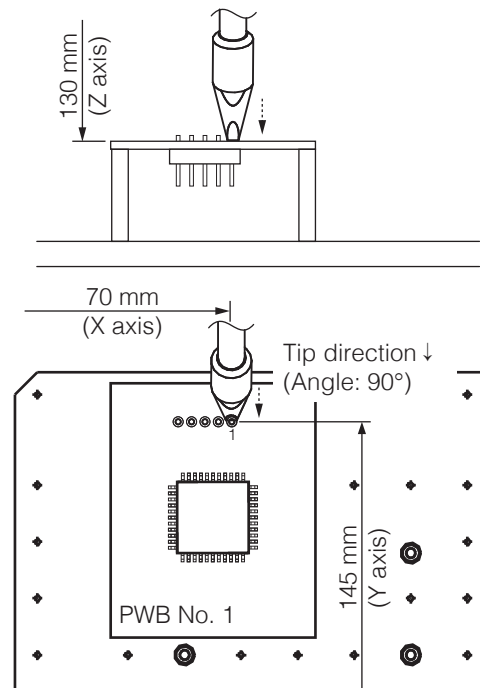
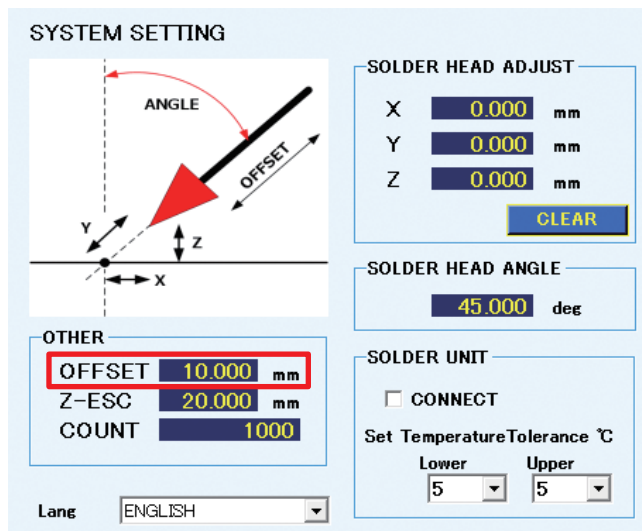
	Current Pos.	Start Pos.	End Pos.	Unit
X	070.000	70.000	070.000	mm
Y	145.000	145.000	149.000	mm
Z	125.000	125.000	131.000	mm
θ	090.000	90.000	090.000	deg
- Buttons**: 'Check Operation', 'Move', and 'Use Current Pos.' buttons are present below the coordinate table.
- Settings Panel**: Includes 'Lifting Pos.', 'Moving Speed', 'Soldering Speed', and 'Lifting Speed' fields. It also has 'CLEANING' options (1-5, Before/After), 'Soldering' options (PS, DS, None), 'Preset No.' (1), and 'Return to' options (Start, Lifted Pos.).
- Advanced Settings**: A 'Palletizing' checkbox, 'STEP' selection, 'POINT' (X, Y), 'OFFSET' (X, Y), and 'ROUTE' (visualized as a yellow rectangle with red arrows) are located on the right side.
- Navigation**: 'Cancel', 'Prev.', 'Next', 'I/O Setting', and 'Exit' buttons are at the bottom.

Inputting the Start Point Offset Value Using AUTO SET

In the screen for setting the start point offset amount, check **AUTO SET**.



1. Check **AUTO SET**.
2. Use the JOY STICKS to align the tip with the end point position.



3. When the robot's **[Easy Input Switch]** button is pressed, input of the coordinates determined by the operation in step 2 as the end point coordinates and input of the offset amount will be completed. The input position will automatically change to the next point.

— Note —

The offset amount will automatically be input as the value set for **OFFSET** in the **OTHER** section of the System Settings Screen. (Refer to the screenshot above.) To set the offset amount individually for each point, input the value in the offset space before pressing the **[Easy Input Switch]** button.

7. Operation (continued)

7-7-1-2 Using Gerber Data

If the Gerber data for the PWB is available, input of coordinates can be performed using the Gerber data. Gerber data can be used only for PS (point soldering) mode.

Program List (TEST)													
STEP	X0	Y0	Z0	θ 0	X1	Y1	Z1	θ 1	O	Z	P	D	I/O
▶ 1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>		1	<input type="checkbox"/> **C**
○ 2									<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>

Update Run COPY PASTE + - Gerber

1. Select the row to import data into in the Program Edit Screen, and tap **[Gerber]** to open the Import Gerber Data Screen.

Import Gerber

D-Code Back Side

Z Solder Position

OFFSET

Board Origin mm

Board (0,0)

CANCEL IMPORT

2. Specify the D-code No. of the aperture on the PWB for the layer to be soldered.

Import Gerber

D-Code Back Side

Z Solder Position

OFFSET

Board Origin mm

Board (0,0)

CANCEL IMPORT

3. When BackSide is not checked, the front side of the PWB is specified; when **Back Side** is checked, the back side of the PWB is specified. For soldering to the PWB backside such as for throughholes, etc., check **Back Side**. The PWB standard point (0.0) is different when the PWB front side is set than when the PWB back side is set.

Import Gerber

D-Code Back Side

Z Solder Position

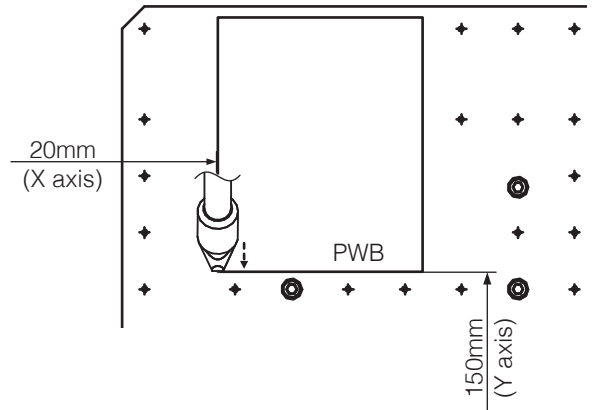
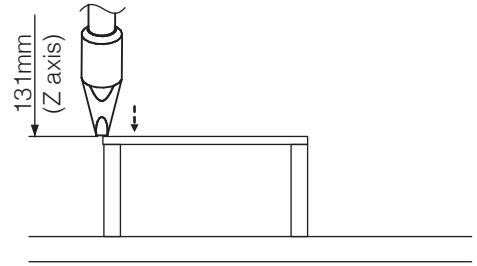
OFFSET

Board Origin mm

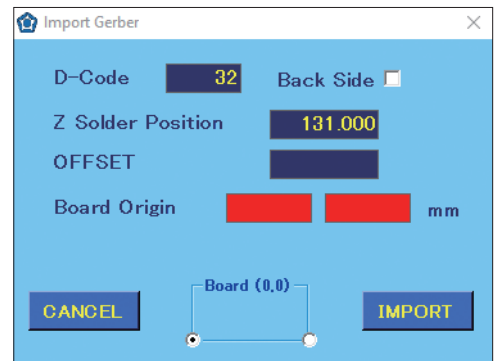
Board (0,0)

CANCEL IMPORT

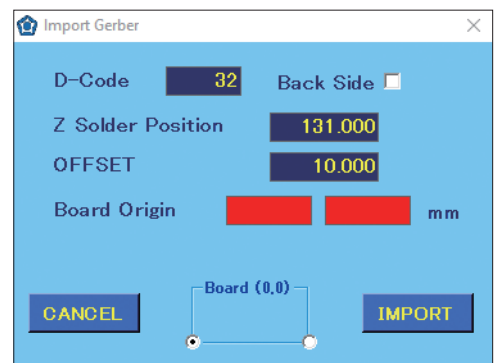
- Use the JOY STICKS to align the tip with the PWB's standard point (0.0) and then with the height of the soldering position. For the front surface, align with the front surface's standard point; for the back surface, align with the back surface's standard point.



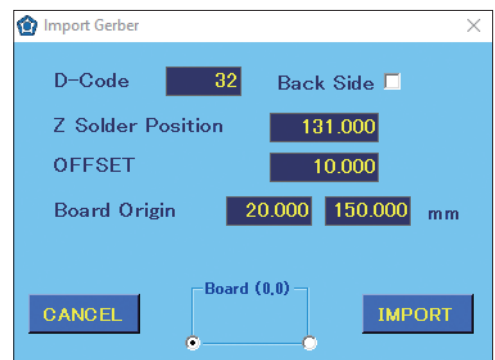
- Input the Z axis coordinate from **Step 4** as the **Z Solder Position**. This value will be set as the Z axis coordinate for soldering.



- Set the soldering offset amount in **OFFSET**. This value will be set as the start point during soldering.



- Input the X axis and Y axis coordinates from **Step 4** as the **Board Origin**. This will be the PWB's standard point (0.0).



7. Operation (continued)

- 8.** Tap **[IMPORT]** to open the read file selection screen, and select the file to be read. All items with the same selected aperture will be converted into the respective point coordinates and imported.

— Note —

- If moving to the next item is attempted without inputting the **D-Code** or **Board Origin**, the input spaces will become red. In this condition, the file selection screen will not open.
- θ axis settings are not included when reading Gerber data. Manually check and set the tip direction during soldering.
If it is not input, the last value set for θ axis in the Program Edit Screen will be used. If no value has been set for θ axis in all rows, the direction will be set to 0° .

- 9.** After reading, the **Board Origin** will be input into the **NOTE** for the first row.
- 10.** θ axis settings are not included when reading Gerber data. For detailed settings of the tip's θ axis angle, position, etc., manually check them and change the program information.

7-7-2 Using the Palletizing Function

Palletizing can be used to combine repeated programs into a single one.

When pins are lined up at a fixed interval (such as for D-sub connectors), the soldering program for the 1st point can be duplicated and repeated for the remaining points.

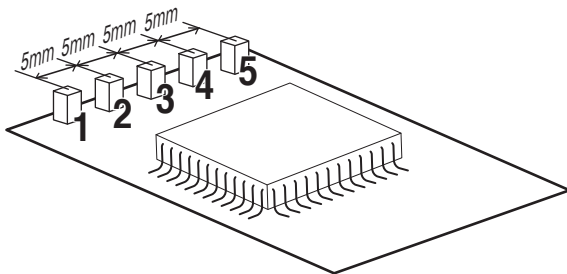
Not only can a single point be repeated, but a continuous series of points can also be duplicated.

7-7-2-1 Repeating a Single Point

1. In this example, the soldering work for the 1st point will be repeated, so open the Point Edit Screen for the 1st point.

Program List (TEST)												
STEP	X0	Y0	Z0	θ 0	X1	Y1	Z1	θ 1	O	Z	P	I/O
▶ 1	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	■	■	1	***+
○ 2									■	■		

Update Run COPY PASTE + - Gerber



2. Check **Palletizing** in the Point Edit Screen.

STEP = 1
NOTE

	Current Pos.	Start Pos.	⇄	End Pos.	
X	070.000	50.000		50.000	mm
Y	149.000	145.000		149.000	mm
Z	131.000	125.000		131.000	mm
θ	090.000	90.000		90.000	deg

AUTO SET Use Current Pos. Use Current Pos.

Check Operation Move Move

Lifting Pos. mm

Moving Speed mm/s

Soldering Speed mm/s

Lifting Speed mm/s

CLEANING: 1 2 3 4 5
 Before After

Soldering PS DS None

Preset No. 1

Return to Start Lifted Pos.

Palletizing

STEP 1 ~ 1

POINT X 1 Y 1

OFFSET X 0.000 mm Y 0.000 mm

ROUTE

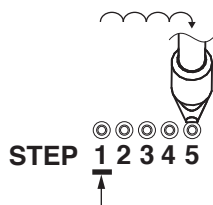
WORK ORIGIN ■

Cancel
Prev.
Next
I/O Setting
Exit

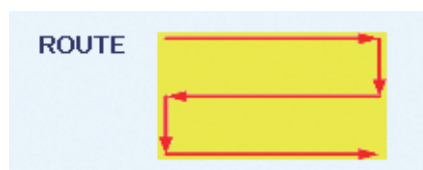
7. Operation (continued)

3. Input rows from the current STEP to the STEPS that will be repeated (1 – 9999).
The first value is fixed as the number of the opened STEP. In this example, the soldering for the 1st point will be repeated. The second value will be left as 1.
4. Input the number of times to repeat work respectively in the X direction and Y direction. (1 – 9999)
In this example, the settings for repeating work 5 times in the X direction × 1 time in the Y direction were set.
5. Set the amount of offset when repeating the work.
For this example, 5 mm was input for the X axis and 0 mm was input for the Y axis.

6. Set the **ROUTE** order in which soldering should be performed. There are 4 kinds of ROUTES, and each time the **ROUTE** diagram is tapped it will switch to the next **ROUTE**. This time, the **ROUTE** selected by default was selected.



This will be duplicated as the standard.



7. Tap **[Exit]** to complete the **Palletizing** settings.
With these settings, the 1st point will be repeated 5 times in the X direction × 1 time in the Y direction.

7-7-2-2 Duplicating a Program that Uses the Palletizing Function and Work Origin

- In addition to the program created in “7-7-2-1 Repeating a Single Point” (p. 101) for up to the 5th point, settings for the 6th to 9th point will be performed. For the values in the screenshot below, refer to “7-5-2 DS (Drag Soldering) Settings” (p. 84). These values will be input into the rows for STEP 2 to STEP 5.

STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/U
1	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***
2	50.000	165.000	130.000	90.000	75.000	165.000	130.000	90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C-
3	80.000	170.000	130.000	0.000	80.000	195.000	130.000	0.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	***
4	75.000	200.000	130.000	-90.000	50.000	200.000	130.000	-90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	***
5	45.000	195.000	130.000	-180.000	45.000	170.000	130.000	-180.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C-
6									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
7									<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	

- The values of the work origins for the copy source will be input in advance. In this example, X: 80.000, Y: 0.000 will be input as work origin 2, X: 80.000, Y: 100.000 will be input as work origin 3, and X: 0.000, Y: 100.000 will be input as work origin 4.
- Select rows 1 – 5 by tapping and dragging, and then tap **[COPY]**.
- Tap row 6, and then tap **[PASTE]**.

No.	X	Y
1	0.000	0.000
2	80.000	0.000
3	80.000	100.000
4	0.000	100.000
5	0.000	0.000
6	0.000	0.000
7	0.000	0.000
8	0.000	0.000
9	0.000	0.000
10	0.000	0.000
11	0.000	0.000
12	0.000	0.000
13	0.000	0.000
14	0.000	0.000
15	0.000	0.000
16	0.000	0.000
17	0.000	0.000
18	0.000	0.000
19	0.000	0.000
20	0.000	0.000

Tap the values

STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/U
1	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***
2	50.000	165.000	130.000	90.000	75.000	165.000	130.000	90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C-
3	80.000	170.000	130.000	0.000	80.000	195.000	130.000	0.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	***
4	75.000	200.000	130.000	-90.000	50.000	200.000	130.000	-90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	***
5	45.000	195.000	130.000	-180.000	45.000	170.000	130.000	-180.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C-
6									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
7									<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	

Update Run COPY PASTE + - Gerber

Set the work origin

Same as source Work origin 2 Cancel

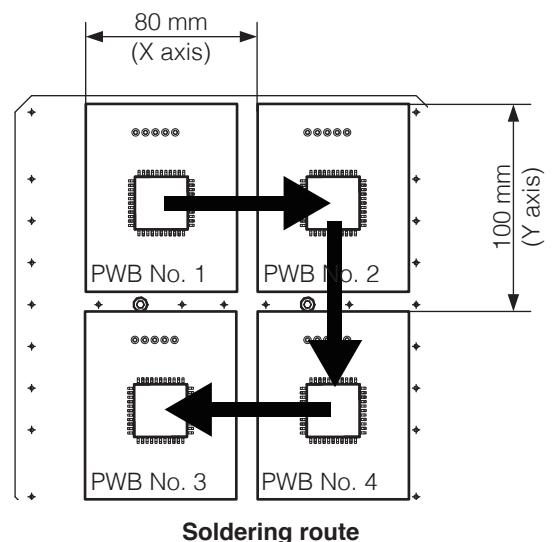
Select up to row 5 and then tap **[COPY]**.

Select row 6 and then tap **[PASTE]**.

The tapped number will be shown.

- Tap the values in the work origin screen and then tap **[Work origin 2]** to complete the copying process.
- Repeat the same procedure to paste the programs for work origins 3 and 4.

This completes duplication of the programs using the palletizing function.



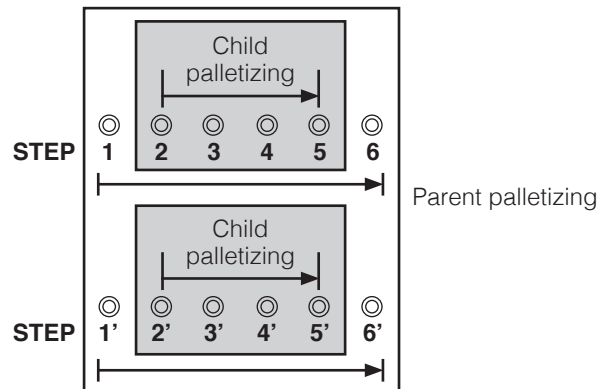
7. Operation (continued)

7-7-2-3 Duplicating a Series of Multiple Points as a Group

→ The first STEP of the parent must be before the first STEP of the child.

→ The last STEP of the parent must be after the last STEP of the child.

Ex.) The 2nd – 5th points are repeated using the palletizing function, and soldering including those points for the 1st – 9th points will be repeated using the palletizing function.



STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/O
1	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	**C**P
2	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	****P
3	50.000	165.000	130.000	90.000	75.000	165.000	130.000	90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C*S*
4	80.000	170.000	130.000	0.000	80.000	195.000	130.000	0.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	****S*
5	75.000	200.000	130.000	-90.000	50.000	200.000	130.000	-90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	****S*
6	45.000	195.000	130.000	-180.000	45.000	170.000	130.000	-180.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C*S*
7									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	
8									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	

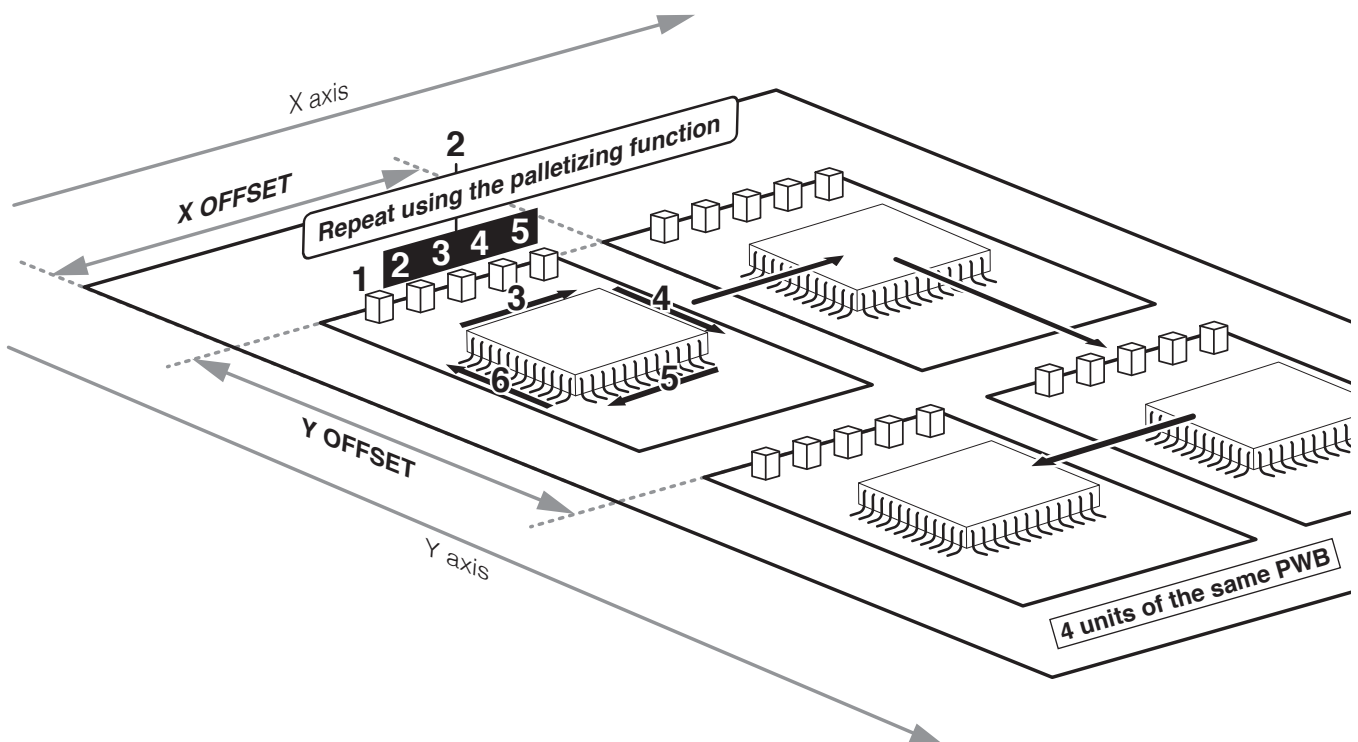
Row 1: Soldering of the 1st – 9th points will be repeated (4 times).

Row 2: Soldering of the 2nd point will be repeated (4 times).

In this way, 36 rows (9 points × 4) of soldering programs are collected into 6 rows.

⚠ CAUTION

Table movement in the Y axis direction is opposite to the displayed direction. Be careful since proper soldering cannot be performed if the opposite direction is set.



7. Operation (continued)

7-7-3 Calling up a Program Using a Bar Code or I/O

If the PWB to perform work on and the created program are linked in advance in the Bar Code Setting Screen, the program can be called up using a bar code or by I/O.

7-7-3-1 Registering a Bar Code

1. Select the name of the program to be linked in the Program List Screen and tap **[BAR CODE]**.

The screenshot shows the 'Program List' screen with a table containing the following data:

BarCode	Program name	Modification date	Creation date
	TEST		

Below the table are buttons for OSK, Edit, Run, and BAR CODE. The 'BAR CODE' button is highlighted with a red box. A red arrow points from this button to the 'PROGRAM CODE' field in the configuration dialog shown on the right.

The configuration dialog contains the following fields:

- PROGRAM NAME: TEST
- PROGRAM CODE: (empty field)
- CUSTOMER CODE: (empty field)
- CUSTOMER NAME: (empty field)
- PROGRAM NO.: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
- COMMENT: (empty text area)
- CANCEL and OK buttons.

2. Reading the bar code while the **PROGRAM CODE** space is selected will cause the code to be input. A commercially available USB type bar code reader is necessary to read bar codes.

This screenshot shows the same configuration dialog as above, but the 'PROGRAM CODE' field is now highlighted with a red box, indicating it is selected for input.

3. Tap **[OK]** to complete the setting. To finish without saving the setting, tap **[CANCEL]**.

The screenshot shows the 'Program List' screen with a barcode in the 'BarCode' column for the 'TEST' program. The 'BAR CODE' button is also visible at the bottom.

BarCode	Program name	Modification date	Creation date
▶ [Barcode]	TEST		

7-7-3-2 Calling up a Program with a Bar Code

If a bar code is read with a bar code reader while HAKKO SOLDERING SYSTEM 2 is running, the program which was linked to the bar code in advance will be called up.

A read confirmation dialog will appear. Tap **[OK]** to read in the program.

If there is no registered program, a warning message will appear.

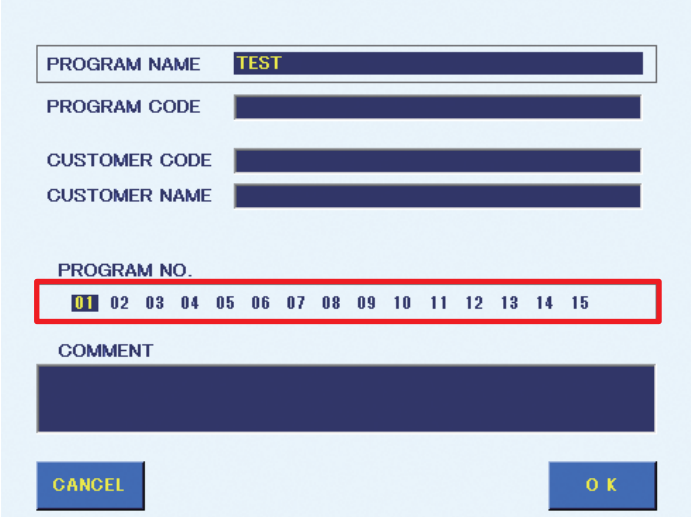
The program which was read in can be run by following the same procedure as in “7-6 Running a Program” (p. 93).

7-7-3-3 Registering an I/O Setting

I/O setting registration can be performed in the same screen as bar code registration. For details how to get to this screen, refer to “7-7-3-1 Registering a Bar Code” (p. 106).

1. Select the name of the program to be linked in the Program List Screen and tap **[BAR CODE]**.

2. The number for selecting a program can be set in **PROGRAM NO.** Tap on the desired number to select it.

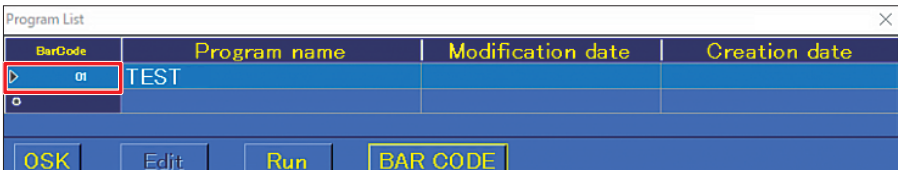


The screenshot shows a dialog box for program registration. It contains the following fields and controls:

- PROGRAM NAME:** A text field containing the value "TEST".
- PROGRAM CODE:** An empty text field.
- CUSTOMER CODE:** An empty text field.
- CUSTOMER NAME:** An empty text field.
- PROGRAM NO.:** A numeric keypad with digits 01 through 15. The number "01" is highlighted with a red border.
- COMMENT:** A large empty text area.
- Buttons:** "CANCEL" and "OK" buttons at the bottom.

3. Tap **[OK]** to complete the setting. The selected number (“01” in this example) will be shown in the BarCode column as in the screenshot below.

To finish without saving the setting, tap **[CANCEL]**.



The screenshot shows the "Program List" screen with a table of programs. The "BarCode" column contains the value "01".

BarCode	Program name	Modification date	Creation date
01	TEST		

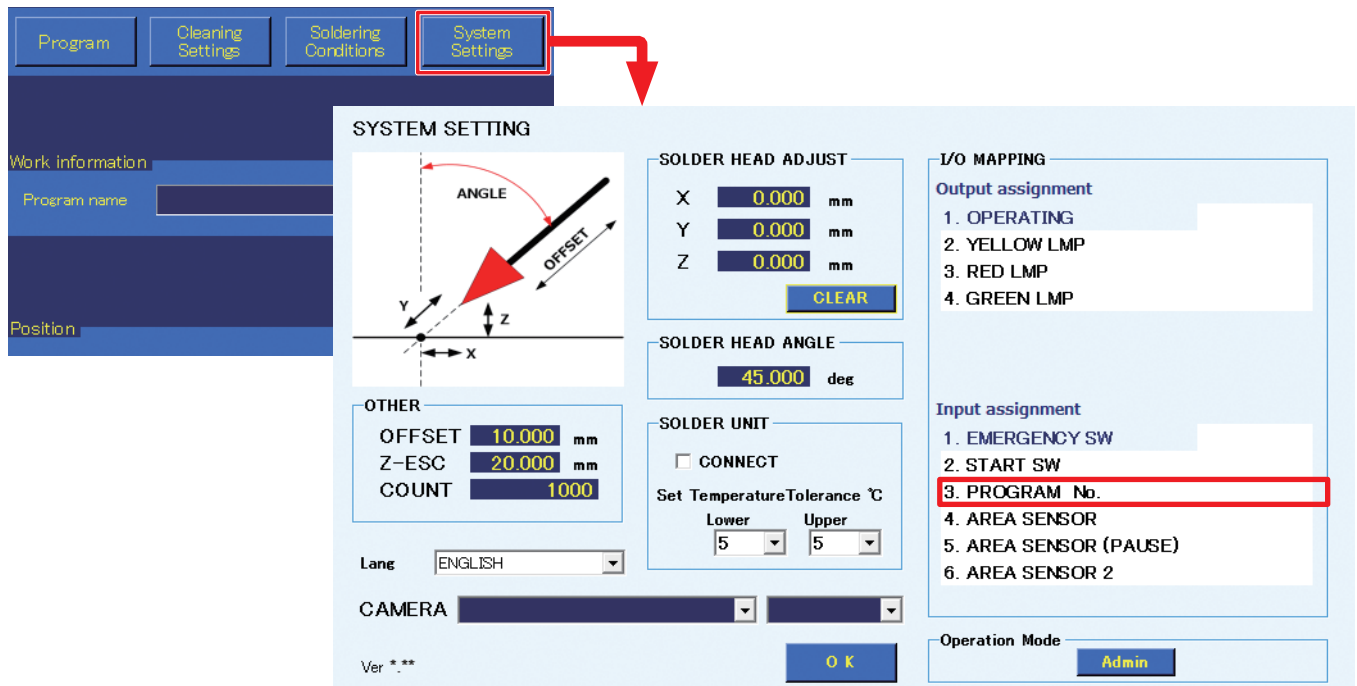
At the bottom of the screen, there are buttons for "OSK", "Edit", "Run", and "BAR CODE".

7. Operation (continued)

7-7-3-4 Calling up a Program via I/O

Programs can be called up by external equipment using the number set for the program in **PROGRAM NO.** in “7-7-3-3 Registering an I/O Setting” (p. 107). For details, refer to “7-7-3-3 Registering an I/O Setting” (p. 107).

1. Tap **[System Settings]** on the top screen.
2. Assign the input signal for program number input in the Input signal assignment frame of **I/O MAPPING** in the SYSTEM SETTING screen.



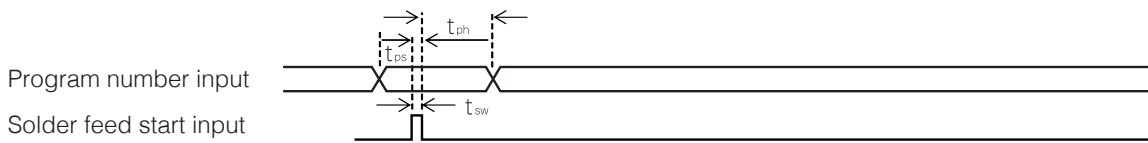
3. When the number set in **PROGRAM No.** is specified by an external device using binary numbers and START is input, the program will be called up and automatically started. Program number input uses 4 signals starting with the signal assigned to program number input in I/O MAPPING. For example, when INP0 is selected, the 4 signals from INP0 to INP3 will be used.

Ex.) Assignment table when INP0 is selected for program number input

No.	INP0	INP1	INP2	INP3
01	ON			
02		ON		
03	ON	ON		
04			ON	
05	ON		ON	
06		ON	ON	
07	ON	ON	ON	
08				ON
09	ON			ON
10		ON		ON
11	ON	ON		ON
12			ON	ON
13	ON		ON	ON
14		ON	ON	ON
15	ON	ON	ON	ON

The program set for PROGRAM NO. 01 on the previous page would be run by setting the INP0 signal to on.

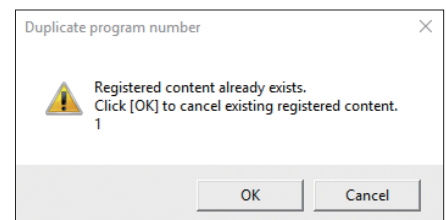
The timing chart when starting a program using **PROGRAM No.** input is shown below.



Program specification setup time: $t_{ps} > 5$ msec
Start signal pulse width: $400\text{msec} > t_{sw} > 15\text{msec}$
Program specification hold time: $t_{ph} > 150$ msec

PROGRAM NAME: Shows the program name.

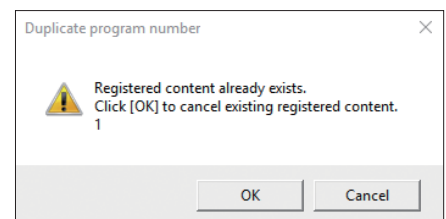
PROGRAM CODE: Input the code for calling up the program. When a bar code is read while this is selected, the code read from the bar code will be input. If the code is a duplicate, an error will be shown. Tapping **[OK]** will cause the duplicated destination setting to be erased, and the code to be assigned to the current program.



CUSTOMER CODE: The customer (or PWB) identification code, etc. can be input.

CUSTOMER NAME: The customer name, etc. can be input.

PROGRAM NO.: The number for selecting the program using external I/O can be set. Tap the desired number to select it. If the code is a duplicate, an error will be shown. Tapping **[OK]** will cause the duplicated destination setting to be erased, and the number to be assigned to the current program.



COMMENT: A comment for the program can be input.

7. Operation (continued)

7-7-4 I/O Settings

The I/O settings for each point can be set by tapping **I/O** in the Program Edit Screen or selecting **I/O Setting** in the Point Edit Screen.

I/O Settings Screen

Program List (TEST)

STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/O
1									<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>
2	+216.936	+000.000	50.000	+000.000	+216.936	+064.819	+074.799	180.000	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
3		50.000						90.000	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
4					100.000	40.000		0.000	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

STEP = 1 NOTE

Current Pos. Start Pos. ⇄ End Pos.

X 000.000 mm
Y 000.000 mm
Z 000.000 mm
 θ 000.000 deg

Lifting Pos. mm
Moving Speed mm/s
Soldering Speed mm/s
Lifting Speed mm/s

CLEANING: 1 2 3 4 5
 Before After
 Soldering: PS DS None
 Preset No. 1
 Return to: Start Lifted Pos.

STEP POINT OFFSET ROUTE WORK ORIGIN

Cancel Prev. Next **I/O Setting** Exit

Input settings section

Output settings section

SHOT: 100 ms

CANCEL OK

Input settings section: After movement to the start point for each point, if an input which has been set in external I/O occurs, the subsequent operations will be performed. Inputs used in “7-7-5 System Settings” (p. 111) cannot be used.

Tapping **[INP *]** will cause it to switch between ON and OFF.

ON: Sets input to ON.

OFF: Sets input to OFF.

[(), [)], [AND], and [OR] can be used to create logical AND and OR statements.

Ex.) (INP4 OR INP5) AND INP6

The operation will be performed when either INP4 or INP5 is on and INP6 is also on.

Tapping **[DEL]** will move back one step in the equation.

Output settings section:

After each point's soldering has been completed and the robot has moved to the start point, the output set in external I/O will be performed.

Outputs used in "7-7-5 System Settings" (p. 111) cannot be used.

Tapping **[OUT *]** will cause it to switch in the following order: ON, OFF, SHOT, SHOT B.

ON: Sets output to ON.

OFF: Sets output to OFF.

SHOT: The output will be set to ON only for the SHOT period. Even if soldering of the next point has been completed, the program will not proceed to the next point until the signal becomes OFF.

SHOT B: The output will be set to ON only for the SHOT period. If soldering of the next point has been completed, the program will proceed to the next point without waiting for the signal to become OFF.

SHOT [] ms: Input the SHOT output time in msec.

* **Minimum time for IN:** 10 msec

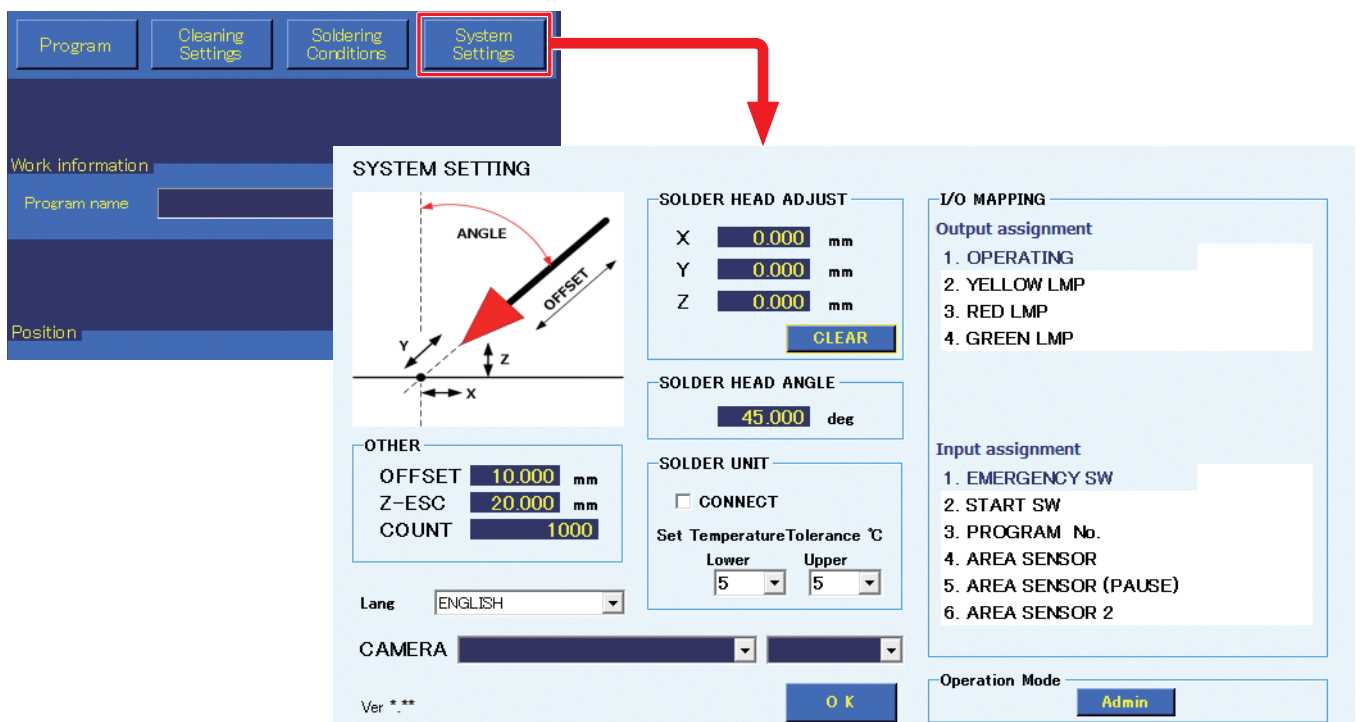
ON detection current for IN: Around 5 mA

Rated current for OUT: 150 mA

(Since it is the element rating, the actual value is around 100 mA)

7-7-5 System Settings

The System Settings Screen can be opened from the top screen.



