Panasonic

MACHINE VISION SYSTEM

# IMAGECHECKER® PV260

# User's Manual


WMJ-PV260-OP-01

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Please read this Instruction Manual carefully and thoroughly before operating this product.

# Safety Precautions

Before starting installation, operation, maintenance or inspection, please carefully read and fully understand the following safety precautions for proper usage. The safety requirements are classified as follows. Either of them is important information on safety. Make sure to observe them.

⚠ **WARNING** : Suggests that the user's mishandling can lead to personal death or serious injury.

⚠ **CAUTION** : Suggests that the user's mishandling can lead to personal injury or damage to the property.

## ⚠ WARNING

| | | | |
|---|---|---|---|
|  PROHIBITION | ● Do not use this product in an atmosphere containing an inflammable gas.<br>Use in such an atmosphere can cause an explosion.<br>● Do not throw this product into the fire.<br>Doing so can result in an explosion.<br>● Do not store a lens in any place where it is exposed to direct sunlight. It may cause smoking. |  PROHIBITION | ● Do not look at the sun through a lens.<br>It could lead to blindness. |
| | |  Strict Observance | ● To make the whole system work on safe side in the event of an error due to a failure of this product or an external factor, safety measures should be taken outside this product. |

## ⚠ CAUTION

| | | | |
|---|---|---|---|
|  Prohibition of Disassembly | ● Do not dismantle or remodel the product.<br>It could lead to excessive exothermic heat or smoke generation. |  Strict Observance | ● To prevent abnormal high heat or smoking, do not use this product at the top of its characteristics or performances assured.<br>● Use an external structure for emergency and interlock circuits.<br>● Connect the wires or connectors securely.<br>Loose connection can lead to abnormal high heat or smoking.<br>● When laying or removing wires, be sure to turn off the power supply.<br>Otherwise, electric shock may occur. |
|  Prohibition of Contact | ● Do not touch the terminal while turning on electricity.<br>It could lead to an electric shock. | | |
|  PROHIBITION | ● Keep the inside of the product free from foreign matters such as liquid, flammable material, and metal.<br>Otherwise, abnormal high heat or smoking may occur.<br>● Prevent bending the cables forcibly or placing a heavy object on them. Keep this product away from thermal appliances.<br>Otherwise, electric shock or smoking may occur. | | |

# Introduction

Thank you for purchasing Panasonic Industrial Devices SUNX's IMAGECHECKER PV260.
Please read this Instruction Manual carefully and thoroughly for the correct, optimum and safe use of this product.
All our products are strictly inspected before shipped. However, before using this product, check for problems that occurred during transport and then perform operation check. If the product is found to be damaged or does not operate as specified, we are sorry to trouble you, but please contact the shop where you purchased the product or our nearest local office to you.

# Manual Configuration

This manual describes the robot application functions of the PV260 and the procedure for setting it. Robot applications have been added to the PV260 based on the PV230 Ver1.22. For the hardware information and the functions other than robot applications, please refer to and fully understand the PV200 Manual to use the product correctly. For the functions of the Optical Character Reader (OCR) checker and code reader checker, refer to the PV230 Manual.
Every effort is made to produce this manual. However, if you find any questions or any errors or have anything to point out, please do not hesitate to contact our nearest local office to.

The following manuals have been prepared for this product. Go through these manuals according to the objectives and use them fully. Keep the manuals at hand after reading over so that you can see them whenever necessary.

☑ IMAGECHECKER PV260 - Operation Manual (This description)

Describes items necessary for operating the PV260.

- Basic operation procedure and how to use the screens
- Procedure for setting robot application functions
- Communication Settings

☐ IMAGECHECKER PV200 Manual Operation Edition

Describes items necessary for operating the PV200. Use this manual for preprocessing functions and procedure for setting inspection conditions of various checkers. If you need the booklet, please contact our personnel in charge of sales.

- Procedure for setting inspection conditions with various checkers used (except for Optical Character Reader (OCR) checker and code reader checker)
- Operation and procedure for setting RUN Menu
- Environment Setting
- Tool Setting (Configuration change)
- Debugging of main unit (Inspection re-examination function)
- Select Menu
- Communication Settings
- Tool software for PC
- Specification and Part No. List

☐ IIMAGECHECKER PV230 Manual Operation Edition

Describes items necessary for operating the PV230, which is the base type of PV260. For the functions of the Optical Character Reader (OCR) checker and code reader checker and the procedure for setting, refer to this manual.

# Contents


Introduction ..... 3

Manual Configuration ..... 3

## Overview of PV260 ..... 7

1.1 Features of PV260 ..... 8

1.2 System Configuration ..... 9

1.3 Procedure for Setting ..... 10

## Robot Setting ..... 11

2.1 Robot Environment Setting ..... 12

2.1.1 Setting of Camera Attachment ..... 12

2.1.2 Setting of Robot Information ..... 13

2.1.3 Setting of Robot Coordinates ..... 14

## Communication Settings ..... 17

3.1 Robot Communication ..... 18

3.1.1 Communication Settings ..... 18

3.2 Robot Coordinates Format Setting ..... 20

3.2.1 What is Robot Coordinate Format? ..... 20

3.2.2 About Input / Output of Robot coordinates ..... 21

3.3 Robot Control Command Format ..... 27

3.3.1 What is Robot Control Command Format? ..... 27

3.3.2 Basic Setting of Robot Control Command Format ..... 30

3.3.3 About Movement Instruction and Get Current Robot Position Response ..... 37

3.4 Robot Control Setting ..... 39

3.4.1 What is Robot Control Setting? ..... 39

3.4.2 Setting Procedure ..... 41

3.5 Communication Port and Protocol ..... 45

3.5.1 RS-232C Interface ..... 45

3.5.2 Ethernet Interface ..... 47

3.5.3 Protocol ..... 49

3.6 Serial Communication Setting (COM Port) ..... 50

3.7 Network Setting ..... 51

3.8 General Communication ..... 52

3.8.1 Overview and Communication Specifications ..... 52

3.8.2 Setting General Communication ..... 53

3.8.3 Outputting Data through General Communication ..... 54

3.8.4 List of Commands for General Communication ..... 59

3.8.5 Details on General Communication Command ..... 61

3.9 PLC Communication ..... 70

3.9.1 Overview and Communication Specifications ..... 70

3.9.2 Setting of PLC Communication ..... 76

3.9.3 Outputting Data through PLC Communication ..... 82

3.9.4 Controlling PV260 through PLC Communication ..... 86

3.9.5 List of PLC Communication Commands ..... 90

3.9.6 Descriptions of PLC Communication Commands ..... 92

3.9.7 Details of PLC Communication Command (external communication commands) ..... 99

## Inspection ..... 101

4.1 Robot Tool Offset Function ..... 102

4.1.1 Tool Position ..... 103

4.1.2 Tool Offset ..... 103

4.1.3 Setting Procedure When Installation Position is in R Axis ..... 104

4.1.4 Setting Procedure When Installation Position is in 2nd Axis ..... 106

4.1.5 Method of calculating the R-Coordinates ..... 107

4.2 Calibration Setting ..... 108

4.2.1 About Calibration Setting ..... 108

4.2.2 Calibration Setting Items ..... 108
4.2.3 Set transformation of robot coordinate .. 110
4.3 Teaching Support ..... 123
4.3.1 Teaching Support Menu ..... 124
4.3.2 Setting of Robot Teaching ..... 125
4.3.3 Output of Teaching Coordinates ..... 128
4.4 Work Detection ..... 133
4.4.1 Find Gravity Coordinates of Work (1 Field of View) ..... 135
4.4.2 Find Adjustment Amount of Work (1 Field of View) ..... 140
4.4.3 Find Gravity Coordinates of Work (Multiple fields of View) ..... 143
4.4.4 Find Adjustment Amount of Work (Multiple Fields of View) ..... 147
4.4.5 Convenient Function for Work Detection ..... 153
4.5 Working Position Setting ..... 154
4.5.1 List of Output to Numerical Calculation, Judgement and Data R/W ..... 162
4.5.2 Other Numerical Calculation ..... 164
4.6 Output of Robot Coordinates ..... 168
4.6.1 Output of Robot Coordinates When Running ..... 171

Sequence ..... 175

5.1 Sequence of Auto Calibration ..... 176
5.1.1 General Communication With Robot Control Command ..... 176
5.1.2 General Communication without Robot Control Command ..... 177
5.1.3 PLC Communication With Robot Control Command ..... 178
5.1.4 PLC Communication Without Robot Control Command ..... 179
5.2 Teaching Coordinate Request Sequence ..... 181
5.3 Execution Sequence (View Field 1) ..... 182
5.3.1 General Communication ..... 182
5.3.2 When YAMAHA is selected by "Maker" . 183
5.4 Base Position Re-registration Sequence (With captured image) ..... 184
5.4.1 General Communication ..... 184
5.5 Base Position Re-registration Sequence (Without Captured Image) ..... 185
5.5.1 General Communication ..... 185

Other Functions ..... 187

6.1 Other Functions ..... 188
6.1.1 Calibration Update ..... 188
6.1.2 Command Communication Log ..... 190
6.1.3 Select Menu ..... 192
6.1.4 Print Screen Function ..... 196

Appendix ..... 197

About Format for Each Maker ..... 198
DENSO ..... 198
EPSON ..... 199
IAI 200
JANOME: JR2000/JS Series ..... 205
JANOME: JR3000 Series ..... 206
TOSHIBA ..... 207
YAMAHA ..... 209
ASCII Code Table ..... 211
Revision history ..... 214
Warranty ..... 215

# Chapter 1

## Overview of PV260

# 1.1 Features of PV260

The PV260 is an image processing system equipped with robot applications based on the IMAGE-CHECKER PV230 that has both Optical Character Reader (OCR) function and code reader checker function. The system converts coordinates in pixels obtained from inspection results of the PV260 into robot coordinates for operating the robot to play a role as a robot vision.

■ Simple Calibration

Calibration is the function that converts inspection result from the coordinate in pixels that is a unit for the PV260 to the actual value of robot coordinate and outputs it. The PV260 can easily convert the camera coordinate system into the robot coordinate system simply by detecting the reference mark (arbitrary) in three view ranges while it is being moved via a camera.

■ Teaching Assistant Function

Teaching operation can easily be performed via a monitor from images of target work captured in the PV260. Originally, teaching operation was performed in actual-thing matching by visual check between robot and target work in most cases. However, using this teaching assistant function can eliminate variation at teaching points caused by the operator, dealing with minute work that is difficult to check visually.

■ Operation Position Setting

If the base position of operation for target work is registered in the PV260 in advance, it can automatically calculate the shift amount of the work during execution of operation, outputting appropriate work position information to the robot.

■ "TOOL" that can specify a tool position as a detection position

The coordinates of the point of the tip of a tool can be detected by the camera by registering the offset position of "TOOL" to be installed at the tip of the robot. This allows the PV260 to calculate to which position the robot should be moved with respect to the operation position.

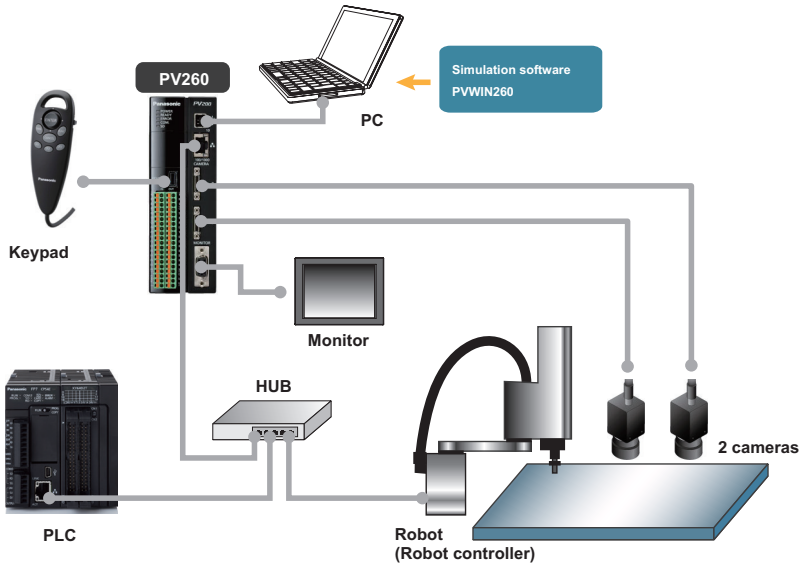
■ Direct Communication with Robot

The PV260 is equipped with a direct communication function supporting robots of various manufacturers. The dedicated communication format of each robot manufacturer is available to provide communication without using PLC between the PV260 and the robot.

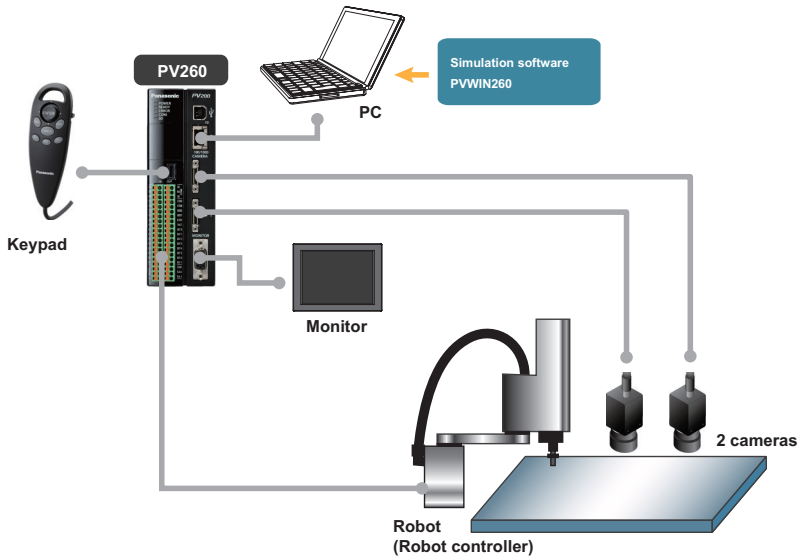
# 1.2 System Configuration

The following system configuration is allowed in the robot vision system using the PV260.

## System configuration example with PLC used

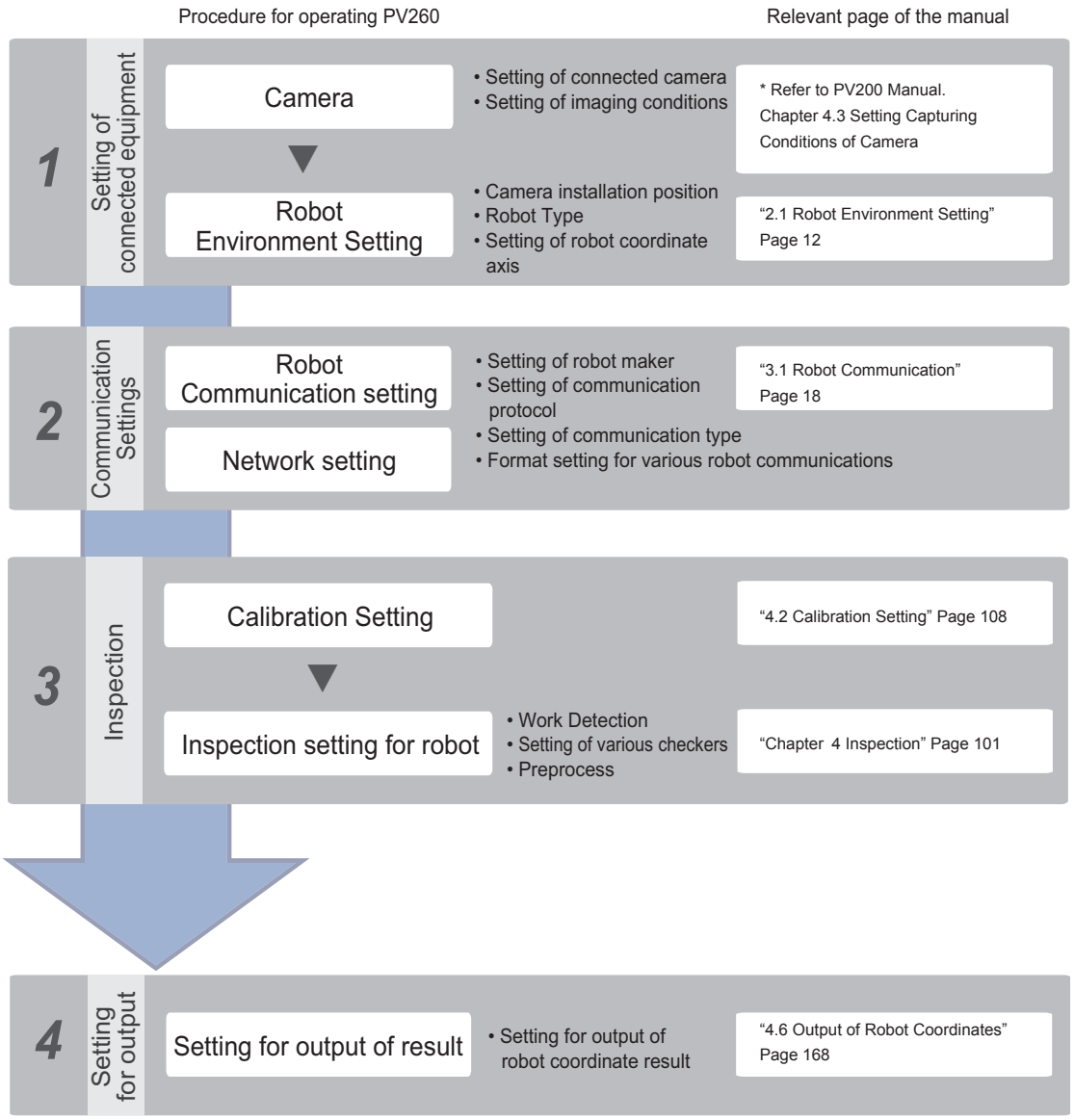



## System configuration example with PLC not used



# 1.3 Procedure for Setting

## Flowchart

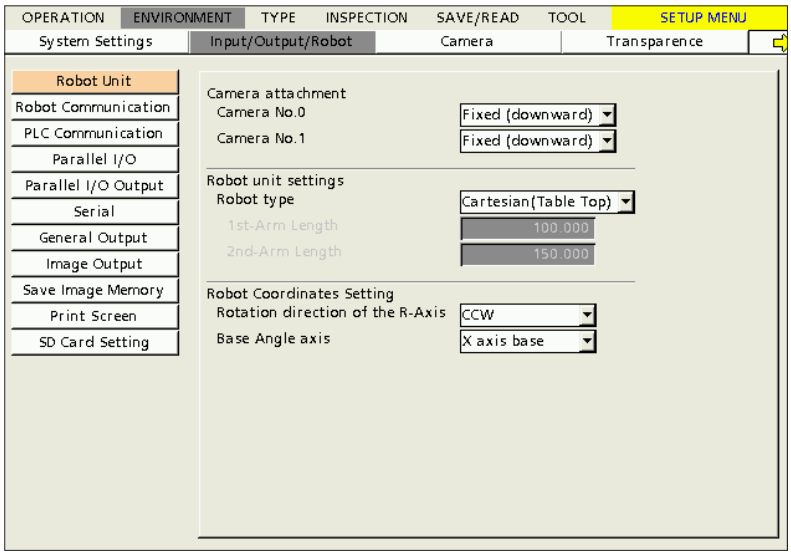


# Chapter 2

## Robot Setting

# 2.1 Robot Environment Setting

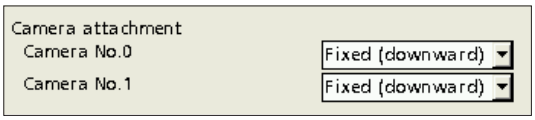
Settings related to a robot connected to the PV260 are made.




"Robot Unit" screen

## 2.1.1 Setting of Camera Attachment

For each camera, set the method of attaching a camera to be used.

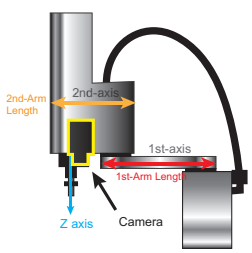
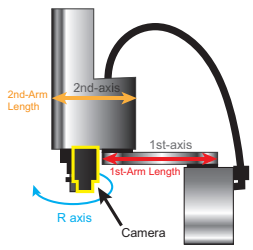
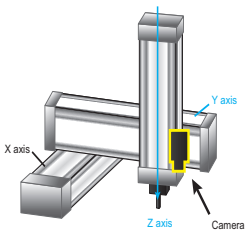
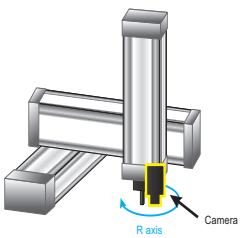



1. Select "ENVIRONMENT" > "Input/Output/Robot" and then display the "Robot Unit" menu.

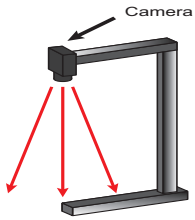
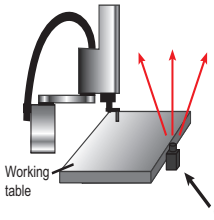
2. Set each of " Camera No.0" and "Camera No.1" in "Camera attachment" by selecting one of the following types.

### Camera Attachment Types

Installation of movable part

| SCARA 2nd-Axis | SCARA R-Axis | Cartesian(Table Top) 2nd-Axis | Cartesian(Table Top) R-Axis |
|---|---|---|---|
|  |  |  |  |

Installation of fixed part

| Fixed (downward) | Fixed (upward) |
|---|---|
|  |  |



▶Caution

Please note that the following changes require initializing calibration settings for all Types.

- When "2nd-Axis" or "R-Axis" was changed in "Camera attachment"
- When "Robot Type" was changed with "2nd-Axis" or "R-Axis" selected for "Camera attachment"

▶ Note

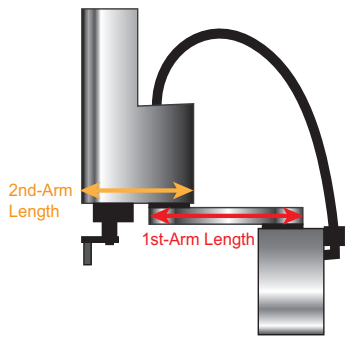
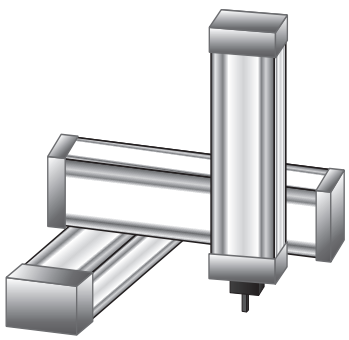
- When "Unused" is selected for a camera in the "Camera" menu under "ENVIRONMENT", camera attachment cannot be set.
- "Movable part attachment (2nd-axis/R-axis)" cannot be set for both cameras.

## 2.1.2 Setting of Robot Information

Type of the robot connected to the PV260 is specified. For SCARA type robot, set the arm length of 1st-axis and 2nd-axis of the relevant robot.

***1.*** Select "ENVIRONMENT" > "Input/Output/Robot" and then display the "Robot Unit" menu.

***2.*** In "Robot type" under "Robot unit settings", select the robot to be used from "SCARA" or "Cartesian (Table Top)". Default: Cartesian (Table Top)

| SCARA robot | Cartesian robot |
|---|---|
|  |  |



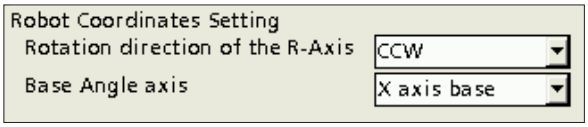
***3.*** When "SCARA" is selected in 2, set "1st-Arm Length" and "2nd-Arm Length".

▶ Note

- For 1st-/2nd-Arm Length, Robot Type is set to "SCARA". They are selectable only when "2nd-Axis" is selected in Camera attachment.
- Set the arm length accurately according to the specifications of the robot to be connected.

## 2.1.3 Setting of Robot Coordinates

Set whether the rotation direction of robot coordinate system is clockwise or counterclockwise. In addition, set whether the base angle of the robot coordinate system (axis specified as 0 degree) is X axis or Y axis.



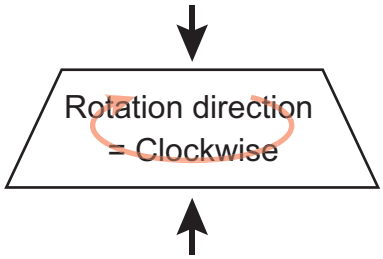
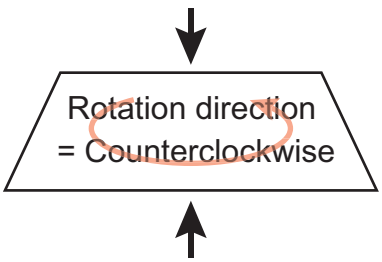

1. Select "ENVIRONMENT" > "Input/Output/Robot" and then display the "Robot Unit" menu.

2. Set "Rotation Direction" and "Base Angle axis" in "Setting of Robot Coordinates" according to the following concept.

### Concept of Robot Coordinate Setting

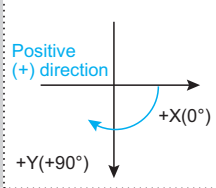
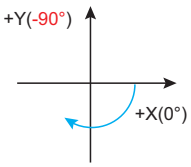
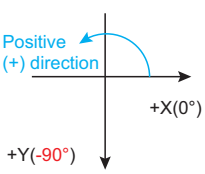
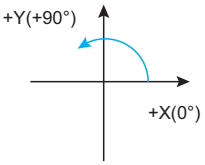
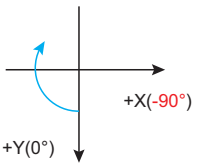
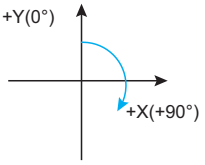
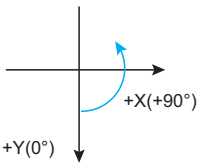
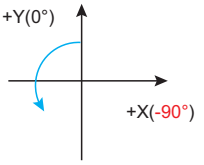
Rotation Direction

Set the rotation direction of the coordinate system of the robot to be used actually. The PV260 calculates the angle according to camera installation direction and robot coordinate space.

| | |
|---|---|
| With movable camera fixed (downward), the robot rotation direction is "Clockwise" viewed from the camera. | With movable camera fixed (downward), the robot rotation direction is "Counterclockwise" viewed from the camera. |
|   |   |
| With fixed (upward), the robot rotation direction is "Counterclockwise" viewed from the camera. | With fixed (upward), the robot rotation direction is "Clockwise" viewed from the camera. |

## Base Angle axis

Specify whether the base axis, where the angle in robot coordinate system is 0 degree, is "X axis base" or "Y axis base". The angle for calculating the robot coordinate system is specified according to combinations of rotation direction and base angle axis, as follows:

| | Clockwise | Counterclockwise |
|---|---|---|
| X axis base |   |   |
| Y axis base |   |   |

**Note**

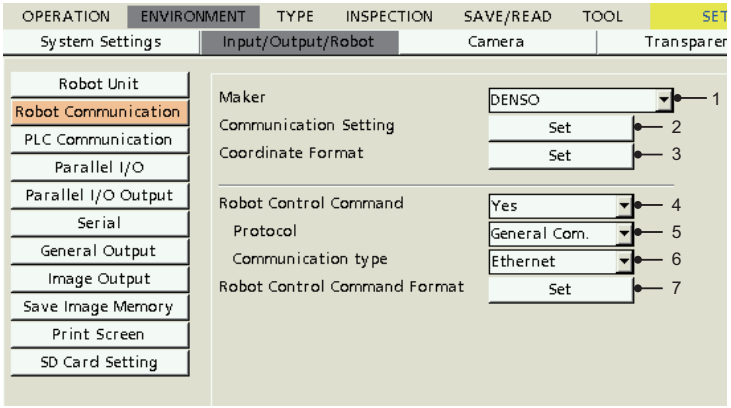
Make the setting according to the specifications of the robot to be connected.

# Chapter 3

## Communication Settings

# 3.1 Robot Communication

This chapter makes settings related to communication between the PV260 and the robot. Setting [Coordinate Format] allows the PV260 to output a format that the robot can receive easily. Setting [Robot Control Command Format] can directly operate the robot from the PV260, performing later-described [Auto Calibration Start] without programming robot operation.

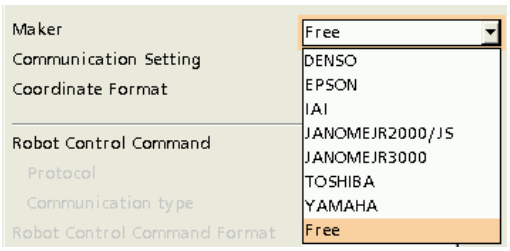



| | | |
|---|---|---|
| 1 | Maker | Select the manufacturer of the robot you want to connect. |
| 2 | Communication Settings | Basic communication settings, such as error correcting code and timeout period, are made. |
| 3 | Coordinate Format | Create a format of robot coordinate. |
| In the following, the setting is made when robot control commands are used | | |
| 4 | Robot Control Command | Set whether robot control command is used. |
| 5 | Protocol | Select a communication protocol. |
| 6 | Communication type | Set communication type from serial or Ethernet. |
| 7 | Robot Control Command Format | Create a format of command to be transmitted from the PV260 to the robot. |

## 3.1.1 Communication Settings

***1.*** Select "Maker" from the pull-down list according to the robot to be used.

| | |
|---|---|
| Value | DENSO |
| | EPSON |
| | IAI |
| | JANOME: JR2000 / JS |
| | JANOME: JR2000 |
| | TOSHIBA |
| | YAMAHA |
| | Free (Default) |




Note

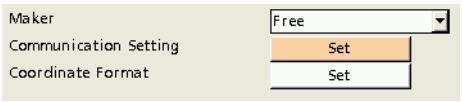
- Selecting a maker sets a fixed form of command format in SETUP menu of Coordinate Format / Robot Control Command Format according to the specification of each maker.
- Note that switching a maker after the completion of robot communication settings initializes Communication Settings, Coordinate Format, and Robot Control Command Format.

# Communication Settings

Note

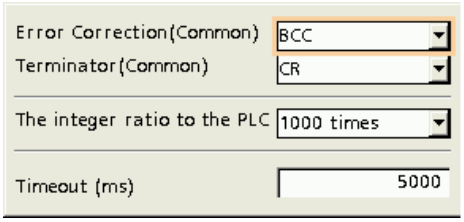
"Error Correction" and "Terminator" that are set in these Communication Settings are added to General command and General Output.

***1.*** Press "Set" for "Communication Setting".




***2.*** Set "Error Correction(Common)".

| | |
|---|---|
| Value | BCC (Default) |
| | SUM |
| | NONE |




***3.*** Set "Terminator(Common)".

| | |
|---|---|
| Value | CR(Default) |
| | CRLF |
| | LF |

***4.*** Set "The integer ratio to the PLC".

Output the coordinate value to PLC in the magnification specified here.

Note

Make the setting only when robot coordinates are output to PLC.

| | |
|---|---|
| Value | 1000 times(Default) |
| | 100 times |
| | 10 times |
| | 1 time |

***5.*** Set "Timeout".

Note

Timeout period that is specified when a command is sent / received between the PV260 and a robot in auto calibration or with Robot Control set. A timeout error occurs when no movement completion command is received from the robot within the timeout period.

| | |
|---|---|
| Value | 1000 to 50000 (Default: 5000) |

# 3.2 Robot Coordinates Format Setting

## 3.2.1 What is Robot Coordinate Format?

### What is Robot Coordinates Format?

Robot coordinates indicate the position of work in the robot coordinate system. The PV260 sends / receives robot coordinates of work detected according to the format set in "Coordinate Format". Robot coordinates can easily be sent / received by setting the format according to the specification of the robot.

▶ Note

One type of robot coordinates format can be set in the PV260.

### Elements of Robot Coordinates Format

For Robot Coordinates Format, a format can be created by combining up to 35 elements, such as "X, Y, R Coordinate", "Constant", "Hand-System", "Character", "Control Character", and "Delimiter".

| Element | Parameter |
|---|---|
| X, Y, R Coordinate | Integer number of digits: 1 to 5<br>Decimal Digit: 0 to 3<br>Plus Sign: Added / No Addition |
| Constant | Integer number of digits: 1 to 10<br>Decimal Digit: 0 to 3<br>Plus Sign: Added / No Addition |
| Hand-System | Right-Hand: -99 to 99<br>Left-Hand: -99 to 99<br>NONE(Cartesian): -99 to 99 |
| Delimiter | Space / Comma / Semicolon / Tab / Other (1 desired character) |
| Character | Maximum of 8 characters (alphabetic character and symbol) |
| Control Character | 29 types of control codes |

### Conditions for Establishment of Robot Coordinates Format

1. Three elements of Coordinate X, Coordinate Y and Coordinate R shall be included.
2. Any one of the elements of “Character”, “Delimiter”, and “Control Code” must be placed before and after each of “Coordinate”, “Constant, and “Hand-System” elements to identify the delimiter of the data. (* In the case of hexadecimal representation for robot control command, fixed length makes data separation unnecessary.)
3. For the elements of coordinate X, coordinate Y, and coordinate R, multiple settings are not allowed.

▶ Note

When Robot Type is "SCARA" and the element of "Hand-System" is not included, a warning message is displayed.

## 3.2.2 About Input / Output of Robot coordinates

The format set in Robot Coordinates Format is used in the following cases.

- Robot position at the time of measurement is notified to the PV260.
- Measured coordinates are output from the PV260 to the robot.

### When Robot position at the time of measurement is notified to the PV260

Notification of a robot position at the time of measurement to the PV260 must follow the format set in the Robot Coordinates Format. Whether or not a format matches the format that is set is judged for each element, as follows.

| Element | Condition that is judged not to be met |
|---|---|
| X, Y, R, Constant | • The number of digits notified is larger than the digits of integer specified<br>• The number of digits notified is smaller than the Decimal digit specified<br>• When notification is made with plus sign added although "No Addition" has been specified for plus sign<br>▶ Note<br>If a fixed constant has been specified, it is unnecessary to make notification according to the constant specified. |
| Hand-System | When data notified is other than the constants set in Right-hand-System, Left-Hand-System, or NONE (Cartesian) |
| Delimiter, character, Control Character | When data notified is different from that of Delimiter, Character, and Control Character that have been set |
| Error Correction | When error correction notified is wrong |
| Termination | When other than CR, CR / LF, LF is notified<br>▶ Note<br>CR, CR / LF, or LF is accepted even when the terminator received is other than that specified in “Terminator” from “Input / Output / Robot” > “Robot communication” > “Communication Setting”. |

▶ Note

When coordinates (XYR) or Constants are specified as, no problem is caused by space or zero that may included in data between separations (Delimiter, Character String, etc.) of elements, each of which is put between the front and the rear of them.

If, for example, the format is Coordinate X△ Coordinate Y△ Coordinate R (△: space),

| | |
|---|---|
| Input data example 1 | △△△100.000△△△200.000△△△300.000△△<CR> |
| | Front and rear spaces (dotted line portion) are allowed so as to receive data as numeric data. |
| Input data example 2 | 000100.000△000200.000△000300.000<CR> |
| | Padding with zeros the portion before a constant is allowed to receive the constant after it as numeric data. (Dotted line portion) |

### When measured coordinates are output from the PV260 to the robot

Measurement result is output according to the format set in Robot Coordinates Format. In this case, the following processes are performed for each element.

| Element | Processing at the time of output |
|---|---|
| X, Y, R | • If the number of digits is more than that specified, 0 is output.<br>• A round-off operation is performed according to decimal digits. |
| Constant | Output the specified constant. |
| Hand-System | Output the constant specified in Right-Hand-System, Left-Hand-System, and NONE(Cartesian) according to Hand-System. |
| Delimiter, character, Control Character | Output Delimiter, character, and Control Character that are specified. |
| Error Correction | Output the specified Error Correction. |
| Termination | Output the specified terminator. |

## Example of Robot Coordinates Format

Set the Default value of Robot Coordinates Format according to a maker selected from "ENVIRONMENT" > "Input / Output / Robot" > "Robot Communication" > "Maker". Format can be edited even when a maker has been selected. Adjust the format as needed. For the format of each maker, refer to “About Format for Each Maker” on page 198.

### ■ Example: Robot Coordinates Format of Company A

Format: Pnnnn=X Y Z R A B t<CR+LF>

Example of data: P1000=100.00 -200.00 10.00 300.00 0.00 0.00 0<CR+LF>

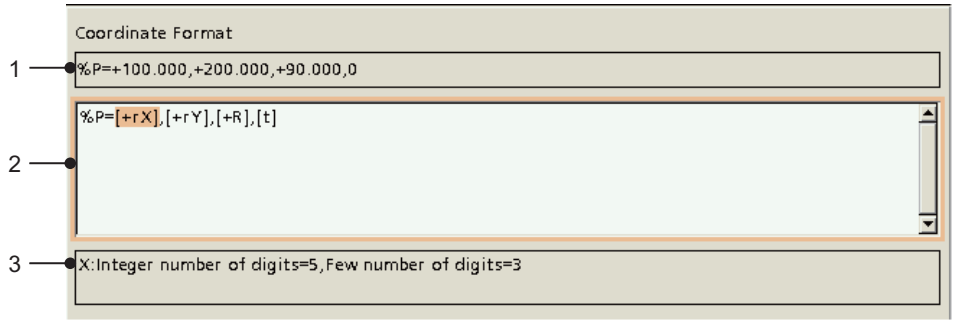
| P | 1000 | = | 100.00 | △ | -200.00 | △ | 10.00 | △ | 300.00 | △ | 0.00 | △ | 0.00 | △ | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Character | Constant<br>Digits of integer = 4<br>Decimal Digit = 0<br>Plus Sign = No addition<br>Value = 1000 | Character | Coordinate X<br>Digits of integer = 5<br>Decimal Digit = 2<br>Plus Sign = No addition | | Coordinate Y<br>Digits of integer = 5<br>Decimal Digit = 2<br>Plus Sign = No addition | | Constant (Coordinate Z)<br>Digits of integer = 5<br>Decimal Digit = 2<br>Plus Sign = No addition<br>Value = 10 | | Coordinate R<br>Digits of integer = 5<br>Decimal Digit = 2<br>Plus Sign = No addition | | Constant (Additional axis 1)<br>Digits of integer = 5<br>Decimal Digit = 2<br>Plus Sign = No addition<br>Value = 0 | | Constant (Additional axis 2)<br>Digits of integer = 5<br>Decimal Digit = 2<br>Plus Sign = No addition<br>Value = 0 | | Hand-System |

△ : 0x20 (Space)

Common Setting

| | |
|---|---|
| Hand-System | Right-Hand-System = 1 |
| | Left-Hand-System = 2 |
| | NONE (Cartesian) = 0 |
| Delimiter | Space |
| Error Correction | NONE |
| Terminator | CR+LF |

## Viewing Robot Coordinates Format SETUP Menu



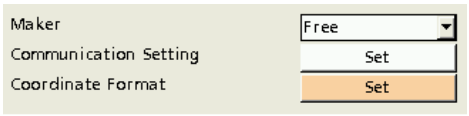

| | | |
|---|---|---|
| 1 | Coordinate Format | Displays a example sentence in a format in which it is entered in the coordinate format input field. |
| 2 | Coordinate format input field | Input field of robot coordinates format. Elements are registered one by one according to the style of each robot maker. A selection made in "Maker" changes the format displayed by default. |
| 3 | Message field | Displays explanation of each element of Robot Coordinates Format. |

## Setting Procedure of Coordinate Format

This section describes the procedure for setting when "Free" is selected for the maker of the robot.

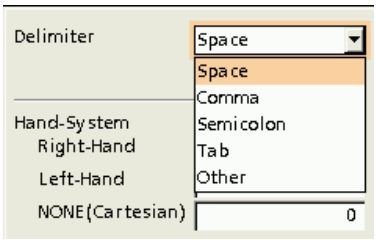
***1.*** Press "Set" for "Coordinate Format".

The detailed screen of Coordinate Format is opened.




***2.*** Select "Delimiter" from the list.

| | |
|---|---|
| Value | Space |
| | Comma (Default) |
| | Semicolon |
| | Tab |
| | Other |




▶ Note

If you select "Other", enter your desired symbol into the comment field under it.

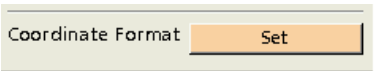
***3.*** Set "Hand-System" for each of "Right-Hand" and "Left-Hand".

Confirm the specification of robot and enter the code of Hand-System.

▶ Note

- You cannot set the same constant for both Right-Hand and Left-Hand.

| | | |
|---|---|---|
| Value | Right-Hand | -99 to 99 (Default: 1) |
| | Left-Hand | -99 to 99 (Default: 2) |
| | NONE(Cartesian) | -99 to 99 (Default: 0) |

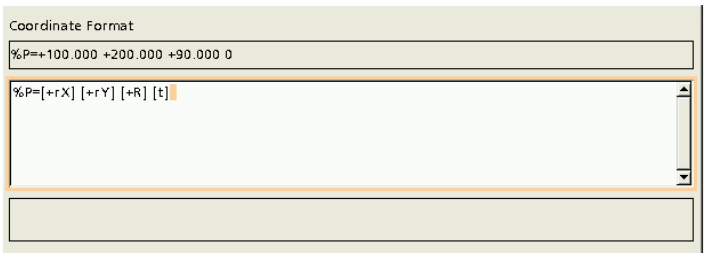



***4.*** Press "Set" for "Coordinate Format" to set the Robot Coordinates Format.

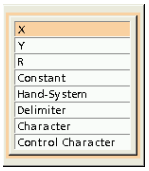
SETUP menu for Robot Coordinates Format is displayed.

**5.** Move the cursor to the input field and press the ENTER key.

A list of element setting items is displayed.




**6.** Select an item to be registered from the list of element setting items and press the ENTER key.



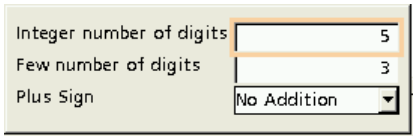

**7.** Enter items and press the CANCEL key to register them.

Note

- Neither "Hand-System" nor “Delimiter” has a specified setting screen. If an item is specified, it is directly entered.
- For editing elements, use the following keys.

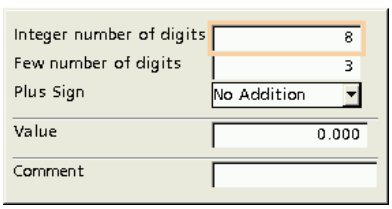
| | |
|---|---|
| F1 key | Insertion of item |
| F2 key | Deletion of item |
| F3 key | Deletion of all items |

Coordinate X / Coordinate Y / Coordinate R



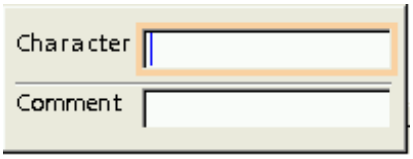

| | | |
|---|---|---|
| Value | Integer number of digits | 1 to 5 (Default: 5) |
| | Few number of digits | 0 to 3 (Default: 3) |
| | Plus sign | No Addition / Addition (Default: No Addition) |

Constant



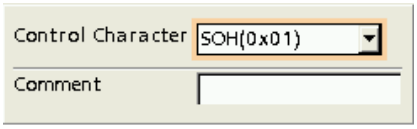

| | | |
|---|---|---|
| Value | Integer number of digits | 1 to 10 (Default: 8) |
| | Few number of digits | 0 to 3 (Default: 3) |
| | Plus sign | No Addition / Addition (Default: No Addition) |
| | Value | 2147483647.000 t o -2147483648.000 |
| | Comment | (Up to 16 characters) |

Character




| | | |
|---|---|---|
| Value | Character | Desired character string (Number not allowed, up to 8 characters) |
| | Comment | (Up to 16 characters) |

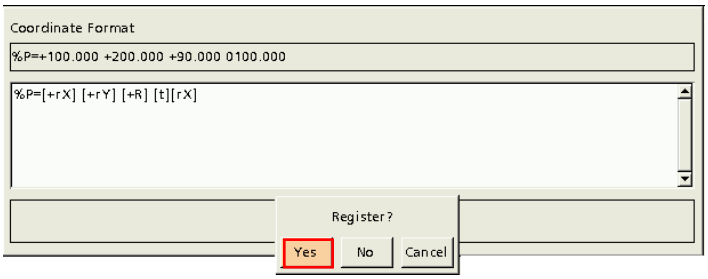
Control Character




| | | |
|---|---|---|
| Value | Control Character | Select from control code* list (*Refer to the control code setting list in the next page.) |
| | Comment | (Up to 16 characters) |

***8.*** When the items are entered completely, press the CANCEL key. When the message "Register?" appears, press "Yes" to determine the format.

| | | |
|---|---|---|
| Answer to the message "Register?" | Yes | Determines the robot coordinates format entered. |
| | No | Deletes the robot coordinates format entered to close the input screen. |
| | Cancel | Exit the Coordinate Format setting screen without reflecting the entered Robot Coordinates Format upon the settings. |



## ■ Control code setting list

| Control code | Content | |
|---|---|---|
| --- | NUL* | Null character |
| SOH (0x01) | SOH | Start of header |
| STX (0x02) | STX | Start of text |
| ETX (0x03) | ETX | End of text |
| EOT (0x04) | EOT | End of transfer |
| ENQ (0x05) | ENQ | Inquiry |
| ACK (0x06) | ACK | Reception OK |
| BEL (0x07) | BEL | Warning |
| BS (0x08) | BS | Backward |
| HT (0x09) | HT | Horizontal tab |
| --- | LF* | Line feed |
| VT (0x0B) | VT | Vertical tab |
| FF (0x0C) | FF | Page feed |
| --- | CR* | Recovery |
| SO (0x0E) | SO | Shift out |
| SI (0x0F) | SI | Shift in |
| DLE (0x03) | DLE | Data link escape |
| DC1 (0x11) | DC1 | Device control 1 |
| DC2 (0x12) | DC2 | Device control 2 |
| DC3 (0x13) | DC3 | Device control 3 |
| DC4 (0x14) | DC4 | Device control 4 |
| NAK (0x15) | NAK | Reception failure |
| SYN (0x16) | SYN | Synchronization |
| ETB (0x17) | ETB | End of transfer block |
| CAN (0x18) | CAN | Cancellation |
| EM (0x19) | EM | End of media |
| SUB (0x1A) | SUB | Replacement |
| ESC (0x1B) | ESC | Escape |
| FS (0x1C) | FS | Form separation |
| GS (0x1D) | GS | Group separation |
| RS (0x1E) | RS | Record separation |
| US (0x1F) | US | Unit separation |
| --- | DEL* | Delete |

*: Unsupported code (gray-out)

# 3.3 Robot Control Command Format

## 3.3.1 What is Robot Control Command Format?

Robot Control Command means a command that is used from the PV260 side to control the robot. The PV260 allows you to create a format of control command according to the specification of each robot maker. According to the format created in this setting, movement instruction command or Get Current Robot Position command is sent from the PV260 to the robot. Using a robot control command enables the PV260 to directly control the robot in auto calibration*1, resulting in reducing the man-hours of creating programs on the robot side.
In addition, if Get Current Robot Position command and movement instruction command are combined, "Robot control setting*2" is available to directly control the robot from the PV260.

