YASKAWA

MotoSight 3D BinPick
INSTRUCTIONS

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MotoSight 3D BinPick INSTRUCTION LIST

Canon 3D Machine Vision System RV1100/RV500/RV300 USER'S MANUAL

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Yaskawa America, Inc.
Motoman Robotics Division
100 Automation Way
Miamisburg, OH 45342
Phone: 937-847-6200

www.motoman.com

Safety

Summary of Warning Information

This manual provides help to establish safe conditions for operating the MotoSight 3D BinPick. Specific considerations and precautions are described in this manual as DANGER, WARNING, CAUTION, and NOTICE.

It is important users operate the equipment in accordance with this instruction and any additional information provided by Yaskawa. Address any questions regarding safe and proper operation to Customer Support.

Notes for Safe Operation

Read this instruction carefully before installing, operating, maintaining, or inspecting.

In this instruction, Safe Operations are classified as “DANGER”, “WARNING”, “CAUTION”, or “NOTICE”.

Indicates an hazardous situation which, if not avoided, **WILL** result in death or serious injury. Safety Signs identified by the signal word DANGER.This is used sparingly and only for those situations presenting the most serious hazards.

Indicates a hazardous situation which, if not avoided, **MAY** result in death or serious injury.

Indicates a hazardous situation, which if not avoided, can result in minor to moderate injury. It may also be used without the safety symbol as an alternative to “NOTICE”.

“CAUTION” without the safety symbol is used to indicate a situation which if not avoided may result in equipment damage.

NOTICE is preferred signal word for practices not related to personal injury. The safety symbol is not used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety symbol may be used to indicate a message not relating to injury.

A “CAUTION” may result in a serious accident in some situations.

WARNING

- Read and understand this manual and other included documentation before installing, operating, or maintaining the MotoSight 3D BinPick.
  - This instruction manual is intended to explain the MotoSight 3D BinPick.

Any matter not described in this manual must be regarded as “prohibited” or “improper”.

- Read chapter 1 “Safety” of the Controller instructions before using the MotoSight 3D BinPick.

Not reading and understanding chapter 1 of the Controller instruction can result in death or serious injury.

- Read and understand all Warning Labels before operating.

Not reading and understanding all Warning Labels can result in death or serious injury.

- Observe the following when performing a teaching operation within the operating range:
  - Lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence.
  - Display a sign that operations are being performed so no other person closes the safety fence.
  - View from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this precautions may cause improper or unintended movement, which may result in personal injury.

- Maintenance and inspection must be performed by specified personnel.

Failure to observe this Warning may result in electric shock or injury.

- Contact Customer Support for disassembly or repairs.

Not contacting Customer Support can result in electrical shock or injury.

WARNING

- Turn OFF servo power before operating.
  - Press the EMERGENCY STOP button to turn off SERVO POWER. When servo power is OFF, the SERVO ON LED on the Programming Pendant is OFF.

Severe injury or death may result during an emergency if the EMERGENCY STOP button(s) do not work correctly. Do not use if the EMERGENCY STOP button does not perform correctly.

Fig. : EMERGENCY STOP Button

- Clear the cell of all items which could interfere with the operation before releasing the EMERGENCY STOP button.

Injury may result from unintentional or unexpected motion.

Fig. : Release of EMERGENCY STOP Button

- Make sure no person is in the operating range and the operator is in a safe location before:
  - Turning ON power to the Controller
  - Moving the Manipulator with the Programming Pendant
  - Running the system in the TEACH mode
  - Performing automatic operations

Personal injury may result if a person enters the operating range during operation. Immediately press an EMERGENCY STOP button whenever there is a problem.

CAUTION

- Make sure all covers and shields are installed correctly before operating.
  - Some drawings in this manual may have protective covers or shields removed to show details.

Not having all covers and shields installed correctly can result in injury.

- Do not make unauthorized modification.

Unauthorized modifications can result in injury or equipment damage and will void the products warranty.

- Inspect:
  - For problems with movement
  - Damages to external wires

Repair any problems immediately and perform all necessary process. If these problems are not repaired or processes completed can cause unexpected results that can cause death or severe injury

CAUTION

- Always return the Programming Pendant to the hook on the Controller after use.

The Programming Pendant can be damaged if it is left in the work area, on the floor, or near fixtures.

NOTICE

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- Yaskawa may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a Yaskawa representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” or “CAUTION”.

Programming, Operation, and Maintenance Safety

WARNING

- Make sure equipment has no potentially hazardous conditions.
  - area is clean and free of water, oil, debris, etc.
  - all safeguards are in place.
  - all safety equipment work correctly. Repair or replace any non-functioning safety equipment immediately.
  - Check the EMEREGENCY STOP button(s) for proper operation before programming. The equipment must be in Emergency Stop (E-Stop) mode when not in use.

If a hazardous condition is present death or serious injury may occur.

- Use care when modifying software.
  - The equipment allows modifications to the software for maximum performance.

All modifications made to the software will change the way the equipment operates and may cause death or serious injury, as well as damage parts of the system.

- Make sure all modifications did not make create a hazardous or dangerous condition in all modes.

All modifications made to the software will change the way the equipment operates and may cause death or serious injury, as well as damage parts of the system.

- Disconnect and lockout/tagout all sources of energy before making modifications or connections.

Not disconnecting and doing lockout/tagout of all sources of energy can result in death or serious injury.

- Read and understand all maintenance procedures before completing procedures.

Not reading and understanding maintenance procedure may result in death or serious injury.

CAUTION

- All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of the equipment.

Improper operation can result in personal injury and/or damage to the equipment.

- Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this equipment should program, or maintain the system.

Any personnel involved with the operation of the equipment must understand potential dangers of operation.

CAUTION

- Do not modify the Controller.

Making modifications without written permission from Yaskawa will void the warranty.

- Back up all programs and jobs onto suitable media before program changes are made.

To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.

- Use proper replacement parts only.

Not using proper replacement parts can cause damage to equipment.

- All connections must be made within the standard voltage and current ratings of the equipment.

Improper connections can damage the equipment.

NOTICE

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- Yaskawa may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- Some operations require standard passwords and some require special passwords.
- If your copy of the manual is damaged or lost, contact a Yaskawa representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” or “CAUTION”.

Safeguarding Tips

CAUTION

- All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must be familiar with the operation of this equipment.
  - All personnel involved with the operation of the equipment must understand potential dangers of operation.
- General safeguarding tips:
  - Place system in Emergency Stop (E-Stop) mode whenever it is not in use.
  - Use lockout/tagout procedures during equipment maintenance in accordance with ANSI/RIA R15.06-2012, section 4.2.5, Sources of Energy. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).
  - Only trained personnel familiar with the operation of this equipment, the operator's manuals, the system equipment, and options and accessories can operate equipment.

Improper operation can result in personal injury and/or damage to the equipment.

Mechanical Safety Devices

CAUTION

The safe operation of this equipment is ultimately the users responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

National Safety Standard

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment.

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Definition of Terms Used Often in This Manual

The Motoman is the Yaskawa industrial robot product.

The Motoman usually consists of a Manipulator, Controller, Programming Pendant, and supply cables.

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
YRC1000/DX100/DX200 Controller	Controller
YRC1000/DX100/DX200 programming pendant	Programming pendant
XXXXXX Manipulator	Manipulator
Cable between the manipulator and the Controller	Manipulator cable
XXXXXXX Positioner	Positioner
Canon 3D Machine Vision System RV1100/RV500/RV300	Vision System

Descriptions of the Programming Pendant keys, buttons, and displays are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. PAGE key  The Cursor is an exception, and a picture is not shown.
	Axis Keys Numeric Keys	“Axis Keys” and “Numeric Keys” are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them. ex. SHIFT key  +COORD key 
	Mode Key	Three kinds of modes that can be selected by the mode key are denoted as follows: REMOTE, PLAY, or TEACH
	Button	Three buttons on the upper side of the programming pendant are denoted as follows: HOLD button START button EMERGENCY STOP button
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}
PC Keyboard		The name of the key is denoted ex. Ctrl key on the keyboard

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or bland names for each company or corporation. The indications of (R) and TM are omitted.

Customer Support Information

If assistance is needed with any aspect of the system, please contact Customer Support at the following 24-hour telephone number:

(937) 847-3200

Customer Support also has an e-mail address for **routine** technical inquiries, to contact Customer Support through e-mail use the following address:

techsupport@motoman.com

When using e-mail to contact Customer Support, please provide a detailed description of the issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to the inquiry.

WARNING

- Maintenance and inspection must be performed by specified personnel.

Failure to observe this caution may result in electric shock or injury.

- For disassembly or repair, contact Customer Support.
- Do not remove the motor, and do not release the brake.

Failure to observe these safety warnings may result in death or serious injury from unexpected turning of the manipulator's arm.

NOTICE

Use e-mail for **routine** inquiries only. If there is an urgent or emergency need for service, replacement parts, or information, contact Customer Support at the telephone number shown above.

Have the following information ready before calling Customer Support:

- System: MotoSight 3D BinPick
- Primary Application:
- Controller: YRC1000/DX100/DX200
- Software Version:

Access this information on the Programming Pendant's LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}

- Manipulator Serial Number:

Located on the Manipulator data plate

- Manipulator Sales Order Number:

Located on the Controller data plate

- Positioner:

Table of Contents

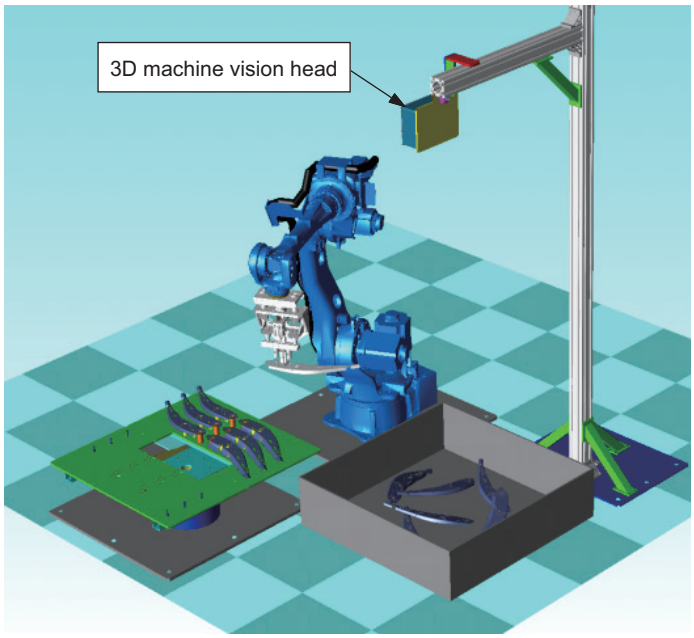
1 Overview

An overview of MotoSight 3D BinPick is described below.

1.1 Overview of MotoSight 3D BinPick

MotoSight 3D BinPick is a package that includes the software and sensors for bin picking. It corrects the trajectory of the manipulator by recognizing the position and posture of the parts stacked in bulk by using “Canon 3D Machine Vision System RV1100/RV500/RV300.”

Fig. 1-1: System Configuration Example



1.2 Description of Terms

Terms used in this system are described in *Table 1-1 “Description of Terms”*.

Table 1-1: Description of Terms

Term	Description
PC	PC used for recognition
RC	Manipulator Controller YRC1000 or DX200 or DX100
Scanner	Main body (sensor) of RV1100/RV500/RV300
Scanner ID (scId)	Number allocated to the scanner Use this value to specify the scanner which executes a command. Regarding the setting procedures for the scanner ID, refer to *section 2.4 “IP Address Setting (RC)”*.
CAD data	Three-dimensional model data of the workpiece and the hand Only STEP files (with the extension “.stp”) can be used in MotoSight 3D BinPick.
Workpiece information	Information of the target workpiece to be recognized by MotoSight 3D BinPick This includes the CAD data (.stp) and data for recognition created from the photographed image of workpieces stacked in bulk, etc.
Hand information	Information of the hand which grasps the target workpiece This is read from the CAD data (.stp).
Grasp information	This contains information about the way to grasp the target workpiece such as a position and a pattern to grasp the workpiece.
Pallet information	Information of the pallet in which the target workpiece to be feed Enter the size of the pallet to create this.
Task information	The aforementioned workpiece information, hand information, grasp information, pallet information, and the settings at the time of recognition are assembled here.
RV calibration data	Information of the positional relation of the manipulator and the scanner
Grasp teaching	Operation to teach the way to grasp the workpiece and create the grasp information
P3	Approach position for workpiece-grasping and workpiece-setting
P4	Final position for workpiece-grasping and workpiece-setting

1.3 Data and Program

1.3.1 Program List

Programs used in this system are listed below.

Table 1-2: Program List

Program	Description
RCIF (made by Yaskawa)	This program relays communication between MotoPlus application and the vision module.
MotoPlus application (made by Yaskawa)	This program receives a command from the job and transmits it with an argument to the RCIF, and receives the result from the RCIF and writes it in a variable.
Vision Module (Canon Inc.)	This program executes the command received from the RCIF and returns the result to the RCIF.

1.3.2 Flow of Data and Program

The general flow of the data and programs of this system is as follows:

(1) A command is sent from the JOB to MotoPlus application.

(2) MotoPlus application reads an argument from a variable.

(3) MotoPlus application sends the command and the argument to the RCIF.

(4) The RCIF sends the command and the argument to the vision module.

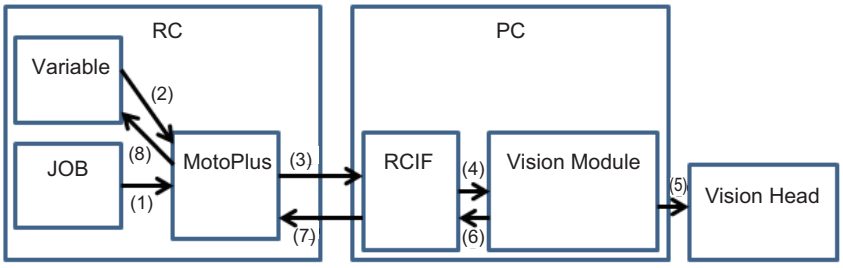
(5) The vision module executes the command.

(6) The vision module sends a result to the RCIF.

(7) The RCIF sends the result to MotoPlus application.

(8) MotoPlus application writes the result into the variable.

Fig. 1-2: Data and Program



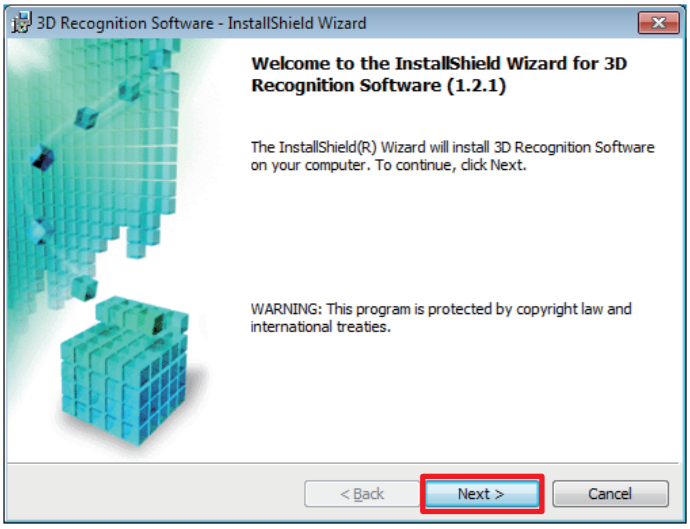
2 Setup of PC and RC for Recognition

Before using this system, installation of the vision module and RCIF on the PC is needed. Setting of the IP address for communication between the PC and the RC is also needed. For setting of the IP address for communication between the scanner and the PC, refer to “Canon 3D Machine Vision System RV1100/RV500/RV300 USER’S MANUAL” and perform setting.

2.1 Vision Module Installation

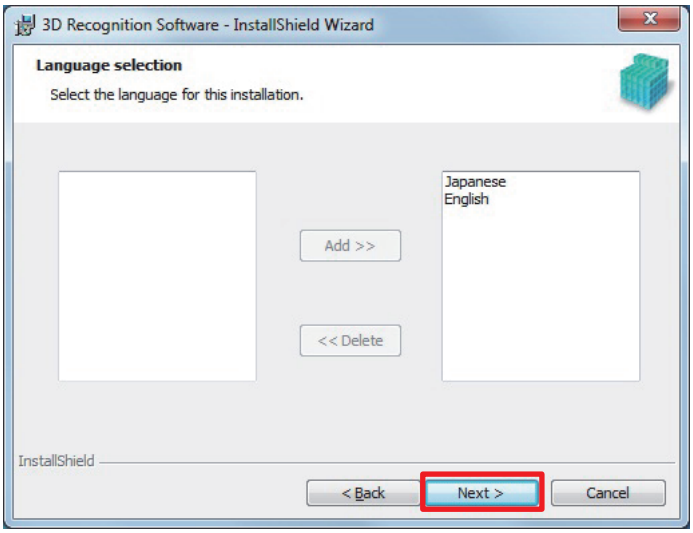
The installation procedures of the vision module are described below.

1. Insert the DVD of the 3D Machine Vision Recognition Software version 1.2.1.
2. Click {Next}.

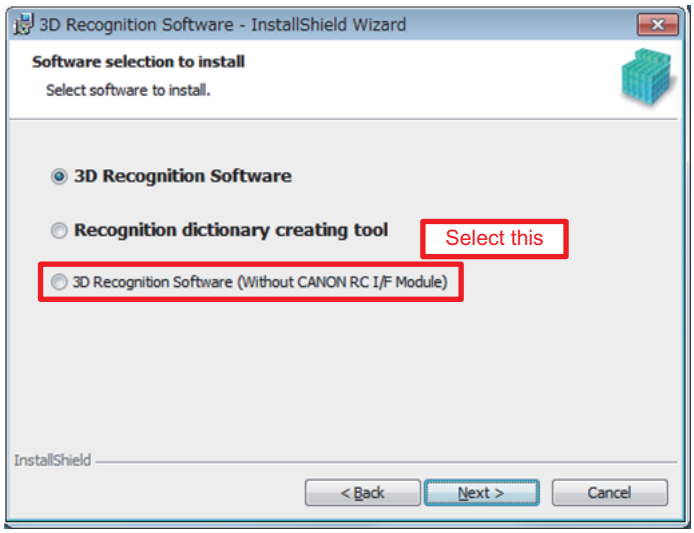


3. Select “I accept the terms in the license agreement,” and then click {Next}.

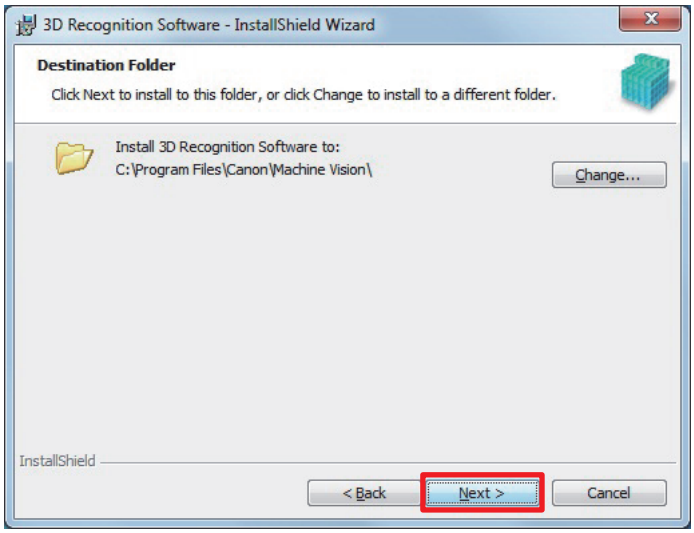
4. Select the language to install, and then click {Next}.



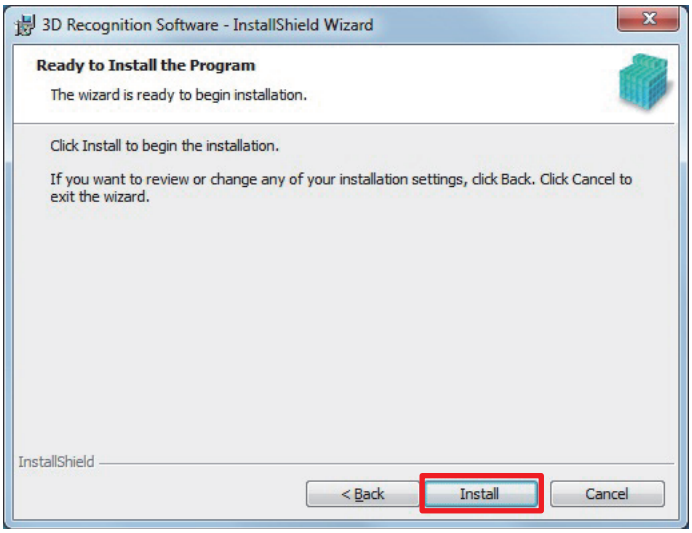
5. Select “3D Recognition Software (Without CANON RC I/F Module)”, and then click {Next}.



