JANOME DESKTOP ROBOT

JR3000 Series

JANOME CARTESIAN ROBOT

JC-3 Series

JANOME SCARA ROBOT

JS3 Series

Operation Manual

Functions I

(Point Teaching)

Thank you for purchasing this Janome Robot.

- **Before using this robot, read this manual thoroughly and always make sure you use the robot correctly. In particular, be sure to thoroughly read "For Your Safety" as it contains important safety information.**

- **After reading this manual, store in a safe place that can be easily accessed at any time by the operator.**

Original Instructions

JANOME

PREFACE

This manual covers the JR3200, JR3300, JR3400, JR3500, JR3600, JC-3, and the JS3 Series.

There are several manuals pertaining to these robots.

Manual	Details	JR3000	JC-3	JS3
Read This First	• For Your Safety Be sure to thoroughly read “For Your Safety” as it contains important safety information. • Package Contents (JS3 Series only) Check the items included with your robot. • CD-ROM Contents Explains the CD-ROM contents.	✓	✓	✓
Setup (JR3000 / JC-3) Installation (JS3)	Explains how to set up the robot. ■ Make sure you read this manual when installing the robot ■ NOTE: This manual is designed for people who have received safety and installation training regarding the robot.	✓	✓	✓
Maintenance	Explains maintenance procedures for the robot. ■ Make sure you read this manual when performing maintenance ■ NOTE: This manual is designed for people who have received safety and maintenance training regarding the robot.	✓	✓	✓
Basic Instructions	Provides part names, data configurations, and the basic knowledge necessary to operate the robot.	✓ (Common)		✓
Quick Start	Explains the actual operation of the robot by creating and running simple programs.	✓ (Common)		✓
Teaching Pendant Operation	Explains how to operate the robot via the teaching pendant.	✓ (Common)		✓
Functions I	Explains point teaching.	✓ (Common)		
Functions II	Explains commands, variables, and functions.	✓ (Common)		
Functions III	Explains functions such as All Program Common Settings and PLC programs.	✓ (Common)		
Functions IV	Explains Customizing Functions.	✓ (Common)		
External Control (I/O / Fieldbus)	Explains I/O and Fieldbus. Refer to this manual if you are using Fieldbus.	✓	✓	✓
Communication Control (COM/LAN)	Explains COM 1 – 3 and LAN communication control.	✓ (Common)		
Camera & Sensor Functions	Explains the functions of the attachable camera and Z position sensor.	✓ (Common)		

Manual	Details	JR3000	JC-3	JS3
Specifications	Outlines general specifications such as the robot's operating range, mass, etc.	✓	✓	–
Auxiliary Axis Functions	Explains the auxiliary axis functions.	✓ (Common)		
Application Specifications	Explains the specialized functions of the various application specifications.	Standard model: - Application model: ✓		

⚠ Warning

Do not handle or operate the robot in ways not covered in the manuals listed here.
Contact Janome (listed on the back of this manual) for repairs.
Failure to do so can cause electric shock or injury.

⚠ Caution

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

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

Before using this robot for the first time, make sure you back up robot data and save the individual configuration information. Individual configuration information is needed when replacing internal circuit boards.
For details on how to back up robot data, refer to "3. BACKING UP AND RESTORING ROBOT DATA" in the operation manual *Setup* for the JR3000 Series, "6.1 Backing Up and Restoring Robot Data" in the operation manual *Setup* for the JC-3 Series, and "9.1 Backing Up and Restoring Robot Data" in the operation manual *Installation* for the JS3 Series.

- The descriptions within this manual are based on standard specifications. The menu item names etc. may vary depending on the model type.
- Menu items related to the Z axis may appear with 2 axis specifications; however settings made for these items are not applied.

- For information regarding optional additions for this robot, refer to "24. Specifications" in the operation manual *Specifications* for the JR3000 Series,“14. Specifications” in the operation manual *Specifications* for the JC-3 Series, and "15. Specifications" in the operation manual *Basic Intructions* for the JS3 Series. The notation “optional” is not used in the main text of this manual except for diagrams.
- Machine specifications may be modified without prior notice to improve quality.

Remarks:

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

  TP Operation via the teaching pendant

  PC Operation via PC (JR C-Points II)

- Click text that appears blue and is underlined to jump to that section.
  Example: Refer to “1. PROGRAM.”

CONTENTS

PREFACE 1
FOR YOUR SAFETY 6
1. PROGRAM 43
1.1 Data 46
1.2 Running Programs 51
2. POINT DATA 52
2.1 New Input 52
2.2 Modifying Point Data 53
2.2.1 Coordinates 53
2.2.2 Type 54
2.2.3 Line Speed 54
2.2.4 Point Job Number and Additional Function Number 54
2.2.5 Adding a Point Job/Additional Function 55
3. PROGRAM NAME 57
4. PTP CONDITION NUMBER FOR HOME (JC-3/JS3 Series Only) 58
5. WORK HOME 59
5.1 Point Type 59
5.2 Point Job Data and Additional Function Data 60
6. INDIVIDUAL JOB ON START OF CYCLE 61
7. CYCLE MODE 62
8. PTP CONDITION (PROGRAM DATA) 63
8.1 JR3000/JC-3 Series 63
8.2 JS3 Series 65
9. CP CONDITION (PROGRAM DATA) 68
10. TOOL DATA 69
10.1 JC-3 Series (2-Axis Model), JR3000/JC-3 Series (3-Axis Model) 69
10.2 JR3000/JC-3 Series (4-Axis Model) 72
10.3 JS3 Series (4-Axis Model) 74
10.4 Main Tool Configuration 76
11. CAMERA CONFIGURATION 77
12. MOVE AREA LIMIT 78
13. ABSOLUTE, RELATIVE & MOVING AMOUNT (POSITION DATA TYPES) 79
14. WORKPIECE MASS (JR3000 Series Only) 81
15. COMMON DATA (JS3 Series Only) 82
15.1 Evasion Points of Going Home 82
16. PTP MOVEMENT 84

16.1 PTP Point 84
16.2 PTP Evasion Point 85
17. CP MOVEMENT 86
17.1 Linear Movement 86
17.2 Arc Movement 86
17.2.1 Countermeasures for the CP Speed Exceeded Error with a CP Arc Point 87
17.3 Circle Start Points and Circle Center Points 88
18. POINT JOBS 89
18.1 Job Before Moving 91
18.2 Job While Moving 91
18.3 Job After Moving 92
18.4 Job While CP Moving 92
19. PTP CONDITION (ADDITIONAL FUNCTION DATA) 94
20. CP CONDITION (ADDITIONAL FUNCTION DATA) 96
21. POINT TOOL DATA SETTINGS (ADDITIONAL FUNCTION DATA) 97
22. PALLET ROUTINE DATA SETTINGS 99
22.1 Pallet Routine Types 100
22.2 Parameters 101
22.3 Pallet Routine Commands at Point Jobs 103
22.4 PTP Point Pallet Routine 104
22.5 CP Start Point Pallet Routine 105
22.6 Circle Pallet 106
22.7 Pallet Pick-and-Place Operation 107
22.8 Skip Missing Job 111
22.9 How to Terminate the Pallet Routine 115
23. WORKPIECE ADJUSTMENT SETTINGS (NUMERIC ADJUSTMENT) 118
24. EXECUTE CONDITION SETTINGS 120
25. TAG CODE 122

FOR YOUR SAFETY

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

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

Symbols are also listed alongside the safety note explanations. Refer to the information below for understanding these terms and symbols.

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

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

■ The following symbols indicate the nature of the danger and any necessary safety precautions to be taken.

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

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■■■ JR3000 Series ■■■■■■■■■■■■■■■■■■■■

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

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

⚠ Danger

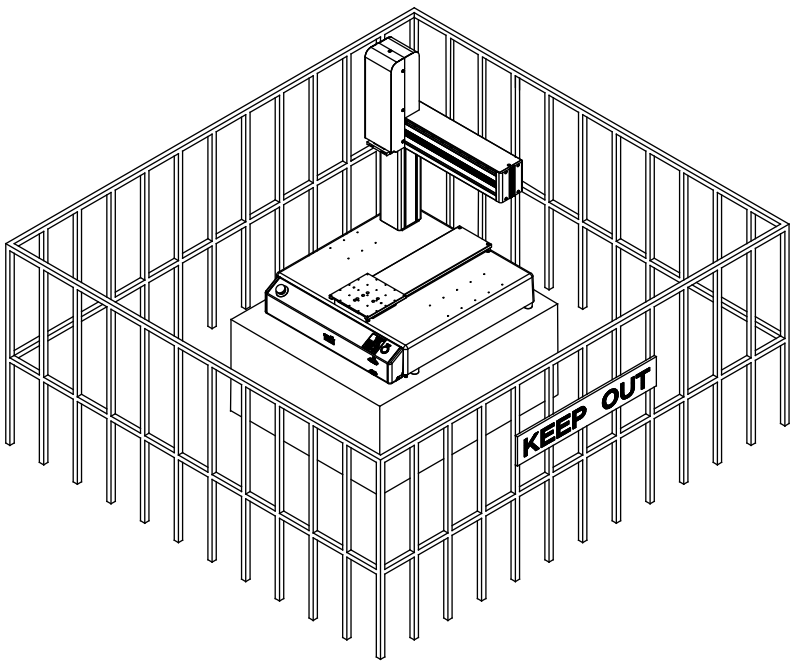
Always set up safety guards around the robot or the auxiliary axes so the moveable parts cannot be touched.

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

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

Furthermore, put up a **"Keep Out"** or **"Do Not Operate"** warning sign in a clearly visible place.

Example:



FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■■■ JR3000 Series ■■■■■■■■■■■■■■■■■■■■

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

⚠ Danger

When power to the robot is ON, never enter the safety guard or put your head, hands, or any part of your body inside.
Entering the safety guard could result in injury.

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

⚠ Warning

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

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

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

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

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■■■ JR3000 Series ■■■■■■■■■■■■■■■■■■■■

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

⚠ Warning	
	**Construct safety guards that are strong enough to protect the operator against such dangers as the tool or workpiece splintering, etc.** When working within the safety guard, use protective gear such as a helmet, protective gloves, protective goggles, and safety shoes. Failure to follow these safety measures can result in injury.
	If objects that the robot grasps have a risk of falling or being projected, **take into account the size, mass, and chemical composition of the objects for the required safety precautions.** Failure to do so can result in injury or unit breakdown.
	**When working within the safety guard, make sure not to come within the maximum range of the robot.** Failure to do so can cause injury.
	When starting a run, first confirm there are **no people inside of the safety guard and there are no obstacles that could interfere with the run.** Failure to do so can cause injury or unit breakdown.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■■■ JR3000 Series ■■■■■■■■■■■■■■■■■■■■

⚠ Danger

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

⚠ Warning

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

Make sure to power the unit within its rated current range.
Failure to do so causes electric shock, fire, or unit breakdown.

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

Be sure to use the unit within its indicated voltage range.
Failure to do so causes unit breakdown, fire, or electric shock.

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

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■■■ JR3000 Series ■■■■■■■■■■■■■■■■■■■■

⚠ Warning	
	Always **make sure the machine is grounded through the power cord. Do not use the machine when it is not grounded.** Improper grounding causes electric shock, fire, malfunction, or unit breakdown.
	**Wipe the power plug with a clean, dry cloth periodically to eliminate dust.** Dust accumulation deteriorates the electrical insulation or causes fire.
	**Be sure to unplug the power cord from the power outlet when the unit is not in use for long periods of time.** Dust accumulation causes fire.
	**Be sure to turn OFF the unit before inserting or removing cords and cables such as the teaching pendant cable or LAN cable.** Failure to do so causes electric shock, data loss, unit breakdown, or malfunction.
	**If disassembling this machine, follow the instructions in the operation manual *Maintenance*, and do not disassemble in any other way other than those specified.** Do not modify the machine in any way. Inappropriate disassembly or modification causes electric shock or unit breakdown.
	**Do not allow water or oil to come in contact with the unit, control box or the power cord.** Contact with water or oil causes electric shock, fire, or unit breakdown. IP Protection Rating: IP20.
	**If anything unusual occurs, such as a burning smell or unusual sound, stop operation and unplug the power cord immediately. Contact Janome (details on the back of this manual) or a Janome dealer.** Continuing to use the robot without addressing the problem causes electric shock, fire, or unit breakdown.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■■■ JR3000 Series ■■■■■■■■■■■■■■■■■■■■

⚠ Caution	
	**Do not drop or jar the unit during transport and/or installation.** This can cause injury or damage the unit.
	**Before performing any operation, ensure there is no imminent danger to any of the operators.** Failure to do so causes injury.
	**Use the unit in an environment between 0 and 40 °C, with a humidity level of 20 to 90 %, and without condensation.** Use outside of these conditions can cause unit breakdown or malfunction.
	**Use the unit in an environment where no electrical noise is present.** Failure to do so causes unit malfunction or breakdown.
	**For models with I/O-S circuits*, when installing the unit, take safety measures such as setting up area sensors and safety guards.** If there are no safety measures in place and someone enters the area of operation when the robot is running, they may be injured.
	**Keep the emergency stop switch within reach of the operator when running or operating the robot.** If the robot is operated when the emergency switch is not within reach, it may not be possible to stop the robot immediately and safely. This is potentially dangerous.
	**Make sure that you regularly perform a function check of the emergency stop switch(es). Also, for models with I/O-S circuits*, regularly perform an I/O-S circuit function check.** If the robot is operated without making these checks, it may not be possible to stop the robot immediately and safely in an emergency. This is potentially dangerous.

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

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■■■ JR3000 Series ■■■■■■■■■■■■■■■■■■■■

⚠ Caution	
	**When attaching tools, a USB camera, or any other device, make sure they are securely fitted before running the robot.** Failure to do so causes injury or breakdown.
	**When using the machine for extended periods of time, check and make sure none of the main unit's mounting screws are loose, and perform a routine inspection every 3 months or after every 750 hours of operation.** Failure to do so causes injury or breakdown.
	**Be sure to check the connections of the cords and cables to the main unit.** Improper wiring causes unit malfunction or breakdown.
	**When lifting or transporting the robot, do so in accordance with the following:** • **Secure the movable parts of the unit (the Z/ZR mechanism) before transportation.** • **Lift and transport the JR3200 Series with 2 or more people.** • **Lift and transport the JR3300 – JR3600 Series with 2 or more people or use a lifter.** • **Hold the bottom of the base and keep the robot horizontal.** • **Do not hold the robot by the column or Y body.** Failure to adhere to this can cause injury or damage the robot.
	**Use the unit in an environment that is not exposed to direct sunlight.** Direct sunlight causes unit malfunction or breakdown.
	Individual Configuration Information varies for each individual unit even if they are the same model. **Do not use backup data with a different robot. The robot cannot function normally with backup data from a different robot.**

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■■ JC-3 Series ■■■■■■■■■■■■■■■■■■■

Industrial Robot Safety Standards

Make sure to use the robot in accordance with the laws and guidelines of the country where it is used.

FOR YOUR SAFETY

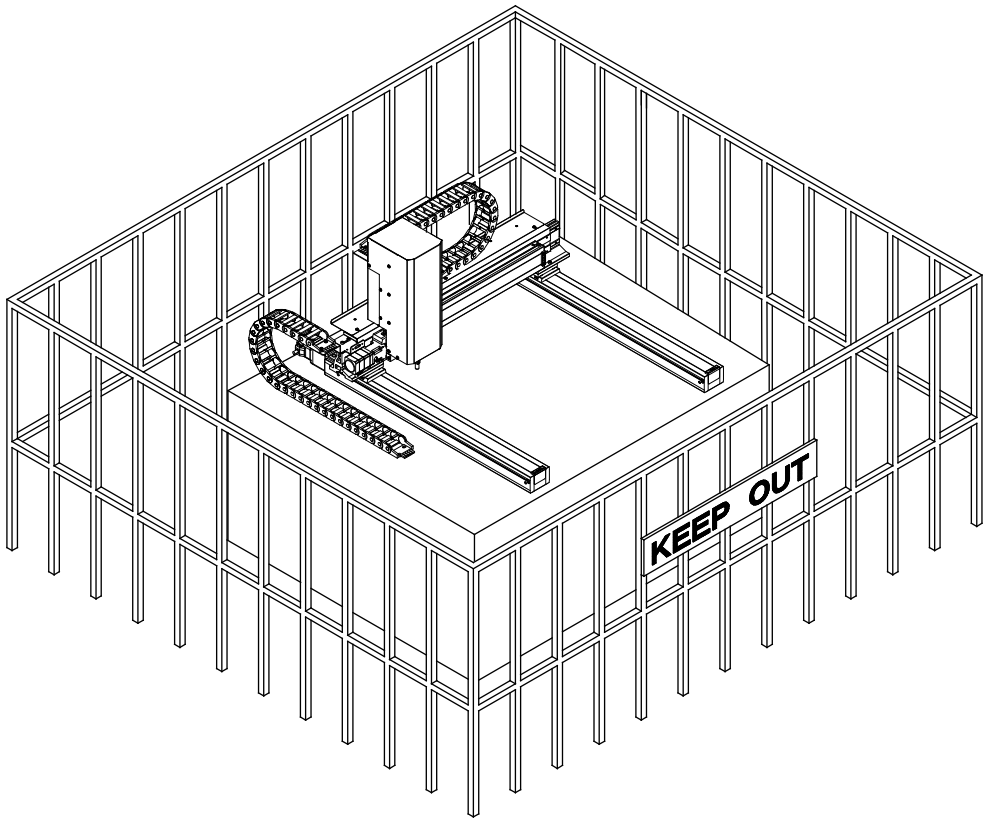
■■■■■■■■■■■■■■■■■■■■ JC-3 Series ■■■■■■■■■■■■■■■■■■■■

⚠ Danger

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

Always set up safety guards.
Anyone within the maximum reach of the robot may be injured.
Using the included EMG OUT connector, set up an emergency stop interlock system that is triggered when the entrance to the safety guard is opened and make sure this entrance is the only way to access the machine.
Furthermore, put up a **"Keep Out"** or **"Do Not Operate"** warning sign in a clearly visible place.

Example:



FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JC-3 Series ■■■■■■■■■■■■■■■■■■

⚠ Danger

Construct a safety circuit before operating the robot.
Use the EMG OUT connector to maintain safety by installing a relay such as an external stop device on the power supply line which cuts the DC 48 V power input. Construct the safety circuit so it operates as a category 0 stop when the emergency stop switch is pressed. Without the construction of a safety circuit, motor power 48 V will not be cut OFF even if the emergency stop switch is pressed, leading to unexpected accidents and injury. An error will occur if you construct the safety circuit without it operating as a category 0 stop when the emergency stop switch is pressed.

When power to the robot is ON, never enter the safety guard or put your head, hands, or any part of your body inside.
Entering the safety guard could result in injury.

Before entering the safety guard or inspecting or performing maintenance on the robot, make sure there is no electrical current.
・ Unplug the controller power cord from the power outlet. Do not touch any of the power inlet pins within 5 seconds of removing the power cords.
・ If using a controller with a terminal block (DC 48 V), turn the power OFF and remove the wiring from the terminal block.
Failure to follow these steps can cause unexpected operation, electric shock, or injury.

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

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

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

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JC-3 Series ■■■■■■■■■■■■■■■■■■

⚠ Danger

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

Make sure that you regularly perform a function check of the emergency stop switch(s). Also regularly perform an EMG OUT circuit function check.
If the robot is operated without making these checks, it may not be possible to stop the robot immediately and safely in an emergency. This is potentially dangerous.

⚠ Warning

Make sure to power the unit within its rated current range.
Failure to do so causes electric shock, fire, or unit breakdown.

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

Make sure to connect and use crimp terminals with the power cord connecting to the terminal block (DC 48 V input) and to securely tighten the terminal block screws. Failure to do so causes electric shock, fire, or unit breakdown.

Make sure to perform work from outside of the safety guards when the power is ON. Failure to do so can cause injury.

Be sure to use the unit within its indicated voltage range.
Failure to do so causes unit breakdown, fire, or electric shock.

Install the controller within an industrial control panel, and make sure when the industrial control panel door is opened, the controller power is automatically cut off. In addition, for controllers with a cooling fan, allow for a clearance of 30 cm or more from the top of the controller, as well as 10 cm or more from the air vent on the side. Inadequate installation can cause overheating, fire, electric shock, or injury.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JC-3 Series ■■■■■■■■■■■■■■■■■■

⚠ Warning

With the 3 axis specifications, if releasing the brake, do so after either removing the attached tool or taking measures to prevent the tool from dropping.
If you release the brake when turning the power ON in Teaching Mode, Switch Run Mode, or External Run Mode, the axis may drop down depending on the mass attached to the Z axis. If the Z axis drops down, it can cause injury or unit breakdown.

When inspecting or performing maintenance on the controller, **make sure there is no electrical current and perform the following**:

- **Unplug the controller power cord from the power outlet. Do not touch any of the power inlet pins within 5 seconds of removing the power cords.**
- **If using a controller with a terminal block (DC 48 V), turn the power OFF and remove the wiring from the terminal block.**

Failure to follow these steps can cause electric shock, injury, data loss, unit breakdown, or malfunction.

Always **make sure the machine is grounded through the power cord.**
Do not use the machine when it is not grounded.
Improper grounding causes electric shock, fire, malfunction, or unit breakdown.

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

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

If disassembling this machine, follow the instructions in the operation manual *Maintenance*, and do not disassemble in any other way other than those specified. Do not modify the machine in any way.
Inappropriate disassembly or modification causes electric shock or unit breakdown.

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

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JC-3 Series ■■■■■■■■■■■■■■■■■■

⚠ Warning

If anything unusual occurs, such as a burning smell or unusual sound, stop the run, unplug the controller power cord from the power outlet, and make sure there is no electrical current. Contact Janome (details on the back of this manual) or a Janome dealer.

- **Unplug the controller power cord from the power outlet. Do not touch any of the power inlet pins within 5 seconds of removing the power cords.**
- **If using a controller with a terminal block (DC 48 V), turn the power OFF and remove the wiring from the terminal block.**

Continuing to use the robot without addressing the problem causes electric shock, fire, or unit breakdown.

Make sure to use the robot in accordance with the laws and guidelines of the country where it is used.

⚠ Caution

Do not drop or jar the unit during transport and/or installation.
This can cause injury or damage the unit.

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

Use the unit in an environment between 0 and 40 °C, with a humidity level of 20 to 90 %, and without condensation.
Use outside of these conditions can cause unit breakdown or malfunction.

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

When attaching tools, a USB camera, or any other device, make sure they are securely fitted before running the robot.
Failure to do so causes injury or breakdown.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JC-3 Series ■■■■■■■■■■■■■■■■■■

⚠ Caution	
	**When using the machine for extended periods of time, check and make sure none of the main unit's mounting screws are loose, and perform a routine inspection every 3 months or after every 750 hours of operation.** Failure to do so causes injury or breakdown.
	**Be sure to check the connections of the cords and cables to the main unit and controller.** Improper wiring causes unit malfunction or breakdown.
	**Secure the movable parts of the unit before transportation.** Failure to do so causes injury or breakdown.
	**When lifting and transporting the robot, do so with 2 or more people.** Failure to do so causes injury or breakdown.
	**Use the unit in an environment that is not exposed to direct sunlight.** Direct sunlight causes unit malfunction or breakdown.
	Individual Configuration Information varies for each individual unit even if they are the same model. **Do not use backup data with a different robot. The robot cannot function normally with backup data from a different robot.**

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Industrial Robot Safety Standards

Make sure to use the robot in accordance with the laws and guidelines of the country where it is used.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Safety Precautions Regarding Installation

Robot Unit

⚠ Danger

Anyone within the maximum reach of the robot may be injured.
Install safety guards in adherence with the following:

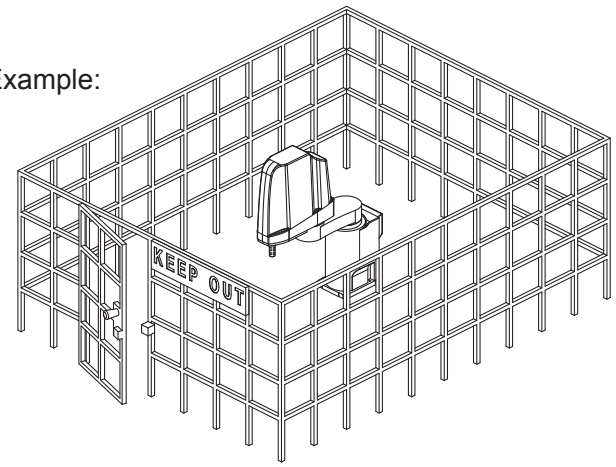
- The safety guards cannot easily be moved.
- The safety guards cannot easily fall over or be broken.
- Allow enough clearance between the robot and the safety guards so that even if the robot falls over, it does not hit the safety guards.
- No part of your body, such as your head or hands, can enter the safety guards.
- Install an interlock device on the entrance to the safety guards that activates an emergency stop when opened and make sure this entrance is the only way to access the machine. Connect the interlock device to the controller by using the included I/O-S connector.
- Place a warning sign such as [Keep Out] or [Do not Operate] on the safety guard entrance in a location that is easily visible.
- Affix the included danger sticker (shown below) in a location that is easily visible.

NOTE:

- A stop made via a device connected to the I/O-S connector is a category 1 stop. Make sure to perform a separate risk assessment for the interlock device.
- Refer to the operation manual *Installation* for details regarding I/O-S connections.
- After installing the unit, make sure to perform pre-operation checks from outside of the safety guards.

Warning Sticker

Example:



FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Danger

Do not remove the fixing plates from the robot arm until after transportation is complete.
Failure to do this can cause injury or breakdown.