▶ Note

*1: Auto calibration --- Calibration data can be generated by detecting Calibration Mark several times via cameras mounted in the robot. For details, refer to “About Calibration Setting” on page 108.
*2: Robot control setting --- Operating the keypad or specifying coordinates allows the PV260 to directly operate the robot. If robot current position information is obtained, it can be reflected upon the setting data. For details, refer to “Get Current Robot Position Format Setting” on page 36. Using robot control setting requires setting "Get Current Robot Position format" described later. For the setting of "Get Current Robot Position Format", refer to 36 page.

### ■ Types of Robot Control Command Format used in the PV260

A Robot Control Command Format can be set for each of the following commands.

- Movement instruction (absolute coordinates) format / movement instruction (absolute coordinates) operation completion response
- Get Current Robot Position format / Get Current Robot Position completion response

### Elements of Robot Control Command Format

Robot Control Command Format is created by combining the following elements: "Coordinates X, Y, Z, and R (decimal / hexadecimal representation)", "Speed (decimal / hexadecimal representation)", "Constant (decimal / hexadecimal representation)", "Hand-System (decimal / hexadecimal representation)", "Delimiter", "Character", and "Control Character". Up to 35 items can be set.

| Element | Parameter |
|---|---|
| Coordinates X, Y, R, and Z (decimal representation) | Integer number of digits: 1 to 5<br>Decimal digits: 0 to 3<br>Plus sign Addition / No Addition |
| Number (decimal representation) | Integer number of digits: 1 to 10<br>Decimal digits: 0 to 3<br>Plus sign Addition / No Addition |
| Speed (decimal representation) | Integer number of digits: 1 to 3<br>Decimal digits: 0 to 3<br>Plus sign Addition / No Addition |
| Hand-System | Right-Hand: -99 to 99<br>Left-Hand: -99 to 99<br>NONE(Cartesian): -99 to 99 |
| Delimiter | Space / Comma / Semicolon / Tab / Other (1 desired character) |
| Character | Maximum of eight characters (alphabetic character and symbol) |
| Control Character | 29 types of control codes |
| Coordinates X, Y, R, and Z, and Hand-System (Hexadecimal representation) | Number of digits (1 to 8)<br>* Output in fixed length. |
| Number (hexadecimal representation) | |
| Speed (hexadecimal representation) | |

▶ Note

When a response is made for Get Current Robot Position command, data can correctly be received even if portion before an element, such as coordinates or constant, is padded with zeros or spaces. When, for example, the format of a response of Get Current Robot Position command is Coordinate X △ Coordinate Y △ Coordinate R (△: space),

| | |
|---|---|
| Input data example 1 | △△△100.000△△△200.000△△△300.000△△<CR> |
| | Front and rear spaces (dotted line portion) are allowed so as to receive data as numeric data. |
| Input data example 2 | 000100.000△000200.000△000300.000<CR> |
| | Padding with zeros the portion before a constant is allowed to receive the constant after it as numeric data. (Dotted line portion) |

# Conditions to Establish Robot Control Command Format

## ■ Movement Instruction Format

Condition of setting of movement instruction command format

1. Three elements of Coordinate X, Coordinate Y and Coordinate R shall be included.
2. For the elements of "Coordinate", "Constant", "Speed" and "Hand-System", characters, delimiters, or elements of control character shall be set at the front and rear of them so as to indicate separation positions of the data (* In the case of hexadecimal representation for robot control command, fixed length makes data separation unnecessary.)
3. Each of the elements of coordinate X, coordinate Y, coordinate R, Speed, and Hand-System shall be set once.

▶ Note

When Robot Type is "SCARA" and the element of "Hand-System" is not included, a warning message is displayed.

Condition for establishment of setting of movement instruction command response

1. One or more "Character" elements shall be included.

## ■ Get Current Robot Position format

Condition for establishment of Setting of Get Current Robot Position Format

1. One or more "Character" elements shall be included.

Condition for establishment of Setting of Get Current Robot Position command response

1. Three elements of coordinate X, Coordinate Y and Coordinate R shall be included.
2. For the elements of "Coordinate", "Constant", "Speed" and "Hand-System", characters, delimiters, or elements of control character shall be set at the front and rear of them so as to indicate separation positions of the data (* In the case of hexadecimal representation for robot control command, fixed length makes data separation unnecessary.)
3. Each of the elements of coordinate X, coordinate Y, coordinate Z, coordinate R, Speed, and Hand-System shall be set once.

▶ Note

When Robot Type is "SCARA" and the element of "Hand-System" is not included, a warning message is displayed.

# Example of Robot Control Command Format

For Robot Coordinates Format, elements are set by putting them in order from the front as follows. The fixed form of format is registered according to the robot maker selected. Adjust the format as needed.

## ■ Example: Robot Coordinates Format of Company B

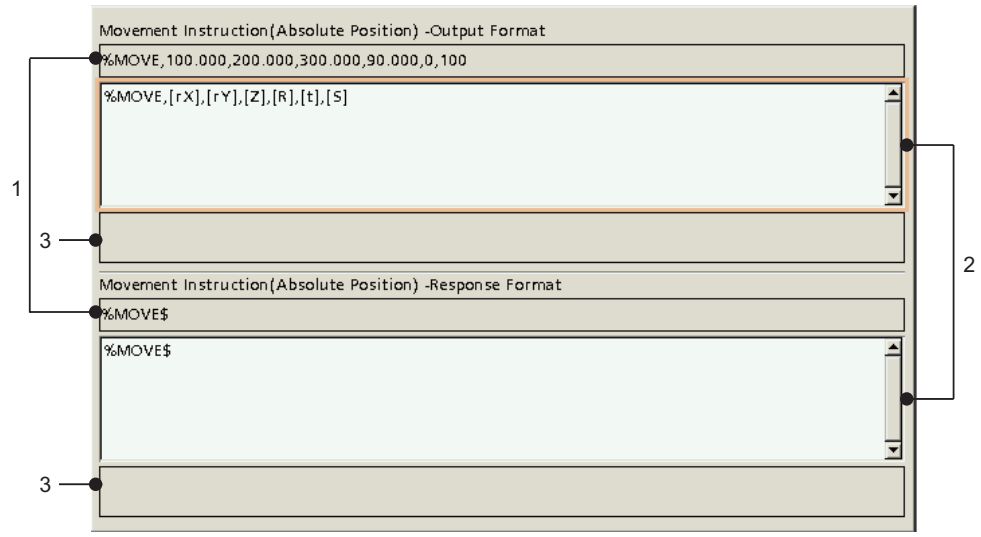
Format: $M1xxxxxxyyyyyyzzzzzzrrrrrrss<CR>
Example of data: $M10060720C3500016378FFEC0456<CR>>

| $M | 1 | 006072 | 0C3500 | 016378 | FFEC04 | 56 |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Character | Constant (Fixed value 1) | Coordinate X 6 digits Expression X*1000*2+1 | Coordinate Y 6 digits Expression Y*1000*2 | Constant (Coordinate Z) 6 digits Fixed value 91000(*1) | Coordinate R 6 digits Expression R*100*2 | Error Correction |

Common Setting

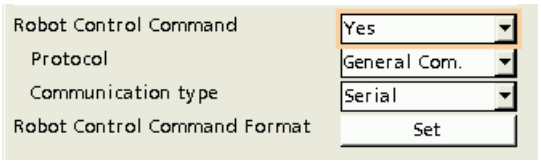
| | |
|---|---|
| Numeric data format | Plus sign = No Addition |
| Representation of robot control command | Hexadecimal representation |
| Delimiter | Space |
| Data format | Error Correction=SUM |
| | Terminator=CR |

Robot Control Command Format SETUP menu




| | | |
|---|---|---|
| 1 | Coordinate Format Display | Displays a format example sentence in a format in which it is entered in the coordinate format input field. |
| 2 | Coordinate format input field | Input field of Robot Coordinates Format. The fixed form of format is registered according to the robot maker selected. Adjust the format as needed. |
| 3 | Message field | Displays explanation of each element of Robot Coordinates Format. |

## 3.3.2 Basic Setting of Robot Control Command Format




***1.*** Set "Robot Control Command" by selecting "Yes" or "No".

Note

Auto calibration and robot control setting under the control of the PV260 can be used only when a robot control command is used.

***2.*** Select "General Com." or "PLC Com." for the protocol.

Note

If "Unused" is specified for "Robot Control Command", the selection is not allowed.

***3.*** Select "Serial" or "Ethernet" for Communication type.

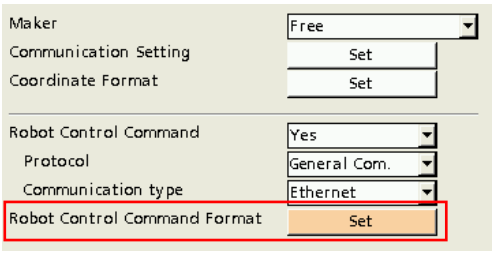
Note

- If "Unused" is specified for "Robot Control Command", the selection is not allowed.
- When "PLC Com." is specified for "Protocol", the selection is not allowed, and the communication type set by selecting "ENVIRONMENT" > "Input / Output / Robot" > "PLC Com." is automatically displayed.

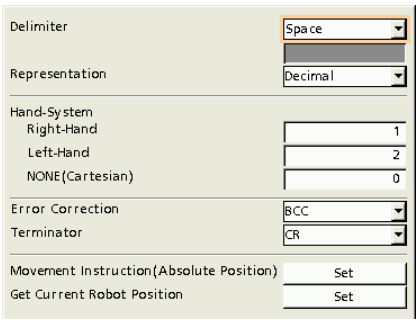
# Robot Control Command Format

This procedure is available when "Free" is specified for robot maker.

## 1. Press "Set" for "Robot Control Command Format".




The detailed screen for Robot Control Command Format is displayed.




## 2. Select "Delimiter" from the list.

| | |
|---|---|
| Value | Space |
| | Comma (Default) |
| | Semicolon |
| | Tab |
| | Other |


▶ Note

If you select "Other", enter your desired symbol into the comment field under it.

## 3. Set "Representation".

Make the setting according to the specification of data format of the robot.

| | |
|---|---|
| Value | Decimal(Default) |
| | Hexadecimal |

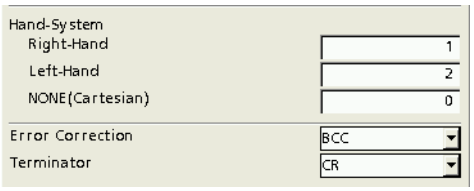
## 4. Set "Hand-System" for each of "Right-Hand" and "Left-Hand".

Confirm the specification of robot and enter the code of Hand-System.

▶ Note

You cannot set the same constant for both Right-Hand and Left-Hand.

| | | |
|---|---|---|
| Value | Right-Hand | -99 to 99 (Default: 1) |
| | Left-Hand | -99 to 99 (Default: 2) |
| | NONE (Cartesian) | -99 to 99 (Default: 0) |




## 5. Set "Error Correction" and terminator.

| | | |
|---|---|---|
| Value | Error Correction | Common* |
| | | BCC (Default) |
| | | SUM |
| | | NONE |
| | Terminator | Common* |
| | | CR(Default) |
| | | CRLF |
| | | LF |

* Refer to the setting values of "Error Correction" and terminator set in Communication Settings.

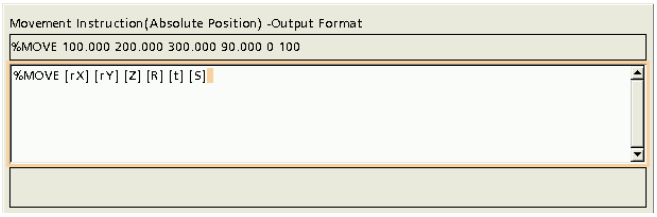
# Movement Instruction (Absolute Position) Format Setting

Set a command format to move the robot from current robot position to specified absolute coordinates. This procedure is available when "Free" is specified for robot maker. If a specific maker is selected, Movement Instruction(Absolute Position) Format is displayed by default according to the specification of the maker.

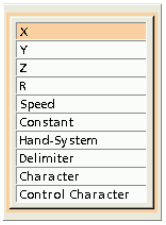
**1.** Press "Set" for "Movement instruction (Absolute Position)".

SETUP menu for robot control command format is displayed.

**2.** Move the cursor to the input field and press the ENTER key.



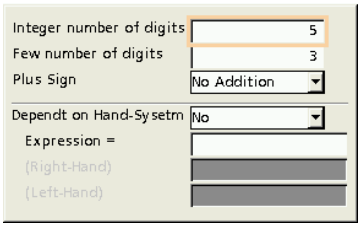

**3.** Select an item to be registered from the list of element setting items and press the ENTER key. When the items are entered, press the CANCEL key to register them.




Note

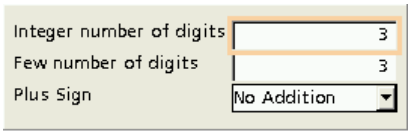
- Neither "Hand-System" nor “Delimiter” has a specified setting screen. If an item is specified, it is directly entered.

Coordinate X / Coordinate Y / Coordinate R



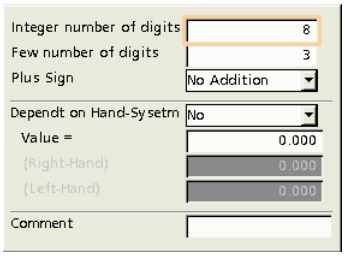

| | | |
|---|---|---|
| Value | Integer number of digits | 1 to 5 (Default: 5) |
| | Few number of digits | 0 to 3 (Default: 3) |
| | Plus sign | No Addition / Addition (Default: No Addition) |

Speed



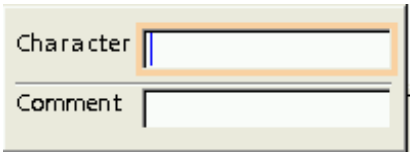

| | | |
|---|---|---|
| Value | Integer number of digits | 1 to 3(Default: 3) |
| | Few number of digits | 0 to 3 (Default: 3) |
| | Plus sign | No Addition / Addition (Default: No Addition) |

Constant



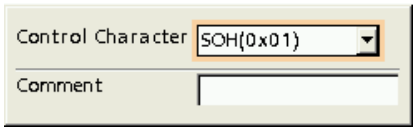

| | | |
|---|---|---|
| Value | Integer number of digits | 1 to 10 (Default: 8) |
| | Few number of digits | 0 to 3 (Default: 3) |
| | Plus sign | No Addition / Addition (Default: No Addition) |
| | Value | 2147483647.000 to -2147483648.000 |
| | Comment | (Up to 16 characters) |

Character




| | | |
|---|---|---|
| Value | Character | Desired character string (Number not allowed, up to 8 characters) |
| | Comment | (Up to 16 characters) |

Control Character



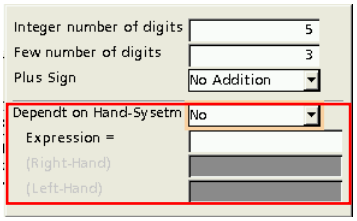

| | | |
|---|---|---|
| Value | Control Character | Select from control code* list (*Refer to the control code setting list in *26 page.) |
| | Comment | (Up to 16 characters) |

## Setting Expression

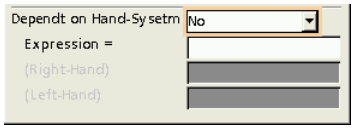
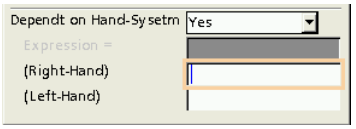
An expression can be set for each element to process coordinate data.

1. Select setting items for "Depend on Hand-System" in the pull-down menu.

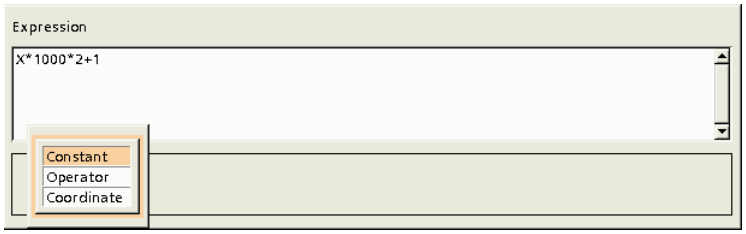
| | | |
|---|---|---|
| Value | "Yes" | Changes coordinate data for each Hand-System based on the expression. |
| | "No" | Changes coordinate data based on the expression. |




2. When "No" is specified for "Depend on Hand-System", press the ENTER key in the setting field under it. When "Yes" is specified, press the ENTER key in the setting field of the expression for each Hand-System.

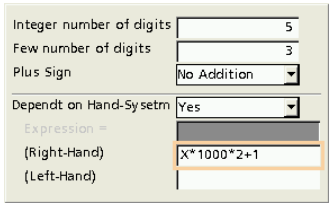
| When "No" is specified for "Depend on Hand-System" | When "Yes" is specified for "Depend on Hand-System" |
|---|---|
|  |  |

3. When the expression input screen appears, set the expression.




| | | |
|---|---|---|
| Value | Constant | -9999999.999 to 9999999.999 |
| | Operator | + , - , * , / , ( , ) |
| | Coordinate | Automatically enters X Y, or R according to the item being selected. |

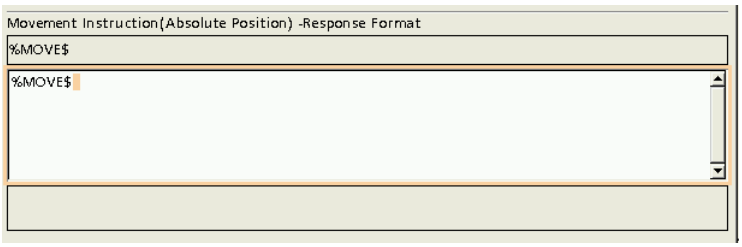
4. Entry of the expression has been completed.




***4.*** When the format has been set completely, set a response. Move the cursor to "Response Format" at the lower stage and press the ENTER key to perform input.

▶ Note

For the response to be set here, set a command that is issued when movement is completed. Do not set a response for the reception of a command.




***5.*** When the items are entered completely, press the CANCEL key. When the message "Register?" appears, press "Yes" to determine the format.

| | | |
|---|---|---|
| Answer to the message "Register?" | Yes | Determines the robot coordinates format entered. |
| | No | Deletes the robot coordinates format entered to close the input screen. |
| | Cancel | Does not determine the robot coordinates format entered. The coordinate format input screen remains displayed. |

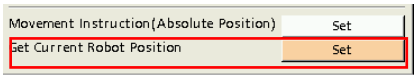
# Get Current Robot Position Format Setting

Set a format of Get Current Robot Position command to be used for "robot control setting*". If a specific maker is selected, Get Current Robot Position Format is displayed by default according to the specification of the maker.

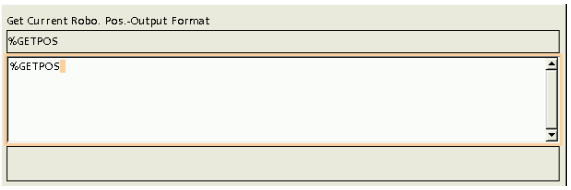
*: Robot control setting --- Operating the keypad or specifying coordinates allows the PV260 to directly operate the robot. If robot current position information is obtained, it can be reflected upon the setting data. For details, refer to “Get Current Robot Position Format Setting” on page 36.

**1.** Press "Set" in "Get Current Robot Position".

SETUP menu for robot control command format is displayed.




**2.** Move the cursor to the input field and press the ENTER key.




**3.** Set each element of format setting and Response Format..

The contents of element settings are the same as those of format settings for "Movement instruction (Absolute coordinates)".

# 3.3.3 About Movement Instruction and Get Current Robot Position Response

## ■ Movement instruction

Movement instruction is used when a robot is directly operated with a keypad or in auto calibration. The robot is notified, by specifying the destination, according to the format set in Movement Instruction. In this case, processes as shown below are performed for each element.

| Element | Processing at the time of output |
|---|---|
| X, Y, R, Speed (Decimal) | • If the number of digits is more than that specified, 0 is output.<br>• A round-off operation is performed according to decimal digits. |
| Constant (Decimal) | Output the specified constant. |
| Hand-System(Decimal) | Output the constant specified in Right-Hand-System, Left-Hand-System, and NONE (Cartesian) according to Hand-System. |
| X, Y, R, Speed (Hexadecimal) | • If the number of integer digits is more than or equal to that specified, 0 is output.<br>• The specified number of digits is used for output. |
| Constant (Hexadecimal) | Output the specified constant. |
| Delimiter, Character, Control Character | Output Delimiter, Character, and Control Character that are specified. |
| Error Correction | Output the specified Error Correction. |
| Termination | Output the specified terminator. |

## ■ Response to Get Current Robot Position

Response to Get Current Robot Position requires information indicating the current robot position. Notification of the robot position to the PV260 requires following the format specified in response to Get Current Robot Position. Judgement is made for each element as to whether the format is matched, as follows:

| Element | Condition that is judged not to be met |
|---|---|
| X, Y, R, Constant, Speed (decimal) | • The number of integer digits notified is larger than the digits of integer specified<br>• The number of decimal digits notified is smaller than the decimal digits specified<br>• Notification is made with plus sign added although "No Addition" has been specified for plus sign<br>▶ Note<br>If a fixed constant has been specified, it is unnecessary to make notification according to the constant specified. |
| Hand-System(Decimal) | Notified constants are other than those set in Right-Hand-System, Left-Hand-System, or NONE(Cartesian). |
| X, Y, R, Constant, Speed (hexadecimal) | The notified number of digits is not that specified<br>Example) 0AF is notified with the number of digits = 4 |
| Delimiter, Character, Control Character | When Delimiter, Character or Control Character other than specified is notified |
| Error Correction | When error Correction notified is wrong |
| Termination | What is notified is other than CR or CR / LF, or LF<br>▶ Note<br>When the terminator received is other than that specified in "Terminator" from "Input / Output / Robot" > "Robot communication" > "Communication Setting", CR, CR / LF, or LF, if received, is accepted. |

▶ Note

If element is coordinates (XYR) / Constants (decimal), and spaces or zeros are included in data between separations (Delimiter, Character String, etc.) of elements, each of which is put between the front and the rear of them, they are allowed to be obtained as numeric data.
When, for example, the format is Coordinate X△ Coordinate Y△ Coordinate R△ (△: space),

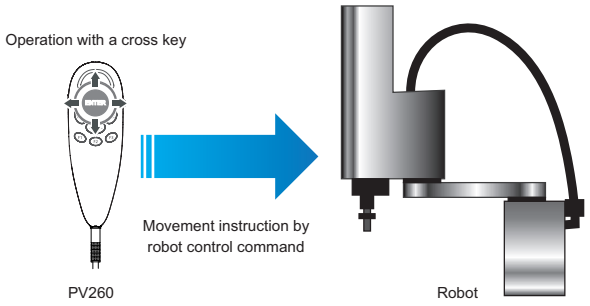
| | |
|---|---|
| Input data example 1 | △△△100.000△△△200.000△△△300.000△△<CR> |
| | Front and rear spaces (dotted line portion) are allowed so as to receive data as numeric data. |
| Input data example 2 | 000100.000△000200.000△000300.000<CR> |
| | Padding with zeros the portion before a constant is allowed to receive the constant after it as numeric data. (Dotted line portion) |

# 3.4 Robot Control Setting

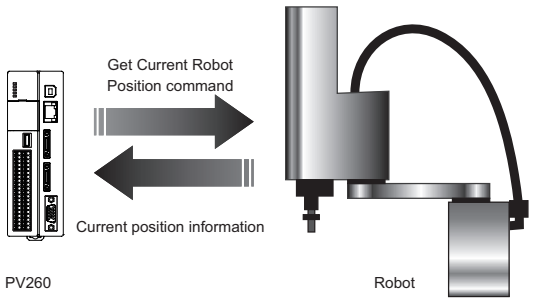
Operating the keypad or specifying coordinates allows the PV260 to directly operate the robot. If robot current position information is obtained, it can be reflected upon the setting data.

## 3.4.1 What is Robot Control Setting?

1. By operating the keypad, the PV260 can send movement instruction command to the robot to directly control it.




2. When robot current position information is obtained, it can be reflected upon parameters of the coordinates of each robot of the PV260.




Note

To perform Get Current Robot Position Setting, communication of robot control commands (Movement Instruction and Get Current Robot Position) must normally be carried out between the PV260 and the robot.

### Operation Method

The PV260 adopts the following two methods for giving movement instruction to the robot.

■ Movement instruction command is transmitted to the robot in conjunction with keypad operation.

- X axis, Y axis, Z axis, and R axis are controllable. For SCARA robot, Hand-System can be specified.
- Movement speed can be set within the range from 1 to 100.
- Key operations are performed as shown at right.

| | |
|---|---|
| Up / Down / Left / Right key | Movement of X axis and Y axis of robot coordinates |
| Shift + Up / Down key | Movement of Z axis of robot coordinates |
| Shift + Left / Right key | Movement of R axis of robot coordinates |

Note

Positive / negative direction of each key varies depending on positional relation between the robot and a camera, and the positive direction can be set by "Key Setting". For "Key Setting", refer to Page 42.

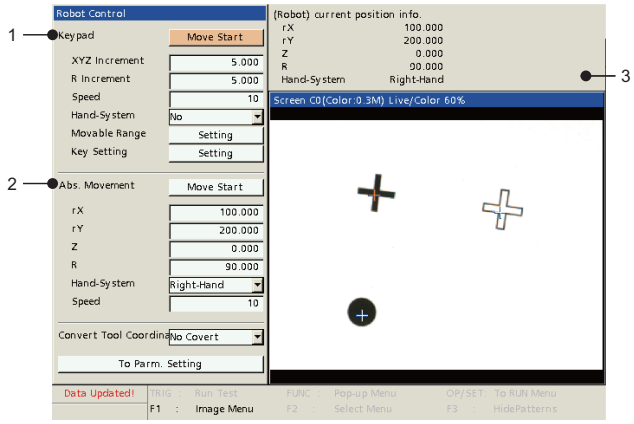
■ Movement instruction command is transmitted to the robot by specifying the coordinates of robot position.

- A movement instruction command format is generated by sing the X, Y, R, and Z values specified in each screen of the PV260.

- X axis, Y axis, Z axis, and R axis are controllable. For SCARA robot, Hand-System can be specified.
- Movement speed can be set within the range from 1 to 100.

# Using the Robot Control Screen

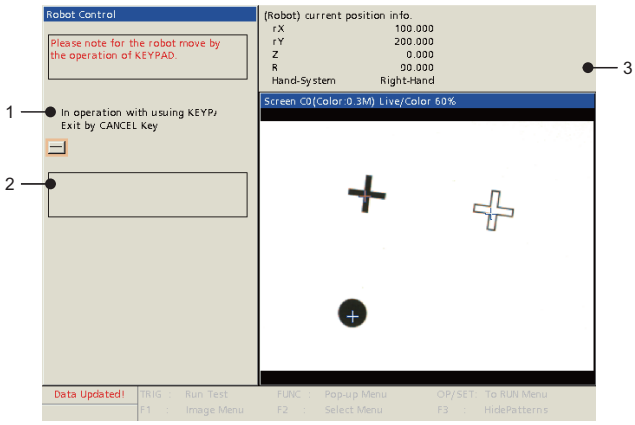
## Robot Control Setting Screen




| | | |
|---|---|---|
| 1 | Robot Control Setting for Keypad Operation | This setting field is provided to perform robot control with the keypad. |
| 2 | Robot Control Setting for Specifying Coordinates | This setting field is provided to perform robot control by specifying coordinates. |
| 3 | Robot current position information | Displays robot current position information. When the robot is moving, the current position of the robot that is moving is calculated and displayed. |

## Robot Control In-movement Screen

Pressing the Move Start button displays the screen shown in the figure below. (At the time of keypad operation)




| | | |
|---|---|---|
| 1 | Message area | Displays wordings for movement operation in progress or communication in progress. |
| 2 | Error Message Area | Displays an error message. |
| 3 | Robot current position information | Displays the coordinates of current position of the robot. |

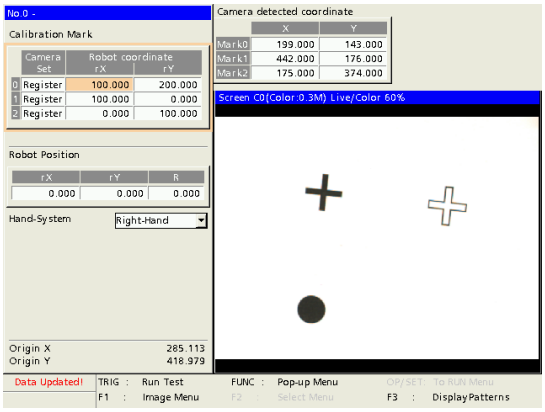
# 3.4.2 Setting Procedure

## Moving the Robot with Keypad

Move the robot by transmitting movement instruction command from the PV260 to the robot in conjunction with keypad operation.

**1.** Open SETUP menu in which the robot control is available.

The Calibration Setting screen is shown in the right figure.

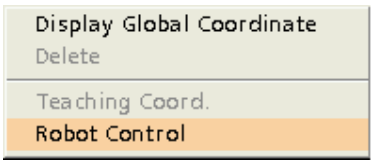



▶ Note

Reflection of robot coordinates is available in the SETUP menu below.

| SETUP menu | Content |
|---|---|
| "TYPE" > "Robot" > "Calibration" | Setting of calibration mark, Robot Position |
| "TYPE" > "Robot" > "Work Detection" | Robot position information setting of base position registration |
| "TYPE" > "Robot" > "Work Detection" > "Working Pos." | Robot work position setting |
| "TYPE" > "Robot" > "Tool" > "1st / 2nd" | Tool offset setting |
| "TYPE" > Robot" > "Teaching Support" | Robot position information setting |
| "Calibration Update" | Robot position information setting |

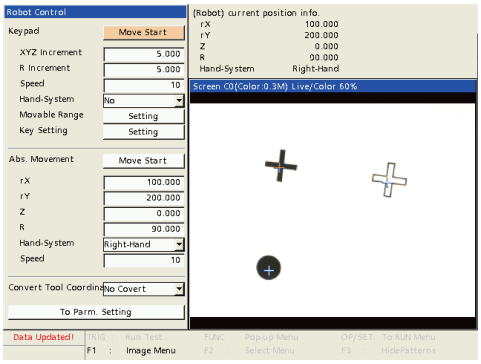
**2.** Move the cursor to the entry item to be set, press the FUNC key, and then press "RobotControlSetting".




**3.** Robot Control screen opens.

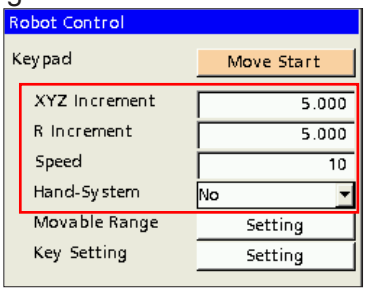
▶ Note

When opening Robot Control screen, transmit Get Current Robot Position command to the robot. Failure in acquiring robot current position prevents displaying the Robot Control screen, displaying the following message.

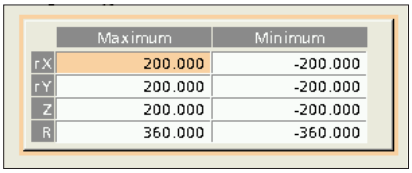
**4.** Set each item of "Keypad" for robot control setting.

| | |
|---|---|
| XYZ Increment | 0.001 to 10.000 (Default: 5) |
| R Increment | 0.001 to 10.000 (Default: 5) |
| Speed | 1 to 100 (Default: 10) |
| Hand-System | NONE / Right-Hand / Left-Hand (Default: NONE) |




**5.** Press the Set button for "Movable Range" to set the movable range.

Register the movable range by keypad operation in advance.

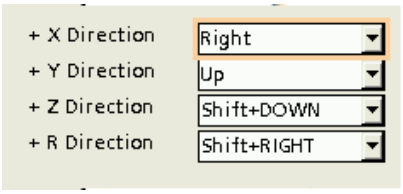



| | |
|---|---|
| rX, rY, Z | -99999.999 to 99999.999 (Default: Maximum limit 200.000, Minimum limit -200.000) |
| R | -360.000 to 360.000 (Default: Maximum limit 360.000, Minimum limit -360.000) |

**6.** Press the Set button for "Key Setting" to set key assignments in the positive (+) direction.

For the registration, make the buttons of keypad correspond to X, Y, Z, and R positive directions according to the positional relations between the robot and a camera.

| | |
|---|---|
| +X direction | Right / Left / Up / Down (Default: Right) |
| +Y direction | Right / Left / Up / Down (Default: Up) |
| +Z direction | Shift+ Up / Shift+ Down (Default: Shift+ Down) |
| +R direction | Shift+ Right / Shift+ Left (Default: Shift+ Right) |




**7.** Press the “Move Start” button.


SETUP menu is switched to the screen for robot operation in progress, and the robot is operated in conjunction with keypad operation.

▶ Note

In the following state, the robot control is not performed and an error message is displayed.

| | |
|---|---|
| "Over Movable Range" | When the internally specified movable range of absolute coordinates has been exceeded |
| “Cannot move in the direction” | When coordinate Z does not exist in the format |
| "Specified value is overflow" | When the specified value (coordinate / speed) exceeds the specified range of the format |

**8.** After the movement of a robot, pressing the "To Parm. Setting" button sets the parameter to the robot coordinates.

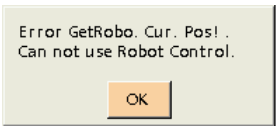
## Move Robot with Keypad by Specifying Coordinates

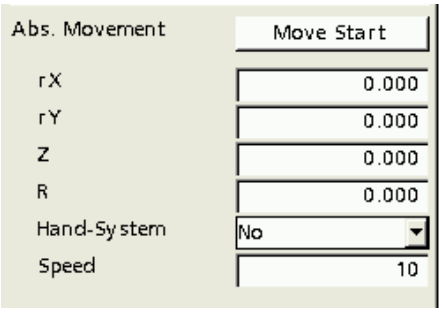
Move the robot by transmitting movement instruction commands based on the desired X, Y, Z, and R coordinates entered into SETUP menu.

**1.** Open Robot Control SETUP menu.

▶ Note

Failure in acquiring robot current position prevents displaying the Robot Control screen, displaying a message.




**2.** Set each item of "Abs. Movement" for robot control setting.

| | |
|---|---|
| rX, rY, Z | -99999.999 to 99999.999 |
| R | -360.000 to 360.000 |
| Hand-System | NONE / Right-Hand / Left-Hand |
| Speed | 1 to 100 (Default: 10) |

▶ Note

- For the parameters of robot coordinates, current position information and Hand-System information acquired just before are displayed.
- If the format of robot control command has an element of "Speed", "Speed" for "Abs. Movement" on the "Robot Control" screen is set in command data.

**3.** Press the “Move Start” button.

The robot moves to the specified coordinates.

▶ Note

In the following state, the robot control is not performed and an error message is displayed.

| | |
|---|---|
| "Over Movable Range" | When the internally specified movable range of absolute coordinates has been exceeded |
| “Cannot move in the direction” | When coordinate Z does not exist in the format |
| "Specified value is overflow" | When the specified value (coordinate / speed) exceeds the specified range of the format |

## Reflect Acquired Robot Coordinates upon Settings

Parameters in each SETUP menu are directly set to robot coordinates X, Y, Z and R acquired by Get Current Robot Position setting (Robot Control).

▶ Note

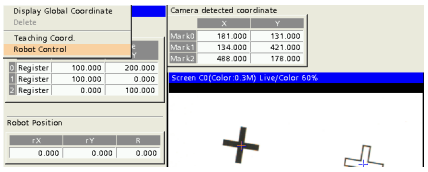
Reflection of robot coordinates is available in the SETUP menu below.

| SETUP menu | Content |
|---|---|
| "TYPE" > "Robot" > "Calibration" | Setting of calibration mark, Robot Position |
| "TYPE" > "Robot" > "Object Detection" | Robot position information setting of base position registration |
| "TYPE" > "Robot" > "Object Detection" > "Working Pos." | Robot work position setting |
| "TYPE" > "Robot" > "Tool" > "1st / 2nd" | Tool offset setting |
| "TYPE" > Robot" > "Teaching Support" | Robot position information setting |
| "Calibration update" | Robot position information setting |

**1.** Open the SETUP menu in which you want to enter robot coordinates.

The description of this step takes the calibration setting screen for example.

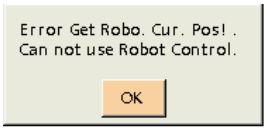
**2.** Move the cursor to the entry item to be set, press the FUNC key, and then press "Robot Control".

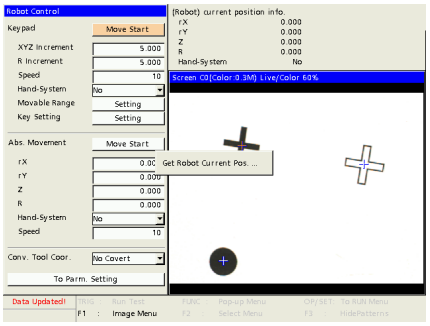



**3.** Robot Control SETUP menu opens.

▶ Note

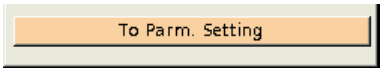
Failure in acquiring robot current position prevents displaying the Robot Control screen, displaying the following message.



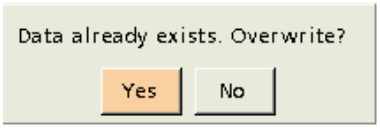

**4.** Move the robot to a desired position by operating the keypad or specifying the coordinates.

**5.** Pressing the "To Parm. Setting" button reflects acquired robot coordinates upon the parameters on the source screen.




▶ Note

If data in the registration destination has already been set, the message at right appears.




## Set Tool Coordinates Based on Robot Coordinates Acquired

Based on the robot coordinates acquired, calculate "Tool Coordinates" (X, Y) by using the offset values of tool Nos. 0 to 2, and then set the parameters to them. For details on tool setting, refer to “4.1 Robot Tool Offset Function” on page 102.

▶ Note

- If the offset values have not been set, use the default (rX=0, rY=0) as the offset to calculate the tool coordinates.
- Reflection of tool coordinates is available in the SETUP menu below.

| SETUP menu | Content |
|---|---|
| "TYPE" > "Robot" > "Calibration" | Setting of Calibration Mark |
| "TYPE" > "Robot" > "Work Detection" > "Working Pos." | Robot work position setting |

**1.** Open the screen on which you want to enter tool coordinates and obtain robot coordinates in Robot Control Setting.

**2.** Select Tool No. in "Convert Tool Coordinates".

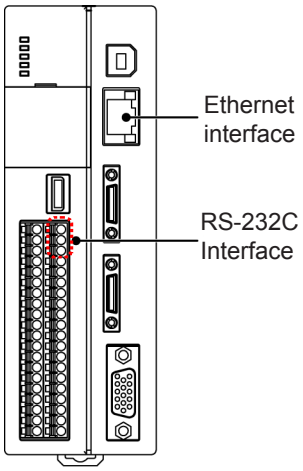
**3.** Pressing the "To Parm. Setting" button sets the parameter to the robot coordinates taking into account tool position.

# 3.5 Communication Port and Protocol

The PV260 is equipped with the following communication ports.

- I/O terminal (COM port): RS-232C interface
- Ethernet port: Ethernet interface

The two types of protocols, i.e., "General Com." and "PLC Com.", have been provided for each communication port. Communication contents differ depending on a protocol. Select the protocol according to the purpose.




## 3.5.1 RS-232C Interface

Using COM port, the PV260 communicates with the external device through RS-232C. Outputting inspection result data and sending / receiving control commands can be performed.
Make the settings for RS-232C interface from the following items.

| | |
|---|---|
| Setting of communication condition | "ENVIRONMENT" > "Input / Output / Robot" > "Serial" |
| Setting of serial output contents | "ENVIRONMENT" > "Input / Output / Robot" > "General Output" > "Serial" column |
| Setting of PLC communication | "ENVIRONMENT" > "Input / Output / Robot" > "PLC Com." |
| Setting when selecting "PLC Communication" - "Command Read Type" -"Parallel Input" | "ENVIRONMENT" > "Input / Output / Robot" > "Parallel I/O" > "ASSIGN0-1 / EXTRA0-2" > Read PLC Communication Command |

Note

- For PLC communication, either RS-232C interface or Ethernet interface must be selected.

### Communication Specification of RS-232C

| | | |
|---|---|---|
| Communication method | | Full duplex |
| Synchronous method | | Asynchronous |
| Baud rate *1) | | 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps (Factory default: 9600) |
| Transmission code | | ASCII |
| Transmission format | Bit length | 7-bit, 8-bit (Factory default: 8-bit) |
| | Stop bit | 1-bit, 2-bit (Factory default: 1-bit) |
| | Parity check | None / Odd / Even (Factory default: Odd) |
| | Flow control | None / Soft Flow (Factory default: None) |
| | Delimiter | CR / CRLF / LF |

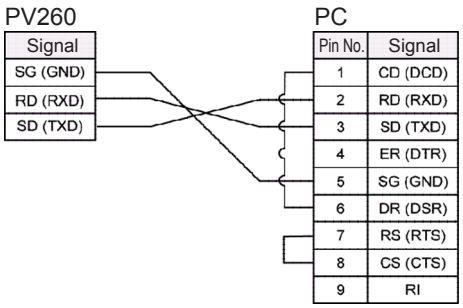
*1) When Baud Rate is "115200 bps", the communication may not be carried out stably in accordance with the device to communicate with. In the case, set Baud Rate to "57600 bps" or lower.

Note

For information how to set communication speed and transmission format, refer to “3.6 Serial Communication Setting (COM Port)” on page 50.

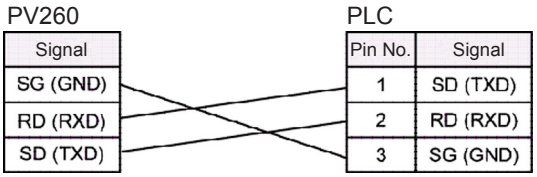
# Connecting with a PC or a PLC

## Example of connections with PC

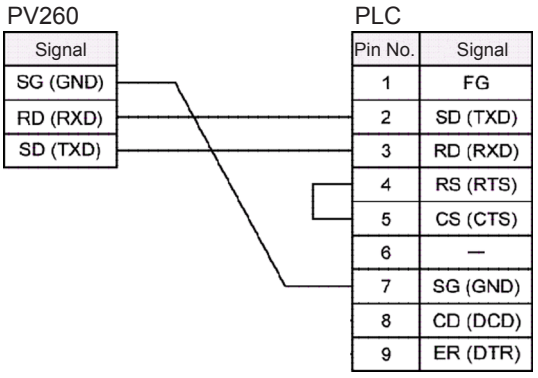



## Examples of connections with Panasonic PLC

FP0R / FP-X Series / FP7

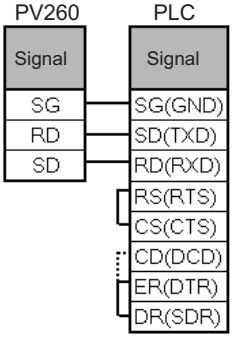



FP2 MCU




## Connections with other companies' PLC (Reference)

| PLC Type | | | Pin No. |
|---|---|---|---|
| Mitsubishi: | A/Q Series | 9Pin | A |
| | | 25Pin | E |
| | FX/FX2N Series | | B |
| | Q Series | 6Pin | D |
| OMRON C series, CV series, CS1 series | | 9Pin | C |
| | | 25Pin | F |
| Allen-Bradley: SLC Series | | | A |
| Fuji SX Series | | | A |




Signal Pin List

| Pin No. | | | | | |
|---|---|---|---|---|---|
| A | B | C | D | E | F |
| 5 | 5 | 9 | 3 | 7 | 7 |
| 3 | 3 | 2 | 2 | 2 | 2 |
| 2 | 2 | 3 | 1 | 3 | 3 |
| 7 | - | 4 | - | 4 | 4 |
| 8 | - | 5 | - | 5 | 5 |
| 1 | 1 | - | - | 8 | - |
| 4 | 4 | - | 6 | 20 | 20 |
| 6 | 6 | - | 5 | 6 | - |

▶ Note

- About the broken line in the connecting example, please refer to an instruction manual of PLC to connect it as necessary.
- The above pin numbers are those of typical devices such as communication units of each company. Refer to the instruction manual of PLC you use for the actual pin numbers.