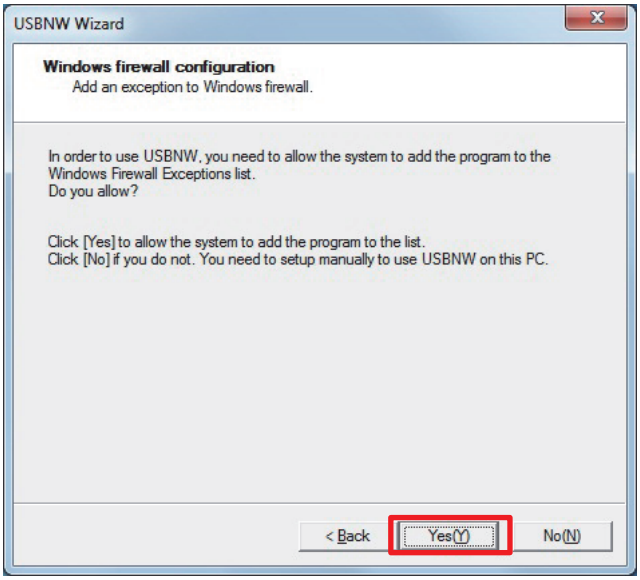
6. If necessary, change the installation destination, and then click {Next}.



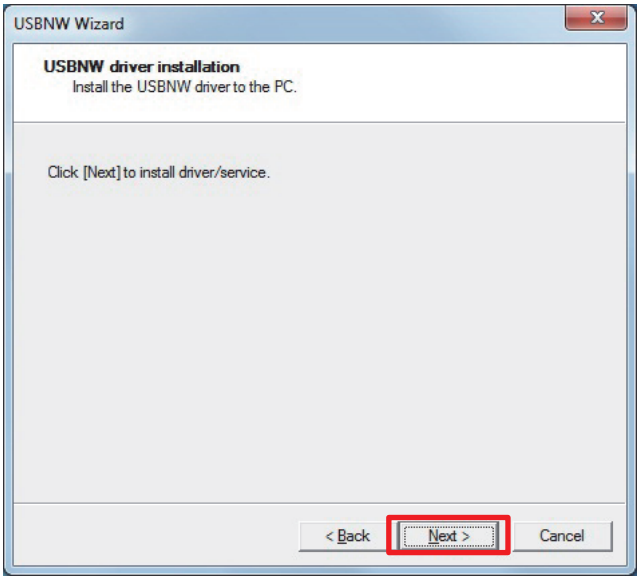
7. Click {Install}.



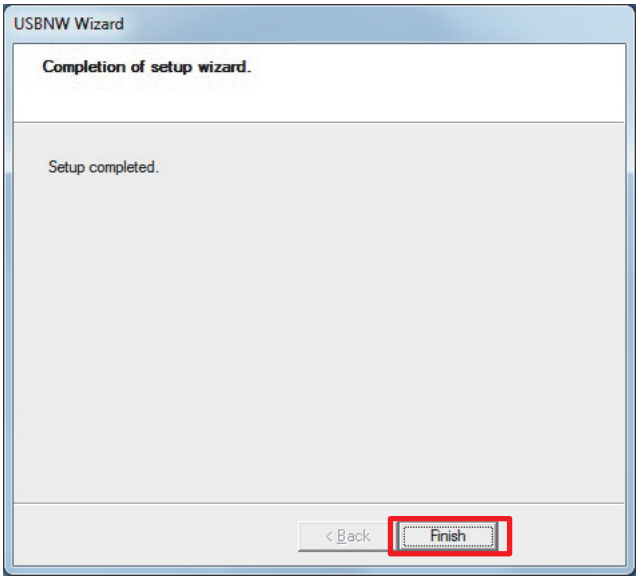
8. Click {Yes}.



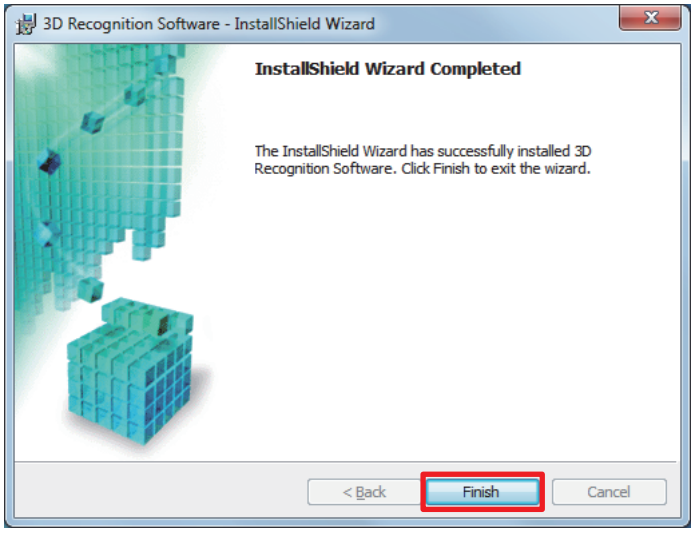
9. Click {Next}.



10. Click {Finish}.



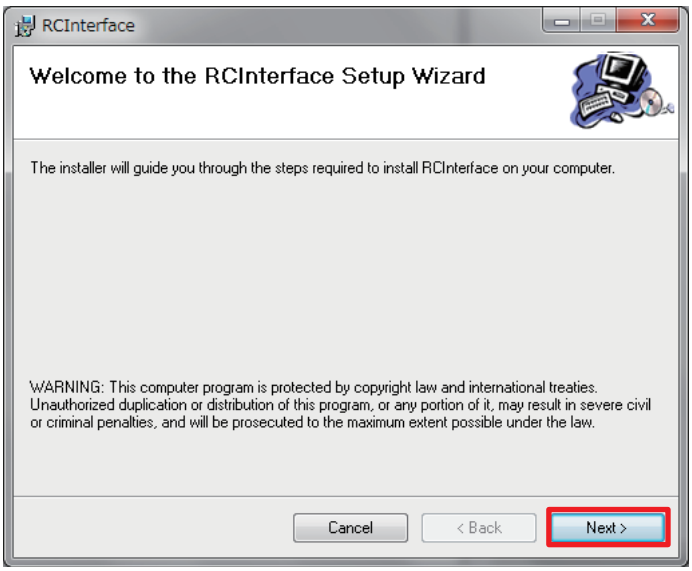
11. Click {Finish}.



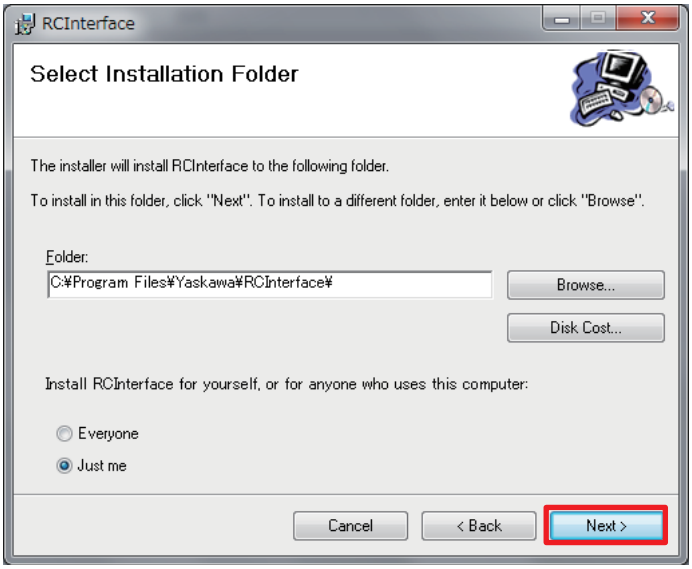
2.2 RCIF Installation

The installation procedures are described below.

1. Insert the most recent version of “MotoSight 3D-RV1100/RV500/ RV300 RCIF MODULE” (provided as accessory) into the PC.
2. Start the installer, and then click {Next}.



3. Confirm the installation destination, and then click {Next}.

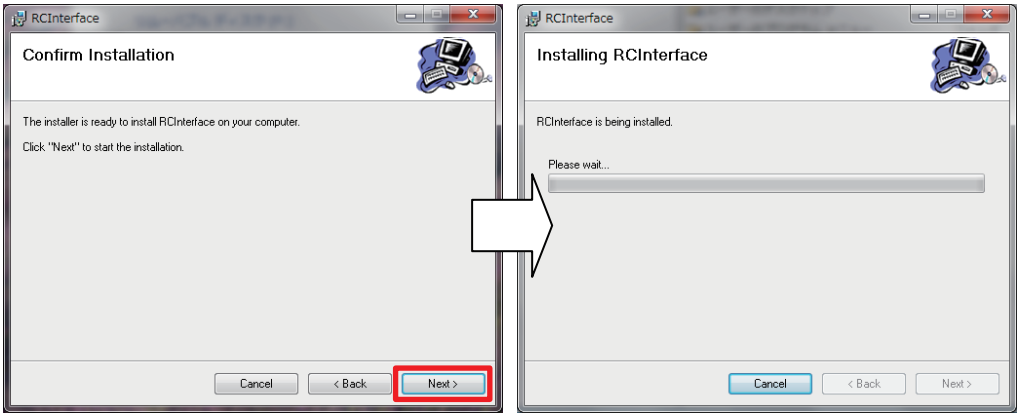


NOTICE

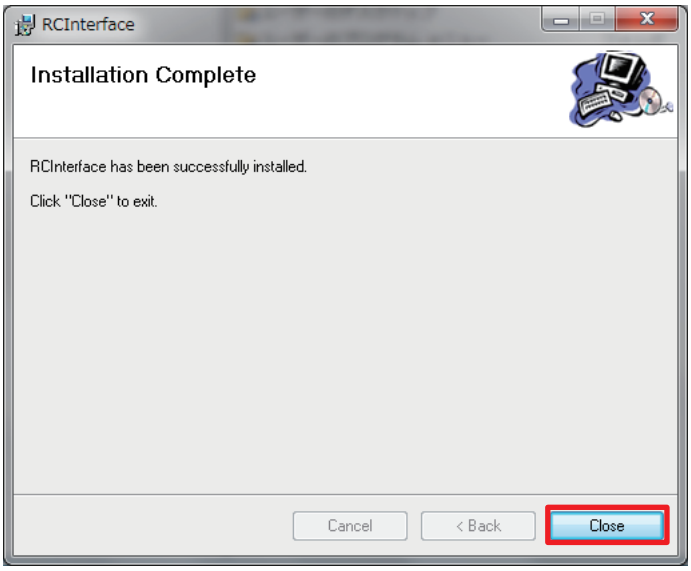
The default installation destination is

<C:\ProgramFiles\YASKAWA\RCInterface\>.

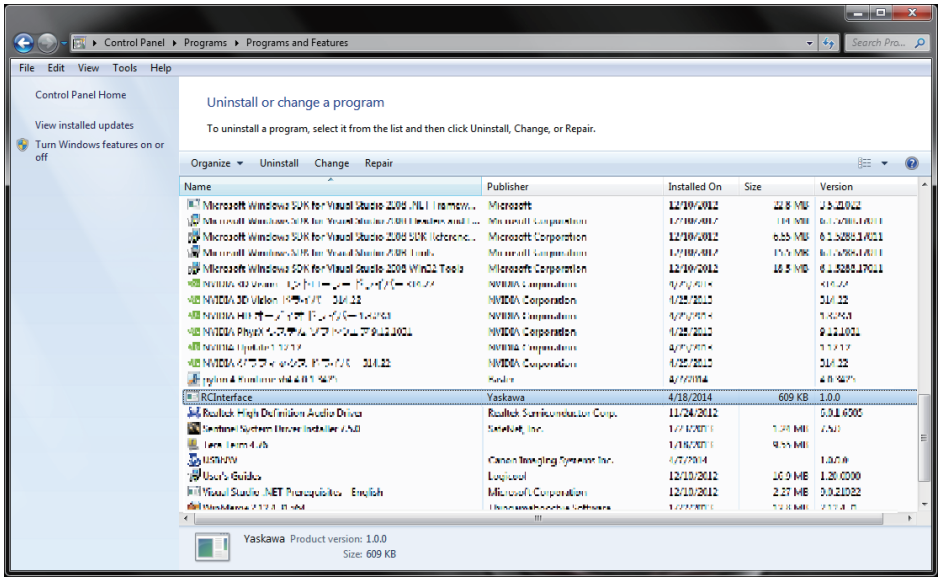
4. Click {Next}.



5. Click {Close} to close the window.



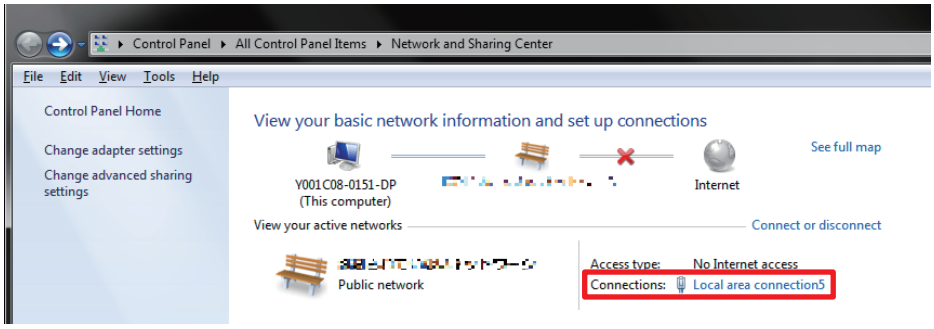
6. Confirm that RC Interface is created in Programs and Features at Control Panel.



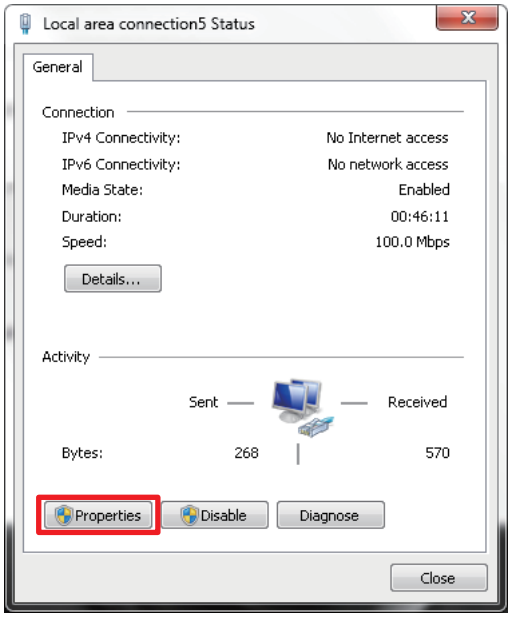
2.3 IP Address Setting (PC)

The setting procedures of IP address used for RC I/F are described below.

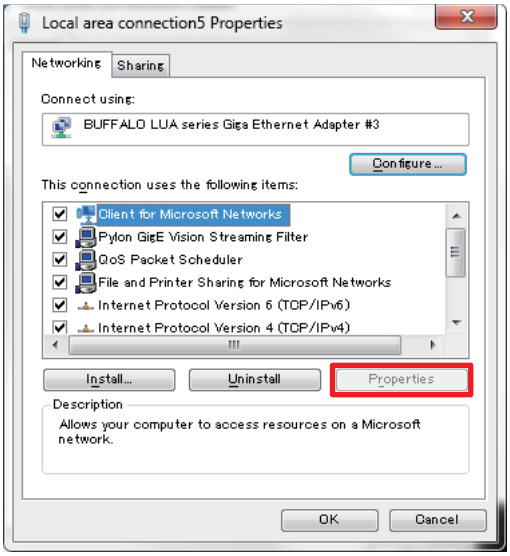
1. Open “Network and Sharing Center” at Control Panel, and then click “Local area connection” connected to the Controller.



2. Click {Properties}.



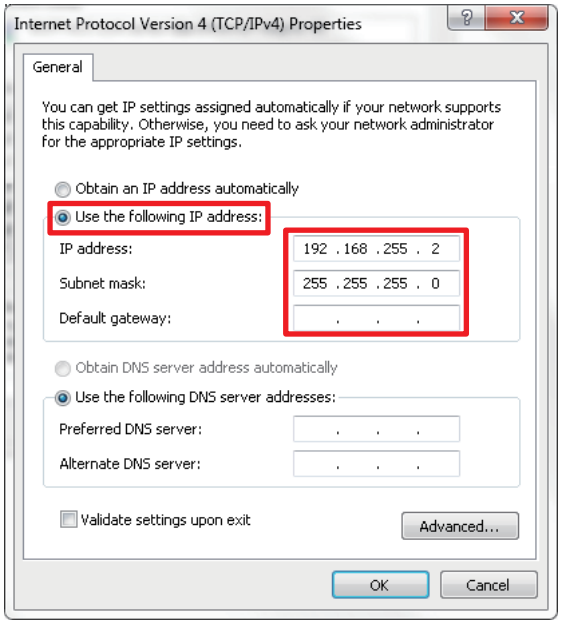
3. Select “Internet Protocol Version 4 (TCP/IPv4)”, and then click {Properties}.



4. Select “Use the following IP address:”, and then set as follows:

   IP address: 192.168.255.2 (Default)

   Subnet mask: 255.255.255.0

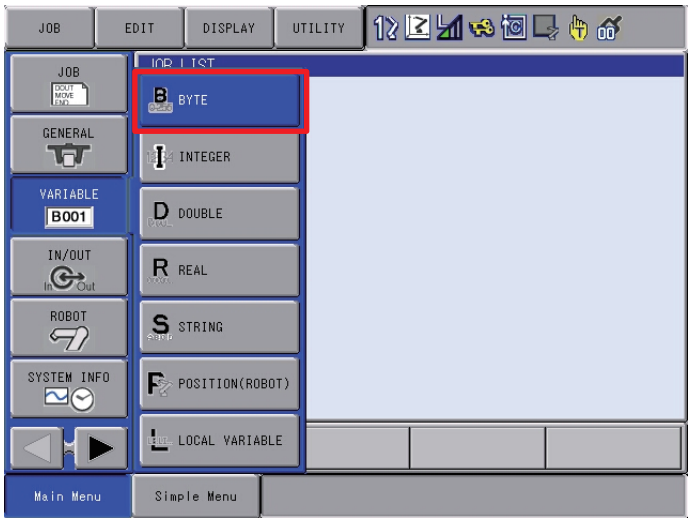


The IP address setting is now complete.

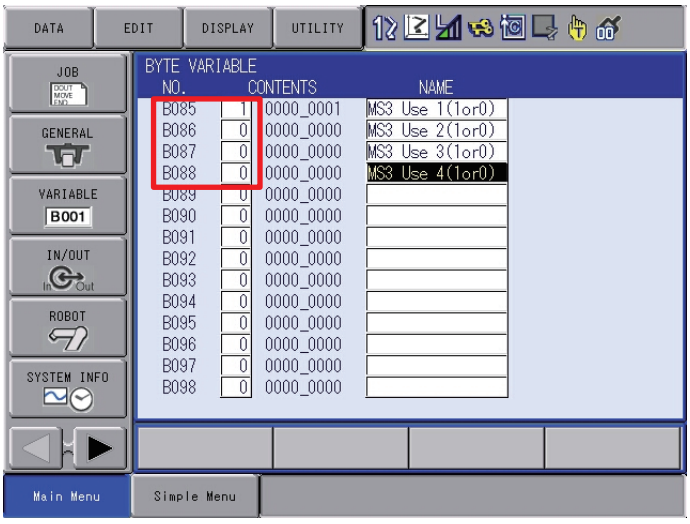
2.4 IP Address Setting (RC)

The setting procedures of IP address used for RC are described below.