If temporarily placing the robot on a mount, etc., make sure to secure the robot to the mount by tightening 2 or more bolts into the mounting holes on the mounting base to prevent the robot from tipping over.
Failure to do this may cause the robot to fall, resulting in injury or breakdown.

To set the home position for the J3 or J4-axis, release the brake and move the J3-axis (shaft) manually with two hands. When releasing the brake, take the following precautions:

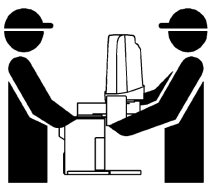
- Always release the brake with at least 2 people present.
- After the brake is released, the tool mass may cause the J3-axis to drop down. Make sure no people are within the operating range of the robot before releasing the brake.
- If there is risk that the robot may hit a peripheral device, make sure to position the robot arm appropriately before releasing the brake.

Failure to adhere to this can cause injury or breakdown.

⚠ Warning

Construct safety guards that are strong enough to protect the operator against such dangers as the tool or workpiece splintering, etc.
For the safety of the operator when working within the safety guard, use protective gear such as a helmet, protective gloves, protective goggles, and safety shoes.
Entering the safety guards could result in injury.

Always have 2 people carry the robot with the fixtures attached as shown in the illustration to the right.
Mass: JS3-3520: Approx. 39 kg, JS3-4520: Approx. 40 kg
JS3-5520: Approx. 41 kg
Refer to “2.3 Transporting the Robot Unit” in the operation manual *Installation* for further details.



FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Warning

Avoid using the robot in operating environments such as the ones below. If using the robot in environments such as these, take measures to protect the robot from the direct effects of the work environment.

- An environment where the robot vibrates or is bumped at 3.5 G or more during transportation.
- An environment where the robot vibrates or is bumped at 0.5 G or more during operation.

Using the robot in these environments can cause malfunction or breakdown.

Avoid using the robot in an environment that exceeds the radiation tolerance value for the average person. If using the robot in an environment such as this, take measures to protect the robot from the direct effects of the work environment.
Using the robot in this environment can cause malfunction or breakdown.

⚠ Caution

Do not hold the robot from the left and right sides or hold the robot by the covers. Doing so may tip the robot over or the covers may break; causing the robot to fall resulting in injury.

Do not hold the robot by the J2 arm cover during transportation.
Doing so can damage the cover.

Do not apply force to the shaft (J3-axis).
Doing so can damage the shaft and cause an overload error to occur when the robot is run.

Do not tip or place the robot on its side.
Doing so can cause a grease leak or breakdown.

Mount the robot on a steel base that is designed to withstand both the robot's mass and the force generated during operations. Inadequate installation may cause the robot to fall, resulting in injury or breakdown.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Caution	
	Firmly fix the robot to a specified horizontal mounting surface using the mounting bolts and make sure that positional displacements cannot occur.
	Install the robot in a location that provides enough clearance to replace the battery at the front of the robot and enough clearance to connect the motor power cable and the encoder cable to the back of the robot. Also, do not install the robot in a place where it is exposed to direct sunlight or heat from lighting. The robot surface may heat up and cause errors to occur.
	The robot requires periodic lubrication. Make sure you install the robot in a location where greasing is possible. (Refer to “4.8 Lubrication” in the operation manual *Maintenance*.
	Check the air tubing is connected correctly, has not come loose, or cannot easily come loose. If there is a problem, reconnect the tubing as required. Failure to do so can cause injury or breakdown.
	**After installing the robot, make sure to remove the fixing plates attached to the robot arm.** Failure to do so may cause breakdown.
	After installation, perform a periodic inspection (every 3 months or 750 hours of use, depending on how often the robot is in use) to check the tightening torque of the mounting screws with a torque wrench, etc.
	Adhere to the following when constructing or selecting a hand for the robot: • Make sure the total mass of the hand and the workpiece does not exceed the rated payload capacity of the robot. Especially if attaching an unconventional hand, check that the wrist does not exceed the allowable moment of inertia. • Use a hand or tool that has sufficient ability to grasp workpieces. • Secure the hand to the mechanical interface using bolts that are sized accordingly for the attachment dimensions. Make sure the tool has no protruding parts or sharp edges, other than those required for operation, and construct a cover for the tool if required. Failure to adhere to this can cause injury or breakdown.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Caution

If connecting cables or hoses to the hand, make sure they do not restrict the robot movements and make sure the robot operations do not cause the cables or hoses to get tangled and/or cause them to break.
Improperly attached cables or hoses can cause breakdown.

If using a pneumatic hand, make sure to provide clean air at the specified pressure. Also, make sure the air pressure does not exceed 0.7 MPa (7 kgf/cm^2).
Air pressure higher than this may cause the robot's internal air hoses to burst.

Robot Unit and Controller

⚠ Danger

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

⚠ Warning

Use protective gear such as a helmet, protective gloves, protective goggles, and safety shoes when installing the machine.
Entering the safety guards could result in injury.

Before wiring the power cords, make sure there is no electrical current and perform the following:

- **Lockout/tagout with the power source circuit breaker in the OFF position, and remove the power cords from the terminal block.**
- Do not touch the terminal block within 5 seconds of removing the power cords.

Failure to adhere to this may cause electric shock, injury, data loss or breakdown.

Be sure to use the unit within its indicated voltage range.
Failure to do so causes unit breakdown, fire, or electric shock.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Warning

Make sure to isolate the robot motor power cable, the encoder cable, and external I/O cables from the power cable or grounding wire of other devices. Also make sure the external I/O cables are shielded.
Do not apply voltages to terminals other than those specified in the operation manuals. Doing so can damage the robot or cause the terminal to explode.

⚠ Caution

When transporting the robot, **do not excessively shock or vibrate the robot.** Doing so can cause malfunction or breakdown.

Do not drop or jar the unit during transport and/or installation.
This can cause injury or damage the unit.

Use the robot in an indoor environment where it is not exposed to direct sunlight.
Direct sunlight can cause unit malfunction or breakdown.

Place the machine in a well-ventilated area for the health and safety of the operator.

Use the robot in an environment that meets the following conditions:

- **Ambient temperature of 0 to 40 °C**
- **Relative humidity of 45 to 85 % (no condensation)**
- **Altitude not exceeding 1000 m above sea level**
- **The installation space is not in a vacuum.**

Use outside of these conditions may cause malfunction or unit breakdown. If the unit is used where these conditions are not met, we cannot guarantee its operation. IP protection rating for the both the robot and the controller is IP20.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Caution	
	**Use the unit in an environment where no electrical noise is present.** Noise may cause unit malfunction or breakdown.
	**Do not use the machine in an environment that is damp or dusty.** Dust and moisture can cause malfunction or breakdown. IP protection rating for the both the robot and the controller is IP20 (not water resistant).
	Install the cables and connectors so there is no stress on them and do not forcefully bend or pull, or stand on them after they are installed. Protect the cables and connectors by using piping and covers, etc., as necessary. Make sure the latches and screws securing the cables and connectors are firmly secured. If the cables and connectors are not secure, they may come loose during a run.
	If the hand input cable (optional) has free terminals, make sure to insulate them before supplying power to the hand input cable (optional). Uncovered terminals can cause a short circuit to occur.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Controller

⚠ Danger	
	**Mount the controller outside of the safety guards in a location where the switches can easily be reached and the controller can always be monitored by the operator without turning their back on the robot unit itself.** Mount the controller so that the operation panel is 600 mm or more above floor level for maintenance work.
	Before connecting a Fieldbus, make sure safety can be maintained at all times when the robot is run. If signals such as a start signal, etc., are assigned to the Fieldbus, the Fieldbus may standby waiting to send signals and cause the robot to start running immediately after it is connected. Failure to do so can cause injury or breakdown.

⚠ Warning	
	Use a lifter, etc., to transport the controller. Failure to do so can cause injury or breakdown.
	If external vibrations can cause the controller to move, fix it in place using the base plate of the controller. (Do so without removing the rubber feet)
	**Make sure that you securely install the unit in a place that can fully withstand both the unit's mass and its usage.** If installation is inadequate, the unit can drop or fall over causing injury and unit breakdown. Inadequate installation can also cause overheating and fire.
	The controller has a fan and ventilation intakes for cooling. Do not block these openings and make sure there is a clearance of at least 20 mm on both the left and right sides and at least 40 mm on the back side. Blocking these openings can cause overheating or breakdown.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Warning	
	Leave approximately 200 mm or more clearance from the front of the controller so there is no stress on the connectors and enough room to work. Failure to do so can cause malfunction or breakdown.
	In addition to the clearance required for installation, leave sufficient space around the controller for removing covers (with a screwdriver) as a contingency for maintenance work. The controller may get hot during a malfunction. Do not touch the controller immediately after use.
	Make sure the power cord prepared on your side uses the **correct crimped terminals for connecting to the terminal block. Make sure they are within the sizes outlined below and never forcefully connect them.** Incorrect connections may cause fire or breakdown. • Conductor size: AWG10 (cross-sectional area: 6.0 mm^2) • Crimped terminal: M4, with a width of 9.5 mm or less
	After wiring the power supply terminal block, attach the cover included to prevent electric shock. An unprotected terminal block can cause electric shock, fire, or unit breakdown.
	**Always make sure to connect the protective ground through the power cord.** **Do not use the machine when the protective ground is not connected.** **Make sure the protective grounding resistance is 100 Ω or less.** Improper grounding causes electric shock, fire, malfunction, or unit breakdown, etc.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Caution	
	Do not apply pressure to any protruding parts, such as a switch, the terminal block, or a connector when transporting the controller. Doing so can cause breakdown.
	If you want to use the controller, operation box (optional), or teaching pendant as a monitor while in Run Mode, **mount the respective device 600 mm or more above floor level in an easily accessible place so that the emergency stop switch can be immediately reached in the event of an emergency.** It is dangerous to operate the machine without the emergency stop switch within reach; you will not be able to stop the robot immediately and safely in the event of an emergency. Installing one of these devices too low can also result in malfunction from people knocking the device with their feet, etc.
	Make sure installation allows for access to the memory port during maintenance.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Safety Precautions Regarding Usage

Robot Unit

⚠ Warning	
	If objects that the robot grasps have a risk of falling or being projected, **take into account the size, mass, and chemical composition of the objects for the required safety precautions.** Failure to do so can result in injury or unit breakdown.
	**When manually moving the robot arm, do not insert your hands or fingers into any of the joints or openings.** Your hands or fingers may get caught in these openings depending on the robot pose.

⚠ Caution	
	Before performing any operation, make sure there is no imminent danger to any of the operators. Failure to do so causes injury.
	**When attaching tools, etc., make sure they are securely fitted before running the robot.** A loose tool can cause injury or breakdown.
	If weight is applied to the J3 (Z) / J4 (R) axis, the load may cause the J3/J4 axis to drop down when the power to the robot is turned OFF. To prevent this from happening, remove the load from the J3/J4 axis or install a safety block, etc.
	When performing work inside the safety guards, perform your own risk assessment and establish **"work regulations", as outlined below, with thorough planning for safety.** Entering the safety guards may result in injury. • Work regulations should be relevant and appropriate for the type of work, and consist of details such as robot operating procedures and signs to be used between operators. • When creating work regulations, incorporate the opinion of operators and work safety specialists. Make sure to review and update the contents of the work regulations regularly.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Caution	
	If manually moving the robot arm, do so slowly. Moving the arm at high speed can cause large amounts of backlash, reducing the robot's accuracy and damage the backup data.
	Depending on the arm pose, the shaft may come in contact with the robot base even when operating the robot within the work envelope. Make sure the shaft does not come in contact with the base while making JOG movements*. * A JOG movement refers to moving the robot arm via the teaching pendant.
	The J3 (Z) axis is equipped with a brake. Do not forcibly move the J3-axis using an external source when the brake is active. Forcibly moving the axis can reduce accuracy and/or wear the brake, damaging the reduction drive.
	If the robot picks up a workpiece that is charged with static electricity, the electricity is discharged through the hand and the robot arm. To prevent the robot from malfunctioning, make sure to insulate the hand and robot arm. Also, when the robot places a charged workpiece on a device, the electricity is discharged through the device and may cause it to malfunction. Configure the system so that it provides a route for appropriate electrical discharge from charged workpieces. Failure to do so can cause malfunction or unit breakdown.
	The lubricant is not completely effective at low temperatures. Make sure to use the warmup function to prevent loss of positioning accuracy and to prevent servo errors such as Excessive Margin of Error.
	Take care when affixing tape that has a strong adhesive, such as gummed tape, to the painted surfaces on the robot. The tape may damage the painted surfaces when it is peeled off.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Robot Unit and Controller

⚠ Danger	
	**When power to the robot is ON, never enter the safety guard or put your head, hands, or any part of your body inside.** Entering the safety guards could result in injury.
	When changing modes or starting a run, first confirm there are **no people inside of the safety guard and there are no obstacles that could interfere with the run.** Entering the safety guards could result in injury.
	**Before performing a run or operation, always check the following:** • **Obstacles** Make sure there are no obstacles or people within the safety guard. • **Installation** Make sure the robot is installed properly, that there are no abnormalities with the robot and the surrounding devices, and that the teaching pendant and tools are in the appropriate places. • Emergency Stop Function Check Make sure the I/O-S circuit (interlock) and emergency stop switch(es) are functioning properly. It is potentially dangerous to operate the robot without making these checks first.
	If entering the safety guards without cutting off the power, **always make sure the select switch on the teaching pendant is set to TEACH (Teaching Mode).** If the select switch is set to AUTO (Run Mode), external commands can start the robot while you are inside the safety guards. Failure to adhere to this can cause injury or breakdown.
	If there are any safety devices that you disable while teaching, make sure to enable them after teaching to reestablish full functionality. Example: Enable the interlock device on the safety guard entrance, etc. Failure to do so can result in injury.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Warning	
	**Make sure to use a power source that is in accordance with the range indicated on the rating identification plate.** Failure to do so causes electric shock, fire, or unit breakdown.
	**Do not allow water or oil to come in contact with the unit or power cord.** Contact with water or oil causes electric shock, fire, or unit breakdown. IP Protection Rating: IP20.
	**Make sure that no foreign objects can enter the robot or controller.** In particular, a conductive or flammable foreign matter, such as a screw, metal shard or oil, can cause an explosion or damage the unit, etc.
	**Be sure to turn OFF the unit before inserting or removing cords and cables such as the teaching pendant cable or LAN cable.** Failure to do so can cause electric shock, data loss, unit breakdown, or malfunction.
	**Firmly connect and secure the power cord after checking that the connection area is not covered with dust, etc.** If the power cord is not firmly plugged in, the connectors may heat up and cause a fire.
	**Be sure to unplug the power cord from the power outlet when the unit is not in use for long periods of time.** Dust accumulation may cause fire.
	**If anything unusual occurs, such as a burning smell or unusual sound, stop operation and turn the power supply circuit breaker OFF. Unplug the power cord after confirming there is no power supplied to the robot and then contact Janome or a Janome dealer.** Continuing to use the robot without addressing the problem causes electric shock, fire, or unit breakdown.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Caution	
	**Be sure to check the connections of the cords and cables to the main unit.** Improper wiring may result in unit malfunction or breakdown.
	Make sure to save if you modify any settings or data. If you turn OFF the power after making changes to robot settings or data without saving, those changes are lost and the robot will revert to its original settings.
	Diagnostic Mode and Mechanical Adjustment Mode are for maintenance personnel* use only.

* Maintenance personnel are individuals who have received maintenance training from Janome or from a Janome dealer.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Controller

⚠ Warning

Do not touch the terminal block when there is an electrical current present. Touching the terminal block can result in electric shock or injury.

⚠ Caution

Keep the emergency stop switch within reach of the operator when running or operating the robot.
If you operate the robot without the emergency switch in reach, you may not be able to stop the robot immediately and safely. This is potentially dangerous.

Individual Configuration Information varies for each individual unit even if they are the same model.
Do not use backup data with a different robot.
The robot cannot function normally with backup data from a different robot.

Do not turn OFF the power while the robot is running.
Turning OFF the power during a run can cause the arm to drop down or coast to a stop, which may result in the arm hitting a peripheral device.

When an error occurs, the error code that appears on the 7 segment LED and the teaching pendant display are useful indicators for finding the source of the error. Record the error number and then refer to the operation manual *Maintenance* for the countermeasure.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Safety Precautions Regarding Maintenance

Robot Unit

⚠ Warning	
	Do not touch or come in contact with any potentially hot components on the robot. Doing so can result in burns and serious accidents. The servomotor may get hot. Do not touch or come in contact with the servomotor while the power is ON, only do so when the power is OFF and after it has cooled down.

⚠ Caution	
	**Check that the mounting screws are always firmly tightened with a periodic inspection (every 3 months or 750 hours of use, depending on how often the robot is in use).** A loose tool can cause injury or breakdown.
	**Periodically replace the robot battery.** Failure to do so can cause malfunction or breakdown. Replace the battery approximately every 1 year.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Robot Unit and Controller

⚠ Danger	
	**If entering the safety guards, turn the power source circuit breaker OFF, lock and tag it, and then make sure there is no power supplied to the robot before continuing.** Failure to do so can cause electric shock, injury, or the robot may move unexpectedly.
	**If entering the safety guards, perform your own risk assessment and establish "work regulations," as outlined below, with thorough planning for safety.** • Work regulations should be relevant and appropriate for the type of work, and consist of details such as robot operating procedures and signs to be used between operators. • When creating work regulations, incorporate the opinion of operators and work safety specialists. Make sure to review and update the contents of the work regulations regularly.
	**When setting the home position or other such work that requires you to enter the safety guards with the power ON, make sure to activate the emergency stop switch before entering the safety guards and to perform the work with the robot in this state.** Failure to do so can result in injury.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Warning

When inspecting or performing maintenance on the controller, **make sure there is no electrical current and perform the following:**

- **Lockout/tagout with the power source circuit breaker in the OFF position, and remove the power cords from the terminal block.**
- Do not touch the terminal block within 5 seconds of removing the power cords.

Failure to adhere to this may cause electric shock, injury, data loss or breakdown.

If disassembling this machine, follow the instructions in the operation manual *Maintenance*, and do not dissemble in any ways other than as specified. Do not modify the machine in any way.
Inappropriate disassembly or modification causes electric shock or unit breakdown.

For your safety, **do not modify the machine in any way.**
Inappropriate disassembly or modification causes electric shock or unit breakdown.
We cannot accept any responsibility for machines that malfunction due to modification.

After cutting OFF power to the system, energy stored by the devices is potentially dangerous, so make sure to establish means to reduce this risk.

- Controller
  Make sure the energy stored by the controller is discharged before opening the controller.
- Hand
  Use a hose connected to the solenoid valve to expel compressed air from a pneumatic chuck hand.

⚠ Caution

Perform daily and periodic inspections to check and make sure there are no abnormalities with the robot or peripheral devices. Additionally, keep records of the inspections and store them for 3 years or more so that the details can be referred to for future inspections.

Place a sign such as “Robot Inspection in Progress” in the necessary locations and establish means so as to prevent operation of the robot by those who may be unaware of the maintenance work. Whenever possible, also perform maintenance with at least one other person present so as to stop any unexpected robot movements.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

⚠ Caution	
	For a smooth and long operating life, **lubricate the shaft once for every 2,000 km the robot is run.** If the robot is run for 24 hour periods, lubricate the machine more frequently because the running time between lubrication periods is longer. The lubrication periods are calculated based on runs at maximum speed.
	Make sure to use the specified grease. Use of grease other than the specified grease can adversely affect the robot's performance or cause breakdown.
	If the arm joints or the Z-axis is subject to only minute operational angles or distances, fretting may occur in the internal robot bearings. Fretting refers to wear that occurs when minute operation angles do not allow the lubricant within the bearings to fully coat the working parts as required. This is also applies to axes that are inactive, as the counterforce from other axis operations or vibrations from the robot mounting surface cause minute movements in the inactive axes, which may result in fretting damage. To prevent fretting damage, we recommend running the arm joints more than 30 degrees and the Z-axis more than 20 mm per day.
	Do not charge, dispose of in a fire, or reuse the robot unit battery or controller battery (unit) in any way.
	The robot unit battery and controller battery (unit) are considered industrial waste. Make sure they are disposed of in accordance with the national and/or local authority laws and legislations.

FOR YOUR SAFETY

■■■■■■■■■■■■■■■■■■ JS3 Series ■■■■■■■■■■■■■■■■■■

Controller

⚠ Danger

Before entering the safety guard because of something wrong with the robot or a peripheral device, or to **inspect or lubricate the machine etc., always make sure to turn the controller and power source circuit breakers OFF, lock and tag them, and make sure there is no electrical current.**
Failure to follow these steps can cause electric shock or injury.

⚠ Warning

When replacing fuses, or inspecting or lubricating the unit, turn OFF the power supply, then remove the cord from the main unit and make sure there is no power supplied to the robot before continuing.
Also, **do not touch the terminal block within 5 seconds of removing the power cords.** Failure to follow these steps can cause electric shock or injury.

1. PROGRAM

You can make the robot do various operations by performing program runs.
A program is made up of “individual program settings” and “point data”.
Individual program settings are settings for controlling the programs themselves and can be set to each program individually.
Point data includes data such as position coordinates to operate the robot. A set of multiple point data is referred to as a “point data string.”

■ Individual Program Settings

There are settable items which can be set for both individual program settings and all program common settings. By specifying [Common/Individual] with these settable items, you can switch between the two and select which one to apply when making a program run.

Settable Item	Details		Common/ Individual Conversion
Program Name	The program name. You can enter 40 – 120 characters depending on the type of character used.		Individual only
PTP Condition Number for Home	This item is settable only with the JC-3/JS3 Series. This a setting for the return operation to the work home, such as the movement speed, etc., for when the I/O input signal “Go Home” comes ON. Select a number from the additional function settings [PTP Condition Settings] → [PTP Condition Number].		Individual only
Individual Job on Start of Cycle	The point job of the registered number is executed at the start of a run. If the cycle mode is set to [Continuous Playback], this is executed only when there is a run start signal. This is executed after [Common Job on Start of Cycle] in all program common settings is performed.		Individual only
Cycle Mode	The type of run method. There are 2 types as listed below.		Individual only
	1 Cycle Playback	Executes the program once.	
	Continuous Playback	Executes the program continuously. Enter the “Last Work” command to end the program.	

Settable Item	Details		Common/ Individual Conversion
Position Data Type	The coordinate type held by the point data. There are the 3 types below.		Individual only
	Absolute Coordinates	Position data values used to indicate the robot's fixed coordinates.	
	Relative Coordinates*1	Position data values used to indicate the distance from the program start coordinates.	
	Moving Amount*1	Position data values used to indicate the distance to the next point.	
Work Home	After executing the last point of a program during a 1 cycle playback, this is the point where the robot waits until it receives the next start signal.		Common/ Individual
PTP Conditions	Point to point movement settings such as speed, etc. (Only for PTP movements. These settings do not apply during CP movements.)		Common/ Individual
CP Conditions	Point to point movement settings such as speed, etc. (Only for CP movements. These settings do not apply during PTP movements.)		Common/ Individual
Move Area Limit	The moveable range limits for each axis. If the robot goes beyond the coordinates set here during a run, a positioning error occurs and the robot stops. Also, you cannot make movements which exceed this range in JOG Mode. It is possible to make settings for each axis. The settable range for each axis is from 0 to the maximum moveable range for the model you are using.		Common/ Individual
Workpiece Mass*2	Mass settings for the mass carried by the X-table. The X axis moves at the optimum speed and acceleration according to the set mass. If the mass applied to the X-table is heavier than the workpiece mass settings, a positioning error may occur.		Common/ Individual
Restart Method After Pos. Offset	This item is only settable with the JR3000E Series. The JR3000E Series detects motor step-outs and stops during movements. You can set how to restart the operation from the position where the robot stopped.		Common/ Individual
Valid/Invalid Settings of Move Axis	This item is only settable with robots equipped with auxiliary axis functions. Refer to the operation manual *Auxiliary Axis Functions*.		Common/ Individual

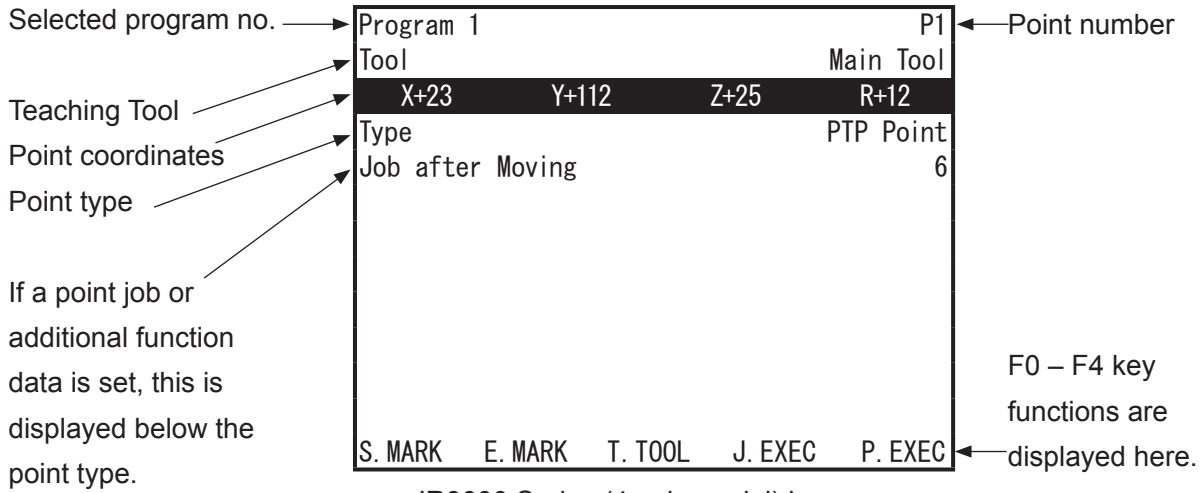
*1: A setting which registers the position data type as a relative coordinate or a moving amount is normally used when calling up that data from another program as a subprogram. If this type of data is used individually, the robot may move out of its work range.