## 3.5.2 Ethernet Interface

Ethernet communication is performed with an external device. Outputting inspection result data and sending / receiving control commands can be performed.
PV260 can communicate with the designated setting software PVWIN260. By using "Image Receiver for PV", image data can be also output.
Make the settings for Ethernet interface from the following items.

| | |
|---|---|
| Setting of network | "TOOL" > "General" > "Network" |
| Setting of Ethernet output | “ENVIRONMENT” > “Input / Output / Robot” > “General Output” > "Ethernet" column |
| Setting of PLC communication | "ENVIRONMENT" > "Input / Output / Robot" > "PLC Com." |
| Setting when selecting "PLC Communication" - "Command Read Type" -"Parallel Input" | "ENVIRONMENT" > "Input / Output / Robot" > "Parallel I/O" > "AS-SIGN0-1 / EXTRA0-2" > Read PLC Communication Command |
| Setting software "PVWIN260" | All the settings except the network setting are set with PVWIN260. |
| Image output | "ENVIRONMENT" > "Input / Output / Robot" > "Image Output" |
| Print screen | "ENVIRONMENT" > "Input / Output" > "Print Screen" |

Note

- Note that incorrect setting of the connection to the existing LAN might cause malfunction in the devices on the network. Consult your network administrator before connecting.
- One PV260 cannot be operated by multiple PCs on the network.
- Depending on the network condition, delay might be caused in the communication. It is advisable to use I/O interface or RS-232C interface for the operation that requires speedy response such as inspection trigger input.
- For PLC communication, either RS-232C interface or Ethernet interface must be selected.

### Communication Specification of Ethernet

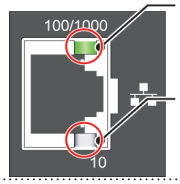
Connector: RJ-45
Media: 10BASE-T / 100BASE-TX / 1000BASE-T
Protocol: General Communication / PLC Communication

Note

According to the network adapter of your PC, 1000BASE-T communication may not be available. When you use Ethernet communication with 1000BASE-T, please check the maximum frame size (which is the data size that can be sent or received in one communication) available in the network environment. In some cases, the network adapter complying with 1000BASE-T also requires a setting change. For details including how to set, please contact a manufacturer of network adapters.

#### About Baud Rate

PV260 automatically adjusts the baud rate according to the speed of the device to communicate. (Auto negotiation)
You can know the current baud rate by the position and color of LED of Ethernet port that lights

| Ethernet Port | LED | Color | Baud Rate |
|---|---|---|---|
|  | Upper | Green | 100 megabits |
| | | Orange | 1000 megabits (1 gigabit) |
| | Lower | Yellow | 10 megabits |

### About Port Number

Port number differs depending on protocol and communication data.

| | | General Communication | PLC Communication |
|---|---|---|---|
| Protocol | | TCP/IP | UDP/IP |
| Communication behavior | | Server | Client |
| Port No. | Data output | 8601 | 1 to 65534 (Except 8600 to 8699, 9090) |
| | Command send / receive Robot control command send / receive | 8650 | |
| | Command send / receive | 8604 | |
| | Image output | 8602 | 8602 |
| Destination setting | IP address Port No. | No | Yes |

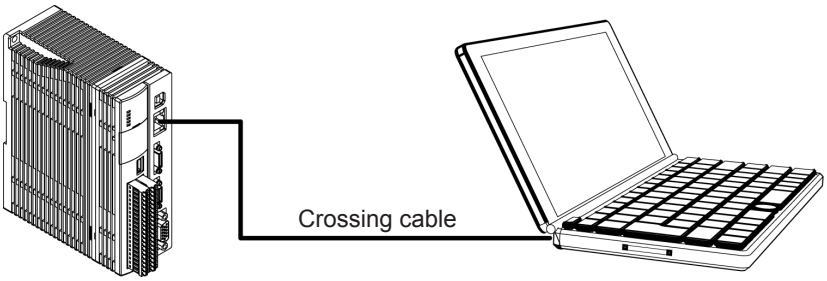
▶ Note

If the setting to cutoff connection in case of no communication is available on a destination device, set it not to cutoff.

## Connecting PV260 with PC

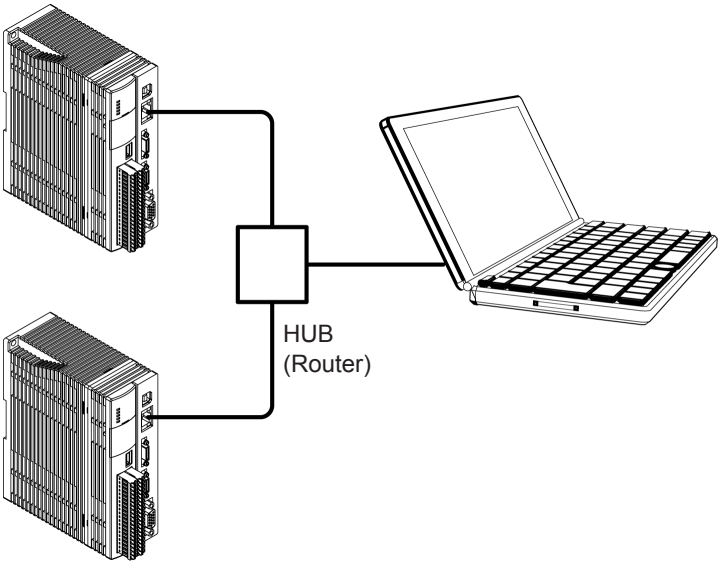
### Communicating between a PV260 and a PC

Connect them with a commercially available crossing cable. (STP crossing cable of category 5e or more is recommended.)




### Communicating between a PV260 and multiple PCs

Connect them with a commercially available straight cable (STP straight cable of category 5e or more is recommended) through a hub or a router, which supports 1000BASE-T, 100BASE-TX, or 10BASE-T.



## 3.5.3 Protocol

The following two protocols are available for PV260.

| | |
|---|---|
| General Communication | This method communicates with external devices according to the protocol specified in PV260. As data is sent and received using ASCII strings, there is no restriction on external devices, however, a communication program for PV260 should be created in the external devices. Using this method enables to output inspection results, control PV260, read and change the setting values of PV260. |
| PLC Communication: | This method communicates with a PLC according to the protocol of the destination PLC. Although usable PLC units are limited, communication can be easily performed by reading or writing specified registers. Inspection results are written in a specified register of PLC. Also, PV260 can be controlled or the setting values can be read and changed by writing commands into another specified register. Unlike General communication, only integers can be read and written.<br>Two methods are available for the timing of reading commands, "Polling" and "Parallel Input". "Polling" checks whether commands are written in the register of PLC or not in a specified "polling time". The response speed is slower than that of "Parallel Input". The time such as the time of inspection or image output gets longer because the polling process is performed even during the inspection. |

▶ Note

For PLC communication, either RS-232C interface or Ethernet interface must be selected.

- The pattern 1 in the table below shows the condition when PLC communication is selected for RS-232C interface. In this case, PLC communication cannot be used for Ethernet interface. Although the result output of RS-232C interface is limited to PLC communication, the control command can be also accepted through general communication.
- The pattern 2 in the table below shows the condition when PLC communication is selected for Ethernet interface. In this case, PLC communication cannot be used for RS-232C interface. Even when PLC communication is selected for Ethernet interface, General communication can be used for both result output and control command. Note that, however, the output port is different from that of PLC communication.

| | RS-232C Interface | | | | Ethernet Interface | | | |
|---|---|---|---|---|---|---|---|---|
| | General Communication | | PLC Communication | | General Communication | | PLC Communication | |
| | Data output | Control command | Data output | Control command | Data output | Control command | Data output | Control command |
| Pattern 1 | N/A | A | A | A | A | A | N/A | N/A |
| Pattern 2 | A | A | N/A | N/A | A | A | A | A |

A: Available. It is also OK not to use.

# 3.6 Serial Communication Setting (COM Port)

This is a setting of the COM port for RS-232C communication. Specify the same values as those for the external device to communicate.

| Item | Value | Content |
|---|---|---|
| Baud Rate | 1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200 (Factory default: 9600) | Transmission speed for communication. The higher number the faster communication speed. |
| Bit length | 7 / 8 (Factory default: 8) | To set the bit number per letter. |
| Stop bit | 1 / 2 (Factory default: 1) | To set the bit number of the signal that recognizes the end of data. |
| Parity check | None / Odd / Even (Factory default: Odd) | To set the number of overhead bits to check for proper data transmission. |
| Flow control | None / Soft Flow (Factory default: None) | To set how to control the handshake flow. |

▶ Note

- When the communication type for "PLC Communication" is set to “Serial”, “Default [PLC]” can be selected. By using this function, you can easily change the setting to the default for the selected PLC model.
- When "PLC Type" is set to "Mitsubishi: MELSEC-FX (older ver.)" or "Fuji: MICREX-SX" and "PLC Communication" is selected for the serial protocol, the communication condition is fixed and cannot be changed according to that of the destination PLC.

# 3.7 Network Setting

Setting of TCP/IP necessary for Ethernet communication and naming of the PV260 are carried out.

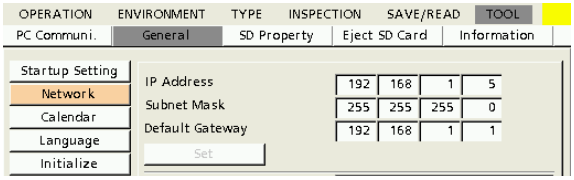
Note

The port number of PV260 depends on type of communication data.

- General communication (PV260 control command send/receive): 8650, 8604
- General output 8601
- Image output 8602
- Sending / receiving of robot control command: 8650

## Changing IP address

**1.** Select "TOOL" > "General" from the menu bar.




**2.** Select "Network".

**3.** Change "IP Address".

Change the subnet mask and default gateway as necessary.
Default setting
IP Address: 192.168.1.5
Subnet Mask: 255.255.255.0
Default Gateway: 192.168.1.1

**4.** After setting is completed, press "Set" button.

Pressing the CANCEL key before the "Set" button clears the change.

## Changing Device Name

**1.** Select "Device Name" in "Network" screen.

**2.** Enter a device name with the software keyboard.

**3.** After the end of entry, select "ENTER" in the soft keyboard.

The entered name is displayed.

**4.** Press the CANCEL key to close the "General" screen.

You do not need to press the "Set" button.

# 3.8 General Communication

## 3.8.1 Overview and Communication Specifications

This method communicates with external devices according to the protocol specified in PV260. Use General Communication for communicating with a PLC other than the PLCs applicable for PLC Communication or PC.  RS232C interface and Ethernet interface can be used simultaneously. (In some cases, they cannot be used simultaneously. For details, refer to“3.5.3 Protocol” on page 49.
The following communications are available with General Communication.

• General output
When accepting an inspection start signal (parallel input including reinspection signal, control command by communication or TRIG input by keypad) in RUN menu, the inspection results that are set to be output (Date / Time, Scan Count, Total Judgement, Judgement, Numerical Calculation, Recognized Characters, Characters decoded by a code reader, Output of Robot Coordinates) and BCC are output, after the inspection, using ASCII strings, and then CR is output at the end of data strings. The following two output methods are available; Outputs data separated with comma and outputs data in fixed digits (unused digits filled with zeros) according to specified output digits (For Scan count and Numerical calculation results only. For Total judgement, it is one digit. For Judgement, it depends on a set judgement formula.).
Numerical calculation results are output as integer omitting the decimal point by specifying digits after decimal point you want to output in advance.
(e.g. When setting "Decimal digit" to "2" for "12.345", it is rounded and output as "1235".)
For the date and time, time of inspection execution can be output to the Ethernet interface and SD card with data on date and time added to before result output. These settings of output are common to all destination devices.

ASCII strings to be output vary depending on the specified settings. Create a program to read data on the external device according to the output strings.
For information on the settings to use this function, refer to “Selecting Destination and Output Data” on page 53.
A function to resend general output is not available.

• Control command
Using this function enables to control PV260, read and change the setting values (including decimal point). (In PLC communication, only integers can be read and changed.)
For the details of the control and commands to be used, refer to “3.8.4 List of Commands for General Communication” on page 59. Even when performing general output and control command using PLC communication, PV260 can accept all the general communication commands described in Chapter 3.8.4.

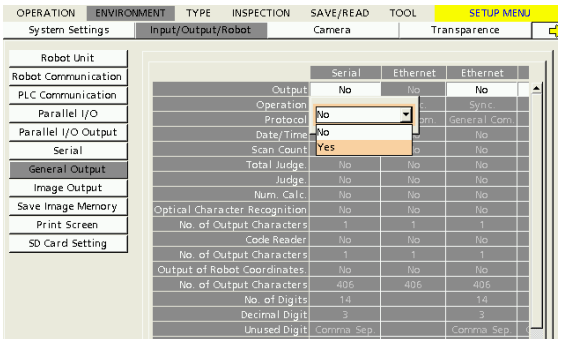
## 3.8.2 Setting General Communication

Set only "General Output" for the setting of general communication. The condition to set for "Control command" using general communication is the setting of communication port only.

### Displaying General Output Setting Window

**1.** In the Menu bar, select "ENVIRONMENT" > "Input/Output/Robot".

**2.** Select "General Output" in setting window.




### Selecting Destination and Output Data

**1.** Select a data destination in "Output".

You can select multiple interfaces as destinations.

▶ Note

Both "Serial" and "Ethernet" can be selected for the general output using general communication as the figure below. However, for PLC communication, either "Serial" or "Ethernet" can be selected.

**2.** To output Date / Time, select "Yes",

▶ Note

When the destination is "Serial" or "Ethernet (PLC) Communication", you cannot add date and time.

**3.** To output Scan Count / Total Judgement / Judgement / Numerical Calculation / Optical Character Reader (OCR) / Code Reader / Output of Robot Coordinates, select "Yes".

▶ Note

- To output "Output of Robot Coordinates", set "Number of Output Characters" in the field under it.
- In addition, to output Optical Character Reader (OCR) and Code Reader, set Number of Output Characters just below the respective fields.

**4.** As to whether to output Error Correction (BCC / SUM), set items of "Error Correction" in Robot Communication.

(Refer to: Page 18)

### Specifying Digit Number of Output Data

In general output, real numbers (values including after decimal point) can be output. Set the digit number of integer and after decimal point.

**1.** Specify total digits of integer part and after decimal point in "No. of Digits".

**2.** In "Decimal Digit", specify digits for after decimal point used from the digits set in step 1.

The outputs specified in "No. of Digits" are "Scan Count" and "Numerical Calculation" only.
If you set "No. of Digits" = 14 (default) and "Decimal Digit" = 3 (default), the value consisting of 11-digit integer and 3-digit decimal number is output. If you set "Decimal Digit" = 2 or 1, the value is rounded.

▶ Note

When the value exceeding the specified digits is processed, the value is output as "0". The number of digits specified in this step has no influence on "Robot coordinates".

**3.** Set "Unused Digit".

If the digit number of the data is less than the output digit number you have set, select a handling of unused digit.

| | |
|---|---|
| Delete | Unused digits are deleted. Multiple data are output in different number of digits. In addition, data is output, delimited by characters specified in "Data Delimiter". |
| Filled with "0" (default) | Unused digits are filled with "0". Although the data become longer, multiple data are output in the same number of digits. |

**4.** Set "Data Delimiter" (when "Delete" is selected in step 3).

Select from Comma, Space, Semicolon, and Tab.

## 3.8.3 Outputting Data through General Communication

### Data Output Flaw

| PV260 | PLC |
|---|---|
| Receives START signal. | Outputs START signal for inspection execution. |
| Outputs response in case of accepting inspection by control command. | Receives response such as %S$52(CR). |
| Executes inspection; capturing image and performing checkers. | ▼ |
| ▼ | |
| Outputs inspection results specified in advance using ASCII strings at a time and outputs CR at the end. | PLC uses transmitted ASCII strings by converting them to values. |
| ▼ | ▼ |
| Waits for the next signal. | Goes back to the beginning and outputs START signal for the next inspection execution. |

### About Data that can be Output

When PV260 executes inspection, the data set to output are output in the following order.

1. Date and Time (It cannot be output when output destination is Serial (RS-232C) or Ethernet (PLC Communication).)
2. Scan Count
3. Total Judgement
4. Judgement result: Up to 1000 points combining judgement and numerical calculation.
5. Numerical Calculation:
6. Recognized character
7. Characters decoded by a code reader

8. Robot coordinates
9. Error Correction (BCC / SUM)

The settings for the above output items 1 to 8 (Output; "Yes" / "No") are common to all the destinations (Serial / Ethernet / SD Card). In the following cases, the data of Judgement and Numeric Calculation are not output.

- Elements are specified to output data but no data exist (is created).
- The setting data exist, but data are set to not to be output.

### Output format of Date and Time

| | |
|---|---|
| Output Data | Date: YY/MM/DD (2-digit of year / 2-digit of Month / 2-digit of Day)<br>8 characters in total<br>Time: HH:MM:SS (2-digit of Hour / 2-digit of Minute / 2-digit of Second)<br>8 characters in total<br>Sixteen characters or seventeen characters (when setting "Unused Digit" to “Delete” are output regardless of output digits. |
| Number of Data | 1<br>However, when "Unused Digit" is "Comma Separated", a comma is put between date and time. |

### Output format of Scan count

| | | |
|---|---|---|
| Output Data | 1 to 2147483647 | |
| Number of Data | 1 | |
| Values to be Output | Normal | 1 to 2147483647 |
| | Overflow | 2147483647 |
| | When the specified number of digits is exceeded | 0 |

### Output format of Total Judgement

| | | |
|---|---|---|
| Output Data | 1 / 0 / E (1 character) | |
| Number of Data | 1 | |
| Values to be Output | OK | 1 |
| | NG | 0 |
| | Error | E |
| | Unset | E |

### Output format of Judgement data

| | | |
|---|---|---|
| Output Data | 1 / 0 / E (1 character) | |
| Number of Data | 1 | |
| Values to be Output | OK | 1 |
| | NG | 0 |
| | Error | E |
| | Unset | E |

### Output format of Numerical Calculation

Values to be output are integers. When setting "Decimal Digit", the integer part and the digits after decimal point that is rounded to the specified decimal place is output without the decimal point.
Example: In case of numerical calculation result is 123.456; when setting "Decimal Digit" to "2", 12346 is output by rounding it to two decimal places.

| | | |
|---|---|---|
| Output Data | Outputs one numerical calculation output as one piece of data. -2147483648 to 2147483647 | |
| Number of Data | Up to 1000 | |
| Values to be Output | Normal | Calculation results: -2147483648 to +2147483647 |
| | When overflowed or the specified number of digits is exceeded | 0<br>("0" is output only for the appropriate numerical calculation results.) |
| | Error | 0 |
| | Unset | Data are not output |

### Output format of recognized characters

| | |
|---|---|
| Output Data | Outputs characters of judgement result of Optical Character Reader (OCR) checker using ASCII characters<br>They are output for the number of data set. (Up to 1000 data) |
| Number of Data | 1 |

### Output format of characters decoded by a code reader

| | |
|---|---|
| Output Data | Outputs codes decoded by a code reader checker using ASCII characters<br>They are output for the number of data set. (Up to 1000 data) |
| Number of Data | 1 |

### Output format of Output of Robot Coordinates

| | | | |
|---|---|---|---|
| Output Data | Format: Point =[X],[Y],[R]<br>Outputs detection result of checker quoted for Output of Robot Coordinates as one data. The format depends on Coordinate Format. | | |
| Number of Data | Up to 100 | | |
| Values to be Output | "X" "Y" "R" | Normal | -99999.999 to +99999.999 |
| | | Overflow or when exceeding the specified "No. of Digits". | 0 |
| | | Error | 0 |
| | "Hand-System" | -99 to +99 | |
| | When the item is other than the above | Follows the settings of Coordinate Format | |
| | Unset | Data are not output | |

### Output format of SUM

| | |
|---|---|
| Output Data | 00 to FF (2 characters) |
| Number of Data | 1 |
| Values to be Output | Outputs low-order 1 byte of summation result of command message added in binary using two ASCII code characters.<br>▼Refer to▼<br>For details, refer to “About Checksum” on page 61. |

### Output format of BCC

BCC is output subsequent to previous data. When "Delete" is specified for "Unused Digit", "Data Delimiter" is placed to separate each piece of data. However, the final piece of data and BCC are output continuously without being separated from each other. If you want to read the last data separated with comma, output one extra data next to it.

| | |
|---|---|
| Output Data | 00 to FF (2 characters) |
| Number of Data | 1 |
| Values to be Output | Obtains an Exclusive OR from the ASCII code of all characters from the first character of output string to the string right before BCC. The obtained Exclusive OR is expressed in hexadecimal and two characters are output regarding four bits as one character.<br>▼Refer to▼<br>For details, refer to “About Block Check Code” on page 61. |

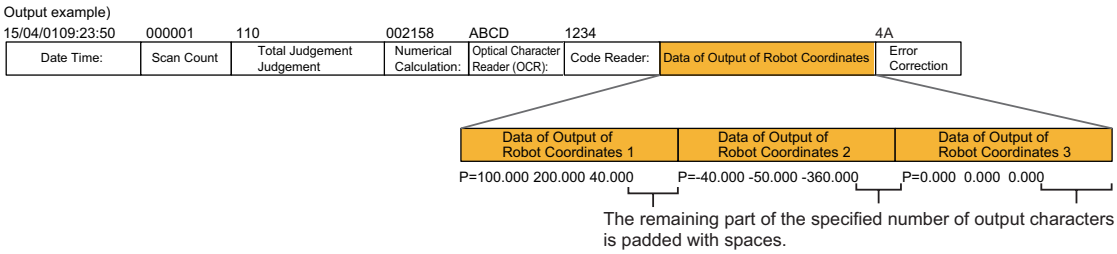
## Example of General Output

| | | |
|---|---|---|
| Output Data | Date | 2015/04/01 |
| | Time | 09:23:50 |
| | Scan Count | 1 time |
| | Total Judgement | OK |
| | Judgement | JDC000 = OK, JDC001 = Unset, JDC002 = NG |
| | Numerical Calculation | CAC000 = 215.8, CAC001 = Unset |
| | Optical Character Reader (OCR) | ABCD |
| | Code Reader | 1234 |
| | Data of Output of Robot Coordinates | P=100.000 200.000 40.000, P=40.000 -50.000 -360.000, P=0.000 0.000 0.000 |
| | Error Correction | 4A |

● For replacement (fixed-length output) with "Unused Digit"

| | | |
|---|---|---|
| Output Condition 1 | Date / time | Output |
| | No. of Digits | 6 |
| | Number of digits following the decimal point | 1 |
| | Unused Digit | Filled with '0' |
| | BCC (Set in Robot Communication) | Output |

Output example)



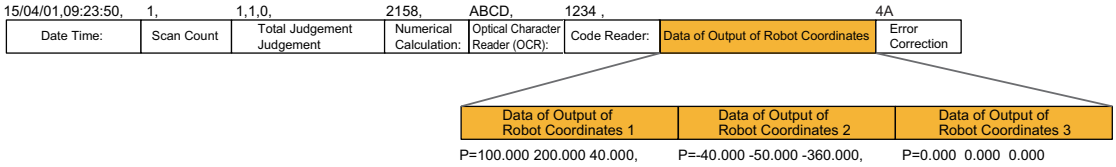

**Note**

- For Data of Output of Robot Coordinates, the remaining part of the specified number of characters is padded with not zeros but spaces.

● With Unused Digit = Deleted (variable-length output)

| | | |
|---|---|---|
| Output Condition 2 | Date / time | Output |
| | No. of Digits | 6 |
| | Number of digits after decimal point | 1 |
| | Unused Digit | Deleted (Variable-length output) |
| | BCC (Set in Robot Communication) | Output |

Output example)




**Note**

- For variable length, a data delimiter is used for each piece of data separated. A delimiter is selectable from "Comma, Space, Semicolon, and Tab". In this case, note that the selected delimiter differs from the Delimiter of Robot Coordinates Format. Data Delimiter is reflected upon all general result data.
- Judgement JDC001 and Numeric Calculation CAC001 are not output because they are unset.
- Date / Time cannot be output to Serial.

# 3.8.4 List of Commands for General Communication

The commands described in this chapter are the common commands for the ports to control PV260 with RS-232C interface and Ethernet interface through general communication.

▶ Note

Port number of Ethernet interface to send / receive commands for PV260 is "8650".

## List of Commands

The commands and the modes permitting the commands are listed below.

| | | | Command Permission (Permitted = Yes) | | | |
|---|---|---|---|---|---|---|
| | | | RUN Menu | | SETUP menu | |
| | | Command | RUN | STOP | STOP | Parallel Processing |
| Robot coordinates acknowledged | | %P = (Robot Coordinates) | Yes | | | Yes |
| Measurement start command (Execute All) | | %CAn | Yes | | | Yes |
| Measurement start command (User Defined) | | %CAn,b | Yes | | | Yes |
| Re-measurement start command (Execute All) | | %RCAn | Yes | | | Yes |
| Re-measurement start command (User Defined) | | %RCAn,b | Yes | | | Yes |
| Auto calibration setting start | | %CASn | Yes | | | Yes |
| Work detection base position reregistering | | %WCS | Yes | | | Yes |
| Work detection base position reregistering start | | %WRSn | Yes | | | Yes |
| Movement completion | | %MVE | Yes | | | Yes |
| Teaching coordinate request | | %TCD | Yes | | | Yes |
| Inspection execution | Common Trigger | %S | Yes | | | Yes |
| Start reinspection (to inspect on the current memory image without capturing a new image) | | %R | Yes | | | Yes |
| Switch product type | | %X | Yes | | | Yes |
| Save the setting data | Storage space in PV260 | %MW | Yes | | | Yes |
| | SD memory card | %CW | Yes | | | Yes |
| Read the setting data | Storage space in PV260 | %MR | Yes | | | Yes |
| | SD memory card | %CR | Yes | | | Yes |
| Abort save / read setting data (Cancel) | | %CD | Yes | | | Yes |
| Image memory | Save (in an SD card) | %SS | Yes | | | Yes |
| | Clear | %SR | Yes | | | Yes |
| Print screen | | %PS | Yes | Yes | Yes | Yes |
| Reset statistics | | %Q | Yes | | | Yes |
| Switch between RUN / STOP | | %RM | Yes | Yes | | Yes |
| Reset error signal | | %E | Yes | Yes | Yes | Yes |
| Cancel Inspection / Process (Cancel various operations) | | %CC | Yes | Yes | Yes | Yes |
| Key emulating | | %K | Yes | Yes | Yes | Yes |
| Keypad Operation | Invalid / Valid | %BS | Yes | Yes | | Yes |
| | Confirm Status | %BC | Yes | Yes | Yes | Yes |
| Switch Layout | | %I | Yes | | | Yes |
| Template Setting | | %A | Yes | | | |
| Template Setting for Contour Matching | | %B | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Read | %PR | Yes | *1 | *1 | Yes |
| | Read pairs (Maximum / minimum values) | %PRP | Yes | | | Yes |
| | Change | %PW | Yes | | | Yes |
| | Change pairs (Maximum / minimum values) | %PWP | Yes | | | Yes |

*1 Only operation status (parameter: SYS_RUN) and screen status (parameter: SYS_EDIT) can be read.

# 3.8.5 Details on General Communication Command

"SEND" described in this chapter indicates the commands given from external devices to PV260. On the other hand, "Receive" indicates the responses for the sent commands from PV260 to external devices.

## About Block Check Code

All command messages are added with a block check code, which checks an error using horizontal parity to improve reliability of transmission data. This manual describes a block check code as "BCC". As a block check code of PV260, a code that is given by converting Exclusive OR data (8-bit) of a command message, excepting termination code, into ASCII code (two characters) is used.
If you do not employ block check, add "**" (2AH2AH) instead of a block check code.

Example) When reading execution time

Command message

| % | P | R | | S | Y | S | _ | T | I | M | E | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25H | 50H | 52H | 20H | 53H | 59H | 53H | 5FH | 54H | 49H | 4DH | 45H | 31H |

▼

25H

Obtain Exclusive OR

Command message including BCC

| % | P | R | | S | Y | S | _ | T | I | M | E | 1 | 2 | 5 | CR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | BCC | | |

## About Checksum

Checksum used in PV260 is indicated using two ASCII code characters of low-order 1byte of the summation result of a command message added in binary. Whether BCC or checksum is used for error correction can be selected in "3.1 Robot Communication" on page 18.
If checksum is not added, add "**" (2AH2AH) instead of it.

Example) When reading execution time

Command message

| % | P | R | | S | Y | S | _ | T | I | M | E | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25H | 50H | 52H | 20H | 53H | 59H | 53H | 5FH | 54H | 49H | 4DH | 45H | 31H |

▼

3A5H

Obtain sum total

▼

A5H

Obtain low-order 2 digits

Command message including SUM

| % | P | R | | S | Y | S | _ | T | I | M | E | 1 | A | 5 | CR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | SUM | | |

About Response at Error

When sending a command message from the external device, an error response message containing 3-digit error code may be returned. This message is returned when the sent command is wrong or PV260 cannot receive the command.
The response differs depending on commands except the following common responses. Refer to the descriptions of each command.

Error Response Message Common to Commands

| % | ! | 1 | 0 | 0 | BCC(35) | CR |
|---|---|---|---|---|---|---|

- This message is sent when Block Check Code (BCC) error occurred or an undefined command (unrecognizable command) is received.
- ERROR signal turns on.

| % | ! | 1 | 1 | 0 | BCC(34) | CR |
|---|---|---|---|---|---|---|

- Receive buffer overflow of PV260. This might occur when inputting multiple commands in a row from the external device to PV260. If you receive this error response, decrease commands to send to PV260.
- ERROR signal turns on.

# Command Details

▶ Note

To explain commands in detail, commands using BCC are used as examples.

## Robot Coordinates Acknowledged

Send

| ?? | BCC | CR |
|---|---|---|

?? = Coordinate data set in Robot Coordinates Format

Receive

| % | P | $ | BCC | CR |
|---|---|---|---|---|

Error (ERROR signal = ON)

| % | P | ! | eee | BCC | CR |
|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

## Measurement Start Command

When Execution Mode is "Execute All"

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Send | % | C | A | n | BCC | CR | n = 0 to 5 (Calibration No.) |
| Receive | % | C | A | $ | BCC | CR | |

Error (ERROR signal = ON)

| | | | | | | |
|---|---|---|---|---|---|---|
| % | C | A | ! | eee | BCC | CR |

When execution mode is "User-Defined"

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Send | % | C | A | n | , | b | BCC | CR | n = 0 to 5 (Calibration No.)<br>b = 0 to 9 (Block No.) |
| Receive | % | C | A | $ | BCC | CR | | | |

Error (ERROR signal = ON)

| | | | | | | |
|---|---|---|---|---|---|---|
| % | C | A | ! | eee | BCC | CR |

Error code

| | |
|---|---|
| **100** | In the format after command, no calibration No. or outside the range, or excess of parameter |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **201** | Although the command is for “User-Defined”, execution mode is NOT “User-Defined” in PV260. |
| **202** | Although the command is for Execute All, "User-Defined" is specified for Execution Mode. |
| **203** | No camera is connected or both cameras of PV260 are set to "Unused". |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

When the maker is "YAMAHA" with "Execute All" specified for Execution Mode

Send

| % | C | A | n | BCC | CR |
|---|---|---|---|---|---|

n = 0 to 5 (Calibration No.)

Receive

| % | C | A | $ | m,m,m,m,m,m,m,m,m,m | BCC | CR |
|---|---|---|---|---|---|---|

m = 0 to 100 (No. of Objects)

Error (ERROR1 signal = ON)

| % | C | A | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|

When the maker is "YAMAHA" with "User-Defined" specified for Execution Mode

Send

| % | C | A | n | , | b | BCC | CR |
|---|---|---|---|---|---|---|---|

n = 0 to 5 (Calibration No.)
b = 0 to 9 (Block No.)

Receive

| % | C | A | $ | m,m,m,m,m,m,m,m,m,m | BCC | CR |
|---|---|---|---|---|---|---|

m = 0 to 100 (No. of Objects)

Error (ERROR1 signal = ON)

| % | C | A | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **100** | In the format after command, no calibration No. or outside the range, or excess of parameter |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **201** | Although the command is for “User-Defined”, execution mode is NOT “User-Defined” in PV260. |
| **202** | Although the command is for Execute All, "User-Defined" is specified for Execution Mode. |
| **203** | No camera is connected or both cameras of PV260 are set to "Unused". |
| **205** | Since READY signal is not turned on within one second after command is accepted, command is not acceptable. |
| **230** | Execution is not allowed because template setting is in progress. |
| **301** | Current robot position has never been notified since the power supply was turned on. |
| **302** | Recalculation of calibration data failed *1 |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

*1 : This error occurs only when "2nd-Axis" and "SCARA" are selected for Camera mount and robot type, respectively. This error occurs only when coordinates of current position (XY) notified are not settable for the arm length specified.
Example) Current position: X=100, Y=100 with 1st-Arm Length = 10 and 2nd-Arm Length = 10
→ The position is out of reach with the arm length as specified

## Re-measurement Start Command

When Execution Mode is "Execute All"

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Send | % | R | C | A | n | BCC | CR | n = 0 to 5 (Calibration No.) |
| Receive | % | R | C | A | $ | BCC | CR | |

Error (ERROR signal = ON)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | % | R | C | A | ! | eee | BCC | CR |

When execution mode is "User-Defined"

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Send | % | R | C | A | n | , | b | BCC | CR | n = 0 to 5 (Calibration No.)<br>b = 0 to 9 (Block No.) |
| Receive | % | R | C | A | $ | BCC | CR | | |

Error (ERROR signal = ON)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | % | R | C | A | ! | eee | BCC | CR |

Error code

| | |
|---|---|
| **100** | In the format after command, no calibration No. or outside the range, or excess of parameter |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **201** | Although the command is for “User-Defined”, execution mode is NOT “User-Defined” in PV260. |
| **202** | Although the command is for Execute All, "User-Defined" is specified for Execution Mode. |
| **203** | Image has never been captured. Therefore no image exists. |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

When the maker is "YAMAHA" with "Execute All" specified for Execution Mode

Send

| % | R | C | A | n | BCC | CR |
|---|---|---|---|---|---|---|

n = 0 to 5 (Calibration No.)

Receive

| % | R | C | A | $ | m,m,m,m,m,m,m,m,m,m | BCC | CR |
|---|---|---|---|---|---|---|---|

m = 0 to 100 (No. of Objects)

Error (ERROR1 signal = ON)

| % | R | C | A | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|

When the maker is "YAMAHA" with "User-Defined" specified for Execution Mode

Send

| % | R | C | A | n | , | b | BCC | CR |
|---|---|---|---|---|---|---|---|---|

n = 0 to 5 (Calibration No.)
b = 0 to 9 (Block No.)

Receive

| % | R | C | A | $ | m,m,m,m,m,m,m,m,m,m | BCC | CR |
|---|---|---|---|---|---|---|---|

m = 0 to 100 (No. of Objects)

Error (ERROR1 signal = ON)

| % | R | C | A | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **100** | In the format after command, no calibration No. or outside the range, or excess of parameter |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **201** | Although the command is for “User-Defined”, execution mode is NOT “User-Defined” in PV260. |
| **202** | Although the command is for Execute All, "User-Defined" is specified for Execution Mode. |
| **203** | Image has never been captured. Therefore no image exists. |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **301** | Current robot position has never been notified since the power supply was turned on. |
| **302** | Recalculation of calibration data failed *1 |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

*1 : This error occurs only when "2nd-Axis" and "SCARA" are selected for camera mount and robot type, respectively. This error occurs only when coordinates of current position (XY) notified are not settable for the arm length specified.
Example) Current position: X=100, Y=100 with 1st-Arm Length = 10 and 2nd-Arm Length = 10
→ The position is out of reach with the arm length as specified

## Result output request

When the maker is "YAMAHA"

Send

| % | D | O | N | E | 0 | BCC | CR |
|---|---|---|---|---|---|---|---|

Receive

| ?? | BCC | CR |
|---|---|---|

?? = Coordinate data set in Robot Coordinates Format

Error (ERROR1 signal = ON)

| % | D | O | N | E | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **303** | Since result to be output does not exist, result output cannot be performed. |

## Completion of Result Output Request

Send

| % | D | O | N | E | BCC | CR |
|---|---|---|---|---|---|---|

Receive

No response in normal condition

Error (ERROR1 signal = ON)

| % | D | O | N | E | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **303** | Since no result is output, no command is required. |

## Auto Calibration Start

Send

| % | C | A | S | n | BCC | CR |
|---|---|---|---|---|---|---|

n = 0 to 5 (Calibration No.)

Receive

| % | C | A | S | $ | BCC | CR |
|---|---|---|---|---|---|---|

Error (ERROR signal = ON)

| % | C | A | S | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **100** | In the format after command, no calibration No. |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **311** | An error has occurred in auto calibration. |
| **312** | The specified calibration No. is outside the range |
| **313** | Auto Calibration cannot start. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

## Movement completion

Send

| % | M | V | E | BCC | CR |
|---|---|---|---|---|---|

Receive Differs depending on the sequence.

Error (ERROR signal = ON)

| % | M | V | E | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **310** | Execution is not allowed because of waiting for entry of the relevant command during automatic setting |

## Work detection base position setting

Send

| % | W | C | S | BCC | CR |
|---|---|---|---|---|---|

Receive

| % | W | C | S | $ | BCC | CR |
|---|---|---|---|---|---|---|

Error (ERROR signal = ON)

| % | W | C | S | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

## Work detection base position setting start

Send

| % | W | R | S | n | BCC | CR |
|---|---|---|---|---|---|---|

n = 0 to 15 (Work detection No.)

Receive

| % | W | R | S | $ | BCC | CR |
|---|---|---|---|---|---|---|

Error (ERROR signal = ON)

| % | W | R | S | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **100** | No work detection No. in the format of command or after |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **314** | Specified work detection No. is outside the range |
| **315** | Execution is not allowed because work detection base position setting is in progress |
| **316** | Standard setting ended because an error occurred in the execution of checker |
| **317** | Work detection base position setting cannot start |

## Teaching coordinate request

Send

| % | T | C | D | BCC | CR |
|---|---|---|---|---|---|

Receive

| % | T | C | D | $ | BCC | CR |
|---|---|---|---|---|---|---|

Error (ERROR signal = ON)

| % | T | C | D | ! | eee | BCC | CR |
|---|---|---|---|---|---|---|---|

Error code

| | |
|---|---|
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |
| **320** | Execution is not allowed because data to be output is not set |

# 3.9 PLC Communication

## 3.9.1 Overview and Communication Specifications

This method communicates with a PLC according to the protocol of the destination PLC. The method is available in either RS232C interface or Ethernet interface. (For details, refer to “3.5.3 Protocol” on page 49.)
The following communications are available with PV260.

• Result output

When accepting an inspection start signal (parallel input including reinspection signal, control command by communication or TRIG input by keypad) in RUN menu, the inspection results that are set to “Yes” (Output) (Scan count, Total judgement, Judgement, Numerical calculation) are written, after the inspection, with a desired register of PLC placed (specified in advance) at the head. Only integers can be written. The PLC does not need a communication program to receive data. For information on the settings to use this function, refer to “PLC Communication Common Setting” on page 76, “PLC Communication (General) Output Setting” on page 77. For the procedure of result output, refer to “3.9.3 Outputting Data through PLC Communication” on page 82. A function to resend general output is not available.

• Control command

Using this function enables to control PV260, read and change the setting values. Only integers can be read and changed. For information on the settings, refer to “PLC Communication Common Setting” on page 76, “PLC Communication Control Command Setting” on page 78. For the timing of sending and receiving commands between PV260 and PLC, refer to“3.9.4 Controlling PV260 through PLC Communication” on page 86.
For the details of the control and commands to be used, refer to “3.9.5 List of PLC Communication Commands” on page 90.
Even when selecting PLC communication, PV260 can accept all the general communication commands described in Chapter 3.9.5.

### Usable PLCs for PLC Communication

The following list shows the PLC models available for PLC communication via a RS232C or Ethernet interface.

| Manufacturer | Model (series) name | RS-232C | Ethernet |
|---|---|---|---|
| Panasonic | FP series | Available *1) | Available *2) |
| | FP2 ET-LAN unit | | Available |
| Mitsubishi Electric Corporation (MELSEC) | A/FX series | Available | |
| | Q series | Available | Available *3) |
| | FX series(older ver.) (FX1N)*4) | Available | |
| | FX-2N series(older ver.) (FX2N, FX3U, FX3UC)*4) | Available | |
| OMRON Corporation | C series, CV series, CS1 series | Available | |
| Allen-Bradley | SLC500 | Available | |
| Fuji Electric FA Components & Systems Co., Ltd. | MICREX-SX SPH series | Available | |
| Yokogawa Electric Corporation | FA-M3/e-RT3 | | Available |
| (Standard) MODBUS RTU | | Available | |

Notes: 1) TOOL port, COM port, FP2-MCU (RS232C communication block), FP2-CCU
2) Applicable unit: FP-X COM5 communication cassette, FP Web Server 2 unit
3) Applicable unit: CPU with a built-in Ethernet port, Ethernet unit (QJ71E71-100 only)
4) For using FX or FX-2N series, it is recommended to use the settings of A/FX series.

Note

- When Baud Rate is "115200 bps", the communication via RS232C interface may not be carried out stably in accordance with PLC to communicate with. In the case, set Baud Rate to "57600 bps" or lower.
- PLC communication via Ethernet interface is performed with UDP/IP.

## Specifications of PLCs Selected

Note

In accordance with specification of PLCs, some of the registers in "Usable range" of "Usable device" listed below could not be used. Please confirm the specifications of PLC before use.

### ■ Panasonic FP series / Panasonic: FP(ET-LAN unit)

Protocol: MEWTOCOL

Usable device

| | | |
|---|---|---|
| Data output | | DT |
| Data output completion notice | Register* | WR |
| | Bit | 0-15 (0-F) |
| Control command | Control Register | WR |
| | Command Input / Output | DT |
| Robot control command | Control register of robot control command | WR (The 0th bit of the specified register is the command start bit and the 1st bit of the specified register is the process completion bit.) |
| | Input / output of robot control command | DT |

### ■ Mitsubishi: MELSEC-Q

Protocol:

– RS-232C Interface "Format 4", 4C frame compatible for QnA

– Ethernet Interface 3E frame compatible for QnA

CPU with a built-in Ethernet port, Ethernet unit (Applicable unit: QJ71E71-100 only)

Usable device

| | | |
|---|---|---|
| Data output | | D |
| Data output completion notice | Register* | M |
| | Bit | Invalid |
| Control command | Control Register | M ("Specified value" is command start bit, "Specified value +16" is processing bit and "Specified value +17" is error bit.) |
| | Command Input / Output | D |
| Robot control command | Control register of robot control command | M ("Specified value" is a command start bit, and "Specified value + 1" is a Process completion bit) |
| | Input / output of robot control command | D |

- Make the following setting with PLC.

When using RS-232C Interface

– Sum check: Yes (type: BCC)

– Write at RUN time: "Enable"

When using Ethernet interface

– Communication data code: Binary code communication
– Initial timing setting: Always wait for OPEN
– Send frame setting: Ethernet(V2.0)
– Write at RUN time: "Enable"

### ■ Mitsubishi: Mitsubishi: MELSEC-A/FX("Mitsubishi: MELSEC-A" for versions older than Ver.1.3)

Protocol: "Format 4", 1C frame compatible for A

Usable device

| | | |
|---|---|---|
| Data output | | D |
| Data output completion notice | Register* | M |
| | Bit | Invalid |
| Control command | Control Register | M ("Specified value" is command start bit, "Specified value +16" is processing bit and "Specified value +17" is error bit.) |
| | Command Input / Output | D |
| Robot control command | Control register of robot control command | M ("Specified value" is a command start bit, and "Specified value + 1" is a Process completion bit) |
| | Input / output of robot control command | D |

- Make the following setting with PLC.
  – Sum check: Yes (type: BCC)
  – Write at RUN time: "Enable"

### ■ Mitsubishi: MELSEC-FX (* older ver.) ("Mitsubishi: MELSEC-FX" for versions older than Ver.1.3)

For using FX-series, it is recommended to set PLC type to "Mitsubishi: MELSEC-A/FX".
CPU: FX1N
Communication adapter: FX1N-232-BD
Protocol: Special protocol for FX1N
Register for specifying communication format: Store "0" in D8120. (Reboot the PLC after the setting.)