1. From the Main Menu of the programming pendant, select {VARIABLE} and then select {BYTE}.



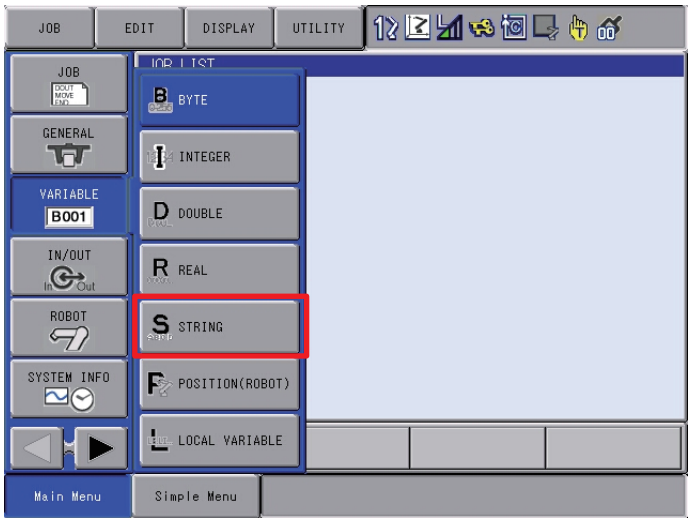
2. Perform setting of the flags used for the PC (B085 to B088 of the B variables).
   - In the example below, two scanners are used (scanner ID=1 and scanner ID=2), so “1” is entered in B085 and B086, and “0” is entered in B087 and B088. Up to four scanners can be connected.
   - B085 to B088 of the B variable represent the flags used by the scanners, from B085 for the scanner ID=1 (scId=1) to B088 for the scanner ID=4 (scId=4) in sequence. Enter “1” into the entry field where the PC is used, and enter “0” where not.



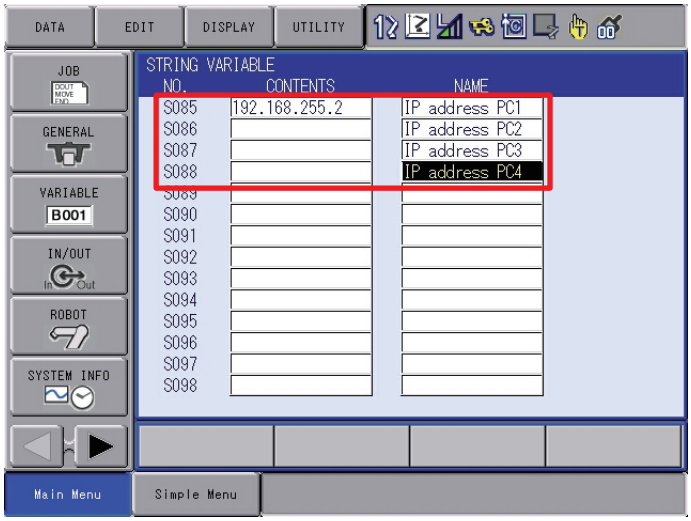
NOTICE

If a value other than “0” or “1” is entered or if “0” is entered in all of the earlier entry fields, an alarm occurs at the RC startup.

3. From the Main Menu of the programming pendant, select {VARIABLE} and then select {STRING}.



4. Enter the IP address of the PC to be connected to S085 to S088 of the S-variables corresponding to the B-variables in which “1” is entered in *step 2*. (Regarding the IP address of the PC, refer to *section 2.3 “IP Address Setting (PC)”*.)



NOTICE

- Restart RC, if B variables B085 through B088 are rewritten due to a change in the PC’s connection configuration, etc.
  - If RC is not restarted in such a case, an alarm occurs at the time of macro job execution.

5. Restart the RC.

The IP address setting of the RC is now complete.

3 Calibration

The calibration procedures of the MotoSight 3D BinPick and the manipulator are described below.

3.1 RV Calibration

1. Install the calibration jig to the manipulator, and perform tool calibration with respect to the dimple at the center.
   - Install the calibration jig near the distal end of the manipulator and where measurement by the scanner can be performed without any disturbance.
   - Install the calibration jig where the manipulator during the calibration can keep its posture similar to that at its actual workpiece grasping. This reduces negative effects caused by variations in the positional accuracy associated with the change in the manipulator's postures.

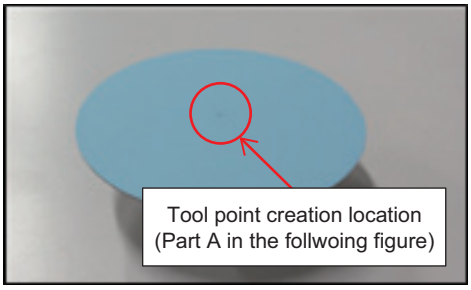


Fig. 3-1(a): Calibration Jig for RV1100

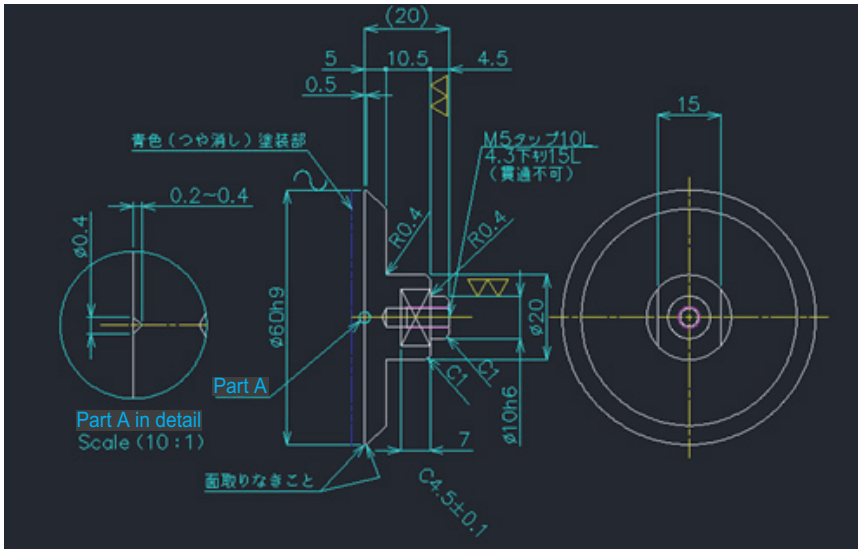


Fig. 3-1(b): Calibration Jig for RV500

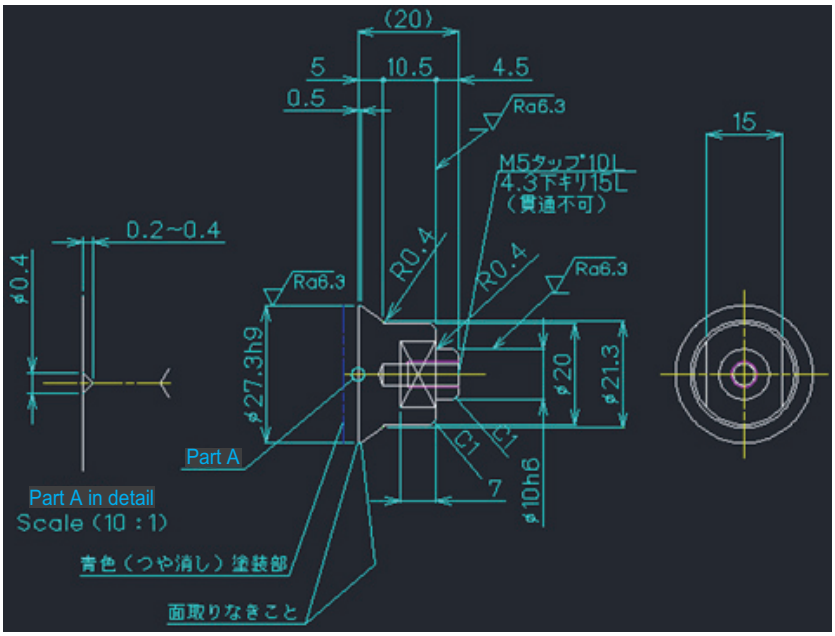
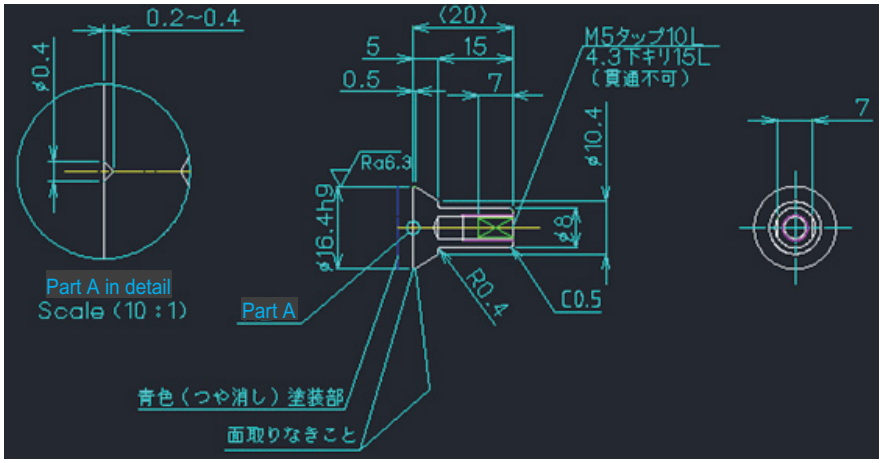


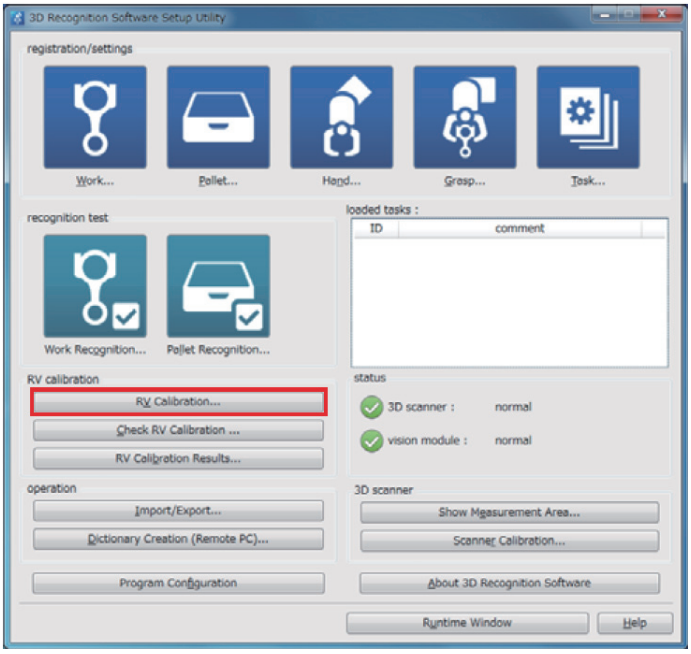
Fig. 3-1(c): Calibration Jig for RV300



2. Create a calibration job as follows:
   For each teaching point in creating a job, set the control point with which the tool calibration was performed.
   The teaching position during the job is described later.

```
JOB:Calibration job
0000 NOP
0001'Calibration start
0002 MS3REG scId=1 sNum=8 Mode=2
0003'Point 1
0004 MOVL V=100.00 PL=0
0005 MS3Stcp scId=1 sNo=1 ToolNo=1 Mode=2
0006'Point 2
0007 MOVL V=100.00 PL=0
0008 MS3Stcp scId=1 sNo=2 ToolNo=1 Mode=2
0009'Point 3
0010 MOVL V=100.00 PL=0
0011 MS3Stcp scId=1 sNo=3 ToolNo=1 Mode=2
0012'Point 4
0013 MOVL V=100.00 PL=0
0014 MS3Stcp scId=1 sNo=4 ToolNo=1 Mode=2
0015'Point 5
0016 MOVL V=100.00 PL=0
0017 MS3Stcp scId=1 sNo=5 ToolNo=1 Mode=2
0018'Point 6
0019 MOVL V=100.00 PL=0
0020 MS3Stcp scId=1 sNo=6 ToolNo=1 Mode=2
0021'Point 7
0022 MOVL V=100.00 PL=0
0023 MS3Stcp scId=1 sNo=7 ToolNo=1 Mode=2
0024'Point 8
0025 MOVL V=100.00 PL=0
0026 MS3Stcp scId=1 sNo=8 ToolNo=1 Mode=2
0027 END
```

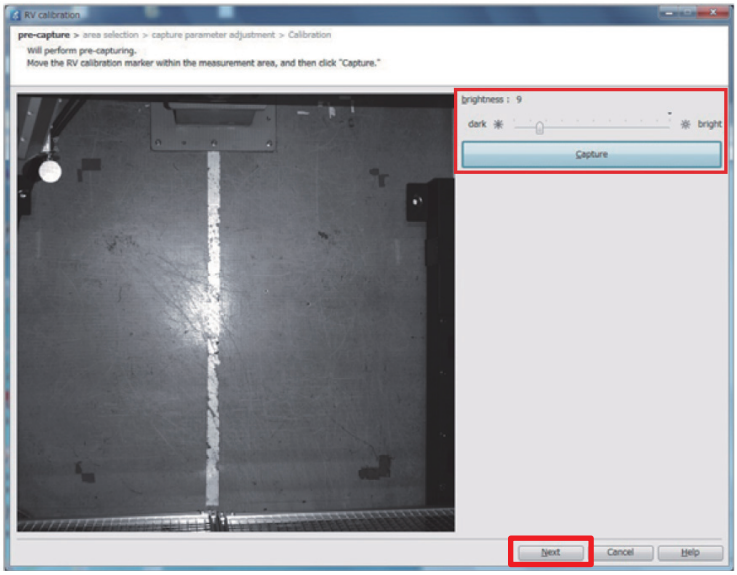
3. Turn ON the power source of RV1100, and then start the "3D Recognition Software."
   Operate the PC to select {RV Calibration} on the "3D Recognition Software Setup Utility" window.



4. When the teaching of 8 points is completed, press {Next}.

   Adjust the brightness with using the slider. While watching the gradation image by clicking {Capture}, operate the Manipulator so that the calibration jigs are allocated at the 4 corners of the visual field and the height of them should be within the measurement range of RV1100 to teach the eight positions of the job described above.

   Allocate the calibration jig parallel to the front of RV1100.



   The following is an allocation image of the calibration jig.
   By referring to the positions of red circles in the figure, perform the teaching to 8 points with operating the Manipulator; nearest surface: 4 corners, and furthest surface: 4 corners.

Fig. 3-2(a): Allocation Image of Calibration Jig for RV1100

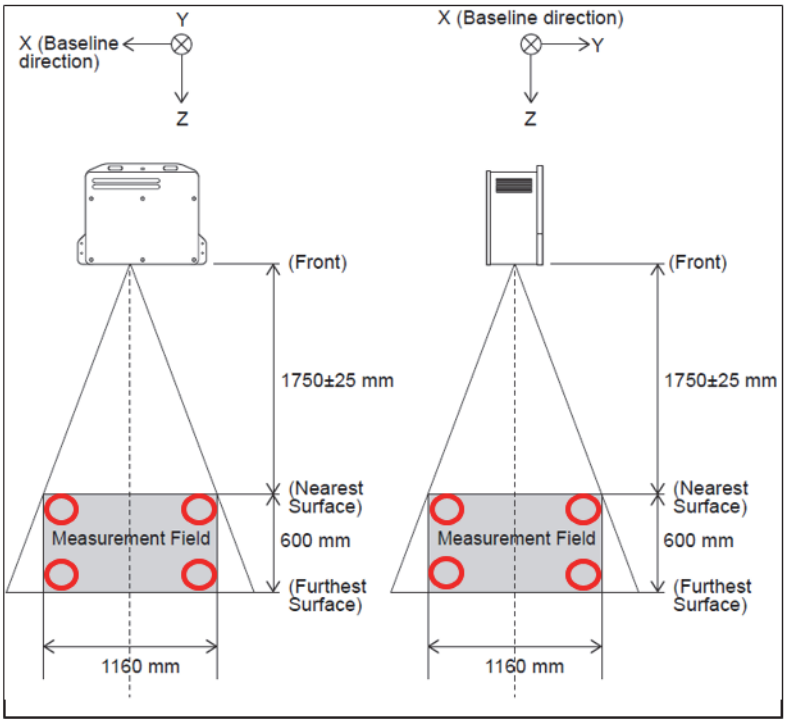


Fig. 3-2(b): Allocation Image of Calibration Jig for RV500

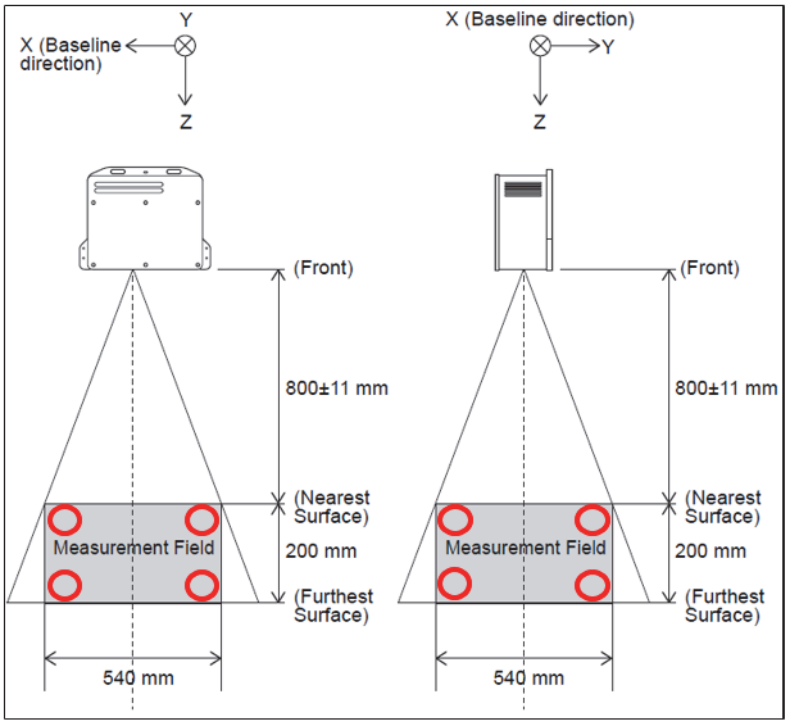
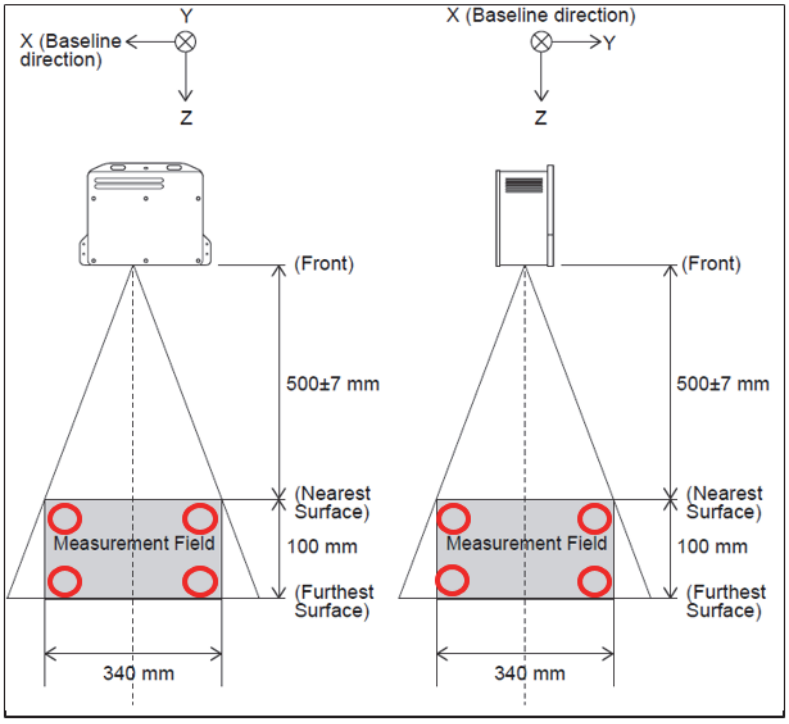


Fig. 3-2(c): Allocation Image of Calibration Jig for RV300



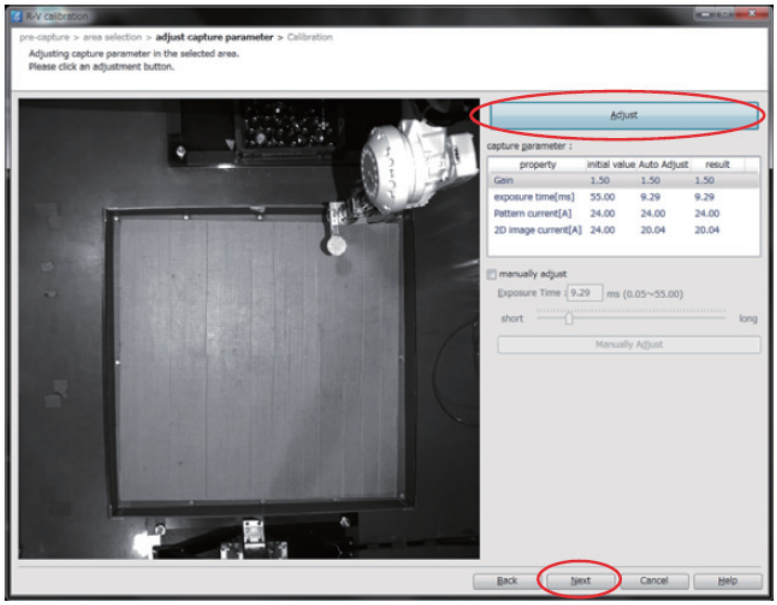
NOTICE

Use the tool number created with respect to the center of calibration jig.