7. Operation (continued)

7-7-5-1 OTHER (OFFSET, Z-ESC, COUNT) Functions

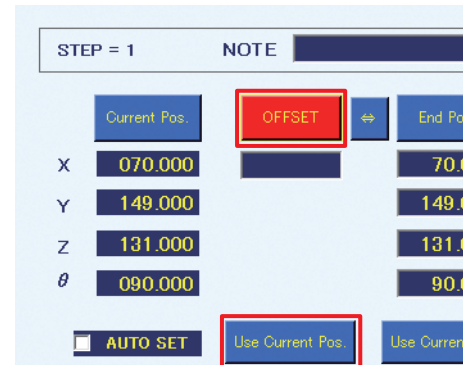
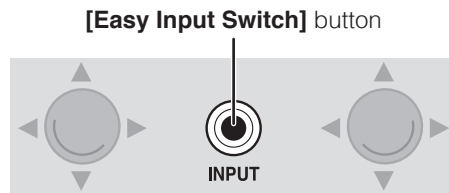
■ OFFSET (Settable range: 0 – 100 mm)

Sets the offset amount to be used when using **AUTO SET**.

In addition, if no offset value is set in **[OFFSET]** mode settings, operation will be performed using this setting.

When a value has been input for individual offset in the Point Edit Screen, that value will be given priority.

After setting, tapping **[Use Current Pos.]** or pressing the robot's **[Easy Input Switch]** button will cause this offset value to be used.



■ Z-ESC (Settable range: 0 – 200 mm)

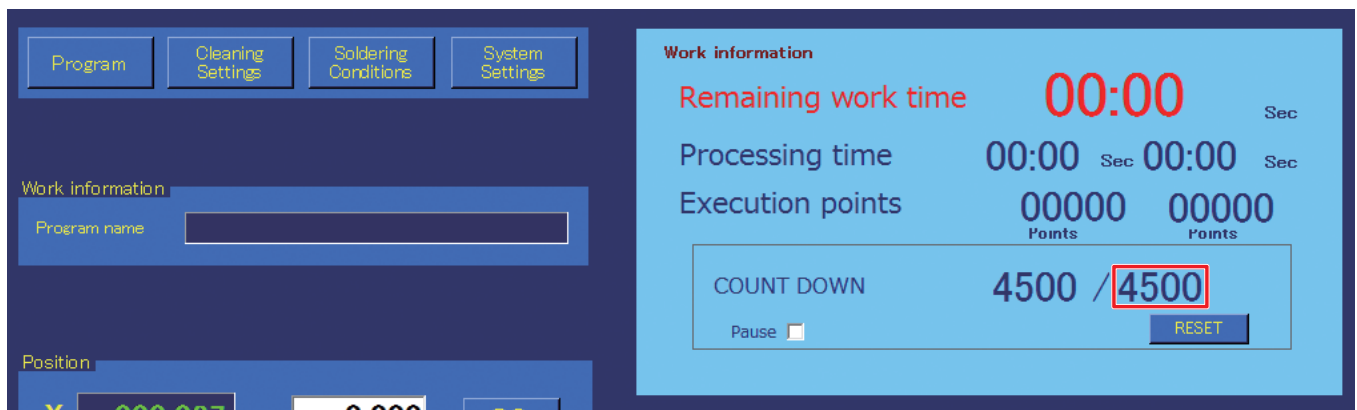
If an FU-601 error or feeder error occurs during program operation, the robot will pause and then lift the Z axis by the set distance. (This setting is not a coordinate.)

If the lift position would become negative because of the Z axis position when an error occurs, the Z axis will be set to the 0.000 coordinate.

■ COUNT (Settable range: 1 – 999999)

Sets the **COUNT DOWN** value shown in the **Work information** area of the top screen.

By setting the value so that the count becomes 0 before the soldering capacity of the tip becomes poor due to wear, countermeasures can be taken before problems occur.



Ex.) If it is assumed that the timing when soldering would become poor is at 5000 points, set the count to 4500.

- 1) When soldering of 4500 points has been performed, the count becomes 0 and operation stops.
- 2) Replace worn parts such as the tip, etc.
- 3) After replacing parts, perform tip position adjustment, etc.
- 4) Use DRY RUN to check positions of soldering points.

— Note —

If **Pause** in the top screen's **Work information** area is checked at this time, countdown will not be performed.

Check **Pause** when counting is not necessary, such as when performing position checking, etc.

When work is restarted after having stopped, this value will be reset.
It can also be reset by tapping **[RESET]** in the work information area.

7-7-5-2 SOLDER HEAD ADJUST Function

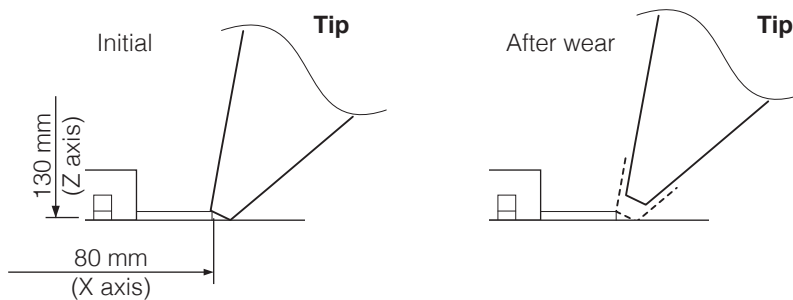
(Settable range: X: 0.000 mm – 10.000 mm; Y: 0.000 mm – 10.000 mm; Z: 0.000 mm – 10.000 mm)

When the tip dimensions have changed due to tip wear, this function can be used to correct the tip position so that soldering can be performed without changing the program.

1. Open the Point Edit Screen for row 7.

STEP	X0	Y0	Z0	$\theta 0$	X1	Y1	Z1	$\theta 1$	O	Z	P	D	I/O
1	70.000	145.000	125.000	90.000	70.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
2	65.000	145.000	125.000	90.000	65.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	
3	60.000	145.000	125.000	90.000	60.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	****S*
4	55.000	145.000	125.000	90.000	55.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	***Z**
5	50.000	145.000	125.000	90.000	50.000	149.000	131.000	90.000	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	**C***
6	50.000	165.000	130.000	90.000	75.000	165.000	130.000	90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**C*S*
7	80.000	170.000	130.000	0.000	80.000	195.000	130.000	0.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	****S*
8	75.000	200.000	130.000	-90.000	50.000	200.000	130.000	-90.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	****S*
9	45.000	195.000	130.000	-180.000	45.000	170.000	130.000	-180.000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	**CZS*
10									<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	

2. The initial coordinates have been input for the end point in the Point Edit Screen.
3. Tap the end point **[Move]** button and check the tip position after wear.



4. Use JOG operation to move the worn tip to the position where it can perform soldering, and perform settings again.
5. Determine the differences from the initial soldering position.

	Initial setting	Position after setting again	Difference
Y axis	80.000 mm	79.000 mm	-1 mm
X axis	195.000 mm	195.000 mm	0 mm
Z axis	130.000 mm	131.000 mm	1 mm

6. Input the differences in **SOLDER HEAD ADJUST** and finish writing the data.

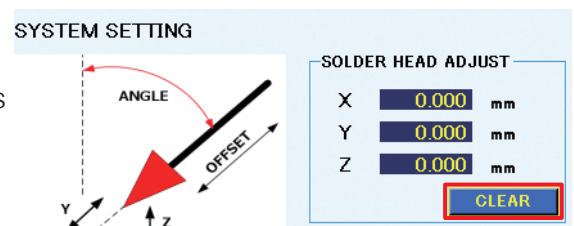
During point soldering, the correction will be applied to both the start point and end point. It is also applied during cleaning.

For drag soldering, perform the correction while taking into account the movement from the start point to the end point.

In addition, even if values have been input in **SOLDER HEAD ADJUST**, the coordinates displayed while moving using the JOG operation, etc. will not include the corrections.

Tapping **[CLEAR]** will set all values to 0.000 (no correction). When the tip is replaced with a new one, be sure to set the correction values to 0. Then perform correction again. If it is used without doing this, there is a danger of damage to the workpiece.

After replacing the tip, perform **Steps 1 – 6** and input the differences between the initial soldering position and the soldering position for the replaced tip into **SOLDER HEAD ADJUST**.



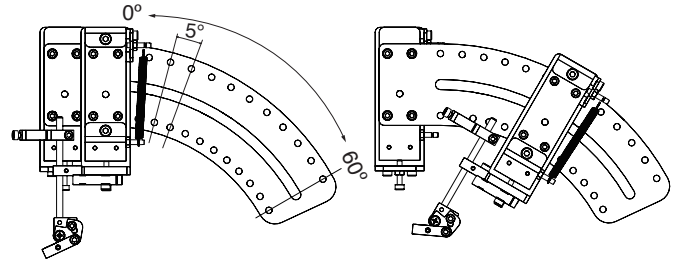
7. Operation (continued)

7-7-5-3 SOLDER HEAD ANGLE Function (Settable range: 0 – 90°)

The angle of the soldering iron unit attached in “5-2-1 Attaching the Feeder Unit (CX5005)” (p. 20) can be set.

When using offset, use this angle setting and determine the offset direction.

Be careful since the angle setting may cause the start point of the point for which offset was set to change.



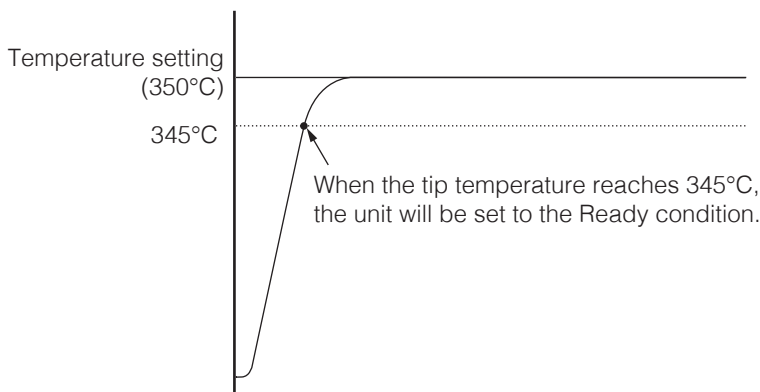
7-7-5-4 SOLDER UNIT

Performs connection with the HAKKO FU-601 and setting of the temperature tolerance standard.

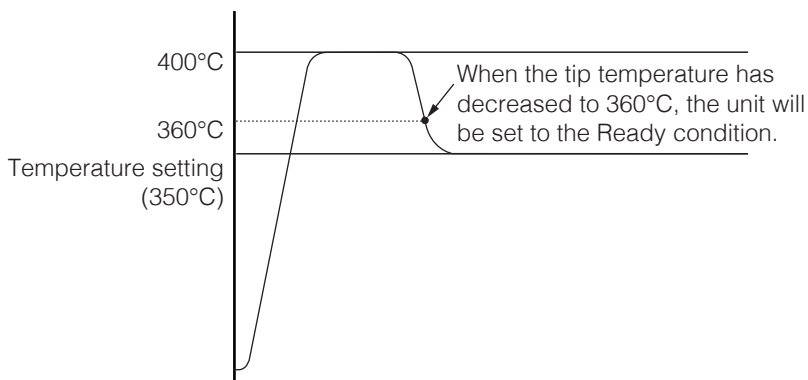
- When **CONNECT** is checked, connection with the HAKKO FU-601 will be performed.
- When **CONNECT** is unchecked, the HAKKO FU-601 will not be connected.

When the tip temperature is judged to have reached the temperature differential between the set temperature and the upper limit tolerance or lower limit tolerance, the unit will be set to the Ready condition. If the upper limit tolerance of the **Temperature Tolerance** standard is such that the set temperature is lower than the current tip temperature, the lower limit will become the judgement standard when the temperature setting increases.

Ex. 1) Temperature setting: 350°C; Lower limit temperature tolerance: 5°C; Starting from room temperature

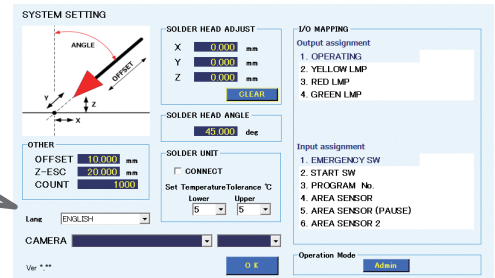
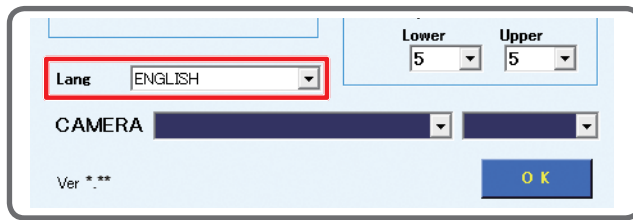


Ex. 2) Temperature setting: 350°C; Upper limit temperature tolerance: 10°C; Decreasing from 400°C



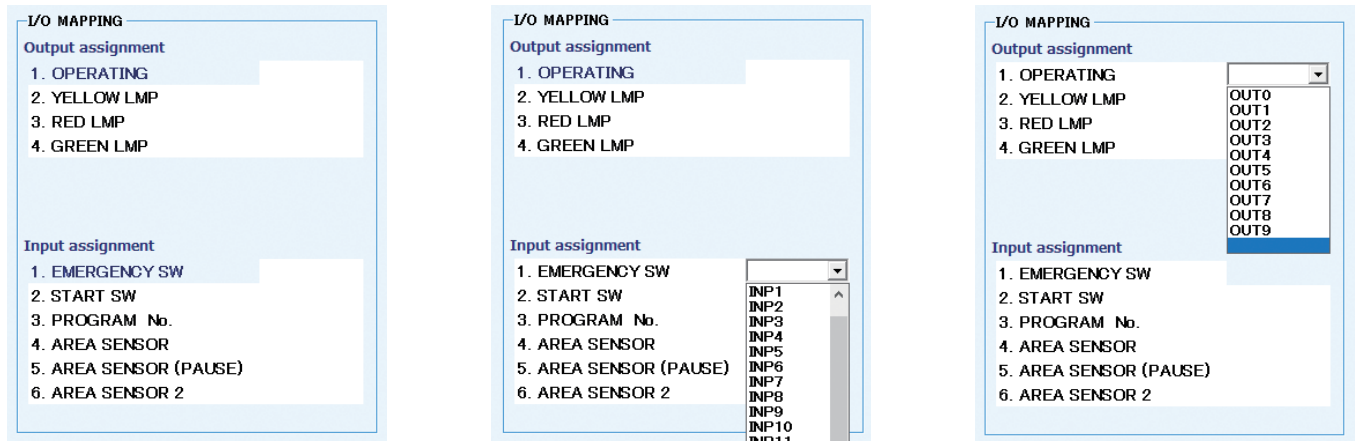
7-7-5-5 Lang (Change of the language)

The indication of the screen becomes the selected language.



7-7-5-6 I/O MAPPING

Performs I/O connection settings for peripheral devices such as external emergency stop devices, etc.



The I/O list is shown in a pull-down list, so output signals can be assigned to the following peripheral devices by selecting the I/O number to be set.

If duplicate numbers are selected, a warning message will be shown. In such case, select a different number.

■ Output Signal Assignment

1.	Working:	Lit while the program is running (Lit when the program is paused.)
2.	Green light:	Blinking while the program is running. (Blinking while the program is paused.)
3.	Red light:	Lit until the program is resumed or stopped after being paused due to a solder feed or FU-601 error while the program is running. Lit when the program is stopped. (emergency stop)
4.	Yellow light:	Lit when the program is not running. (Lit when the program is paused.)

■ List of output states

		When the program is not running	While the program is running	While the program is paused	When the program is resumed or stopped after being paused due to a solder feed or FU-601 error while the program is running	When the program is emergency stopped
1.	Working:	●	○	○	○	●
4.	Green light:	●	◎	◎	◎	●
3.	Red light:	●	●	●	◎	○
2.	Yellow light:	○	●	○	○	○

○ : Lit ◎ : Blink ● : Off

* While the program is running, DRY RUN is included.

* The stop includes the START/PAUSE/STOP button on the PC, start input while driving, an area sensor (stop).

* The emergency stop includes emergency stop inputs, area sensor (emergency stop) and area sensor 2.

7. Operation (continued)

■ Input Signal Assignment

1.	Emergency stop input:	Performs emergency stop.
2.	Start input:	Starts the soldering program.
3.	Program number input:	When the program number is selected, the program corresponding to the input number PROGRAM NO. (set in the Bar Code Settings Screen) will be called up.
4.	Area sensor (emergency stop):	Performs emergency stop when something is detected by an area sensor.
5.	Area sensor (pause):	Performs pause when something is detected by an area sensor.
6.	Area sensor (emergency stop2)*1:	Performs emergency stop when something is detected by an area sensor while a program is running.

*1 Area sensor (emergency stop) performs an emergency stop when something is detected by the sensor regardless of the robot status, but area sensor 2 performs an emergency stop only while a program is running.

— Note —

When values are changed in the System Settings Screen, if there is a program that was already read in, the program will be rescanned when the screen is closed.