*2: Workpiece Mass is not available for the JC-3/JS3 Series.
Workpiece Mass is fixed at 7 kg for the JR3200 Series.

- Default Values (Initial Values)
  When you create a new program, the individual program settings are created with the same values set in [Default All Program Common Settings]. If you set values appropriate to the environment and conditions in which the robot is used in advance to [Default All Program Common Settings], you can save yourself time by not having to enter the individual program settings each time you create a new program. For more information regarding [Default All Program Common Settings], refer to the operation manual *Functions IV (Customizing)*.

1.1 Data

■ Point data

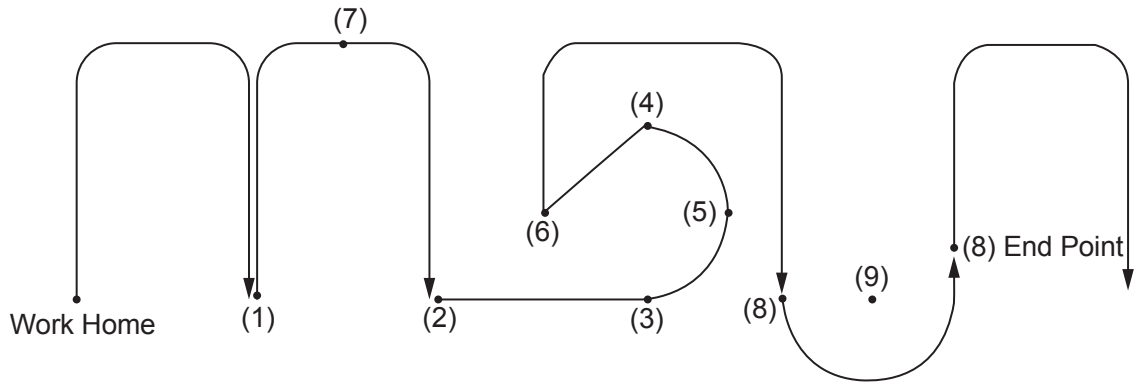


JR3000 Series (4-axis model) base screen example: point settings screen

Point data contains the following items:

1. Coordinates X (righty/lefty), Y (righty/lefty), Z, R
   Point coordinate (X, Y, Z, R) data. (R is for 4 axis specifications only).
   If using the Cartesian coordinate system with the JS3 Series, the coordinate data includes the point coordinates (X, Y, Z, R) and righty (R) and lefty (L) identifiers. With the axial coordinate system, this data contains the J1, J2, J3, and J4-axis coordinate data.

2. Point Type
   Point types defined by the different methods for moving to the next point



(1) PTP Point
The robot moves to the set point by PTP movement.
The main tool TCP tool data is applied for this point.

(2) CP Start Point

The point where the robot changes from a PTP movement and starts a CP movement. The main tool TCP tool data is applied for this point.

(3) CP Passing Point

The point where the robot changes direction in CP movement. The robot moves to the next point at the same speed as it did from the previous point.

(4) CP Stop Point

The point where the robot performs a point job or changes direction in CP movement. The speed is temporarily slowed to 0 mm/s at this point.

(5) CP Arc Point

This point is needed to specify the arc when making an arc movement during CP movement.

(6) CP End Point

The point where the robot completes a CP movement and then makes a PTP movement to the next point.

(7) PTP Evasion Point

The point where the robot evades obstacles during PTP movement.
The main tool TCP tool data is applied for this point.

(8) Circle Start Point

This point is used to make an arc movement with the specified circle center point and circle angle in CP movement. The following point, the circle center point, is the center of the arc. The circle angle is set to the following point, the circle center point. If you set a workpiece adjustment, the Circle Start Point is offset together with the Circle Center Point.
The main tool TCP tool data is applied for this point.

(9) Circle Center Point

This is a point used to indicate the center of the arc movement started by the circle start point in CP movement.

(10) Wait Start Point

The robot waits at this point until the start switch is pressed or until a start signal comes ON. The robot then makes a PTP movement to the next point. The main tool TCP tool data is applied for this point.

(11) Single Camera Shoot Point

The robot makes a PTP movement and photographs marks on the workpiece. The adjustment values from the workpiece adjustment data set in [Ref. Work Adj. No.] are applied. You can use these workpiece adjustments by setting them to PTP Points, etc. By applying [No Tool] tool data to this point, the robot does not deviate from the taught position. The robot position will not change even if the tool data for the main tool TCP is modified.

(12) Multi Camera Shoot Point

Use this point type when you want to split and take photographs and make adjustments separately when photographing multiple workpieces. Use this to collectively photograph the multiple workpieces. After doing so, you can collectively make adjustments so that these adjustments are applied to PTP Points, etc., according to the mark photograph results. Register the workpiece adjustment type as [CCD Camera Adjst. with Counter/ Z-Adjst.] for workpiece adjustment data set to [Ref. Work Adj. No.]. By applying [No Tool] tool data to this point, the robot does not deviate from the taught position. The robot position will not change even if the tool data for the main tool TCP is modified.

(13) Double Camera Shoot Point 1

(14) Double Camera Shoot Point 2

An image acquired with the Double Camera Shoot Points is done by splitting the photographing into two separate shots, allowing you to make adjustments using a wider area than you can with one imaging point. This makes for even more precise adjustments. To execute the Double Camera Shoot Points, you need to consecutively teach Double Camera Shoot Point 1 and Double Camera Shoot Point 2. Create two work adjustment numbers in sequence for the work adjustment used at the two photographing locations. Set the smaller workpiece adjustment number to [Ref. Work Adj. No.] for Double Camera Shoot Point 1. The other workpiece adjustment number, which was created in sequence, is automatically applied to Double Camera Shoot Point 2. The robot makes a PTP movement to the photographing locations and photographs the marks on the workpiece. The photograph results are applied as adjustment values to the workpiece adjustment data set in [Ref. Work Adj. No.]. You can use the adjustment data by setting this workpiece adjustment data to PTP Points, etc. By applying [No Tool] tool data to this point, the robot does not deviate from the taught position. The robot position will not change even if the tool data for the main tool TCP is modified.

(15) User Definition Type

Point types can be created in Customizing Mode. These created point types are called “user-defined” types. (In contrast, point type items 1 – 9 are called “base” point types.) When you create a user-defined point type, the method of moving to the next point, etc., is the same as the base point type it is based on. (User-defined point types are not included in the diagram on the previous page). Refer to the operation manual *Functions IV (Customizing)* for further details.

3. Line Speed

The movement speed to the next point during CP movement. Set this item if the movement to the next point is a CP movement.

4. Condition Number

The numbers assigned to condition data. Condition data entered in the Teaching Mode menu [Condition Data Settings] can be set to points. (Condition data is defined in Customizing Mode and their parameters are entered in Teaching Mode.) For further details, refer to *Functions IV (Customizing)*.

5. Point Job Number

The numbers assigned to point job data. The robot executes point jobs specified by these point job numbers. You can select from the following four point jobs according to the execution timing, etc. Depending on the point type, there are some operations which cannot be set.

- Job before Moving : The robot performs a job before moving from the previous point to the registered point.
- Job while Moving : The robot repeatedly performs a job while moving from the previous point to the registered point during PTP movement.
- Job after Moving : The robot performs a job after reaching the registered point.
- Job while CP Moving : The robot repeatedly performs a job while moving from the registered point to the next point during CP movement.

6. Additional Function Number

The numbers assigned to additional function data. In addition to being able to set point jobs, you can also set additional functions as a supplement. For further information, refer to “12.9.6 Additional Function Data” in operation manual *Basic Instructions* for the JR3000/JC-3 Series or “10.8.6 Additional Function Data” in operation manual *Basic Instructions* for the JS3 Series.

7. Tag Code

The values assigned to points.

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

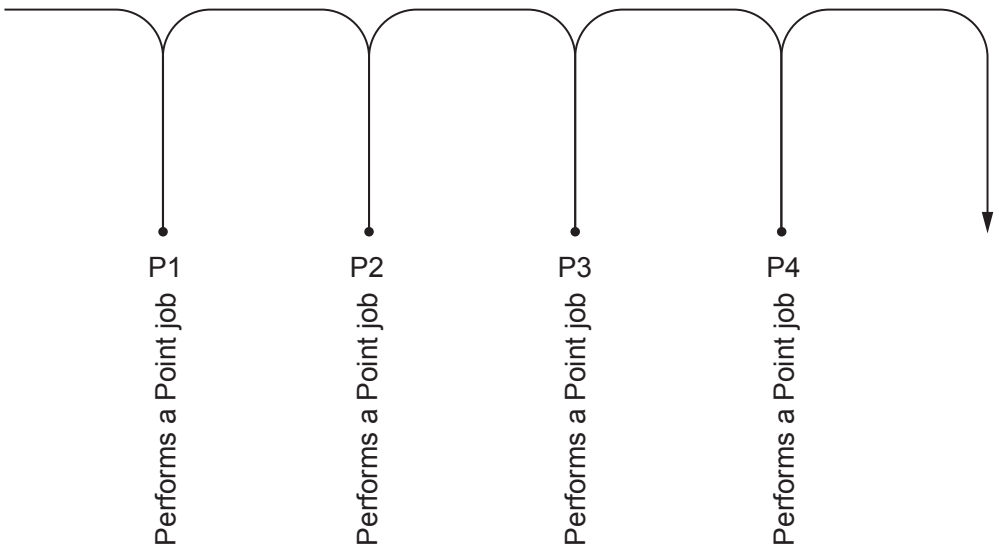
(✓: can be set, blank: cannot be set)

Job/Additional function data / Point Type	Condition Number	Job before Moving	Job while Moving	Job while CP Moving	Job after Moving	Condition Data*	PTP Condition Number	CP Condition Number	Tool Number	Pallet Routine Number	Work Adjustment Number	Execute Condition Number	Tag Code	Ref. Work Adj. No.
PTP Point	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
CP Start Point	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
CP Passing Point	✓				✓						✓	✓	✓	
CP Stop Point	✓			✓	✓			✓			✓	✓	✓	
CP Arc Point					✓						✓	✓	✓	
CP End Point					✓		✓				✓	✓	✓	
PTP Evasion Point							✓			✓		✓		
Circle Start Point	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
Circle Center Point					✓		✓						✓	
Wait Start Point	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
Single Camera Shoot Point	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓
Multi Camera Shoot Point	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓
Double Camera Shoot Point 1	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓
Double Camera Shoot Point 2	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
Camera Error Standby Point	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	
Work Home (PTP point)	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
Work Home (CP start point)	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	

* Condition data is created in Customizing Mode. The menu and item names may vary depending on the settings in Customizing Mode.

1.2 Running Programs

You can operate the robot in various ways by running programs.
A basic operation is “to move from Point 1 to the last point in numerical order and to perform point jobs according to the point job data set to each point”. (See below)



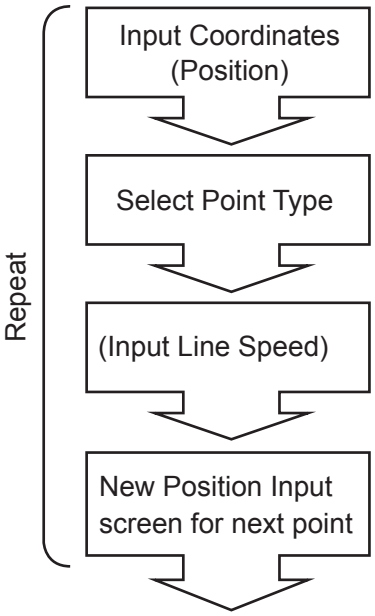
The point job data performed at a point is data independent from programs. By setting point data with a number, you can call up and use that point data at a given point. Accordingly, you can use the same point job data at multiple points.
You can operate the robot in various ways by setting point job data (number) or additional function data (number) to point data.

2. POINT DATA

2.1 New Input

Press the PRG.NO key on the teaching pendant base screen and enter the program number you want to teach.
If you select a new program, the New Position Input screen appears for point number 1.
Input the coordinates (position) and the point type to display the New Position Input screen for the next point. Repeat this process to enter points.

If you select a CP point type, the New Position Input screen appears for the next point after you have input the line speed.

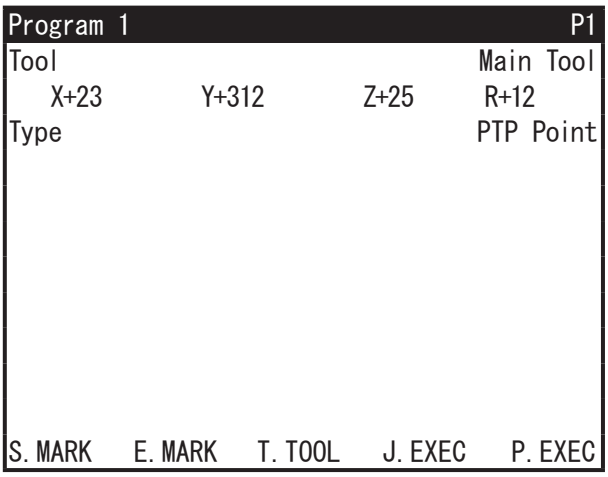


If you want to add a point to an existing program, press the CURSOR ▷ key on the value settings screen of the last point in the program. The New Position Input screen is displayed for the point after the last point. Press the SHIFT + CURSOR ▷ keys to jump to the new position entry screen.

2.2 Modifying Point Data

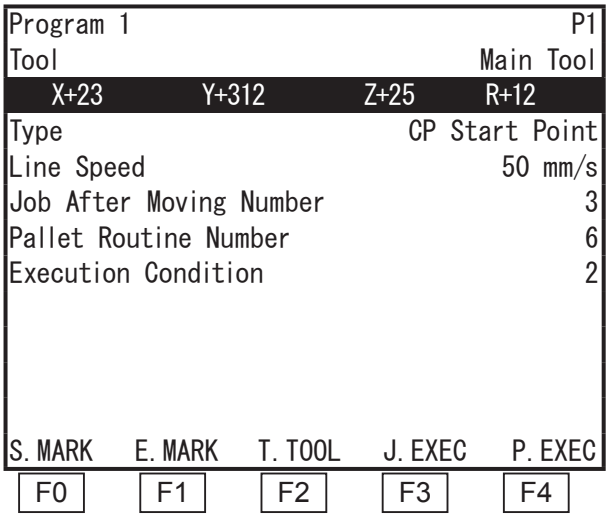
If you want to modify point data, first pull up the value settings screen for the point that you want to modify.

To specify a point number, select the first line and enter a point number.
Also, use the [CURSOR ◁] and [CURSOR ▷] keys to display the previous or next point number's data Setting Value screen.



Point Value Settings Screen Example

Display the point value settings screen for the point you want to modify, and select the item you want to modify. Press the [ENTR] key to set, and press the [ESC] key to cancel.



- Program Number and point number
- Teaching Tool
- Coordinates
- Point Type
- Line Speed (CP) (sometimes absent)
- Point Job (sometimes absent)
- Additional function data (sometimes absent)

Depending on the number of point jobs and additional functions registered, the value settings screen may take up 2 pages.

2.2.1 Coordinates

When you select the coordinates, the Position Input screen appears (position MDI mode). Also, once you fix the coordinates, the display reverts to the point value settings screen.

2.2.2 Type

When you select [Type], the Point Type selection screen appears. Select the point type you want to set. If you select a CP point, the [Line Speed] input screen appears. Once you enter the line speed, the display reverts to the point value settings screen.
If you choose [CP End Point], the [Line Speed] entry screen is not displayed.
NOTE: If you change the point type, the jobs and additional function numbers registered before the change are removed from this point.

2.2.3 Line Speed

If you want to modify the line speed, select this item. The Line Speed input screen is displayed. This item is not available for PTP points.
The maximum line speed is shown in the table below. However, if the distance moved is short, etc., and movement stops before the robot reaches the specified speed, a “CP Speed Over” error occurs. If this occurs, reduce the line speed.

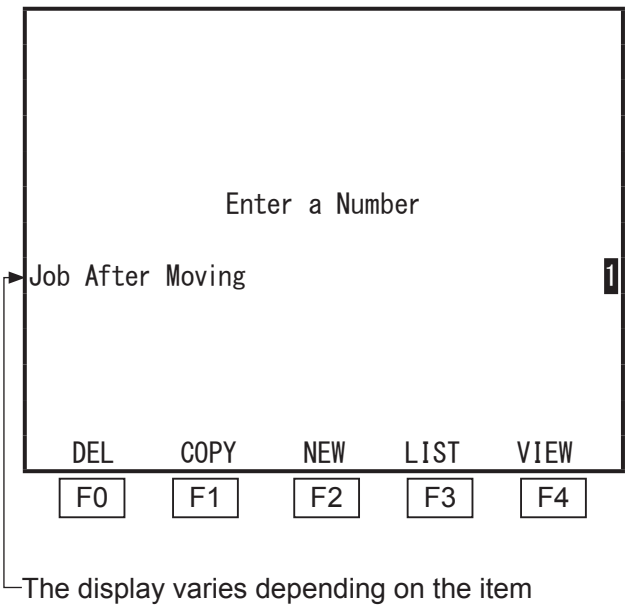
	JR3000 Series	JC-3 Series*	JS3 Series
Maximum Line Speed	850 mm/s (600 mm/s for JR3200)	800 mm/s	5000 mm/s

* This varies depending on the axis assembly.

2.2.4 Point Job Number and Additional Function Number

■ Number Modification
Select the number of the point job/ additional function data that you want to modify.
The point job/additional function data Number Input screen appears as shown to the right.
Enter the point job/additional function data number you want to set.

■ Cancellation
If you enter “0”, the point job/additional function data set to the point is cancelled.



F0 (DEL) Key: The Number Input screen appears for the point job/additional function data to delete. Enter the number of the point job/additional function data you want to delete. You can also select the number to delete by pressing the F3 (LIST) key.

F1 (COPY) Key: The Source Program Number Input screen of the point job/additional function data appears. Enter the source program number and the destination program number, and the contents of the point job/additional function data are copied to the destination number.

F2 (NEW) Key: A list of unused point jobs/additional function data are displayed. Select a number from the list to input a new point job/additional function data. Enter commands/parameters and press the ESC key to set the point job/additional function data to the point and revert to the point value settings screen.

F3 (LIST) Key: Displays a list of the registered point jobs/additional function data. Select a number from the list to set the selected point job/additional function data to the point. The display will then revert to the point value settings screen.

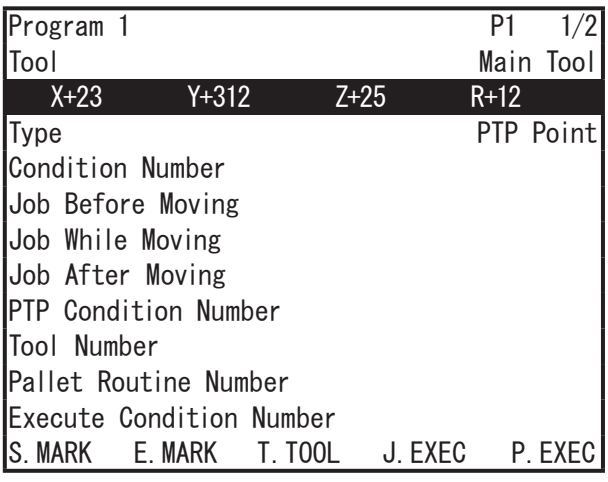
F4 (VIEW)Key: The point job/additional function data value settings screen for the currently selected number is displayed. You can also modify content here.

2.2.5 Adding a Point Job/Additional Function

You can set multiple types of additional functions to one point. Only one additional function of the same type can be set to one point. For example, you can set [PTP Drive Condition] and [Tool Data] to one point; however, you cannot make two [PTP Drive Condition] settings.

Display the value settings screen for the point to which you want to add a point job/additional function data.

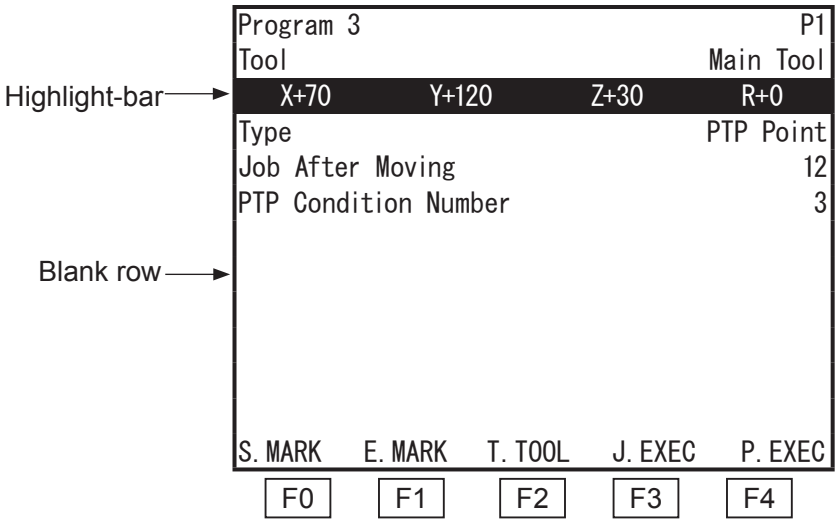
Highlight the bottom item on the point value settings screen and press the CURSOR ▽ key.
The point job/additional function data types that can be set to that point are displayed after the point data items as shown to the right.
Also note that the number items displayed vary according to the point type.



Select the point job/additional function data type that you want to set and enter the number. (The additional function data that is not set to the point does not show a number on the right side of the screen.)

NOTE: Even if you enter a number that has not been entered on the Number Input screen for the selected point job/additional function data, the display does not change to the point job/additional function data new input/selection screen

On the point value settings screen of the teaching pendant, if you move the highlight-bar to a blank row, point jobs and/or additional functions which can be assigned to that point are displayed. (Depending on the point type, information may run onto page 2.)



Point Setting Screen Example

3. PROGRAM NAME

You can name registered programs so as to identify the contents.
Existing program names can also be modified.

TP MENU [Individual Program Settings]
[Program Name]

PC [Program] → [Individual Program Settings] → [Program Name]

NOTE: A program name entry column appears in the dialog for adding programs (if adding a new program)

Depending on what kind of characters you are using, you can use 40 – 120 characters to name the program. (Up to 120 characters can be entered using the teaching pendant. When using the PC, the maximum number of characters is 40 depending on the character type).
However, up to 36 characters* are displayed on the registered program list and up to 40 characters* (the maximum number of characters per line) are displayed on the screen in Run Mode. The rest of the characters are not shown.

* when using characters that can be entered on the teaching pendant

4. PTP CONDITION NUMBER FOR HOME (JC-3/ JS3 Series Only)

This item sets the speed, etc., for the movement back to the work home when the I/O input signal [Go Home] comes ON. Select this number from [PTP Condition Settings] [PTP Condition Number] in the additional function settings

- Go Home
  #sysIn2
  #sysIn3 (JC-3 Series only)

At the end of one cycle, when the robot returns to the work home or when the robot is set for continuous playback after the last point of the program is run, this setting is not used for the return movement from the last point to point 1.

TP MENU [Individual Program Settings]
[PTP Condition Number for Home]

PC [Program] → [Individual Program Settings] → [Work Home]
→ [PTP Condition Number for Home]

If there is no number set to [PTP Condition Number For Home], the work home movement is made according to the [Individual Program Settings] → [PTP Condition] settings.

If [PTP Condition Number For Home] is set with the number “0,” this is shown as no settings made.

5. WORK HOME

The work home is the point to where the robot returns and waits for the next start command after running the last point of the program with 1 Cycle Playback.
The work home is the point to where the robot returns and waits for the next start command after running the last point of the program with continuous playback only if the Last Work command (#sysIn11 (JR3000), #sysIn13 (JC-3/JS3) is ON. You can set point job data and additional function data to the work home, just as you do for typical points.

TP MENU [Individual Program Settings]
[Work Home]

Press the CURSOR ◁ key on point 1 (P1) to display the work home.

PC [Program] → [Individual Program Settings] → [Work Home]

5.1 Point Type

We recommend to set the [PTP Point] for the Work Home point type.
NOTE:

- Other point types can also be set, but errors may occur when running.
- If a [CP Start Point] has been set, do not set [CP Arc Point] as the next point. Errors may occur when running.