5. Drag cursor to select area where the calibration jig is displayed to select, and press {Next}.

6. Select the adjustment mode from the pull-down menu, and then click {Adjust}. The capture parameters such as the exposure time are displayed in the right side.

   After the adjustment is completed, press {Next}.

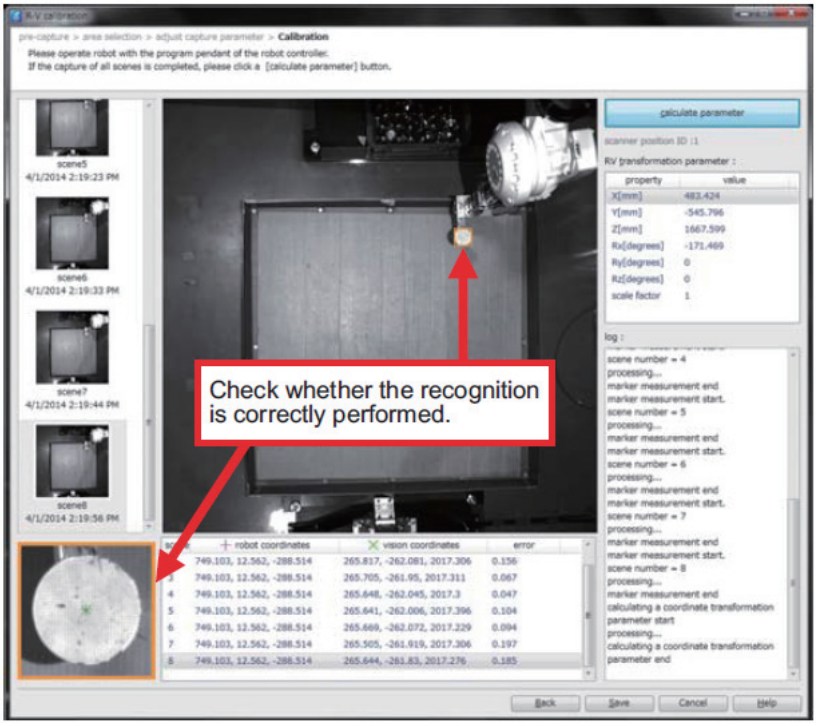


NOTICE

If the flicker which depends on the power supply frequency exists in the environmental light (for example, the non-inverter fluorescent lamp is used for the lighting of the installation environment), the exposure time for capturing should be set as follows:

Power supply frequency	Exposure time
50 Hz area	10 msec or more
60 Hz area	8 msec or more

7. Perform the job for test run, and confirm the recognition of the calibration jig on the PC window. If there are some points in which the recognition was failed or the teaching points are not within the visual field, correct them.



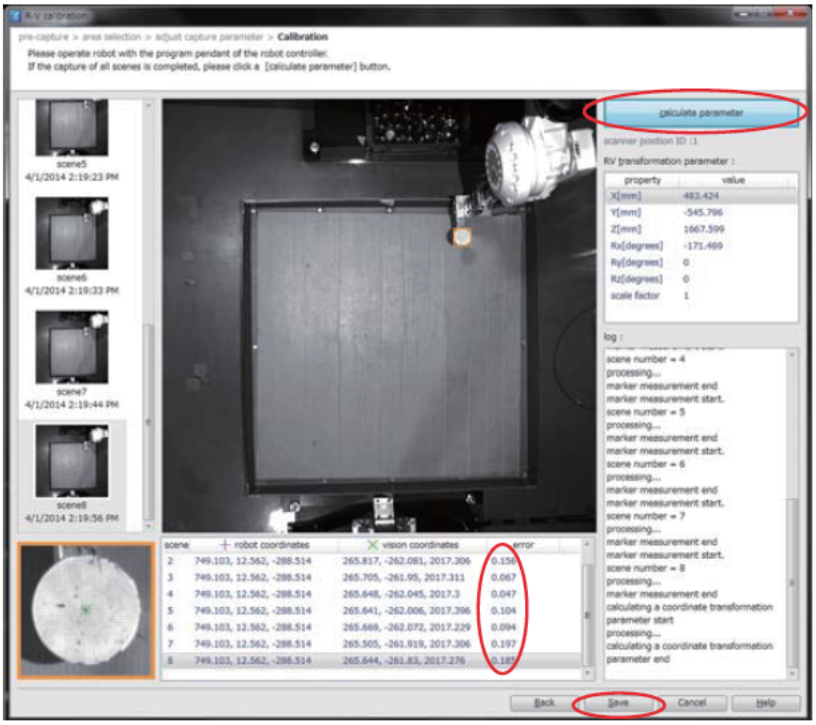
8. After recognizing 8 points, press {calculate parameter} and confirm the measurement error. If there are no problems, press {Save}.

   The rough standard of the measurement error is approximately within 1 to 3mm even though it depends on the Manipulator type or the precision of the tool calibration.
   When the error value is higher than the standard value, confirm the followings:

   • Is the tool calibration performed correctly?

   • Are the eight points are all within the visual field?

   • Is the exposure time adequate?



   The calibration is now complete.

4 Vision Command (Macro Job)

In MotoSight 3D BinPick, commands are executed by using the following vision commands (macro jobs). The vision commands used in the MotoSight 3D BinPick are described below.

4.1 Vision Command and Mode of Vision Module

The modes of vision modules in which each vision command is executable are described below.

Table 4-1: Mode and Executable Vision Command

Usage	Command name	Setup	Runtime	Grasp teaching	Calibration	Pallet area estimation
Recognition execution and result acquisition	MS3START MS3NEXT VWAIT MS3RES	NG	OK	OK	NG	NG
Pallet recognition	MS3PALp	NG	OK	NG	NG	NG
Grasp teaching	PICKPOS MS3pic	NG	NG	OK	NG	NG
Grasp position acquisition	MS3Gpic	OK	OK	OK	OK	OK
Setting position teaching and acquisition	MS3SsetP MS3GsetP GETTP	OK	OK	OK	OK	OK
Calibration	VCSTART VCPOINT MS3REG MS3Stcp	NG	NG	NG	OK	NG
Pallet position estimation	PSSTART PSPOINT MS3REG MS3Stcp	NG	NG	NG	NG	OK
Scanner position setting	MS3ID	NG	OK	OK	OK	OK

OK: executable
NG: not executable

4.2 Command for Recognition Execution and Result Acquisition

4.2.1 MS3START

Description		Macro job to demand the start of workpiece recognition This is a command to demand the specified scanner to start recognition processing.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	selMax	<Number of recognition result output> Specify the number of recognition results (grasp patterns) to receive from the scanner.	<Set value> 1 to 5
Return value		None (Execute MS3RES or VWAIT to receive the recognition result.)	
Remarks		· If the task of the specified task ID cannot be used (e.g. not registered in the PC yet), an alarm occurs. · If MS3START is consecutively executed five times or more without acquiring the recognition result (ME3RES, VWIAT), an alarm occurs.	

4.2.2 MS3cSTAR

Description		Concurrent macro job to demand the start of workpiece recognition This is a command to demand the specified scanner to start recognition processing. Use this command to send the command from a concurrent job to the scanner. For the description of the function, refer to *section 4.2.1 "MS3START"*.

4.2.3 MS3NEXT

Description		Macro job to demand the next recognition result This is a command to demand the specified scanner to send the next recognition results by the selected maximum number. Use this command to acquire the next result without scanning.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	selMax	<Selected maximum number> Specify the maximum number of recognition results to receive from the scanner.	<Set value> 1 to 5
Return value		None (Execute MS3RES or VWAIT to receive the recognition result.)	
Remarks		· If the recognition by the specified task is not successful yet, an alarm occurs. · If MS3START is consecutively executed five times or more without executing MS3RES, an alarm occurs.	

4.2.4 MS3cNEXT

Description	Concurrent macro job to demand the next recognition result This is a command to demand the specified scanner to send the next recognition results by the selected maximum number. Use this command to acquire the next result without scanning. Use this command to send the command from a concurrent job to the scanner. For the description of the function, refer to *section 4.2.3 “MS3NEXT”*.

4.2.5 VWAIT

Description		Macro job to acquire the workpiece recognition result This is a command to receive the recognition result from the scanner after the command MS3START or MS3NEXT is issued.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	WIndex	<Result storage Index> Specify the variable number to receive the recognition result. If “2” or larger is specified as the value of selMax of MS3START or MS3NEXT, the recognition results from the second recognition result are stored in serial order. Example: When 100 is specified as this argument with selMax=3, the recognition results are stored in the variable numbers 100, 101, 102.	<Set value> 0 to 123
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
Return value		<Vision status> The vision status is stored in the I variable. For the correspondence between the scanner ID and the status storage destination, refer to the cell on the right. For the description of the status, refer to *section 7.1 “Vision Status”*.	I085 (scId=1) I086 (scId=2) I087 (scId=3) I088 (scId=4)
		<Number of recognized workpieces> This is the number of workpieces successfully recognized. For the correspondence between the scanner ID and the storage destination of the number of recognized workpieces, refer to the cell on the right. If a timeout occurs during recognition, the number of coordinate values of locally high points in the pallet is stored. (To return the value of locally high points to the Manipulator, setting in the task is needed.)	D085 (scId=1) D086 (scId=2) D087 (scId=3) D088 (scId=4)
		<Grasp ID> The grasp ID which is able to perform grasping is stored in the B variable. (In *** in the cell on the right, the value specified by WIndex is entered.)	B***
		<Evaluated value> The evaluated value of the recognition result is stored in the I variable. (In *** in the cell on the right, the value specified by WIndex is entered.)	I***

Return value (continued)	<Overlap rate> The rate of area where the grasp target workpiece is overlapped by other workpieces is multiplied by 100 and stored. (In *** in the cell on the right, the value specified by WIndex is entered.) Example: When the overlap rate is 43.8%, this value is 4380. When the overlap rate is 99.9%, this value is 9990.	D***
	<Workpiece position and posture> The value of the position and posture of the grasp target workpiece with respect to the Manipulator base coordinates is stored. (In *** in the cell on the right, the value specified by WIndex is entered.)	P***
Remarks	· If no recognition processing is performed beforehand, an alarm occurs. · Specify the same task ID as specified in MS3START and MS3NEXT.	

4.2.6 IVWAIT

Description	Concurrent macro job to acquire the workpiece recognition result This is a command to receive the recognition result from the scanner after the command MS3START or MS3NEXT is issued. Use this command to send the command from a concurrent job to the scanner. For the description of the function, refer to *section 4.2.5 “VWAIT”*.

4.2.7 MS3RES

Description		Macro job to acquire the workpiece recognition result This is a command to receive the recognition result from the scanner after the command MS3START or MS3NEXT is issued. In addition, a user frame to use in grasp teaching or a relative job is created with respect to the home position of the workpiece. The number of user frames to be created correspond to the number of recognized workpieces.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	WIndex	<Result storage Index> Specify the variable number to receive the recognition result. If “2” or larger is specified as the value of selMax of MS3START or MS3NEXT, the recognition results from the second recognition result are stored in serial order. Example: When 100 is specified as this argument with selMax=3, the recognition results are stored in the variable numbers 100, 101, 102.	<Set value> 0 to 123
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	UF_NO	<UF number> Specify the destination to create the user frame. When two or more recognition results exist, this number is sequentially created according to the number of the recognition results. Example: When 1 is specified as this argument with selMax=3, the user frames are created in the user frame numbers 1, 2, 3.	<Set value> 1 to 16

Return value	<Vision status> The vision status is stored. When 1 is specified as the scanner ID, the status is stored in I085. For other scanner IDs, refer to the cell on the right. For description of the status, refer to *section 7.1 "Vision Status"*.	I085 (scId=1) I086 (scId=2) I087 (scId=3) I088 (scId=4)
	<Number of recognized workpieces> This is the number of workpieces successfully recognized. For correspondence between the scanner ID and the storage destination of the number of recognized workpieces, refer to the cell on the right. If a timeout occurs during recognition, the number of coordinate values of locally high points in the pallet is stored. (To return the value of locally high points to the manipulator, setting in the task is needed.)	D085 (scId=1) D086 (scId=2) D087 (scId=3) D088 (scId=4)
	<Grasp ID> The grasp ID which performs grasping is stored in the B variable. (In *** the cell on the right, the value specified by WIndex is entered.)	B***
	<Evaluated value> The evaluated value of the recognition result is stored in the I variable. The higher this value, the higher the probability of successful recognition. (In *** in the cell on the right, the value specified by WIndex is entered.)	I***
	<Overlap rate> The rate of area where the grasp target workpiece is overlapped by other workpieces is multiplied by 100 and stored. (In *** the cell on the right, the value specified by WIndex is entered.) Example: When the overlap rate is 43.8%, this value is 4380. When the overlap rate is 99.9%, this value is 9990.	D***
	<Workpiece position and posture> The value of the position and posture of the grasp target workpiece with respect to the Manipulator base coordinates is stored. (In *** in the cell on the right, the value specified by WIndex is entered.)	P***
	<UF> The UF created at the home position of the workpiece is stored. The manipulator moves with respect to this UF so that its grasping motion can be performed according to the workpiece position and posture. (In *** in the cell on the right, the value specified by UF_NO is entered.)	UF No.***
Remarks	· If no recognition processing is performed beforehand, an alarm occurs. · If the value other than the task ID specified in MS3START and MS3NEXT is specified, an alarm occurs. · If the creation destination specified by UF_NO is the value out of range of UF, an alarm occurs.	

4.2.8 MS3cRES

Description	Concurrent macro job to acquire the workpiece recognition result This is a command to receive the recognition result from the scanner after the command MS3START or MS3NEXT is issued. Use this command to send the command from a concurrent job to the scanner. For a description of the function, refer to *section 4.2.7 “MS3RES”*.

4.3 Command for Grasp Teaching and Grasp Position Acquisition

4.3.1 PICKPOS

Description		Macro job for grasp teaching This is a command to teach how to grasp a workpiece to the scanner. After recognition is performed, the positions of P3 (grasp waiting position) and P4 (grasp position) registered in the P variable of the number specified by the user is transmitted to the scanner.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	P3/P4	<P3/P4 coordinates Index> Specify the P variable number to register P3. Register P4 in the next P variable number. Register the values of P3 and P4 positions at the base coordinates. Example: When 100 is specified as this argument, P3 is registered in P100 and P4 is registered in P101.	<Set value> 0 to 124
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	pickId	<Grasp ID> Grasp pattern ID to perform registration	<Set value> 1 or larger
Return value		None	
Remarks		· If recognition is not successful, the task to perform grasp teaching, and alarm occurs. · If the grasp ID is already registered a task is specified, and a alarm occurs.	

4.3.2 MS3Spic

Description		Macro job for grasp teaching (writing a USER DEFINED FILE) This is a command to register the coordinates of P3 (grasp waiting position) and P4 (grasp position) by specifying the task ID and the grasp ID with respect to the specified scanner, and register at the same time the manipulator's flange position at P3 and P4 with respect to the workpiece coordinates in the USER DEFINED FILE in the RC. After registering P3 and P4 in the P variable of the number specified with the argument by the user, execute this command.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	P3/P4	<P3/P4 coordinates Index> Specify the Index number to register the coordinates of P3 and P4 for transmission to the scanner. Register values of P3 and P4 positions at the base coordinates. Example: When 100 is specified as this argument, P3 is registered in 100 of the P variable, and P4 is registered in 101 of the P variable.	<Set value> 0 to 124
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	pickId	<Grasp ID> Specify number in the task the grasp pattern is registered in.	<Set value> 1 or larger
	UF_NO	<UF number> Specify the UF number created with respect to the home position of the already recognized workpiece.	<Set value> 1 to 16
	OverW	<Overwrite flag> Specify whether to overwrite or not if another grasp pattern with the same task ID and the same grasp ID exists in the USER DEFINED FILE.	<Set value> 0: No overwrite 1: Overwrite
Return value		None	
Remarks		· If recognition is not successful yet in the task to perform grasp teaching, an alarm occurs. · If the grasp ID already registered in the scanner is specified, an alarm occurs. (If necessary, delete the grasp information by operating the PC.) · If 0 is set as OverW and a grasp ID already registered in the USER DEFINED FILE is specified, an alarm occurs. · When performing recognition, the scanner checks interference between P3 and P4. · This command is for DX200.	

4.3.3 MS3Gpic

Description		Macro job to acquire the coordinates of P3 (grasp waiting position) and P4 (grasp position) This is a command to acquire the coordinates of the grasp position preliminarily registered by MS3Spic command. Specify the scanner ID, task ID, and grasp ID to output the coordinates of the grasp position as the base coordinates to the P variable.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	PickId	<Grasp ID> Specify the grasp ID of the grasp pattern to retrieve.	<Set value> 1 or larger
	PNo	<P variable number for storage> Specify the P variable number to store the retrieved result. Example: When 100 is specified as this argument, the value of P3 is output to P100, and the value of P4 is output to P101.	<Set value> 0 to 126
	UF_NO	<UF number> Specify the UF number created with respect to the home position of the workpiece by using the workpiece recognition result.	<Set value> 1 to 16
	ToolNo	<Tool number> Specify the tool number created with respect to the TCP of the hand used for workpiece grasping.	<Set value> 0 to 31
Return value		<P3, P4 position> The coordinates of P3 and P4 are stored as the base coordinates. Move the manipulator in order of P3 and then P4 to perform the motion of grasping the target workpiece. (In *** in the cell on the right, the value specified by PNo is entered.	P***
Remarks		· If a grasp pattern (scanner ID, task ID, grasp ID) not registered by MS3Spic is specified, an alarm occurs.	

4.3.4 MS3cGpic

Description	Concurrent macro job to acquire the coordinates of P3 (grasp waiting position) and P4 (grasp position) This is a command to acquire the coordinates of the grasp position preliminarily registered by MS3Spic command. Specify the scanner ID, task ID, and grasp ID to output the coordinates of the grasp position as the base coordinates to the P variable. Use this command to send the command from a concurrent job to the scanner. For the description of the function, refer to *section 4.3.3 “MS3Gpic”*.

4.3.5 MS3SsetP

Description		Macro job to teach the setting position This is a command to teach the workpiece setting position (a position to set the workpiece after grasp). Register the positions and postures at the home positions of the workpiece when the workpiece is placed on P5 (setting waiting position) and P6 (setting position) as the base coordinates. To perform teaching, move the Manipulator to positions P5 and P6 with the workpiece actually grasped, register these positions in the P variable, and then execute this macro job.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	PickId	<Grasp ID> Specify the grasp ID of the grasp pattern used to grasp the workpiece during teaching.	<Set value> 1 or larger
	P5/P6	<P5/P6 coordinate Index> Specify the Index number to register the coordinates of P5 and P6 used to teach the workpiece setting position. Example: When 100 is specified as this argument, register P5 as the P variable number 100 and P6 as the P variable number 101.	<Set value> 0 to 126
	Set_NO	<Setting position ID> Specify the ID to allocate with respect to the position and posture of workpiece setting. Two or more IDs can be registered for each task.	<Set value> 0 or larger
	OverW	<Overwrite flag> This is a flag to specify whether to overwrite or not if the same setting position ID exists in the task.	<Set value> 0 or 1
Return value		None	
Remarks		· If information (scanner ID, task ID, grasp ID) not registered by MS3Spic is specified, an alarm occurs. · When 0 is entered in OverW and an setting position ID registered even just once before is specified to the task ID, an alarm occurs.	