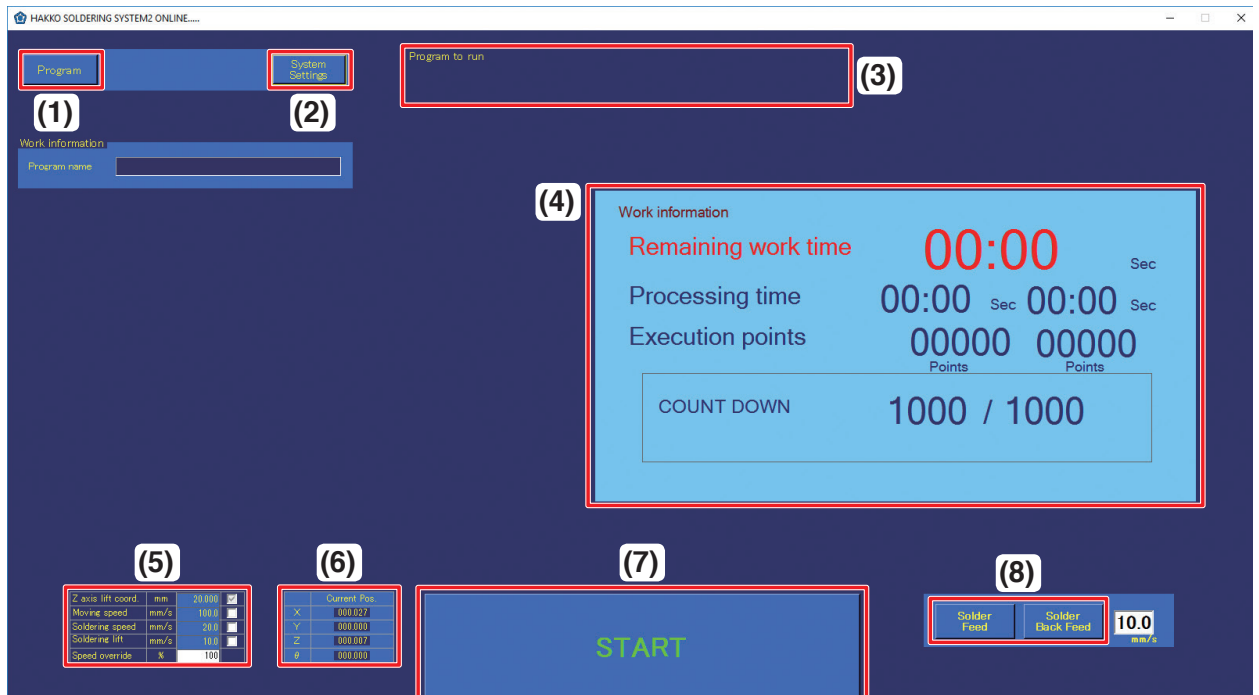
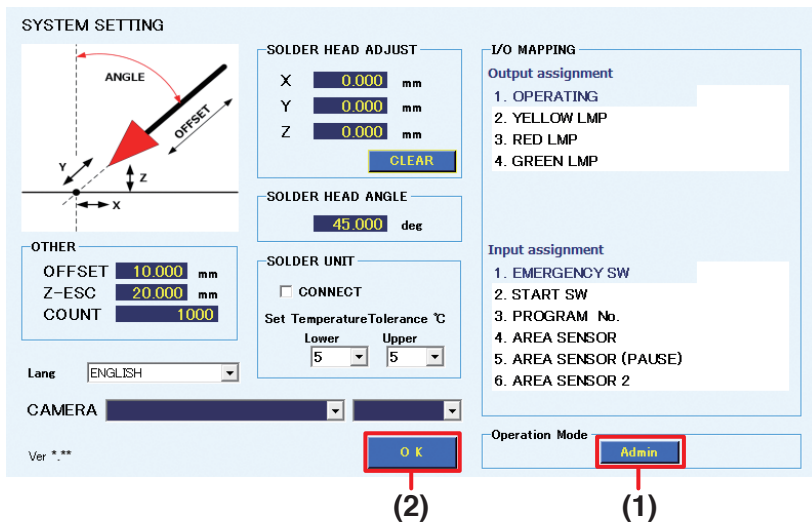
7-7-5-7 Operation Mode

Admin mode or Operator mode can be selected for Operation Mode.

■ Operator mode

The functions which can be used in Operator mode are limited.

1. In the System Settings screen, tap **[Admin]** (1). It will change to **[Operator]**.
2. Tap **[OK]** (2) to switch the mode and close the screen.



Software top screen (Operator mode)

In Operator mode, the following functions can be used.

- | | |
|--|---|
| (1) Program (Call up the selected program.) | (5) Settings (Only speed override can be set. For details, refer to (5a) "Speed override" (p. 53)) |
| (2) System Settings
(Operation Mode settings can be performed.) | (6) Position (Display only) |
| (3) Program to run
(Display the program which was called up.) | (7) Start button
(Execution of program which was called up) |
| (4) Work information
(COUNT DOWN reset/pause function cannot be used.) | (8) Solder Feed/Solder Back Feed
(Use of solder feeding/retraction and speed setting can be performed.) |

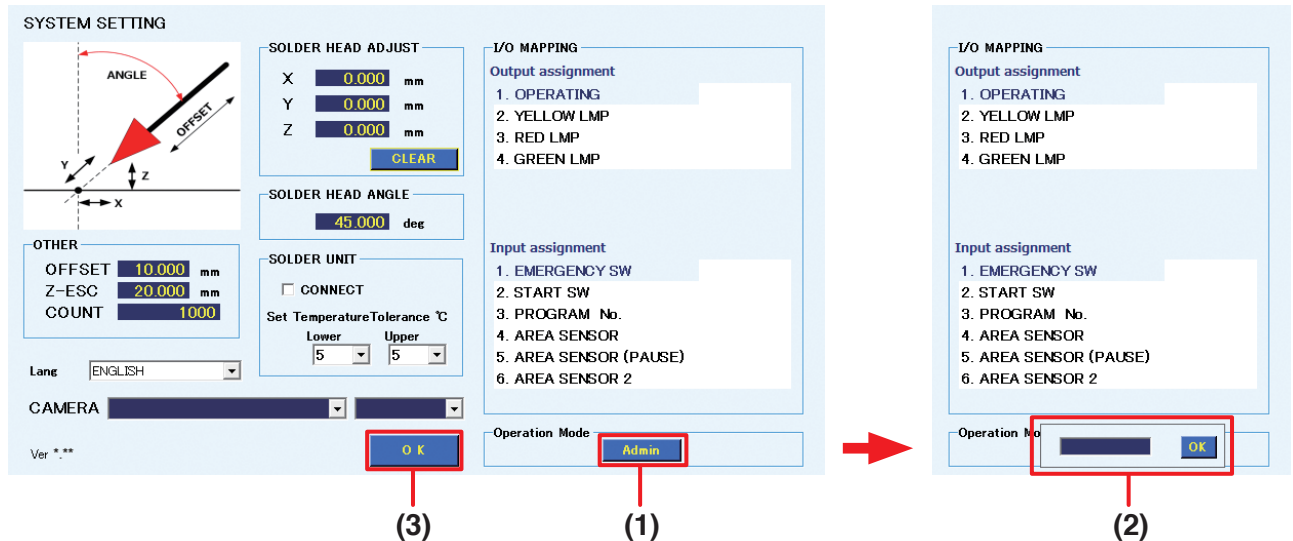
7. Operation (continued)

■ Admin mode

In Admin mode, all functions can be used.

For details, refer to “7-1 Explanation of Software Screen” (p. 40).

1. In the System Settings screen, tap **[Operator]** (1). The password input box will appear.
2. Input the password and tap **[OK]** (2). **[Operator]** will change to **[Admin]**.
3. Tap **[OK]** (3) to switch the mode and close the screen.

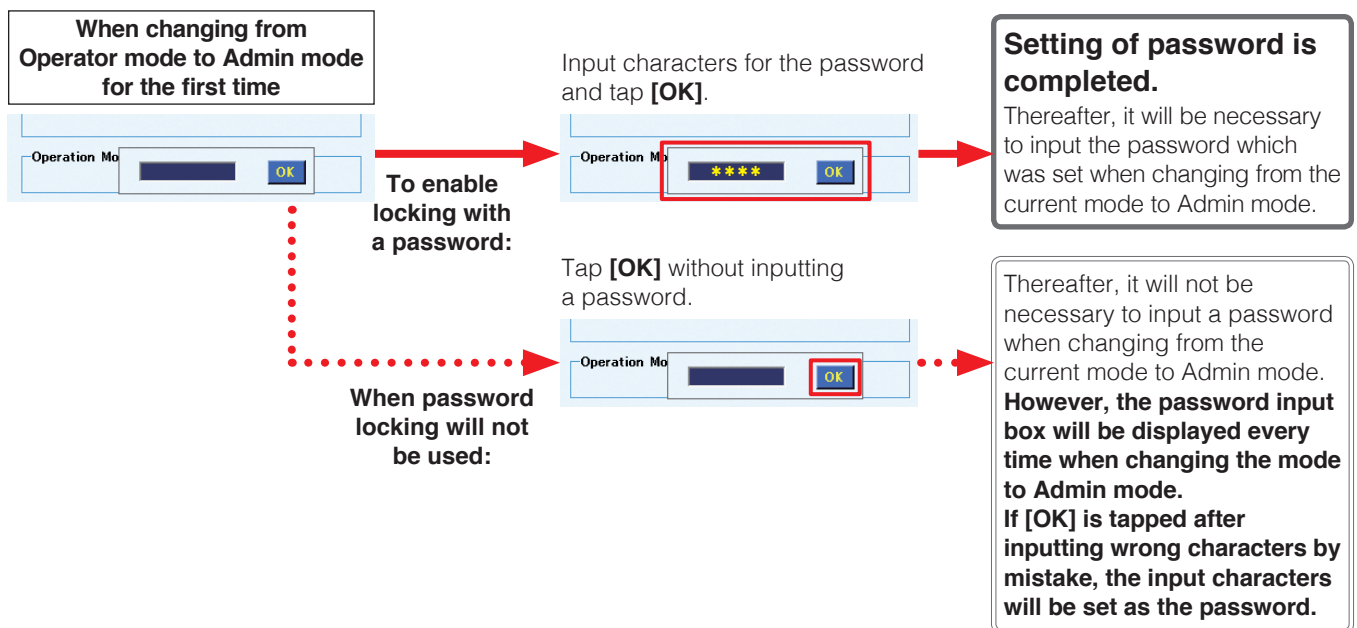


■ Setting password

When changing from Operator mode to Admin mode, the password input box will be displayed.

When setting a password:

- Inputtable characters: Single-byte alphanumeric characters and symbols
- Maximum number of inputtable characters: No limit



⚠ CAUTION

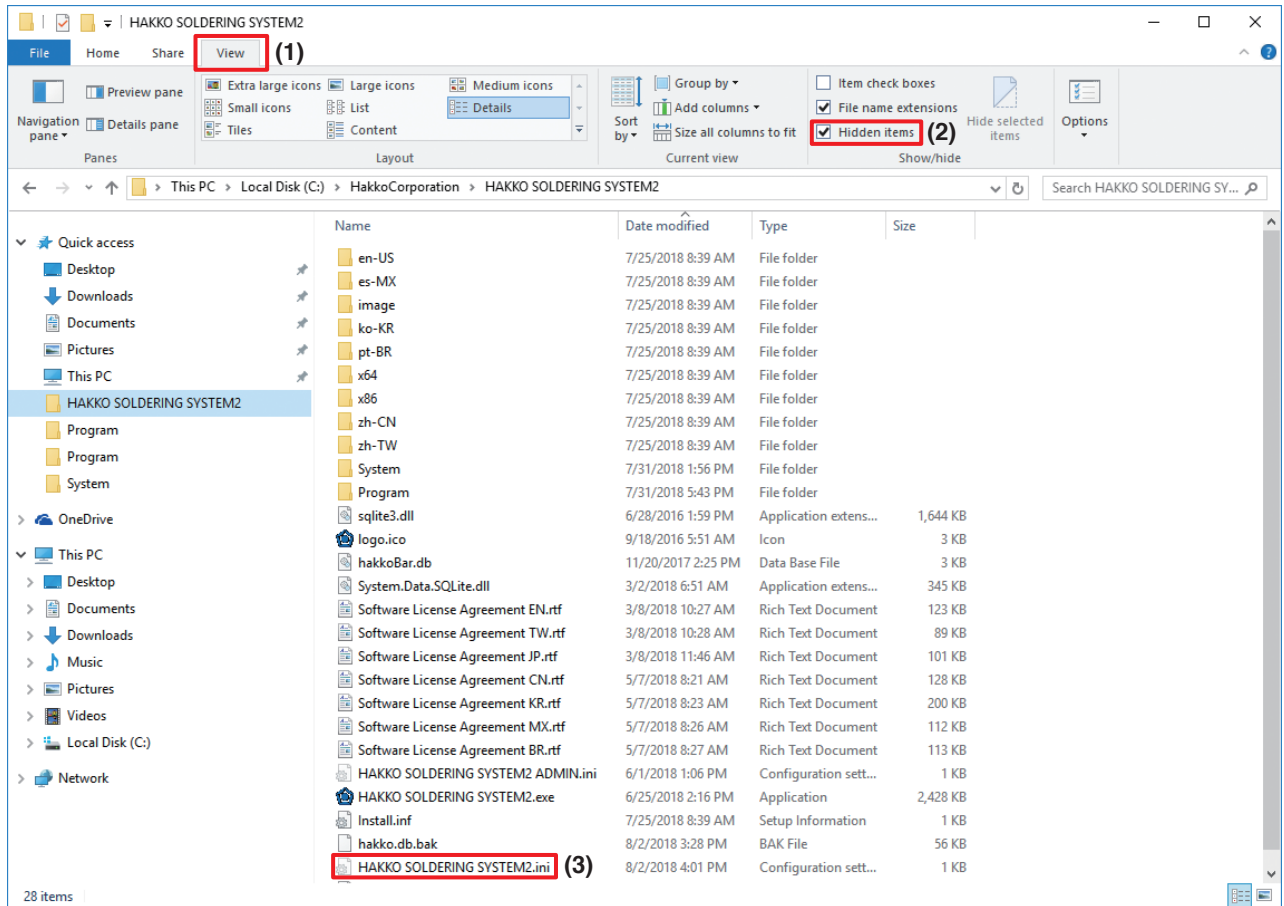
Please manage the password strictly and be careful that it is not given to other people.

When the software is restarted after shutting down, it will start up in the mode which was selected when the software was shut down the previous time.

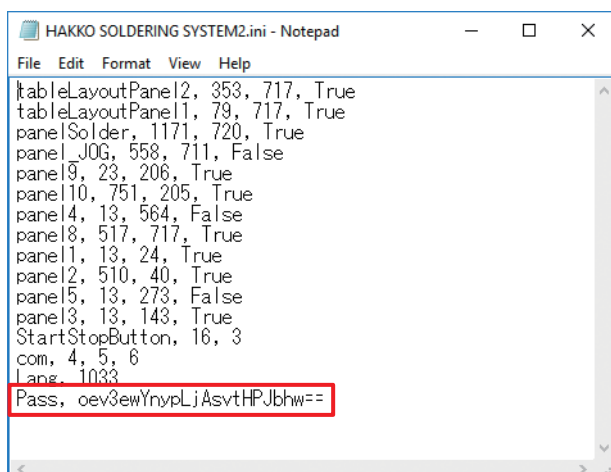
■ Password reset

To change the password or if the set password is forgotten, the password can be reset by the following steps.

1. Tap the “This PC” icon on the desktop and open the C: drive.
Next, open the HakkoCorporation folder and then open the HAKKO SOLDERING SYSTEM2 folder.
2. Select **View (1)** and check **Hidden items (2)** to show hidden files.
3. Double-tap “**HAKKO SOLDERING SYSTEM2.ini**” **(3)**.

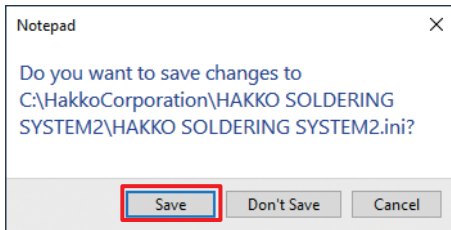


4. Select Notepad as the application to open the file.
5. Delete the final line starting with “Pass,”.



7. Operation (continued)

6. When closing Notepad, tap **[Save]**.



The password will be reset by the above steps.

⚠ CAUTION

Do not touch other lines in the file because deleting or changing other lines will prevent the program from operating normally.

7-7-6 Changing Solder Diameter

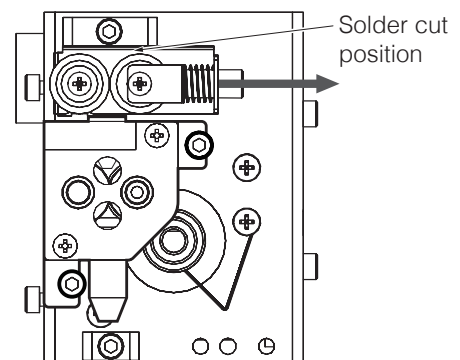
The solder wire diameter can be changed by replacing the tube unit, Teflon tube, solder feed guide set, and solder feed pulley unit.

* The solder feed guide set, Teflon tube, and solder feed pulley unit are sold separately. Use the parts corresponding to the solder wire diameter which will be used.

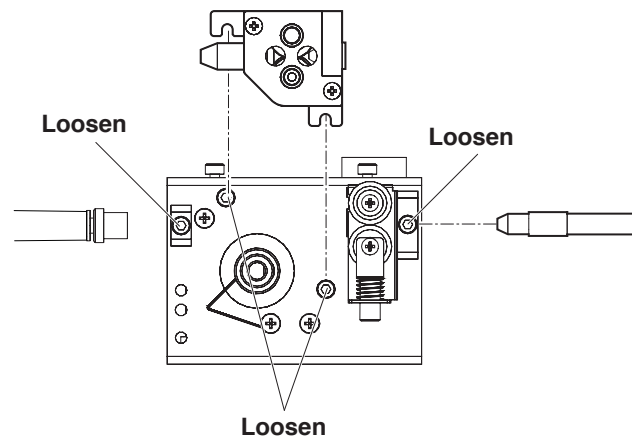
⚠ CAUTION

- **Do not use solder other than the compatible wire diameter. Doing so will cause a malfunction. The attachment method of the solder feed pulley unit for $\Phi 0.3$ mm solder (BX1000) is different. Refer to "Solder setting method" included with the BX1000.**
- **First, switch off the power of the HAKKO FU-601 and let the tip cool down to room temperature before performing work. Performing work while the tip is hot risks causing burns.**

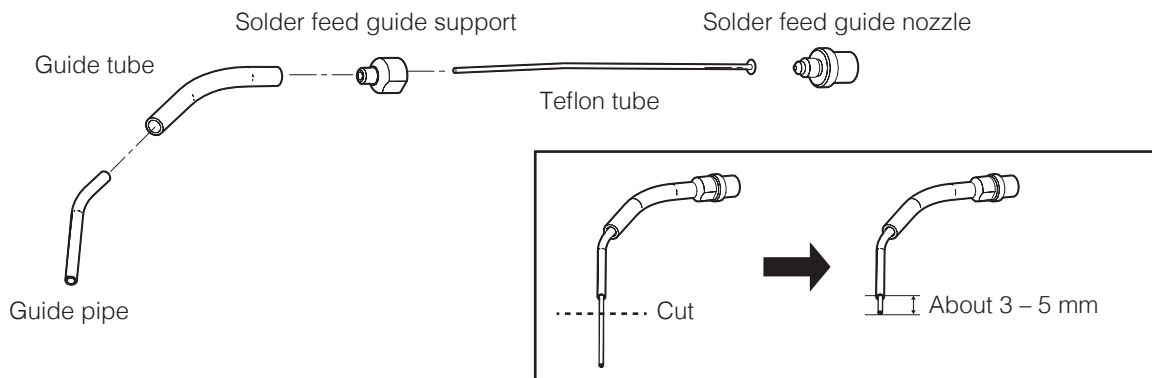
1. First, open the feeder unit cover and cut the solder on the solder reel side of the solder feed pulley unit. At this time, pulling slightly on the roller equipped with a spring will enable cutting to be performed more easily.