5.2 Point Job Data and Additional Function Data

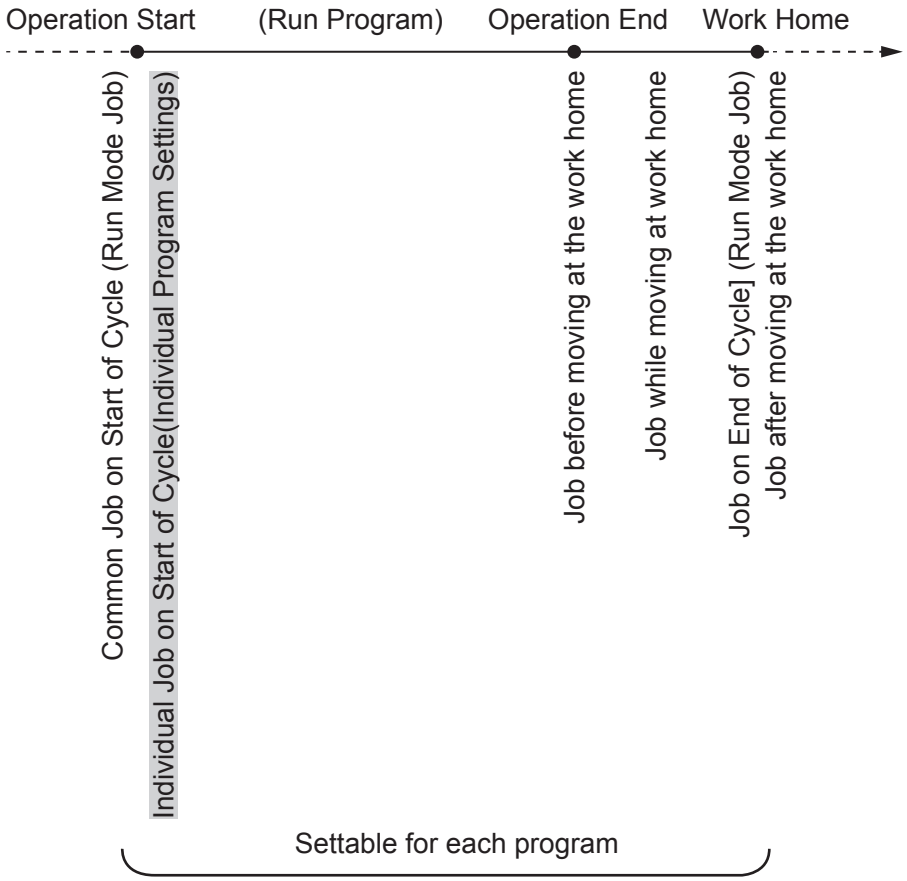
A [Job after Moving] set to the work home is performed at the work home position coordinates only when the tool center point is on the work home position after a cycle of operation.
[Job before Moving] and [Job while Moving] set to the work home are performed when returning to the work home from the last point after a cycle of operation. [Job while CP Moving] set to the work home is performed repeatedly as the robot moves from the work home position to the next point (Point 1). Depending on the point type you set, the point job data and additional point data you can set may vary (refer to the table below).

(✓: Can be set, blank: Cannot be set)

Point Job Data / Additional Function Data / Point Type	Job before Moving	Job while Moving	Job while CP Moving	Job after Moving	PTP Condition Number	CP Condition Number	Tool Number	Pallet Routine Number	Execute Condition	Work Adjustment Number	Tag Code
Work Home (PTP Point)	✓	✓		✓	✓		✓	✓	✓	✓	✓
Work Home (CP Start Point)	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓

6. INDIVIDUAL JOB ON START OF CYCLE

[Individual Job on Start of Cycle] is performed when a run of the set point job data number starts. Unlike the Run Mode job [Common Job on Start of Cycle]; different kinds of point job data can be set to each program using [Individual Job on Start of Cycle]. For more information regarding run mode jobs, refer to the operation manual *Functions III (All Program Common Settings / PLC Programs)*. Jobs are performed in the following order:



TP MENU [Individual Program Settings]
[Individual Job on Start of Cycle]

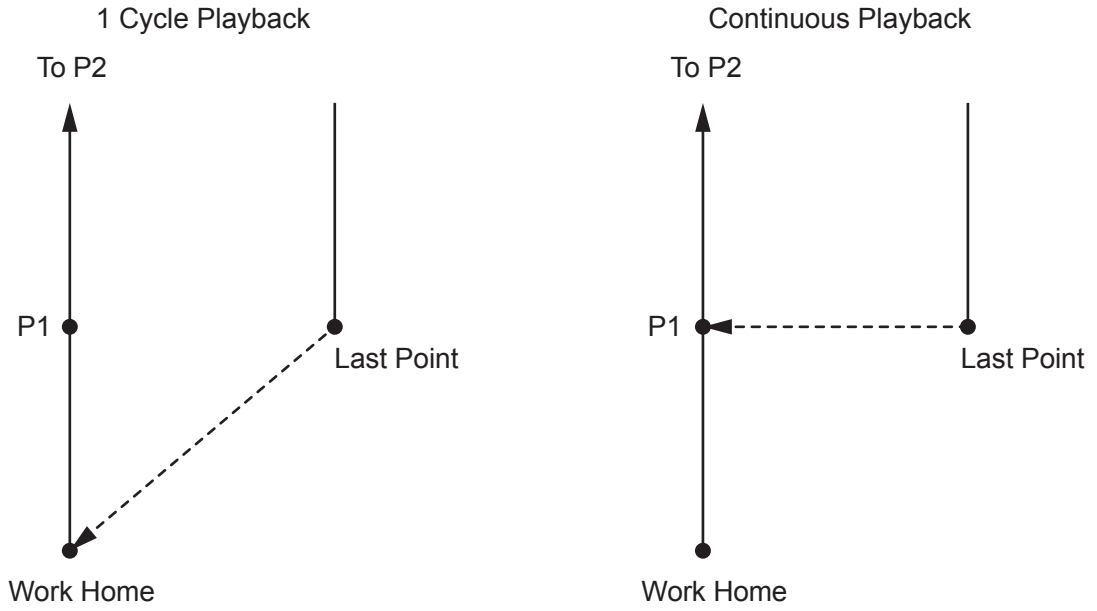
PC [Program] → [Individual Program Settings] → [Individual Data]
→ [Individual Job on Start of Cycle]

7. CYCLE MODE

A run type method is called Cycle Mode. There are two [Cycle Mode] types:

■ 1 Cycle Playback
After running the last point in the selected program, the robot returns to the work home and stops operation.

■ Continuous Playback
After running the last point in the selected program, the robot returns to point 1 and the run repeats. If a Last Work command (#sysIn11 for JR3000 Series, #sysIn13 for JC-3/JS3 Series) is ON when the robot runs the last point in the program, the robot returns to the work home position and stops operation.



If you select [Continuous Playback], the program data [Job before Moving], [Job while Moving] and [Job after Moving] set to the work home are performed only when the robot returns to the work home by the last work command.

TP MENU [Individual Program Settings]
[Cycle Mode]

PC [Program] → [Individual Program Settings] → [Individual Data] → [Cycle Mode]

8. PTP CONDITION (PROGRAM DATA)

PTP Conditions (Program Data) are condition settings for movement between points (PTP movements) in a program. If you modify the PTP conditions (Program Data), all of the PTP speeds and arch motions for that program are modified.
If you wish to make a modification between specific points, teach the additional function data [PTP Condition] and set it to the points you want.

TP MENU [Individual Program Settings]
[PTP Condition]

NOTE: When the bottommost item shown is highlighted, press the CURSOR ▽ key to display the other settable items for that point.

PC [Program] → [Individual Program Settings] → [PTP Condition]

8.1 JR3000/JC-3 Series

There are the following settings for PTP conditions. These settings are enabled during PTP movement.
NOTE: With the JC-3 series, the maximum speed varies depending on the XY stroke.

■ PTP Speed
This is the speed limit for PTP movement. It is definable as a percentage of the maximum speed (1 – 100 %).
The maximum speed for the JR3200 series is 700 mm/s when neither tool nor workpiece is connected, for the JR3300 – JR3600 series it is 900 mm/s (for both X and Y axes) and for the JC-3 series it is 800 mm/s (for both X and Y axes) with the 2 and 3 axis specifications and 800 mm/s (for both X and Y axes) with the 4 axis specifications. However, only use this as reference, as the maximum PTP speed may vary depending on the connected tool, workpiece mass, or stroke length and the distance between points.
Note that [PTP Speed] sets the limit to keep the robot from exceeding that speed when it runs. This does not necessarily mean that the robot runs at that speed when making PTP movement.

■ R-Axis Rotate Speed
This is the speed limit for R-axis rotation in PTP movement. It is definable as a percentage of the maximum speed (1 – 100 %) (only available for 4 axis specification models). When no tools are connected the maximum speed is 600 deg/sec for the JR3200 series, 900 deg/sec for the JR3300 – JR3600 series and 900 deg/sec for the JC-3 series.
Also, if the R-axis cannot complete its rotation before reaching the next point at its set [R-Axis Rotate Speed], the PTP speed reduces to allow the R axis to complete its rotation

■ R-Axis Acceleration

This is the acceleration or deceleration speed limit to rotate or stop the R-axis in PTP movement. It is definable as a percentage of the maximum acceleration (1 – 100 %). (Only available for 4-Axis specification models)

■ Relative Mode/Absolute Mode

These are the settings for the arch motion method. Choose either of the following two modes:

- Relative Mode
  Z-Axis movement is specified in terms of the distance from a certain point. For example, you can designate the Z-Axis to ascend 10 mm from a given point.
- Absolute Mode
  Z-Axis movement is specified in terms of absolute coordinates. For example, you can designate the Z-Axis to ascend to the coordinate Z=20, regardless of the point's height.

If you select [Relative Mode], the other Z-Axis movement related items are [Z Move Height], [Z Up Distance], and [Z Down Distance]. If you select [Absolute Mode], the other Z-Axis movement related items are [Horizontal Move Pos'n], [Start Horizontal], and [Start Down Pos'n].

■ Z Move Height/Horizontal Move Position

- Z Move Height
  Vertical distance between the [Horizontal Move Position] and either the start or the end point, depending on which is higher.
- Horizontal Move Position
  Z axis coordinates where the tool unit moves horizontally in PTP movement.

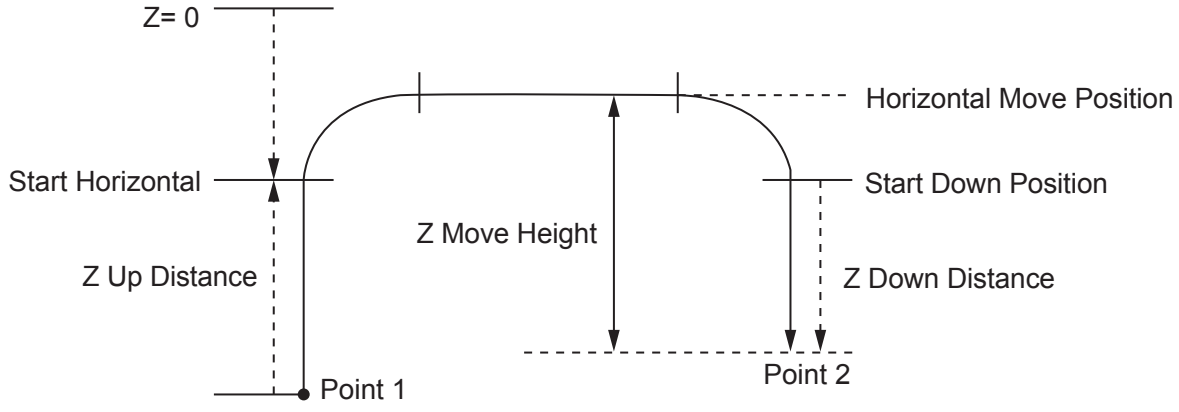
■ Z Up Distance or Start Horizontal

- Z Up Distance: Ascending distance of the Z-axis with the X and Y-axes static.
- Start Horizontal: Z-axis coordinate of the position where an X or Y movement starts.

■ Z Down Distance or Start Down Position

- Z Down Distance: Descending distance of the Z-axis with the X and Y-axes constant
- Start Down Position: Z-axis coordinate of the position where the Z-axis starts to descend after X and Y movements finish.

Arch Motion of a PTP Movement



8.2 JS3 Series

There are the following 14 settings for PTP conditions.

- J1 Speed Limit
- J1 Acceleration Limit
- J2 Speed Limit
- J2 Acceleration Limit
- J3 Speed Limit
- J3 Acceleration Limit
- J4 Speed Limit
- J4 Acceleration Limit

NOTE: The speed limit/acceleration limit for the above 8 settings is set as a percentage (%).

- Relative Mode/Absolute Mode

  These are the settings for the arch motion method. Choose either of the following two modes:

  - Relative Mode

    Z-Axis movement is specified in terms of the distance from a certain point. For example, you can designate the Z-Axis to ascend 10 mm from a given point.
  - Absolute Mode

    Z-Axis movement is specified in terms of absolute coordinates. For example, you can designate the Z-Axis to ascend to the coordinate Z=20, regardless of the point's height.

If you select [Relative Mode], the other Z-Axis movement related items are [Z Move Height], [Z Up Distance], and [Z Down Distance]. If you select [Absolute Mode], the other Z-Axis movement related items are [Horizontal Move Pos'n], [Start Horizontal], and [Start Down Pos'n].

- Z Move Height/Horizontal Move Position
  - Z Move Height

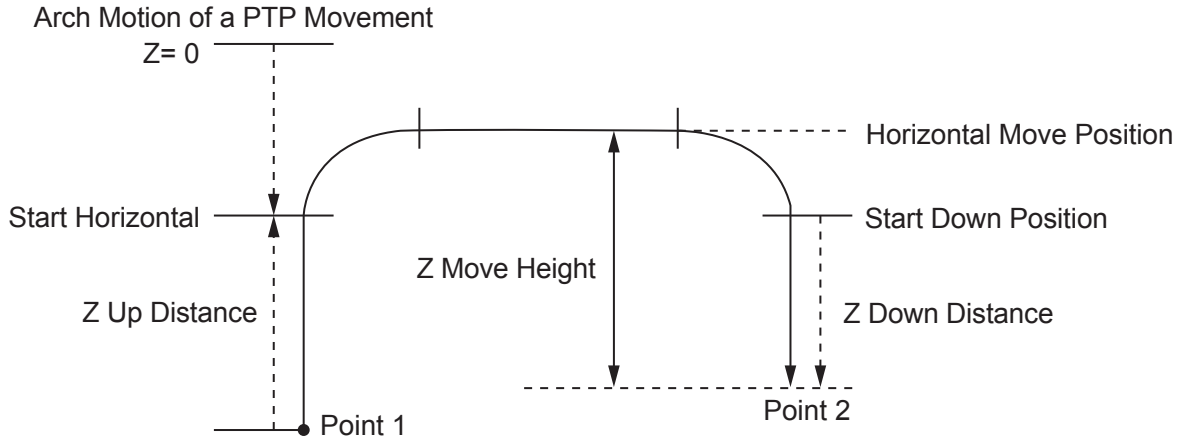
    Vertical distance between the [Horizontal Move Position] and either the start or the end point, depending on which is higher.
  - Horizontal Move Position

    Z axis coordinates where the tool unit moves horizontally in PTP movement.

- Z Up Distance or Start Horizontal
  - Z Up Distance: Ascending distance of the Z-axis with the X and Y-axes static.
  - Start Horizontal: Z-axis coordinate of the position where an X or Y movement starts.

■ Z Down Distance or Start Down Position

- Z Down Distance: Descending distance of the Z-axis with the X and Y-axes constant
- Start Down Position: Z-axis coordinate of the position where the Z-axis starts to descend after X and Y movements finish.



■ Finish Mode

You can select how the robot judges where to finish the PTP movement from among the following five settings:

Finish Signal : The robot judges that PTP movement is done and moves to the next operation when the [Driver Finish] signal comes ON.

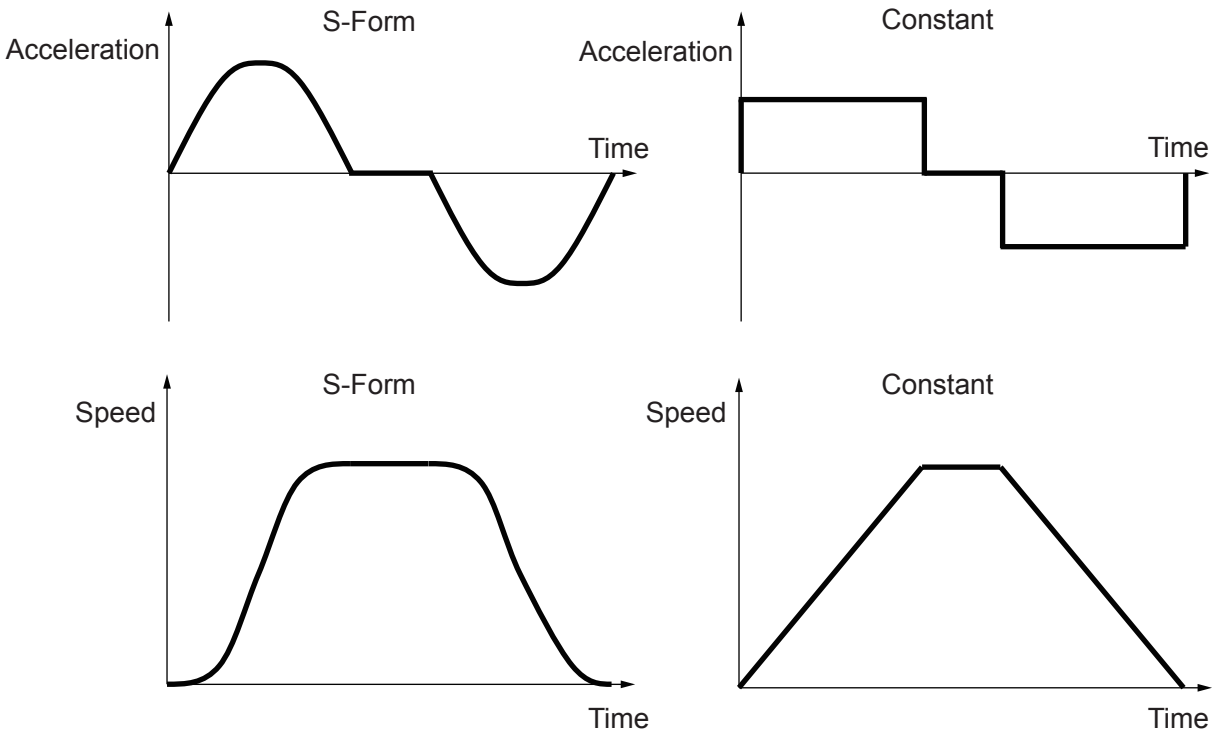
Area 3 :
Area 2 :
Area 1 :
When the encoder read position (the current motor coordinates) relative to the command position (target coordinates of the pulse movement) enters the range indicated below, the PTP movement is determined finished and the robot moves to the next operation.

	JS3-3520			JS3-4520			JS3-5520		
	XY (J1J2) [mm]	**Z (J3) [mm]**	**R (J4) [deg]**	**XY (J1J2) [mm]**	**Z (J3) [mm]**	**R (J4) [deg]**	**XY (J1J2) [mm]**	**Z (J3) [mm]**	**R (J4) [deg]**
Area 1	1.743	0.781	0.781	1.988	0.781	0.781	2.233	0.781	0.781
Area 2	0.436	0.195	0.195	0.497	0.195	0.195	0.558	0.195	0.195
Area 3	0.109	0.049	0.049	0.124	0.049	0.049	0.140	0.049	0.049

Pulse Output: When the command pulse (pulse instructed movement) completes the output to the driver, the robot determines the PTP movement is finished and moves to the next operation.

■ Acceleration Mode

You can select either [S-Form] or [Constant]



If you change the Acceleration Mode without changing the [PTP Speed], the arrival time to the target coordinates will be approximately the same. With [S-Form] (Ap), the robot moves at a peak acceleration of π /2=1.57 in comparison to [Constant] (Ac). If the acceleration time is expressed as Tu and the arrival speed is expressed as Vm, the rate of velocity (A(t) and the speed V (t) can be shown as follows:

A(t) = Ac Constant

A(t) = Ap*sin(ωt) S-Form

$\omega = \pi$ /Tu

Ap = (π /2)*Ac

V(t) = Ac*t = Vm* (t/Tu) Constant

V(t) = (Vm/2)*(1-cos(ωt)) S-Form

Note that the initial speed is calculated as V0=0 for the above calculation. However, this is not entirely true with actual robot operations, as there is a slight initial speed.

9. CP CONDITION (PROGRAM DATA)

CP conditions (Program Data) are condition settings for movement between points (CP movement) in a program. If you modify CP conditions (Program Data), all of the CP speeds and acceleration speeds for that program are modified.
If you want to modify the CP speed or acceleration between specific points, teach the additional function data [CP Condition] and set it to the desired points.

There are the following settings for CP conditions. [CP Speed] (the speed during CP movement) is not included in [CP Condition]. Set the CP speed directly to each CP point.

- ■ CP Acceleration : Acceleration when making a CP movement.
  Definable as a percentage of the maximum acceleration (1 – 150 %).
- ■ R-Axis Rotate Speed (4-axis specification models only) : R-axis rotation speed in a CP movement. Definable as a percentage of the maximum speed (1 – 150 %) (1 – 100 % for auxiliary axis function robots). When no tools are connected the maximum speed is 600 deg/sec for the JR3200 series, 900 deg/sec for the JR3300 - JR3600 series, 900 deg/sec for the JC-3 series and 2500 deg/sec for the JS3 series. Also, if the R axis cannot complete its rotation before reaching the next point at its set [R-Axis Rotate Speed], the CP movement slows to allow the R axis to complete its rotation. If using a CP passing point to rotate the R-axis and change the direction the tool is facing without moving the tool in an X or Y direction, the R-axis rotates at the maximum speed according to [R-Axis Rotate Speed]. If the TCP is set when the robot is performing this operation, the motor may step out. If the motor steps out, lower the R-axis rotation speed as needed.
- ■ R-Axis Acceleration (4-axis specification models only) : R-axis acceleration in CP movements.
  Specified in terms of the maximum acceleration (1 – 150 %) (1 – 100 % for auxiliary axis function robots).

TP MENU [Individual Program Settings]
[CP Condition]

NOTE: When the bottommost item shown is highlighted, press the CURSOR ▽ key to display the other settable items for that point.

PC [Program] → [Individual Program Settings] → [CP Condition]

10. TOOL DATA

Tool data is used to set the characteristics of each tool attached to the robot. If tool data is set according to the characteristics for tools such as the needle (dispensing syringe) or screwdriver, camera, and height sensor, you can point each of the tool tips to the same location on a workpiece by simply switching among the tool data.

Tool data consists of settings for specifying the tool mass and the TCP. The TCP (tool center point) is position related information for the tool tip. The TCP values are calculated differently for 3 axis specifications and 4 axis specifications. The TCP values for 3 axis specifications are calculated according to the difference between the current tool tip position and the standard tool tip position. For 4 axis specifications, the TCP is calculated according to the distance from the R axis center to the tool tip.

Also, when using the additional function data [Tool Data], you can change tool data at intervals between specific points. For example, it is possible to change the registered tool mass settings for only the period of time it is gripping something.

10.1 JC-3 Series (2-Axis Model), JR3000/JC-3 Series (3-Axis Model)

The following settings are in [Tool Data]:

- Tool Mass (the mass affecting the Y axis)
- TCP-X: The X direction distance from the tool tip during teaching to the current tool tip
- TCP-Y: The Y direction distance from the tool tip during teaching to the current tool tip
- TCP-ΔZ: The Z direction distance from the tool tip height during teaching to the current tool tip height.

NOTE: 2 axis specifications do not have the TCP-ΔZ setting.

The offset value for the offset from the tool tip is referred to as the tool center point (TCP).

■ Tool Mass

This [Tool Mass] refers to the total mass of the tool and of the object which the tool is holding. Make sure this mass is equal to or lower than the registered mass.

NOTE: The JC-3 Series does not have this settable item.

Model	Tool Mass Menu Item			
	1	2	3	4
JR3203	1 kg	3.5 kg		
JR3303 – JR3603	1 kg	4 kg	7 kg	
JR3303F, JR3403F	1 kg	5 kg	10 kg	15 kg

Model	Tool Mass (Fixed Value)			
JC-3	2 Axes Single Sided	2 Axes Double Sided	3 Axes Single Sided	3 Axes Double Sided
	4 kg	8 kg	4 kg	8 kg

NOTE: Mount tools so the center of gravity is within 50 mm of the attachment surface.

⚠ Caution

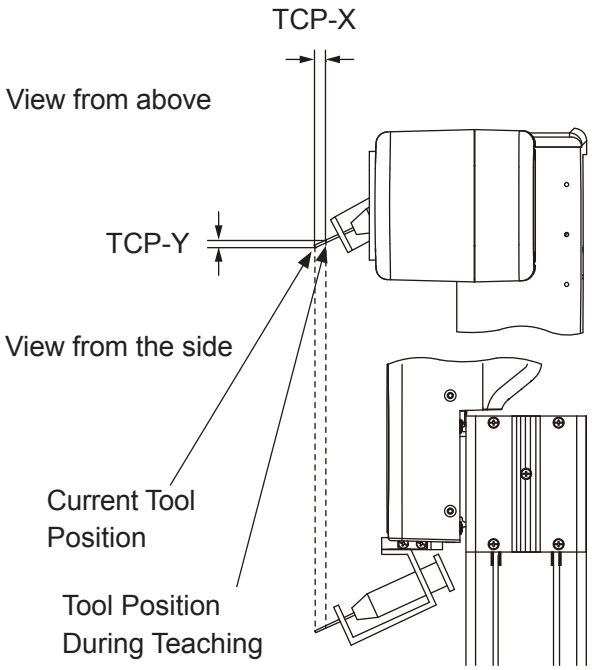
If the tool mass is heavier than the registered settings, a position error may occur.

■ TCP-X, TCP-Y

For 3 axis and 2 axis specifications, set TCP-X and TCP-Y with the offset from the teaching tool position and the current tool position (the offset amount for the X direction and Y directions).

With [Direct TCP-XY Setting], you can automatically calculate (subtract) and set the offset by indicating a registered point when changing tools during teaching.

For 3 axis and 2 specifications, you do not need to set the TCP-X and TCP-Y in advance. Teach with the 0,0 setting as is, and if there is a tool tip offset when you change tools, etc., set that difference for the first time then.



Example: JR3000 Series

■ TCP-deltaZ

After changing tools etc., if the tool height is different from the registered tool center point position, enter the Z-direction difference to TCP-deltaZ.