Usable device

| | | |
|---|---|---|
| Data output | | D |
| Data output completion notice | Register* | M |
| | Bit | Invalid |
| Control command | Control Register | M ("Specified value x16" is command start bit, "Specified value x16 +16" is processing bit and "Specified value x16 +17" is error bit.) |
| | Command Input / Output | D |
| Robot control command | Control register of robot control command | M ("Specified value x 16" is a command start bit, and "Specified value x 16 + 1" is a Process completion bit) |
| | Input / output of robot control command | D |

- Sum check: Yes
- With PLC, you cannot select whether to perform sum check. Automatically "Yes" is selected.

## ■ Mitsubishi: MELSEC-FX-2N (older ver.) ("Mitsubishi: MELSEC-FX-2N" for versions older than Ver.1.3)

For using FX-series, it is recommended to set PLC type to "Mitsubishi: MELSEC-A/FX".
CPU: FX2N, FX3U, FX3UC
Communication adapter: FX2N-232-BD, FX3U-232-BD, FX3U-232-ADP
Protocol: Special protocol for FX2N
Register for specifying communication format: Store "0" in D8120. (Reboot the PLC after the setting.)

Usable device

| | | |
|---|---|---|
| Data output | | D |
| Data output completion notice | Register* | M |
| | Bit | Invalid |
| Control command | Control Register | M ("Specified value x16" is command start bit, "Specified value x16 +16" is processing bit and "Specified value x16 +17" is error bit.) |
| | Command Input / Output | D |
| Robot control command | Control register of robot control command | M ("Specified value X 16" is a command start bit, and "Specified value X 16 + 1" is a Process completion bit) |
| | Input / output of robot control command | D |

- Sum check: Yes
- With PLC, you cannot select whether to perform sum check. Automatically "Yes" is selected.

## ■ OMRON Corporation C, CV, and CS1 series

Protocol: Host link

Usable device

| | | |
|---|---|---|
| Data output | | D / DM |
| Data output completion notice | Register* | CIO / IR |
| | Bit | 0-15 (0-F) |
| Control command | Control Register | CIO / IR |
| | Command Input / Output | D / DM |
| Robot control command | Control register of robot control command | CIO / DM (The 0th bit of the specified register is the command start bit and the 1st bit of the specified register is the process completion bit.) |
| | Input / output of robot control command | CIO / DM |

- Make the following setting with PLC.
  - Sum check: Yes
  - Station No: "0"
- Communication is not available when PLC is in "Run" mode. Change to "Monitor" mode to communicate.

## ■ MICREX-SX (SPH series) by Fuji Electric FA Components & Systems Co., Ltd.

Usable device

| | | |
|---|---|---|
| Data output | | %MW3 |
| Data output completion notice | Register* | %MW3 |
| | Bit | 0-15 (0-F) |
| Control command | Control Register | %MW3 |
| | Command Input / Output | %MW3 |
| Robot control command | Control register of robot control command | %MW (The 0th bit of the specified register is the command start bit and the 1st bit of the specified register is the process completion bit.) |
| | Input / output of robot control command | %MW |

- Sum check: Yes (type: BCC, the calculation method developed by Fuji is used.)

## ■ SLC series by Allen-Bradley

Usable device

| | | |
|---|---|---|
| Data output | | N7 (Only integer registers) |
| Data output completion notice | Register* | N7 |
| | Bit | (Only integer registers) |
| Control command | Control Register | 0-15 (0-F) |
| | Command Input / Output | N7 (Only integer registers) |
| Robot control command | Control register of robot control command | 0 - 15 (The 0th bit of the specified register is the command start bit and the 1st bit of the specified register is the process completion bit.) |
| | Input / output of robot control command | N7 (Only integer registers) |

- Make the following setting with PLC.
  - Duplicate Detect:  OFF
  - ACK Timeout (*20 ms): 20
  - Control Line:  NO HANDSHAKING
  - Error Detect:  CRC
  - NAK Retries:  3
  - ENQ Retries:  0
  - Embedded Responses:  AUTO DETECT

## ■ FA-M3/e-RT3 by Yokogawa Electric Corporation (Available from Ver.1.5)

Protocol: UDP/IP Host link

Usable device

| | | |
|---|---|---|
| Data output | | D |
| Data output completion notice | Register* | I (Specify 1 or more.) |
| | Bit | 0 (Fixed) |
| Control command | Control Register | I (Specify 1 or more.) |
| | Command Input / Output | D |
| Robot control command | Control register of robot control command | The specified register (I) and specified register (I)+1 are the command start bit and process completion bit, respectively. |
| | Input / output of robot control command | D |

- The port number of PLC should be the same as the setting of PV260. (Select 12289 or 12291.)
- Binary is supported for transmission code. It is not supported for ASCII.
- Specify the CPU number of a connected PLC in PV260.

## ■ MODBUS RTU

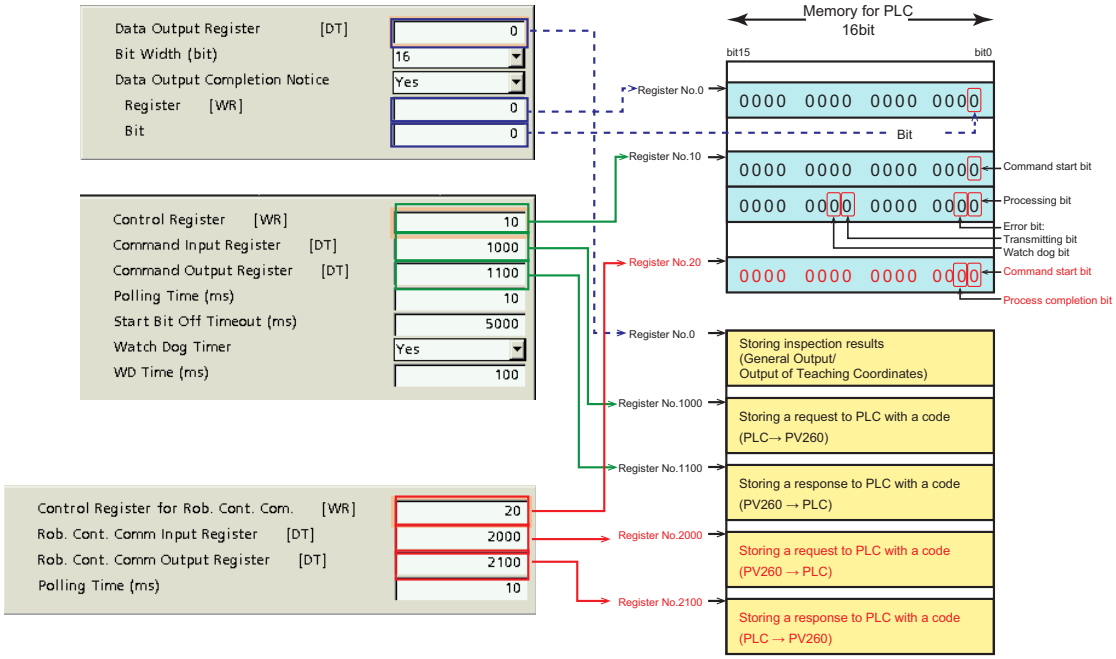
Usable device

| | | |
|---|---|---|
| Data output | | Holding register |
| | Bit | Coil |
| Control command | Control Register | Coil |
| | Command Input / Output | Holding register |
| Robot control command | Control register of robot control command | Coil |
| | Input / output of robot control command | Holding register |

# 3.9.2 Setting of PLC Communication

In PLC communication, commands and results are sent and received using the registers of a PLC to communicate. More than one register area is used for each function. Set register areas as the figure below.

Relation between setting items and PLC registers




## PLC Communication Common Setting

This is the common setting for sending and receiving result output and control commands.

***1.*** Select "ENVIRONMENT" > "Input / Output / Robot" > "PLC Communication" from the menu bar.

***2.*** Select a communication port in "Communication Type" and then select "PLC Type".

| | |
|---|---|
| Serial | Provides communication via RS-232C interface. For details, refer to “When performing PLC communication using RS-232C Interface” on page 79. |
| Ethernet | Provides communication via Ethernet interface. For details, refer to “When performing PLC communication using Ethernet interface” on page 80. |

Selectable PLC types differ depending on the communication type.

***3.*** Set time for "Timeout (ms)".

20 to 20000 msec (default: 5000)

▶ Note

When PV260 writes data in the specified address of PLC, it sends and receives commands and response messages, using dedicated protocol, between PV260 and PLC. The value set here is time for timeout in the message communication in this case.
If PLC sends no response in the time of Timeout, a timeout error occurs.

**4.** Set "No. of Error Retries".
0 to 255 (Default: 0)

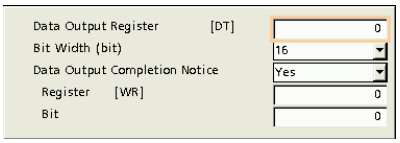
**5.** According to the function to be used, set "Result Output" or "Communication Command".

## PLC Communication (General) Output Setting

**1.** Make PLC communication common settings.
Refer to "PLC Communication Common Setting" above.

**2.** Select "ENVIRONMENT" > "Input / Output / Robot" > "PLC Communication" > "Result Output" from the menu bar.

**3.** In "Data Output Register", specify the first register number of the PLC that PV260 stores data in.




0 to 99999 are available.

▶ Note

Not all addresses 0 to 99999 can be used in destination PLC.
As the address allowed to be written by the external device (PV260) varies depending on PLC, please make sure the address with the instruction manual of PLC.
The number of data registers differ depending on the number of data to be output and "Bit Width".
Be sure to set address number not to destroy the contents of registers used for other applications.

**4.** Select 16-bit or 32-bit to output Scan Count and Numerical Calculation data in "Bit Width" according to the maximum value of the data to be output.
When output data exceed the value which can be output in the selected Bit Width, "0" is output.

**5.** To notice to PLC that data output is complete, set "Data Output Completion Notice" to "Yes".
Specify an address to make the specified bit to "1" and the bit.
Data Output Completion Notice register: 0-99999: It varies according to the PLC used.
Output bit: 0-15: Specifying "15" makes the highest order bit "1".
For Mitsubishi PLC, enter contact No. to output register. (Output bit is invalid.)

**6.** Select "ENVIRONMENT" > "Input / Output / Robot" > "General Output" from the menu bar.

**7.** Set "Output" to "Yes" for the selected communication port, and select "PLC communication" in Protocol.
When the communication port is Ethernet, select the column of PLC communication in advance. For PLC communication, either "Serial" or "Ethernet" can be selected.

**8.** Set "Scan Count", "Total Judgement", "Judgement", and "Numerical Calculation" to "Yes".

## PLC Communication Control Command Setting

**1.** Make PLC communication common settings.

For details, refer to “3.9.2 Setting of PLC Communication” on page 76.

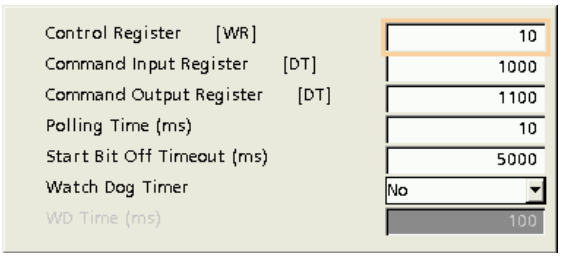
**2.** Select either "Polling" or "Parallel Input" in "Command Read Type" from "ENVIRONMENT" > "Input / Output / Robot" > "PLC Communication".

Select the trigger for PV260 to start reading data from PLC.

| | |
|---|---|
| "No" | Not perform command control. |
| Polling | Periodically checks whether commands are written in PLC or not, and starts reading the commands once the completion is confirmed. The response speed is slower than that of "Parallel Input". The time such as the time of inspection or image output gets longer because the polling process is performed even during the inspection. Set "Polling Time" and "Start Bit Off Timeout" in step 7. Set "Watch Dog Timer" as necessary. |
| Parallel Input | Starts reading commands from PLC when the signal is input to PV260 from a parallel input terminal (*).<br>*: Terminal among one of ASSIGN0, 1 and EXTRA 0 to 2 assigned to "PLC Communication Command". (Set in "ENVIRONMENT" > "Input / Output" > "Parallel I/O") |

**3.** Open the "Communication Command" menu.

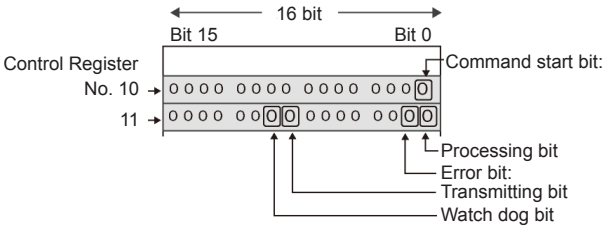
The display of "WR" and "DT" in the menu differs depending on PLC types in use.




**4.** "Control Register": Specify the start address of the control register to be used for sending and receiving the control command.

According to the bit information of the specified control register, it is used as the command start bit, error bit, processing bit or transmitting bit. It is used as the watch dog bit when using watch dog timer.

For how to use the control register, refer to “3.9.4 Controlling PV260 through PLC Communication” on page 86.




Control Register = 10

**5.** "Command Input Register": Specifies the start register number for wiring a command for which PLC gives a request to PV260.

Some command uses a maximum of twelve words. It is recommended to prevent using twelve words for other applications.
For details on commands, refer to Page 92.

### *6.* "Command Output Register": Specifies the start register number of the PLC in which PV260 writes responses.

Some response uses a maximum of nine words. It is recommended to prevent using nine words for other applications.
For details on responses, refer to Page 92.

### *7.* When "Polling" was selected in step 2, set "Polling Time (ms)" and "Start Bit Off Timeout (ms)".

| | |
|---|---|
| "Polling Time" | The cycle that PV260 monitors the registers of PLC. The shorter the cycle, the faster the response after a command is written by PLC. However, it affects the execution time as PV260 monitors the PLC registers during inspections. The actual polling frequency may be longer than the frequency set here. The actual polling frequency is displayed in the information area of RUN menu. Please check it. |
| "Start Bit Off Timeout" | The time until PLC turns off the command start bit after PV260 turns on the command processing bit. The error (E0113) occurs when the command start bit does not turn off within the time set here. |

### *8.* When "Polling" was selected in step 2, set " Watch Dog Timer" as necessary.

The watch dog timer is to notify that PV260 is in the normal communication status such as no disconnection of the communication cable to PLC. When setting "Watch Dog Timer" to "Yes", the watch dog bit is overwritten during inspection. It affects the execution time or the response time to the command transmitted from PLC.

| | |
|---|---|
| "No" | Not activate watch dog timer. |
| "Yes" | Activates watch dog timer. "Watch Dog Time" can be set freely, however, the watch dog timer is activated with a period of polling time. Actually, it is activated with a period of the integral multiple of polling time and a longer period of the set watch dog time. For the register using watch dog, refer to Page 87. |

## When performing PLC communication using RS-232C Interface

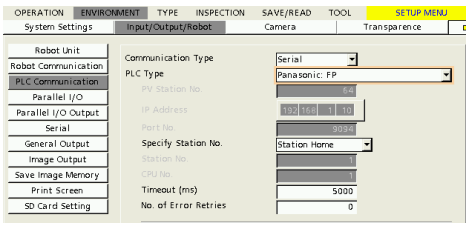
For the information of applicable PLC types, refer to Page 70

### *1.* Make PLC communication common settings.

(For details, refer to “PLC Communication Common Setting” on page 76.)

### *2.* Only when selecting "Panasonic: FP" for PLC Type, set "Specify Station No.".

Station Home (Default):
A command which specifies no station number is issued.
Example) %EE#WDD0001 × × × × ×




Specify Station No. (Station No.: 1 to 99):
A command for a PLC with the specified station number (number of PLC) is issued. For the "Station No." at the lower portion, specify the same number as the station number that is set for the PLC to communicate with.
Example) When Station No. is 99 %99#WDD0001 × × × ×

When performing PLC communication using Ethernet interface

For details on the network setting, refer to “3.7 Network Setting” on page 51.
Three PLC types are available. Refer to Page 70.

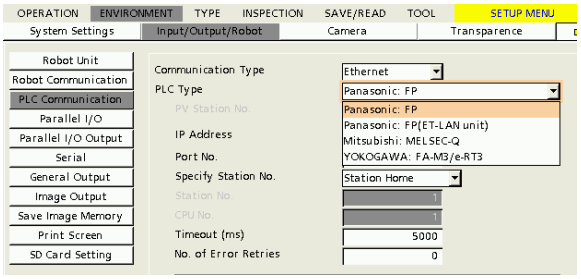
## 1. Make PLC communication common settings.

(For details of network settings, refer to “PLC Communication Common Setting” on page 76.)

## 2. Specify the network setting of the selected "PLC Type".

The network settings are as listed below.
- PV260 Station No.
- PLC IP Address
- PLC Port No.
- Specifying PLC Station No.
- PLC Station No.
- PLC CPU No.

Items to be specified vary depending on the selected PLC type. For the detail, refer to steps 3 to 7.




## 3. Specify the PV260 station No. in "PV Station No."

Selectable station No.: 1 to 64
Set only when PLC Type is Panasonic: FP (ET-LAN unit)

## 4. Assign the IP address to the PLC.

When changing the connection to a PLC with the same IP address as the PLC currently connected, the connection may be disconnected for a maximum of five minutes.

## 5. Specify the port number of the PLC.

Enter the same number as the port number set on the PLC to communicate with.
PLC Type is " Panasonic: FP
When PLC Type is "Panasonic: FP" or "Panasonic: FP (ET-LAN unit)"
Available port No. on PV260: 1 to 32767 (except 8600 to 8699 and 9090)
Default: 9094

When PLC Type is Mitsubishi: MELSEC-Q
Available port No. on PV260: 1 to 65534 (except 8600 to 8699 and 9090)
Default: 5000

When PLC Type is Yokogawa: FA-M3/e-RT3
Available port No. on PV260: 12289, 12291
Default: 12289

## 6. Select whether PLC to communicate with is specified using “Specify Station No.”.

This setting is made when PLC Type is "Panasonic: FP" or
PLC Type is "Panasonic: FP(ET-LAN unit)".

| | |
|---|---|
| Station Home (Default): | A command which specifies no station number is issued.<br>Example) %EE#WDD0001 × × × × × |
| Specify Station No. (Station No.:1 – 99): | A command for a PLC with the specified station number is issued. Specify the same number as the station number that is set for the PLC to communicate with.<br>Example) When Station No. is 50 %50#WDD0001 × × × × |

PLC Type = Panasonic: FP series

Selectable station No.: 1 to 99

When PLC Type is "Panasonic: FP" or "Panasonic: FP (ET-LAN unit)"

Selectable station No.: 1 to 64

The number specified in the step 3 "PV Station No." cannot be used.

**7.** Specify the CPU No. of the PLC in "CPU No.".

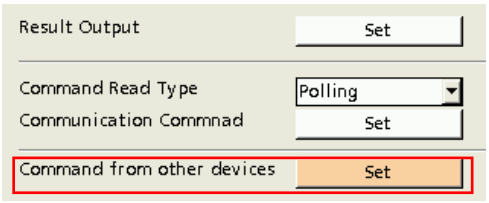
Selectable station No.: 1 to 4

Specify this setting only when PLC Type is Yokogawa: FA-M3/e-RT3.

## Robot Control Command Setting for PLC Communication

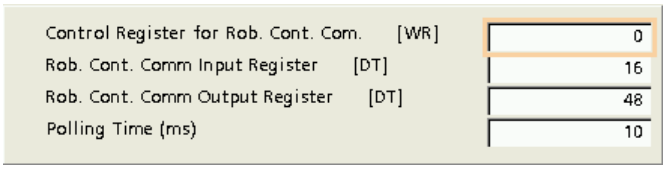
**1.** Make PLC communication common settings.

Refer to Common Setting in “3.9.2 Setting of PLC Communication” on page 76.




**2.** Select "ENVIRONMENT" > "Input / Output / Robot" > "PLC Com." > "Command from other devices" > "Set".

**3.** "Control Register for Rob. Cont. Com.": Specifies the start of control register to be used to send / receive robot control command.




Unlike the control command (command of allowing PLC to control the PV260), robot control command always performs polling to send / receive data. Specify polling frequency for "Polling Time".

**4.** Specify the address.

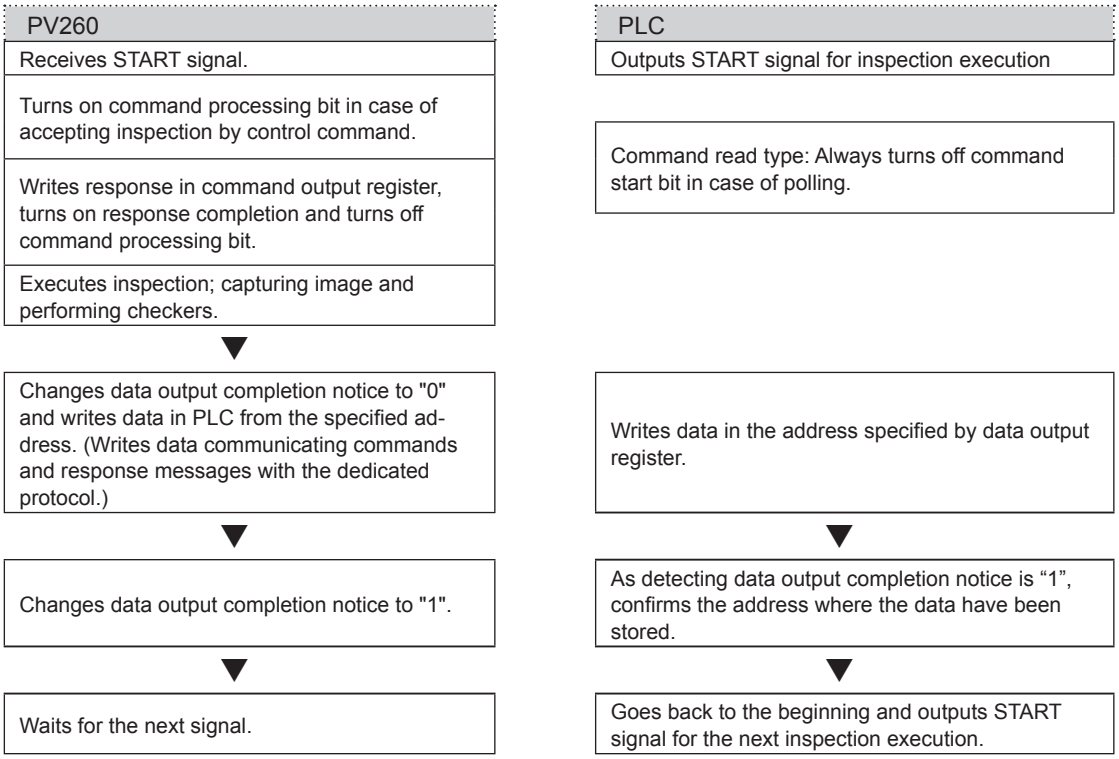
It is used as a command start bit or command completion bit according to the bit information of specified control register. For the command start / process completion bit for each PLC type, refer to Chapter 3.9.1 “Specifications of PLCs Selected” on page 71 (71 page).

**5.** For "Rob. Cont. Com. Output Register", specify the number of the start register in which a command, for which the PV260 gives a request to PLC, is written.

**6.** For "Rob. Cont. Comm Input Register", specify the number of the start register in which responses from PLC to PV260 are written.

# 3.9.3 Outputting Data through PLC Communication

## Data Output Flaw




## About Data that can be Output

When PV260 executes inspection, the data set to output are output in the following order.

1. Date and Time
2. Scan Count
3. Total Judgement
4. Judgement result:
5. Numerical Calculation
6. Recognized character
7. Characters decoded by a code reader
8. Robot coordinates

▶ Note

- In the following cases, the data of Judgement and Numeric Calculation are not output.
  - PV sets data to output, but no data exist (is created).
  - The setting data exist, but data are set to not to be output.
- Robot coordinates are output to outside according to the settings and coordinate format specified by selecting "TYPE" > "Robot" > "Output of Robot Coordinates".
- Up to 1000 points combining judgement and numerical calculation.

Output format of Scan count

| | |
|---|---|
| Output Data | Differs depending on the setting of output bit width.<br>Range (16 bits): 0 and 32767<br>Range (32 bits): 0 and 2147483647 |
| Number of Data | 1 |
| Values to be Output | Normal 0 to 2147483647 |
| | Overflow (when exceeding the specified "Bit Width"): 0 |

Output format of Total Judgement

| | |
|---|---|
| Output Data | One word (16 bits) is used regardless of the setting of output bit width.<br>Range (16 bits): 0 and 32767<br>Range (32 bits): 0 and 2147483647 |
| Number of Data | 1 |
| | OK: 1 in hexadecimal form (0001 in binary form)<br>NG: 0 in hexadecimal form (0000 in binary form)<br>Error: E in hexadecimal form (1110 in binary form)<br>Unset: E in hexadecimal form (1110 in binary form) |

Output format of Judgement data

| | |
|---|---|
| Output Data | A Judgement is output in 4-bit (digit) unit<br>Four data of Judgement per word from PLC are saved starting with LSB. When the outputting data is less than multiples of four, hexadecimal E is output to the others. |
| Number of Data | Up to 1000 |
| | OK: 1 in hexadecimal form (0001 in binary form)<br>NG: 0 in hexadecimal form (0000 in binary form)<br>Error: E in hexadecimal form (1110 in binary form)<br>Unset: Data are not output. (But if the Judgement data Nos. before and after the unset data No. are set to output, E is output in 16-digit form (1110 in binary form).) |

Output format of Numerical Calculation

| | | |
|---|---|---|
| Output Data | Differs depending on the setting of output bit width.<br>• Range (16 bits): 32768 and 32767<br>• Range (32 bits): 2147483648 and 2147483647 | |
| Number of Data | Up to 1000 | |
| Values to be Output | Normal | Range of specified bit width |
| | Overflow (when exceeding the specified "Bit Width") | • Range of 16-bit:<br>If the numerical calculation results to be output exceed the ranges of 16-bit or if they exceed the range of 32-bit regardless of setting to output or not, all the numerical calculation results are output as “0”.<br>• Range of 32-bit:<br>The numerical calculation results to be output that exceeds the ranges of 32-bit are output as "0". |
| | Error | • Range of 16-bit:<br>If an error occurs in any of the set numerical calculation regardless of setting to output or not, all the numerical calculation results are output as "0".<br>• Range of 32-bit:<br>(Only the erroneous numerical calculation result is output as"0".) |
| | Unset or not output | Data are not output |

Output format of Robot Coordinates

| | | |
|---|---|---|
| Output Data | Outputs a value obtained by multiplying the detection result of the checker quoted in Output of Robot Coordinates by a multiple, set by "The integer ratio to the PLC"*.<br>Example: When the detection result of X = 100.123, Y = 200.345, and R = 90.678 is multiplied by a 1000 times multiple<br>The output result is output as 100123 200345 60678.<br>*: A multiple of "The integer ratio to the PLC" can be set by selecting "ENVIRONMENT" > "Input / Output / Robot" > "Robot communication" > "Communication Setting". | |
| Number of Data | Up to 100 | |
| Values to be Output | Normal | Range of specified bit width |
| | Overflow (when exceeding the specified "Bit Width") | • Range of 16-bit:<br>If the numerical calculation results to be output exceed the ranges of 16-bit or if they exceed the range of 32-bit regardless of setting to output or not, all the numerical calculation results are output as “0”.<br>• Range of 32-bit:<br>The numerical calculation results to be output, exceeding the ranges of 32-bit, are output as "0". |
| | Error | • Range of 16-bit:<br>If an error occurs in any of the set numerical calculation regardless of setting to output or not, all the numerical calculation results are output as "0".<br>• Range of 32-bit:<br>(Only the erroneous numerical calculation result is output as"0".) |
| | Unset or not output | Data are not output |

## Example of General Output

Output condition - output data

- Scan Count 1234 time
- Total Judgement OK
- Judgement: Judgement: JDC000=unset, JDC001=OK, JDC002=NG, JDC003 or later=Unset
- Numerical Calculation: CAC000=215.3, CAC001=unset, CAC002= -2184.6, CAC003 or later=unset
- Robot coordinates: When multiple is multiplied by 1000 with X=10.123, Y=20.345, and R=30.678

| Data | Register No. | Value (Hex.) | Description | Remarks |
|---|---|---|---|---|
| Scan Count | 503 | 04D2 | "1234" is stored | Scan Count |
| | | | Bit 15 ←----------→ Bit 0 | |
| Total Judgement | 504 | 0001 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 | Total Judgement=OK |
| Judgement | 505 | E01E | 1 1 1 0 0 0 0 0 0 0 0 1 1 1 1 0 | JDC001 , 002 |
| Numerical Calculation: | 506 | 00D7 | "215" is stored | CAC000 |
| | 507 | F777 | "-2185" is stored | CAC002 |
| Robot coordinates | 508 | 278B | "10123" is stored | X |
| | 509 | 4F79 | "20345" is stored | Y |
| | 510 | 77D6 | "30678" is stored | R |

Concept

- The number of scans is stored in the start register (data output register). When specifying "32-bit" for "Bit Width", the number of scans is stored in the first two registers.
- Four pieces of judgement data are stored per word (16 bits). (Four bits are used for a piece of data.)
- Data is output up to Judgement specified with the largest number. For unset judgement data within the range, "E" is output such as JDC000. Also, when the number of output data is "3" which is not multiples of 4 like this example, "E" is stored in each part which cannot make a word.
- Only the data of Numeric Calculation that are set to output are output. (In the case where the data of CAC000 or CAC002 is out of the range between -32768 and +32767, “0” is stored in registers No.506 and 507.)
- Numerical calculation results are rounded to whole numbers and output.
- Negative numbers are output in the complement number of 2.
- When specifying "32-bit" for “Output data”;
  - Four Judgement data are stored per word as the same as when you select "16-bit".
  - Each data of Scan Count and Numerical Calculation uses two words (32-bit). In the case, the data is output from of lower 16-bit to upper 16-bit, and data of lower word (16-bit) is stored in the register of smaller number.

# 3.9.4 Controlling PV260 through PLC Communication

For controlling PV200 through PLC Communication, PLC sends commands to PV260 and receives the responses.
For the details of the control and commands to be used, refer to “3.9.5 List of PLC Communication Commands” on page 90.
PV260 uses the following signals for the timings at which PV260 reads commands sent by PLC and for the timings at which PLC receives responses. Refer to the timing charts for details on the timing of each signal.
Those signals can be read when PV260 is in RUN menu. PV260 cannot be controlled when it is in SETUP menu. (Refer to 90 page.)

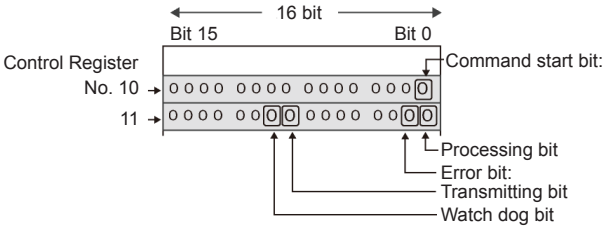
### Timing signal for PV260 to read the command sent by PLC

The timing varies depending on the "Command Read Type".
Polling: Uses the command start bit of the control register. PLC turns on the command start bit after writing a command
Parallel Input: PLC turns on the signal of "Read PLC Communication Command" assigned to ASSIGN or EXTRA after writing a command.

### Timing signal for PLC to read the received response

PV260 sets the response completion (COR = the first word of command output register) to 1 after writing responses Also, PV260 sets the processing bit of the control register to 0 after setting the response completion (COR) to 1.

## Control Register




### Command start bit:

0-th bit of the register number specified in "Control Register".
It is used when setting "Command Read Type" to "Polling". It indicates that a command was sent to PV260 from PLC. Turn on this bit (set it to 1) after PLC sets the command. When polling and then confirming that this bit is set to on, PV260 starts reading the command. Also, turn off this bit (set it to 0) at the timing when the "Processing bit" is set to on.

### Processing bit:

0-th bit of the next register number specified in "Control Register".
PV260 turns on this bit (sets it to 1) during the command processing. When writing a response into the command output register after finishing the processing, PV260 turns this bit off (sets it to 0). Monitoring this bit allows you to use this bit as a timing at which the next trigger is given.

### Error bit:

1st bit of the next register number specified in "Control Register". It indicates that an error occurred. When an error occurred, PV260 turns on this bit (sets it to 1).
(1) When a response error to the control command occurred
(2) When the "Start Bit Off Timeout" error occurred with polling used

### Transmitting bit:

8th bit of the next register number specified in "Control Register".
It indicates PV260 can communicate. When communication can be provided, PV260 turns on this bit (sets it to 1). It turns on when RUN menu is displayed after the startup of PV260. When the screen is switched to SETUP menu, PV200 cannot perform PLC communication and, therefore, turns off this bit (sets it to 0).
If the power supply to PV200 is turned off with this bit turned on or the communication cable is disconnected, this bit remains on.

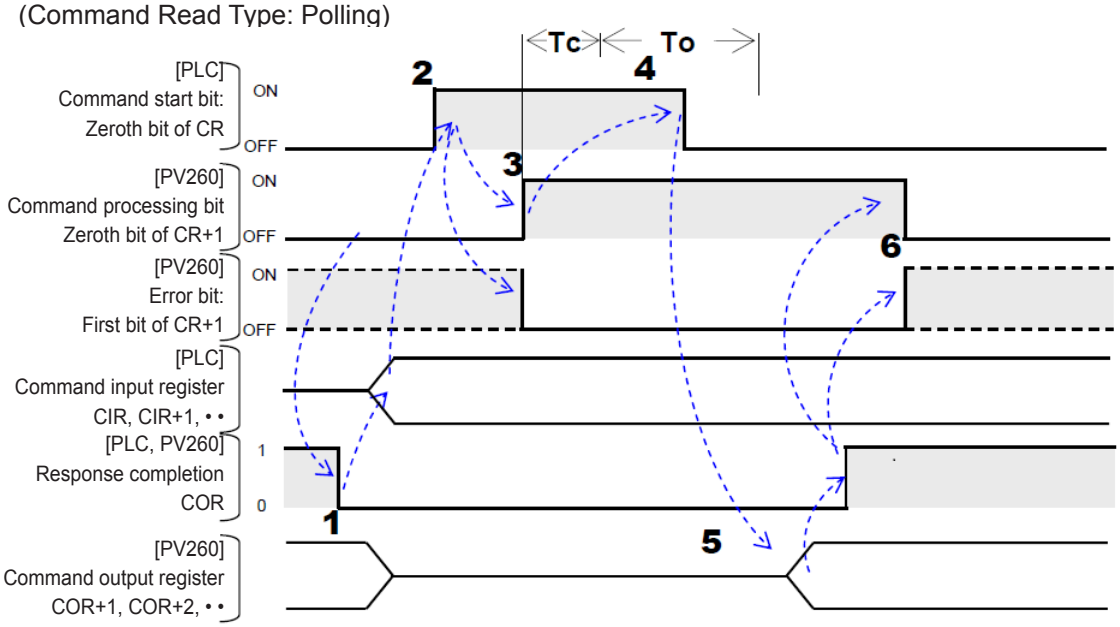
### Watch dog bit:

9-th bit of the next register number specified in "Control Register".
When "Watch Dog Timer" is set to "Yes", PV260 switches this bit on (sets it to 1) and off (sets it to 0) periodically. The watch dog bit is rewritten at multiples of polling cycle when the watchdog cycle is exceeded. However, when the transmitting bit is off, PV260 does not switch the watch dog bit on or off. In addition, the processing time of switching on or off the watch dog bit gets longer while some processing is in progress, e.g., image memory is being saved in SD card (processing bit is turned on). Therefore, when checking for communication errors, take enough time for the check timer by combining processing bit, transmitting bit and watch dog bit.

| | |
|---|---|
| R110 | Processing bit |
| R118 | Transmitting bit |
| R119 | Watch dog bit |
| | |
| T0 | Watch dog bit ON check timer |
| T1 | Watch dog bit OFF check timer |
| R0 | Communication error |

## PLC Communication: control Command Timing Chart

(Command Read Type: Polling)




Tc: Command processing time. It varies depending on the content. For example, the processing time of saving data in a SD card may be over several seconds.
To: Timeout period. An error occurs when the command start bit does not turn off within the time of Tc + To.
CR: PLC address specified in "Control Register".
CIR: PLC address specified in "Command Input Register".
COR: PLC address specified in "Command Output Register".

***1.*** PLC confirms that the command processing bit is off, and resets the response completion (COR) to zero to clear the previous result output. (Off-state) Then, PLC writes a command in the command input registers (CIR, CIR+1, ...) to give PV260.

***2.*** PLC turns on the command start bit.
PV260 monitors the command start bit at specified polling cycles, and starts reading the commands from the command input register (CIR) as the start register once it confirms that the start bit is on.

***3.*** PV260 turns on the command processing bit. Also, PV260 turns off the error bit regardless of the previous state.

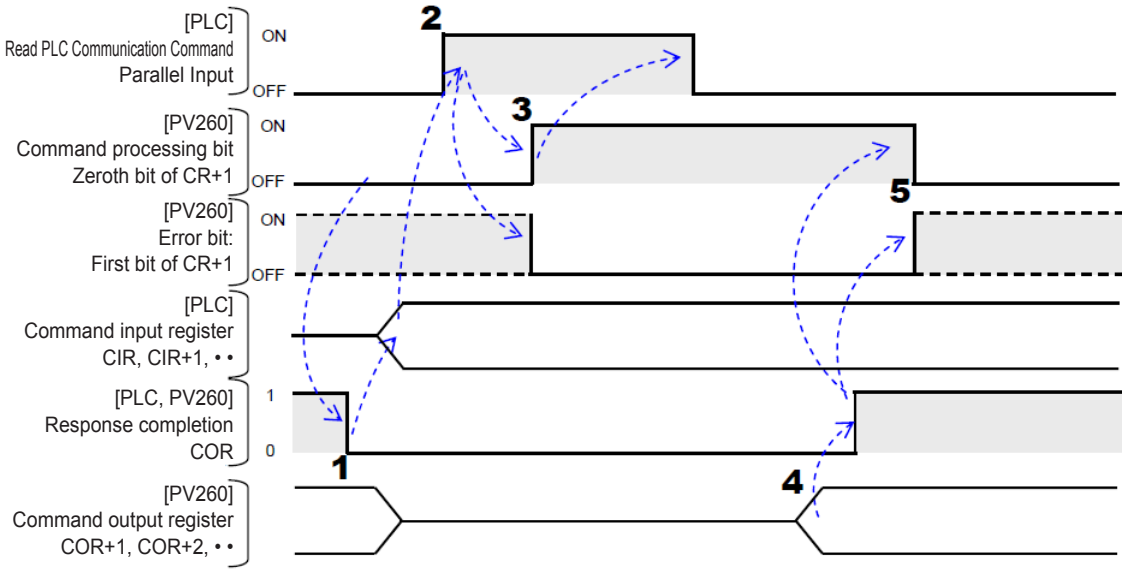
***4.*** PLC turns off the command start bit within the time of Tc + To after confirming the command processing bit is on.
During this process, PV260 confirms that the command start bit is off by polling.
PV260 writes the error code (113) when the command start bit does not turn off within the time of Tc + To.

***5.*** PV260 writes responses in the command output register, and then sets the response completion (COR) to 1. (On-state)

***6.*** PV260 turns off or on the error bit according to the error occurrence, and then turns off the command processing bit.

## PLC Communication: Control Command Timing Chart

(Command Read Type: Parallel Input)




CR: PLC address specified in "Control Register".
CIR: PLC address specified in "Command Input Register".
COR: PLC address specified in "Command Output Register".

***1.*** PLC confirms that the command processing bit is off, and resets the response completion (COR) to zero to clear the previous result output. (Off-state) Then, PLC writes a command in the command input registers (CIR, CIR+1, ...) to give PV260.

***2.*** PLC turns on the "Read PLC Communication Command" assigned to the parallel input terminal of PV260.

PV260 reads the commands from the command input register (CIR) as the first register once it confirms this parallel signal is on.
Assign "Read PLC Communication Command" to one of ASSIGN0-1 and EXTRA0-2 from "ENVIRONMENT" > "Input / Output / Robot" > "Parallel" in SETUP menu.

***3.*** PV260 turns on the command processing bit. Also, PV260 turns off the error bit regardless of the previous state.

PLC can turn off the "Read PLC Communication Command" signal after the command processing bit is turned on.

***4.*** PV260 writes responses in the command output register, and then sets the response completion (COR) to 1. (On-state)

***5.*** PV260 turns off or on the error bit according to the error occurrence, and then turns off the command processing bit.

# 3.9.5 List of PLC Communication Commands

The commands and the modes permitting them are listed below.

| | | For details refer to | Command Permission (Permitted = Yes) | | | |
|---|---|---|---|---|---|---|
| | | | RUN Menu | | SETUP menu | |
| | | | RUN | STOP | STOP | Parallel Processing |
| Robot coordinates acknowledged | | Page 93 | Yes | | | Yes |
| Measurement start command (Execute All) | | Page 94 | Yes | | | Yes |
| Measurement start command (User Defined) | | Page 94 | Yes | | | Yes |
| Re-measurement start command (Execute All) | | Page 95 | Yes | | | Yes |
| Re-measurement start command (User Defined) | | Page 95 | Yes | | | Yes |
| Auto calibration setting start | | Page 96 | Yes | | | Yes |
| Work detection base position reregistering | | Page 97 | Yes | | | Yes |
| Work detection base position reregistering start | | Page 97 | Yes | | | Yes |
| Movement completion | | Page 98 | Yes | | | Yes |
| Teaching coordinate request | | Page 98 | Yes | | | Yes |
| Inspection execution | Common Trigger | Described in the PV200 manual* | Yes | | | Yes |
| Start reinspection (to inspect on the current memory image without capturing a new image) | | | Yes | | | Yes |
| Switch product type | | | Yes | | | Yes |
| Save the setting data | Storage space in PV260 | | Yes | | | Yes |
| | SD memory card | | Yes | | | Yes |
| Read the setting data | Storage space in PV260 | | Yes | | | Yes |
| | SD memory card | | Yes | | | Yes |
| Abort save / read setting data (Cancel) | | | Yes | | | Yes |
| Image memory | Save (in an SD card) | | Yes | | | Yes |
| | Clear | | Yes | | | Yes |
| Print screen | | | Yes | Yes | | Yes |
| Reset statistics | | | Yes | Yes | | Yes |
| Start RUN mode | | | Yes | Yes | | Yes |
| Stop RUN mode | | | Yes | Yes | | Yes |
| Reset error signal | | | Yes | Yes | | Yes |
| Cancel Inspection / Process (Cancel various operations) | | | Yes | Yes | | Yes |
| Keypad Operation | Key emulating | | Yes | Yes | | Yes |
| | Valid | | Yes | Yes | | Yes |
| | Invalid | | Yes | Yes | | Yes |
| | Confirm Status | | Yes | Yes | | Yes |
| Switch layout | | | Yes | | | Yes |
| Template Setting | | | Yes | | | Yes |
| Contour Template Setting | | | Yes | | | Yes |

* Refer to 11.3.6 "Descriptions of PLC Communication Commands" in PV200 Manual.

# List of Read / Write Command Parameters

| | | | Command Permission (Permitted = Yes) | | | |
|---|---|---|---|---|---|---|
| | For details refer to | | RUN Menu | | SETUP menu | |
| | Read | Write | RUN | STOP | STOP | Parallel Processing |
| Inspection Time | Described in the PV200 manual* | | Yes | | | Yes |
| Inspection Frequency | | | Yes | | | Yes |
| Total Judgement | | | Yes | | | Yes |
| Scan Count | | | Yes | | | Yes |
| Operation Status | | | Yes | Yes | | Yes |
| Current Type No. | | | Yes | | | Yes |
| System Register 0 to 7 | | | Yes | | | Yes |
| Date | | | Yes | | | Yes |
| Time | | | Yes | | | Yes |
| Line | | | Yes | | | Yes |
| Binary Window | | | Yes | | | Yes |
| Gray Window | | | Yes | | | Yes |
| Binary Edge | | | Yes | | | Yes |
| Gray Edge | | | Yes | | | Yes |
| Feature Extraction | | | Yes | | | Yes |
| Smart Matching | | | Yes | | | Yes |
| Flaw Detection | | | Yes | | | Yes |
| Connector (Binary Window) | | | Yes | | | Yes |
| Connector (Gray Window) | | | Yes | | | Yes |
| Connector (Gray Edge) | | | Yes | | | Yes |
| Smart Edge (Circle) | | | Yes | | | Yes |
| Smart Edge (Line) | | | Yes | | | Yes |
| Color Window | | | Yes | | | Yes |
| Geometry Calculation | | | Yes | | | Yes |
| Numerical Calculation | | | Yes | | | Yes |
| Marker | | | Yes | | | Yes |
| Slice Level | | | Yes | | | Yes |

* Refer to 11.3.6 "PLC Command Details" in PV200 Manual.