4.3.6 MS3GsetP

Description		Macro job to acquire the workpiece setting position This is a command to acquire the coordinates of P5 (setting waiting position) and P6 (setting position) of the workpiece preliminarily registered by using MS3SsetP. Specify the scanner ID, task ID, and grasp ID to output the coordinates of the grasp position as the base coordinates to the P variable.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	PickId	<Grasp ID> Specify the grasp ID of the grasp pattern used to grasp the workpiece at present.	<Set value> 1 or larger
	PNo	<P variable number for storage> Specify the P variable number to store the retrieved result. Example: When 100 is specified as this argument, the value of P5 is output to P100, and the value of P6 is output to P101.	<Set value> 0 to 126
	Set_NO	<Setting position ID> Specify the setting position ID of the workpiece to retrieve. Use the setting position ID specified as the argument when the setting position was registered (when MS3SsetP was used).	<Set value> 0 or larger
	ToolNo	<Tool number> Specify the tool number used at present.	<Set value> 0 to 31
Return value		<P5, P6 position> The coordinates of P5 and P6 are stored as the base coordinates. Move the manipulator in order of P5 and then P6 to perform the motion of placing the grasped workpiece. (In *** in the cell on the right, the value specified by PNo is entered.)	P***
Remarks		· If a setting position pattern (scanner ID, task ID, grasp ID) not registered by MS3SsetP is specified, an alarm occurs.	

4.4 Command for Pallet Recognition

4.4.1 MS3PALp

Description		Macro job to correct the pallet position This is a command to demand the specified scanner to perform pallet recognition (calculation of the amount of displacement from the pallet base position) to make a correction.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	PIndex	<Result storage Index> Specify the variable number to receive the result of pallet area estimation. Example: If 100 is specified as this argument, the result of pallet area estimation is stored in the variable number 100.	<Set value> 0 to 127
	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
Return value		<Pallet position and posture> The value of the position and posture of the grasp target pallet with respect to the Manipulator base coordinates is stored. (In *** in the cell on the right, the value specified by PIndex is entered.)	P***
Remarks		· If the task of the specified task ID cannot be used (e.g. not registered in the PC yet), an alarm occurs. · If the pallet is displaced from the base position by ±30 mm or more, an alarm occurs.	

4.4.2 MS3cPALp

Description	Concurrent macro job to correct the pallet position This is a command to demand the specified scanner to perform pallet recognition (calculation of the amount of displacement from the pallet base position) to make a correction. Use this command to send the command from a concurrent job to the scanner. For the description of the function, refer to *section 4.4.1 “MS3PALp”*.

4.5 Command for Data Transmission to Scanner (Calibration, etc.)

4.5.1 VCSTART

Description		Macro job to demand the start of RV calibration This is a command to demand the specified scanner to start calibration and to transmit the number of scene images to use.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	sNum	Number of scenes	<Set value> 1 or larger
Return value		None	
Remarks			

4.5.2 VCPOINT

Description		Macro job to shoot the RV calibration image This is a command to demand the specified scanner to shoot the image of the calibration marker. The scene No. at the time of executing the demand and the present value of the tool's TCP (tool center point) are transmitted to the scanner.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	sNo	<Scene No.> Specify the ordinal number of the image in the scene images used for calibration. Specify the number of the scene images used for calibration by VCSTART.	<Set value> 1 or larger
Return value		None	
Remarks		· If VCSTART is not executed beforehand, an alarm occurs. · If a value larger than the number of scenes specified in VCSTART is set as the scene No., an alarm occurs.	

4.5.3 PSSTART

Description		Macro job to demand the start of estimating the pallet base position This is a command to demand the specified scanner to start the estimation of the pallet base position.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	sNum	Number of scenes Specify the number of scenes to use in the estimation of the pallet base position.	<Set value> 1 or larger
Return value		None	
Remarks			

4.5.4 PSPOINT

Description		Macro job for the pallet area estimation This is a command to transmit the scene No. and the present value of the tool's TCP to the specified scanner.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	sNo	<Scene No.> Specify the ordinal number of the scene.	<Set value> 1 or larger
Return value		None	
Remarks		・If PSSTART is not executed beforehand, an alarm occurs. ・If a value larger than the number of scenes specified in PSSTART is set as the scene No., an alarm occurs.	

4.5.5 MS3REG

Description		Macro job to demand the start of RV calibration or the start of pallet area estimation This is a command to transmit the demand for the start of RV calibration or pallet area estimation and the number of scenes to use (the number of the coordinates of the positions of the manipulator's distal end transmitted to the scanner) to the specified scanner.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	sNum	<Number of scenes> Specify how many positions of the manipulator's distal end are transmitted to the scanner. Specify 8 or larger in RV calibration and 4 for pallet area estimation.	<Set value> 1 or larger
	Mode	<Mode> Specify either pallet area estimation or RV calibration to be performed. Specify Mode=1 to perform the pallet area estimation, and Mode=2 to perform the calibration.	<Set value> 1 or 2
Return value		None	
Remarks			

4.5.6 MS3Stcp

Description		Macro job to transmit the tool TCP coordinates of the manipulator to the scanner This is a command to transmit the scene No. and the present value of the tool's TCP in the base coordinates to the scanner specified by the scanner ID. Use this command to perform pallet area estimation by using the manipulator or RV calibration.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	sNo	<Scene No.> Specify the ordinal number of the teaching point.	<Set value> 1 or larger
	ToolNo	<Tool number> Specify the tool number which represents the coordinates to be transmitted to the scanner. To perform RV calibration, specify the tool number created with respect to the center of the calibration jig.	<Set value> 0 to 31
	Mode	<Mode> Specify either pallet area estimation or RV calibration to be performed. Specify Mode=1 to perform the pallet area estimation, and Mode=2 to perform the calibration.	<Set value> 1 or 2
Return value		None	
Remarks		· If MS3REG is not executed immediately before, an alarm occurs. · If a value larger than the number of scenes specified in MS3REG is set as the scene No., an alarm occurs.	

4.6 Others

4.6.1 MS3ID

Description		Macro job to select the scanner position ID (for slider support) This is a command to transmit the scanner position ID to the specified scanner to switch the RV calibration data to use.	
Argument	scId	<Scanner ID> Value allocated by the user to each scanner Specify which scanner to send the command to.	<Set value> 1 to 4
	SId	<Scanner position ID> Value allocated to each stop position of the scanner when the scanner moves by the slider.	<Set value> 1 or larger
Return value		None	
Remarks		· If a value other than 1 is set as the scanner position ID without the slider support function (optional), an alarm occurs.	

4.6.2 MS3cID

Description	Concurrent macro job to select the scanner position ID (for slider support) This is a command to transmit the scanner position ID to the specified scanner to switch the RV calibration data to use. Use this command to send the command from a concurrent job to the scanner. For the description of the function, refer to *section 4.6.1 "MS3ID"*.

4.6.3 GETTP

Description		Concurrent macro job to acquire the coordinates of P3 and P4 This is a command to acquire two teaching points from a relative job corresponding to the information specified by the task Id and the grasp Id, and write them into the P variable specified by the P variable number in the user coordinates of the user coordinate number.	
Argument	taskId	<Task ID> Task ID created in advance	<Set value> 1 or larger
	PickId	Grasp ID	<Set value> 1 or larger
	PNo	P variable number	<Set value> 0 or larger
	UF_NO	User coordinate number	<Set value> 0 or larger
	SftPNo	For shift	<Set value> 0 or larger
Remarks		· If there is no job in the specified format, an alarm occurs. · If the number of teaching points of the job is less than two, an alarm occurs.	

4.7 Sample Job

Examples of using macro jobs are described below. The argument scId set for each macro job represents the ID allocated to the connected scanner. This is used to specify which scanner a command executed by each macro job is transmitted to. The arguments scId=1 to 4 represent the scanners connected to the PC whose IP address is entered in the S variables (S085 to S089).

NOTICE

See *Appendix A* for an alternate sample job structure that matches the sample job format as shipped by default.

4.7.1 Workpiece Recognition

This is a sample job to perform workpiece recognition and receive recognition results.

In the MS3START command, specify the task ID of the workpiece to be recognized by taskID, and the number of recognition results to receive by selMax (up to 5). The recognition results are output in the variable position specified by WIndex of the MS3RES command. (Since 95 is specified in this sample job, the variable positions are B095, I095, D095, and P095.) The position and posture of the workpiece at the home position with respect to the base coordinates is created in the user frame specified by UF_NO. When two or more results exist, the user frames are sequentially created according to the number specified by selMax. The vision status of the recognition result is output to the I variable (if scId=1, fixed to I085). After executing MS3RES, confirm the vision status to check whether the recognition is successful or not. If successful, perform grasp operation by using the created user frame.

For the description of the vision status, refer to *section 7.1 “Vision Status”*.

```
JOB: Recognition job
0000 NOP
0001 MS3START scId=1 taskId=1 selMax=1
0002 MS3RES scId=1 WIndex=95 taskId=1 UF_NO=1
0003'No target
0004 PAUSE IF I085=1
0005'Empty
0006 PAUSE IF I085=2
0007'Cannot judge empty pallet
0008 PAUSE IF I085=3
0009'Time out
0010 PAUSE IF I085=4
0011 END
```

4.7.2 Grasp Teaching

This is a sample job to perform grasp teaching.

Perform workpiece recognition by MS3START and MS3RES. When the recognition is successful and the job stops at the PAUSE in the fourth line, teach the positions and postures of P3 (grasp waiting position) and P4 (grasp position) to the P variable with the number specified by P3/P4 of MS3Spic command with respect to the recognized workpiece. (Since P3/P4=10 in this sample job, P3 is taught to P010 and P4 is taught to P011.) After teaching is completed, execute MS3Spic in the fifth line to transmit the positions of P3 and P4 to the scanner. In MS3Spic, specify the task ID as taskId, the grasp ID as pickId, and the user frame number created by MS3RES as UF_NO. To write the grasp position into the USER DEFINED FILE, permit overwriting by OverW=1.

```
JOB: Grasp teaching job
0000 NOP
0001 MS3START scId=1 taskId=1 selMax=1
0002 MS3RES scId=1 WIndex=95 taskId=1 UF_NO=1
0003 PAUSE IF I085<>0
0004 PAUSE
0005 MS3Spic scId=1 P3/P4=10 taskId=1 pickId=1 UF_NO=1 OverW=1
0006 END
```

4.7.3 Setting Position Teaching

This is a sample job to teach the setting position of the workpiece.

Perform workpiece recognition by MS3START and MS3RES, and then grasp the workpiece by using the grasp job in the fourth line. With the workpiece being grasped, the job stops at the PAUSE in the fifth line, and then teach P5 (setting waiting position) to P020 of the P variable and P6 (setting position) to P021. To change the P variable number to which P5 or P6 is taught, change the value of the argument set by P5/P6 in the sixth line.

In this sample job, it is assumed that the grasp job performs grasping of the workpiece in the grasp pattern of the grasp ID=1. To perform grasping of the workpiece and teaching of the setting position by another grasp ID, set the used grasp ID to PickId in the sixth line.

To change the setting position and posture of the workpiece and register two or more positions and postures, specify the setting position ID in Set_NO in the sixth line and perform teaching twice or more. To write into the setting position definition file, permit overwriting by OverW=1.

```
JOB: Setting position registration job
0000 NOP
0001 MS3START scId=1 taskId=1 selMax=1
0002 MS3RES scId=1 WIndex=95 taskId=1 UF_NO=1
0003 PAUSE IF I085<>0
0004 CALL JOB:Grasp
0005 PAUSE
0006 MS3SsetP SCid=1 taskId=1 PickId=1 P5/P6=20 Set_NO=1 OverW=1
0007 END
```

4.7.4 Workpiece Grasping

This is a job to repeat a sequence of motions until the pallet becomes empty.

In this sequence, MS3START and MS3RES are executed to recognize the workpiece; according to the recognition result, P3 and P4 are output to the P variable specified as PNo in MS3Gpic; after grasping, front- or back-side of the workpiece is detected according to the grasp ID; P5 and P6 are output to the P variable specified as PNo in MS3GsetP; and the workpiece is placed.

```
JOB: Grasp
0000 NOP
0001 MOVJ VJ=100.00
0002*RETRY
0003'Recognition start
0004 MS3START scId=1 taskId=1 selMax=1
0005*LOOP
0006 MOVJ VJ=100.00
0007'Recognition result acquisition
0008 MS3RES scId=1 WIndex=95 taskId=1 UF_NO=1
0009'No target
0010 JUMP *RETRY IF I085=1
0011'Empty
0012 JUMP *END IF I085=2
0013'Cannot judge empty pallet
0014 JUMP *RETRY IF I085=3
0015'Time out
0016 CALL JOB:Time out     IF I085=4
0017 MOVJ VJ=100.00
0018'Grasp position acquisition
0019 MS3Gpic SCid=1 taskId=1 PickId=B095 PNo=10
UF_NO=1 ToolNo=1
0020'P3
0021 MOVL P010 V=100.0
0022'P4
0023 MOVL P011 V=50.0
0024 CALL JOB:Grasp
0025'P3
0026 TIMER T=0.50
0027 MOVL P010 V=50.0
0028 MOVJ VJ=100.00
0029'Outside vision range
0030 MOVJ VJ=100.00
0031'Recognition start
0032 MS3START scId=1 taskId=1 selMax=1
0033 JUMP *Front side  IF B095<=4
0034 JUMP *Back side  IF B095>4
0035 JUMP *END
0036'Setting position acquisition
0037*Front side
0038  MS3GsetP  SCid=1  taskId=1  PickId=B095
PNo=70 Set_NO=1 ToolNo=1
0039 JUMP *Set
0040*Back side
0041  MS3GsetP  SCid=1  taskId=1  PickId=B095
PNo=70 Set_NO=2 ToolNo=1
```

```
0042 JUMP *Set
0043*Set
0044 MOVJ VJ=100.00
0045'Set P3
0046 MOVL P070 V=100.0
0047'Set P4
0048 MOVL P071 V=50.0
0049 CALL JOB:Release
0050 TIMER T=0.50
0051 MOVJ VJ=100.00
0052 JUMP *LOOP
0053*END
0054 END
```

4.7.5 Pallet Recognition

This is a sample job to perform recognition of the amount of displacement from the pallet base position and make a correction.

In MS3PALp command, pallet recognition of the task specified by taskId is performed and the recognition result is stored in the P variable specified by PIndex.

```
JOB: Pallet recognition
0000 NOP
0001 MS3PALp scId=1 PIndex=1 taskId=1
0002 END
```

4.7.6 Calibration

This is a sample job to perform RV calibration to find the positional relation of the scanner and the manipulator.

For the procedures of RV calibration, refer to *chapter 3 “Calibration”*.

```
JOB: Calibration job
0000 NOP
0001' Calibration start
0002 MS3REG scId=1 sNum=8 Mode=2
0003' Point 1
0004 MOVL V=100.00 PL=0
0005 MS3Stcp scId=1 sNo=1 ToolNo=1 Mode=2
0006' Point 2
0007 MOVL V=100.00 PL=0
0008 MS3Stcp scId=1 sNo=2 ToolNo=1 Mode=2
0009' Point 3
0010 MOVL V=100.00 PL=0
0011 MS3Stcp scId=1 sNo=3 ToolNo=1 Mode=2
0012' Point 4
0013 MOVL V=100.00 PL=0
0014 MS3Stcp scId=1 sNo=4 ToolNo=1 Mode=2
0015' Point 5
0016 MOVL V=100.00 PL=0
0017 MS3Stcp scId=1 sNo=5 ToolNo=1 Mode=2
0018' Point 6
0019 MOVL V=100.00 PL=0
0020 MS3Stcp scId=1 sNo=6 ToolNo=1 Mode=2
0021' Point 7
0022 MOVL V=100.00 PL=0
0023 MS3Stcp scId=1 sNo=7 ToolNo=1 Mode=2
0024' Point 8
0025 MOVL V=100.00 PL=0
0026 MS3Stcp scId=1 sNo=8 ToolNo=1 Mode=2
0027 END
```

4.7.7 Pallet Area Estimation

To register the pallet base position in the task, pallet area estimation is performed. In the pallet area estimation, the rough positions of the four corners of the pallet must be specified. There are two ways: specifying them on the screen of the PC, and specifying them by indicating the four corners (on the pallet's upper surface) by using the tool attached to the manipulator. This sample job is used in the latter way.

Specify Mode=1 (pallet area estimation) as the argument of each macro job. Specify the number of data to transmit to the scanner as sNum of MS3REG (specify 4 for pallet area estimation). Move the manipulator so that the tool indicates a corner of the pallet, and transmit the coordinates of the TCP to the scanner by using MS3Stcp. In MS3Stcp, specify the ordinal number of the corner as sNo, and the tool number in use as ToolNo. In the job shown below, in the move commands in the lines 4, 7, 10 and 13, perform teaching so that the tool indicates each corner of the pallet.

```
JOB: Pallet area estimation
0000 NOP
0001' Pallet area estimation start
0002 MS3REG scId=1 sNum=4 Mode=1
0003' Point 1
0004 MOVL V=100.00 PL=0
0005 MS3Stcp scId=1 sNo=1 ToolNo=1 Mode=1
0006' Point 2
0007 MOVL V=100.00 PL=0
0008 MS3Stcp scId=1 sNo=2 ToolNo=1 Mode=1
0009' Point 3
0010 MOVL V=100.00 PL=0
0011 MS3Stcp scId=1 sNo=3 ToolNo=1 Mode=1
0012' Point 4
0013 MOVL V=100.00 PL=0
0014 MS3Stcp scId=1 sNo=4 ToolNo=1 Mode=1
0015 END
```

4.7.8 GETTP Job

In this job, two teaching points are retrieved from a relative job corresponding to the taskId and PickId specified by GETTP, and converts them into the base coordinate system.

Specify the name of the relative job as MOVxx-yy.JBI (xx=task ID, yy=grasp ID).

```
JOB: Teaching point acquisition job
0000 NOP
0001  GETTP  taskId=1  PickId=1  Pno=1  UF_NO=1
SftPno=50
0002 'P3
0003 CNVRT PX114 PX112 BF
0004 'P4
0005 CNVRT PX116 PX113 BF
0007 END
```

```
JOB: MOV1-1
NOP
MOVL C00000 V=480.0  //Ｐ３
MOVL C00001 V=200.0  //Ｐ４
END
```

5 Grasp Job Creating Procedure

The procedures of creating the grasp job of the MotoSight 3D BinPick are described below.

5.1 Grasp Teaching

5.1.1 Preparation

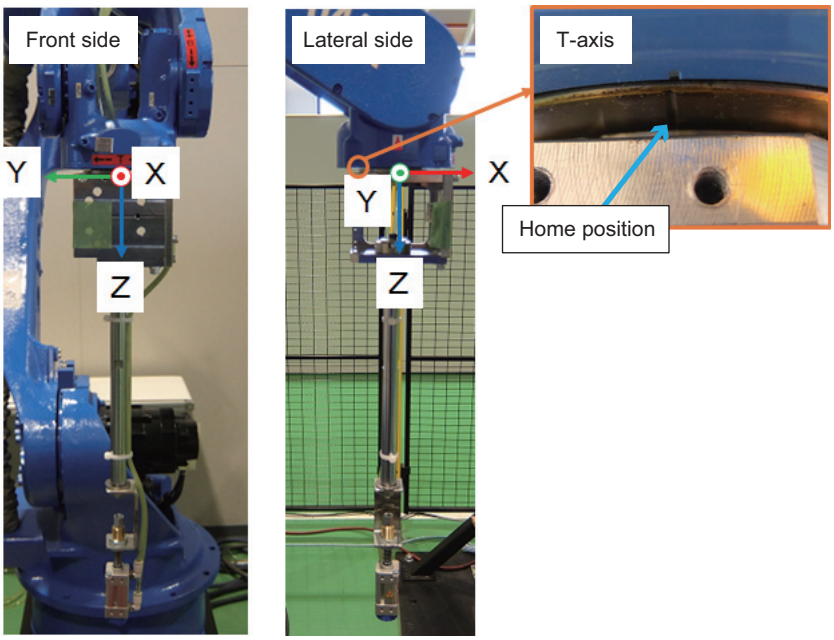
As preparation, operate the PC and register workpiece information, pallet information, hand information, and task information. For the registration procedures for each information, refer to *“Canon 3D Machine Vision System RV1100/RV500/RV300 USER’S MANUAL.”*

The *“Canon 3D Machine Vision System RV1100/RV500/RV300 USER’S MANUAL”* is stored on the installation DVD of the 3D machine vision recognition software.