10.2 JR3000/JC-3 Series (4-Axis Model)

The following settings are in [Tool Data]:

- Tool Mass (mass affecting the Y axis)
- TCP-X: The X direction distance from the R axis center to the tool tip.
- TCP-Y: The Y direction distance from the R axis center to the tool tip.
- TCP-deltaZ: The Z direction distance from the tool tip height during teaching to the current tool tip height.

The offset value for the offset from the tool tip is referred to as the tool center point (TCP).

■ Tool Mass

[Tool Mass] refers to the total mass of the tool and of the object which the tool is holding. Make sure this mass is equal to or lower than the registered mass. The settings are as follows:

Model	Tool Mass		
	1	2	3
JR3204	1 kg	3.5 kg	
JR3304 – JR3604	1 kg	4 kg	7 kg

Model	Tool Mass
JC-3 Series	4 Axes Double Sided
	3 kg

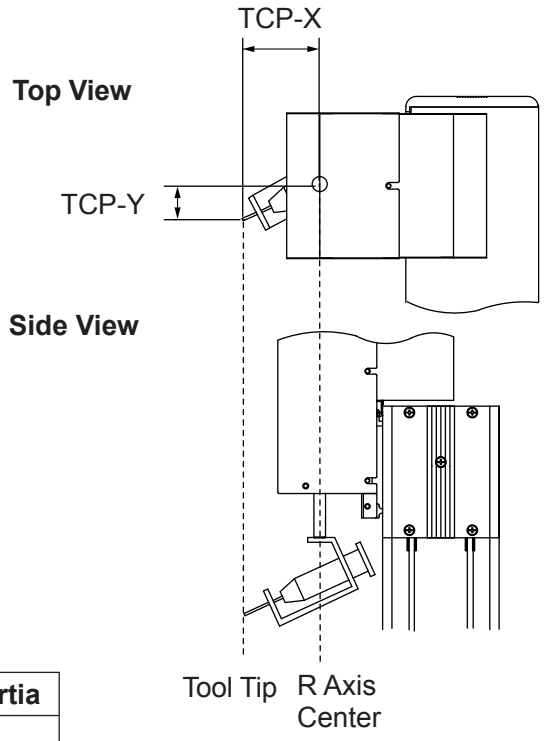
⚠ Caution

If the tool mass is heavier than the registered settings, a position error may occur.

■ TCP-X, TCP-Y

The TCP (tool center point) is the X and Y direction distance from the R axis center to the tool tip.
With [Direct TCP-XY Setting], you can automatically calculate and set the [TCP-X] and [TCP-Y] values by indicating the same point twice with the tool tip (from different R-axis angles).
For 4 axes specifications, make sure to set tool data (TCP-X, Y) before teaching programs. If you perform program teaching etc. without setting tool data, you will have to repeat teaching all of the coordinates whenever you change tools.

If the tool tip exceeds the acceptable moment of inertia, a position error may occur.



Example: JR3000 Series

Model	Acceptable Moment of Inertia
JR3204	65 kg/m^2
JR3304 – JR3604	90 kg/cm^2

Model	Acceptable Moment of Inertia
JC-3	4 Axes Double Sided
	90kg/cm^2

■ TCP-ΔZ

After changing the tool etc., if the tool tip height is different from the registered tool center point position, enter the Z-direction difference to TCP-ΔZ.

10.3 JS3 Series (4-Axis Model)

The following settings are in [Tool Data]:

- Tool Mass (mass affecting the Y axis)
- TCP-X: The X (J1) direction distance from the R (J4) axis center to the tool tip.
- TCP-Y: The Y (J2) direction distance from the R (J4) axis center to the tool tip.
- TCP-deltaZ: The Z (J3) direction distance from the tool tip height during teaching to the current tool tip height.

The offset value for the offset from the tool tip is referred to as the tool center point (TCP).

■ Tool Mass

[Tool Mass] refers to the total mass of the tool and of the object which the tool is holding. Make sure this mass is equal to or lower than the registered mass. The settings are as follows:

Model	Tool Mass		
	1	2	3
JS3	1 kg	3 kg	6 kg

⚠ Caution

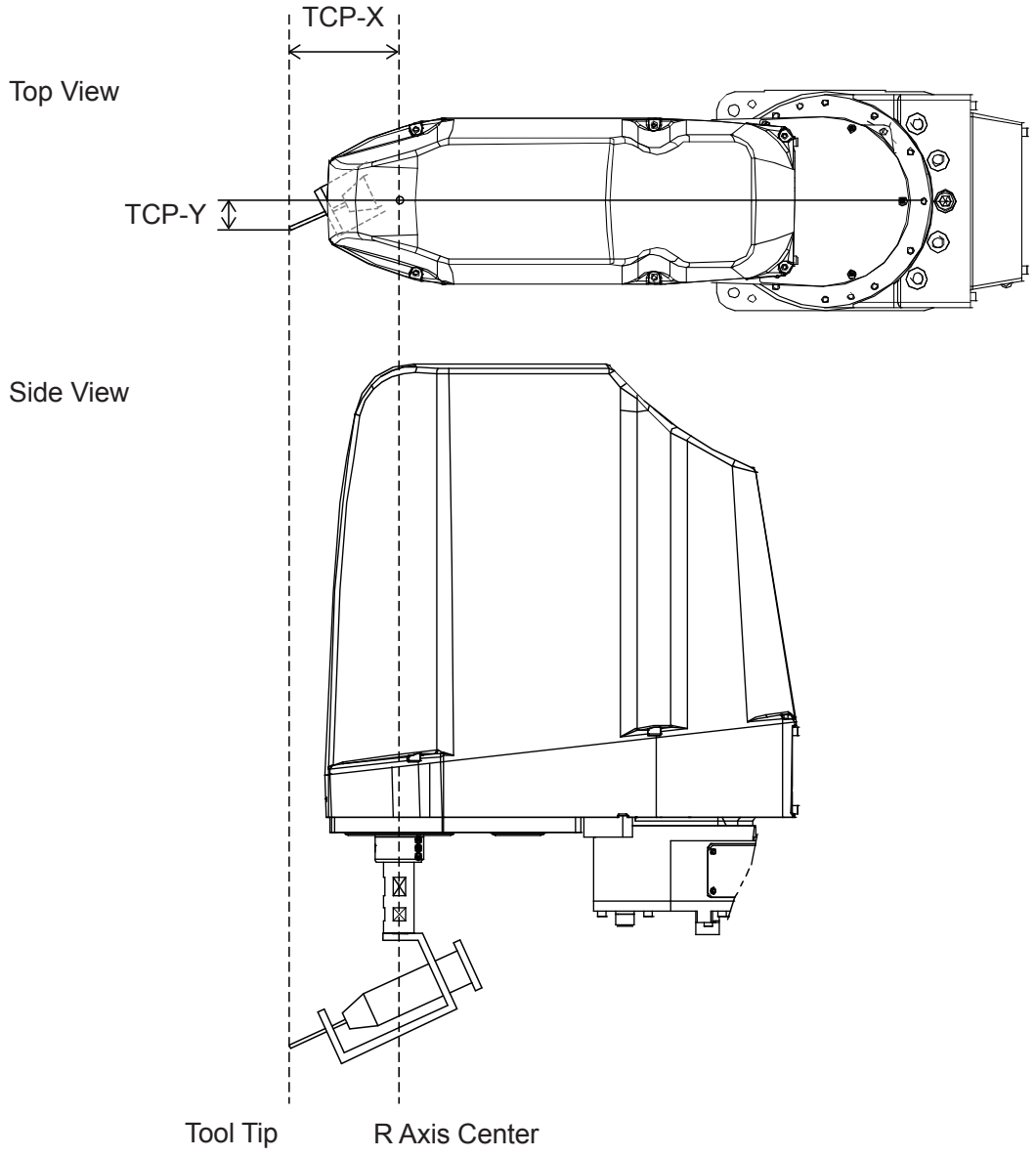
If the tool mass is heavier than the registered settings, a position error may occur.

■ TCP-X, TCP-Y

The TCP (tool center point) is the X (J1) and Y (J2) direction distance from the R (J4) axis center to the tool tip. With [Direct TCP-XY Setting], you can automatically calculate and set the [TCP-X] and [TCP-Y] values by indicating the same point twice with the tool tip (from different R (J4) axis angles).

For 4 axis models, make sure to set tool data (TCP-X, Y) before teaching programs. If you perform program teaching etc. without setting tool data, you will have to repeat teaching all of the coordinates whenever you change tools.

If the tool exceeds the acceptable moment of inertia (0.12 kg/cm^2), a position error may occur.



■ TCP-ΔZ
After changing the tool etc., if the tool tip height is different from the registered tool center point position, enter the Z-direction difference to TCP-ΔZ.

10.4 Main Tool Configuration

The main tool refers to the primary tool used in job content and for jobs.
Tool data for the main tool needs to be set according to the job content and application.

For example, the syringe needle nozzle is considered the “main tool” with dispensing applications, and the screwdriver is considered the “main tool” with screw tightening applications. Furthermore, tools such as a camera or height sensor used for adjusting positions of point jobs that use the main tool are not considered the “main tool.”

Set the tool data for the main tool (TCP, etc.,) in [Main Tool Configuration].

TP MENU [Main-Tool Configuration] → [Main TCP Setting]

PC Refer to the operation manual *PC Operation*.

The tool data set in [Main Tool Configuration] can be applied to points used in program runs.
The tool data set in [Main-Tool Configuration] is automatically set to point types. These point types are as follows:

- PTP Point
- CP Start Point *
- PTP Evasion Point
- Circle Start Point *
- Wait Start Point

* The tool data is applied from the start point through to the end position of the CP movement.

For details regarding point teaching for application models which are not standard application models, refer to the operation manual pertaining to that application.

11. CAMERA CONFIGURATION

NOTE: This is under development for the JS3 Series.

The camera refers to a camera used for adjusting the positions of main tool point jobs in program runs. Configure the camera when you want to make position adjustments using a camera during program runs.

Set tool data and other such settings for the camera in [Camera Configuration].
For details regarding [Camera Configuration], refer to “1.3.6 Workpiece Adjustment Settings 2: Calibration (Match up the Robot and Camera Positioning)” in the operation manual *Camera and Sensor Functions* or “9.2 Camera Configuration” in the operation manual *PC Operation*.

12. MOVE AREA LIMIT

You can make settings so that it is not possible for robot axes to move past certain coordinates. This is referred to as the “Move Area Limit”. You can set a move area limit for each program. If the robot exceeds the move area limit during operation, an error occurs and the run stops. Also, even in Teaching Mode you cannot move the robot to coordinates outside of the selected program’s [Move Area Limit] using the JOG keys.

NOTE: The move area limit does not apply to MDI position entry.
For position entry using this mode, select UTILITY [Test Menu] → [Check Data] after point teaching. This checks to see if there are any coordinates outside the move area limit.

The following items are included in [Move Area Limit]:

JR3000/JC-3 Series	JS3 Series
X Upper Limit	X (J1) Upper Limit (J1 axis + rotation limit)
Y Upper Limit	X (J1) Lower Limit (J1 axis - rotation limit)
Z Upper Limit	Y (J2) Upper Limit (J2 axis + rotation limit)
R Upper Limit	Y (J2) Lower Limit (J2 axis - rotation limit)
R Lower Limit	Z (J3) Upper Limit (J3 axis + rotation limit)
-	R (J4) Upper Limit (J4 axis + rotation limit)
-	R (J4) Lower Limit (J4 axis - rotation limit)

NOTE:

- The XYZ axis lower limits for JR3000/JC-3 Series and the Z (J3) axis lower limit for the JS3 Series are fixed at [0].
- For 3 axis models there is no R-axis move area limit.
- With the JS3 Series, if the X (J1) axis or Y (J2) axis positions coincide with the move area limit values, the “Position is out of range” error may occur.

TP MENU [Individual Program Settings]
[Move Area Limit]

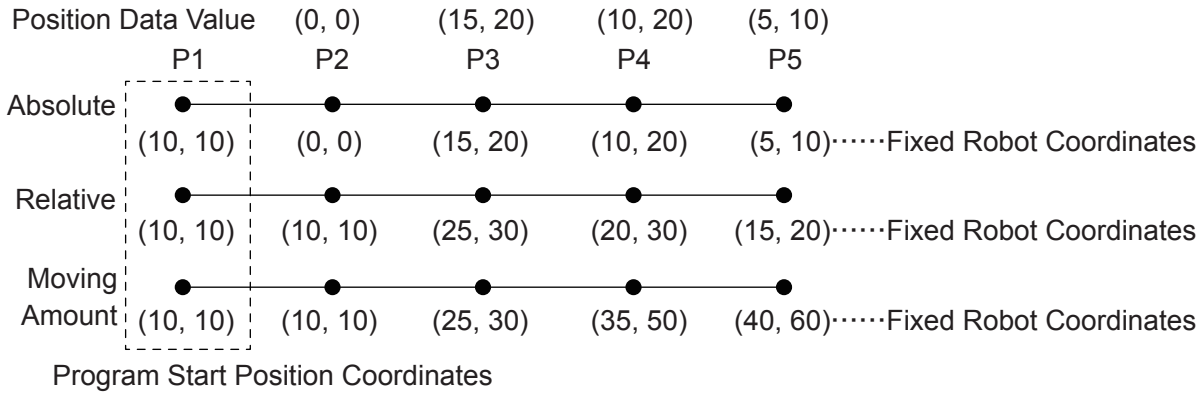
PC [Program] → [Individual Program Settings] → [Move Area Limit]

13. ABSOLUTE, RELATIVE & MOVING AMOUNT (POSITION DATA TYPES)

The handling of coordinates (position data) included in point data can be selected from among three types: [Absolute], [Relative], or [Moving Amount]. The default is set to [Absolute].

- Absolute: Handles position data values as indicators of the robot's fixed coordinates.
- Relative: Handles position data values as indicators of the distance from the coordinates at the start of a program.
  (If the start position coordinates are (0,0), the result is the same as [Absolute] coordinates.)
- Moving Amount: Handles position data values as indicators of the distance to the next point.

Depending on how position data is handled, the point positions the robot moves to can vary even if the numerical values are the same. (See below)



If you run a program as a subprogram, the robot will ignore the work home. Also, if [Relative] or [Moving Amount] is set in a program, the robot does not return to the work home.
The robot returns to the work home only when [Absolute] is set in a program and that program is performed independently, not by a callProg command.

TP MENU [Individual Program Settings]
[Position Data Type]

PC [Program] → [Individual Program Settings] → [Individual Data] → [Position Data]

You can set [Position Data Type] as a default all program common settings.

Customizing Mode

TP [Teaching Mode Customizing]
[All Program Common Default Settings]
[Position Data Type]

PC [Set T.M.C.] → [Default All Program Common Settings] → [Individual Data]
→ [Position Data]

You can convert a program created with [Absolute] coordinates to [Relative] coordinates (convert the coordinate values from point 1 to the last point into relative coordinate values.)

TP EDIT [Convert to Relative Coordinates]

PC [Edit] → [Convert to Relative Coordinates]

■ Teaching a [Relative] Program
When teaching points in JOG Mode, coordinates are taught as [Absolute] regardless of the position data settings.

When creating a program with [Relative] coordinates, after teaching, move (offset) all the points so that the coordinates of the first point are (0, 0, 0).

■ Teaching a [Moving Amount] Program
You cannot convert registered coordinates into [Moving Amount]. Do point teaching using MDI Mode entry.

NOTE: If you run a program separately without using the *callProg* command, the robot may step-out depending on the settings.

14. WORKPIECE MASS (JR3000 Series Only)

The workpiece mass equals the total weight carried by the X-Table.
If the total mass carried by the X-table exceeds 5 kg, set [Workpiece Mass] to [10 kg]; if the mass exceeds 10 kg, set [Workpiece Mass] to [15 kg]. The settings in the table below can be made.

Model	Workpiece Mass			
	1	2	3	4
JR3200	7 kg			
JR3300 – JR3600	5 kg	10 kg	15 kg	
JR3303F, JR3403F	5 kg	10 kg	15 kg	20 kg

NOTE:

- There is no [Workpiece Mass] entry for JR3200. It is fixed at 7 kg.
  For all other models, [Workpiece Mass] has a default of [5 kg].
- With the PC software (JR C-Points II Limited Edition) this item exists but cannot be modified.
- If the workpiece mass is heavier than its settings, a position error may occur.

Teaching Mode

TP MENU [Individual Program Settings]
[Workpiece Mass]

NOTE: When the bottommost item shown is highlighted, press the CURSOR ▽ key to display the other settable items for that point.

TP MENU [All Program Common Data]
[Workpiece Mass]

Customize Mode

[Teaching Mode Customizing]
[All Program Common Default Settings]
[Workpiece Mass]

PC [Program] → [Individual Program Settings] → [Workpiece] → [Workpiece Mass]

PC [Data] → [All Program Common Settings] → [Workpiece] → [Workpiece Mass]

PC [Set T.M.C] → [Default All Program Common Settings] → [Workpiece]
→ [Workpiece Mass]

15. COMMON DATA (JS3 Series Only)

These settings are common to all programs.
The common data menu item names and content varies depending on the application model of your robot. Also refer to the operation manual pertaining to the application model of your robot.

15.1 Evasion Points of Going Home

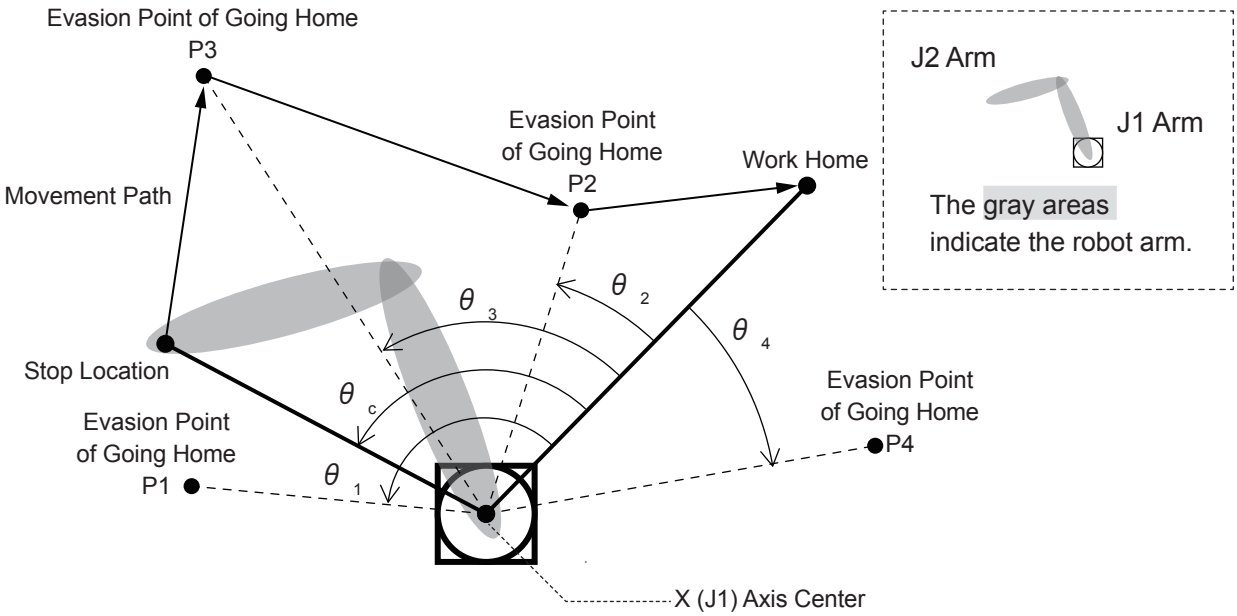
This function is for the JS3 Series only. JR3000N/JC-3 Series do not have this item.

If you stop the robot during operation (using the Urgent Stop signal, etc.) and turn ON the Go Home (#sysIn2) signal, the robot moves to the work home position from where it stopped.
You can specify the movement path to the work home position by setting points to [Evasion Points of Going Home]. This movement can be used to avoid obstacles, etc.

You can set multiple points (a maximum of 100 points) to [Evasion Points of Going Home]. The robot makes PTP movements to these points, and only the additional functions [PTP Conditions] and [Tool Data] are applied for these movements.

The movement order for the points set in [Evasion Points of Going Home] is determined by the angle closest to where the robot stopped, based on point angles from the X (J1) axis center. Accordingly, be aware that the movement order is not necessarily sequential to the point numbers (P1, P2, P3, etc.).
Also take note that the robot does not move to point angles further away from the work home position than where the robot stopped, and also does not move to point angles preceding the work home position.

■ Example



With this example, the point angles are calculated as " $\theta_c > \theta_3 > \theta_2$" and so consequently the robot moves to the work home in this order: "Stop Location → P3 → P2 → Work Home." The robot does not move to P1 and P4.

To start operation when the robot is stopped due to an emergency stop or the Stop signal, you need to turn ON the motor power through the Motor Power ON (#sysIn15) signal or the motor power ON switch on the operation box.

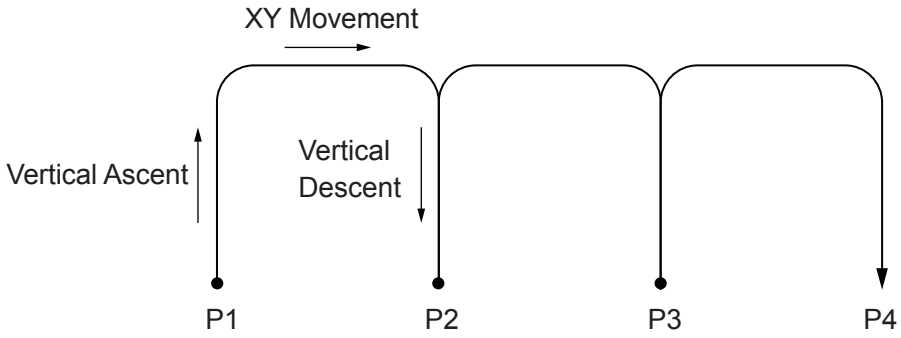
For further information regarding the Go Home (#sysIn2), Urgent Stop (#sysIn14), and the Motor Power ON (#sysIn15) signals, refer to the operation manual *External Control.*

TP MENU [Common Data Settings]
[Evasion Points of Going Home]

PC [Data] → [Common Data Settings] → [Evasion Points of Going Home]

16. PTP MOVEMENT

"PTP" stands for "Point to Point". The robot ascends vertically, moves in the X or Y direction, and descends vertically to the next point (arch motion).

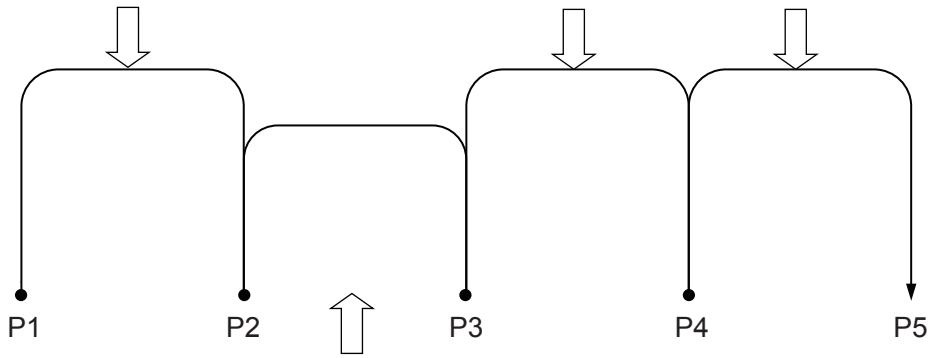


All axis movements are either PTP movements or CP movements, depending on the point type settings in point data. The robot will make a PTP movement to the next point from a [PTP Point] or [CP End Point].

16.1 PTP Point

This a point type where the robot makes a PTP movement to the next point.
You can set the PTP speed and the arc motion height etc., under [PTP Condition] in the program data. Any changes made in program data [PTP Condition] affect all PTP points in a program, except for points for which additional function data [PTP Condition] is set.

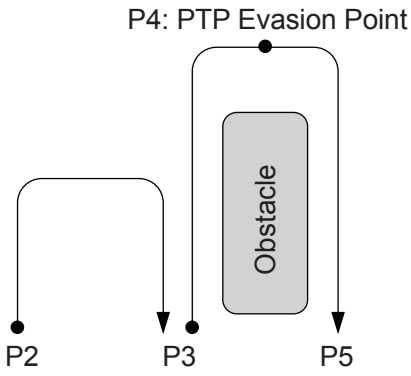
PTP movements according to [PTP Condition] settings in program data



A PTP movement according to [PTP Condition] settings in additional function data. (P2: an additional function data [PTP Condition] registered point.)

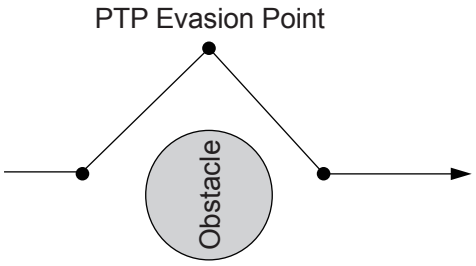
16.2 PTP Evasion Point

Set the point type [PTP Evasion Point] to evade any obstacles during movement to the next point. To evade moving upward (skip over an obstacle), you can also set the additional function data [PTP Condition].



To evade moving upwards

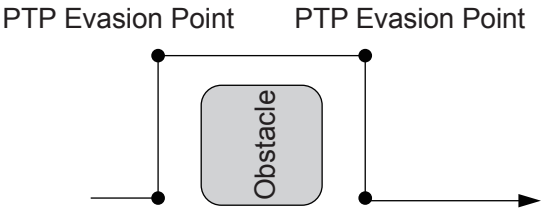
Side View



To evade moving sideways

Top View

You can set several PTP evasion points in succession.