2. Open the Solder Feed Parameter Setting Screen from **[Soldering Conditions]**, tap **[Solder Feed]**, and feed the cut solder out. Since the solder will stop after it feeds out a little, tap **[Solder Feed]** again and when the tip of the solder sticks out a little, pull it out.
For solder remaining in the solder wire spool, turn the spool and wind the solder back onto the spool.
3. Loosen the screws indicated in the diagram below, and remove the tube unit, tube unit B, and solder feed pulley unit. Further, remove the Tube unit B and solder feed guide set from the soldering unit mount. Attach the units for the solder diameter which will be used. (For the solder feed guide set, install the Teflon tube for the solder diameter which will be used before attaching the solder feed guide set.)
For details on the parts compatible with solder wire diameters, refer to "11. Parts List" (p. 136).



7-7-7 Installing the Teflon Tube



Turn the solder feed guide nozzle counterclockwise and remove the solder feed guide support so that the Teflon tube can be installed. Insert the guide pipe last.
The Teflon tube is made somewhat long. Cut the excess length of the Teflon tube protruding from the guide pipe to an appropriate length (about 3 – 5 mm).

⚠ CAUTION

Make sure that the Teflon tube protrudes from the guide pipe before use. If it does not, it could cause solder clogging.

When cutting, use a cutter knife or similar tool instead of scissors so that the cross-section is not crushed.

8. Maintenance

8-1 Attached Accessories

The maintenance items for the various equipment are described below.

8-1-1 Cleaner (CX1003)

For details on maintenance of the cleaner, refer to “5. Maintenance” in the instruction manual of the CX1003.

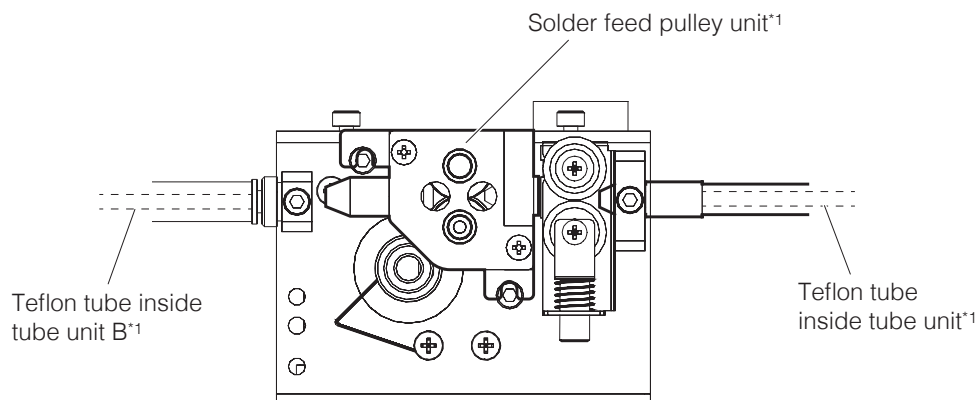
8-1-2 Soldering Iron Unit (HAKKO FU-601)

For the soldering iron unit, maintenance of the tip and soldering iron unit should be performed. Refer to “8. Maintenance” in the instruction manual of the HAKKO FU-601.

8-1-3 Feeder Unit (CX5005)

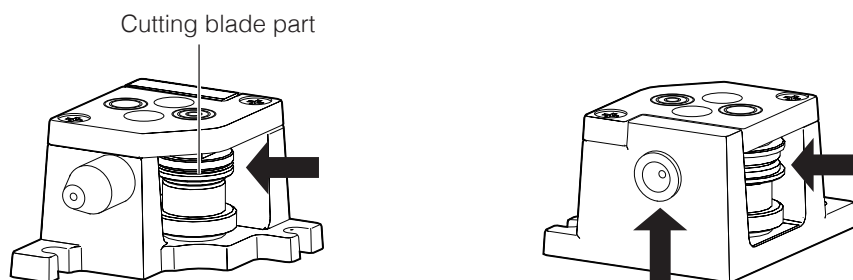
As a general rule, the following inspection and cleaning items should be performed when the solder is replaced.

- If there is solder or flux stuck on the Teflon tube or inside the solder feed pulley unit, use a brush or alcohol to remove it.
- If the Teflon tube is broken or extremely dirty, replace it.
- Regardless of when maintenance is performed, if the cutting amount is insufficient or if spattering of solder balls, etc. is occurring, it is possible that the cutting blade has reached its service life. Replace the solder feed pulley unit.
- If the tube unit is broken or if the inside of the Teflon tube is worn or broken, replace the tube unit.



*1 It is not possible to replace only the cutting blade inside the solder feed pulley unit or the Teflon tubes inside the tube unit or tube unit B.

Locations where dirt is likely to stick



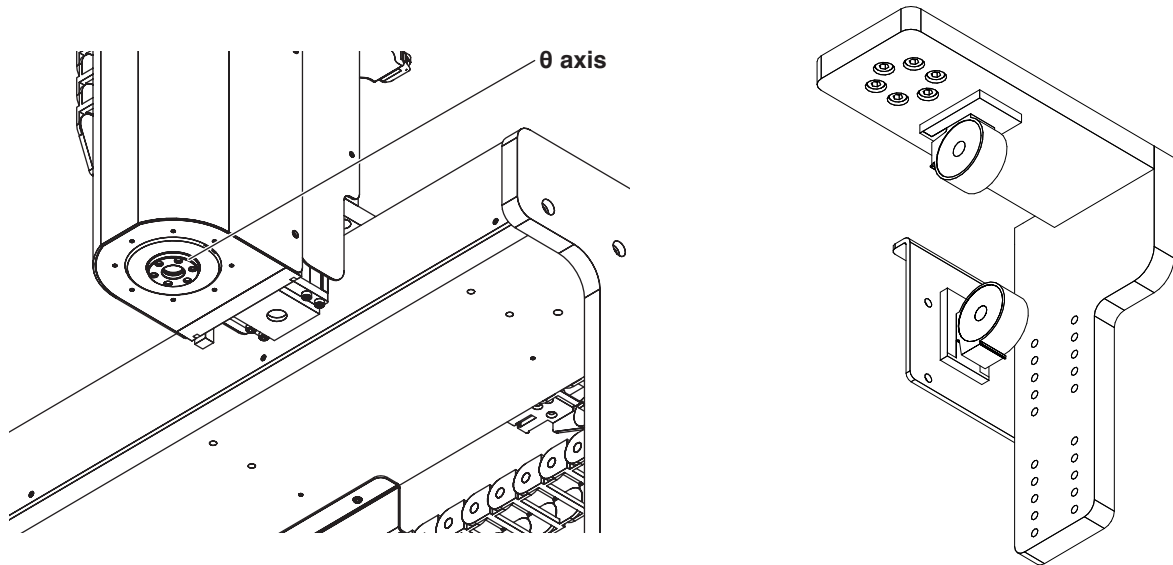
⚠ CAUTION

Be careful not to touch the cutting blade part.

8-1-4 Soldering Unit Fixture Base (CX5002)

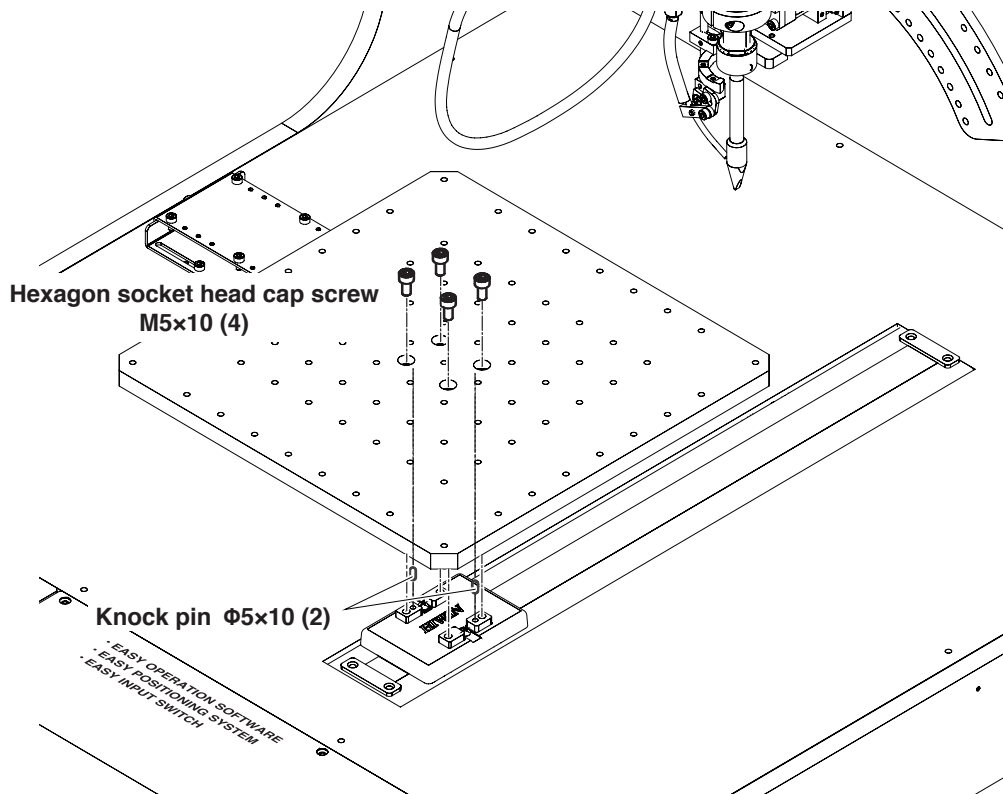
If solder or flux is stuck on the soldering unit fixture base (CX5002) or θ axis, use a brush or alcohol to remove it.

Falling parts or contact with parts may cause warping or scratching. If the warping or scratching is extreme, remove the damaged parts and replace them with new ones.



8-1-5 Jig Table

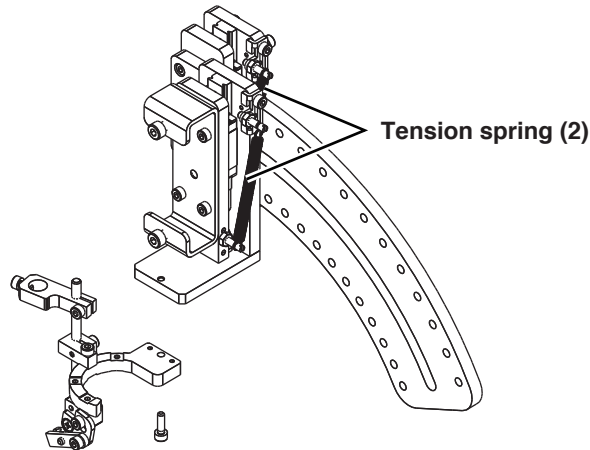
The jig table may become warped or scratched due to falling parts or contact with parts. If the warping or scratching is extreme, remove the damaged parts and replace them with new ones.



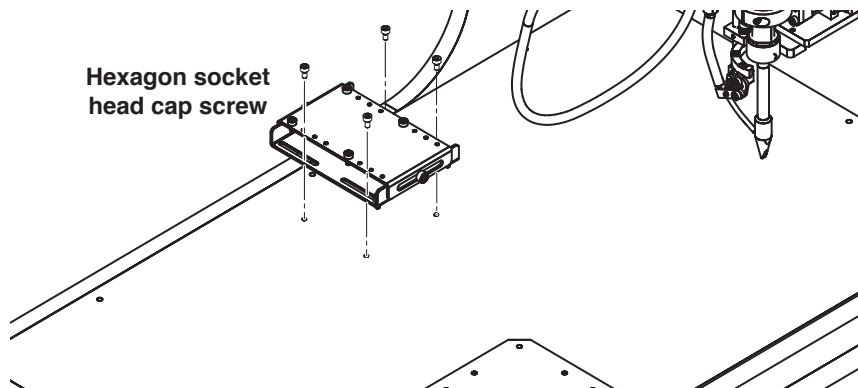
8. Maintenance (continued)

8-1-6 Soldering Unit Mount (CX5004)

If solder or flux is stuck on the soldering unit mount (CX5004) or θ axis, use a brush or alcohol to remove it. If solder or flux is stuck on other areas, use a brush or alcohol to remove it in the same way. If the tension springs of the soldering unit mount (CX5004) deteriorate or wires break, replace the soldering unit mount (CX5004) with a new one.



8-1-7 Cleaner Base (CX5003)



⚠ CAUTION

The various parts use hexagon socket head cap screws with different dimensions. Be careful to manage the parts separately when replacing parts so that they do not get mixed up.

8-2 Inspection Items and Inspection Frequency

Periodic maintenance should be performed in order to use the products for a long time in good condition.

WARNING

Unless otherwise specified, all of the work described below should be performed with the main power switched off.

When performing internal inspection or replacing parts, also unplug the power cord.

Perform maintenance inspection as follows:

External visual inspection	Every time at the start of work
Internal inspection	Every 6 months after starting operation
Grease replenishment	Every 3 months

— Note —

When short-distance movements are performed repeatedly in use, there is a risk of the film of lubrication becoming broken. Periodically perform multiple full-stroke movements.

8-2-1 Items to be Checked during External Visual Inspection

When performing external visual inspection, check the following items:

- That none of the product's screws, nuts, etc. are loose.
- That none of the cables are damaged and that they are all firmly plugged in.
- That there are no abnormal noises or vibrations

CAUTION

- **Since dust getting into gaps may cause malfunctions, do not blow strongly with pressurized air during cleaning.**
- **Do not use petroleum-based solvents. They can damage painted surfaces.**

8-2-2 Cleaning during External Visual Inspection

- Outer surfaces should be cleaned whenever they are dirty.
- Wipe off dirt using a soft cloth, etc.
- If dirt is remarkable, use alcohol, etc. to wipe it off.

8-2-3 Internal Inspection

When performing internal visual inspection, check the following items:

- That none of the product's screws, nuts, etc. are loose.
- The lubrication condition of guide parts and that they are not dirty or contaminated with foreign materials such as dust, etc.
- The lubrication condition of the ball screw section and that it is not dirty or contaminated with foreign materials such as dust, etc.

If the grease is dirty due to dust or is not shiny, or the grease has become worn out due to long-term use, clean all of the parts and then replenish the grease.

8. Maintenance (continued)

8-2-4 Cleaning during Internal Inspection

Wipe off dirt using a soft cloth, etc.

CAUTION

- Since dust getting into gaps may cause malfunctions, do not blow strongly with pressurized air during cleaning.
- Do not use petroleum-based solvents, neutral detergent, or alcohol.

8-2-5 Replenishing Grease

Use the following grease.

X, Z axes: AX1002 (for general-purpose)

Color	Brown
Base oil	Mineral oil
Thickener	Lithium soap based
Operating temperature range	-15 – 120°C
Consistency (0.1 mm)	265 – 295
Viscosity (40°C)	200 cSt
Boiling point	190°C

Y axis: AX1003 (for cleanroom high-speed)

Color	Yellow
Base oil	Synthetic hydrocarbon oil
Thickener	Special calcium soap based
Operating temperature range	-45 – 125°C
Consistency (0.1 mm)	265 – 295
Viscosity (40°C)	30 cSt
(100°C)	5.9 cSt
Boiling point	>210°C

— Note —

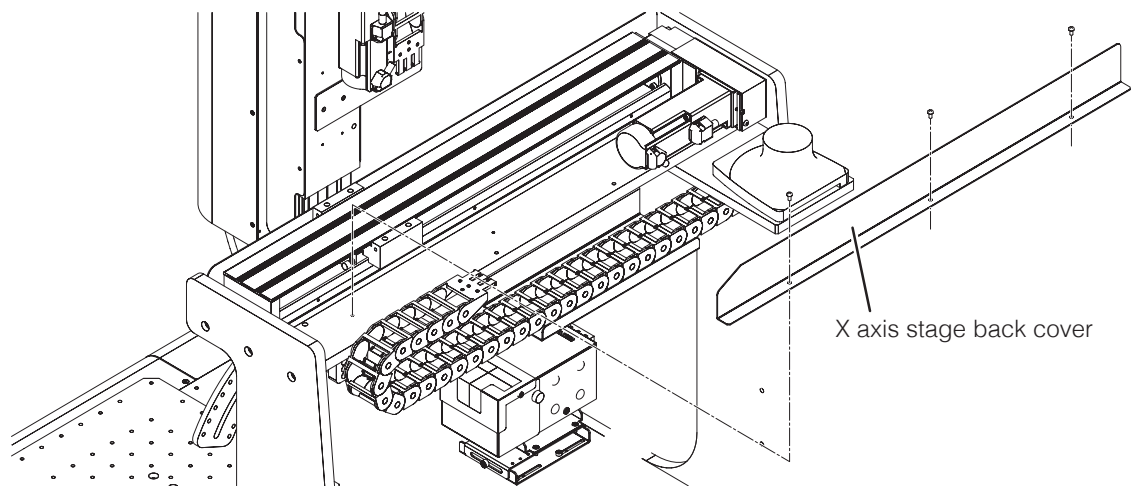
Use only grease of the specified type or specifications. Be careful that it is not mixed with other types of grease.