## 3.9.6 Descriptions of PLC Communication Commands

The "Command" in the tables means commands to be issued (sent) to PV260 from PLC with CIR written at the beginning. The "Response" means the result of a response, sent from the PV260 to PLC, to a command that has been sent. COR is written at the beginning. The CIR and COR in the tables have the following contents.

- CIR: Address specified in "Command Input Register". A request to PV260 is written with this address at the beginning.
- COR: Address specified in "Command Output Register". A response is written by PV260 with this address at the beginning.

The common error codes in PLC communication are as follows. For details on error code specific to each command, refer to the description of the command.

Error code

| | |
|---|---|
| **100** | An undefined command was received. |
| **111** | • PLC response timeout<br>• Register number error<br>• Format error of a response from PLC |
| **113** | Command Start Bit Off Timeout |
| **114** | With "Parallel Input" not selected in Command Read Type, "Read PLC Communication Command" signal has been entered |

For Read and Write commands

| | |
|---|---|
| **200** | Operation is stopped. (However, except Read of "Operation Status") |
| **252** | • The specified parameter does not exist. (e.g. The number of uncreated checker is specified as a parameter.)<br>• The specified parameter value is out of the settable range. (e.g. Maximum value of slice level is being set to over 256.)<br>• When various Max./Min. Values were to be written, the value was specified with Max. Value < Min. Value.<br>• (Only when the moving distance of the marker is specified)<br>• A part of the circumscribing rectangle of the marker (the intersection point when Shape is Cross line) after move was out of the nine screens where checker area is settable. |

## Robot Coordinates Acknowledged

### ■ Usage: Notification of robot current position during calibration execution

▶ Note

Robot coordinates are independent of "Robot Coordinates Format Setting" of communication command setting and are fixed to data order of Coordinate X, Coordinate Y, Coordinate R, and Hand-System.

Command

| | |
|---|---|
| CIR | 6001 h |
| CIR +1 | 0000 h |
| CIR +2 | 10h (parameter length) |
| CIR+3, CIR+4 | Coordinate X*1 |
| CIR+5, CIR+6 | Coordinate Y*1 |
| CIR+7, CIR+8 | Coordinate R*1 |
| CIR+9, CIR+10 | Hand-System*2 |

Response

| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 or error code |
| COR +2 | 0 |

* 1: Set the coordinates by multiplying them by a number specified in "The integer ratio to the PLC" selected from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication" > "Communication Setting".
* 2: For Hand-System, 0: None, 1: Right-Hand, 2: Fixed data of left-hand

Error code

| | |
|---|---|
| **100** | Not allowed since the notified coordinates / "The integer ratio to the PLC" is not within the range from -99999.999 to 99999.999. |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | A command was received when PV260-READY is OFF. Within 1 second, READY did not turn on. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

## Measurement start command (Execute All)

Command

| | |
|---|---|
| CIR | 6002 h |
| CIR +1 | 0110 h |
| CIR +2 | 4h (parameter length) |
| CIR+3, CIR+4 | Calibration No. |

Response

| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 or error code |
| COR +2 | 0 |

## Measurement start command (User-defined)

Command

| | |
|---|---|
| CIR | 6002 h |
| CIR +1 | 0120 h |
| CIR +2 | 8h (parameter length) |
| CIR+3, CIR+4 | Calibration No. |
| CIR+5, CIR+6 | Block No. |

Response

| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 or error code |
| COR +2 | 0 |

Error code

| | |
|---|---|
| **100** | In the format after command, no calibration No. or outside the range, or excess of parameter |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **201** | Although the command is for “User-Defined”, execution mode is NOT “User-Defined” in PV260. |
| **202** | Although the command is for Execute All, "User-Defined" is specified for Execution Mode. |
| **203** | No camera is connected or both cameras of PV260 are set to "Unused". |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

## Re-measurement start Command (Execute All)

Command

| | |
|---|---|
| CIR | 6002 h |
| CIR +1 | 0210 h |
| CIR +2 | 4h (parameter length) |
| CIR+3, CIR+4 | Calibration No. |

Response

| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 or error code |
| COR +2 | 0 |

## Re-measurement start Command (Execute All)

Command

| | |
|---|---|
| CIR | 6002 h |
| CIR +1 | 0220 h |
| CIR +2 | 8h (parameter length) |
| CIR+3, CIR+4 | Calibration No. |
| CIR+5, CIR+6 | Block No. |

Response

| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 or error code |
| COR +2 | 0 |

Error code

| | |
|---|---|
| **100** | In the format after command, no calibration No. or outside the range, or excess of parameter |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **201** | Although the command is for “User-Defined”, execution mode is NOT “User-Defined” in PV260. |
| **202** | Although the command is for Execute All, "User-Defined" is specified for Execution Mode. |
| **203** | Execution not allowed since no image has been captured |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

## Auto Calibration Setting Start

■ **Usage: At the time of auto calibration setting start (with Robot Control Command = not used),**
**Command of auto calibration setting start**

Command

| | |
|---|---|
| CIR | 6010 h |
| CIR +1 | 0100 h |
| CIR +2 | 4h (parameter length) |
| CIR+3, CIR+4 | Calibration No. |

Rsponse

| | | |
|---|---|---|
| COR | Response completion = 1 | |
| COR +1 | At the time of normal end = 0 or error code | |
| COR +2 | Data length = 10(h) | |
| COR+3, COR+4 | Result | Coordinate X[*1] |
| COR+5, COR+6 | | Coordinate Y[*1] |
| COR+7, COR+8 | | Coordinate R[*1] |
| COR+9, COR+10 | | Hand-System[*2] |

* 1: Set the coordinates by multiplying them by a number specified in "The integer ratio to the PLC" selected from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication" > "Communication Setting". (Decimal part is multiplied by a specified number and is then rounded up to the nearest integer)
* 2: For Hand-System, 0: None, 1: Right-Hand, 2: Fixed data of left-hand

▶ Note

In case of an error, the data length is 0 without adding result data.

Error code

| | |
|---|---|
| **100** | In the format after command, no calibration No. |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because work detection base position setting is in progress |
| **311** | • Automatic setting ended because an error occurred in the execution of base checker<br>• Because movement completion is not notified within "Timeout" selected from "ENVIRONMENT" > "Input / Output / Robot" > "Robot communication" > "Communication Setting". |
| **312** | The specified calibration No. is outside the range |
| **313** | Auto Calibration cannot start. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

## Work detection base position reregistering

■ **Usage: When work detection base position is set again (without image captured)**

Command

| | |
|---|---|
| CIR | 6020 h |
| CIR +1 | 0000 h |
| CIR +2 | 0h (parameter length) |

Response

| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 or error code |
| COR +2 | 0 |

Error code

| | |
|---|---|
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |

## Work detection base position reregistering start

■ **Usage: When work detection base position is set again (with an image captured)**

Command

| | |
|---|---|
| CIR | 6021 h |
| CIR +1 | 0000 h |
| CIR +2 | 4h (parameter length) |
| CIR+3, CIR+4 | Work detection No. |

Response

| | | |
|---|---|---|
| COR | Response completion = 1 | |
| COR +1 | At the time of normal end = 0 or error code | |
| COR +2 | Data length = 10(h) | |
| COR+3, COR+4 | Result | Coordinate X*1 |
| COR+5, COR+6 | | Coordinate Y*1 |
| COR+7, COR+8 | | Coordinate R*1 |
| COR+9, COR+10 | | Hand-System*2 |

* 1: Set the coordinates by multiplying them by a number specified in "The integer ratio to the PLC" selected from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication" > "Communication Setting". (Decimal part is multiplied by a specified number and is then rounded up to the nearest integer)

* 2: For Hand-System, 0: None, 1: Right-Hand, 2: Fixed data of left-hand

▶ Note

In case of an error, the data length is 0 without adding result data.

Error code

| | |
|---|---|
| **100** | No work detection No. in the format of command or after |
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | The command is not accepted for one or more seconds because READY signal is off. |
| **230** | Execution is not allowed because template setting is in progress. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **314** | Specified work detection No. is outside the range |

| | |
|---|---|
| **315** | Execution is not allowed because work detection base position setting is in progress |
| **316** | Standard setting ended because an error occurred in the execution of checker |
| **317** | Work detection base position reregistering cannot start |

## Movement completion

■ **Usage: When work detection base position is set again (with an image captured)**

Command

| | |
|---|---|
| CIR | 6030 h |
| CIR +1 | 0000 h |
| CIR +2 | 0h (parameter length) |

Response

| | | |
|---|---|---|
| COR | Response completion = 1 | |
| COR +1 | At the time of normal end = 0 or error code | |
| COR +2 | Data length = 10(h) | |
| COR+3, COR+4 | Result | Coordinate X*1 |
| COR+5, COR+6 | | Coordinate Y*1 |
| COR+7, COR+8 | | Coordinate R*1 |
| COR+9, COR+10 | | Hand-System*2 |

* 1: Set the coordinates by multiplying them by a number specified in "The integer ratio to the PLC" selected from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication" > "Communication Setting". (Decimal part is multiplied by a specified number and is then rounded up to the nearest integer)
* 2: For Hand-System, 0: None, 1: Right-Hand, 2: Fixed data of left-hand

▶ Note

In case of an error, the data length is 0 without adding result data.

Error code

| | |
|---|---|
| **310** | Execution is not allowed because of waiting for entry of the relevant command during automatic setting |

## Teaching coordinate request

■ **Usage: Request for execution of teaching coordinate output**

Command

| | |
|---|---|
| CIR | 6040 h |
| CIR +1 | 0000 h |
| CIR +2 | 0h (parameter length) |

Response

| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 or error code |
| COR +2 | 0 |

Error code

| | |
|---|---|
| **200** | Execution is not allowed since operation is stopped (STOP) |
| **205** | Acceptance is not allowed for one more seconds because READY signal is off. |
| **230** | The command is not accepted for one or more seconds because READY signal is off. |
| **310** | Execution is not allowed because auto calibration setting sequence is in progress. |
| **315** | Execution is not allowed because work detection base position setting is in progress |
| **320** | Execution is not allowed because data to be output is not set |

# 3.9.7 Details of PLC Communication Command (external communication commands)

The "Command" in the tables means commands to be issued (sent) to PLC from the PV260. CIR (Input register of robot control command) is written at the beginning. The "Response" means the responses to the PV260 from PLC in response to the sent commands. COR (Output register of robot control command) is written at the beginning. The CIR and COR in the tables mean the following contents.

- CIR: Address specified in "Input register of robot control command". A request to PLC is written with this address at the beginning.
- COR: Address specified in "Output register of robot control command". PLC writes the contents of a response with this address at the beginning.

For common error codes in PLC communication, refer to “3.9.6 Descriptions of PLC Communication Commands” on page 92. For details on error code specific to each command, refer to the description of the command.

## Absolute coordinate movement instruction

### ■ Usage: Auto Calibration, Calibration Setting, and Movement of Robot Control Setting

Command

| | |
|---|---|
| CIR | 6101 h |
| CIR +1 | 0100 h |
| CIR +2 | 18h (parameter length) |
| CIR+3, CIR+4 | Coordinate X*1 |
| CIR+5, CIR+6 | Coordinate Y*1 |
| CIR+7, CIR+8 | Coordinate Z*1 |
| CIR+9, CIR+10 | Coordinate R*1 |
| CIR+11, CIR+12 | Hand-System*2 |
| CIR+13, CIR+14 | Speed |

Response

| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 or error code |
| COR +2 | 0 |

* 1: Set the coordinates by multiplying them by a number specified in "The integer ratio to the PLC" selected from "ENVIRONMENT" > "Input / Output / Robot" > "Robot communication" > "Communication Setting". (Decimal part is multiplied by a specified number and is then rounded up to the nearest integer)
* 2: For Hand-System, 0: None, 1: Right-Hand, 2: Fixed data of left-hand

## Get Current Robot Position

### ■ Usage: Robot Control Setting

Command

| | |
|---|---|
| CIR | 6101 h |
| CIR +1 | 0300 h |
| CIR +2 | 0h (parameter length) |

Response

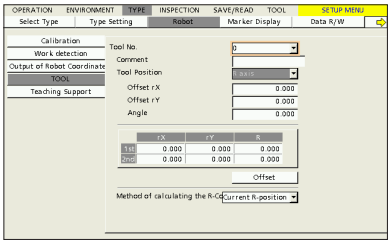
| | |
|---|---|
| COR | Response completion = 1 |
| COR +1 | At the time of normal end = 0 |
| COR +2 | 14h (parameter length) |
| COR+3, COR+4 | Coordinate X*1 |
| COR+5, COR+6 | Coordinate Y*1 |
| COR+7, COR+8 | Coordinate Z*1 |
| COR+9, COR+10 | Coordinate R*1 |
| COR+11, COR+12 | Hand-System*2 |

* 1: Set the coordinates by multiplying them by a number specified in "The integer ratio to the PLC" selected from "ENVIRONMENT" > "Input / Output / Robot" > "Robot communication" > "Communication Setting". (Decimal part is multiplied by a specified number and is then rounded up to the nearest integer)
* 2: For Hand-System, 0: None, 1: Right-Hand, 2: Fixed data of right-hand

# Chapter 4

## Inspection

# 4.1 Robot Tool Offset Function

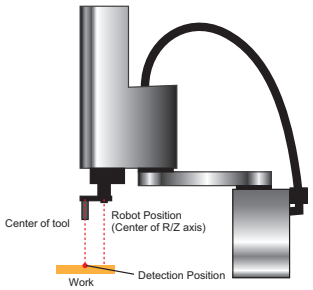



Dispense nozzle, picking handle, and others, with which the robot is equipped to perform operations are called tools. The PV260 provides a function that allows the PV260 to communicate with a robot about the "robot position where the tool is allowed to seize work", which is a current robot position taking into account information on tool position.
Select "TYPE" > "Robot" > "Tool" to make the setting. This setting allows you to set three tools for each type.

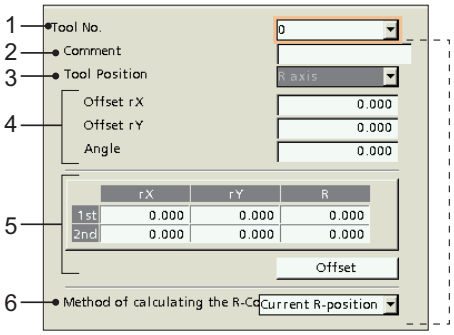
▶ Note

This setting does not require the setting of "Calibration".

## ■ For what "TOOL" is available

| | Coordinates to be output | Features |
|---|---|---|
| With Tool | Robot position that allows the tool to move to seize work | Position of actual robot movement (robot position) is calculated and output to seize work detected by the camera.   |
| Without Tool | Robot coordinates of work | Outputs the robot coordinates of work detected by the camera. The position from which the robot actually moves (robot position) must be calculated in the robot unit or external device of PLC, etc., based on the output robot coordinates. |

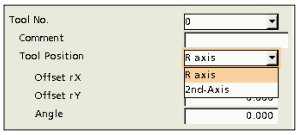
## Using Tool Setting Screen




| | | |
|---|---|---|
| 1 | Tool No. | Specify the target No. of the tool to be set. For the No., select from 0, 1, and 2. For each tool No., regain data between "Comment" and "Method of calculating the R-Coordinates". |
| 2 | Comment | For the tool No. being selected, set a comment. (Up to 16 alphanumeric characters can be entered.) |
| 3 | Tool Position | Set the installation position of the tool. Select R axis (default) or 2nd-Axis. When the Robot Type is SCARA, "R axis" is fixed. |

| | | | |
|---|---|---|---|
| 4 | Offset | Enter the distance between the robot position and the tool. If the distance is known beforehand, enter it directly. If it is unknown, use the automatic offset entry function. | |
| | | rX | Enter distance X between the robot position and the tool. |
| | | rY | Enter distance Y between the robot position and the tool. |
| | | Angle | Enter the angle of R axis with offset rX/rY set. |
| 5 | Automatic offset entry | 1st time<br>2nd time<br>Offset setting | This function is available to enter offset of a tool automatically.<br>When a desired point is indicated twice at the center of a tool, entering the robot position at that time makes the PV260 calculate the offset. The angle indicated is different between 1st time and 2nd time. A desired angle can be entered. However, a larger angle, e.g., 90 degrees, makes the result more stable. (Refer to Page 103.) |
| 6 | Method of calculating the R-Coordinates | When moving the tool to the work, select the Method of calculating the R-Coordinates. | |
| | | Current R-position | While R axis is fixed at the current angle, move the tool position on the X/Y axis. |
| | | Inspection Deg. | When moving a tool, change the angle of the tool to the angle measured with a checker. |

## 4.1.1 Tool Position



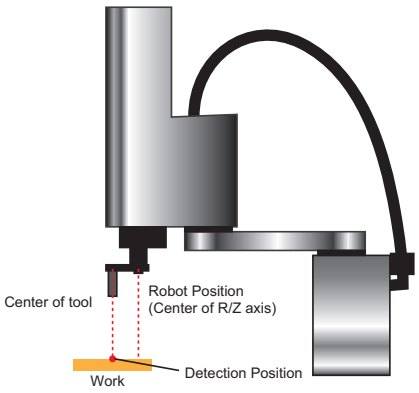

For "Tool Position", specify in what part of the robot the tool is installed.

| | |
|---|---|
| R axis (default) | : Selected when installed in R axis. |
| 2nd-Axis | : Selected when installed in Y axis or Z axis.<br>When the Robot Type is SCARA, "2nd-Axis" is not selectable. |

## 4.1.2 Tool Offset

Set the distance between the robot position (center of R axis) and the center of a tool. The following two methods of setting offset are available:

| | |
|---|---|
| Method 1 | : Direct entry<br>(When the amount of offset is known beforehand) |
| Method 2 | : Calculates a desired point on the robot coordinate system by aligning the center position of a tool by using two postures with different angle of R axis.<br>* This method is available only for robots whose R axis is movable, because postures must be different in angle of R axis. |



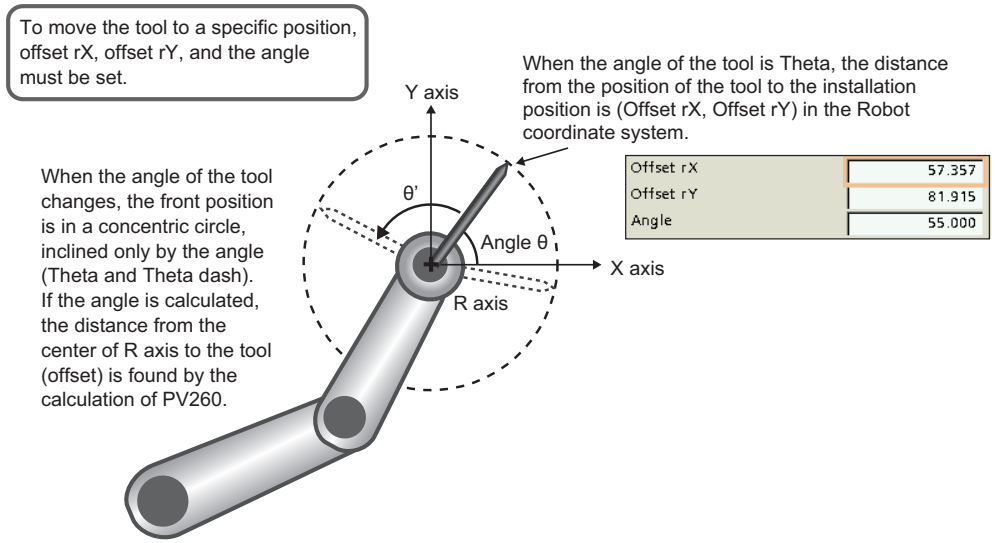
# 4.1.3 Setting Procedure When Installation Position is in R Axis

## When the amount of offset is known beforehand

Enter into "Angle" the angle of R axis obtained when the distances in X axis direction and Y axis direction of the robot coordinates between the robot position and the tool position are entered into "Offset rX" and "Offset rY" respectively.

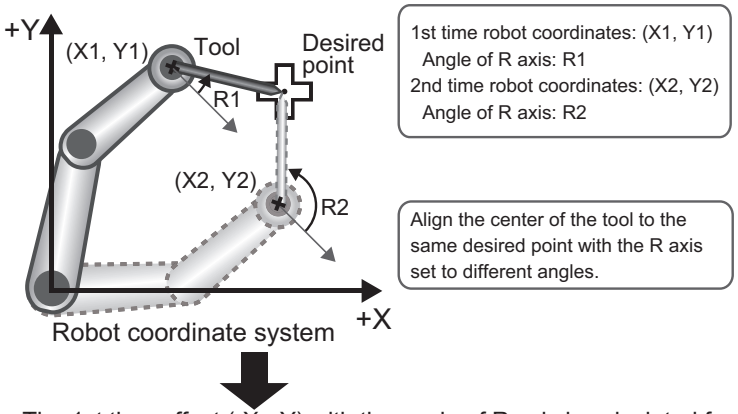
| | |
|---|---|
| Offset rX | 00000.000 |
| Offset rY | 0.000 |
| Angle | 0.000 |

Installation position: Concept of "Angle" in R axis




## When offset is found in the PV260 by moving the robot

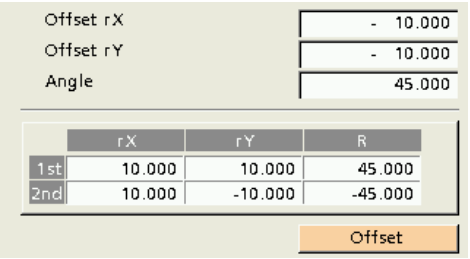
Calculates a desired point on the robot coordinate system by aligning the position to the center position of a tool by using two postures with different angle of R axis.
This method is available for robots whose R axis is movable.




The 1st time offset (rX, rY) with the angle of R axis is calculated from 1st time coordinates (rX1, rY1) and 2nd time coordinates (rX2, rY2).

## Procedure for Setting (When Installed in R Axis)

***1.*** Move the tool of the robot to a desired point. Enter the robot position obtained at this time into "1st" rX, rY, and R.



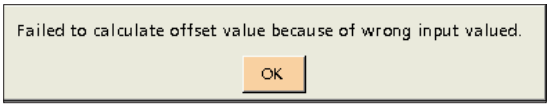

▶ Note

- Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.

***2.*** With a angle different from that in Step 1 above, move the tool of the robot to the desired point given in Step 1 above. Enter the robot position obtained at this time into "2nd" rX, rY, and R.

▶ Note

- When the tool is aligned to the desired point 2nd time, the point should meet the desired point to which the tool was moved 1st time. Deviation will cause deterioration in accuracy of offset values of rX and rY to be calculated.
- If R is the same between "1st" and "2nd", the message shown in the right figure appears. Enter values different between "1st" and "2nd".




***3.*** Press the ENTER key in response to the "Offset" button.

▶ Note

If this button has been pressed, "Offset rX", "Offset rY", and "Angle", entered in advance, are over-written in Step 4 below.

***4.*** The PV260 calculates "Offset rX" and "Offset rY" based on the robot position entered in "1st", "2nd" and "Angle".

# 4.1.4 Setting Procedure When Installation Position is in 2nd Axis

Installation Position: Concept When Installed in 2nd Axis

Available only when the robot in use is in Cartesian(Table Top). However, the concept differs depending on the number of axes of the robot in Cartesian(Table Top).

## For the robot in Cartesian(Table Top) with 3 axes

In this section, 3 axes mean X, Y and Z axes. TOOL is used in three axes when two or more tools are installed. If only one tool is installed, TOOL is unnecessary.
When two or more tools are installed, each tool is available to align detected work by setting offset for the tool specified as a base.

Enter the offset (rX, rY) from the center of the tool specified as the base to the center of another tool.

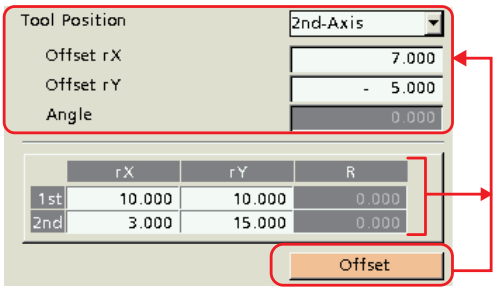
## For the robot in Cartesian(Table Top) with 4 axes

In this section, 4 axes mean X, Y, Z, and R axes. When 4 axes are used, and a tool is installed in the 2nd axis, TOOL is required. Detected work can be aligned with a tool by setting offset for the center of the tool installed in the 2nd axis from the center of R axis specified as the base of 4-axis robot.

Enter the offset (rX, rY) to the center of a tool installed in the 2nd axis from the center of R axis.

## Procedure for Setting (When Installed in 2nd Axis)

***1.*** Move the center of R axis (when a 4-axis robot is used) or a tool specified as the base (when a 3-axis robot is used) in such a manner that it matches one desired point. Enter the robot position obtained at this time into "1st" rX and rY.




Note

- If the tool is installed in "2nd-Axis", it is indicated that the input field of angle (R) is invalid.
- Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.

***2.*** Move the tool different from that in "1st" in such a manner that it matches one desired point in step 1 above. Enter the robot position obtained at this time into "2nd" rX and rY.

Note

- When the tool is aligned to the desired point 2nd time, the point should meet the desired point to which the tool was moved 1st time. Deviation will cause deterioration in accuracy of offset values of rX and rY to be calculated.

***3.*** Press the ENTER key in response to the "Offset" button.

▶ Note

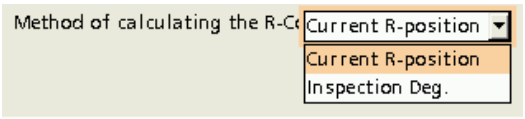
If this button has been pressed, "Offset rX" and "Offset rY", entered in advance, are overwritten in Step 4 below.

***4.*** The PV260 calculates "Offset rX" and "Offset rY" based on the robot position entered in "1st" and "2nd".

## 4.1.5 Method of calculating the R-Coordinates

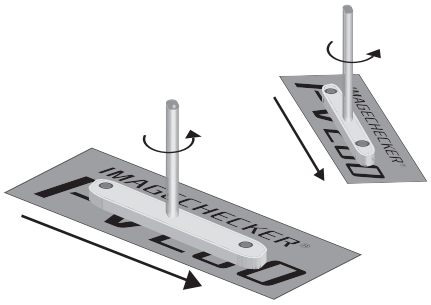
### What is Method of calculating the R-Coordinates?

When a tool is used for operation, this item determines whether or not the angle of the tool is changed according to the angle of work. Select one from Current R-position (default) / Inspection Deg.



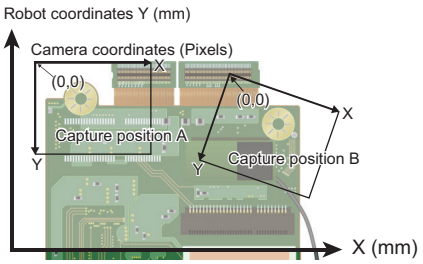

| | |
|---|---|
| Current R-position | When using the tool, keep the angle (R) of the current robot position unchanged without changing R axis of the robot. Receiving the current robot position from the robot, the PV260 uses the tool without changing the angle of R axis. Using X/Y axis only, to move the tool position without moving R axis. |
| Inspection Deg. | Rotate R axis of the robot according to the angle of work detected by a checker for work detection, etc. |

Setting example

| Should be seized regardless of angle of tool | Should always be seized without changing the direction facing to the work |
|---|---|
| → "Current R-position" | → "Inspection Deg." |
|  |  |
| Use the tool based on the angle obtained until just before. | Rotate the tool according to the direction of target work. Obtain the direction of work according to "Work detection". |

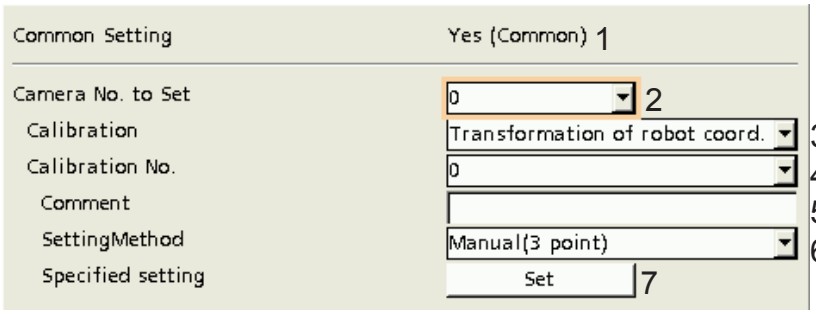
# 4.2 Calibration Setting

## 4.2.1 About Calibration Setting




Association of camera coordinate system (in pixels) with robot coordinate system (units of mm, etc.) is called calibration. Data to be associated is called calibration data.
The PV260 is allowed to have up to 6 calibration data per camera. Distance between the camera and work (WD: work distance) may differ depending on the type of work. Since difference in WD causes difference in resolution of camera, calibration data must be created for each WD.
When "2nd-Axis" or "R-Axis" is set in "Camera attachment", calibration data created at capture position A is also available at capture position B, as shown in the figure above. However, this requires a robot position at each capture position.

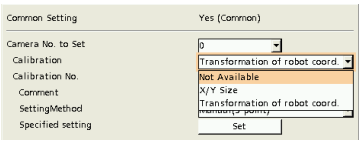
## 4.2.2 Calibration Setting Items




| | | |
|---|---|---|
| 1 | Common setting | The setting contents of "Common setting" selected from "TYPE" > "Type Setting" > "Camera" are displayed. |
| 2 | Set camera No. | Select the number of camera to set calibration. Settings can be made for each of camera Nos. 0 and 1. |
| 3 | Calibration | Select the calibration method. No / X/Y size / Transformation of robot coordinate |
| 4 | Calibration No. | Select the calibration No.<br>Fixed to No.0 when the installation method of the camera selected in "Set camera No." is "Fixed (downward)" or "Fixed (upward)". For "2nd-Axis" or "R-Axis", up to 6 calibration data of Nos. 0 to 5 can be set.<br>(The camera installation method is set by selecting "ENVIRONMENT" > "Robot / Input/Output" > "Robot Unit".) |
| 5 | Comment | Comment related to calibration can be entered. (Up to 16 characters) Comment can be entered or displayed according to each calibration No. |
| 6 | Setting method | When "Calibration" is set to "Transformation of robot coordinate", calibration setting method is selectable.<br>Manual (3 point) (Default) / Semi-Auto(1 point) / Auto(1 point)<br>The above option differs depending on "Robot Type" and "Camera attachment". For details, refer to Page 183.<br>• If the setting method is changed, values other than comment returns to the defaults. |
| 7 | Specified setting | Specified setting is made according to the setting method. |

# Calibration Method

Select from No (Default), X/Y size, and Transformation of robot coordinate.




| | |
|---|---|
| No: | Not converted into camera coordinates or robot coordinates. The PV260 outputs camera coordinates. |
| X/Y size: | Used to specify coordinate axis and origin.<br>For camera coordinates, when the upper left coordinates of the image is (0, 0,), horizontal direction is X axis, vertical direction is Y axis, and the unit of position direction is given in pixels, the origin position can be set at a desired position to change the direction of each axis (X axis: right and left and Y axis: up and down). The PV260 outputs positions, on the coordinate system, converted based on the above.<br>For details on the setting method, Refer to 4.3.6 Changing the Coordinate Origin and Unit (Calibration) in the PV200 manual. |
| Transformation of robot coordinate: | Camera coordinates are converted into robot coordinate system.<br>For details on the setting method, refer to “4.2.3 Set transformation of robot coordinate” on page 110. |

# 4.2.3 Set transformation of robot coordinate

This section describes the setting method when "Transformation of robot coordinate" is selected for calibration. When calibration is selected for "Transformation of robot coordinate", the PV260 converts the camera coordinates into robot coordinates and outputs the results.

## About setting method

Settings necessary for association of camera coordinate system with robot coordinate system differs depending on "Setting method". The outline of each "Setting method" and setting items required are listed in the table below.

| Method | Calibration Marks | Set robot position | Calibration Method |
|---|---|---|---|
| Manual (3 point) | 3 point | • When "2nd-Axis" or "R-Axis" is selected for "Camera attachment": Requires the entry of robot position at the time of calibration setting. | Find calibration elements based on the relationships between 3-mark camera coordinates and robot coordinates.. |
| | | • When "Fixed (downward)" or "Fixed (upward)" is selected for "Camera attachment": Entry of robot position at the time of calibration setting is not required. | |
| Semi-Auto (1 point) | 1 point | Entry of robot position is required at three places where calibration mark can be detected. | When generating calibration data in a state where the position of 1 calibration mark is known in the robot coordinate system, you just have to detect the calibration mark at a different capture position while moving the robot. |
| Auto (1 point) | 1 point | Entry of robot position is required at four places where calibration mark can be detected. | When generating calibration data, you just have to detect 1 calibration mark at a different capture position while moving the robot. |

In the setting method above, options differ depending on "Robot type" and "Camera attachment".
Use the table below for confirmation.
Options available for calibration setting method in robot type/camera attachment (A: Available N/A: Not available)

| | | Cartesian(Table Top) robot | | | SCARA robot | | |
|---|---|---|---|---|---|---|---|
| | Camera Attachment: | Fixed | 2nd-axis | R axis | Fixed | 2nd-axis | R axis |
| Setting method | Manual (3 point) | A | A | A | A | A | A |
| | Semi-Auto (1 point) | N/A | A | A | N/A | A | A |
| | Auto (1 point) | N/A | N/A | A | N/A | A | A |

For details on the setting after the selection, refer to the following pages.

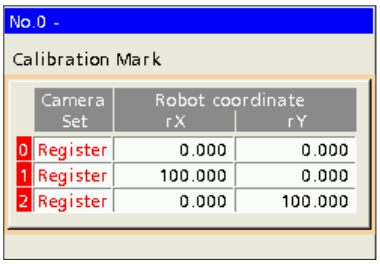
# Specified setting screen

For the setting items in "Specified setting", items to be set differ depending on the selected "Setting method" described above. This section describes "Calibration Mark", "Robot Hand-System", and "Display Global Coordinate", which are common items independent of "Setting method". For other items, refer to Page 113 and later.

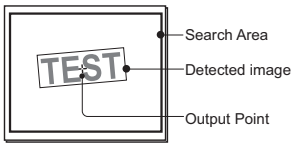
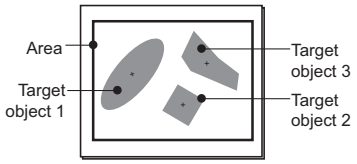
Setting of Calibration Mark

Using dedicated base checkers, set calibration marks. Available base checkers differ depending on the calibration method, as shown in the table below.

| Method | Base Checker |
|---|---|
| Manual (3 point) | Desired position |
| | Smart Matching |
| | Contour Matching |
| | Intersection |
| | Circle Center |
| | Feature Extraction |
| Semi-Auto(1 point)/ Auto(1 point) | Smart Matching |
| | Contour Matching |
| | Feature Extraction |

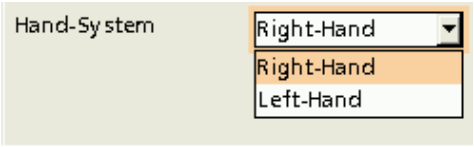


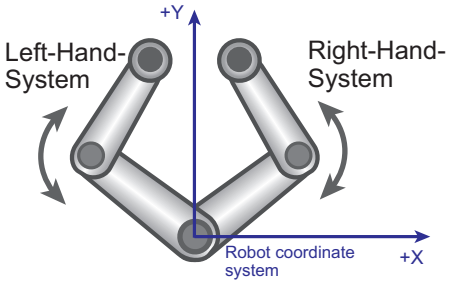

Marker detection method with each checker

| Base Checker | | Detection image |
|---|---|---|
| Smart Matching | This function registers a base image (template) to search for and detect portions similar to the image pattern. For details on the procedure for setting, refer to 4.7.10 "Smart Matching" in PV200 Manual. |   |
| Contour Matching | This function registers a base image based on contour information to search for and detect portions similar to the contour pattern. For details on the procedure for setting, refer to 4.7.11 "Contour Matching" in PV200 Manual. |   |
| Intersection | This function registers smart edges (lines) as horizontal base checker and vertical base checker to detect an intersection based on two approximate lines. For details on the procedure for setting, refer to 4.7.16 "Smart Edge (Line)" in PV200 Manual. | |
| Circle Center | Virtual circles are detected based on the same principle as that of "Detect Mode: Radius" in Smart Edge(Circle). The coordinates of the center point of a virtual circle detected are specified as a base position. Even if whole circumference cannot be seized or corner of a target object is round, position detection can be performed. For details on the procedure for setting, refer to 4.7.15 "Smart Edge (Circle)" in PV200 Manual. | |
| Feature Extraction | This function displays in binary the images captured by a camera and detects white or black block (target object) of a specified size. For details on the procedure for setting, refer to 4.7.9 "Feature Extraction" in PV200 Manual. |   |
| Desired position | This function moves the cursor arbitrarily according to an image to detect the coordinates of the cursor position. | |

About Robot Hand-System

For SCARA robot, "Hand-System" is set to indicate the operation direction of the robot.



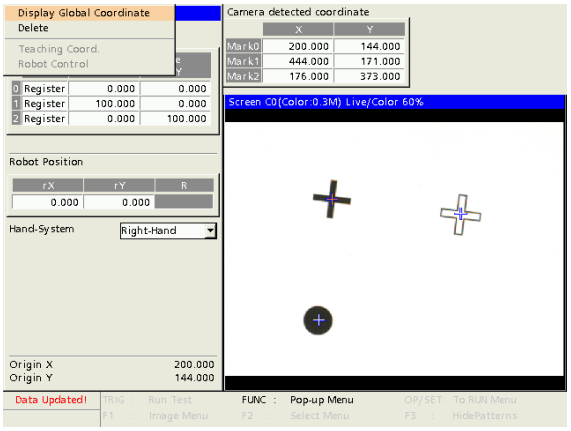




## Display Global Coordinate Function

In the "Specified setting", coordinates converted by executing calibration (global coordinates) can be confirmed.

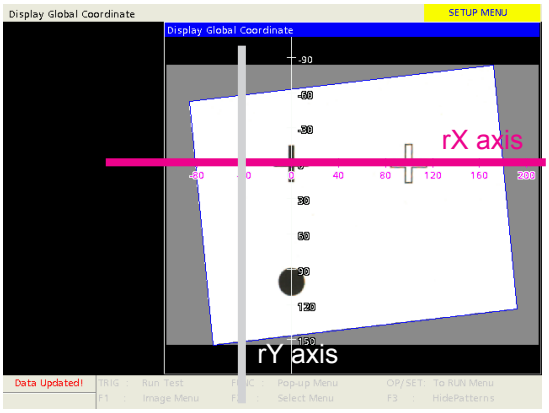
***1.*** Press the FUNC key on the "Specified setting" screen.

***2.*** Select "Display Global Coordinate".




***3.*** You can confirm the scale of the camera coordinate system to the robot coordinate system and the positional relation based on the calibration data generated.

In the Display Global Coordinate, rX axis is displayed in magenta, and rY axis, white.
If the positional relation is matched between the origin of robot coordinate system and the camera, the calibration can be judged to be successful.




On the image above, the lines are made thicker than the actual lines to make the coordinate axes easier to see.

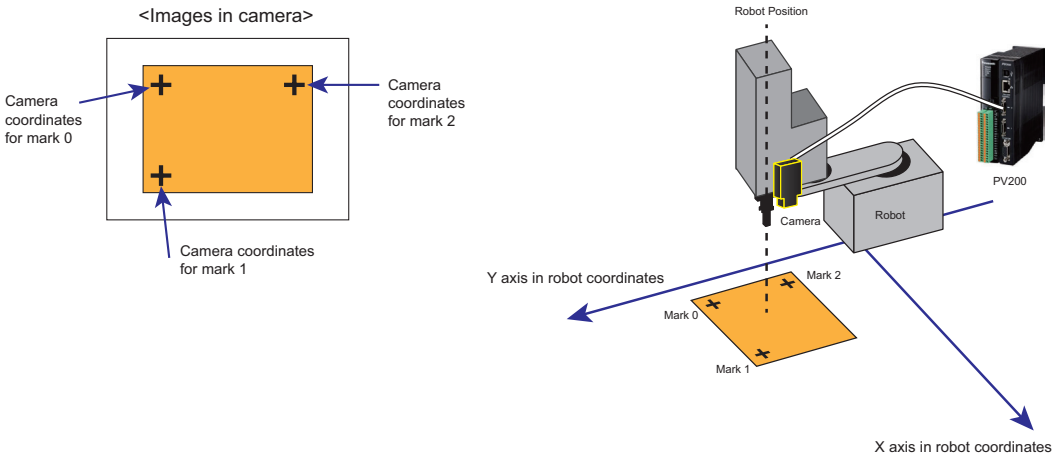
# Calibration Setting Procedure - Manual(3 point)

Calibration data is generated by associating the robot coordinate system for 3 calibration marks with the camera coordinates for them. This function is selectable for all "Robot types" and "Camera attachment".

**Note**

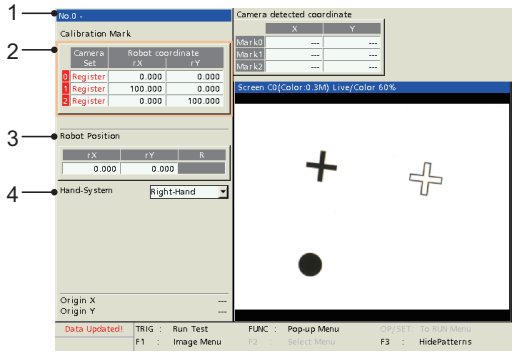
If "2nd-Axis" or "R-Axis" is set in "Camera attachment", the robot position at the time of Calibration Setting is required.

Operation image




Specified setting screen

The calibration method for Manual(3 point) is carried out without moving the camera position. Adjust the robot position or calibration mark position in advance for 3 calibration marks to come out in one field.

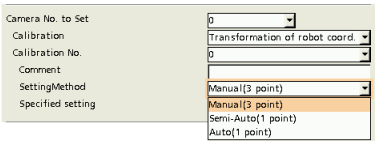



| | | |
|---|---|---|
| 1 | Title | Display the calibration No., and comment. |
| 2 | Setting of Calibration Mark | Register the positions of three calibration marks in the camera coordinate system and robot coordinate system. A position in the camera coordinate system is detected by one of the following: Desired Position, Smart Matching, Contour Matching, Intersection point, Circle Center, and Feature Extraction.<br>In addition, a position in the robot coordinate system is calculated by one of the following methods:<br>• Method of entering a robot position with tool and mark aligned to each other in a state where the position of tool front is known on the robot side<br>• Method of entering the position of tool front with tool and mark aligned to each other in a state where TOOL is specified in the PV260<br>For the latter, refer to “4.1 Robot Tool Offset Function” on page 102. |

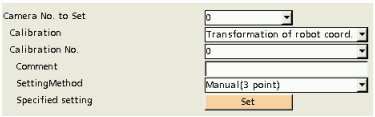
| | | |
|---|---|---|
| 3 | Robot Position | This entry is required when "2nd-Axis" or "R-Axis" is set in "Camera attachment".<br>Enter the robot position when calibration is set (in the state where three calibration marks come out within the field of view of camera). |
| 4 | Hand-System | This entry is required when "SCARA" is set in "Robot type". For Hand-System, refer to Page 112. |
| 5 | Press the FUNC key.<br>(Out of the screen) | You can confirm the global coordinates that are constructed via calibration. |

Setting Procedure

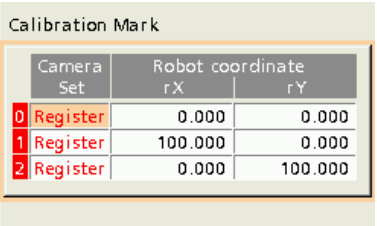
***1.*** Select "Manual(3 point)" in "Setting method" on the Calibration Setting screen.

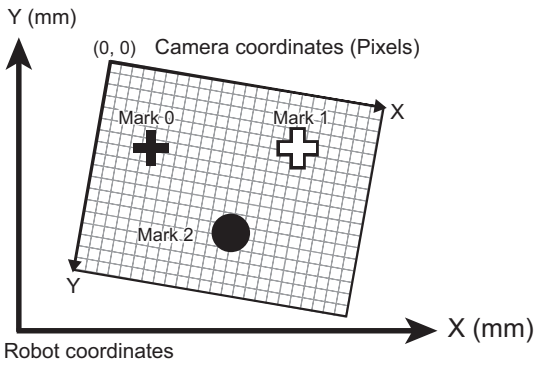



***2.*** Press the ENTER key in response to the "Set" button in "Specified setting".




***3.*** In "Calibration Mark", press the "Register" field for "Camera" selected from "Mark0" to "Mark2" and then specify the mark position on the camera coordinate system by selecting Base Checker.

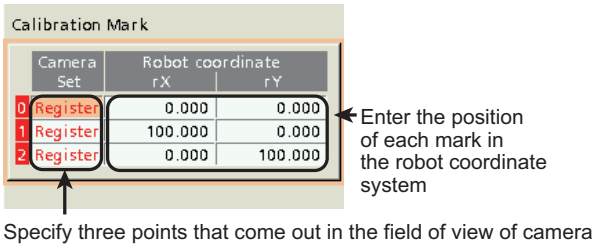


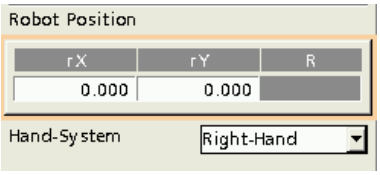

***4.*** Enter robot coordinates for each mark registered.

Note

Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.