5.1.2 Setting XYZ Axes of Hand CAD

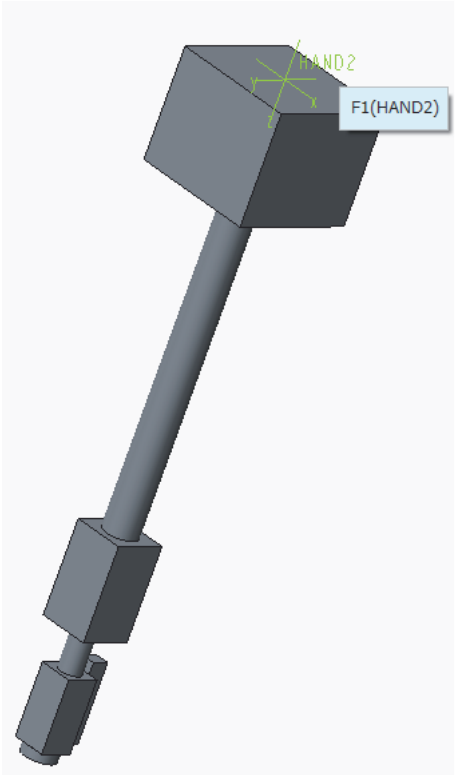
The procedures of setting the coordinate system of the hand are described below. An example of a manipulator with a hand installed is shown in *Fig. 5-1 "Hand Installation"*. In the figure, the T-axis is aligned to the home position.

Fig. 5-1: Hand Installation



Create the coordinate system which correspond with the coordinate system at the center of the face attached to the manipulator's flange, and set the created coordinate system as the home position.

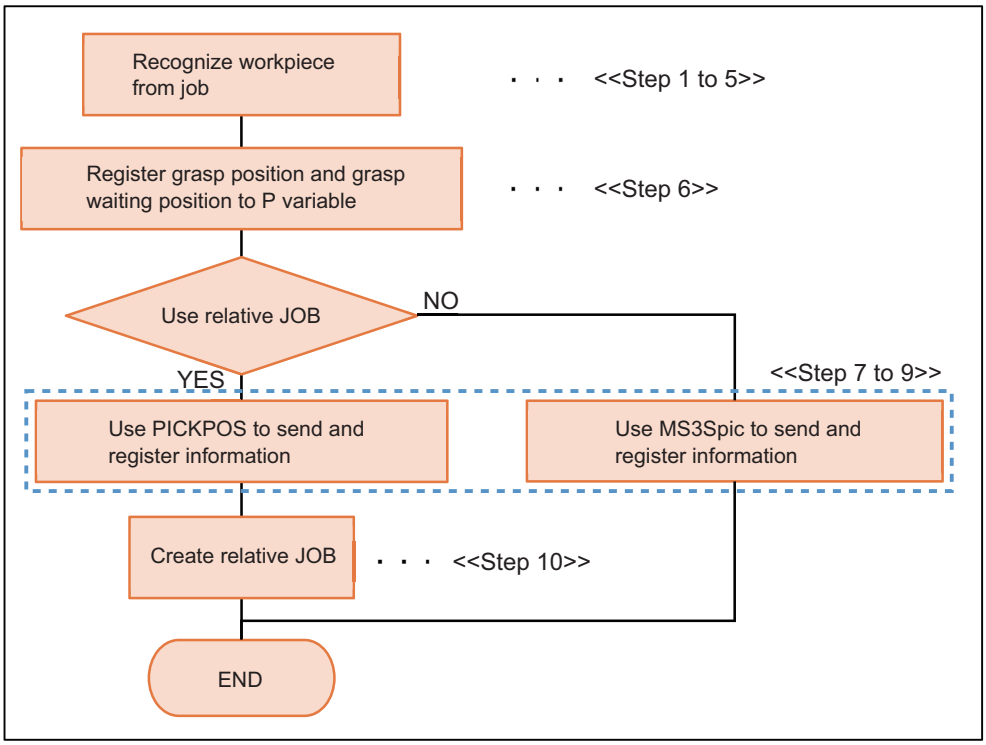
Fig. 5-2: Example of Hand CAD Model



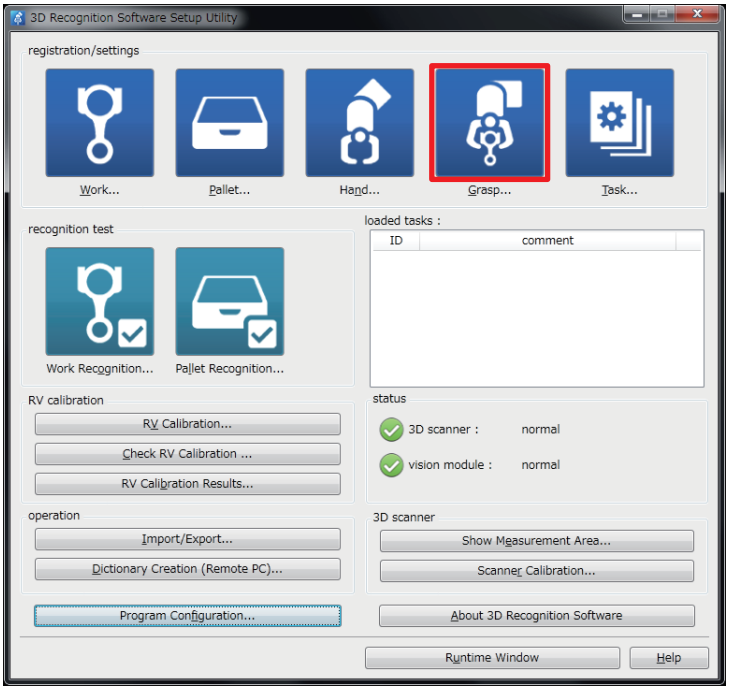
5.1.3 Grasp Teaching Procedure

The procedures of grasp teaching are described below.

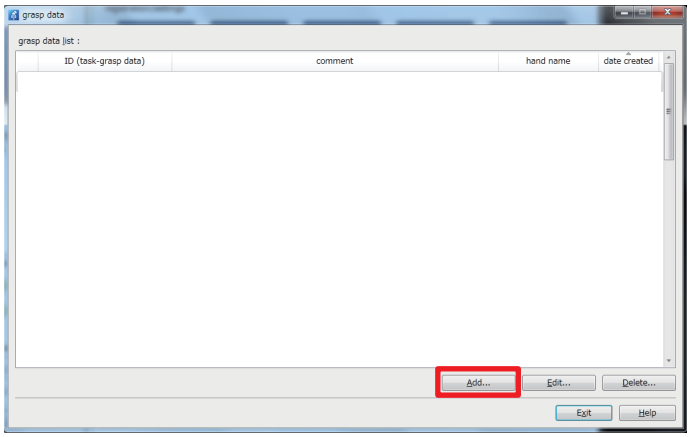
Fig. 5-3: Flow Chart of Grasp Teaching Procedure



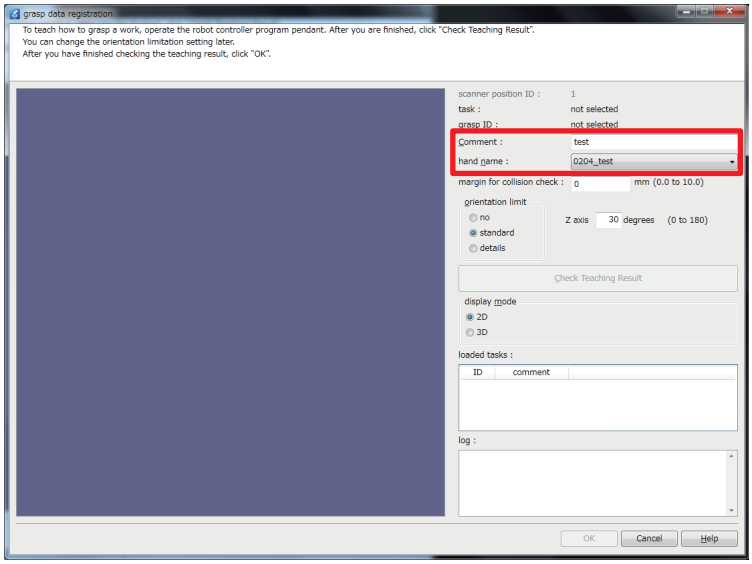
1. Operate the PC to select {Grasp} on the setup menu window.



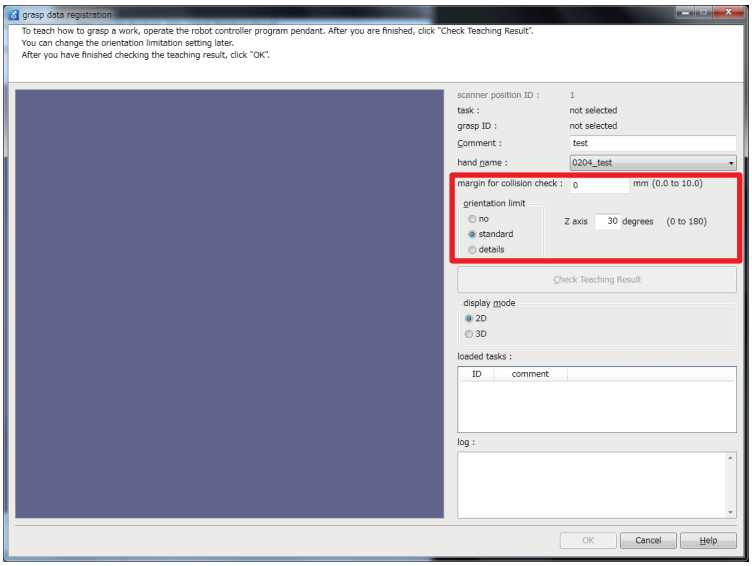
2. Click {Add}.



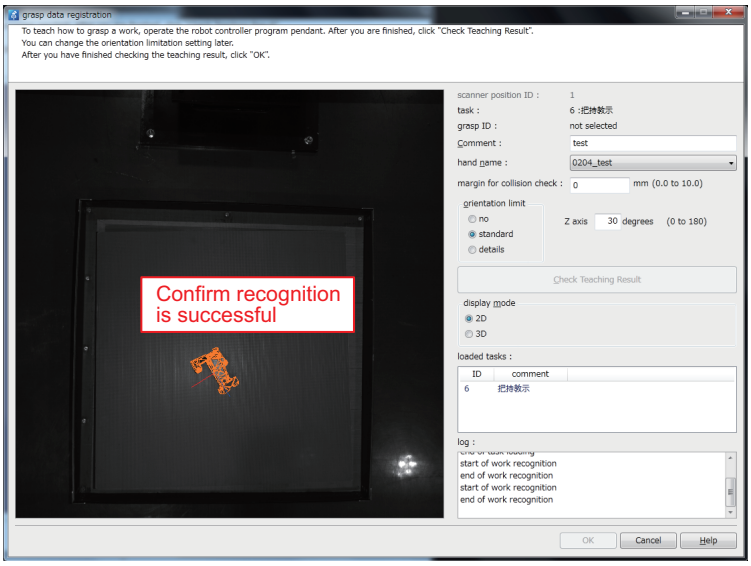
3. Input a comment into the “Comment” column and select hand.
   • Register the information of the hand to be used in advance.



4. Set “margin for collision check” and “orientation limit.”
   - For setting procedures, refer to the “*Canon 3D Machine Vision System RV1100/RV500/RV300 USER’S MANUAL.*”

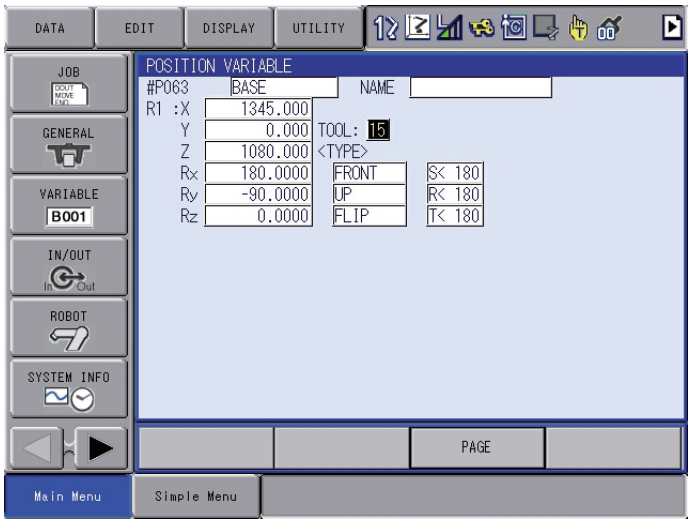


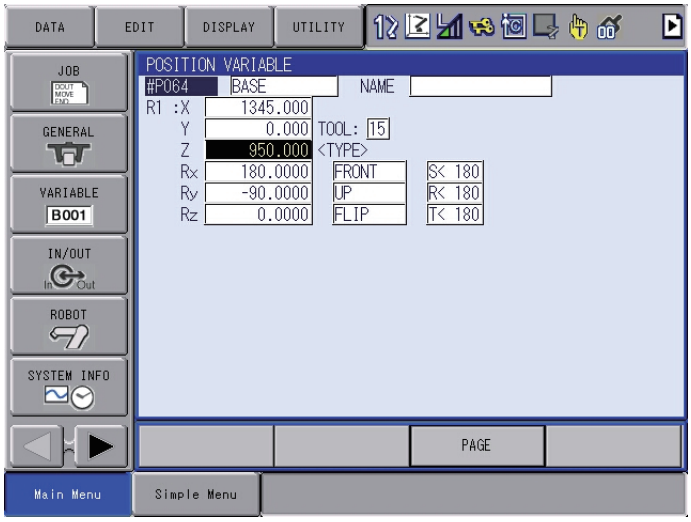
5. Perform recognition processing from the job for grasp teaching.
   - Confirm that the recognition is successful on the screen of the PC.
   - Use the workpiece recognition result and create a user frame for the workpiece. When MS3RES is used to receive the recognition result, the user frame is automatically created with the number specified by the argument.



6. Operate the Manipulator and teach the positions of P3 and P4 in the base coordinate system to the P variable.

   • The P variable number is specified by PICKPOS or MS3Spic (macro job for grasp teaching). For details, refer to *chapter 4 "Vision Command (Macro Job)"*.

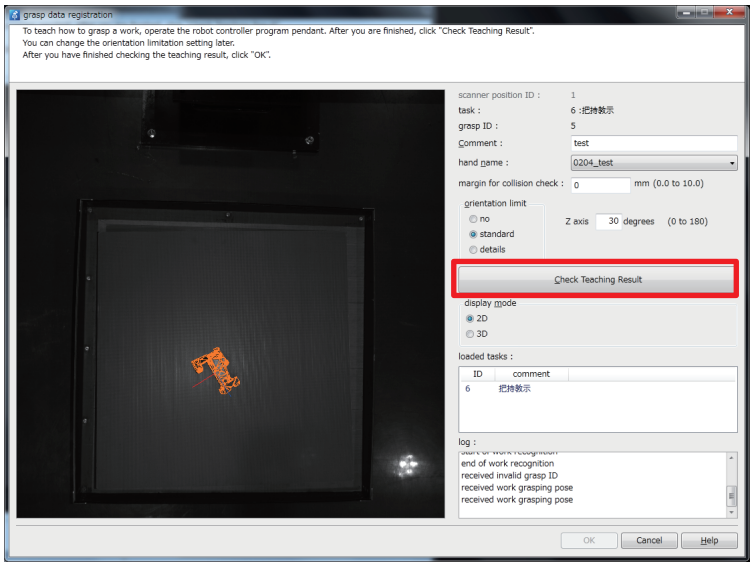




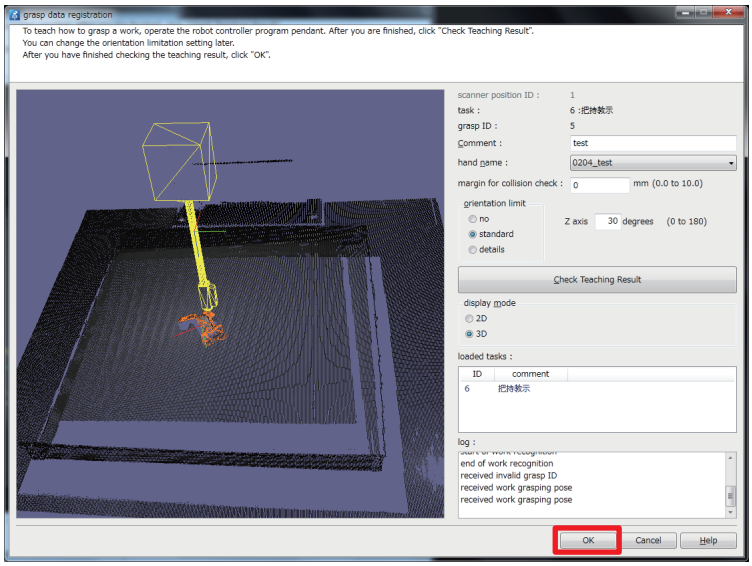
7. Transmit the coordinates of the teaching point from the job for grasp teaching to the scanner.

   • When a relative job is not used for workpiece grasping, use MS3Spic and transmit the values of P3 and P4 to write into the USER DEFINED FILE. (When grasp teaching is successful, writing into the USER DEFINED FILE is automatically performed.)

8. Click {Check Teaching Result}.



9. Confirm that the model of the hand is shown at the taught point, and then click {OK}.
   - If the model of the hand is not shown at the taught point, possible causes are as follows:
     - RV calibration is not performed correctly.
     - The home position of the hand CAD model is not set at the flange position of the manipulator.



10. Use the teaching point registered in the P variable in *step 6* and create a relative job to be used for grasping the workpiece.
    - When creating the relative job, use the user frame created with respect to the workpiece home position in the recognition process in the *step 5*. To create the user frame, use MS3RES to receive the recognition result or create the user frame with respect to the workpiece home position based on the recognition result.
    - If the relative job is not used to grasp the workpiece (when MS3Spic is used in *step 7*), there is no need to create the relative job.

```
JOB：Relative JOB example
NOP
MOVL C00000 V=480.0  //P 3
MOVL C00001 V=200.0  //P 4
END
```

5.1.4 Grasp Pattern Calling Procedure (Grasp during Runtime)

The procedures of calling the grasp pattern during runtime are described below.

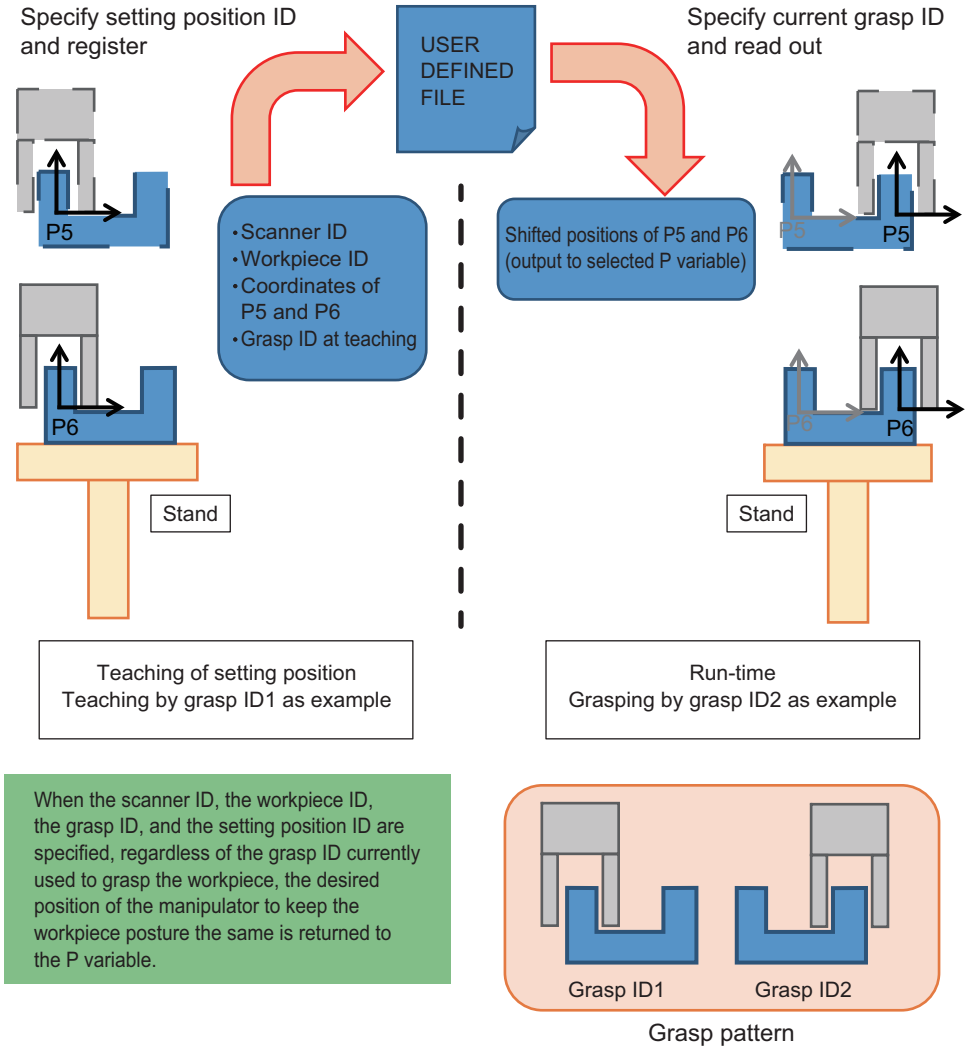
1. Perform workpiece recognition.
   - After using MS3START (or MS3NEXT), use MS3RES or VWAIT to acquire the recognition result.
2. Create a user frame with respect to the home position of the recognized workpiece.
   - When MS3RES is used to receive the workpiece recognition result in the step 1 above, use the user frame of the number specified by the argument (US_NO).
   - When VWAIT is used to receive the recognition result, or when the user frame is manually created in *step 10* in *section 5.1.3 “Grasp Teaching Procedure”*, create the user frame in the same procedure.
3. Move the manipulator to the workpiece grasp position.
   - When MS3Spic is used in *section 5.1.3 “Grasp Teaching Procedure”*
     - Use MS3Gpic to take the positions P3 and P4 into the P variable. (As arguments, specify the user frame number created in *step 2* above and the grasp ID acquired as a return value of MS3RES.)
     - Move the manipulator to the workpiece grasp position by using the move command to the P variable in which P3 and P4 are taken.
   - When the relative job is created in *section 5.1.3 “Grasp Teaching Procedure”*
     - Move the manipulator to the workpiece grasp position by using the move command to P3 and P4 taught in the relative job corresponding to the grasp ID acquired by receiving the workpiece recognition result in *step 1*.