⚠ CAUTION

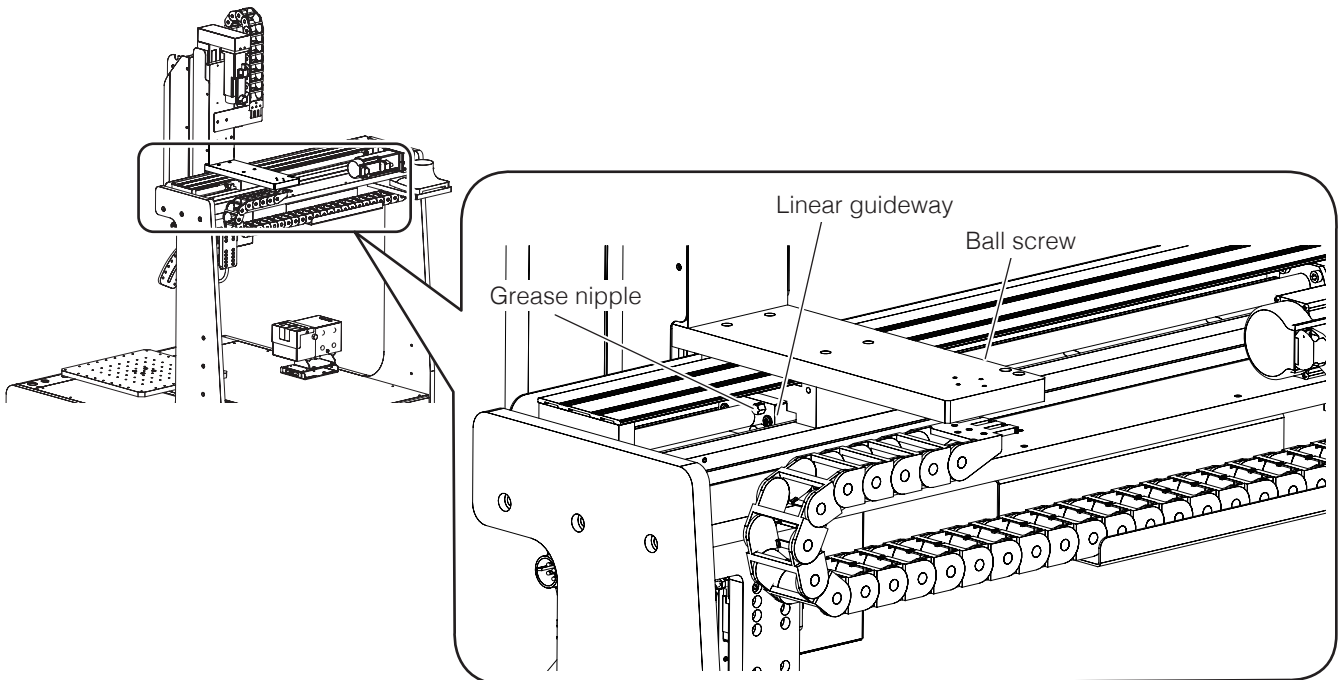
**After replenishing grease, wash hands well with soap and water.
If grease somehow gets in eyes, immediately consult a medical specialist and receive appropriate treatment.**

8-2-5-1 X Axis

- 1.** Remove the X axis stage back cover.



- 2.** Replenish grease (AX1002) on the ball screw and linear guideway.

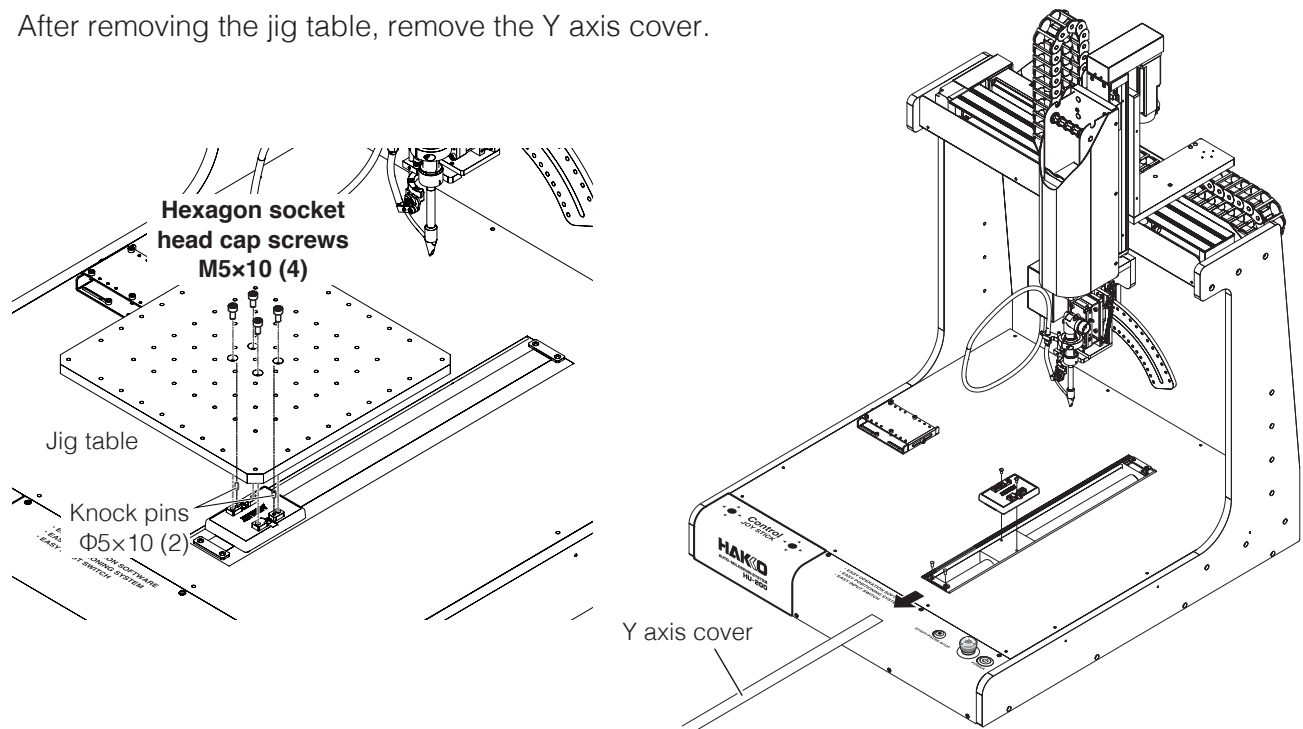


- 3.** Slide the slider back and forth several times by hand so that the grease (AX1002) reaches the entire axis.

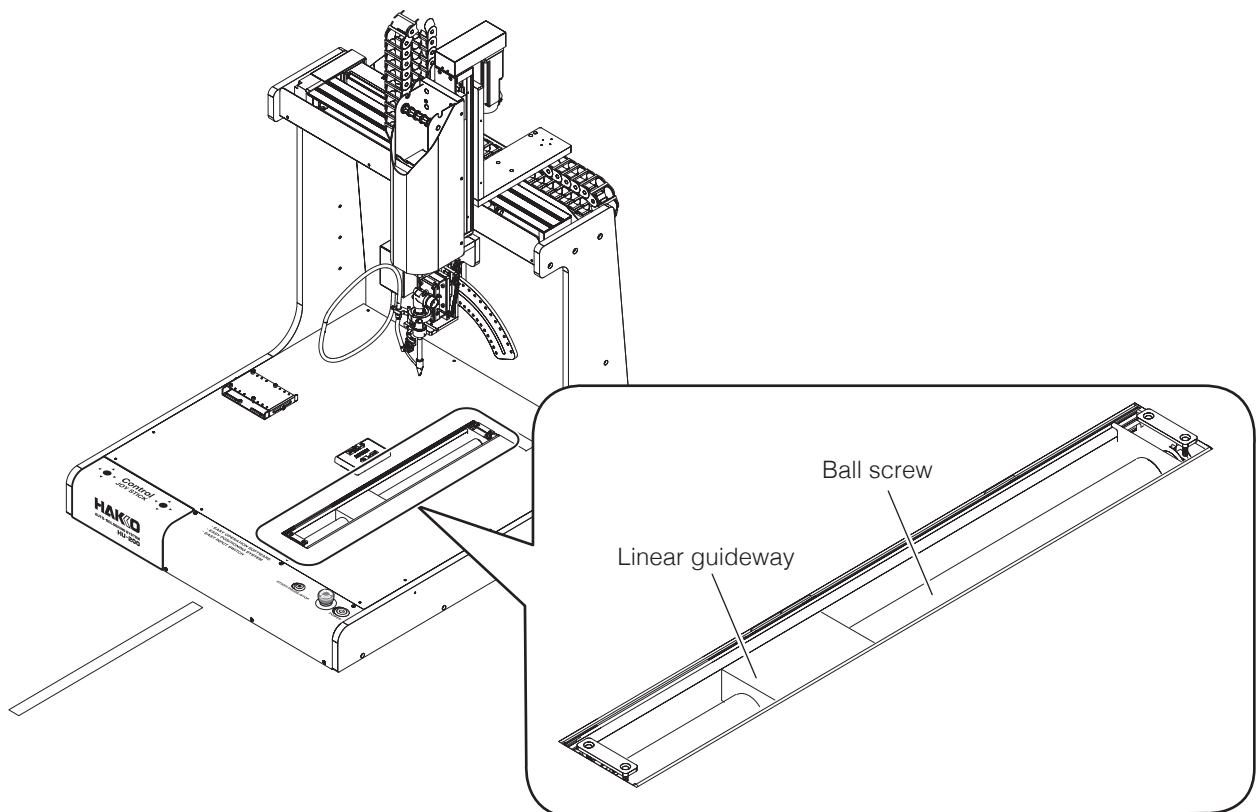
8. Maintenance (continued)

8-2-5-2 Y Axis

1. After removing the jig table, remove the Y axis cover.



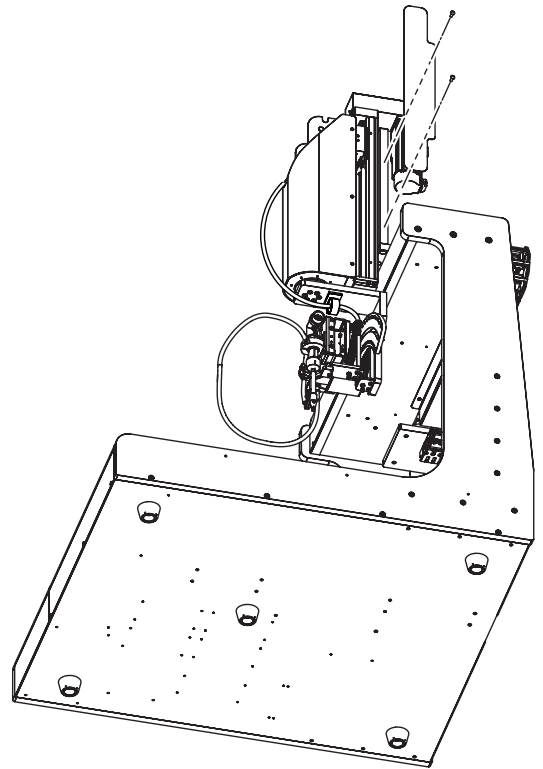
2. Replenish grease (AX1003) on the ball screw and linear guideway.



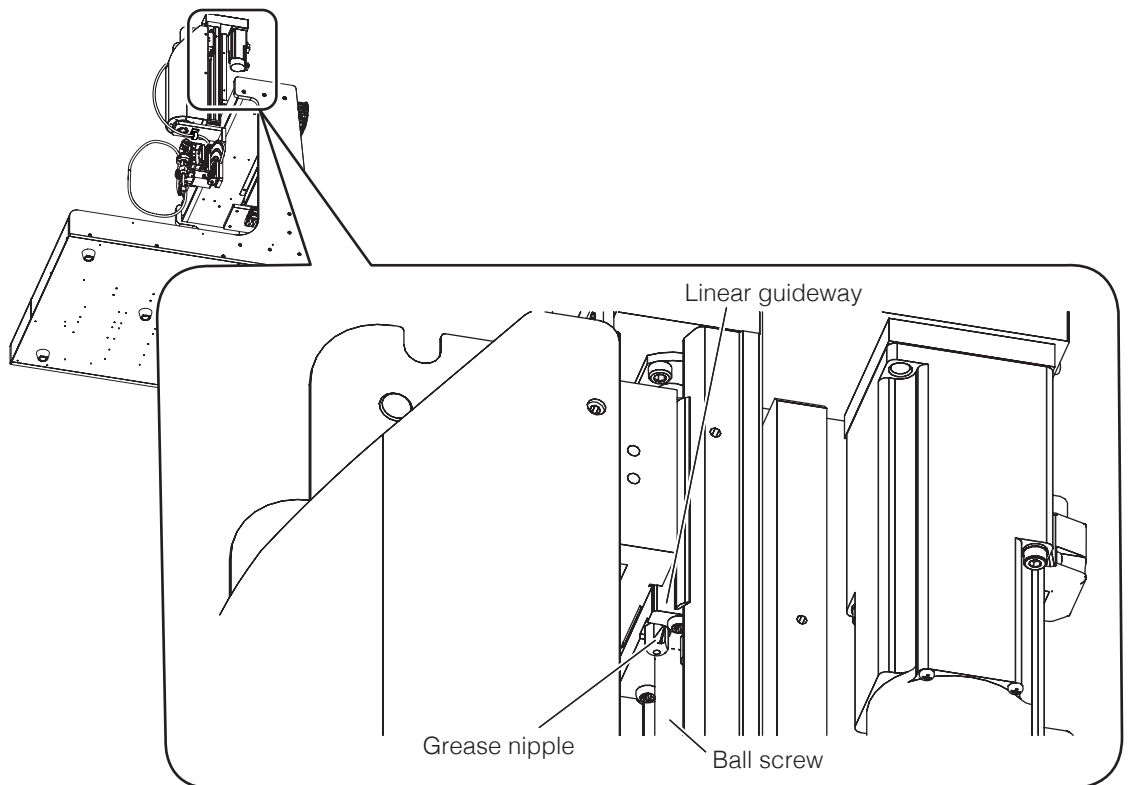
3. Slide the slider back and forth several times by hand so that the grease (AX1003) reaches the entire axis.

8-2-5-3 Z Axis

1. Remove the Z axis cover (left side surface).



2. Replenish grease (AX1002) on the ball screw and linear guideway.



3. Slide the slider back and forth several times by hand so that the grease (AX1002) reaches the entire axis.

8. Maintenance (continued)

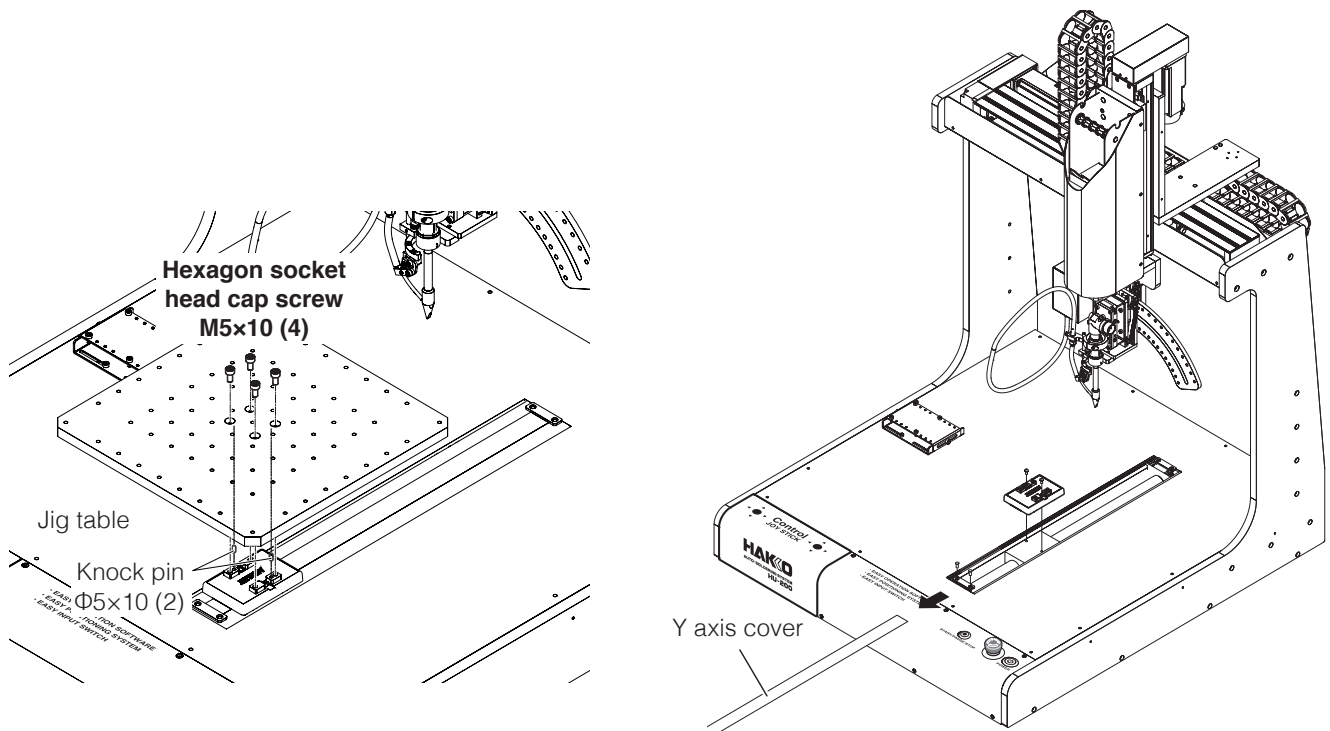
8-3 Mechanical Adjustments (when Replacing Timing Belt or Y-axis Cover)

Timing belt service life (X, Y, Z axes): Replace after more than 10,000 km as a general rule

Y axis cover:

When there is visibly noticeable breakage or chipping

When the Y axis cover has deformed or the cover no longer fits tightly in to form a sealed condition



When a timing belt needs replacement, please contact the sales office or distributor.

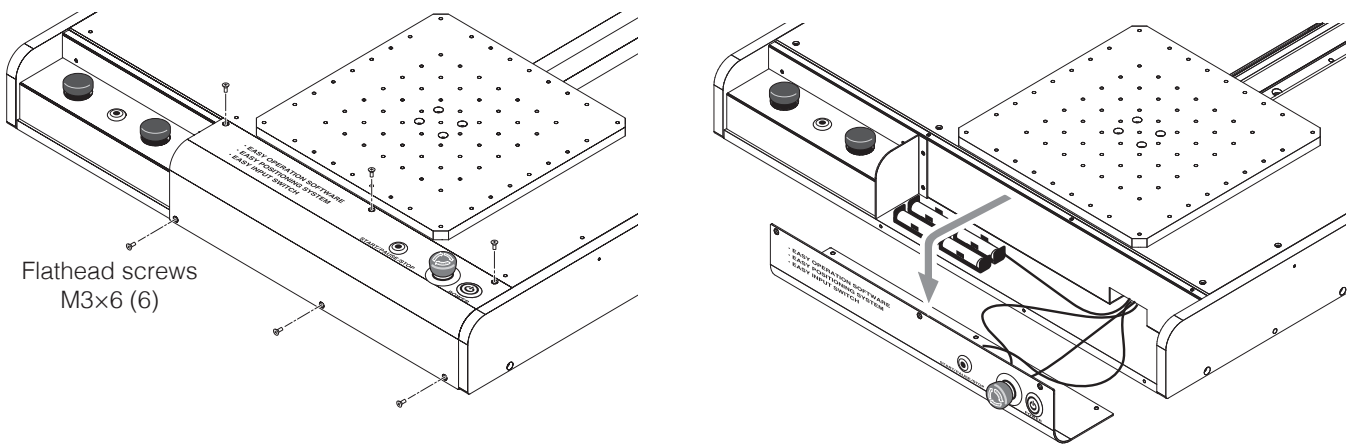
8-4 How to replace batteries (for backup AX1004)

CAUTION

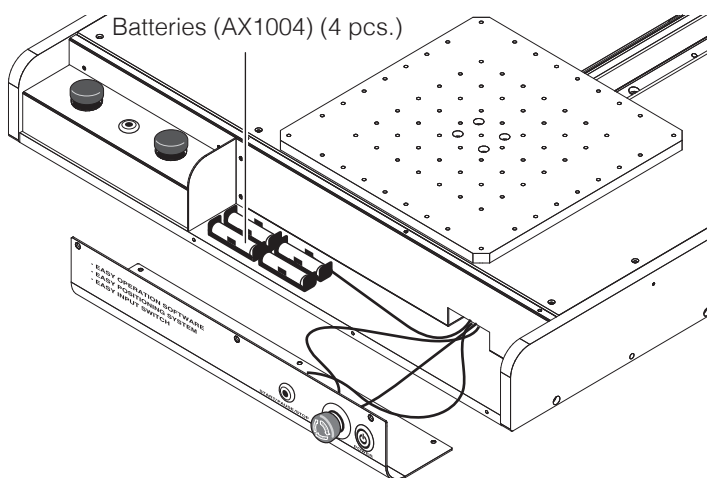
- When replacing batteries (AX1004), be sure to replace them while keeping the power switched on.
- If replacement is performed with the power switched off, the axis position information will be lost.
- If replacement was performed with the power switched off, please contact the sales office or distributor.
- Always replace all 4 batteries (AX1004).