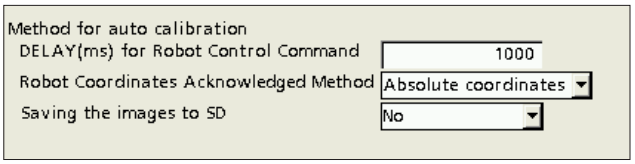
**5.** If "2nd-Axis" or "R-Axis" is set in "Camera attachment", enter the robot position and "Hand-System" at the time of Calibration Setting in "Robot Position".




**6.** Making the settings in Steps 1 to 5 generates calibration data. In "Display Global Coordinate", confirm the positional relation between the robot coordinate system and the camera coordinate system.

## Setting of method for auto calibration

"Method for auto calibration" selected from "TYPE" > "Robot" > "Calibration" is related to the setting for execution of auto calibration.




| | |
|---|---|
| DELAY(ms) for Robot Control Command | When auto calibration is executed with the robot control command, the PV260 receives "Movement completion" from the robot. After the time set in "DELAY for Robot Control Command", the PV260 then captures/detects calibration marks. This function is used to reduce impact caused by vibration after the completion of movement.<br>Value: 20 to 10000 (20ms to 10s) (Default: 1000ms) |
| Robot Coordinates Acknowledged Method | Absolute coordinates (default) or Relative coordinates is selected.<br>In response to a movement instruction sent from the PV260 to the robot, either absolute coordinates or relative coordinates is selected to move the robot to a position specified from "Specified setting" > "Robot Position" in the PV260 during the execution of auto calibration. |
| Saving the images to SD | Saves images, captured at the time of execution of auto calibration, in an SD memory card.<br>Images saved are available for reproduction of auto calibration, etc. in PVWIN260.<br>Images for 10 latest auto calibrations (3 to 4 pieces X 10 times) can be saved in an SD card.<br>Default: Yes<br>Destination to save SD images: Panasonic-ID SUNX Vision\PV260\Image\Robot |

▶ Note

- How to use the file name of calibration image when SD image is saved

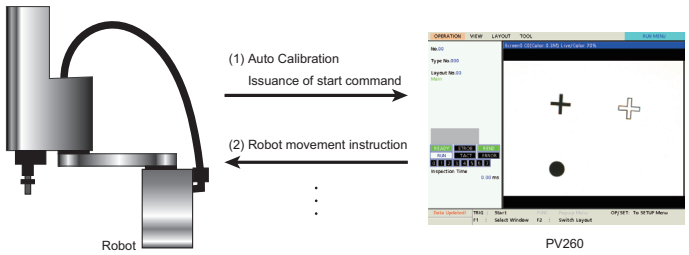
Calibs_Basex_Cc_n_xxx.bmp
1 2 3 4 5

| | |
|---|---|
| 1 | s: Set No. |
| 2 | x: Base No. (0 to 3) |
| 3 | c: Camera No. (0, 1) |
| 4 | n: Calibration No. (0 to 5) |
| 5 | xxx: Image No. (000 to 039) |

# Difference in calibration operation with the robot control command used

Auto calibration is performed by using "Robot control command" or by sending/receiving commands to/from the robot or PLC. Differences between them are as follows:

When auto calibration is carried out by sending/receiving commands to and from the robot or PLC

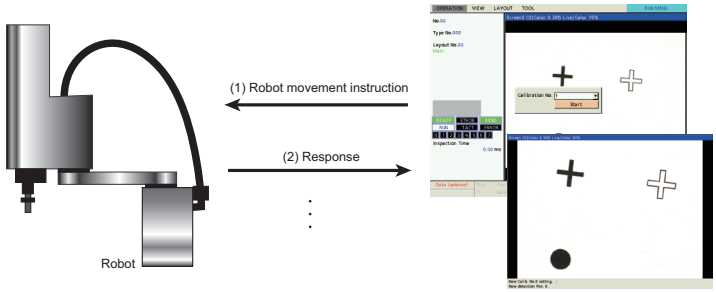



Auto calibration is carried out by sending the "Calibration Auto. Setting Start" command, instructing the execution of auto calibration, from the robot or PLC to the PV260.
Note that this execution requires you to prepare a program following the auto calibration sequence described later on the robot or PLC side.

▶ Note

When executing auto calibration, confirm in "RUN Menu" that READY for the PV260 is turned on, and then send the "Calibration Auto. Setting Start" command from the robot or PLC to the PV260.

For auto calibration with the robot control command



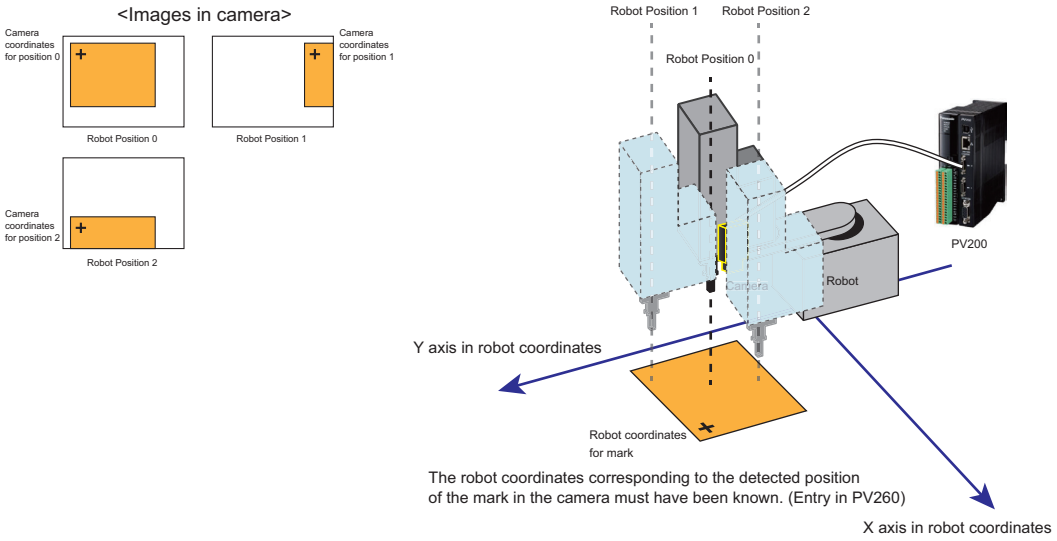

If a command of moving a robot is sent from the PV260 to the robot, auto calibration can be carried out without the robot program.
Note that the specifications of the command of directly operating the robot from external devices (when viewed from the robot) differ depending on the robot maker. If the robot maker is not listed in "Maker" from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication", settings must be made in "Robot Control Command Format" according to the specifications of the robot to be used.
Similarly, auto calibration can also be carried out for PLC under the control of the PV260. For the PLC, however, a program must be created to operate the robot in response to the commands the PV260 sends.
"Robot control command" is available to carry out auto calibration under the following conditions:

| | |
|---|---|
| 1 | "2nd-Axis" or "R-Axis" shall be selected for "Camera attachment" |
| 2 | The settings in "Specified setting" selected from "Calibration" shall have been made |
| 3 | "Used" is selected for "Robot Control Command". |
| 4 | The settings shall have completely been made in "Movement Instruction (Absolute Position)" from "Robot Control Command Format".<br>Refer to “3.3 Robot Control Command Format” on page 27 for "Robot Control Command Format". |
| 5 | Communication shall have been established. |

# Calibration Setting Procedure - Semi-Auto (1 point)

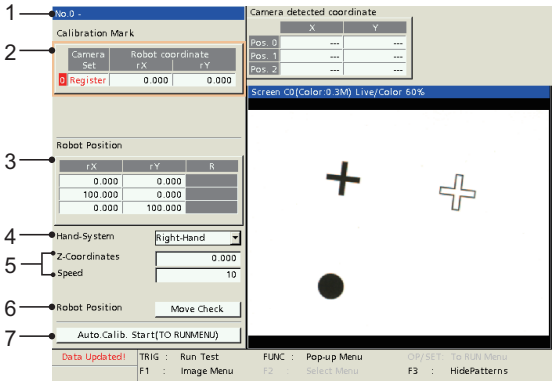
To generate calibration data in a state where the position of one calibration mark is known in the robot coordinate system, you just have to detect the calibration mark at a different capture position while moving the robot. This function is available regardless of "Robot type" when "Camera attachment" is set to "2nd-Axis" or "R-Axis".

Operation image




Specified setting screen

Calibration data is generated by detecting calibration marks at 3 places, changing the robot position within the range where calibration marks come out in the field of view of camera without moving the positions of the calibration marks.

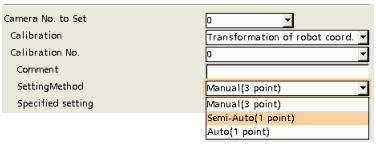



| | | |
|---|---|---|
| 1 | Title | Display the calibration No., and comment. |
| 2 | Setting of Calibration Mark | Register the position of one calibration mark in the robot coordinate system. Calculate the positions in the robot coordinate system by using robot teaching, etc. Also set the checkers (Smart Matching/Contour Matching/Feature Extraction) for detecting calibration marks. For the procedure for setting, refer to Page 114 step 3. |
| 3 | Robot Position | When executing auto calibration, enter three points of the robot positions to capture calibration marks. It is advisable at this time to adjust the positions of calibration marks that come out in the field of view of camera by using the settings in "Robot Control" selected by pressing the FUNC key.<br>For the robot control setting, refer to “3.4.1 What is Robot Control Setting?” on page 39. |

| | | |
|---|---|---|
| 4 | Robot Hand-System | This entry is required when "SCARA" is set in "Robot type". For Hand-System, refer to Page 112. |
| 5 | Z-coordinates / speed for robot control command | Z-coordinates and speed for robot control command during auto calibration execution can be specified in this step. |
| 6 | Robot Position Move Check | This function is used to confirm whether or not the mark comes out in the field of view of camera and can be detected when the robot is moved to a position specified in "Robot position".<br>The PV260 issues a command of movement to the robot by using the "Movement Instruction (Absolute Position)" command set in "Robot Control Command Format" to move the robot to a specified position.<br>▶ Note<br>• Refer to “3.3 Robot Control Command Format” on page 27 for "Robot Control Command Format".<br>• This function is available only when "Yes" is set in "Robot Control Command" selected from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication". This window does not appear when "No" is selected.<br>• The movement confirmation cannot be performed when "TOSHIBA" is selected from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication" > "Maker". |
| 7 | Auto.Calib. Start | Pressing this button moves to the RUN Menu. To execute the auto calibration by the robot control command, select "OPERATION" > "Auto Calibration Start".<br>To execute auto calibration with a command from robot or PLC, send the "Calibration Auto. Setting Start" command to the PV260. |
| 8 | Press the FUNC key. (Out of the screen) | You can confirm the global coordinates that are constructed via calibration. |

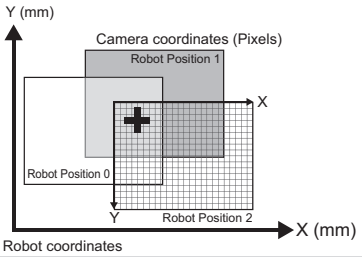
Setting method

***1.*** Select "Semi-Auto (1 point)" in "Setting method".




***2.*** Press the ENTER key in response to the "Set" button in "Specified setting".

***3.*** In "Calibration Mark", enter the position (rX, rY) of calibration mark in the robot coordinate system. Also set the checkers (Smart Matching/Contour Matching/Feature Extraction) for detecting calibration marks. For the procedure for setting, refer to Page 114 step 3.

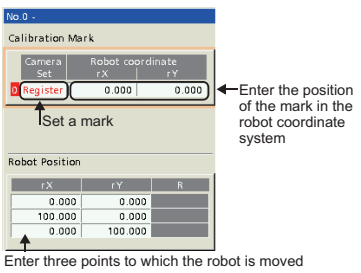



***4.*** In "Robot Position", specify three points of robot positions to be moved during calibration execution.

Set "Robot position" that allows calibration marks to come out in the field of view of camera.

▶ Note

Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.

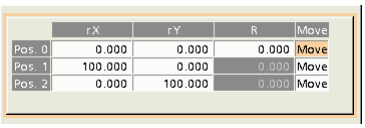


**5.** Enter "Hand-System".

▶ Note

Setting of "Hand-System" is required only when "SCARA" is set in "Robot type".

**6.** Moving the robot to the position set in "Robot Position", confirm whether or not calibration mark can be detected by a checker set in "Calibration Mark".




Specify the robot position, move the cursor to the "Movement" field, and then press the ENTER key.

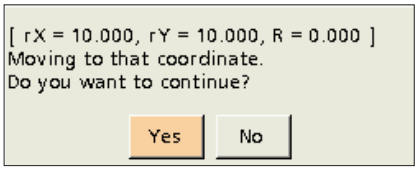
▶ Note

[When no calibration mark exists in the field of view]

- Adjust the robot position in "Robot Position".
- Adjust the position of calibration mark.

[When calibration mark is falsely detected]

- Adjust the setting of checker in "Calibration Mark".

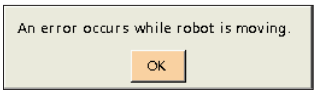



**7.** A message is displayed to confirm the start of execution of movement instruction.

Pressing "Yes" starts moving the robot.

▶ Note

If the message at right appears, the possible causes are as follows:




[When communication is not established between the PV260 and the robot (PLC)]

- Confirm the connections of communication cables.
- Confirm the baud rate and IP address settings.

[When the device to communicate with cannot accept the robot control command]

- Confirm whether or not the robot (PLC) can accept the robot control command.
  (Example: The command cannot be accepted due to maintenance mode, servo motor is not turned on, etc.)

[When the robot control command is set incorrectly]

- Confirm that the command is set according to the specifications of the robot.

**8.** Pressing the ENTER key in "Auto.Calib. Start(TO RUNMENU)" automatically goes to RUN Menu.

Switch to the RUN Menu. To execute the auto calibration by the robot control command, select "OPERATION" > "Auto Calibration Start".

To execute auto calibration with a command from robot or PLC, send the "Calibration Auto. Setting Start" command to the PV260.

▶Caution

Note that the robot moves during the execution of auto calibration.

▶ Note

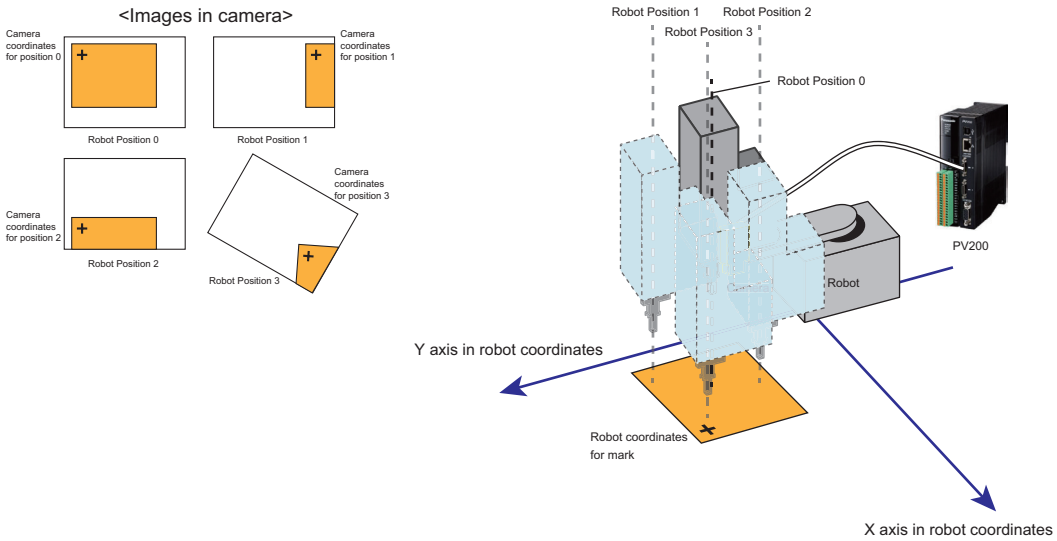
- To execute auto calibration by a command from the robot or PLC, prepare a program of executing the auto calibration on the robot or PLC side in advance.
- For details on auto calibration, refer to “5.1 Sequence of Auto Calibration” on page 176.

**9.** After the completion of the execution of auto calibration, switch to SETUP MENU by pressing OPE/SET.

# Calibration Setting Procedure - Auto(1 point)

When generating calibration data, you just have to detect one calibration mark at a different capture position while moving the robot. Unlike other methods, the position of the calibration mark does not have to be known in the robot coordinate system. This function is available for the following combinations:
"Robot type" : "Camera mount" = "SCARA" : "2nd-Axis"/"R-Axis"
"Robot type" : "Camera mount" = "Cartesian(Table Top)" : "R-Axis"

Operation image

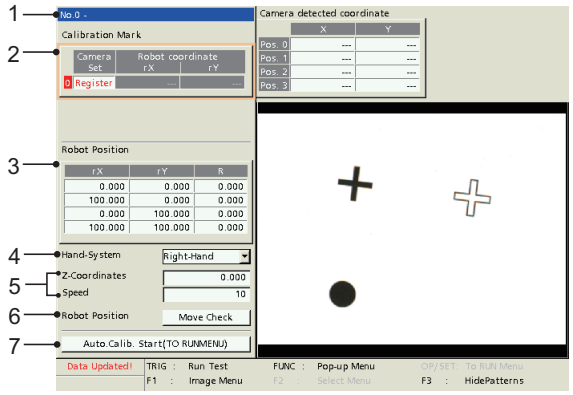



**Note**

When the camera is mounted in R axis, at least one of the R values of positions 0 to 3 should be different from the others.
If all points have the same R value, calibration data cannot be generated.

Specified setting screen

Calibration data is generated by detecting calibration marks at 4 places, changing the robot position within the range where calibration marks come out in the field of view of camera without moving the positions of the calibration marks.

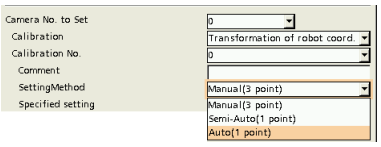



| | | |
|---|---|---|
| 1 | Title | Display the calibration No., and comment. |
| 2 | Setting of Calibration Mark | Set the checkers (Smart Matching/Contour Matching/Feature Extraction) for detecting calibration marks. |

| | | |
|---|---|---|
| 3 | Robot Position | When executing auto calibration, enter three points of the robot positions to capture calibration marks. it is advisable at this time to adjust the positions of calibration marks that come out in the field of view of camera by using the settings in "Robot Control" selected by pressing the FUNC key.<br>For the robot control setting, refer to “3.4.1 What is Robot Control Setting?” on page 39. |
| 4 | Robot Hand-System | Enter the movable direction of the robot. This setting can be made only for SCARA robot. For Hand-System, refer to Page 112. |
| 5 | Z-coordinates / speed for robot control command | Z-coordinates / speed for robot control command during calibration execution can be specified in this step. |
| 6 | Robot Position Move Check | This function is used to confirm whether or not the mark comes out in the field of view of camera and can be detected when the robot is moved to a position specified in "Robot Position".<br>The PV260 issues a command of movement to the robot by using the "Movement Instruction (Absolute Position)" command set in "Robot Control Command Format" to move the robot to a specified position.<br>▶ Note<br>• Refer to“5.1 Sequence of Auto Calibration” on page 176 for "Robot Control Command Format".<br>• This function is available only when "Yes" is set in "Robot Control Command" selected from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication". This window does not appear when "No" is selected. |
| 7 | Auto.Calib. Start | Pressing this button moves to the RUN Menu. To execute the auto calibration by the robot control command, select "OPERATION" > "Auto Calibration Start".<br>To execute auto calibration with a command from robot or PLC, send the "Calibration Auto. Setting Start" command to the PV260. |
| 8 | Press the FUNC key. (Out of the screen) | You can confirm the global coordinates that are constructed via calibration. |

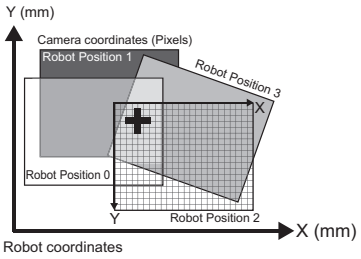
Setting method

***1.*** Select "Auto (1 point)" in "Setting method".




***2.*** Press the ENTER key in response to the "Set" button in "Specified setting".

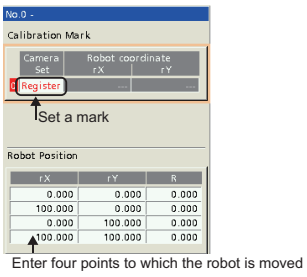
***3.*** In "Calibration Mark", set the checkers (Smart Matching/Contour Matching/Feature Extraction) for detecting calibration marks.




***4.*** In "Robot Position", specify four points of robot positions to be moved during calibration execution.

▶ Note

- Set "Robot position" that allows calibration marks to come out in the field of view of camera.
- If a camera is mounted in R axis, the angle of R axis at one point at least must be different from the angle at the other three points.



Enter four points to which the robot is moved

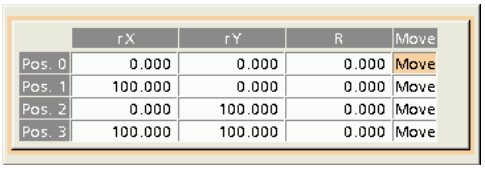
- Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.

**5.** Enter "Hand-System".

▶ Note

Setting of "Hand-System" is required only when "SCARA" is set in "Robot type".

**6.** Moving the robot to the position set in "Robot Position", confirm whether or not calibration mark can be detected by a checker set in "Calibration Mark".



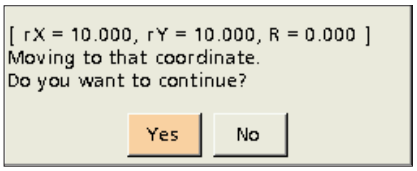
| | rX | rY | R | Move |
|---|---|---|---|---|
| Pos. 0 | 0.000 | 0.000 | 0.000 | Move |
| Pos. 1 | 100.000 | 0.000 | 0.000 | Move |
| Pos. 2 | 0.000 | 100.000 | 0.000 | Move |
| Pos. 3 | 100.000 | 100.000 | 0.000 | Move |

Specify the robot position, move the cursor to the "Movement" field, and then press the ENTER key.

▶ Note

[When no calibration mark exists in the field of view]
- Adjust the robot position in "Robot Position".
- Adjust the position of calibration mark.

[When calibration mark is falsely detected]
- Adjust the setting of checker in "Calibration Mark".

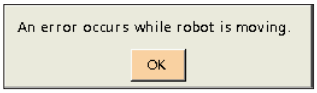



**7.** A message is displayed to confirm the start of execution of movement instruction.

Pressing "Yes" starts moving the robot.

▶ Note

If the message at right appears, the possible causes are as follows:




[When communication is not established between the PV260 and the robot (PLC)]
- Confirm the connections of communication cables.
- Confirm the baud rate and IP address settings.

[When the device to communicate with cannot accept the robot control command]
- Confirm whether or not the robot (PLC) can accept the robot control command.

(Example: The command cannot be accepted due to maintenance mode, servo motor is not turned on, etc.)

[When the robot control command is set incorrectly]
- Confirm that the command is set according to the specifications of the robot.

**8.** Pressing the ENTER key in "Auto.Calib. Start" automatically goes to RUN Menu.

Switch to the RUN Menu. To execute the auto calibration by the robot control command, select "OPERATION" > "Auto Calibration Start".

To execute auto calibration with a command from robot or PLC, send the "Calibration Auto. Setting Start" command to the PV260.

▶Caution

Note that the robot moves during the execution of auto calibration.

▶ Note

- To execute auto calibration by a command from the robot or PLC, prepare a program of executing the auto calibration on the robot or PLC side in advance.
- For details on auto calibration, refer to “5.1 Sequence of Auto Calibration” on page 176.

**9.** After the completion of the execution of auto calibration, switch to SETUP MENU by pressing OPE/SET.

# 4.3 Teaching Support

## What is Teaching Support?

"Teaching Support" is a function to support robot teaching by specifying teaching points on camera-captured images.
Unlike existing actual-thing matching, an operator does not have to come close to the movable parts of the robot and therefore, the safety of the operator can be secured. In addition, since the operator can perform teaching while watching the monitor, a burden of the operator can be reduced.
The coordinates after teaching can be output to the robot/PLC via "Output of Teaching Coordinates". Perform adjustment of Z axis, etc., based on the coordinates output. These teaching coordinates can be reflected upon "Working Pos." described later.

### ■ For what teaching support is available

- Teaching can be performed by specifying a desired position of a calibrated camera image with the keypad.
- Teaching coordinates (X, Y) can be output to the robot/PLC.
- Teaching coordinates can be reflected upon working positions.

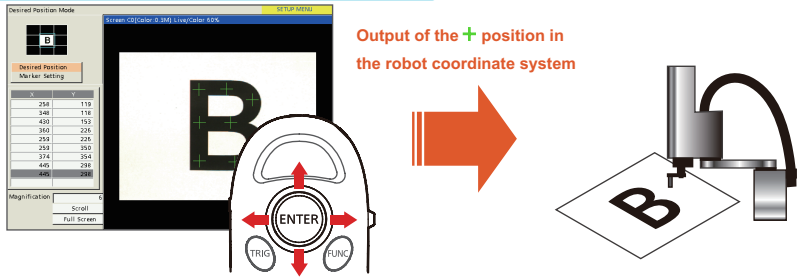
### ■ Features of This Function

- Up to 10 desired positions can be specified per field of view.
  (Up to 10 fields of view and up to 100 data of teaching coordinates can be retained.)
- Magnification change of camera window and fine tuning of specified position can be performed when desired positions are specified.
- The size of cross marker to be used for specifying desired positions can be changed.

### ■ Image

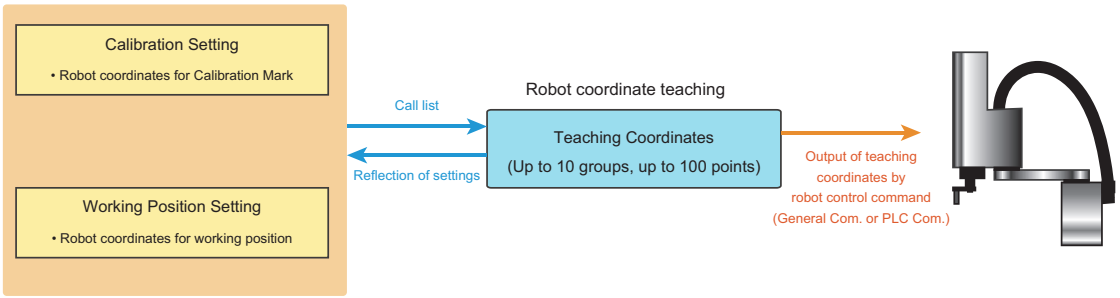
The robot coordinates of a specified position (work) are calculated by specifying a desired position of work that comes out in the camera after calibration setting. When the mark in the camera window of the PV260 is moved to a desired position with the keypad, pressing the ENTER key allows the PV260 to retain the robot coordinates. Retained data can be output to the robot/PLC by the command described later.

PV260 Teaching Support Setting Screen

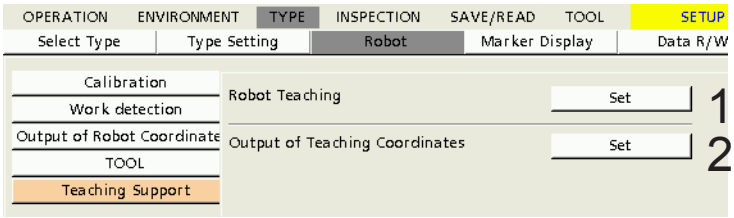


## ■ About the Use of Teaching Coordinates

1. Use as a temporary position of teaching
   A rough position calculated by teaching support is available for fine tuning of X, Y, Z, and R.
2. Coating and screw tightening
   If a working position of work at a base position has been calculated by teaching support and registered at the working position, the working position can be calculated even when work deviates from the base position.
3. Transfer to a pallet
   If a position to which work is transferred is calculated by teaching support and registered at the working position, the picked up work can be corrected and transferred.




# 4.3.1 Teaching Support Menu




| | | |
|---|---|---|
| 1 | Robot Teaching | The robot coordinates of a specified position are calculated by specifying a desired position of work that comes out in the camera after calibration setting. |
| 2 | Output of Teaching Coordinates | Settings of teaching are made to specify data to be output to the robot. For the output of teaching coordinates, refer to “4.3.3 Output of Teaching Coordinates” on page 128. |

▶ Note

Setting "Teaching Support" requires setting "Calibration" in advance.

## 4.3.2 Setting of Robot Teaching

Specify teaching point in units of field of view of camera. Up to 10 teaching points can be registered per field of view and are registered as a group.
To perform teaching at 11 or more points in one field of view, teaching points exceeding 10 points should be registered in a different group(s).

***1.*** Move the robot to a position at which the teaching point comes out in the field of view of camera.

For a fixed camera, place work in such a manner that the teaching points come out in the field of view of camera.

***2.*** Press the Set button in "Robot Teaching" selected from "TYPE" > "Robot" > "Teaching Support" menu.

The Field of view No. screen appears.

***3.*** Select Field of view No.

***4.*** Enter comment into "Comment".

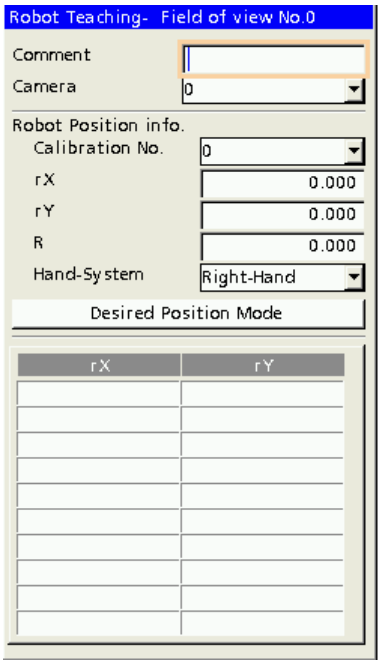
***5.*** Specify the No. of the camera to capture images for "Camera".

***6.*** In "Calibration No.", select the calibration No. in the field of view to be specified for teaching support.

***7.*** Enter the robot position, at the place where teaching is performed, into "rX", "rY", "R", and "Hand-System".

▶ Note

- Hand-System is set when the robot type is "SCARA". Menu display is not available for "Cartesian".
- Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.




***8.*** Press the ENTER key in "Desired Position Mode".

The Desired Position Mode screen appears.

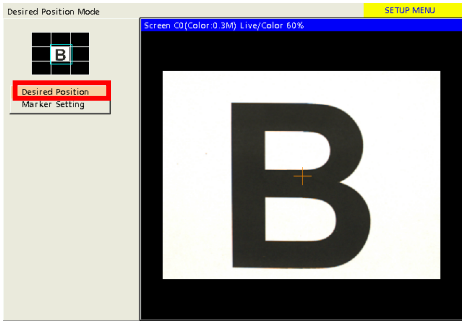
▶ Note

If switching to the desired position mode is not allowed, the possible causes are as follows:

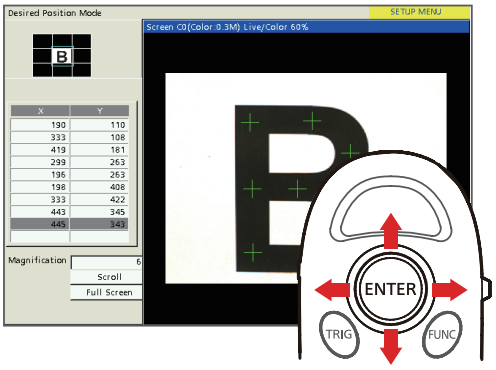
| Message to be displayed | Cause |
|---|---|
| "The operation cannot be executed with the selected camera." | This error occurs when camera No. for which "Unused" is selected is set in "Camera" from "ENVIRONMENT" > "Camera" > "Camera". |
| "The selected calibration No. is not set to Transformation of robot coordinate, or the settings of Transformation of robot coordinate have not yet been made." | This error occurs in a camera or calibration No. being selected when calibration setting has not yet been completed. |
| "Recalculation of calibration coefficient failed." | This error may occur when "Robot type" is "SCARA" with "2nd-Axis" selected for "Camera mount". |

**9.** Press the ENTER key in "Desired Position".

Up to 10 teaching points can be set in the field of view at the present time.
Pressing the ENTER key in the list of X, Y can move the cross marker.




**10.** Move the cross mark (cross marker) to the place where teaching is performed.



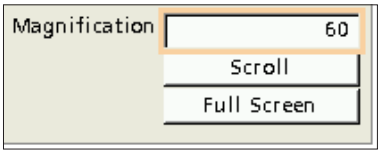

While looking at an image displayed in the monitor, specify the teaching position by operating the up, down, left and right keys on the keypad. Press the ENTER key to determine a place where teaching is performed. Pressing ENTER allows you to specify the next point.
Make the settings for the number of points at which you want to perform teaching.

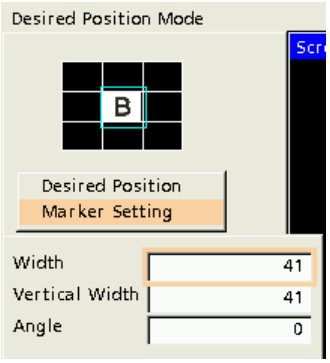
▶ Note

If a point is found to be unnecessary after it has been set, press the CANCEL key to move the cursor to the list and then press the FUNC key to select "Delete".

▶ Note

- If the teaching position is narrow and it is difficult to set a point, the display screen of the PV260 can be expanded by using "Magnification" at the lower left portion of the screen. Scrolling the screen is allowed after expansion by "Scroll", and pressing "Full Screen" returns the screen to the initial state in which full screen appears.
- The size and angle of the cross marker to be used for specifying teaching position can be changed. Change the marker as needed. The size can be specified by "Width", "Vertical Width", and "Angle".
- The F2 key and F3 key are available for Magnification and Scroll, respectively.




**11.** After the end of the setting of teaching point, pressing the CANCEL key moves the cursor to over the list.

**12.** When the teaching position has completely been specified, pressing the CANCEL key in the list returns to the robot teaching setting screen.

## Addition of Teaching Point

Teaching points can be added.

**1.** On the "Desired Position Mode" screen, press "Desired Position" to display the list of teaching points.

**2.** Move the cursor onto the line of the teaching point into which you want to insert a line, and press the FUNC key.

**3.** Select "Insert" in the FUNC menu.

A line is inserted at the top of the line selected.

▶ Note

If the number of lines exceeds 10, the settable upper limit number, with a line inserted, the message in the figure below appears. Selecting "Yes" deletes the final line.

## Deleting Teaching Point

Registered teaching points can be deleted.

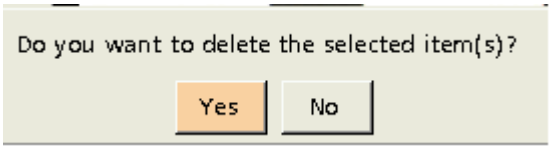
**1.** On the "Desired Position Mode" screen, press "Desired Position" to display the list of teaching points.

**2.** Move the cursor onto the line of the teaching point from which you want to delete a line,
and press the FUNC key.

A deletion menu appears. Select the menu according to the purpose.

| | |
|---|---|
| Delete | Delete the teaching point from the target line.<br>After the deletion, a blank line is left. |
| Deletion of line | After the teaching point is deleted from the target line, lines are top-aligned. |

**3.** In response to a message asking you whether you want to delete, pressing "Yes" completes the deletion.



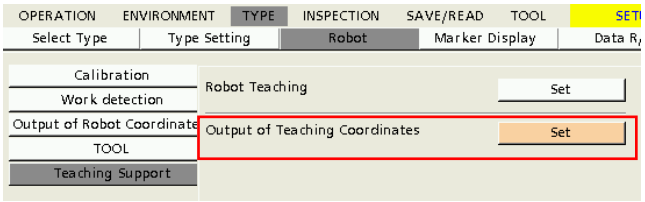
# 4.3.3 Output of Teaching Coordinates

Teaching coordinates set by teaching support are output from the PV260 to the robot/PLC.

## Output robot coordinates

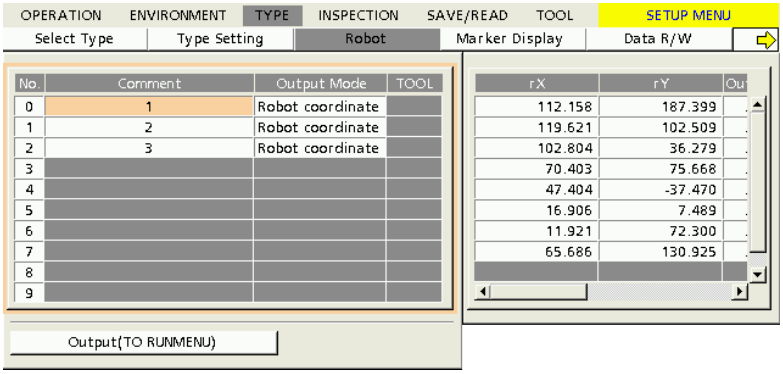
This section describes the case where teaching coordinates are output to the robot/PLC without changes. This function is used when a calculation can be performed on the robot side to find a position where tool is aligned to teaching coordinates.

***1.*** Press the Set button in "Output of Teaching Coordinates" selected from "TYPE" > "Robot" > "Teaching Support" menu.

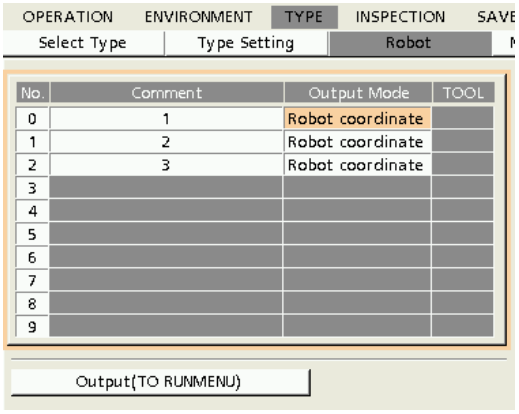



***2.*** Teaching points set in "Robot Teaching" are displayed in the list on a group basis.

A list of coordinate data of teaching points for each group is displayed on the right side.



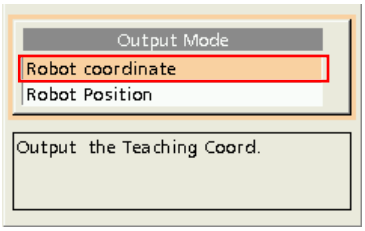

***3.*** Move the cursor to the "Output Mode" field of a teaching group from which you want to output robot position information, and then press the ENTER key.



**4.** When the "Output Mode" selection screen appears, select "Robot coordinate".

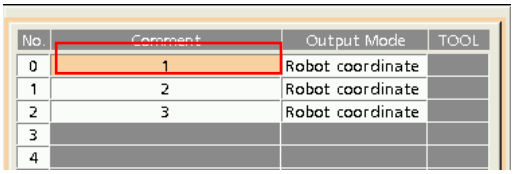
▶ Note

Output mode is set to "Robot coordinate" with default settings.




**5.** Confirm that "Output Mode" is set to "Robot coordinate" and press the ENTER key in the comment field.

The cursor moves to the "Output" field in the list of coordinate data at right.

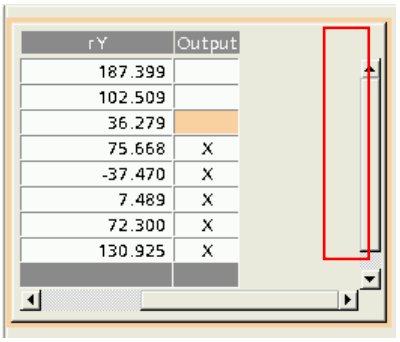


| No. | Comment | Output Mode | TOOL |
|---|---|---|---|
| 0 | 1 | Robot coordinate | |
| 1 | 2 | Robot coordinate | |
| 2 | 3 | Robot coordinate | |
| 3 | | | |
| 4 | | | |

**6.** Select coordinate data to be output. If unnecessary data are found, press the ENTER key in the "Output" field to delete "X" mark.

▶ Note

- With default settings, "X" mark appears in all "Output" fields of coordinate data.
- If coordinate data is output from none of the groups registered ("X mark is not found at all), the "Output (TO RUN-MENU)" button is displayed as an invalid button.



| rY | Output |
|---|---|
| 187.399 | |
| 102.509 | |
| 36.279 | |
| 75.668 | X |
| -37.470 | X |
| 7.489 | X |
| 72.300 | X |
| 130.925 | X |

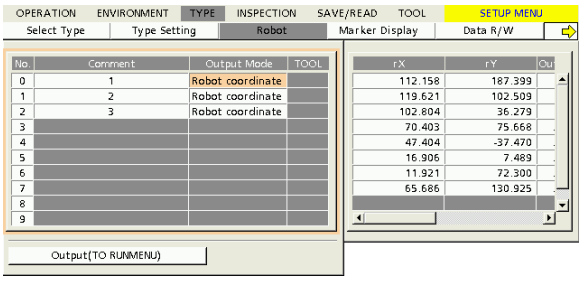
**7.** Pressing the "Output(TO RUNMENU)" button switches to RUN Menu.

Teaching coordinates can be output by entering the command into the PV260. Even when the screen normally switches to RUN Menu, teaching coordinates can be output.

## Output robot coordinates

Output teaching coordinates set by teaching support, which take into account tool position information with R = 0, from the PV260 to the robot.

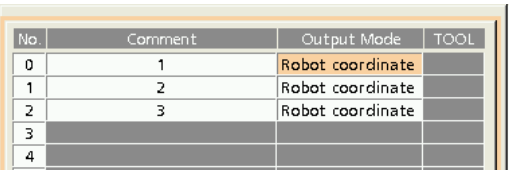
**1.** Open the "Output of Teaching Coordinates" screen.




| No. | Comment | Output Mode | TOOL |
|---|---|---|---|
| 0 | 1 | Robot coordinate | |
| 1 | 2 | Robot coordinate | |
| 2 | 3 | Robot coordinate | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |

| rX | rY | Ou |
|---|---|---|
| 112.158 | 187.399 | |
| 119.621 | 102.509 | |
| 102.804 | 36.279 | |
| 70.403 | 75.668 | |
| 47.404 | -37.470 | |
| 16.906 | 7.489 | |
| 11.921 | 72.300 | |
| 65.686 | 130.925 | |

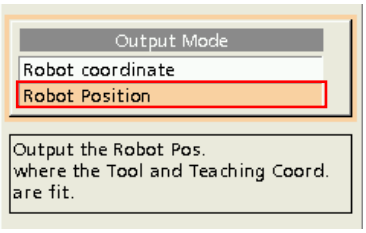
**2.** Move the cursor to the "Output Mode" field of a teaching group from which you want to output the robot position, and then press the ENTER key.



| No. | Comment | Output Mode | TOOL |
|---|---|---|---|
| 0 | 1 | Robot coordinate | |
| 1 | 2 | Robot coordinate | |
| 2 | 3 | Robot coordinate | |
| 3 | | | |
| 4 | | | |

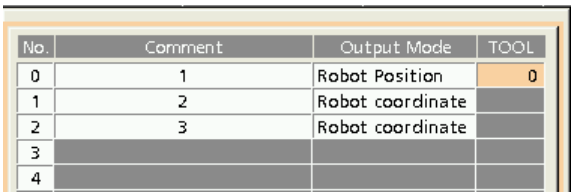
**3.** When the "Output Mode" selection screen appears, select "Robot Position".

The "Tool" field on the right side of the "Output Mode" field is made valid.




**4.** Press the ENTER key in the "Tool" field.

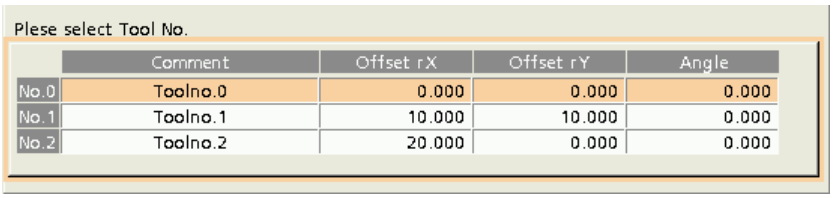
The Select tool No. screen appears.



| No. | Comment | Output Mode | TOOL |
|---|---|---|---|
| 0 | 1 | Robot Position | 0 |
| 1 | 2 | Robot coordinate | |
| 2 | 3 | Robot coordinate | |
| 3 | | | |
| 4 | | | |

**5.** Select "Tool" No.

Using the cursor, select the Tool No. field you want to select, and press the ENTER key.



Plese select Tool No.

| | Comment | Offset rX | Offset rY | Angle |
|---|---|---|---|---|
| No.0 | Toolno.0 | 0.000 | 0.000 | 0.000 |
| No.1 | Toolno.1 | 10.000 | 10.000 | 0.000 |
| No.2 | Toolno.2 | 20.000 | 0.000 | 0.000 |

**6.** The tool No. selected makes the value of coordinate data list take into account the value of tool offset.

**7.** Press the ENTER key in the comment field of each teaching group.

The cursor moves to the "Output" field in the list of coordinate data at right.