To evade moving sideways

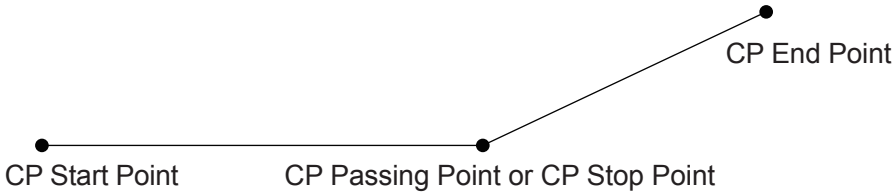
Top View

17. CP MOVEMENT

"CP" stands for "Continuous Path". Make "CP Movements" when you want to move the axis in a straight line or in an arc, or when you want to move without using an arch motion.
Axis movements are either PTP movements or CP movements, depending on the point type settings in point data.
The robot makes a CP movement from the point type [CP Start Point] to [CP End Point]. (The robot will make a PTP movement to the next point from a [CP End Point].)
[Circle Start Point] and [Circle Center Point] are also included in CP movements.

17.1 Linear Movement

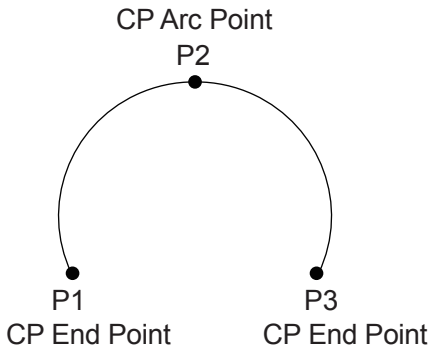
You can make a turn with straight lines as illustrated below if you set either a [CP Passing Point] or [CP Stop Point] between the [CP Start Point] and [CP End Point].



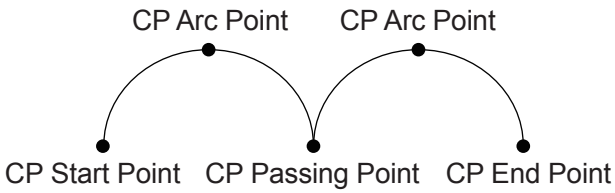
If you are using any of the following point types, you need to set a CP speed (line speed): [CP Start Point], [CP Passing Point], [CP Stop Point], [CP Arc Point], and [Circle Start Point].

17.2 Arc Movement

With a CP movement, you can move the robot in an arc.
Set [CP Start Point] → [CP Arc Point] → [CP End Point] to three consecutive points in that order. The robot moves on the arc created by these three points.



If you want to continue the CP movement and draw another arc, set [CP Passing Point] or [CP Stop Point] to the point instead of [CP End Point].

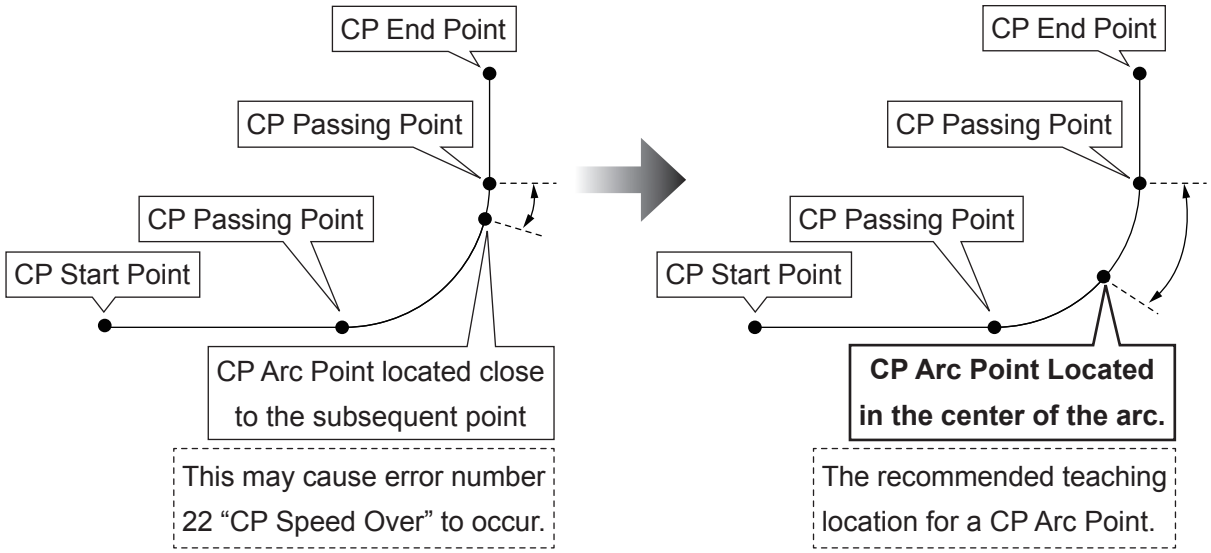


17.2.1 Countermeasures for the CP Speed Exceeded Error with a CP Arc Point

We recommend placing a CP Arc Point approximately in the middle of the arc.

If a CP Arc Point is placed too close to either the previous point or the subsequent point, error number 22 “CP Speed Over” occurs.

This is shown in the diagrams below:



In this example, the point coming after the CP Arc Point is a CP Passing Point, however this applies to all CP movements using a CP Arc Point, regardless of the point composition (i.e. even if a CP End Point or a CP Stop Point comes after a CP Arc Point).

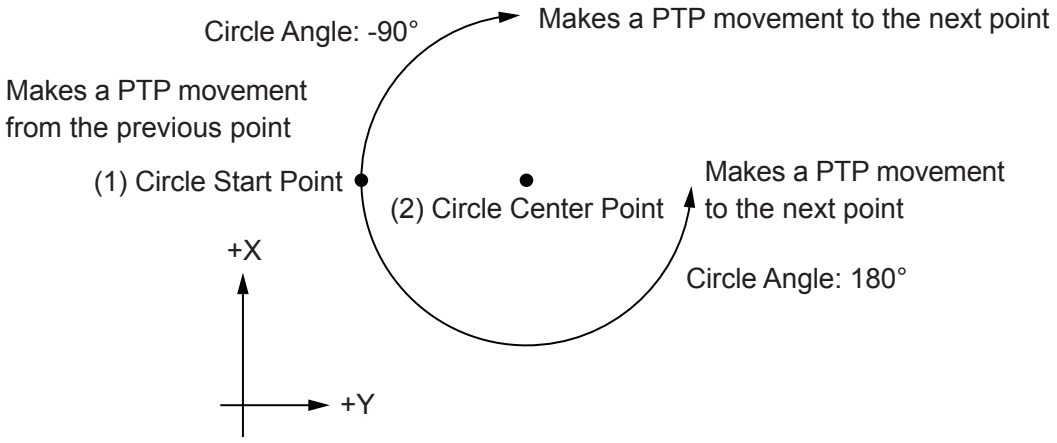
If error number 22 “CP Speed Over” occurs with CP movements that include a CP Arc Point, confirm the location of the CP Arc Point and relocate it as shown in the diagram above.
If the “CP Speed Over” error occurs even after relocating the CP Arc Point, reduce the Line Speed of the movement.

17.3 Circle Start Points and Circle Center Points

(1) Circle Start Point (2) Circle Center Point

By setting a circle start point → circle center point consecutively you can draw a circle or an arc (CP movement). Set [Line Speed] to the Circle Start Point and set [Circle Angle] to the Circle Center Point. If you set a workpiece adjustment, the Circle Start Point is offset together with the Circle Center Point.

For [Circle Angle] you can set up to ±9999.999° at units of 0.001°. If the value of [Circle Angle] is a positive number, the robot will draw a circle or an arc in a counterclockwise direction (when looking at the front of the robot from above) as illustrated below.



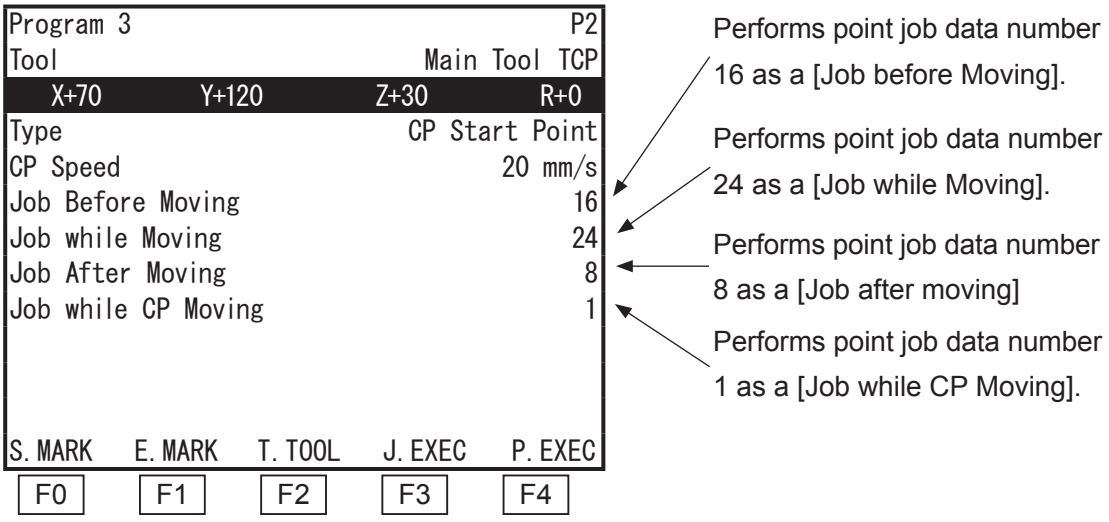
NOTE:

- If you use a Circle Start Point → Circle Center Point consecutively to draw a circle or an arc, the robot makes a PTP movement from the previous point to the circle start point and from the arc to the next point. If you want to make a CP movement from the previous point to the arc or circle or from the arc or circle to the next point, use a CP Arc Point.
- Make sure you always register a Circle Start Point and a Circle Center Point in consecutive order. If you set any other point other than a Circle Center Point directly after a Circle Start Point, an error occurs.

  Since the robot makes a PTP movement to the next point after an arc, an error occurs if a CP Passing Point, CP End Point, or CP Arc Point is set directly after a Circle Center Point. Also, since the robot makes a PTP movement from the previous point to the arc, an error occurs if the previous point is a CP Start Point, CP Passing Point or CP Arc Point.

18. POINT JOBS

Point job data is a set of commands and/or logical operations performed at points.
Set point data with point job data numbers and when you run the robot it does the point job data set to those numbers. You can set up to four point jobs to one point: [Job before Moving], [Job while Moving], [Job after Moving] and [Job while CP Moving], which are each executed with separate timing.



Point Settings Screen Example

■ Point Job Data Creation

TP MENU [Point Job Settings]

PC [Data] → [Point Job]

After creating point job data, set that number to points you want with that point job.

T P CURSOR ▽ (Move to a blank line.)
[Job before Moving]
[Job while Moving]
[Job after Moving]
[Job while CP Moving]

P C (Main screen) [Job before Moving], [Job while Moving], [Job after Moving],
[Job while CP Moving]

■ Settable Points

(✓: can be set, blank: cannot be set)

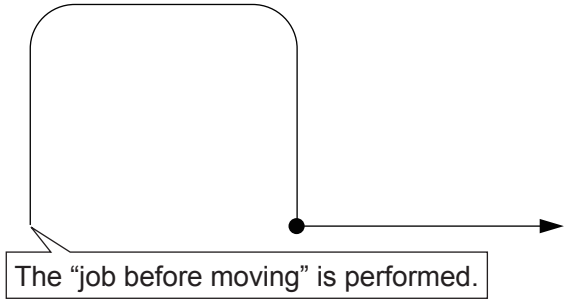
Point Type / Point Job	PTP Point	CP Start Point	CP Passing Point	CP Stop Point	CP Arc Point	CP End Point	PTP Evasion Point	Circle Start Point	Circle Center Point	Single Camera Shoot Point	Multi Camera Shoot Point	Double Camera Shoot Point 1	Double Camera Shoot Point 2	Wait Start Point	Work Home (PTP Point)	Work Home (CP Start Point)
Job before Moving	✓	✓						✓		✓	✓	✓	✓	✓	✓	✓
Job while Moving	✓	✓						✓		✓	✓	✓	✓	✓	✓	✓
Job after Moving	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Job while CP Moving		✓		✓				✓								✓

18.1 Job Before Moving

This is a point job done before starting to move to the set point. After performing the point job at the previous point, the robot performs the “job before moving”, and then starts moving. If the previous point is a PTP Evasion Point, the robot performs the point job one more point previous, before starting to move to the PTP Evasion Point.
If you set the Job before Moving to the work home, the point job is performed before the robot returns to the work home from the last point at the end of an operation cycle.

Example: [Job Before Moving] Is set to the [CP Start Point]

Indicates the point to where the job before moving is set.

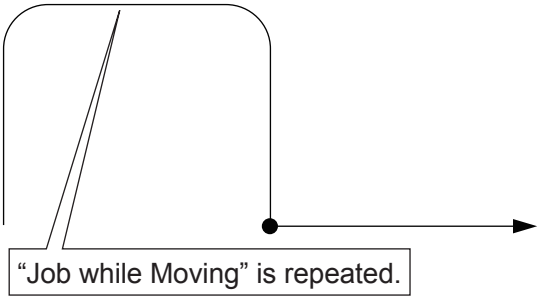


18.2 Job While Moving

This is a job which is executed when the robot starts moving from the previous point to the set point, and the robot repeatedly executes this job until it reaches that set point. When the robot reaches the point, it terminates the point job even if it is in the middle of doing it. If the previous point is a PTP Evasion Point, the robot repeatedly executes the point job one more point previous to the PTP Evasion Point, from the time it starts moving to the time it reaches the PTP Evasion Point.
If Job while Moving is set to the work home, the point job is performed before the robot returns to the work home from the last point at the end of an operation cycle.
Do not use Job while Moving in combination with move commands, such as *goPoint* and *lineMove*, because Job while Moving is performed while the robot is moving.

Example: [Job while Moving] is set to a CP Start Point.

Indicates the point where [Job before Moving], and [Job while Moving] are set.

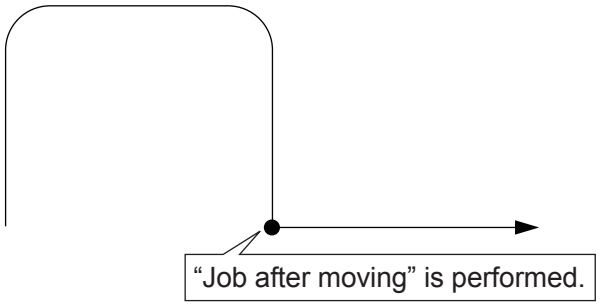


18.3 Job After Moving

This is a job done after the robot reaches the set point. After performing the point job, the robot moves to the next point.
If a point job is set to the work home, it is performed only when the tool center point is at the work home position at the end of an operation cycle.

Example: [Point Job] Is Set to a CP Start Point

Indicates the point where [Job Before Moving], [Job While Moving], and [Job after moving] are set.

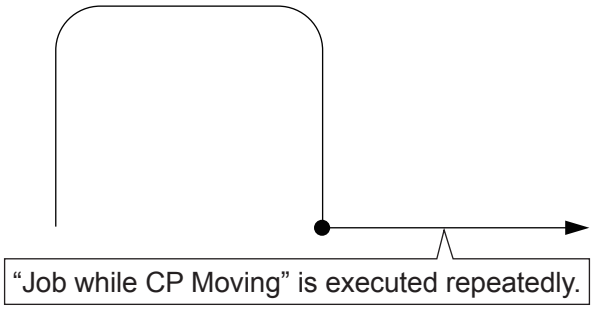


18.4 Job While CP Moving

This is a job which is executed repeatedly while the robot makes a CP movement from the set point to the subsequent [CP End Point] or [CP Stop Point]. When the robot reaches the subsequent point, it terminates the point job even if it is in the middle of doing it.
Do not use [Job while CP Moving] in combination with move commands, such as goPoint and lineMove, because Job while CP Moving is performed while the robot is moving.

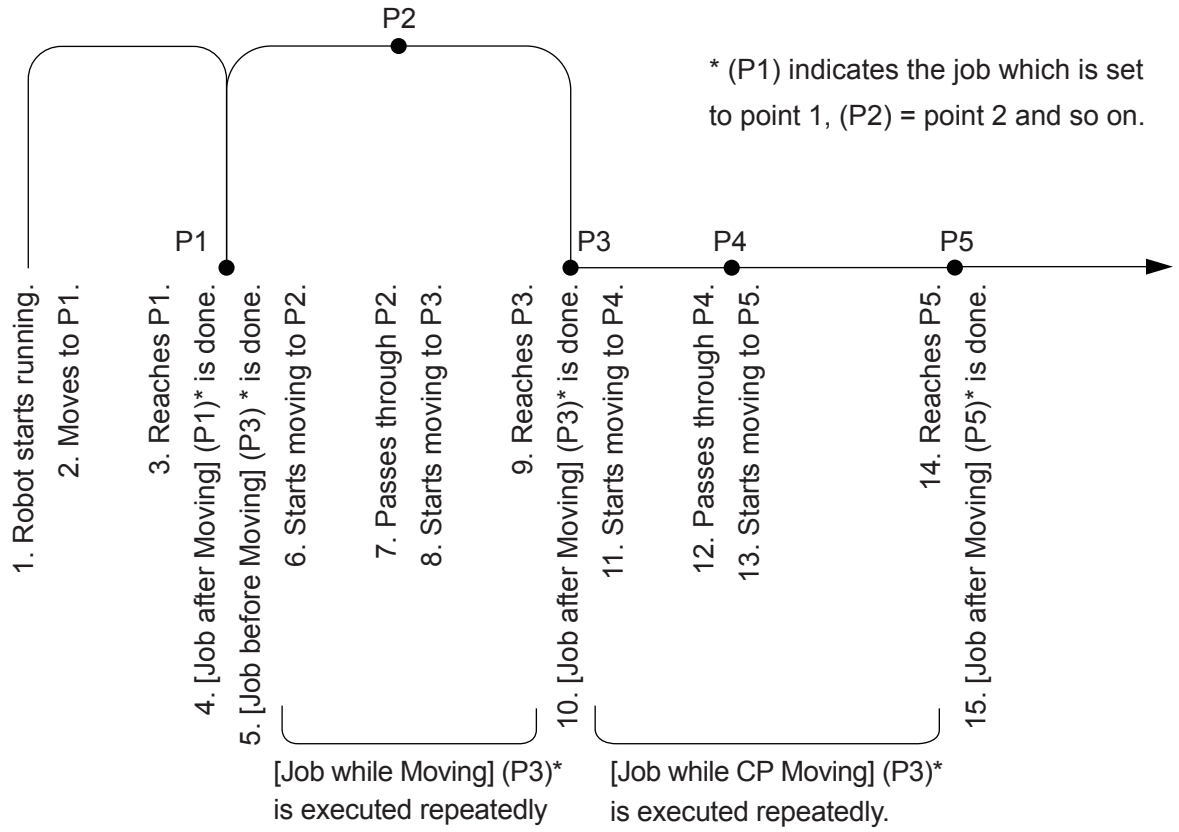
Example: [Job while CP Moving] is set to a CP Start Point.

Indicates the point where [Job before Moving], [Job while Moving], [Job after Moving], and [Job while CP Moving] are set.



If point types such as the ones below are in succession, the various point jobs are performed in a sequence such as the diagram below.

P1: PTP Point
P2: PTP Evasion Point
P3: CP Start Point
P4: CP Passing Point
P5: CP Stop Point

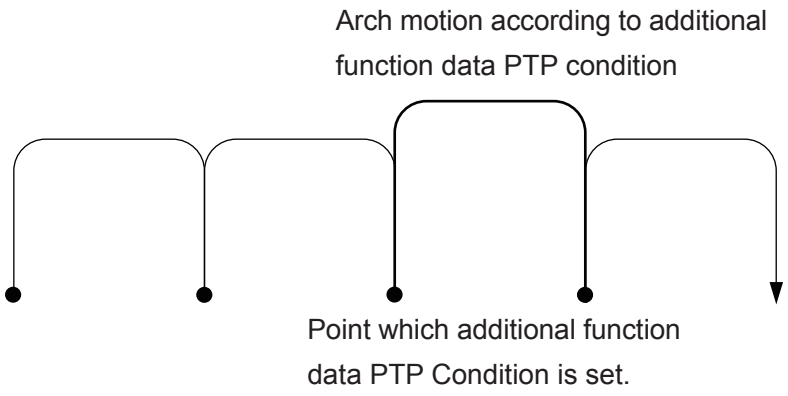


If [Job before Moving] is set to the point immediately after a PTP Evasion Point, the robot starts the Job Before Moving when it starts moving from the point before the PTP Evasion Point. In the example on the previous page, “Job before Moving” set to P3 is executed repeatedly during movement from P1 to P3.
A Job while CP Moving is executed repeatedly until the robot reaches a CP End Point/CP Stop Point. It goes through the CP Passing Point/CP Arc Point while performing the point job. In the example above, Job while CP Moving set to P3 is executed repeatedly during movement from P3 to P5.

19. PTP CONDITION (ADDITIONAL FUNCTION DATA)

If you want to change the speed between only certain points in one program, or change the arch motion height etc., create the additional function data [PTP Condition] and set it to the point for which you want to change conditions. The robot obeys to the registered additional function data PTP conditions only when moving between the registered point and the next point, instead of the program data PTP conditions. The contents of additional function data PTP conditions are exactly the same as program data PTP conditions.

For PTP movements to points which [PTP Condition] in additional function data are not set, the robot makes PTP movements according to [PTP Condition] in all program data.



TP MENU [Additional Function Data Settings]
[PTP Condition Settings]

PC [Data] → [Additional] → [PTP Condition]

NOTE: Even if you change program data PTP conditions, additional function PTP conditions set to points in that program are not changed.

After creating an additional function data PTP condition, set that number to points to which you want to assign those conditions.

TP CURSOR ▽ (Move to a blank line.)
[PTP Condition Number]

PC (Main screen) [PTP Condition No.]

■ Settable Points

(✓: can be set, blank: cannot be set)

Point Type / Point Job	PTP Point	CP Start Point	CP Passing Point	CP Stop Point	CP Arc Point	CP End Point	PTP Evasion Point	Circle Start Point	Circle Center Point	Single Camera Shoot Point	Multi Camera Shoot Point	Double Camera Shoot Point 1	Double Camera Shoot Point 2	Wait Start Point	Work Home (PTP Point)	Work Home (CP Start Point)
PTP Condition No.	✓					✓	✓		✓	✓	✓	✓	✓	✓	✓	

20. CP CONDITION (ADDITIONAL FUNCTION DATA)

If you want to change acceleration between only certain points in one program, create the additional function data [CP Condition] and set it to the point for which you want to change conditions.
The contents of additional function data CP conditions are exactly the same as program data CP conditions.
If you set an additional function data CP condition to a CP Start Point or CP Stop Point, the robot moves according to the additional function data CP conditions until it reaches the next CP End Point or CP Stop Point. When moving from a CP Start Point/CP End Point to which [CP Condition] in additional function data is not set, the robot makes a CP movement according to [CP Condition] in all program data.

TP MENU [Additional Function Data Settings]
[CP Condition Settings]

PC [Data] → [Additional] → [CP Condition]

NOTE: Even if you change program data CP conditions, additional function CP conditions set to points in that program are not changed.

After creating an additional function data [CP Condition], set that number to points to which you want to assign those conditions.

TP CURSOR ▽ (Move to a blank line.)
[CP Condition Number]

PC (Main screen) [CP Condition No.]

■ Settable Points

(✓: can be set, blank: cannot be set)

Point Type / Point Job	PTP Point	CP Start Point	CP Passing Point	CP Stop Point	CP Arc Point	CP End Point	PTP Evasion Point	Circle Start Point	Circle Center Point	Single Camera Shoot Point	Multi Camera Shoot Point	Double Camera Shoot Point 1	Double Camera Shoot Point 2	Wait Start Point	Work Home (PTP Point)	Work Home (CP Start Point)
CP Condition No.		✓		✓				✓								✓

21. POINT TOOL DATA SETTINGS (ADDITIONAL FUNCTION DATA)

If you want to change the tool unit or the tool tip position between only certain points in the same program, or if the tool mass changes during a pick-and-place operation, set the additional function data [Point Tool Data Settings] to the first point of those certain points.

TP MENU [Additional Function Data Settings]
[Point Tool Data Settings]

PC [Data] → [Additional] → [Tool Data]

There are two methods to create [Point Tool Data Settings]; [Numeric TCP] and [Set TCP by Camera]. Refer to the operation manual *Camera and Sensor Functions* for information regarding [Set TCP by Camera].

[Numeric TCP] contains the following settings:

- Tool Mass
- Point Tool TCP (3-axis specifications only)
- TCP-X
- TCP-Y
- TCP-ΔZ
- Direct TCP-XY Settings

For details regarding the settable items [Tool Mass], [TCP-X], [TCP-Y], [TCP-deltaZ], and [Direct TCP-XY Settings] refer to “10. TOOL DATA.”

■ Point Tool TCP (3-axis specifications only)
You can select and set [Preference] or [Adding] with [Point Tool TCP].
If set to [Preference], the robot gives priority to the Additional Function Data [Point Tool Data Settings] over the (main) [Tool Settings].
If set to [Adding], the robots adds the Additional Function Data [Point Tool Data Settings] to the (main) [Tool Settings] values.

After creating the additional function data [Point Tool Data Settings], set that number to points to which you want to assign this tool data.