Perform battery (AX1004) replacement with the power left on.

1. Remove the flathead screws (M3 × 6) and remove the front panel.



2. Remove the used batteries (AX1004) and replace them with new ones.



3. Reattach the front panel.

Battery (AX1004) replacement is completed.

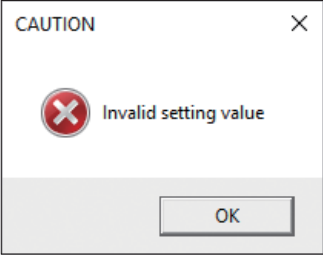
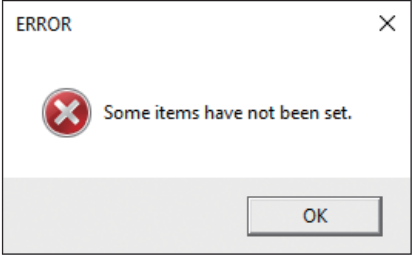
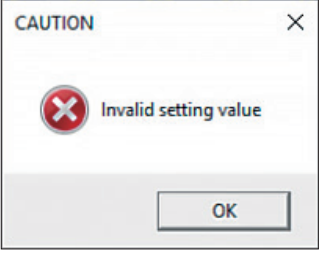
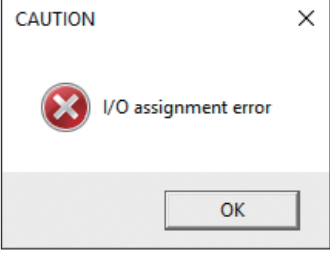
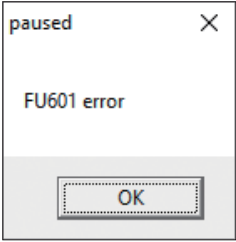
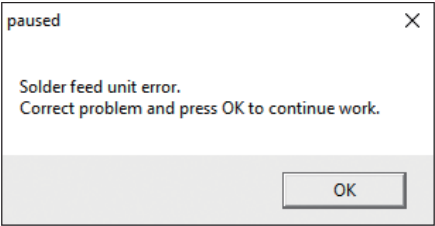
9. Error Messages

9-1 Attached Accessories

The soldering iron unit will show error information in the settings display screen.
For error information, refer to “10. Error displays” in the instruction manual of the HAKKO FU-601.

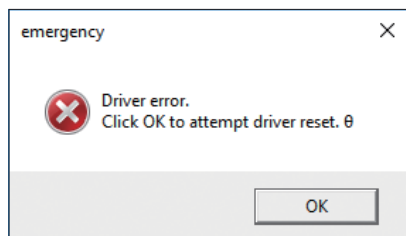
9-2 Robot

Software error

<p>Input error Shown when the setting value is invalid.</p>  <p>A dialog box titled 'CAUTION' with a close button (X) in the top right corner. It features a red circle with a white 'X' icon and the text 'Invalid setting value'. At the bottom, there is an 'OK' button.</p>	<p>Setting error Shown when [Finish] is tapped in the Point Edit Screen while some items are still not set.</p>  <p>A dialog box titled 'ERROR' with a close button (X) in the top right corner. It features a red circle with a white 'X' icon and the text 'Some items have not been set.'. At the bottom, there is an 'OK' button.</p>
<p>Coordinates value error Shown when Gerber data is being read and the coordinates converted from the Gerber data would be outside the robot's coordinate range, causing reading in to be stopped.</p>  <p>A dialog box titled 'CAUTION' with a close button (X) in the top right corner. It features a red circle with a white 'X' icon and the text 'Invalid setting value'. At the bottom, there is an 'OK' button.</p>	<p>I/O assignment error Shown when duplicate assignments for I/O setting were set in the System Settings Screen and closing the System Settings Screen was attempted.</p>  <p>A dialog box titled 'CAUTION' with a close button (X) in the top right corner. It features a red circle with a white 'X' icon and the text 'I/O assignment error'. At the bottom, there is an 'OK' button.</p>
<p>FU-601 error (Pause) Shown when the READY signal from the FU-601 has stopped while the program is running, causing the program to pause.</p>  <p>A dialog box titled 'paused' with a close button (X) in the top right corner. It contains the text 'FU601 error'. At the bottom, there is an 'OK' button.</p>	<p>Solder feed unit error Shown when the solder feed detection sensor has detected that solder has run out or solder clogging has occurred, causing the feed operation to be stopped immediately.</p>  <p>A dialog box titled 'paused' with a close button (X) in the top right corner. It contains the text 'Solder feed unit error. Correct problem and press OK to continue work.'. At the bottom, there is an 'OK' button.</p>

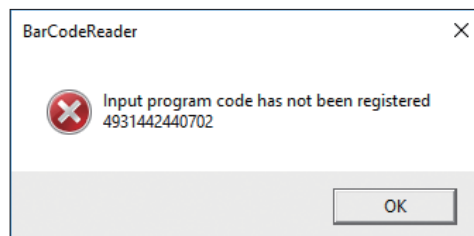
Driver abnormality

Shown when the motor driver has detected abnormal heat, causing operation to stop immediately.



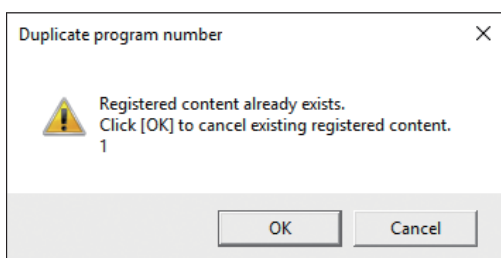
Bar code reading error

Shown when an unregistered bar code was read.



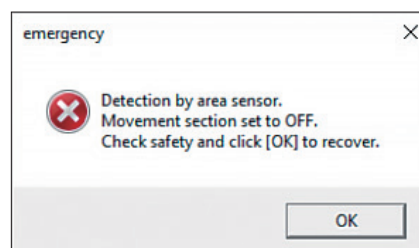
Bar code registration error

Shown when the bar code to be registered is a duplicate.



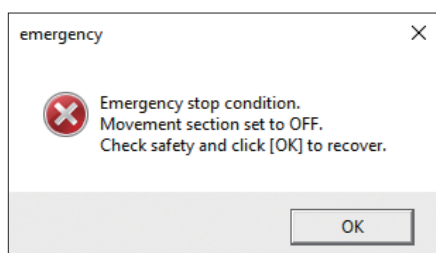
Area sensor

Shown when area sensors have been set as I/O connections and a sensor has detected something, causing operation to stop.



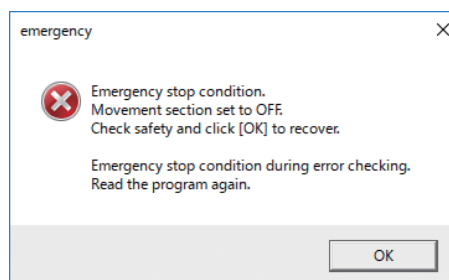
Emergency stop

Shown when the emergency stop button (including emergency stopping via I/O) has been pressed, causing operation to stop.



Emergency stop (when error-checking)

Shown when the emergency stop button has been pressed during error-checking, causing operation to stop.



10. Troubleshooting

Malfunction diagnosis (How to check robot operation, how to check the buttons and screen lists for each function, how to check external I/O-related problems)

- Software does not start.
- Connection with the robot cannot be achieved.
- The soldering program doesn't run.
- Operation stopped while a soldering program was being run.
- Solder isn't being fed.

Robot

Symptom	Cause	Solution
It doesn't operate even though the power switch is set to ON.	The power cord isn't properly connected.	Connect the power cord properly.
Connection with the robot cannot be achieved.	The robot power supply is switched off.	Switch on the power supply.
	The cable isn't properly connected.	Connect the cable properly.
	The emergency stop button is pressed.	Release the emergency stop button.
The soldering program doesn't run.	Return to origin hasn't been performed.	Tap the [HOME] button.
	The emergency stop button is pressed.	Release the emergency stop button.
	The I/O connector is disconnected.	Connect the I/O connector.
	The motor connector is disconnected.	Connect the motor connector.
	An error message is being shown.	Cancel the error message display.
Y axis movement is poor.	The stainless-steel belt is broken or deteriorated.	Replace the stainless-steel belt.
Solder isn't being fed well./ A solder feed error is shown.	Solder clogging has occurred.	Remove the solder clogging.
	Solder has run out.	Replenish with new solder.
	Solder or flux is stuck on the cutting blade or pulleys.	Use a brush or alcohol to remove it.
	The tube unit or Teflon tube is extremely dirty, worn, or damaged.	If it is extremely dirty, worn, or damaged, replace the parts with new ones.
	The tube unit is forcibly bent.	Make the bending radius more gentle.
	Flux is clogging the tip of the Teflon tube or inside of the guide pipe.	Use a brush or alcohol to remove it.
	Parts such as the solder feed pulley unit, etc. are not compatible with the solder wire diameter being used.	Replace with compatible products. Refer to "11. Parts List" (p. 136)

HAKKO U-601

Symptom	Cause	Solution
It doesn't operate even though the power switch is set to ON.	The power cord isn't properly connected.	Connect the power cord properly.
	The fuse has blown.	After determining the cause of the blown fuse, replace the fuse.
The tip doesn't get hot. S-E is shown.	The tip isn't firmly inserted.	Insert the tip fully to the end.
	The soldering iron cable is disconnected.	Refer to "9. Inspection" in the instruction manual for the HAKKO FU-601.
	The heater or sensor is disconnected.	
Solder doesn't stay on the tip.	The temperature setting of the tip is too high.	Set the appropriate temperature.
	Oxidized materials are stuck on the tip.	Remove the oxidized materials.
The tip temperature is too high.	Soldering iron cable is disconnected.	Refer to "9. Inspection" in the instruction manual for the HAKKO FU-601.
	The input offset value is incorrect.	
The tip temperature is too low.	Oxidized materials are stuck on the tip.	Remove the oxidized materials.
	The input offset value is incorrect.	Input the correct value.
An error is being displayed.	—	Refer to "10. Error displays" in the instruction manual for the HAKKO FU-601, and correct each error.

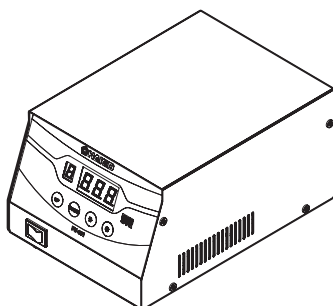
— Note —

For maintenance and inspection, refer to "8. Maintenance" and "9. Inspection" in the instruction manual for the HAKKO FU-601.

11. Parts List

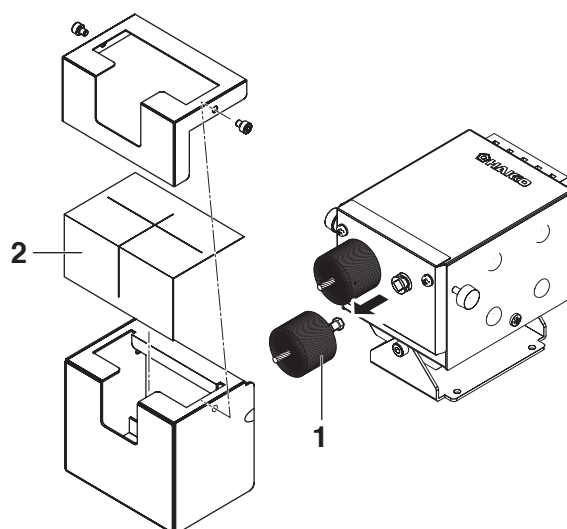
• Accessories

	Product Number	Specifications
FU-601	HAKKO FU-601	—

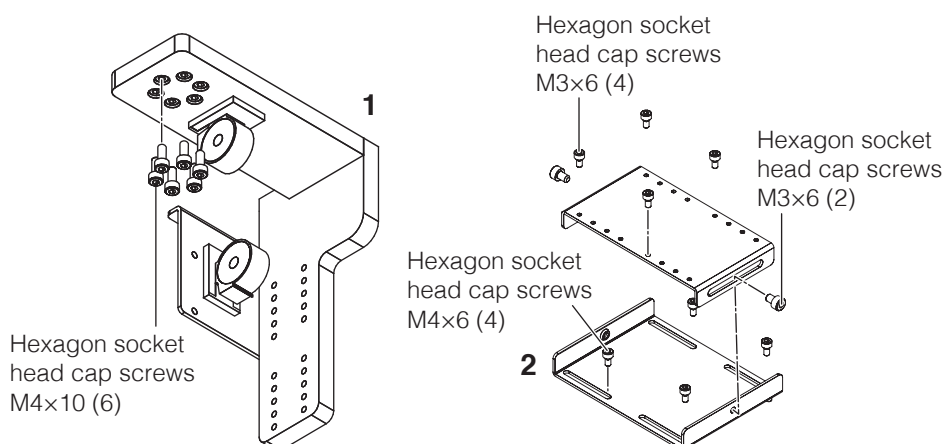


Cleaner	Product Number	Specifications
	CX1003	—

Number in Diagram	Product Number	Product Name	Comments
1	A1567	Cleaning brush B	Metal brushes (package of 2)
2	BX1028	Spatter prevention sheet	—

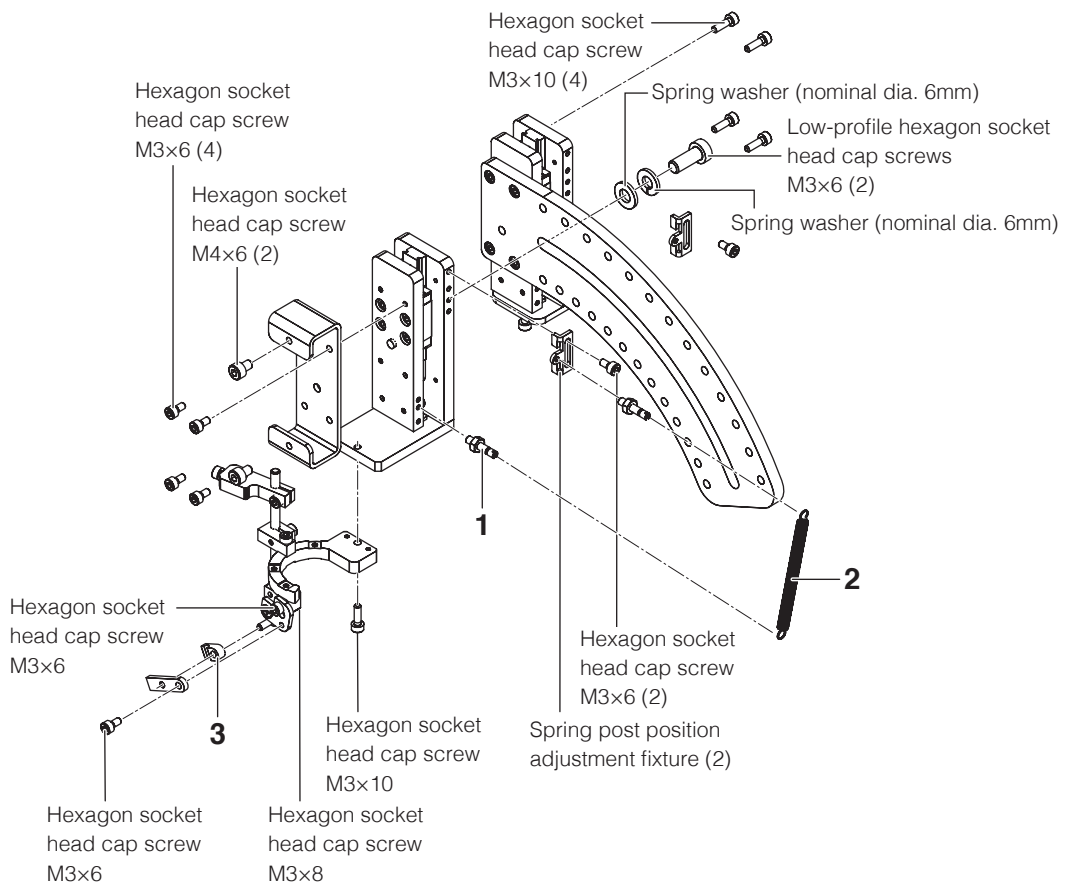


Number in Diagram	Product Number	Product Name	Comments
1	CX5002	Soldering unit fixture base/for HU-200	—
2	CX5003	Cleaner base/for HU-200	



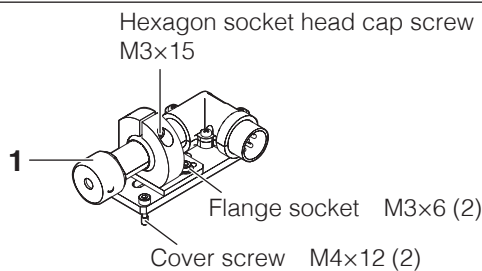
Soldering Unit Mount/ for HU-200	Product Number	Specifications
		CX5004

Number in Diagram	Product Number	Product Name	Comments
1	BX1043	Spring post	—
2	BX1044	Tension spring	
3	BX1063	Guide pipe fixing plate/for 0.3 – 1.6 mm	