5.2 Setting Position Teaching

By this setting position teaching function, the way of setting the workpiece (on which position in what posture) after it is grasped from the pallet is registered in the USER DEFINED FILE. Once the setting position is taught, even if the workpiece grasp pattern is changed, the way is automatically corrected and the workpiece is placed in the taught way of setting. Multiple ways of setting can be registered.

Even without this function, however, the way of setting can be changed for each grasp pattern by making a conditional branch and teaching a setting motion for each grasp pattern in the job.

Fig. 5-4: Outline of Setting Position Teaching



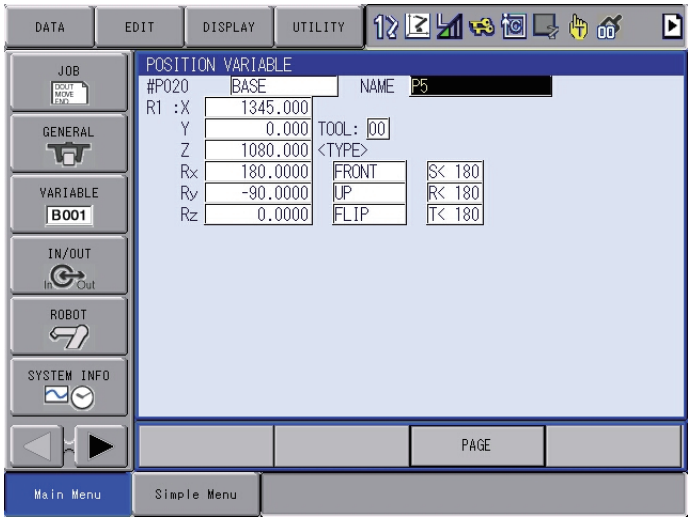
5.2.1 Preparation

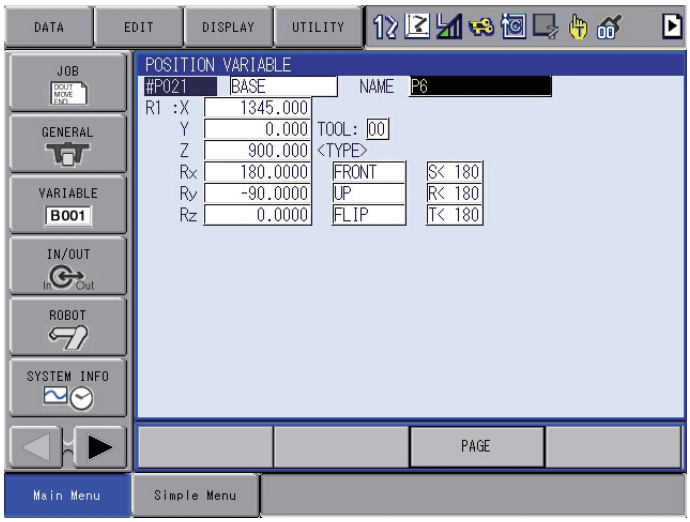
Perform grasp teaching to the task to be used by referring to *section 5.1 "Grasp Teaching"*.

5.2.2 Setting Position Teaching Procedure

The procedures of teaching the setting position are described below.

1. Perform workpiece recognition, and specify a desired grasp ID to perform workpiece grasping.
   - Grasp of the workpiece by referring to *section 5.1.4 “Grasp Pattern Calling Procedure (Grasp during Runtime)”*.
2. With the workpiece being grasped, operate the Manipulator to teach the positions P5 and P6 to the P variable.
   - Specify the P variable number by MS3SsetP (macro job for setting position teaching). For details, refer to *section 4.3.5 “MS3SsetP”*.





3. Use MS3SsetP and write the positions P5 and P6 into the USER DEFINED FILE.
   - Specify the setting Position ID, the workpiece ID, the scanner ID, and the grasp ID. If multiple setting position IDs, workpiece IDs, or scanner IDs exist, perform the setting position teaching multiple times.
   - Regarding the grasp ID, even if multiple grasp patterns exist, once the grasp ID of one of the patterns is registered, setting positions for the others are automatically created. For details, refer to *section 4.3.5 “MS3SsetP”*.

5.2.3 Setting Position Calling Procedure (Workpiece Setting during Runtime)

When teaching of the setting position is performed according to *section 5.2.2 “Setting Position Teaching Procedure”*, the setting position can be taken into the specified P variable by calling the setting position during runtime. The procedures of calling the setting position are described below.

1. Grasp the workpiece.
   - After using MS3START (or MS3NEXT), use MS3RES or VWAIT and grasp the workpiece based on the acquired recognition result.
2. Acquire the setting position of the workpiece.
   - Use MS3GsetP and read out the desired position which the manipulator should move to from the user variable to the P variable. For details of MS3GsetP, refer to *section 4.3.6 “MS3GsetP”*.
3. Move the manipulator to the setting position.
   - By the move command, move the manipulator to the P variable specified by the argument (PNo) of MS3GsetP.

6 Alarm List

Alarms shown on the screen of the Programming Pendant are described below.

Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	0	<Cause> An error occurred in the API of MotoPlus application. <Solution> Restart the RC. If the same error occurs repeatedly, contact Customer Support.
8000	MOTOPLUS ERROR	1	<Cause> Creation of MotoPlus thread failed. <Solution> Restart the RC. If the same error occurs repeatedly, contact Customer Support.
8000	MOTOPLUS ERROR	2	<Cause> A system error occurred in the RC. <Solution> Restart the RC. If the same error occurs repeatedly, contact Customer Support.
8000	MOTOPLUS ERROR	3	<Cause> MotoPlus application received an undefined user demand from the job. <Solution> Confirm that skillsend is not used in the job. Also, confirm that no unsupported macro job is used.
8000	MOTOPLUS ERROR	4	<Cause> MotoPlus application received an invalid argument from the job. <Solution> Confirm whether the argument value of the vision command used in the job is valid.
8000	MOTOPLUS ERROR	5	<Cause> The format of the job file used in GETTP (vision command) is invalid. <Solution> Correct the job contents by referring to *section 4.7.8 “GETTP Job”*.

Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	6	<Cause> No job file to use in GETTP (vision command) <Solution> Confirm whether the job file specified by the argument of GETTP is already created. If not, create it by referring to *section 4.7.8 "GETTP Job"*.
8000	MOTOPLUS ERROR	7	<Cause> The tool numbers of P3 and P4 sent by the vision command for grasp teaching (PICKPOS or MS3Spic) are not the same. <Solution> Confirm that teaching operations of the two P variables were conducted by using the same tool number.
8000	MOTOPLUS ERROR	8	<Cause> The scene number specified in MS3REG or VCPOINT or PSPOINT (vision command) is invalid. <Solution> Confirm the argument of each command in the executed job. For the details of the arguments, refer to *chapter 4 "Vision Command (Macro Job)"*.
8000	MOTOPLUS ERROR	9	<Cause> MS3RES (vision command) was executed before MS3START (vision command) was executed. <Solution> Execute MS3START before executing MS3RES.
8000	MOTOPLUS ERROR	10	<Cause> The task IDs specified as arguments of MS3START (vision command) and MS3RES (vision command) are not the same. <Solution> Confirm the arguments of MS3START and MS3RES in the executed job.

Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	11	<Cause> The value of SelMax specified as an argument of MS3START (vision command) is 0 or smaller, or larger than 5. <Solution> Confirm the argument of MS3START in the executed job.
8000	MOTOPLUS ERROR	12	<Cause> MotoPlus application failed to write variables in the programming pendant. <Solution> Confirm that the variable number specified in the job is within the range of each variable.
8000	MOTOPLUS ERROR	13	<Cause> MotoPlus application failed to write P variable in the programming pendant. <Solution> Restart the RC. If the same error occurs repeatedly, contact Customer Support.
8000	MOTOPLUS ERROR	14	<Cause> An invalid scanner position ID was specified as a vision command argument. <Solution> Confirm whether the scanner supports the slider (optional). If so, confirm that the USB key is connected to the PC, and no negative value is set as the scanner position ID.
8000	MOTOPLUS ERROR	15	<Cause> The IO number for UNTIL specified as an argument of INCMOVE is invalid. <Solution> Specify the argument of INCMOVE within the range of general-purpose input.

Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	16	<Cause> When MS3Spic (vision command) was executed, writing of the USER DEFINED FILE for grasp position registration failed. <Solution> Confirm whether the RC supports the USER DEFINED FILE. If so, overwriting of the grasp position information may have failed. If it is OK to overwrite the information, permit overwriting by using the argument of MS3Spic.
8000	MOTOPLUS ERROR	17	<Cause> When MS3Gpic (vision command) was executed, reading of the USER DEFINED FILE for grasp position registration failed. <Solution> Confirm whether the RC supports the USER DEFINED FILE. If so, specify the grasp ID already registered in the USER DEFINED FILE for grasp position registration.
8000	MOTOPLUS ERROR	18	<Cause> When MS3SsetP (vision command) was executed, writing of the USER DEFINED FILE for setting position failed. <Solution> Confirm whether the RC supports the USER DEFINED FILE. Confirm that the grasp pattern (workpiece ID and grasp ID) specified by MS3SsetP is already registered by MS3Spic (vision command) in the USER DEFINED FILE for grasp position. Also, if an already-registered setting position ID is specified and if it is OK to overwrite it, permit overwriting by using the argument of MS3SsetP.

Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	19	<Cause> When MS3GsetP (vision command) was executed, reading of the USER DEFINED FILE for setting position failed. <Solution> Confirm whether the RC supports the USER DEFINED FILE. If so, confirm that writing in the USER DEFINED FILE for setting position was already performed in advance.
8000	MOTOPLUS ERROR	20	<Cause> The value of the flag used by the PC is invalid. Or, the flag used by the PC was rewritten after the RC was started. <Solution> Correct the value by referring to *section 2.4 “IP Address Setting (RC)”*. After the correction, restart the RC.
8000	MOTOPLUS ERROR	21	<Cause> The inverse matrix could not be calculated in the calculation of the coordinates to be written in the USER DEFINED FILE. <Solution> Modify the teaching point and the tool information and recalculate.
8000	MOTOPLUS ERROR	22	<Cause> MS3START (vision command) was consecutively executed five times or more in the job. <Solution> Correct the job so that the number of consecutive command execution to one scanner is limited to four times.
8000	MOTOPLUS ERROR	23	<Cause> Before a process in the scanner is completed, another command is issued to the same scanner. <Solution> Do not issue plural commands to one scanner at the same time.

Alarm code	Alarm name	Sub code	Description
8001	RC PC CONNECTION ERROR	0	<Cause> A communication error occurred between the RC and the PC (RCIF). <Solution> Confirm the connection of the LAN cable connecting the RC and the PC. If the LAN cable is connected, refer to *section 2.3 "IP Address Setting (PC)"* and confirm whether the IP address of the PC is correctly set. If the IP address of the PC is correctly set, refer to *section 2.2 "RCIF Installation"* and confirm whether the RCIF is started. If not, restart the vision module. (The RCIF is then restarted automatically.)
8001	RC PC CONNECTION ERROR	1	<Cause> An error occurred in the data transmission from the RC to the PC (RCIF). <Solution> Confirm the connection of the LAN cable connecting the RC and the PC. If the LAN cable is connected, refer to *section 2.3 "IP Address Setting (PC)"* and confirm whether the IP address of the PC is correctly set. If the IP address of the PC is correctly set, refer to *section 2.2 "RCIF Installation"* and confirm whether the RCIF is started. If not, restart the vision module. (The RCIF is then restarted automatically.)

Alarm code	Alarm name	Sub code	Description
8001	RC PC CONNECTION ERROR	2	<Cause> An error occurred in the data transmission from the PC (RCIF) to the RC. <Solution> Confirm the connection of the LAN cable connecting the RC and the PC. If the LAN cable is connected, refer to *section 2.3 "IP Address Setting (PC)"* and confirm whether the IP address of the PC is correctly set. If the IP address of the PC is correctly set, refer to *section 2.2 "RCIF Installation"* and confirm whether the RCIF is started. If not, restart the vision module. (The RCIF is then restarted automatically.)
8002	VISION PC CONNECTION ERROR	0	<Cause> An error occurred in the data transmission from the RCIF to the vision module. <Solution> Restart the vision module. (The RCIF is then restarted automatically.)
8002	VISION PC CONNECTION ERROR	1	<Cause> An error occurred in the data transmission from the vision module to the RCIF. <Solution> Restart the vision module. (The RCIF is then restarted automatically.)
8003	VISION MODULE ERROR	0	<Cause> A fatal error occurred in the scanner. <Solution> Restart the scanner.
8003	VISION MODULE ERROR	1	<Cause> A fatal error occurred in the PC. <Solution> Restart the PC.
8003	VISION MODULE ERROR	2	<Cause> A fatal error occurred in the vision module. <Solution> Restart the vision module.

Alarm code	Alarm name	Sub code	Description
8003	VISION MODULE ERROR	3	<Cause> A serious error occurred in the vision module. <Solution> Restart the scanner.
8003	VISION MODULE ERROR	4	<Cause> A serious error occurred in the PC. <Solution> Restart the PC.
8003	VISION MODULE ERROR	5	<Cause> A serious error occurred in the vision module. <Solution> Restart the vision module.
8003	VISION MODULE ERROR	6	<Cause> A temporary error occurred in the scanner. <Solution> Restart the scanner.
8003	VISION MODULE ERROR	7	<Cause> A temporary error occurred in the PC. <Solution> Restart the PC.
8003	VISION MODULE ERROR	8	<Cause> A temporary error occurred in the vision module. <Solution> Restart the vision module.
8004	VISION COMMAND ERROR	0	<Cause> The vision module received an undefined command from the RCIF. <Solution> Restart the vision module.
8004	VISION COMMAND ERROR	1	<Cause> The vision module is running in the mode in which the execution of the vision command sent from RCIF is not allowed. <Solution> Confirm the mode of the vision module and change it to an appropriate mode. Regarding the correspondence between modes and commands, refer to *section 4.1 “Vision Command and Mode of Vision Module”*.

Alarm code	Alarm name	Sub code	Description
8004	VISION COMMAND ERROR	2	<Cause> The number of loaded tasks of the vision module exceeded the upper limit. <Solution> Restart only the RCIF.
8004	VISION COMMAND ERROR	3	<Cause> In MS3Stcp (vision command), a scene number out of range of the scene number specified by MS3REG was specified. <Solution> Increase the scene number of MS3REG (vision command) or correct the scene number of MS3Stcp (vision command) to a number within the range, and then execute the operation again.
8004	VISION COMMAND ERROR	4	<Cause> The status of the task specified by MS3START (vision command) is not registered yet. <Solution> Register the task information by referring to the *“3D Machine Vision System RV1100/RV500/ RV300 USER’S MANUAL.”*
8004	VISION COMMAND ERROR	5	<Cause> Recognition was demanded from the RCIF by using a task which is not yet loaded in the vision module. <Solution> Restart the vision module.
8004	VISION COMMAND ERROR	6	<Cause> PICKPOS or MS3Spic (vision command) was executed before the workpiece was measured. <Solution> Perform the recognition of the workpiece, and then execute the operation again.
8004	VISION COMMAND ERROR	7	<Cause> MS3Stcp (vision command) was executed before MS3REG (vision command) was executed. <Solution> Execute MS3REG, and then execute the operation again.

Alarm code	Alarm name	Sub code	Description
8004	VISION COMMAND ERROR	8	<Cause> In MS3Stcp (vision command), a scene number out of range was specified. <Solution> Correct the scene number of MS3Stcp (vision command) to a number within the range, and then execute the operation again.
8004	VISION COMMAND ERROR	9	<Cause> While the vision module was in process, a vision command was sent from the RCIF to the vision module. <Solution> Execute the operation again at a later time.
8004	VISION COMMAND ERROR	10	<Cause> When calibration (MS3Stcp (vision command)) was performed, the detection of the calibration marker failed. <Solution> Modify the position of the calibration marker so that it can be seen from the scanner and is parallel to the scanner, and then execute the operation again.
8004	VISION COMMAND ERROR	11	<Cause> Pallet measurement (MS3PALp (vision command)) failed. <Solution> Modify the pallet position to a position within the range of ±30 mm from the estimated pallet position, and then execute the operation again.
8004	VISION COMMAND ERROR	12	<Cause> The grasp ID (pickid) specified by PICKPOS or MS3Spic (vision command) cannot be used because it is already used. <Solution> Modify the grasp ID (pickid) of PICKPOS or MS3Spic (vision command), and then execute the operation again.

Alarm code	Alarm name	Sub code	Description
8004	VISION COMMAND ERROR	13	<Cause> MS3REG or PSSTART (vision command) was executed before the pallet was measured. <Solution> Measure the pallet, and then execute the operation again.
8004	VISION COMMAND ERROR	14	<Cause> The position of the calibration marker is invalid. <Solution> Modify the position of the calibration marker, and then execute the operation again.
8004	VISION COMMAND ERROR	15	<Cause> An invalid scanner position ID (SId) was specified in MS3ID (vision command). <Solution> If the MS3D system does not support the slider, set 1 as the scanner position ID (SId). If it supports the slider, confirm that the dongle key is inserted.
8004	VISION COMMAND ERROR	16	<Cause> A vision command was executed before RV calibration was performed. <Solution> Perform RV calibration by referring to *chapter 3 “Calibration”*.
8005	RCIF MODULE ERROR	0	<Cause> A status error occurred in the RCIF. <Solution> Restart the PC, the RC, and the scanner. If the problem is not solved, contact Customer Support.

Alarm code	Alarm name	Sub code	Description
8005	RCIF MODULE ERROR	1	<Cause> The vision module is running in the mode in which the execution of the vision command executed by the job is not allowed. <Solution> Confirm the mode of the vision module and change it to an appropriate mode. Regarding the correspondence between modes and commands, refer to *section 4.1 "Vision Command and Mode of Vision Module"*.
8005	RCIF MODULE ERROR	2	<Cause> An error occurred during loading the task. <Solution> Check the PC to confirm whether the task used in the job is in a usable state. If the specified task is not created or if the grasp registration in the task is not performed, perform task creation and grasp registration.
8005	RCIF MODULE ERROR	3	<Cause> A status error occurred in the RCIF. <Solution> Restart the PC, the RC, and the scanner. If the problem is not solved, contact Customer Support.
8005	RCIF MODULE ERROR	4	<Cause> The RCIF received an invalid argument. <Solution> Confirm the argument of the macro job used in the job.

7 Variable and IO List

Variables used in MotoSight 3D BinPick are described below. In the remarks column, “RB common” means that the same variable is used even if different manipulators are used (e.g., R1 and R2 of a dual-arm Manipulator), and “Do NOT use” means that the user cannot use the variable because MotoSight 3D BinPick uses it.