**8.** Select the robot position coordinates to be output. If unnecessary data are found, press the ENTER key in the "Output" field to delete "X" mark.

▶ Note

- With default settings, "X" mark appears in all "Output" fields of coordinate data.
- If coordinate data to be output to all groups registered are not found ("X" mark is not found at all), the "Output(TO RUNMENU)" button is displayed as an invalid button.

**9.** Pressing the "Output(TO RUNMENU)" button switches to RUN Menu.

Teaching coordinates can be output by entering the command into the PV260. Even when the screen normally switches to RUN Menu, teaching coordinates can be output.

# Use teaching coordinates with other functions

Teaching coordinates set by the teaching assistant function are available for calibration setting and working position setting.

Settings with which teaching coordinates are available

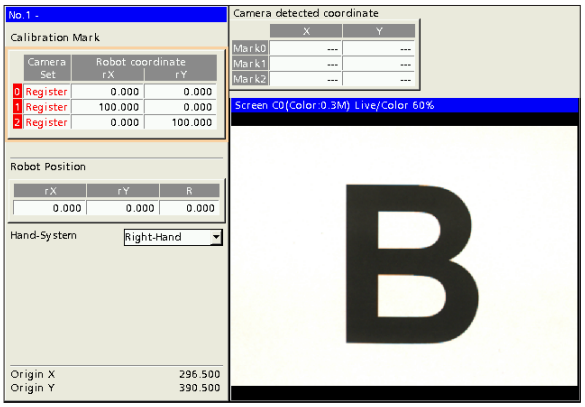
| Function | Relevant control |
|---|---|
| Calibration setting (manual) | Calibration setting screen<br>rX column and rY column of "Robot coordinate" grid |
| Calibration setting (Semi-Auto) | Calibration setting screen<br>rX column and rY column of "Robot coordinate" grid |
| Working Position Setting | Working Position Setting screen<br>rX column and rY column of "Working Pos." grid |

## Use teaching coordinates in calibration setting

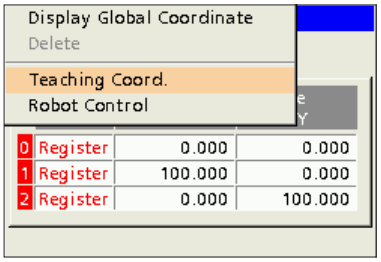
Teaching coordinates are available as robot coordinates at the time of calibration mark setting.

***1.*** Open the specified setting screen for calibration.

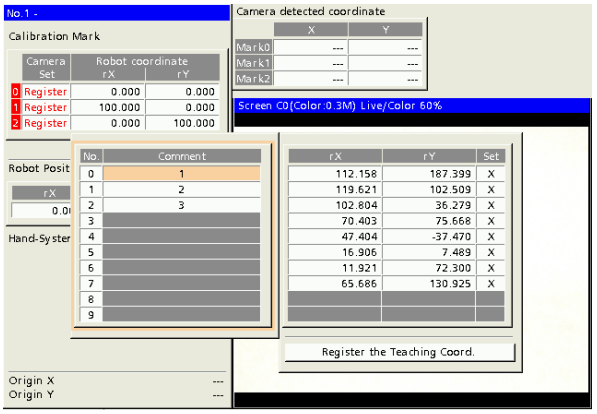
The right figure shows a screen available when the calibration method is "Manual(3 point)".




***2.*** Press the FUNC key in the robot coordinate field of calibration mark setting to display a pop-up menu, and then select "Teaching Coord."

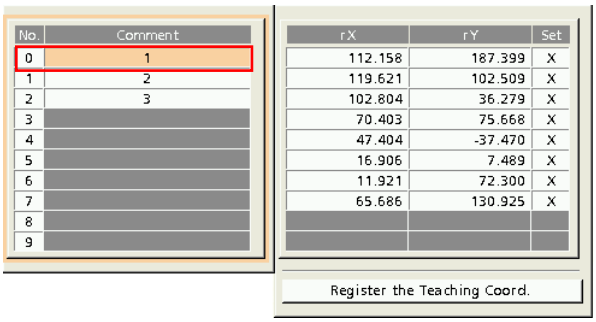



***3.*** SETUP Menu for teaching coordinates then appears.

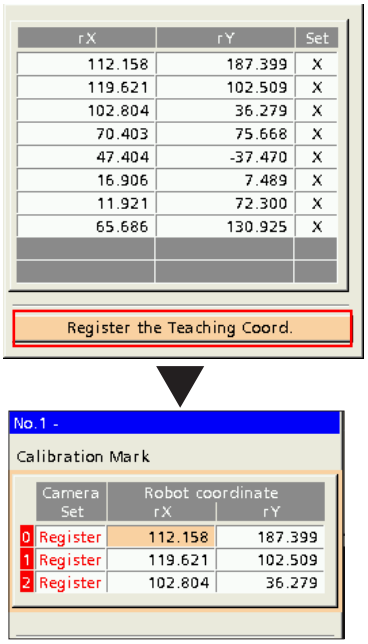


**4.** Press the ENTER key in the comment field of the teaching coordinate group you want to use.

Comment list screen disappears and the cursor moves to the "Register the Teaching Coord." button.




**5.** Pressing the "Register the Teaching Coord." button reflects the values upon the Robot coordinate setting field with calibration marks.




▶ Note

- When selecting teaching coordinates to be used for settings, move the cursor to the list of coordinates and press the ENTER key. When mark "X" is displayed or hidden by pressing the ENTER key in the setting field, coordinate values can be selected for settings.

▶ Note

### Rules for Applying Teaching Coordinates

The following conditions are applied to the No. of Set Checkers to be reflected upon the setting field when teaching coordinates are used for functions.

| Function | Registration Conditions | |
|---|---|---|
| Calibration setting (manual) | Execution of Output of Teaching Coordinates with the coordinate field of mark 0 selected | Registration of 1st to 3rd data in teaching coordinates |
| | Execution of Output of Teaching Coordinates with the coordinate field of mark 1 selected | Registration of 1st to 2nd data in teaching coordinates |
| | Execution of Output of Teaching Coordinates with the coordinate field of mark 2 selected | Registration of 1st data in teaching coordinates |
| Calibration setting (Semi-Auto) | Registration of 1st data in teaching coordinates | |
| Working Position Setting | Registration of all data in teaching coordinates<br>* However, when three data are to be registered in No. 998 of working position, they are registered in Nos. 998 and 999 only and are not registered in No. 000. | |

# 4.4 Work Detection

## Outline of Work Detection

In Work Detection, you can calculate the position of center of gravity of work, which is too large for the whole view to come out within one field, amount of deviation from the base position of substrate, etc., and working position taking into account the amount of deviation.

■ For what the working detection function is available

<Calculation of absolute position>

- When work is too large for the whole image to come out within one field, the absolute position can be calculated by capturing the position of the center of gravity of the work in 2 to 4 fields of view.
- It is used to calculate pickup positions, place positions, coating positions, etc.

<Adjustment Amount>

- Adjustment amount can be calculated by capturing images in 1 to 4 fields of view for the amount of deviation (△X, △Y, △θ) from the base position of substrate, etc.
- Palletizing or coating work can be performed at adjusted positions by creating adjustment program based on the amount of deviation in the robot, PLC, etc.

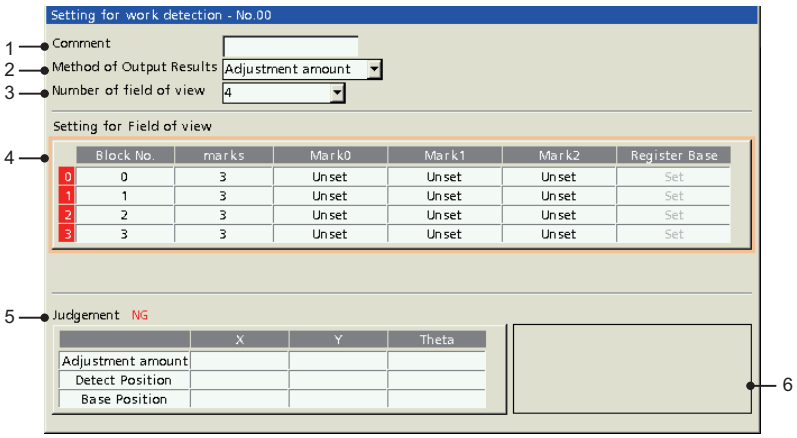
<Working position>

- Working position with the position deviated can be calculated, based on the amount of deviation (△X, △Y, △θ) from the base position of substrate etc., and the work position specified as the base position.
- Unlike adjustment amount, calculation on the robot or PLC side is unnecessary.
- Palletizing work and coating work can be performed.

■ Feature of work detection function

- Work detection can be set for up to 16 pieces per type. (8 pieces per camera)

## How to use the work detection screen




| | | |
|---|---|---|
| 1 | Comment | Up to 16 alphanumeric characters can be entered. |
| 2 | Method of Output | Selects the results to be calculated by the work detection. Absolute coordinates, adjustment amount, or working position can be selected. |

<table>
<tr><td>3</td><td>Number of field of view</td><td>For multiple fields of view, 1 to 4 fields of view can be set. This field appears when "User Defined" is selected for the execution mode.<br>▶ Note<br>• Perform work detection in multiple fields of view requires selecting "User Defined" for the execution mode. The number of field of view selectable varies according to the number of blocks. For details on work detection in multiple fields of view, refer to “4.4.3 Find Gravity Coordinates of Work (Multiple fields of View)” on page 143.<br>• In one field of view, "Execute All" is selected for the execution mode and, therefore, this field is hidden.</td></tr>
<tr><td>4</td><td>Setting for Field of view</td><td>Set the number of marks and the checkers to be used for mark detection. When calculating adjustment amount, register the base position.<table><tr><td>Block No.</td><td>Block Nos. 0 to 9 can be registered according to the number of blocks to be used.</td></tr><tr><td>Marks</td><td>The number of marks that can be registered is 1 to 3.</td></tr><tr><td>Marks 0 to 2</td><td>Checker, Result Type, and Result No. are specified to detect each mark.</td></tr><tr><td>Register Base</td><td>Setting button for base position registration to calculate adjustment amount.</td></tr></table>▶ Note<br>• When "Execute All" is selected for the execution mode, "Block No." cannot be specified.<br>• When "Absolute coordinates" is selected for "Method of Output", it is indicated that the "Register Base" field is invalid.</td></tr>
<tr><td>5</td><td>Judgement field</td><td>Displays the calculation results of adjustment amount, center of gravity coordinates and angle.</td></tr>
<tr><td>6</td><td>Error message field</td><td>Displays an error message.</td></tr>
</table>

# 4.4.1 Find Gravity Coordinates of Work (1 Field of View)

Detecting marks 1 to 3 of work coming out within 1 field of view, calculate robot coordinates. The center of gravity coordinates found in this section can be registered as a base position to be used for calculating the adjustment amount of work in the next chapter.

■ Data to be output

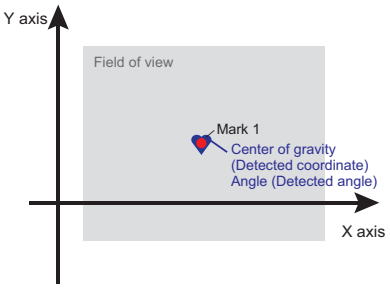
- Center of gravity coordinates
- Angle

### How to find the center of gravity <1 mark>

Find the angle by calculating the detected coordinates of mark 1 as the center of gravity coordinates.

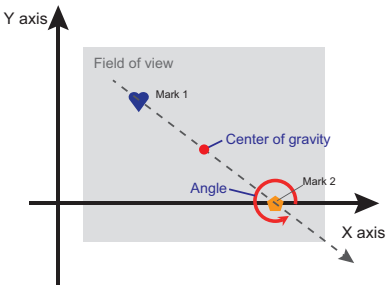
Note

For the detected angle found with 1 mark, the angle can be detected only when the mark shows an angle direction. In addition, when FE detection checker is used for work detection, the results of range of +/- 90 degrees are calculated.



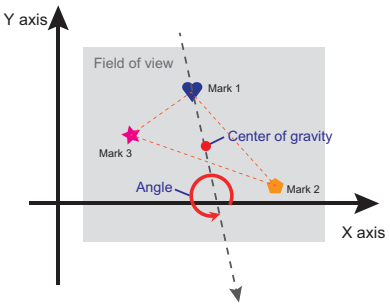

### How to find the center of gravity <2 mark>

The center of gravity coordinates is calculated from a straight line connecting the detected coordinates of mark 1 and mark 2. In addition, the angle formed by the straight line connecting the detected coordinates of mark 1 and the center of gravity, and the X axis is specified as the detected angle.



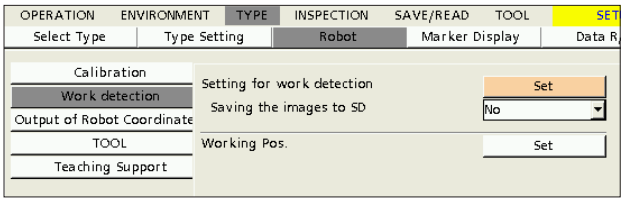

### How to find the center of gravity <3 mark>

The center of gravity of a triangle formed by connecting detected coordinates of marks 1, 2, and 3 is specified as the center of gravity coordinates. In addition, the angle formed by the straight line connecting the detected coordinates of mark 1 and the center of gravity is specified as the detected angle.




## Setting Procedure (Absolute coordinates)

***1.*** Press the "Set" button in "Setting for work detection" from "TYPE" > "Robot" > "Work detection".



**2.** Select the camera and then select a work detection No.

| | |
|---|---|
| Camera No. 0 | 0 to 7 |
| Camera No. 1 | 8 to 15 |

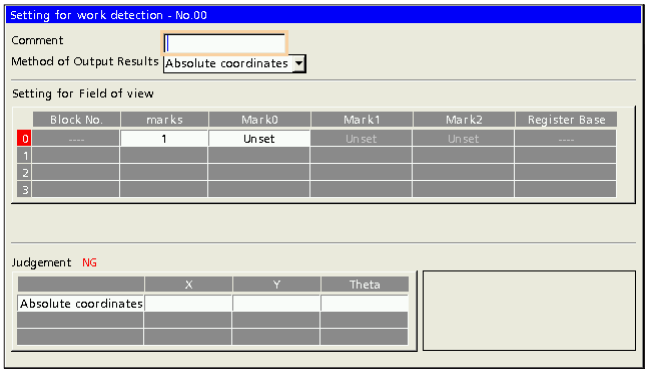
▶ Note

Work detection can be set for up to 16 pieces per type.

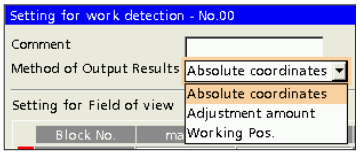
**3.** The work detection setting screen appears.

**4.** Enter "Comment" as needed.

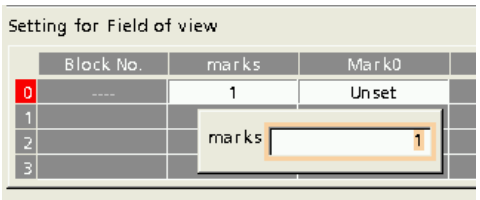
Comment entered is displayed in the list on the work detection No. setting screen.




**5.** Select "Absolute coordinates" for "Method of Output".




**6.** Select the "Marks" field and enter the number of marks.




| | |
|---|---|
| Value | 1 to 3 (Default: 1) |

▶ Note

Entry in the [Mark 0] to [Mark 2] fields is allowed according to the number of marks. If the number of marks is changed after the checker setting is made for each mark, inappropriate mark fields are displayed in gray.

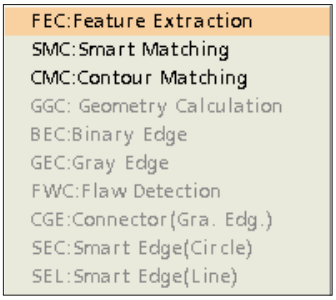
| | |
|---|---|
| When the number of marks is 1 | Only Mark 0 is valid |
| When the number of marks is 2 | Mark 0 and Mark 1 are valid |
| When the number of marks is 3 | Mark 0, Mark 1, and Mark 2 are valid |

## 7. Set the checker to be used for work detection in the "Mark 0" to "Mark 2" fields according to the number of marks set.

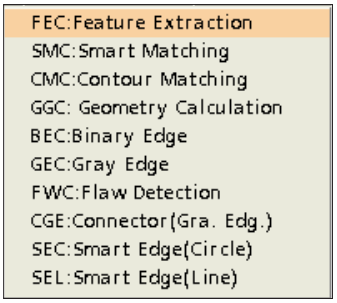
▶ Note

When the number of marks is 1, only the Feature Extraction, Smart Matching, and Contour Matching checkers are available.

When the number of marks is 1




When the number of marks is 2 or 3

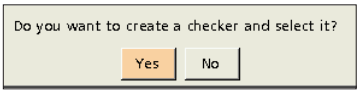


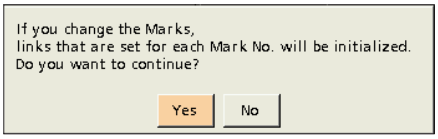

| List of work detection checkers | 1 point | 2 point | 3 point |
|---|---|---|---|
| BEC: Binary Edge | No | Yes | Yes |
| GEC: Gray Edge | No | Yes | Yes |
| FEC: Feature Extraction | Yes | Yes | Yes |
| SMC: Smart Matching | Yes | Yes | Yes |
| CMC: Contour Matching | Yes | Yes | Yes |
| FWC: Flaw Detection | No | Yes | Yes |
| CGE: Connector (Gray Edge) | No | Yes | Yes |
| SEC: Smart Edge (Circle) | No | Yes | Yes |
| SEL: Smart Edge (Line) | No | Yes | Yes |
| GGC: Geometry Calculation | No | Yes | Yes |

(Yes: Referable, No: Not referable)

▶ Note

- Various checkers registered from "Inspection > "Checker" can be referred. When checker to be referred does not exist, the message "Do you want to create a checker?" appears.
- If the number of marks is changed from 2 or 3 to 1, and the checker selected cannot be referred in Mark 0, the message at right appears. In response to it, selecting "Yes" initializes information on the checker.

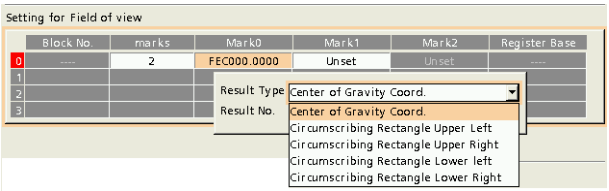



## 8. Press the CANCEL key to close the checker setting window.

## 9. Set "Result Type" and "Result No."

Setting items of "Result Type" and "Result No." differ depending on the checker selected. Refer to the list on the next page.

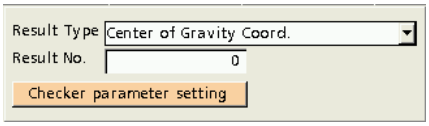


| Checker Type | Result Type | Target Result No. | Display Character |
|---|---|---|---|
| Binary Edge | XY coordinate | 0 to 255 | BEC000.000 |
| Gray Edge | XY coordinate | 0 to 255 | GEC000.000 |
| Feature Extraction | Center of gravity coordinates | 0 to 9999 | FEC000.0000 |
| | Circumscribing Rectangle Upper Left | 0 to 9999 | FEC000_LU.0000 |
| | Circumscribing Rectangle Upper Right | 0 to 9999 | FEC000_RU.0000 |
| | Circumscribing Rectangle Lower left | 0 to 9999 | FEC000_LD.0000 |
| | Circumscribing Rectangle Lower Right | 0 to 9999 | FEC000_RD.0000 |
| Smart Matching | XY coordinate | 0 to 255 | SMC000.000 |
| Contour Matching | XY coordinate | 0 to 63 | CMC000.000 |
| Flaw Detection | XY coordinate | 0 to 511 | FWC000.000 |
| Connector (Gray Edge) | Area0 | 0 to 99 | CGE000_0.00 |
| | Area1 | 0 to 99 | CGE000_1.00 |
| Smart Edge (Circle) | Center0 | --- | SEC000_C0 |
| | Center1 | --- | SEC000_C1 |
| | Cell Individual Result0 | 0 to 3599 | SEC000_0.0000 |
| | Cell Individual Result1 | 0 to 3599 | SEC000_1.0000 |
| Smart Edge (Line) | Max. Measurement Coord. | --- | SEL000_MAX |
| | Min. Measurement Coord. | --- | SEL000_MIN |
| | Line0 Start Coord. | --- | SEL000_S0 |
| | Line0 End Coord. | --- | SEL000_E0 |
| | Line1 Start Coord. | --- | SEL000_S1 |
| | Line1 End Coord. | --- | SEL000_E1 |
| | Cell Individual Result0 | 0 to 2999 | SEL000_0.0000 |
| | Cell Individual Result1 | 0 to 2999 | SEL000_1.0000 |
| Geometry Calculation | XY coordinate | --- | GGC000_P0 |
| | Intersection0 XY coordinate | --- | GGC000_C0 |
| | Intersection1 XY coordinate | --- | GGC000_C1 |

▶ Note

The 3-digit number after 3 alphabetic characters of Checker type in "Display Character" represents a checker number, the number after the period, a Result No. Example: FEC000.0000
Checker number ↑ ↑ Result No.

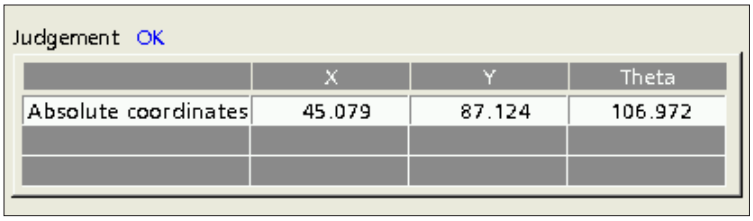
**10.** To change the setting contents of the checker referred, press the "Checker parameter setting" button.




▶ Note

The "Checker parameter setting" button is not displayed when the checker for each mark is set for the first time. To use the button, exit the mark field by pressing the CANCEL key and then select it again.

**11.** Press the TRIG key to carry out work detection and confirm the absolute coordinates of the Judgement field.

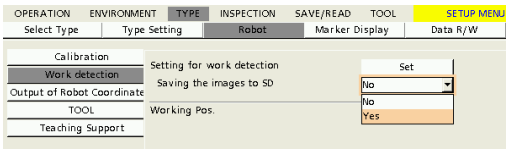


# Saving Work Detection Image in an SD card

Images at the time of base registration can be saved in an SD card. For Register Base, refer to “4.4.2 Find Adjustment Amount of Work (1 Field of View)” on page 140 and “4.4.4 Find Adjustment Amount of Work (Multiple Fields of View)” on page 147 described later.

**1.** Select "Yes" for "Saving the images to SD" from "TYPE" > "Robot" > "Work detection".

Default: "No"




Destination to save SD images: Panasonic-ID SUNX Vision\PV260\Image\Robot

▶ Note

How to use the file name of work detection image when SD image is saved

Workss_Basex_Cc_nn_xxx.bmp
1 2 3 4 5

| | |
|---|---|
| 1 | ss: Set No. |
| 2 | x: Field of view No. (0 to 3) |
| 3 | c: Camera No. (0, 1) |
| 4 | nn: Work Detection No.(00 to 15) |
| 5 | xxx: Image No. (000 to 063)* |

* : For Image No., 4 fields of view (4 images) are used by the set, and up to 16 sets can be saved. Note that the serial number format of set numbers to be added differs depending on whether the screen used for base position registration is RUN Menu or SETUP Menu. The table below is an example where 4 fields of view are used.

Image No. applicable when a base position is registered in RUN Menu

| Set No. | Field of view No. | Image No. |
|---|---|---|
| No.0 | Field of view 1 | 000 |
| | Field of view 2 | 001 |
| | Field of view 3 | 002 |
| | Field of view 4 | 003 |
| No.1 | Field of view 1 | 004 |
| | Field of view 2 | 005 |
| | Field of view 3 | 006 |
| | Field of view 4 | 007 |
| No.2 | Field of view 1 | 008 |
| | Field of view 2 | 009 |
| | Field of view 3 | 010 |
| | Field of view 4 | 011 |
| : | : | : |
| No.15 | Field of view 1 | 060 |
| | Field of view 2 | 061 |
| | Field of view 3 | 062 |
| | Field of view 4 | 063 |

Image No. applicable when a base position is registered in SETUP Menu

| Set No.*1 | Field of view No. | Image No. |
|---|---|---|
| No. 0 | View field 1 | 000 |
| No.1 | View field 2 | 005 |
| No.2 | View field 3 | 010 |
| No.3 | Field of view 4 | 015 |
| : | : | : |
| No.14 | Field of view 1 | 056 |
| No.15 | Field of view 2 | 061 |

*1: A set No. is added each time a base position is registered in SETUP Menu. (A set No. is added for each image.)

▶ Note

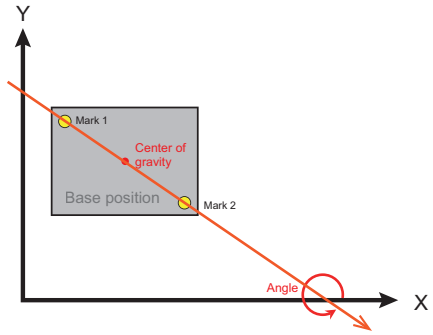
- If a field of view No. is not used, the image No. corresponding to it is skipped to register data.
- When file set Nos. 0 to 15 are full, files are overwritten in order from the set with the oldest date.

# 4.4.2 Find Adjustment Amount of Work (1 Field of View)

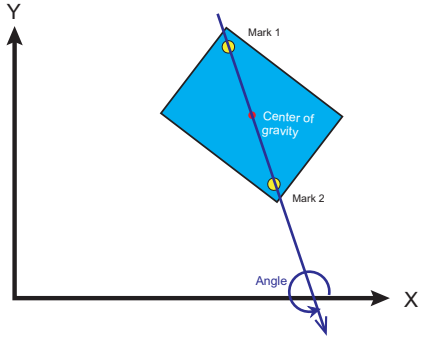
Detecting marks 1 to 3 that come out within 1 field of view, calculate the robot coordinates of center of gravity, and then register them as the base position. Calculate X adjustment amount, Y adjustment amount, and θ adjustment amount based on the center of gravity detected at the time of inspection execution and the registered base position.

How to find adjustment amount

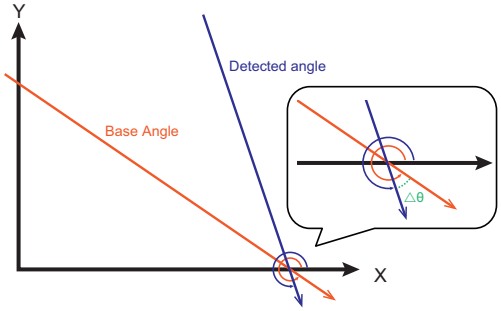
1. After finding the center of gravity coordinates, register the base, and set the center of gravity coordinates to be specified as the base position and the angle.



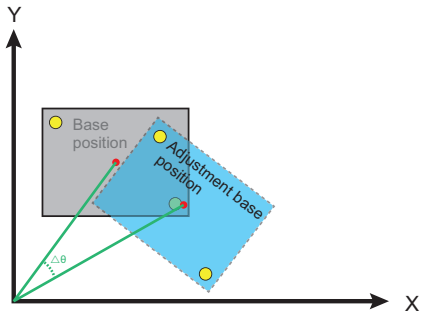

2. Execute the inspection and detect the center of gravity coordinates and angle.



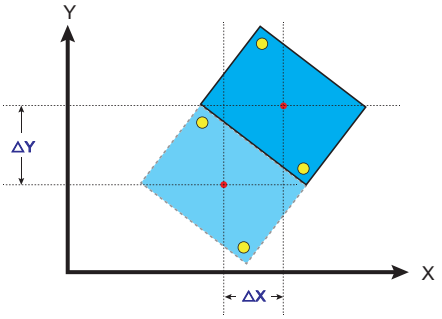

3. Subtracting the base angle from the angle detected in Step 2 above, find angle adjustment amount.




4. Rotate the base center of gravity coordinates for the angle adjustment amount in Step 3 around the origin of robot coordinates.




5. Specify the amount of movement for X, Y between the detected center of gravity coordinates and the base center of gravity coordinates after the rotation.



## Setting Procedure (adjustment amount)

**1.** Press the "Set" button in "Setting for work detection" from "TYPE" > "Robot" > "Work detection".

**2.** Select the camera and then select a work detection No.

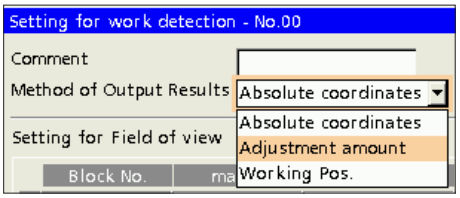
| | |
|---|---|
| Camera No. 0 | 0 to 7 |
| Camera No. 1 | 8 to 15 |

▶ Note

Work detection can be set for up to 16 pieces per type.

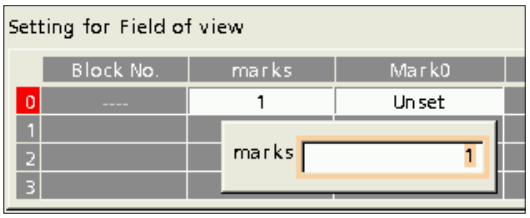
**3.** The work detection setting screen appears.

**4.** Select "Adjustment Amount" for "Method of Output".

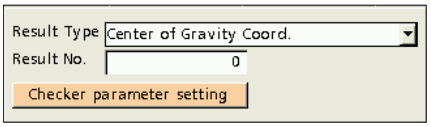



**5.** Set "Marks" and the "Mark0" to "Mark2" fields.

The settings of "Marks" and the "Mark0" to "Mark2" fields are the same as those of Steps 6 to 9 in the section above. Referring to the section above, make the settings.



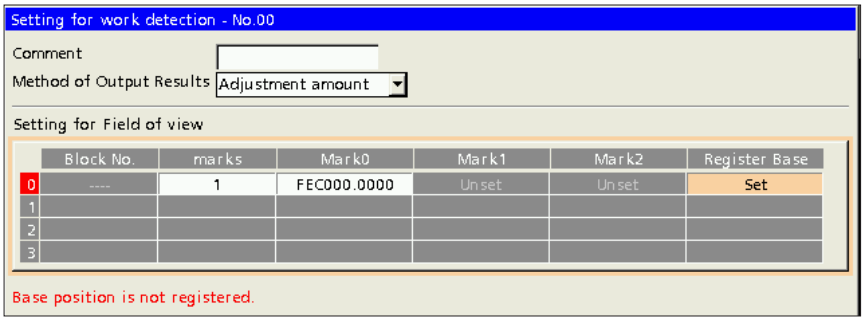

**6.** To change the setting contents of the checker referred, press the "Checker parameter setting" button.




▶ Note

The "Checker parameter setting" button is not displayed when the checker for each mark is set for the first time. To use the button, exit the mark field by pressing the CANCEL key and then select it again.

**7.** Press the ENTER key in the "Register Base" field.



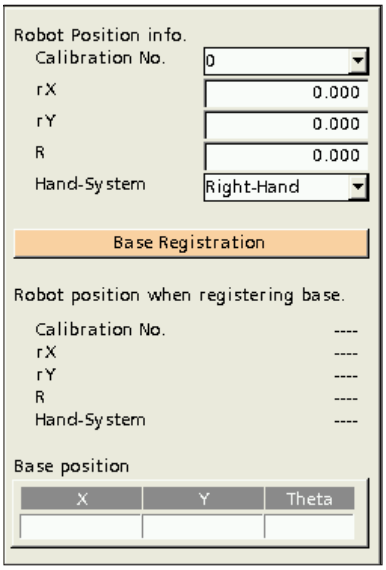
## 8. The robot position information registration screen appears.

From the pull-down menu, select the calibration No. of the robot currently being used, and then press the "Register Base" button. The base position can be calculated by the coefficient of the calibration No. specified.

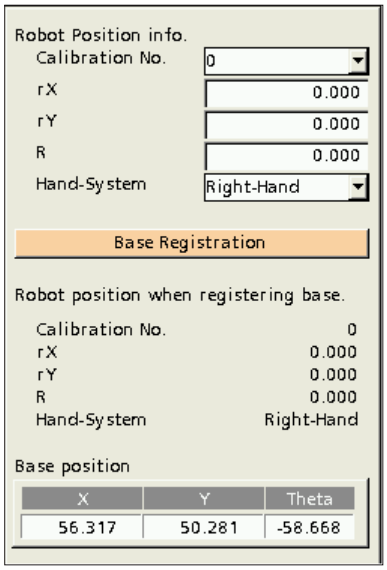
▶ Note

- If "Yes" is selected from "TYPE" > "Robot" > "Work detection" > "Saving the images to SD", images at the time of base registration can be saved in an SD card.
- Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.

Before registration




After registration



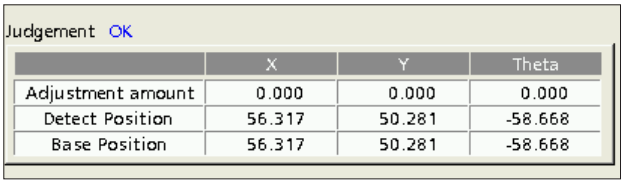

▶ Note

When fixed camera is used, setting of robot position information is not required and no entry is allowed. Press the Register Base button for completion.

## 9. When the base registration is performed normally, the message "Base position is registered." appears.

When the base registration is completed, press the CANCEL key to close the register base screen.


## 10. Press the TRIG key to carry out work detection and confirm the adjustment amount of the Judgement field.



# 4.4.3 Find Gravity Coordinates of Work (Multiple fields of View)

Detecting marks of the work coming out within 2 to 4 fields of view, calculate robot coordinates of center of gravity in each field of view. When the inspection in all fields of view is completed based on the robot coordinates of center of gravity in each field of view, calculate the robot coordinates of view in multiple fields of view.

## Work Detection in Multiple Fields of View and Execution Mode

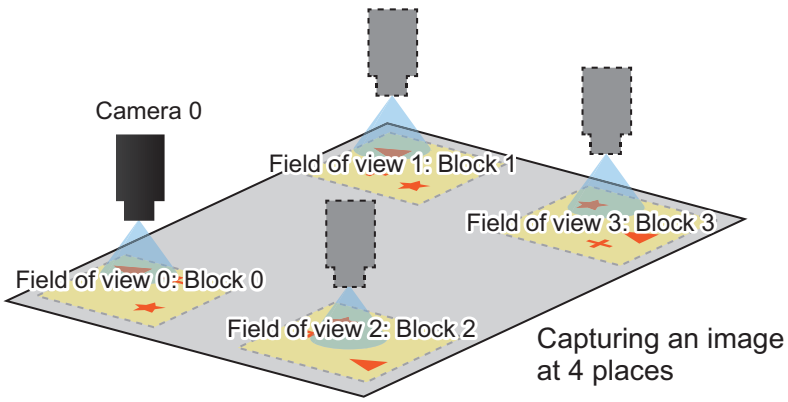
When the work detection is performed in multiple fields of view, the robot coordinates of center of gravity and adjustment amount are calculated in a state where the execution results in each field of view are retained and, therefore, "User Defined" must be selected for the execution mode of the PV260. If the block No. to be used is determined in each field of view in advance, the work detection can be carried out in each block No. (each field of view) specified.

▶ Note

"User-defined mode" is a function of executing an inspection in units of specified blocks (Nos. 0 to 9). For details on the execution mode, refer to Section 4.4 "Inspecting Divided Type (Execution Mode)" in the PV200 Manual.

| Execute All | User Defined |
|---|---|
| Number of field of view: 1 | Number of field of view: 1 to 4 |
| • In the inspection execution, all checkers, Numerical Calculation, and Judgement within Type are carried out (block No. is not allowed to be specified). | • Executed only when inspection is executed for the specified block (Block No. must be specified)<br>• If the number of field of view is 2 or more, the results of multiple fields of view are calculated with the inspection executed in all the fields of view). |

Image of "User Defined" in multiple fields of view




"User Defined" is carried out in each block during the inspection execution by assigning a block No. to each field of view.

▶ Note

- Calculate the position of center of gravity by detecting the marks in all specified fields of view.
- Blocks are specified regardless of the order.
- Execute one of the following if no mark can be detected in each field of view when multiple fields of view are used. Incorrect result may be output if the following actions are not taken with no mark detected.
  - Repeat the inspection until the mark is detected.
  - Inspect the next work regarding the target work as an NG product. Note that images should be captured in the same order of fields of view.

## Setting Procedure

**1.** Select "User Defined" for "Execution Mode" from "TYPE" > "Type Setting" > "Execution Condition", and then enter the number of blocks.

Note

- If you change the Execution Mode to "Execute All" after various settings are made for setting for work detection with "User Defined", only the setting contents for "No. 0 of field of view" are valid, and the setting contents for Field of view 1 to Field of view 3 are hidden. However, since the setting contents for each field of view are retained in type data, selecting "User Defined" again displays the previous setting contents for Field of view 1 to Field of view 3.

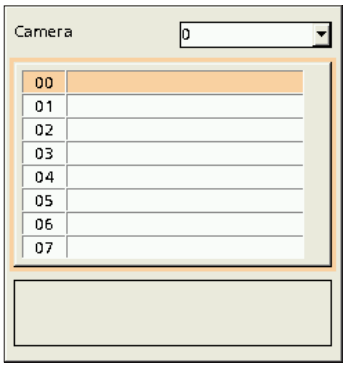
**2.** Press the "Set" button in "Setting for work detection" from "TYPE" > "Robot" > "Work detection".

**3.** Select the camera and then select a work detection No.

| | |
|---|---|
| Camera No. 0 | 0 to 7 |
| Camera No. 1 | 8 to 15 |

Note

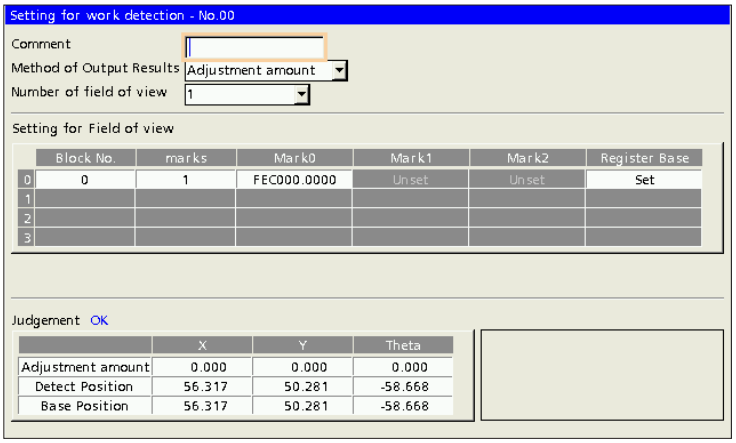
Work detection can be set for up to 16 pieces per type.



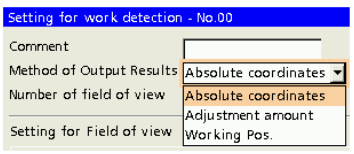

**4.** The work detection setting screen appears.

**5.** Enter "Comment" as needed.

Comment entered is displayed in the list on the work detection No. setting screen.

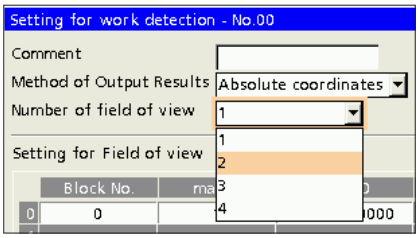



**6.** Select "Absolute coordinates" for "Method of Output".



## 7. Set "Number of field of view".

| Value | 1 to 4 (Default: 1) |
|---|---|

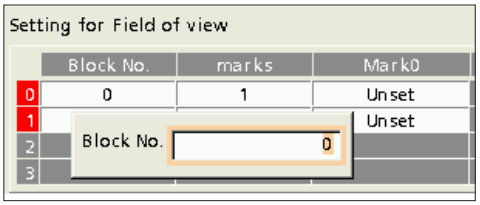



▶ Note

- The display of the selectable number of field of view varies depending on "Number of Blocks" selected for "Execution Condition".
- If "Execute All" is selected for "Execution Condition", the setting field for "Number of fields of view" is not displayed.
- If the number of field of view decreases after the registration of checker information on each mark, the block Nos. for irrelevant fields of view are hidden but the setting contents are retained in type information. If the number of field of view increases, checker information of the block Nos. set previously appears again.

## 8. Move the cursor to the "Setting for Field of view" field, and press the ENTER key in the "Block No." field to set the block No.

| | | |
|---|---|---|
| Value | Field of view 0 | 0 to 9 (Default: 0) |
| | Field of view 1 | 0 to 9 (Default: 1) |
| | Field of view 2 | 0 to 9 (Default: 2) |
| | Field of view 3 | 0 to 9 (Default: 3) |

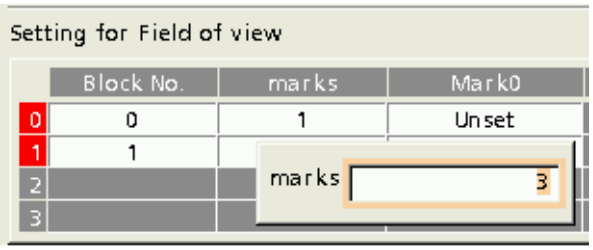



▶ Note

- The selectable range of settable block No. changes depending on "Number of Blocks" selected for "Execution Condition".
- If "Execute All" is selected for Execution Mode in "Execution Condition", the Block No. setting field cannot be selected.

## 9. Select the "Marks" field and enter the number of marks.

| Value | 1 to 3 (Default: 1) |
|---|---|




▶ Note

Entry in the [Mark 0] to [Mark 2] fields is allowed according to the number of marks.
If the number of marks is changed after the checker setting is made for each mark, inappropriate mark fields are displayed in gray.

| | |
|---|---|
| When the number of marks is 1 | Only Mark 0 is valid |
| When the number of marks is 2 | Mark 0 and Mark 1 are valid |
| When the number of marks is 3 | Mark 0, Mark 1, and Mark 2 are valid |

## 10. Set the checker to be used for work detection in the "Mark 0" to "Mark 2" fields.

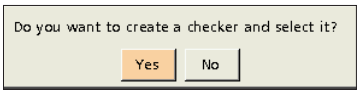
| List of work detection checkers | 1 point (When the number of field of view is 1) | 1 point | 2 point | 3 point |
|---|---|---|---|---|
| BEC: Binary Edge | No | Yes | Yes | Yes |
| GEC: Gray Edge | No | Yes | Yes | Yes |
| FEC: Feature Extraction | Yes | Yes | Yes | Yes |
| SMC: Smart Matching | Yes | Yes | Yes | Yes |
| CMC: Contour Matching | Yes | Yes | Yes | Yes |
| FWC: Flaw Detection | No | Yes | Yes | Yes |

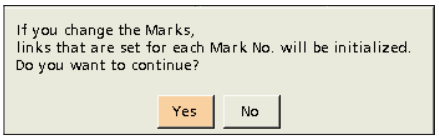
| List of work detection checkers | 1 point (When the number of field of view is 1) | 1 point | 2 point | 3 point |
|---|---|---|---|---|
| CGE: Connector (Gray Edge) | No | Yes | Yes | Yes |
| SEC: Smart Edge (Circle) | No | Yes | Yes | Yes |
| SEL: Smart Edge (Line) | No | Yes | Yes | Yes |
| GGC: Geometry Calculation | No | Yes | Yes | Yes |

(Yes: Referable, No: Not referable)

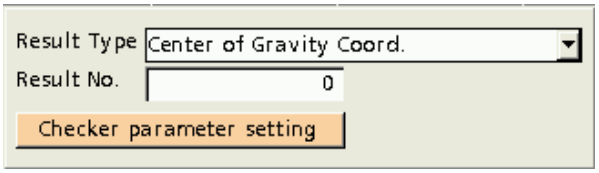
Note

- Various checkers registered from "Inspection" > "Checker" can be referred. When checker to be referred does not exist, the message "Do you want to create a checker?" appears.
- If the number of field of view is 1 and the number of marks is changed from 2 or 3 to 1, and the checker selected cannot be referred in Mark 0, the message at right appears. In response to it, selecting "Yes" initializes information on the checker.



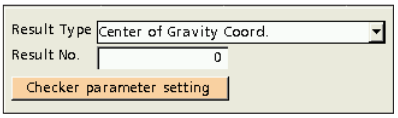

## *11.* Set "Result Type" and "Result No."




Note

Setting items of "Result Type" and "Result No." differ depending on the checker selected. Confirm the Result No. list in step 9 in Page 137.

## *12.* To change the setting contents of the checker referred, press the "Checker parameter setting" button.

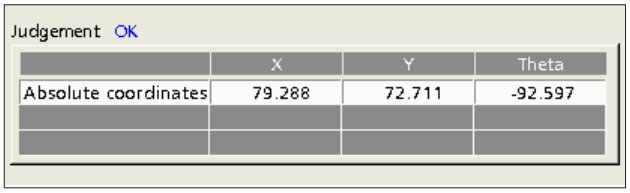



Note

The "Checker parameter setting" button is not displayed when the checker for each mark is set for the first time. To use the button, exit the mark field by pressing the CANCEL key and then select it again.