T P CURSOR ▽ (Move to a blank line.)
[Tool Number]

P C (Main screen) [Tool Number]

You can set [Point Tool Data Settings] to the following point types:

(✓: can be set, blank: cannot be set)

Point Type / Point Job	PTP Point	CP Start Point	CP Passing Point	CP Stop Point	CP Arc Point	CP End Point	PTP Evasion Point	Circle Start Point	Circle Center Point	Single Camera Shoot Point	Multi Camera Shoot Point	Double Camera Shoot Point 1	Double Camera Shoot Point 2	Wait Start Point	Work Home (PTP Point)	Work Home (CP Start Point)
Tool Number	✓	✓						✓		✓	✓	✓	✓	✓	✓	✓

22. PALLET ROUTINE DATA SETTINGS

When placing objects in the same location or at regular intervals (PTP points), or when systematically drawing lots of patterns (CP start points), create a [Pallet Routine] and set it to those points. (Note that the way the pallet is used differs when setting it to a CP start point and a PTP point.)
The pallet is offset against a position with a counter, and as the counter advances, the offset value changes.

TP MENU [Additional Function Data Settings]
[Pallet Routine Data Settings]

PC [Data] → [Additional] → [Pallet Routine]

Also, you can assign names to the pallets. Press the EDIT key on the Pallet Routine Data settings screen. The Name Editing screen will appear.

After creating the additional function data [Pallet Routine Data Settings], set that number to points to which you want to assign this pallet routine.

TP CURSOR ▽ (Move to a blank line.)
[Pallet Routine Number]

PC (Main screen) [Pallet Routing No.]

■ Settable Points

(✓: can be set, blank: cannot be set)

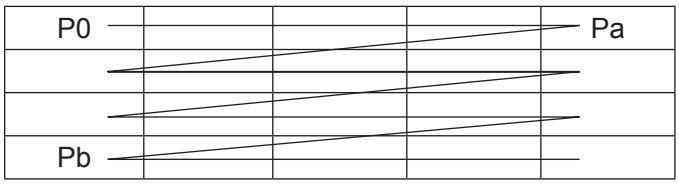
Point Type / Point Job	PTP Point	CP Start Point	CP Passing Point	CP Stop Point	CP Arc Point	CP End Point	PTP Evasion Point	Circle Start Point	Circle Center Point	Single Camera Shoot Point	Multi Camera Shoot Point	Double Camera Shoot Point 1	Double Camera Shoot Point 2	Wait Start Point	Work Home (PTP Point)	Work Home (CP Start Point)
Pallet Routine No.	✓	✓					✓	✓		✓	✓	✓	✓	✓	✓	✓

22.1 Pallet Routine Types

These are the following seven pallet types:

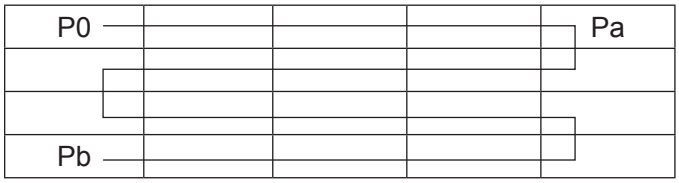
1. Plane Top Return Pallet

   The [Plane Top Return Pallet] is a pallet routine that moves to the start of the next column in the series. (two-dimensional repetition): 5 Rows, 4 Columns (Example)

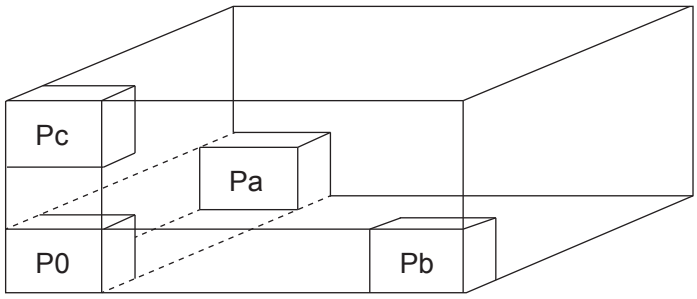


2. Plane Turn Pallet

   The [Plane Turn Pallet] is a pallet routine that moves to a job in the same column when moving to the next column in the series.
   (two-dimensional repetition): 4 Columns, 5 Rows (Example)



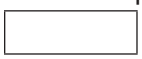
3. Cubic Pallet (three-dimensional repetition): 4 Rows, 5 Columns, 6 Tiers (Example)



4. Row (one-dimensional repetition): 5 Rows (Example)

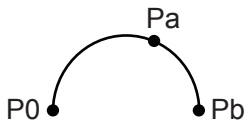
P0				Pa

5. 1 Point Repeat (zero-dimensional repetition)

   For 1 point repeat, the point coordinates themselves become the pallet job points.

6. Circle Pallet (two-dimensional repetition)



7. Repeat By Camera
   This is a pallet which the camera uses. For further details, refer to the operation manual *Camera & Sensor Functions*.

22.2 Parameters

Depending on the pallet routine type, there are parameters that can or cannot be set.
In addition to these parameters, you need to select either [Auto Increment] or [Increment by Point Job] for all pallet routines.
With [Auto Increment], the pallet counter increases automatically in increments of one. With [Increment by Point Job], you need to set commands in the point job data to update the pallet counter.

Pallet Routine Type	**Parameter**						
Plane Top Return Pallet	Row	Column		P0	Pa	Pb	
Plane Turn Pallet	Row	Column		P0	Pa	Pb	
Cubic Pallet	Row	Column	Tier	P0	Pa	Pb	Pc
Row	Row			P0	Pa		
1 Point Repeat	(Repeat) Times						
Circle Pallet	(Repeat) Times		Step Angle	P0	Pa	Pb	

P0, Pa, Pb, and Pc are coordinates to calculate the distance between the job points. Each coordinate in the pallet is obtained by adding in the values (offset values) you get from the following formulas to the point coordinates.

(Pa - P0) / (Value of Row - 1) x Value of Row counter
(Pb - P0) / (Value of Column - 1) x Value of Column counter
(Pc - P0) / (Value of Tier - 1) x Value of Tier counter

For example, if you set the following pallet to Point 01 (X: 50, Y: 20, Z: 30),
Pallet Routine Type: Row (5 Rows)

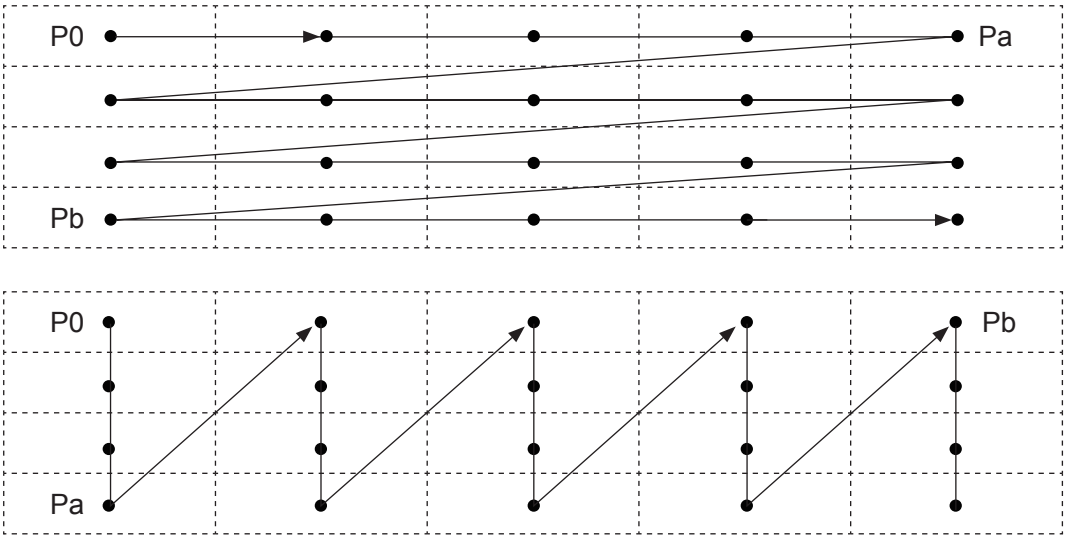
P0 X: 10 Y: 100 Z: 0				Pa X: 110 Y: 100 Z: 0

The actual job points are as follows:
Pallet Routine Type: Row (5 Rows)

Row 1	Row 2	Row 3	Row 4	Row 5	
X: 50	X: 75	X: 100	X: 125	X: 150	50+(110-10)/(5-1)*C
Y: 20	Y: 20	Y: 20	Y: 20	Y: 20	20+(100-100)/(5-1)*C
Z: 30	Z: 30	Z: 30	Z: 30	Z: 30	30+(0-0)/(5-1)*C

Although the P0, Pa, Pb, and Pc coordinates themselves are not used, they are necessary because the distances between the points are used to calculate the coordinates of each job point in the pallet. In other words, any numbers can be set to the coordinates of P0, Pa, Pb, and Pc as long as the distances among them are the same.

The order of job points in the pallet varies according to the settings for the coordinates P0, Pa, Pb etc. as shown below.



You can also use P0, Pa, Pb etc. to set an inclined pallet.

22.3 Pallet Routine Commands at Point Jobs

There are two types of pallet control functions; [Auto Increment] that updates the counter automatically (the robot progresses along the sequence to the next point in the pallet) and [Increment by Point Job] that does not update the counter (the robot does not move to the next point in the pallet) unless the point job is set to renew the counter. You can switch between these two types. With [Auto Increment], you do not need any point job command to control the pallet. The robot progresses sequentially to the next point in the pallet and the pallet counter is updated automatically. When the pallet counter is at maximum, the robot moves to the next point (if [Pallet Routine] is set to Point 03, the robot moves to Point 04).

There are three types of pallet routine commands:

- loopPallet (LOOP)
  Adds 1 to the pallet counter. If the counter does not reach maximum value, the robot moves to the specified point.
- resPallet (RESET)
  Resets the pallet counter to 0.
- incPallet (INCREMENT)
  Adds 1 to the pallet counter.

For example, the following two commands get the same result:
Add 1 to the Pallet 10 counter. When the counter is at maximum, the robot proceeds to the next command.
If it is not at maximum, the robot moves to Point 03.

With LOOP

```
loopPallet 10, 3
```

Without LOOP

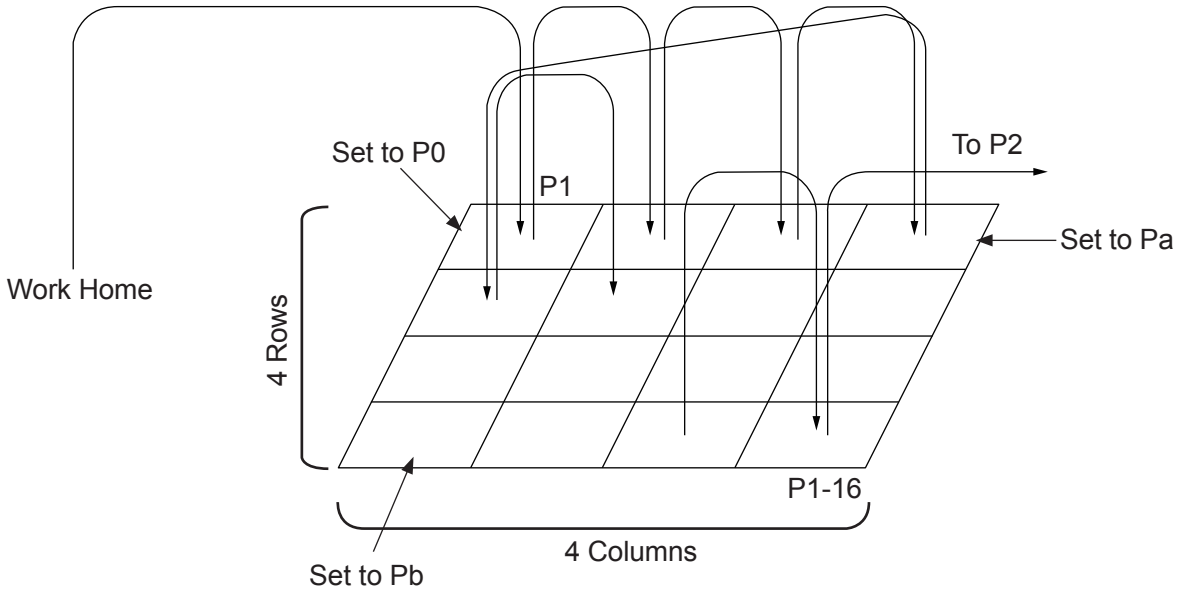
```
incPallet 10
if
  ld #palletFlag (10)
else
  goPoint  PTP0, 3
endIf
```

22.4 PTP Point Pallet Routine

When you want to place objects in the same location or at regular intervals etc., set [Pallet] to PTP point(s).

For example, if you set an [Auto Increment] pallet to a PTP point, the robot will move as illustrated below.

1. Teach [Pallet Routine].
2. Set the [Pallet Routine] number to point data.



Pallet Routine Type: Plane Top Return Pallet
Counter Control: Auto Increment
Rows: 4
Columns: 4

TP MENU [Additional Function Data Settings]
[Pallet Routine Data Settings]

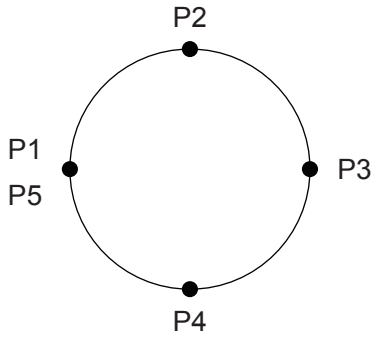
PC [Data] → [Additional] → [Pallet Routine]

After creating the additional function data [Pallet Routine], set that number to points to which you want to assign this pallet routine.

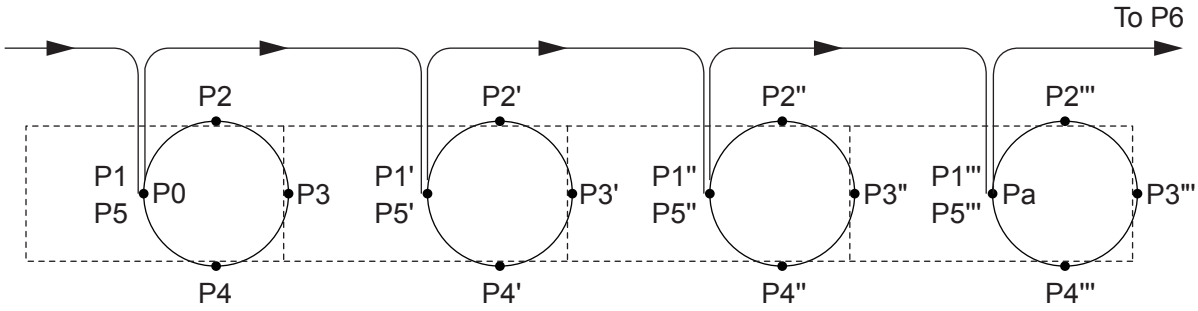
22.5 CP Start Point Pallet Routine

Register the following points P1 – P5, and then set [Pallet Routine] to P1 (CP Start Point).

P1: CP Start Point (start of dispensing)
P2: CP Arc Point
P3: CP Passing Point
P4: CP Arc Point
P5: CP End Point (end of dispensing)



If you set an [Auto Increment] pallet to a [CP Start Point], the robot will move as illustrated below. The robot recognizes CP Start Point – CP End Point as one pattern and repeats the operation as many times as there are pallets.



Pallet Routine Type: Row
Counter Control: Auto Increment
Row: 4

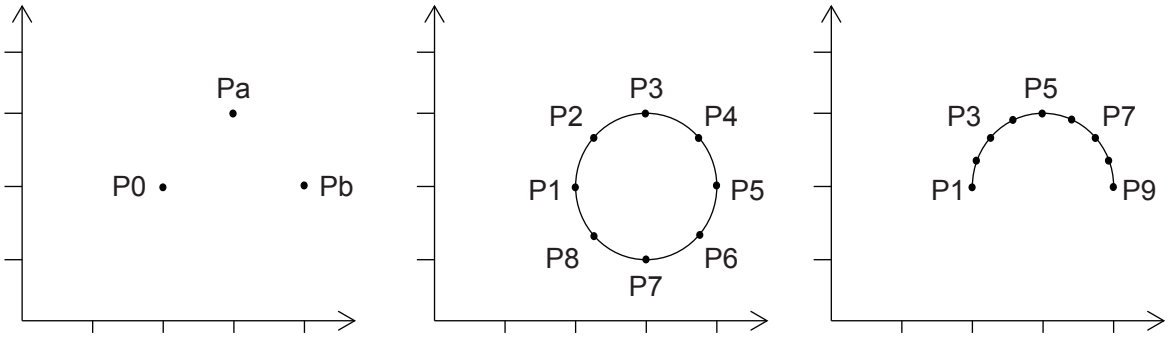
TP MENU [Additional Function Data Settings]
[Pallet Routine Data Settings]

PC [Data] → [Additional] → [Pallet Routine]

After creating the additional function data [Pallet Routine], set that number to the points to which you want to assign the pallet routine.

22.6 Circle Pallet

If you select [Circle Pallet] from the additional function data [Pallet Routine], you can use arc and circle pallets.
Designate three points to determine the circle size and execution sequence, and you can divide the circle up with the setting [Times].
Also, you can make the circle into an arc pallet if you change [Step Angle].



Example: Sequence: P0 → Pa → Pb direction
If Pa and Pb are switched, the sequence becomes P0 → Pb → Pa.

Example: Times: 8
Step Angle: 45

Example: Times: 9
Step Angle: 22.5

TP MENU [Additional Function Data Settings]
[Pallet Routine Data Settings]

PC [Data] → [Additional] → [Pallet Routine]

After creating the additional function data [Pallet Routine], set that number to the points to which you want to assign the pallet routine.

22.7 Pallet Pick-and-Place Operation

Example 1: How to place an object on a pallet

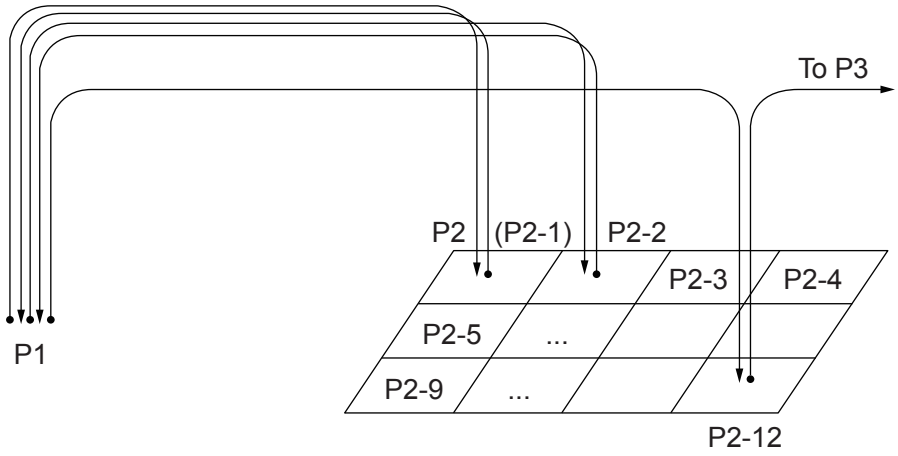
The tool unit picks up an object at Point 01 (P1) and places it on the pallet set to Point 02 (P2), then the robot moves to the next point (P3) once the pallet is at maximum.

Register the pallet routine according to the following procedures:

1. Pallet Teaching.
2. Point Job Data Teaching.
3. Set the [Pallet Routine] number to point data.
4. Set the [Point Job] number to the job after moving number in point data.

The [Pallet Routine] settings are as follows:

Pallet Number: 10
Pallet Type: Plane Top
Return Pallet
Counter Control: Increment by
Point Job, Row: 4, Column: 3



The tool unit is connected according to the following settings:

Pick: #genOut1(I/O-1) is ON.

Place: #genOut1(I/O-1) is OFF.

Point Job Data 15

set #genOut1	Pick.

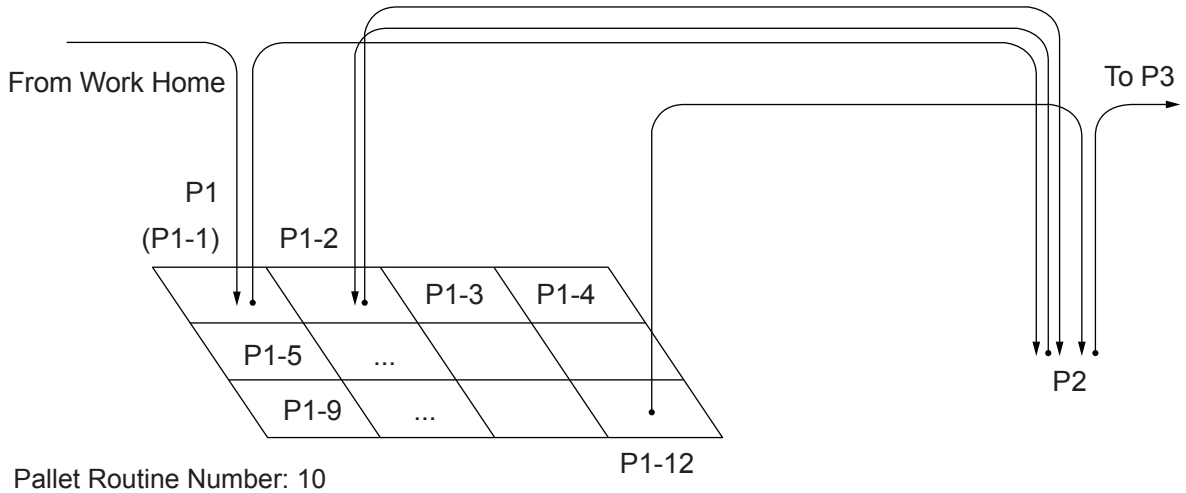
Point Job Data 16

reset #genOut1	Place (Release).
loopPallet 10, 1	Add 1 to the Pallet 10 counter. Once the counter is at maximum, the robot proceeds to the next command (in this example, the point job is over because there are no more commands). If the counter is not at maximum, the robot moves to Point 01 (P1).

Registered Job and Additional Function	
Point 01 (P1)	Point 02 (P2)
Point Job Number 15	Point Job Number 16 Additional Function Pallet No. 10

Example 2: How to pick up an object from the pallet

The tool unit picks up an object on the pallet set to Point 01 (P1) and places it on Point 02 (P2). If all the objects are picked up and placed, the robot moves to the next point (P3).



Pallet Routine Number: 10
Pallet Routine Type: Plane Top Return Pallet
Counter Control: Increment by Point Job
Row: 4
Column: 3

Point Job Data 5

set #genOut1	Pick.

Point Job Data 6

reset #genOut1	Place (Release).
loopPallet 10, 1	Add 1 to the Pallet 10 counter. If the counter is at maximum, the robot proceeds to the next command (in this example, the point job is over because there are no more commands). If the counter is not at maximum, the robot moves to Point 01 (P1).

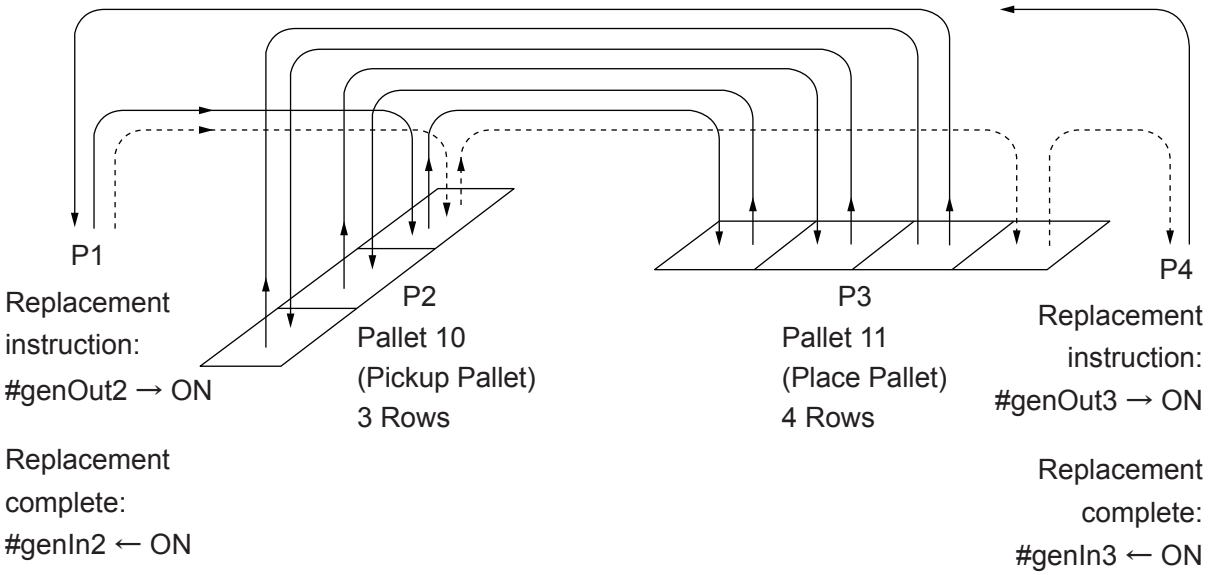
Registered Job and Additional Function	
Point 01 (P1)	Point 02 (P2)
Point Job Number 05 Additional Function Pallet No. 10	Point Job Number 06

Example 3: pick-and-place from one pallet to another.

This example explains how to set the point job data for pick-and-place operations between two pallets of different sizes.