HAKKO FU-6002	Product Number	Specifications
		FU6002-01X

Number in Diagram	Product Number	Product Name	Comments
1	BX1027	Flux protector	—

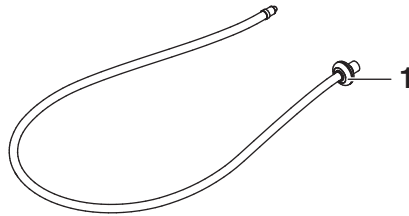


11. Parts List (continued)

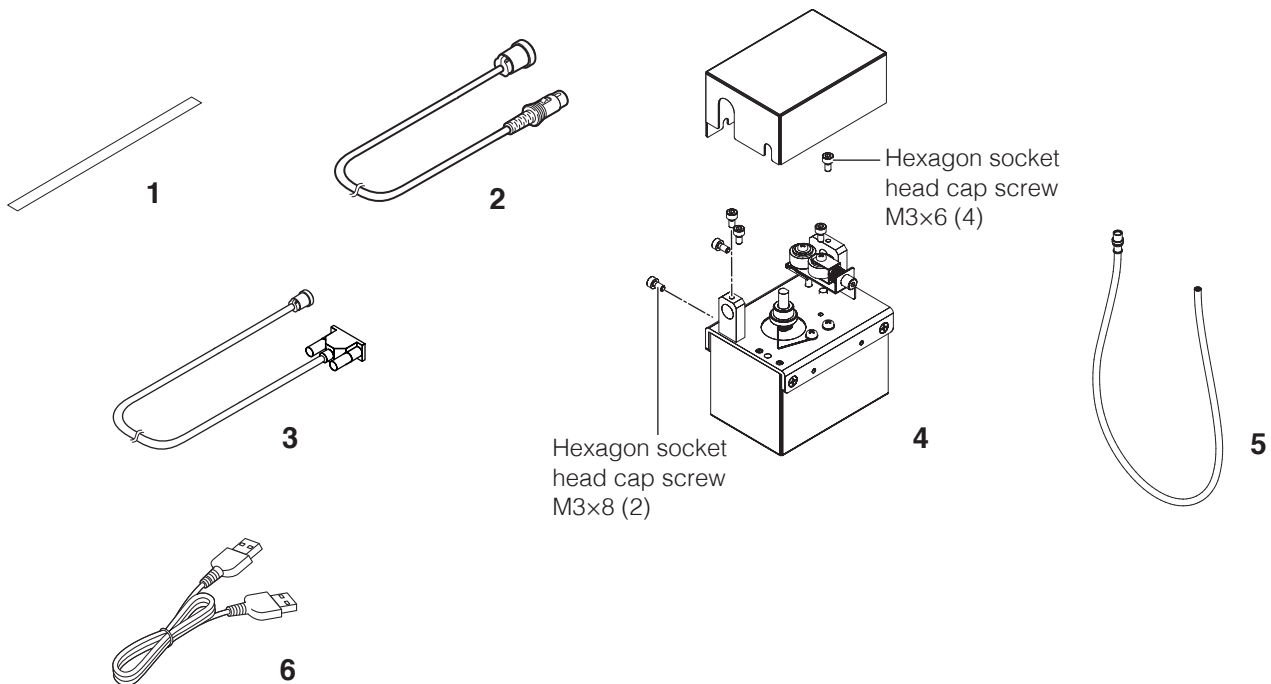
• Parts

Tube unit		Product Number	Specifications
		BX1055	For 0.3 – 1.0 mm
		BX1042	For 1.2 – 1.6 mm

Number in Diagram	Product Number	Product Name	Comments
1	BX1022	Grommet	—



Number in Diagram	Product Number	Product Name	Comments
1	AX1001	Y axis cover	—
2	BX1033	Soldering iron cable/5m	
3	BX1045	Feeder cable/4 m; for HU-200	
4	CX5005	Feeder unit/0.3 – 1.6 mm; for HU-200	
5	BX1054	Tube unit B/for 0.3 mm	
	BX1052	Tube unit B/for 0.5 – 1.0 mm	
	BX1053	Tube unit B/for 1.2 – 1.6 mm	
6	BX1062	USB cable	

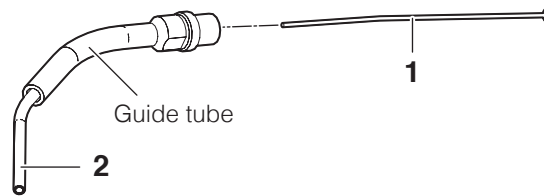


Product Number	Product Name	Comments
AX1004	Battery/LSI14500 Lithium-thionyl chloride battery	4 qty

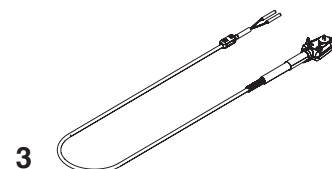
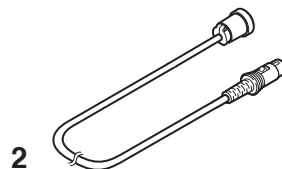
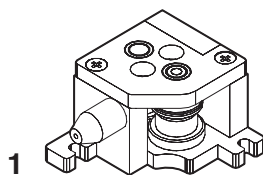
• **Optional Accessories**

Solder feed guide set	Product Number	Specifications
	BX1046	0.3 mm
	BX1047	0.5 – 1.0 mm
	BX1048	1.2 – 1.6 mm

Number in Diagram	Product Number	Product Name	Comments
1	BX1010	Teflon tube/0.3 mm Package of 10	—
	BX1011	Teflon tube/0.5 – 0.6 mm Package of 10	
	BX1012	Teflon tube/0.8 mm Package of 10	
	BX1013	Teflon tube/1.0 mm Package of 10	
	BX1014	Teflon tube/1.2 mm Package of 10	
	BX1015	Teflon tube/1.6 mm Package of 10	
2	BX1049	Guide pipe/0.3 mm For HU-200	—
	BX1050	Guide pipe/0.5 – 1.0 mm For HU-200	
	BX1051	Guide pipe/1.2 – 1.6 mm For HU-200	



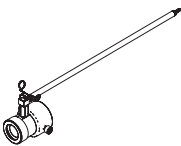
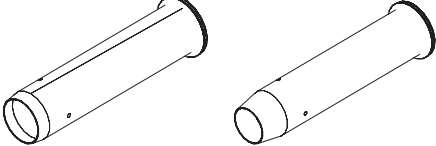
Number in Diagram	Product Number	Product Name	Comments
1	BX1000	Solder feed pulley unit/0.3 mm	—
	BX1001	Solder feed pulley unit/0.5 mm	
	BX1002	Solder feed pulley unit/0.6 mm	
	BX1003	Solder feed pulley unit/0.8 mm	
	BX1004	Solder feed pulley unit/1.0 mm	
	BX1005	Solder feed pulley unit/1.2 mm	
	BX1006	Solder feed pulley unit/1.6 mm	
2	BX1034	Soldering iron cable/8 m	
3	CX1002	Temperature probe/for auto-soldering systems	



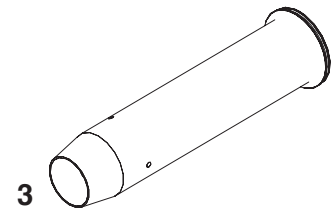
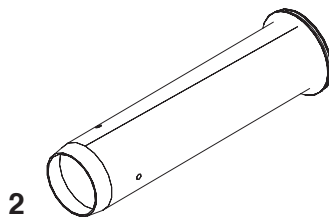
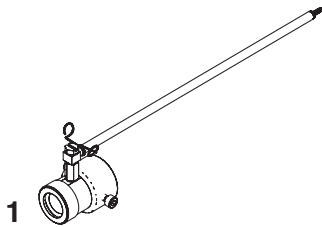
Product Number	Product Name	Comments
AX1002	Grease/70G X, Z axes	—
AX1003	Grease/70G Y axis	

11. Parts List (continued)

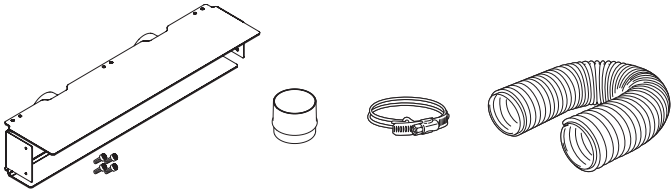
• Optional Accessory (N₂ adapter, nozzles)

N ₂ adapter/ nozzle set	Set Contents		Specifications
	BX1029 	BX1030 or BX1031 	

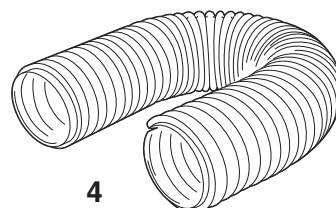
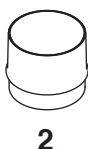
Number in Diagram	Product Number	Product Name	Comments
1	BX1029	Adapter assembly A	FU-601
2	BX1030	Nozzle assembly D	XD4, XD6, XDR4, XDR6, XBCR4, XBCR6, XRX
3	BX1031	Nozzle assembly E	XD3, XDR3, XBCR3



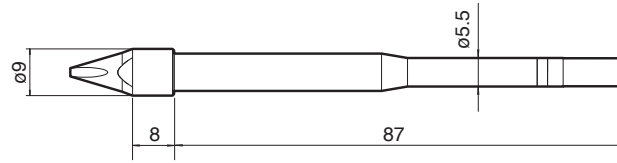
• Optional Accessory (smoke absorber nozzles)

Smoke absorber nozzle set	Set Contents		Specifications
	BX1059 		With hexagon socket head cap screws M4 × 12 (4) The net is already attached to the smoke absorber nozzle duct opening The duct band is already installed on the duct

Number in Diagram	Product Number	Product Name	Comments
1	B3625	Net	Already attached to the smoke absorber nozzle duct opening
2	B3621	Adapter	For 3-inch duct
3	B2416	Duct band	Already attached to duct
4		Duct	

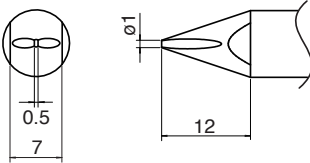


Tip Types

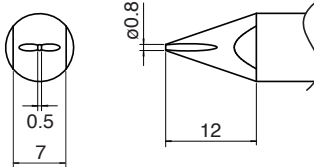


Units: mm

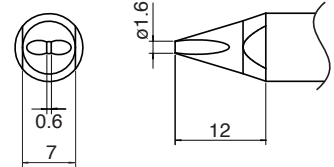
TX1-XD Shape-XD



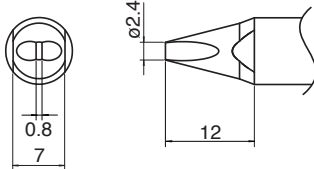
TX1-XD08 Shape-0.8XD



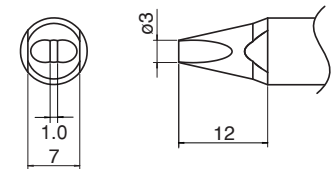
TX1-XD16 Shape-1.6XD



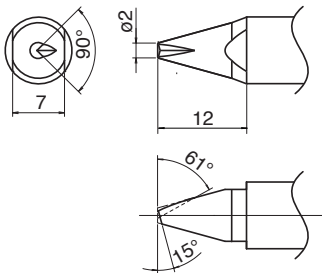
TX1-XD24 Shape-2.4XD



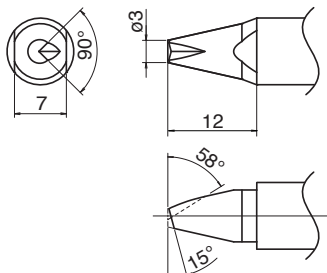
TX1-XD3 Shape-3XD



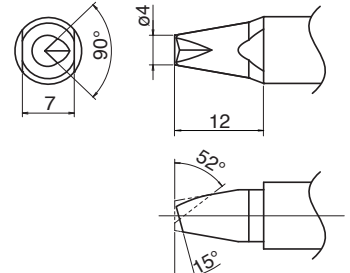
TX1-XBCR2 Shape-2XBCR



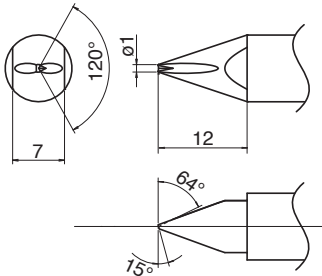
TX1-XBCR3 Shape-3XBCR



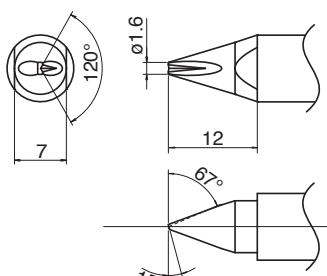
TX1-XBCR4 Shape-4XBCR



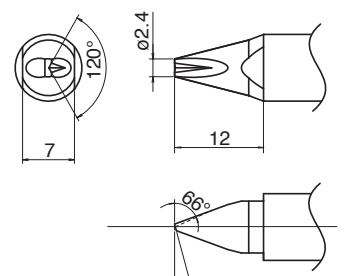
TX1-XDR Shape-XDR



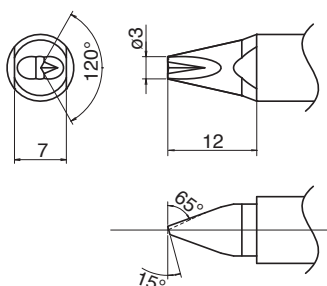
TX1-XDR16 Shape-1.6XDR



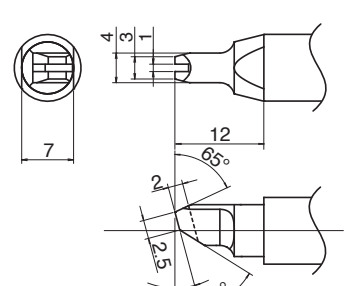
TX1-XDR24 Shape-2.4XDR



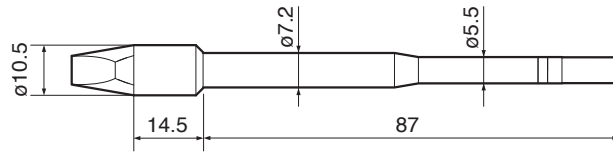
TX1-XDR3 Shape-3XDR



TX1-XRK Shape-XRK

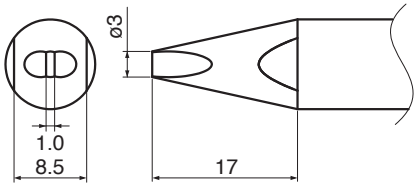


11. Parts List (continued)

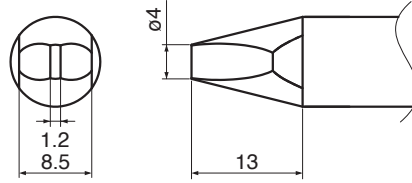


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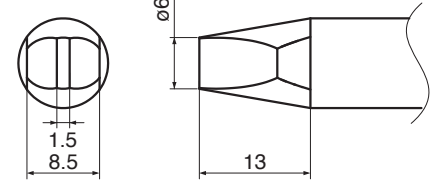
TX2-XD3 Shape-3XD



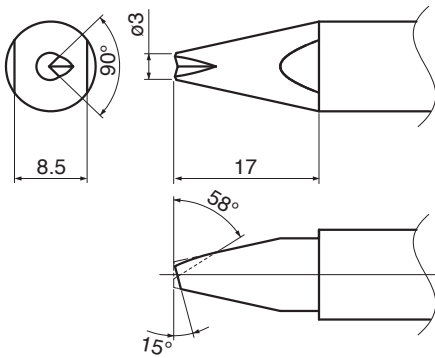
TX2-XD4 Shape-4XD



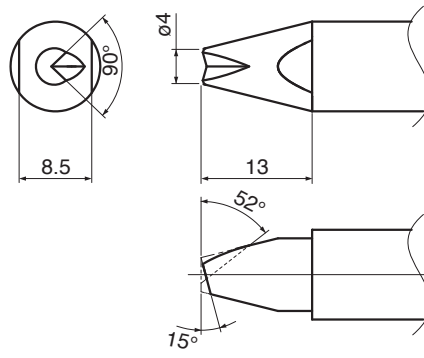
TX2-XD6 Shape-6XD



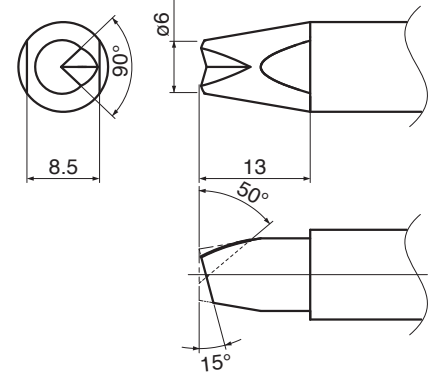
TX2-XBCR3 Shape-3XBCR



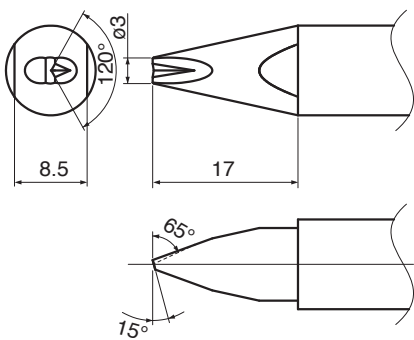
TX2-XBCR4 Shape-4XBCR



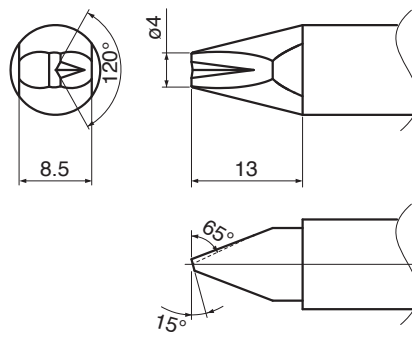
TX2-XBCR6 Shape-6XBCR



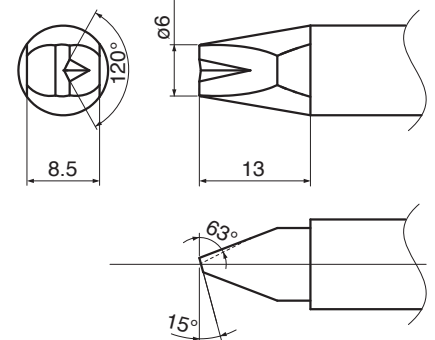
TX2-XDR3 Shape-3XDR



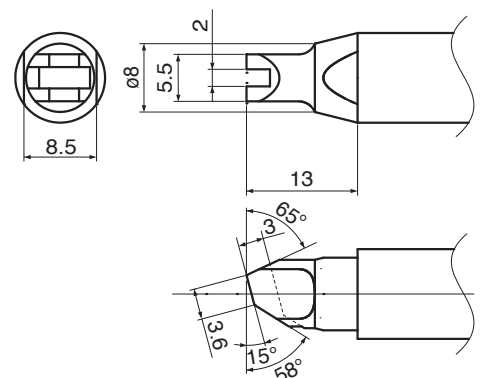
TX2-XDR4 Shape-4XDR



TX2-XDR6 Shape-6XDR



TX2-XRK Shape-XRK





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