7.1 Vision Status

Description of the vision status is shown below. The vision status is the output to the variable numbers 85 to 88 of the I variable.

Table 7-1: Vision Status

Value	Status
0	Successful recognition
1	No target
2	Empty pallet
3	Cannot judge empty pallet
4	Time out

7.2 B Variable

Table 7-2: B Variable List

Variable number	Variable name	Description	Remarks
B85	MS3PC1 flag	Flag used by PC1	RB common
B86	MS3PC2 flag	Flag used by PC2	RB common
B87	MS3PC3 flag	Flag used by PC3	RB common
B88	MS3PC4 flag	Flag used by PC4	RB common
・ ・ ・	・ ・ ・	・ ・ ・	・ ・ ・
B100	INCMOVE status	For INCMOVE status storage	R1
・ ・ ・	・ ・ ・	・ ・ ・	・ ・ ・
B126	Reserved by MS3 system		Do NOT use
B127	Reserved by MS3 system		Do NOT use
B128	Reserved by MS3 system		Do NOT use
B129	Reserved by MS3 system		Do NOT use
B130	Reserved by MS3 system		Do NOT use
B131	Reserved by MS3 system		Do NOT use
B132	Reserved by MS3 system		Do NOT use
B133	Reserved by MS3 system		Do NOT use
B134	Reserved by MS3 system		Do NOT use
B135	Reserved by MS3 system		Do NOT use
B136	Reserved by MS3 system		Do NOT use
B137	Reserved by MS3 system		Do NOT use

Table 7-2: B Variable List

Variable number	Variable name	Description	Remarks
B138	Reserved by MS3 system		Do NOT use
B139	Reserved by MS3 system		Do NOT use
B140	Reserved by MS3 system		Do NOT use
B141	Reserved by MS3 system		Do NOT use
B142	Reserved by MS3 system		Do NOT use
B143	Reserved by MS3 system		Do NOT use
B144	Reserved by MS3 system		Do NOT use
B145	Reserved by MS3 system		Do NOT use
B146	Reserved by MS3 system		Do NOT use
B147	Reserved by MS3 system		Do NOT use
B148	Reserved by MS3 system		Do NOT use
B149	Reserved by MS3 system		Do NOT use
B150	Reserved by MS3 system		Do NOT use
B151	Reserved by MS3 system		Do NOT use
B152	Reserved by MS3 system		Do NOT use
B153	Reserved by MS3 system		Do NOT use
B154	Reserved by MS3 system		Do NOT use
B155	Reserved by MS3 system		Do NOT use
B156	Reserved by MS3 system		Do NOT use
B157	Reserved by MS3 system		Do NOT use
B158	Reserved by MS3 system		Do NOT use
B159	Reserved by MS3 system		Do NOT use
B160	Reserved by MS3 system		Do NOT use
B161	Reserved by MS3 system		Do NOT use
B162	Reserved by MS3 system		Do NOT use
B163	Reserved by MS3 system		Do NOT use
B164	Reserved by MS3 system		Do NOT use
B165	Reserved by MS3 system		Do NOT use
B166	Reserved by MS3 system		Do NOT use
B167	Reserved by MS3 system		Do NOT use
B168	Reserved by MS3 system		Do NOT use
B169	Reserved by MS3 system		Do NOT use

7.3 I Variable

Table 7-3: I Variable List

Variable number	Variable name	Description	Remarks
I85	MS3 status PC1	Vision status of PC1	RB common
I86	MS3 status PC2	Vision status of PC2	RB common
I87	MS3 status PC3	Vision status of PC3	RB common

Table 7-3: I Variable List

Variable number	Variable name	Description	Remarks
I88	MS3 status PC4	Vision status of PC4	RB common
⋮	⋮	⋮	⋮
I126	Reserved by MS3 system		Do NOT use
I127	Reserved by MS3 system		Do NOT use
I128	Reserved by MS3 system		Do NOT use
I129	Reserved by MS3 system		Do NOT use
I130	Reserved by MS3 system		Do NOT use
I131	Reserved by MS3 system		Do NOT use
I132	Reserved by MS3 system		Do NOT use
I133	Reserved by MS3 system		Do NOT use
I134	Reserved by MS3 system		Do NOT use
I135	Reserved by MS3 system		Do NOT use
I136	Reserved by MS3 system		Do NOT use
I137	Reserved by MS3 system		Do NOT use
I138	Reserved by MS3 system		Do NOT use
I139	Reserved by MS3 system		Do NOT use
I140	Reserved by MS3 system		Do NOT use
I141	Reserved by MS3 system		Do NOT use
I142	Reserved by MS3 system		Do NOT use
I143	Reserved by MS3 system		Do NOT use
I144	Reserved by MS3 system		Do NOT use
I145	Reserved by MS3 system		Do NOT use
I146	Reserved by MS3 system		Do NOT use
I147	Reserved by MS3 system		Do NOT use
I148	Reserved by MS3 system		Do NOT use
I149	Reserved by MS3 system		Do NOT use
I150	Reserved by MS3 system		Do NOT use
I151	Reserved by MS3 system		Do NOT use
I152	Reserved by MS3 system		Do NOT use
I153	Reserved by MS3 system		Do NOT use
I154	Reserved by MS3 system		Do NOT use
I155	Reserved by MS3 system		Do NOT use
I156	Reserved by MS3 system		Do NOT use
I157	Reserved by MS3 system		Do NOT use
I158	Reserved by MS3 system		Do NOT use
I159	Reserved by MS3 system		Do NOT use
I160	Reserved by MS3 system		Do NOT use
I161	Reserved by MS3 system		Do NOT use
I162	Reserved by MS3 system		Do NOT use
I163	Reserved by MS3 system		Do NOT use
I164	Reserved by MS3 system		Do NOT use
I165	Reserved by MS3 system		Do NOT use

Table 7-3: I Variable List

Variable number	Variable name	Description	Remarks
I166	Reserved by MS3 system		Do NOT use
I167	Reserved by MS3 system		Do NOT use
I168	Reserved by MS3 system		Do NOT use
I169	Reserved by MS3 system		Do NOT use
I170	Reserved by MS3 system		Do NOT use
I171	Reserved by MS3 system		Do NOT use
I172	Reserved by MS3 system		Do NOT use
I173	Reserved by MS3 system		Do NOT use
I174	Reserved by MS3 system		Do NOT use
I175	Reserved by MS3 system		Do NOT use
I176	Reserved by MS3 system		Do NOT use
I177	Reserved by MS3 system		Do NOT use
I178	Reserved by MS3 system		Do NOT use
I179	Reserved by MS3 system		Do NOT use
I180	Reserved by MS3 system		Do NOT use
I181	Reserved by MS3 system		Do NOT use
I182	Reserved by MS3 system		Do NOT use
I183	Reserved by MS3 system		Do NOT use

7.4 D Variable

Table 7-4: D Variable List

Variable number	Variable name	Description	Remarks
D85	MS3 recognition number PC1	Number of recognized workpieces of PC1	RB common
D86	MS3 recognition number PC2	Number of recognized workpieces of PC2	RB common
D87	MS3 recognition number PC3	Number of recognized workpieces of PC3	RB common
D88	MS3 recognition number PC4	Number of recognized workpieces of PC4	RB common

7.5 S Variable

Table 7-5: S Variable List

Variable number	Variable name	Description	Remarks
S74	Reserved by MS3 system		Do NOT use
S75	Reserved by MS3 system		Do NOT use
S76	Reserved by MS3 system		Do NOT use
S77	Reserved by MS3 system		Do NOT use
S78	Reserved by MS3 system		Do NOT use
S79	Reserved by MS3 system		Do NOT use
S80	Reserved by MS3 system		Do NOT use

Table 7-5: S Variable List

Variable number	Variable name	Description	Remarks
S81	Reserved by MS3 system		Do NOT use
S82	RCIF version information	RCIF version information	RB common
S83	MotoPlus version information	MotoPlus version information	RB common
S84	MotoPlus version information	MotoPlus version information	RB common
S85	IP address PC1	IP address of PC1	RB common
S86	IP address PC2	IP address of PC2	RB common
S87	IP address PC3	IP address of PC3	RB common
S88	IP address PC4	IP address of PC4	RB common

7.6 General-Purpose Output

MotoSight 3D BinPick uses the general-purpose outputs shown below.

Table 7-6: General-Purpose Output List

OG#	OT#	Description	Remarks
32	249	Reserved by MS3 system	Do NOT use
	250	Reserved by MS3 system	Do NOT use
	251	Reserved by MS3 system	Do NOT use
	252	Reserved by MS3 system	Do NOT use
	253	Reserved by MS3 system	Do NOT use
	254	Reserved by MS3 system	Do NOT use
	255	Reserved by MS3 system	Do NOT use
	256	Reserved by MS3 system	Do NOT use

7.7 Network Input

Information of the vision status is input into the network input variables shown below. To check the connection condition of the PC and RC from an external device, refer to this information.

Table 7-7: Network Input

Vision Type	Network input variable	Description	Remarks
Vision 1	27010 to 27017	10000000	READY ON
		00000001	READY OFF
Vision 2	27020 to 27027	10000000	READY ON
		00000001	READY OFF
Vision 3	27030 to 27037	10000000	READY ON
		00000001	READY OFF
Vision 4	27040 to 27047	10000000	READY ON
		00000001	READY OFF

Even if communication to the RC I/F is available, when the vision status is an error status, READY OFF is shown.

Appendix A

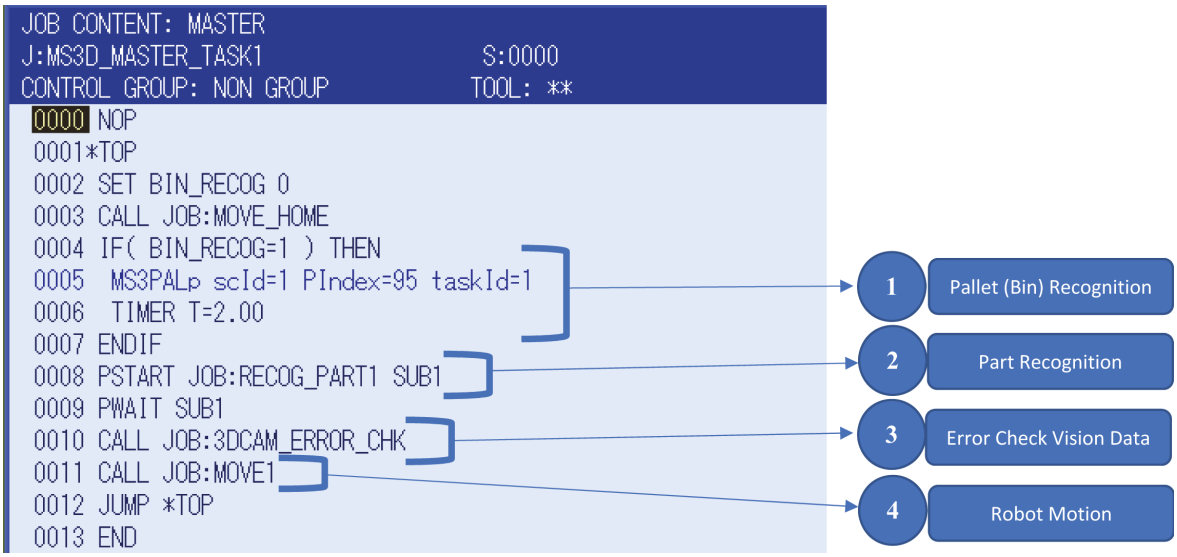
A sample master job is described that is included in all MotoSight 3D BinPick Controllers as a template job. “MS3D_MASTER_TASK1.JBI” is the master job that handles:

1. Pallet (Bin) Recognition
2. Part Recognition
3. Error Check Vision Data
4. Robot Motion

NOTICE

This template uses PSTART (Parallel Start) and PWAIT (Parallel Wait) commands. These commands can reduce cycle time by executing manipulator motion in parallel to workpiece recognition.

.



A.1 Pallet (Bin) Recognition

CAUTION

- Complete a Pallet (Bin) Recognition when loading a new bin into the system.

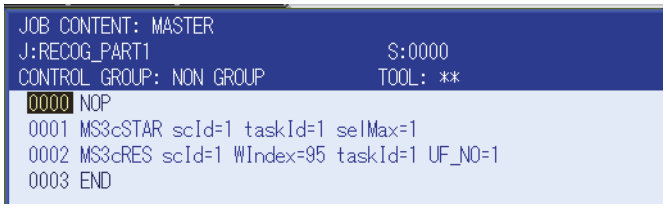
Not completing a Pallet Recognition function when loading a new bin into the system can cause a collision between the bin and the Manipulator tooling.

In this example, LB000 (BIN_RECOG), decides if to inspect the bin or not. Most applications do this when loading a new bin and does not require re-execution.

A.2 Part Recognition

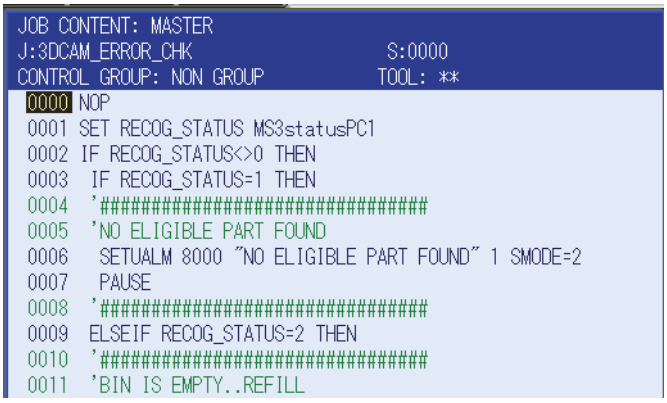
This job requests a specified scanner to begin recognizing the workpiece and get the vision data results. The user must execute each macro entirely for successful operation.

This job uses the MS3cSTAR macro to request the specified scanner (scId) to begin workpiece recognition for the specified task (taskId) and return a specified maximum number of results (selMax). The MS3cRES macro is then used to acquire the vision data results after defining the specified scanner (scID), the variable (I, B, D, & P) storage index number where the recognition results are written (WIndex), the task number (taskId) and finally the user frame number that will be created based on the workpiece location (UF_NO). The user must execute each macro entirely for successful operation. See *chapter 4 "Vision Command (Macro Job)"* for detailed descriptions of each macro.



A.3 Error Check Vision Data Results

Upon completion of 'RECOG_PART1.JBI' the status of I085 ('MS3StatusPC1') is updated to reflect the outcome of the vision results. See *section 7.1 “Vision Status” on page 7-1* for complete listing of I085 statuses.



A.4 Robot Motion

After successfully identifying a part, in this example, B095 updates a valid grasp number for a selected part. (This variable location is specified in the MS3cRES macro of the Windex field.) At this point, motion for a specific grasp is determined by the status of B095.

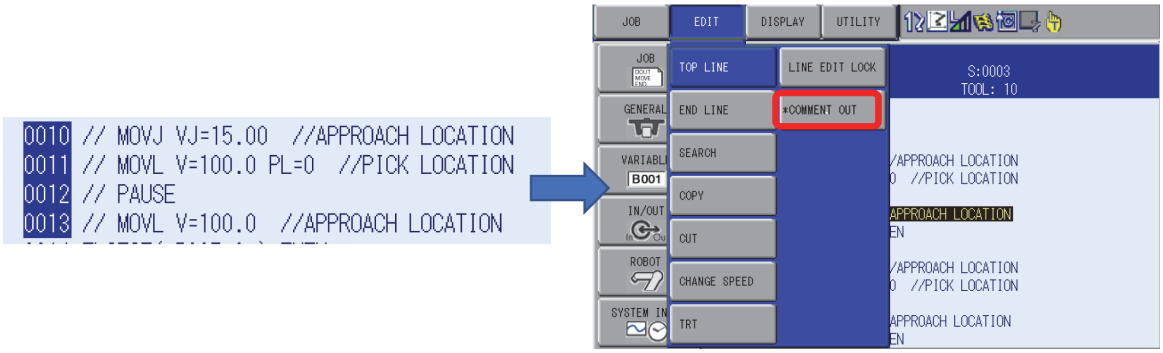
NOTICE

- With respect to User Frame #1, 'MOVE1' is a Relative Job. (The user frame number is in the MS3cRES macro of the UF_NO field).
- 'RECOG_PART1.JBI' creates User Frame #1 which is the part location.
  - An easy mistake is to make is leaving 'MOVE1.JBI' as a standard pulse-based job or making 'MOVE1.JBI' a Relative Job with respect to the incorrect user frame.

The 'MOVE1.JBI' sample job has all motion commented out by default. The user must uncomment these lines and press [MODIFY]+[ENTER] keys to teach these points with the same points taught in the grasp teaching process. Be sure to run the recognition job immediately prior to teaching these points so the part user frame is in the correct location.

```
JOB CONTENT: MASTER
J:MOVE1                                  S:0000
CONTROL GROUP: R1                        TOOL: **
0000 NOP
0001' B95 indicates which grasp is
0002' going to be used.
0003'
0004' The user must uncomment and
0005' MODIFY+ENTER these positions at
0006' the same time a grasp is taught
0007 IF( B095=1 ) THEN
0008 'GRASP 1
0009  PAUSE
0010 // MOVJ VJ=15.00  //APPROACH LOCATION
0011 // MOVL V=100.0 PL=0  //PICK LOCATION
0012 // PAUSE
0013 // MOVL V=100.0  //APPROACH LOCATION
0014 ELSEIF( B095=2 ) THEN
0015 'GRASP 2
0016 // MOVJ VJ=15.00  //APPROACH LOCATION
0017 // MOVL V=100.0 PL=0  //PICK LOCATION
0018 // PAUSE
0019 // MOVL V=100.0  //APPROACH LOCATION
```

Lines can be commented out (or uncommented) by pressing the [SHIFT]+[SELECT] while the cursor is on the right side of the job. Use the arrow keys on the Programming Pendant to select one or many lines, press [EDIT], and then select {COMMENT OUT}.



MotoSight 3D BinPick
INSTRUCTIONS

HEAD OFFICE
2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004, Japan
Phone +81-93-645-7703 Fax +81-93-645-7802

YASKAWA America Inc. (Motoman Robotics Division)
100 Automation Way, Miamisburg, OH 45342, U.S.A.
Phone +1-937-847-6200 Fax +1-937-847-6277

YASKAWA Europe GmbH（Robotics Divsion ）
Yaskawastrasse 1, 85391 Allershausen, Germany
Phone +49-8166-90-100 Fax +49-8166-90-103

YASKAWA Nordic AB
Verkstadsgatan 2, Box 504 ,SE-385 25 Torsas, Sweden
Phone +46-480-417-800 Fax +46-486-414-10

YASKAWA Electric (China) Co., Ltd.
22F, One Corporate Avenue, No.222, Hubin Road, Huangpu District, Shanghai 200021, China
Phone +86-21-5385-2200 Fax ＋86-21-5385-3299

YASKAWA SHOUGANG ROBOT Co. Ltd.
No7 Yongchang North Road, Beijing E&T Development Area, China 100176
Phone +86-10-6788-2858 Fax +86-10-6788-2878

YASKAWA India Private Ltd. (Robotics Division)
#426, Udyog Vihar, Phase- IV, Gurgaon, Haryana, India
Phone +91-124-475-8500 Fax +91-124-475-8542

YASKAWA Electric Korea Corporation
35F, Three IFC, 10 Gukjegeumyung-ro, Yeongdeungpo-gu, Seoul, Korea 07326
Phone +82-2-784-7844 Fax +82-2-784-8495

YASKAWA Electric Taiwan Corporation
12F, No.207, Sec. 3, Beishin Rd., Shindian District, New Taipei City 23143, Taiwan
Phone +886-2-8913-1333 Fax +886-2-8913-1513

YASKAWA Electric (Singapore) PTE Ltd.
151 Lorong Chuan, #04-02A, New Tech Park, Singapore 556741
Phone +65-6282-3003 Fax +65-6289-3003

YASKAWA Electric (Thailand) Co., Ltd.
59,1st-5th Floor, Flourish Building, Soi Ratchadapisek 18,Ratchadapisek Road,
Huaykwang, Bangkok 10310, THAILAND
Phone +66-2-017-0099 Fax +66-2-017-0199

PT. YASKAWA Electric Indonesia
Secure Building-Gedung B Lantai Dasar & Lantai 1 JI. Raya Protokol Halim Perdanakusuma,
Jakarta 13610, Indonesia
Phone +62-21-2982-6470 Fax +62-21-2982-6741

YASKAWA

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