■ Conditions

- Pick up from Pallet 10 set to Point 02 (P2) and place on Pallet 11 set to Point 03 (P3).
- If the pickup pallet (Pallet 10) becomes empty, the robot returns to Point 01 (P1) and waits until the pallet is replaced.
- If the place pallet (Pallet 11) becomes full, the robot moves to Point 04 (P4) and waits until the pallet is replaced.
- Pickup pallet: Pallet Routine Number 10, Pallet Routine Type: Row, Counter Control: Increment by Point Job, Row: 3
- Place pallet: Pallet Routine Number 11, Pallet Routine Type: Row, Counter Control: Increment by Point Job, Row: 4
- Command to pick up: #genOut1 is ON.
- Command to place: #genOut1 is OFF.
- Command to replace the pickup pallet: #genOut2 is ON.
- Pickup pallet replacement complete: #genIn2 is ON.
- Command to replace the place pallet: #genOut3 is ON.
- Place pallet replacement complete: #genIn3 is ON.



Point Job Data 05 (Set to P2)

set #genOut1	Pick.

Point Job Data 06 (Set to P3)

reset #genOut1	Place.
incPallet 10	Add 1 to the pickup pallet counter.
incPallet 11	Add 1 to the place pallet counter.
if	If
ld #palletFlag (11)	the place pallet is full,
then	
goPoint PTP0, 4	move to Point 04 (P4).
endIf	
if	If
ld #palletFlag (10)	the pickup pallet is empty,
then	
goPoint PTP0, 1	move to Point 01(P1).
endIf	
goPoint PTP0, 2	move to Point 02 (P2).

Point Job Data 07 (Set to P4)

set #genOut3	The place pallet replacement instruction signal comes ON.
waitCond	
ld #genIn3	Wait for the place pallet replacement completed signal.
endWait	
reset #genOut3	The place pallet replacement instruction signal goes OFF.
if	If
ld #palletFlag (10)	the pickup pallet is empty,
then	
goPoint PTP0, 1	move to Point 01(P1).
endIf	
goPoint PTP0, 2	Move to Point 02 (P2).

Point Job Data 08 (Set to P1)

set #genOut2	The pickup pallet replacement instruction signal comes ON
waitCond	
ld #genIn2	Wait for the pickup pallet replacement completed signal.
endWait	
reset #genOut2	The pickup pallet replacement instruction signal goes OFF.

Registered Job and Additional Function	
Point 01 (P1)	Point 02 (P2)
Point Job Number 08	Point Job Number 05 Additional Function Pallet Routine Number 10 (Type: Row, Row: 3)

Registered Job and Additional Function	
Point 03 (P3)	Point 04 (P4)
Point Job Number 06 Additional Function Pallet Routine Number 11 (Type: Row, Row: 4)	Point Job Number 07

22.8 Skip Missing Job

This is a function to remove a registered workpiece from a run or a job when the workpiece is detected as missing before the run or job starts. This function allows you to reduce the cycle time. To use this function, you first need a sensor or camera, etc., capable of detecting missing workpieces.

The skip missing workpiece function can be used with the following 2 types of program elements:

- Points
  Points you select by specifying the point number and program number are skipped. For example, with a program run that consists of repetitive PTP movements and jobs, this function can be used to remove unnecessary points (those which are missing on the workpiece) from the run cycle.

- Pallet Routines
  Points you select by specifying the pallet count and the pallet routine number are skipped. For example, for a plane top return pallet routine with a workpiece on a tray, this function can be used to remove points from the pallet routine when such points are missing from the workpiece on the tray.

Points and pallet routines you specify as missing are handled independent of each other. If you specify a missing job as both a point and a pallet routine, the specified point takes priority.

Example: Skip Missing Job by Specifying the Point Number
This is an example of determining the presence of job objects using sensor input from I/O-1 for a 4 job operation from point 1 to point 4. If a job object is missing, you can use this function to skip that job.

■ Conditions

- Use I/O-1 #genIn1, #genIn2, #genIn3, and #genIn4 signals to determine the presence of job objects at the start of the operation. ON if the object is present and OFF if it is missing.
- Use point 1 to point 4 for the job points.
- Use program number 1.

1. Register the missing jobs at the start of the operation.
   Teach the following to point job number 1:

```
let clearPointSkip ( )
if
  ldi #genIn1
then
  let addPointSkip (1, 1)
endif
if
  ldi #genIn2
then
  let addPointSkip (1, 2)
endif
if
  ldi #genIn3
then
  let addPointSkip (1, 3)
endif
if
  ldi #genIn4
then
  let addPointSkip (1, 4)
endif
```

Clear all registered missing jobs.

If #genIn1 is OFF,

Register job missing at program 1, point number 1.

If #genIn2 is OFF,

Register job missing at program 1, point number 2.

If #genIn3 is OFF,

Register job missing at program 1, point number 3.

If #genIn4 is OFF,

Register job missing at program 1, point number 4.

   Specify [Individual Job on Start of Cycle] for program number 1 as “1”. (Refer to “6. INDIVIDUAL JOB ON START OF CYCLE.”)

2. Teach the job content to points 1 to 4.

3. Execute program number 1.

Example: Using the Skip Missing Job Function with a Pallet Routine

This is an example of a pick-and-place operation on a pallet which the robot repeatedly picks up objects from a pre-arranged tray and places them at a given location. With such a pick-and-place operation when a tray filled with the required number of objects (4 x 3 = 12 in the example below), you can easily teach the robot to perform the pick-and-place operation using the [Plane Top Return Pallet] function. However, even if an object is missing from a tray, the robot unnecessarily processes and performs the entire pallet routine as instructed to do so. By using this function, you can eliminate such unnecessary movements and actions from a pallet routine with missing objects.

■ Conditions

- The robot determines if an object is missing or not according to the #genIn1 status directly above the object (#genIn1 = ON indicates the object exists)
- Checking Pallet Routine: pallet number 10; routine type: row; 4 rows x 3 columns; counter control: auto increment
- Pickup Pallet Routine: pallet number 11; routine type: row; 4 rows x 3 columns; counter control: increment by point job
- Pick-up: #genOut1 = ON
- Place: #genOut1 = OFF
- Defined by the global variable gMissingCount (numerical value, one dimension)
- The robot checks whether or not the objects are missing from the tray (pallet) according to the pallet number 10 settings. Register the missing objects as a missing job during the check to skip them in the subsequent operation (pallet number 11).
- The robot performs the pick-up operation according to pallet routine 11.
- If all objects are missing, the robot returns to the standby point without performing any operation.

Teaching Overview

1. Set the run start procedure
2. Set the procedure for determining if objects are missing
3. Set the pick-up procedure
4. Set the place procedure

1. Set the Run Start Procedure

- Teach the following point job to point job number 4:

reset #genOut1	Initialize hand for grasping object
let delPalletSkip(11, -1)	Delete all skip job operation data from pallet 11
let gMissingCount = 0	Clear the number of missing to jobs to 0

- Specify the individual job on start of cycle as 4
  (refer to “6. INDIVIDUAL JOB ON START OF CYCLE”)

2. Set the Procedure for Determining if Objects are Missing
   - Check the status (whether or not there are any jobs missing) of the objects placed on the tray (pallet) and teach P1 accordingly.
   - Specify the P1 pallet number as 10
   - Teach the following point job to point job number 5:

delay 100	Wait for stability
If	
ldi #genIn1	Perform the following if #genIn1 is OFF
then	
let gMissingCount = gMissingCount + 1	Add 1 to the missing job count
let addPalletSkip(11, #palletCount(10))	Add missing job information to pallet 11
endIf	

   - Specify the job after moving for P1 to 5

Job/Additional Function Settings	
At Run Start (P0)	Point 01(P1)
Point Job 04 Additional Function: Pallet Number 11	Point Job 05 Additional Function: Pallet Number 10

3. Set the Pick-up Procedure
   - Check the status (whether or not there are any jobs missing) of the objects placed on the tray (pallet) and teach P2 accordingly (the same as P1).
   - Specify the P2 pallet number as 11
   - Teach the following point jobs to point job number 6:

if	
ld gMissingCount >= 12	Return to standby point if gMissingCount is more than 12 as all jobs are missing.
then	
goPoint PTP0,1	
endIf	

   - Teach the following point job to point job number 7:

set #genOut1	Pick up the object

   - Specify the job before moving for P2 to 6
   - Specify the job after moving for P2 to 7

Job/Additional Function Settings	
Point 02 (P2)	Point 02(P2)
Point Job 06 Additional Function: Pallet Number 11	Point Job 07 Additional Function: Pallet Number 11

4. Set the Place Procedure
   - Teach the location for placing the object to P3.
   - Teach the following point job to point job number 8:

reset #genOut1 loopPallet 11, 2	Place the object. Add 1 to the pallet 11 counter and move to the subsequent point when the counter is full. Move to P2 if the counter is not full.

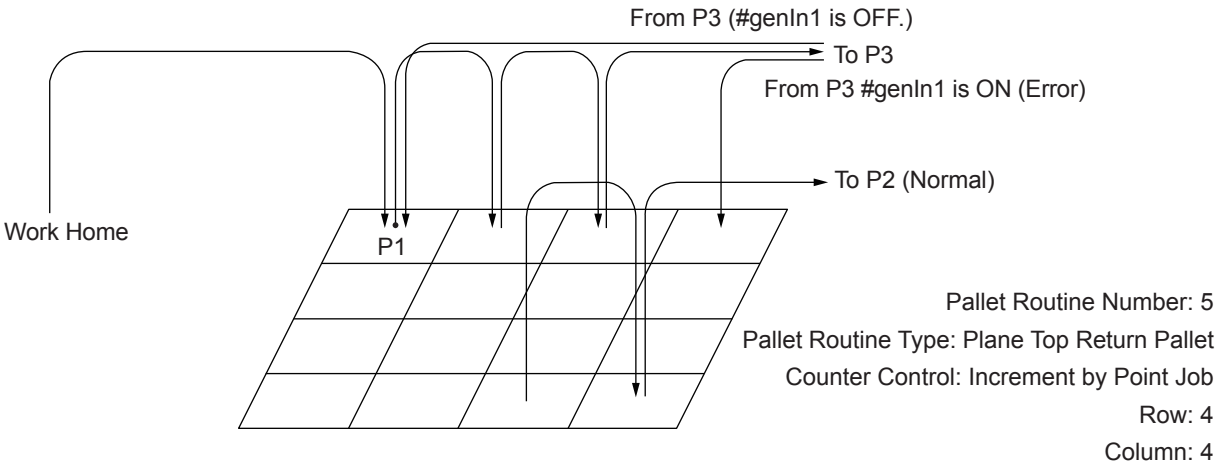
   - Specify the job after moving for P3 to 8

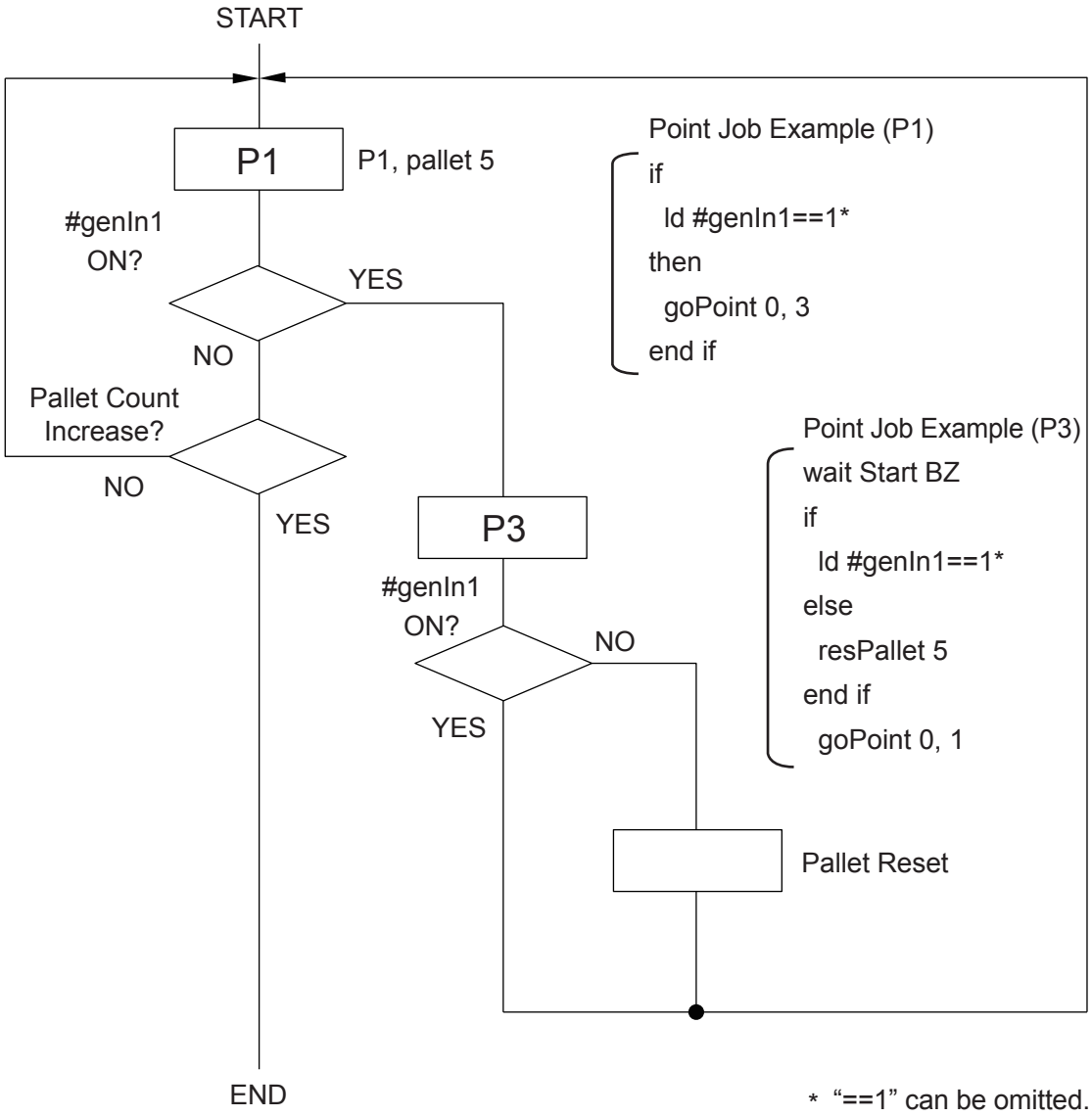
Job/Additional Function Settings	
Point 03 (P3)	
Point Job Number 08 Additional Function: Pallet Number 11	

22.9 How to Terminate the Pallet Routine

In some cases, you have to stop the pallet operation mid-operation. You can stop the pallet using point job data with a combination of if and goPoint commands.
If you want to restart the pallet from the beginning, you have to reset the pallet counter. Unless the counter is reset, the robot restarts operation from the place where it stopped operation.
To reset the pallet counter, enter a reset command into the point job data. resPallet is the point job command for resetting the pallet counter. If you enter a [Pallet Routine] and pallet number into the resPallet parameters, you can reset the counter of the designated pallet number.

Example: If an error occurs (#genIn1 is ON) during operation of Pallet 05 set to Point 01 (P1), the robot moves to Point 03 (P3).
The robot's buzzer sounds and the robot waits for a start signal at Point 03 (P3). If the robot receives the start signal and #genIn1 is ON, it restarts operation from the point immediately after the point where the error occurred. If #genIn1 is not ON, the robot restarts the pallet from the beginning. (Refer to the following page).





* “==1” can be omitted.

Point Job Data 20

set #genOut3	#genOut3 comes ON.
waitCondTime 800	after 0.8 seconds,
endWait	#genOut3 goes OFF. (Job at the base point 1)
reset #genOut3	
if	If
ld #genIn1	#genIn1 is ON (error),
then	
goPoint PTP2, 3	move to Point 03 (P3).
endIf	

Point Job Data 21

waitStartBZ	The buzzer sounds and the robot waits for a start signal.
if	If
ld #genIn1	#genIn1 is ON (error),
then	move to Point 01 (P1).
goPoint PTP2,1	
else	If #genIn1 is not ON (error),
resPallet 5	The Pallet Number 5 counter is reset and
goPoint PTP2, 1	the robot moves to Point 01 (P1).
endIf	

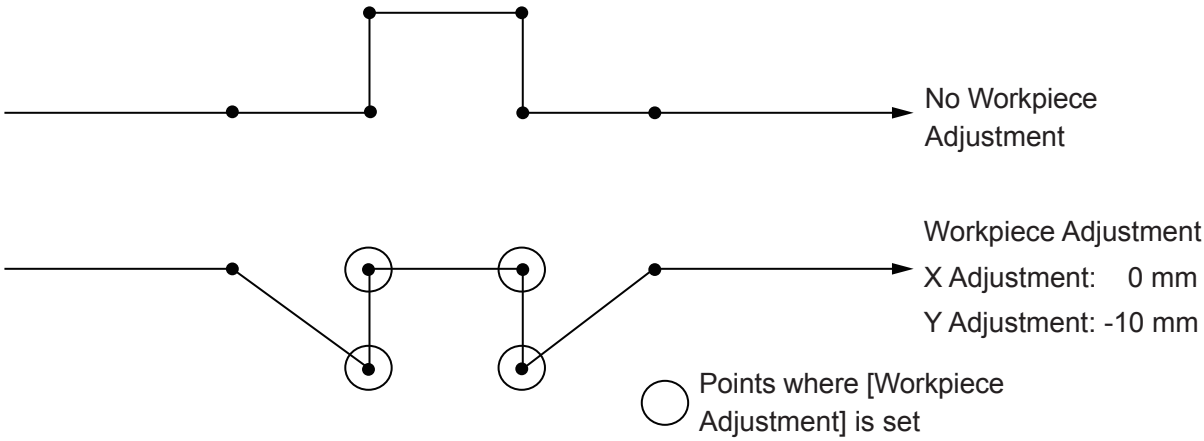
- When #genIn1 is ON (error), the pallet counter is not reset, so when the robot goes back to P1 it continues the pallet routine. If there is no error (when it goes from P2 to P3), the pallet counter resets, so when the robot goes back to P1, the pallet routine is done from the beginning.

Registered Job and Additional Function	
Point 01 (P1)	Point 03 (P3)
Point Job Number 20 Additional Function Pallet Routine Number 05	Point Job Number 21

23. WORKPIECE ADJUSTMENT SETTINGS (NUMERIC ADJUSTMENT)

With an MDI adjustment, you can move certain point positions (coordinates) by the exact numerical values you enter.
Create the additional function data [Workpiece Adjustment Settings] and set it to the point position to where you want to move.

For details about [Workpiece Adjustment] with a camera or a distance sensor, refer to the operation manual *Camera & Sensor Functions.*



TP MENU [Additional Function Data Settings]
[Workpiece Adjustment Settings]

PC [Data] → [Additional] → [Work Adjustment]

After creating an additional function data [Workpiece Adjustment], set that number to points to which you want to assign those conditions.

TP CURSOR ▽ (Move to a blank line.)
[Work Adjustment Number]

PC (Main screen) [Work Adjustment No.]

■ Settable Points

(✓: can be set, blank: cannot be set)

Point Type / Point Job	PTP Point	CP Start Point	CP Passing Point	CP Stop Point	CP Arc Point	CP End Point	PTP Evasion Point	Circle Start Point	Circle Center Point	Single Camera Shoot Point	Multi Camera Shoot Point	Double Camera Shoot Point 1	Double Camera Shoot Point 2	Wait Start Point	Work Home (PTP Point)	Work Home (CP Start Point)
Work Adjustment No.	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓

NOTE:

- CP Start Point to CP End Point are handled as a block of points. If you set a workpiece adjustment to a CP Start Point, that workpiece adjustment affects all the points up until the CP End Point.
- For robots running system software version 6 or Higher, the Circle Start Point to Circle Center Point are handled as a block of points. If you set a workpiece adjustment to the Circle Start Point, the workpiece adjustment is also applied to the Circle Center Point.

If you use the teaching pendant to carry out the following operation, you can set a specific workpiece adjustment number to all points in a specific string (block) of points. If a workpiece adjustment is already set to a point in the block, it is replaced by this particular work adjustment number.

NOTE: With CP movements, only workpiece adjustment numbers set to the CP start point are modified. Workpiece adjustment numbers set to other CP point types in the block are not modified.

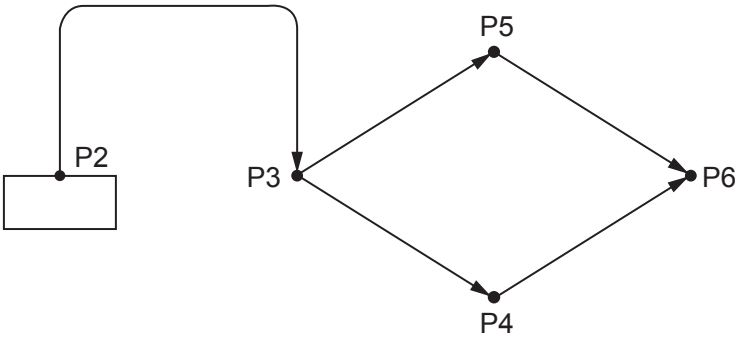
T P EDIT [Common Block Settings]
Enter a Block Start Number.
Enter a Block End Number.
[Work Adjustment Number]

You can set names to workpiece adjustments. Press the EDIT key on the workpiece adjustment value settings screen and the name editing screen appears.

24. EXECUTE CONDITION SETTINGS

With [Execute Condition Settings], you can change the robot's route according to the specified conditions.
In this example, a sensor is connected to I/O-1.
#genIn1(I/O-1) is entered ON/OFF according to the sensor results at Point 02 (P2), and this is retained to #mv(1) (built-in Boolean variable). Create additional function data [Execute Condition] for #mv(1), such as, "execute if ON" and "execute if OFF", and set these to point 04 (P4) and point 05 (P5) respectively.

From this, the robot's path from point 03 (P3) onwards is as such:
#mv(1) = ON: P3 → P4 → P6
#mv(1) = OFF: P3 → P5 → P6



- [Execute Condition] settings:

For Point 04 (P4)	For Point 05 (P5)
ld #mv(1)	ldi #mv(1)

TP MENU [Additional Function Data Settings]
[Execute Condition Settings]

PC [Data] → [Additional] → [Execute Condition]

After creating an additional function data [Execute Condition Settings], set that number to points to which you want to execute those conditions.

TP CURSOR ▽ (Move to a blank line.)
[Execute Condition Number]

PC [Execute Condition No.] (Last line on the main screen)

■ Settable Points

(✓: can be set, blank: cannot be set)

Point Type / Point Job	PTP Point	CP Start Point	CP Passing Point	CP Stop Point	CP Arc Point	CP End Point	PTP Evasion Point	Circle Start Point	Circle Center Point	Single Camera Shoot Point	Multi Camera Shoot Point	Double Camera Shoot Point 1	Double Camera Shoot Point 2	Wait Start Point	Work Home (PTP Point)	Work Home (CP Start Point)
Execute Condition No.	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

25. TAG CODE

You can set values (tag codes) to points. Set tag codes can be referenced within point jobs as the built-in variable “#point_TagCode.” With the dataOut command, a tag code can be output to I/O-SYS, I/O-1, I/O-H (JS3 Series only), or free Boolean variables (#mv (1 – 99) and #mkv (1 – 99)).
For example, if you set different values to multiple points as tag codes, you can output different values using the same point job data.

TP CURSOR ▽ (Move to a blank line.)
[Tag Code]

PC [Tag Code] (Last line on the main screen)

■ Settable Points

(✓: can be set, blank: cannot be set)

Point Type / Point Job	PTP Point	CP Start Point	CP Passing Point	CP Stop Point	CP Arc Point	CP End Point	PTP Evasion Point	Circle Start Point	Circle Center Point	Single Camera Shoot Point	Multi Camera Shoot Point	Double Camera Shoot Point 1	Double Camera Shoot Point 2	Wait Start Point	Work Home (PTP Point)	Work Home (CP Start Point)
Tag Code	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

■ Point Job Data

Use the dataOut command to output tag codes.

When you register point job data, select the command category [ON/OFF Output Control], and select the output command dataOut → Output Tag Code.

dataOut commands requires two parameters: [Output Bit Number] (I/O numbers used for output) and [Output Number] (the smallest I/O number used for output; for example, select 5 if using #genOut5 to #genOut7.)

Example:

Designation		**Command**	**Output 6 = 110 (binary digit)**	
Tag Code	: 6		#genOut5	: 0 (OFF)
Output Bit Number	: 3	dataOut#point_TagCode,#genOut5,3	#genOut6	: 1 (ON)
Output No	: #genOut5		#genOut7	: 1 (ON)

I/O numbers and free Boolean variables used for output must be sequential.
The output bit number can be set up to a maximum of 32.*
However, you cannot extend over and output to different types of I/O.
Additionally, if the output values do not fit within the output bit number, the excess digits are omitted.

* When designating an I/O alias used by an Internal Relay (#mv), Keep Relay (#mkv).

Example of omission:

Designation		**Command**	**Output14 = 1110 (binary digit)**	
Tag Code	: 14		#genOut5	: 0 (OFF)
Output Bit Number	: 3	dataOut #point_TagCode, #genOut5,3	#genOut6	: 1 (ON)
Output No	: #genOut5		#genOut7	: 1 (ON)
				: 1 (omitted)

Janome Sewing Machine Co., Ltd.

Industrial Equipment Sales Division

1463 Hazama-machi, Hachioji-shi, Tokyo 193-0941, Japan

Tel: +81-42-661-6301

Fax: +81-42-661-6302

E-mail: j-industry@gm.janome.co.jp

Machine specifications may be modified without prior notice to improve quality.

No part of this manual may be reproduced in any form, including photocopying, reprinting, or translation into another language, without the prior written consent of JANOME.

170812106 as of 2019-04

Japanese Ver. 2019-04