## *13.* Press the TRIG key to carry out work detection and confirm the absolute coordinates of the Judgement field.

If the inspection ends for all the block Nos., Judgement appears.



# 4.4.4 Find Adjustment Amount of Work (Multiple Fields of View)

Detecting marks of the work coming out within 2 to 4 fields of view, calculate robot coordinates of gravity in each field of view. You can calculate the adjustment amount (ΔX, ΔY, Δθ) between the calculated center of gravity and the base position set in advance.
Work detection in multiple views of field requires specifying "User-Defined" for Execution Mode beforehand. Since one block is used per field of view, the number of blocks to be set should be more than or equal to the number of fields of view. For the image of User-Defined in multiple fields of view, refer to Page 143.

▶ Note

- Calculate the position of center of gravity by detecting the marks in all specified fields of view.
- Blocks are specified regardless of the order.

▶Caution

Execute one of the following if no mark can be detected in each field of view when multiple fields of view are used. Incorrect result may be output if the following actions are not taken with no mark detected.

- The inspection is repeated until the mark is detected.
- The target work is regarded as an NG product to inspect the next work. Note that images are captured in the same order of fields of view.

Example: <Work 0> View field 0: OK → View field 1: OK → View field 2: OK → View field 3: OK → To proceed to next work 1

Good example of capturing order of images of work 1:View field 0 → View field 1 → View field 2 → View field 3

Bad example of capturing order of images of work 1: View field 3 → View field 2 → View field 1 → View field 0

When view field 3 is OK, the position of center of gravity is to be calculated by the results detected in view fields 0 to 2 of work 0 and the results detected in view field 3 of work 1. Therefore, execute in the order of fields of view.

## Setting Procedure

***1.*** Select "User-Defined" for "Execution Mode" from "TYPE" > "Type Setting" > "Execution Condition", and then enter the number of blocks.

▶ Note

- If you change the Execution Mode to "Execute All" after various settings are made for setting for work detection with "User-Defined", only the setting contents for "No. 0 of field of view" are valid, and the setting contents for Field of view 1 to Field of view 3 are hidden. However, since the setting contents for each field of view are retained in type data, selecting "User-Defined" again displays the previous setting contents for Field of view 1 to Field of view 3.

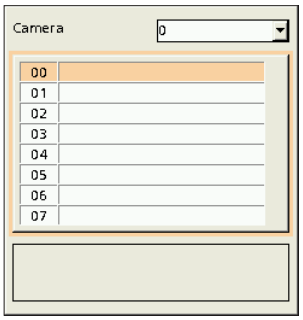
***2.*** Press the "Set" button in "Setting for work detection" from "TYPE" > "Robot" > "Work detection".

***3.*** Select the camera and then select a work detection No.

| | |
|---|---|
| Camera No. 0 | 0 to 7 |
| Camera No. 1 | 8 to 15 |

▶ Note

Work detection can be set for up to 16 pieces per type.

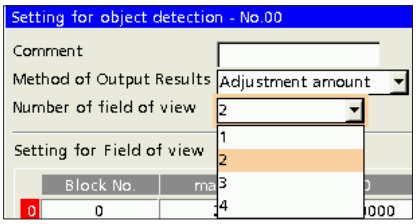


**4.** The work detection setting screen appears. Enter "Comment" as needed.

Comment entered is displayed in the list on the work detection No. setting screen.

**5.** Select "Adjustment Amount" for "Method of Output".

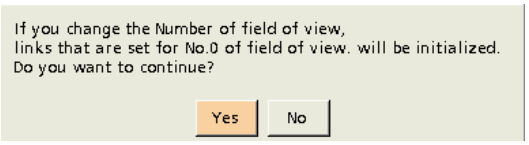
**6.** Set "Number of field of view".



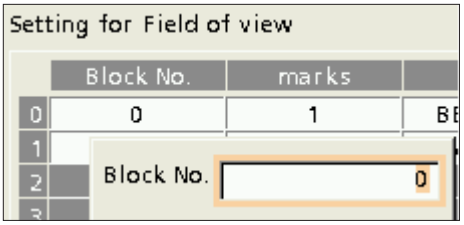

| Value | 1 to 4 (Default: 1) |
|---|---|

Note

- The display of the selectable number of field of view varies depending on "Number of Blocks" selected for "Execution Condition".
- If "Execute All" is selected for "Execution Condition", the setting field for "Number of fields of view" is not displayed.
- If the number of field of view decreases after the registration of checker information on each mark, the block Nos. for irrelevant fields of view are hidden but the setting contents are retained in type information. If the number of field of view increases, checker information of the block Nos. set previously appears again.
- Note that when the number of field of view is changed from two or more to one, and the number of marks in view field 1 is 1, and a checker not available with the number of marks set to 1 is used in mark 0, the message shown in the right figure appears.




**7.** Move the cursor to the "Setting for Field of view" field, and press the ENTER key in the "Block No." field to set the block No.

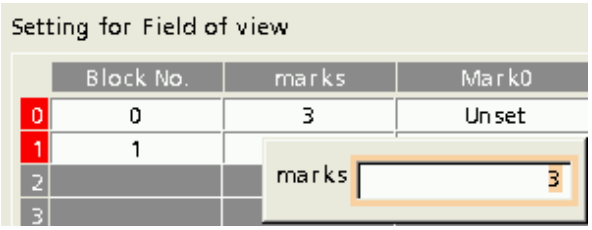



| Value | Field of view 0 | 0 to 9 (Default: 0) |
|---|---|---|
| | Field of view 1 | 0 to 9 (Default: 1) |
| | Field of view 2 | 0 to 9 (Default: 2) |
| | Field of view 3 | 0 to 9 (Default: 3) |

Note

- The selectable range of settable block No. changes depending on "Number of Blocks" selected for "Execution Condition".
- [[If "Execute All" is selected for Execution Mode in "Execution Condition", the Block No. setting field cannot be selected.

**8.** Select the "Marks" field and enter the number of marks.




| Value | 1 to 3 (Default: 1) |
|---|---|

Note

Entry in the [Mark 0] to [Mark 2] fields is allowed according to the number of marks. If the number of marks is changed after the checker setting is made for each mark, inappropriate mark fields are displayed in gray.

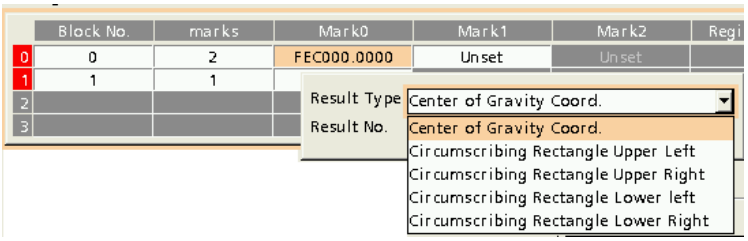
| When the number of marks is 1 | Only Mark 0 is valid |
|---|---|
| When the number of marks is 2 | Mark 0 and Mark 1 are valid |
| When the number of marks is 3 | Mark 0, Mark 1, and Mark 2 are valid |

**9.** Set the checker to be used for work detection in the "Mark 0" to "Mark 2" fields according to the number of marks set.

▶ Note

- The checker quotes new or existing settings.
- The type of available checkers is changed according to the number of marks. For the list of available checkers, refer to the table in step 10 on Page 145.

**10.** Set "Result Type" and "Result No."




▶ Note

Setting items of "Result Type" and "Result No." differ depending on the checker selected. Confirm the Result No. list in step 9 on Page 137.

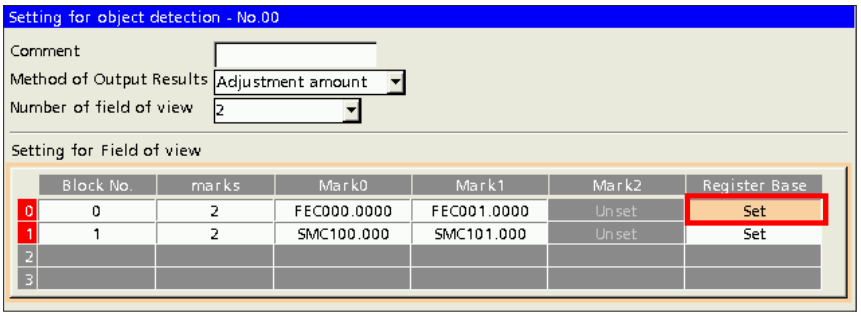
**11.** To change the setting contents of the checker referred, press the "Checker parameter setting" button.

▶ Note

The "Checker parameter setting" button is not displayed when the checker for each mark is set for the first time. To use the button, exit the mark field by pressing the CANCEL key and then select it again.

**12.** When the "Mark" settings are completed for each field of view, register the base position.

Press the ENTER key in the "Register Base" setting field.

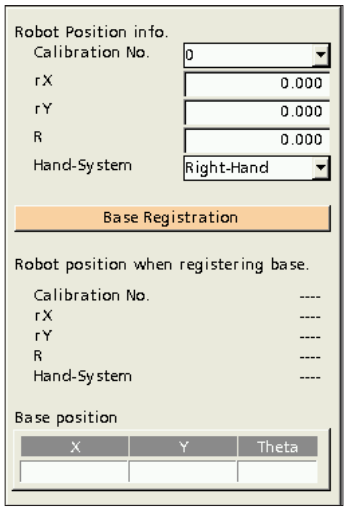
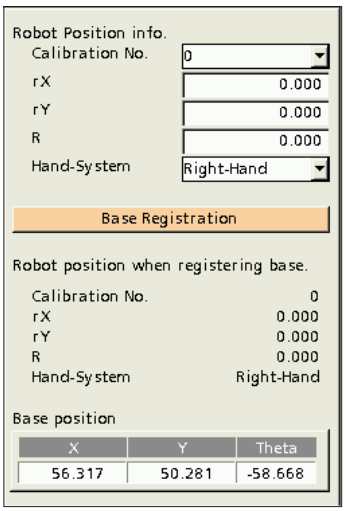


## 13. The Register Base screen appears.

Enter the robot position at the Capture position in view field 0 and Calibration No. to be used into "Robot Position Info.", and then press the ENTER key with the "Register Base" button selected. Detect the mark with a checker set in "Mark", calculate the robot coordinates based on the calibration data set in "Robot Position Info.", and then register them as the Base position.

▶ Note

Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.

| Before registration | After registration |
|---|---|
|  |  |





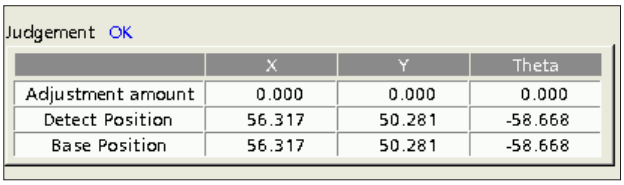
▶ Note

When fixed camera is used, setting of robot position information is not required and no entry is allowed. Press the Register Base button for completion.

## 14. When the base registration is performed normally, the message "Base position is registered." appears.


When the base registration is completed, press the CANCEL key to close the register base screen.

## 15. Press the TRIG key to carry out work detection and confirm the adjustment amount of the Judgement field.



# Copy Mark Detection Checker.

A checker set in each mark is available to set other marks by copying it.

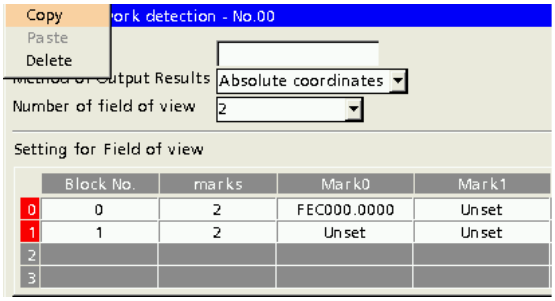
Copy the mark detection checker within the same field of view

Note

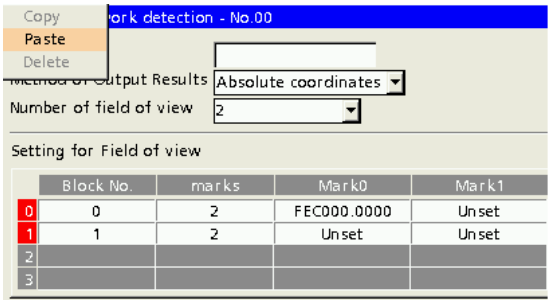
When copying within the same field of view, copy Checker type, Checker number and Result Type, and register them in the destination (copy to) by changing the result No.

***1.*** Select the mark field in which mark detection checker is set, and then press the FUNC key.

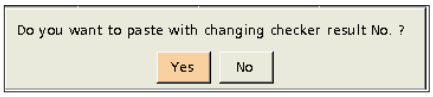
***2.*** When the pop-up menu appears, press "Copy".




***3.*** Select the mark field of the destination to paste to with the cursor and select "Paste".



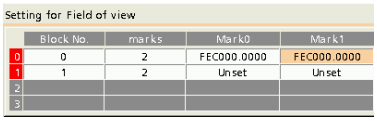

***4.*** In response to the message asking whether or not you want to paste the checker, select "Yes".




Selecting "Yes" copies the contents of checker to the mark field of the destination to paste to. Pressing "No" prevents pasting.

***5.*** Change Result No.


***6.*** The checker has been copied from the Mark 0 field to the Mark 1 field.



Copy mark detection checker between multiple fields of view.

▶ Note

- When copying between multiple fields of view, copy Checker type, Result Type, and Result No., and register them in the destination (copy to) by changing the checker No.*

* Copying a mark detection checker between multiple fields of view requires copying the checker to the block No. of the field of view (copy to). Note that the copy operation differs from that in the same field of view. Copying a mark detection checker between multiple fields of view changes the block No., resulting in changing the checker No.

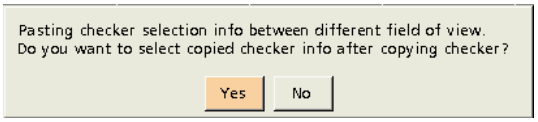
***1.*** Select the mark field in which mark detection checker is set, and then press the FUNC key.

***2.*** When the pop-up menu appears, press "Copy".

***3.*** Select the mark field of the destination to paste to with the cursor and select "Paste".

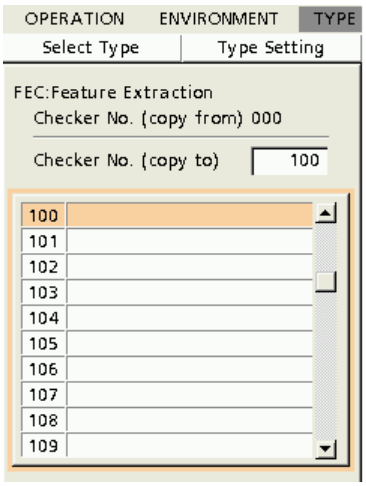
***4.*** In response to the message asking whether or not you want to paste the checker to the Block No. of the field of view (copy to), select "Yes".

Pressing "No" prevents pasting.

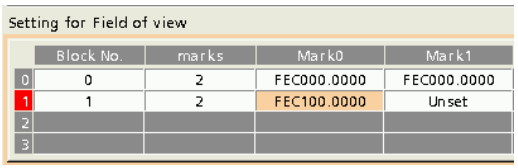



***5.*** Specify the checker No. (copy to).

The right figure shows that the checker of block No. 0 (copy from) is attempted to be copied to the checker of block No. 1 (copy to).




***6.*** The checker was copied from No. 0 of field of view (block No. 0) to Field of view 1 (block No. 1).



# 4.4.5 Convenient Function for Work Detection

## Work Detection Base Position Re-registration Command

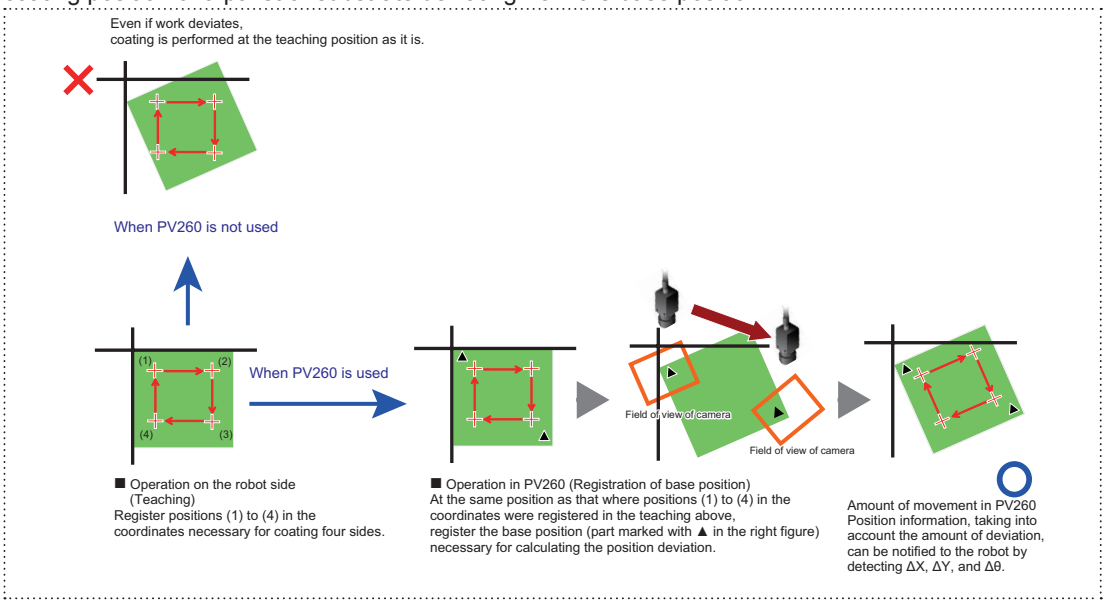
"Base Position" at the time of work detection requires setting Calibration No. If, for example, calibration No. 0 is set, changing the setting of calibration No. 0 after base position registration requires registering the base position again.
Therefore, if the work detection base position re-registration command (%WCS) is sent to the PV260, the base position can automatically be recalculated. For details on the command, refer to.“3.8.5 Details on General Communication Command” on page 61.

## Work Detection Base Position Re-registration Start Command

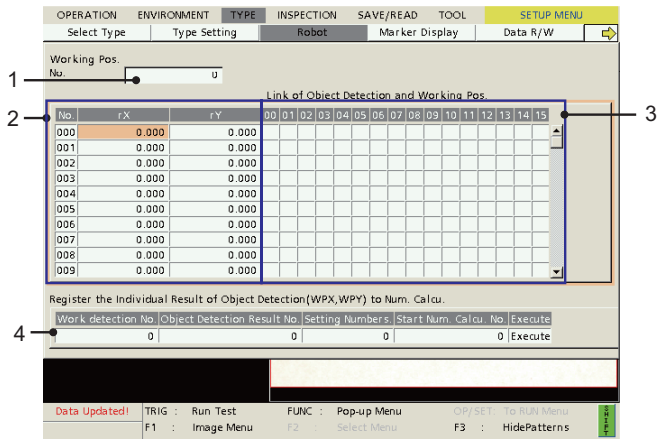
When base work is changed after base position registration, the base position must be registered again. Base position can automatically be re-registered by using the work detection base position re-registration start command (%WRSn) if the settings are not changed from those at the time of base position registration number of field of view, number of marks, and robot position information at the time of base registration). However, since the control by robot program is required, you must create an independent program. For details on the command, refer to.“3.8.5 Details on General Communication Command” on page 61.

# 4.5 Working Position Setting

Working position is a position where the robot performs picking up, placing, coating, etc. for the work. The PV260 can retain a pickup position, place position and coating position in a pallet or substrate that is installed in the base position. Based on the retained working position and the amount of deviation that can be calculated in work detection, you can calculate the pickup position, place position and coating position of a pallet or substrate deviating from the base position.



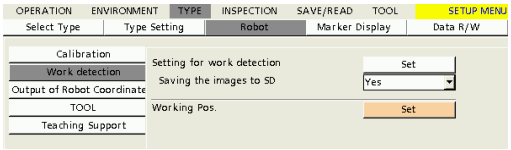

## How to use Working Position Setting Screen




| | | |
|---|---|---|
| 1 | Working Position No. Designation field | When the working position No. is specified in this field, press the ENTER key can select and display the grid field of the specified working position No. |
| 2 | Working Position Setting No.000 to No.299 | Register the coordinates specified as working positions. Up to 300 positions can be registered per type, ranging from No. 000 to No. 299. |
| 3 | Link of Object Detection and Working Pos. field | Vertical column numbers are work detection Nos. Whether to refer to a number is switched depending on whether "X" is displayed or hidden. Up to 100 work position Nos. can be referred per work detection No. |
| 4 | Registration of individual results to Numerical Calculation | Setting item to register the Individual Result of Object Detection (WPX, WPY) to Num. Calcu. For the procedure for setting, refer to Page 160. |

## Procedure for Setting Working Position

**1.** Press the "Set" button in "Operation Position Setting" from "TYPE" > "Robot" > "Work detection".




**2.** When the Operation Position Setting screen appears, press the ENTER key with the grid field selected at the center.

The cursor moves to the rX coordinate field of No. 000.

**3.** Select the rX and rY coordinate fields, press the ENTER key, and then enter the coordinates specified as working positions.

| | |
|---|---|
| Value | -99999.999 to 99999.999(Default: 0.000) |

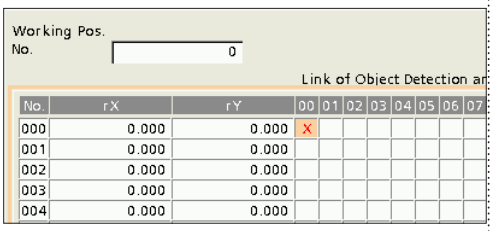
▶ Note

For Working Pos Nos., No. 000 to No. 299 can be registered per type.

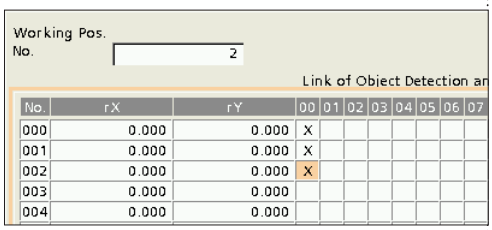
**4.** After the coordinate values are entered, move the cursor to the "Link of Object Detection and Working Pos." field, and press the ENTER key in the Work detection No. field to be referred to. Pressing the ENTER key first time displays red "X" mark, and pressing the ENTER key second time determines the selected portion.

### ■ About the Method of Setting Grid Field for Link of Object Detection and Working Pos.

(1) The position at which the ENTER key is pressed first time is specified as the start position to display red "X" mark.




(2) The portion is determined by pressing the ENTER key second time, and the portion between the start position and the position at which the ENTER key was pressed is filled with black "X".
The figure below shows how Working Pos No. 2 is selected as the second ENTER position.




▶ Note

- When the number of "X" marks exceeds 100 with the ENTER key pressed second time, "X" mark at the start position where the key was entered first time is cancelled.
- If the position at which the ENTER key is pressed second time is not included in the column in which it was entered first time, the "X" mark at the start position is handled as a cancelled mark and then deleted.
- If the number at the position where the ENTER key is pressed second time is smaller than that at the start position, the portion to the position where the ENTER key was pressed is filled with "X" from down to up.
- If "X" marks are registered in the entire selection range before the ENTER key is pressed first time or second time, the registration of the "X" marks is cancelled.

■ **About the Method of Deleting Link of Object Detection and Working Pos.**

<When deleting "X" mark by directly selecting it>

(1) Select the "X" mark field of a line you want to delete and press the ENTER key once. The 1st pressing of the ENTER key displays the "X" mark in red. This red mark is recognized as the start position of deletion target. To delete a setting number only at a position, press the ENTER key twice in the "X" mark field.

| No. | rX | rY | 00 | 01 |
|---|---|---|---|---|
| 000 | -2.198 | 0.348 | X | |
| 001 | -8.251 | 46.684 | X | |
| 002 | 14.371 | 78.277 | X | |

(2) When the "X" mark field of the final line to be deleted is selected, pressing the ENTER key completely deletes the link from the target line.

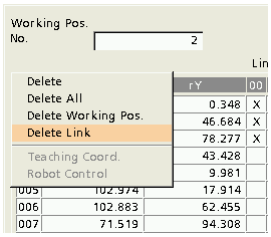
| No. | rX | rY | 00 | 01 |
|---|---|---|---|---|
| 000 | -2.198 | 0.348 | X | |
| 001 | -8.251 | 46.684 | X | |
| 002 | 14.371 | 78.277 | X | |

▶

| No. | rX | rY | 00 | 01 |
|---|---|---|---|---|
| 000 | -2.198 | 0.348 | | |
| 001 | -8.251 | 46.684 | | |
| 002 | 14.371 | 78.277 | | |

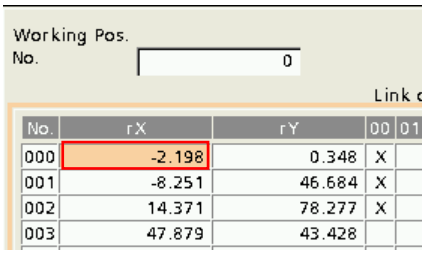
<When deleting from FUNC menu>

(1) Select the "X" mark field of a line you want to delete and press the FUNC key once.
(2) Select "Delete Link" from the list of the FUNC menu.
(3) All the registered setting numbers are deleted.

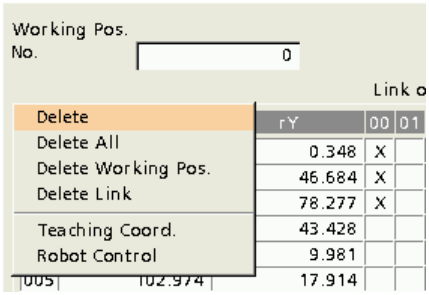



## Delete Working Position

***1.*** Move the cursor to the coordinate value of the working position you want to delete and press the FUNC key.




***2.*** A deletion menu appears. Select the deleting method according to the usage.




| | |
|---|---|
| Delete | Delete only data from the selected cell.<br>(The item is invalid when the selected cell is not set.) |
| Delete All | Delete all data on working position and setting number. (The item is invalid when no data on working position or setting number is set.) |
| Deletion of working position | Delete all working positions. Setting numbers are not deleted.<br>(The item is invalid when none of working positions are set.) |
| Delete Link | Delete all setting numbers.<br>(The item is invalid when none of setting numbers are set.) |

## Set a Working Position in Robot Control Setting

Robot coordinates obtained in Robot Control Setting can be registered as a working position.

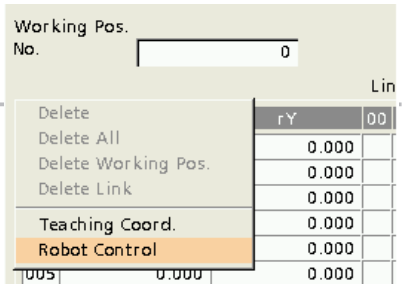
▶ Note

For details on Robot Control Setting, refer to “3.4.1 What is Robot Control Setting?” on page 39.

***1.*** Move the cursor to the working position No. you want to register and press the FUNC key.

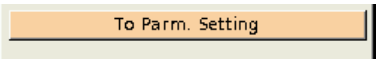
***2.*** Select "RobotControlSetting".

Selecting "RobotControlSetting" displays the Robot Control Setting screen.




***3.*** Move the robot by operating the keypad or specifying the coordinates.

***4.*** With the robot position determined, press the "To Parm. Setting" to reflect the obtained robot coordinates upon the Working Pos.




## Reflect Teaching Coordinates upon Working Position

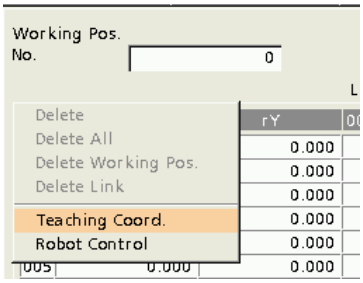
Specified teaching coordinates can be registered as working positions.

▶ Note

For details on the setting of teaching coordinates, refer to “4.3 Teaching Support” on page 123.

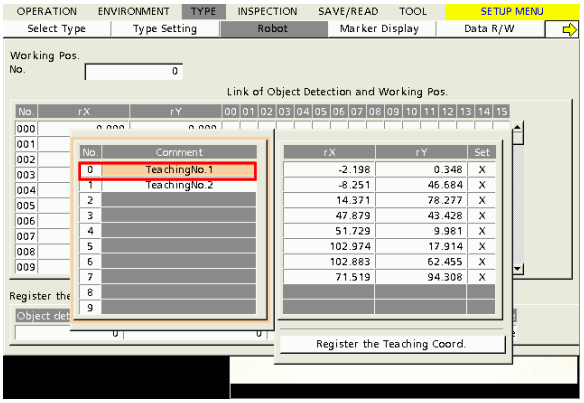
***1.*** Move the cursor to the working position No. you want to register and press the FUNC key.

***2.*** Select "Teaching Coord."

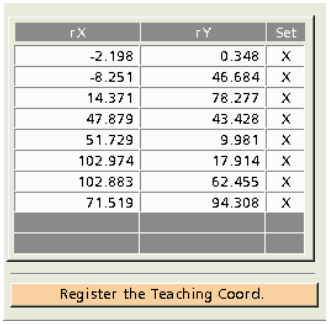


**3.** When a list of teaching coordinates appears, select the No. of the teaching group you want to register.

When the No. is selected, only the list of coordinate data on teaching data appears.



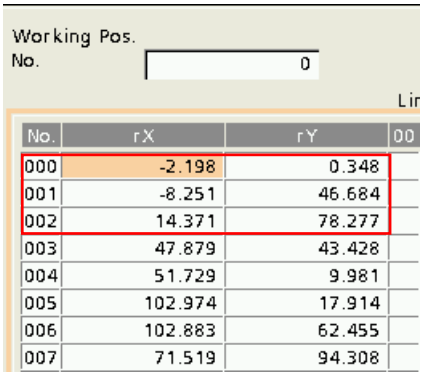

**4.** In "Register the Teaching Coord.", press the ENTER key.




▶ Note

If you do not want to reflect some teaching points upon the working positions, move the cursor to the list of coordinate data and press the ENTER key. With the ENTER key pressed in the "Set" field, deleting the X mark prevents reflecting the coordinate data upon the working positions.

**5.** The teaching coordinates are then reflected upon Working Pos.

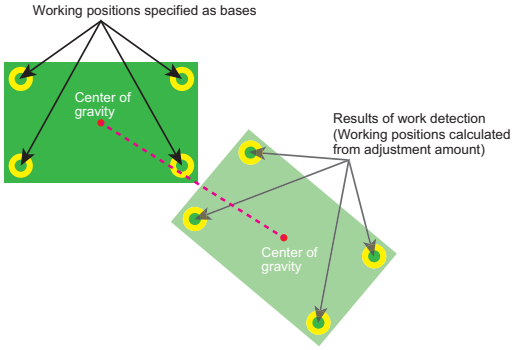


# Use the Results of Working Position for Work Detection

The coordinates of working position after adjustment by work detection is calculated based on the work position registered in Working Pos.

Note

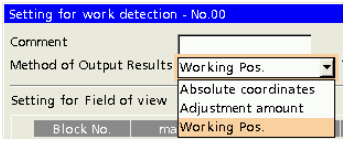
Using this function requires Link of Object Detection and Working Pos. setting. For the procedure for setting, refer to“Procedure for Setting Working Position” on page 155.




**1.** Press the "Set" button in "Setting for work detection" from "TYPE" > "Robot" > "Work detection".

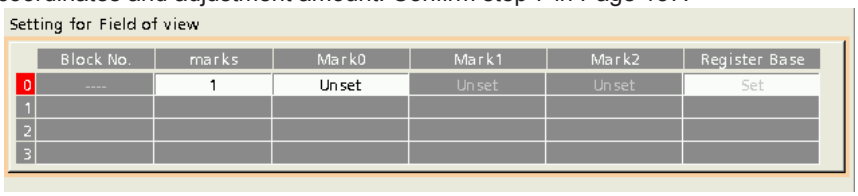
**2.** Select the camera and then select a work detection No.

**3.** Enter comment and select "Working Pos." for "Method of Output".




**4.** Set Block No. (with multiple fields of view), the number of marks, and Base Checker for each mark.

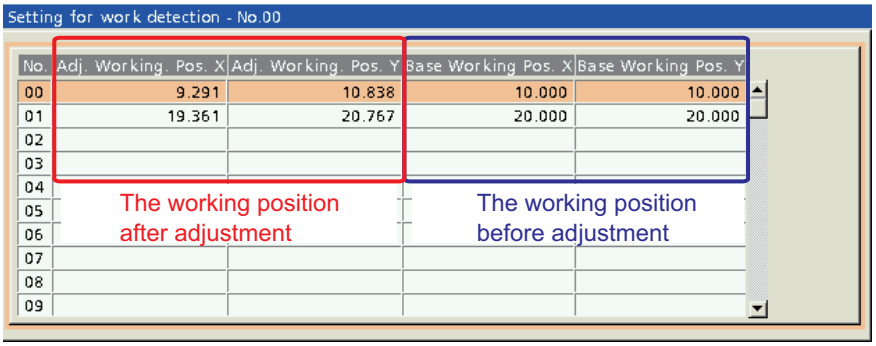
The procedure for setting Base Checker, etc., is the same as those for general output of center of gravity coordinates and adjustment amount. Confirm step 7 in Page 137.




**5.** Press the ENTER key in the "Register Base" field and then register the base position.

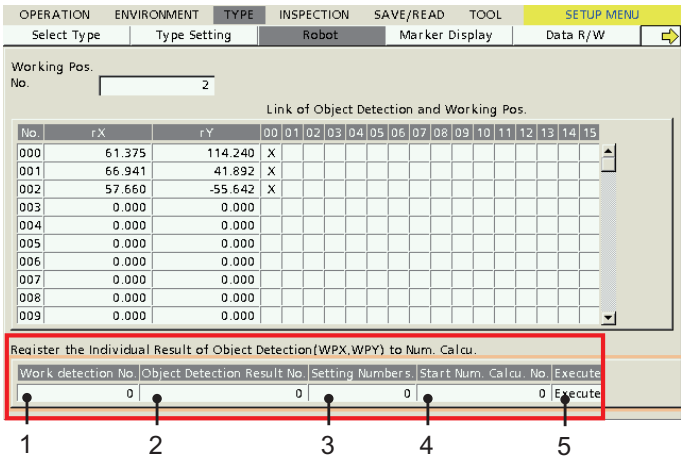
**6.** Press the TRIG key to perform the inspection, press the FUNC key to display the "Detail Result" menu, and then press the ENTER key.

Display the detailed screen of the coordinates of working position for setting for work detection.



# Register Individual Result of Work Detection in Numerical Calculation

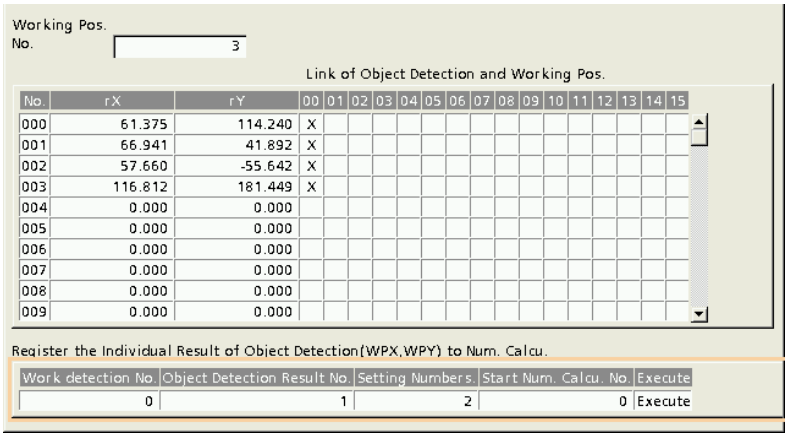
The Individual Result of working position of work detection (WPX, WPY after judgment) can be registered to numerical calculation.



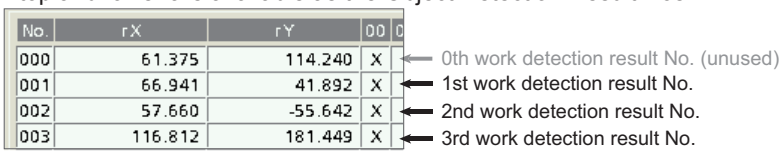

| | | |
|---|---|---|
| 1 | Work detection No. | Enter the work detection No. to be registered in Numerical Calculation. The selectable range is from 0 to 15. |
| 2 | Object Detection Result No. | Enter the start position of Object Detection Result No. to be registered in Numerical Calculation. The number of setting numbers to be registered is specified in "Setting Numbers". |
| 3 | Setting Numbers | Specify the number of Working Position result Nos. to be registered for Numerical Calculation. Specifying the number set in Object Detection Result No. as a start position, you can select the number of Working Position result Nos. after that number. |
| 4 | Start Num. Calcu. No. | Register the registration start No. for Numerical Calculation. The selectable range per block is 0 to 99. (The allowable registration number for Numerical Calculation varies depending on the number of blocks in use.)<br>▶ Note<br>If the Setting Numbers exceed the effective No. of Set Checkers for Numerical Calculation, the Setting Numbers are reset to 0 at the time of Execute. (When Start Num. Calcu. No. is 99, Setting Numbers cannot be set to 2 or more.) |
| 5 | Execute | Press the ENTER key to execute the registration to Numerical Calculation. |

## ■ Setting example

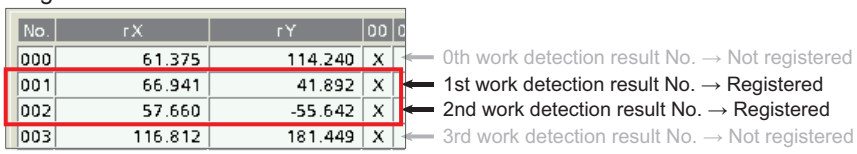
Condition: When two results are registered with detection result No. 1 for work detection No. 0 placed at the beginning



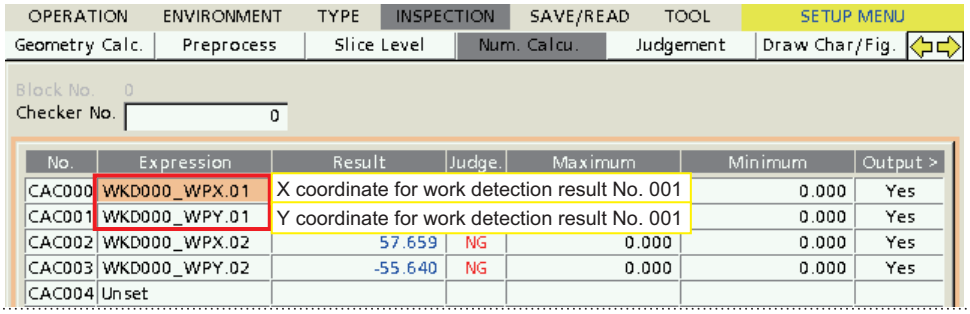

In the figure above, 4 Work detection Nos. 000 to 003 are registered as the settings of referring to Work detection No. 00 and, therefore, a number ranging from 0 to 3 can be entered into the Object Detection Result No. field. If "1" is entered into this field, the numbers at the second position from the top and lower are available as the Object Detection Result Nos.




If Setting Numbers are "2" under the condition above, the following Object Detection Result Nos. are registered in Numerical Calculation.




Pressing the ENTER key in "Execute" registers in "Numerical Calculation" selected from "Inspection".



# 4.5.1 List of Output to Numerical Calculation, Judgement and Data R/W

## Judgement

Data that can be entered into judgement expressions. The symbols in parentheses are displayed in expressions.

| | |
|---|---|
| Work detection (WKD) Nos. 0 to 15 | Judgement (JUDGE) |
| | Judgement of field of view (VJUDGE) Nos. 0 to 3 |

## Numerical Calculation:

### Work Detection

Data that can be entered into expressions from inspection results of Work Detection. The symbols in parentheses are displayed in expressions.

Data that can be entered

| Item | Result No. | Result Type | Target for statistics | Result output value and others |
|---|---|---|---|---|
| Work Detection (WKD) | --- | Judgement (JUDGE) | 1 | OK=1, NG=0 |
| | | Inspection Time (TIME) | 2 | |
| | | X (X) | 2 | |
| | | Y (Y) | 2 | |
| | | θ (ANG) | 2 | -179.999 to +180.000, -180.000 |
| Results by field of view<br>* Results by field of view are individual result data for each field of view in the case of multiple fields of view. | 0 to 3 | Judgement for field of view (VJUDGE) | 1 | OK=1, NG=0 |
| | | Field of view X (VX) | 2 | |
| | | Field of view Y (VY) | 2 | |
| Individual result<br>* Valid only with Method of Output<br>Working position | --- | Number of working positions (WPNUM) | 2 | 0 - 100 |
| | 0 to 99 | Working position X(WPX) | 2 | |
| | | Working position Y(WPY) | 2 | |

▶ Note

When "Statistics" is selected with result data of Numerical Calculation set, selectable type of statistical data differs depending on the data. Since numeric values appear in the target statistics field, confirm them in conjunction with the table below.

Statistics type: 1:

| | | | | | |
|---|---|---|---|---|---|
| Scan count | (@COUNT) | OK count | (@OKCOUNT) | NG count | (@NGCOUNT) |

Statistics type: 2:

| | | | | | |
|---|---|---|---|---|---|
| Min. Measurement | (@MIN) | OK Judge. Min. | (@OKMIN) | NG Judge. Min. | (@NGMIN) |
| Max. Measurement | (@MAX) | OK Judge. Max. | (@OKMAX) | NG Judge. Max. | (@NGMAX) |
| Average | (@AV) | OK Average Measurement | (@OKAV) | NG Average Measurement | (@NGAV) |
| Range | (@RG) | OK Range | (@OKRG) | NG Range | (@NGRG) |
| Variance | (@DV) | OK Variance | (@OKDV) | NG Variance | (@NGDV) |

# Data R/W

Items that can be registered in cells of data R/W are as follows:

| Work Detection (WKD) | | Change | Target for statistics |
|---|---|---|---|
| Common Result | Judgement | Changes from data R/W sheet are not allowed | 3 |
| | Inspection time | | 2 |
| | X | | 2 |
| | Y | | 2 |
| | θ | | 2 |
| Results by field of view (0-3)<br>* Results by field of view are individual result data for each field of view in the case of multiple fields of view. | Judgement for field of view | | 3 |
| | Field of view X | | 2 |
| | Field of view Y | | 2 |
| Individual result (0-99)<br>* Valid only with Method of Output = Working position | Working Pos. Num. | | 2 |
| | Working position X | | 2 |
| | Working position Y | | 2 |

▶ Note

When "Statistics" is selected with result data of Numerical Calculation set, selectable type of statistical data differs depending on the data. Since numeric values appear in the target statistics field, confirm them in conjunction with the table below.

Statistics group

| No | Numeric Statistics | All Statistics | OK Statistics | NG statistics |
|---|---|---|---|---|
| 2 | Statistics of checker results<br>If the checker is OK, calculates "All Statistics" and "OK Statistics". If the judgement is NG, calculates "All Statistics" and "NG Statistics". | Min. Measurement | OK Judge. Min. | NG Judge. Min. |
| | | Max. Measurement | OK Judge. Max. | NG Judge. Max. |
| | | Average | OK Average | NG Average |
| | | Range | OK Range | NG Range |
| | | Variance | OK Variance | NG Variance |
| 3 | Judgment Statistics<br>If the checker is OK, calculates "All Statistics" and "OK Statistics".<br>If the checker is NG, calculates "All Statistics" and "NG Statistics". When referring the statistics of judgments (JDC / JRC) during in RUN mode, the latest result is referred. | Scan Count (Judgment Count) | OK count | NG count |

## 4.5.2 Other Numerical Calculation

A robot position where the tool meets the work can be calculated even in Numerical Calculation. It is used to calculate a position where the tool meets the work, excepting Feature Extraction, Smart Matching, Contour Matching, and Object Detection Result. It is also used to calculate a robot position in a case where the work is placed at a specified position by making adjustments.

### Calculating a Position where Tool Meets Work

| Item | Content | Detail |
|---|---|---|
| Coord.Conv.Func. POSTOL (X, Y, R, N, T) | Calculate a position where (X, Y) meets Tool (T) according to N.<br>N=0 : X<br>N=1 : Y<br>N=2 : R | For XY, quote a checker that detects work.<br>For R, specify Coordinate R when the tool meets the work in a case where "Inspection Deg." is specified for "Method of calculating the R-Coordinates" for TOOL. When "Current R-position" is selected for "Method of calculating the R-Coordinates", set argument R to 0 because of no reference. For T, specify the tool No. that you want to meet it. |

### Calculate the Robot Position to Place it at the Target Position

| Item | Content | Detail |
|---|---|---|
| Coord.Conv.Func. POSTGT (tgX, tgY, tgR, X, Y, R, N) | According to N, calculate the position where the work of (X,Y,R) is placed at the target position (tgX, tgY, tgR),<br>N=0 : X<br>N=1 : Y<br>N=2 : R | For R, quote a checker that calculates the absolute angle of work.<br>For tgXtgYtgR, enter a fixed value into the target position or quote a checker that detects the target position.<br>For XYR, quote a checker that detects the position of work you want to place at the target position. |

Robot Position for placing it at the target position can be output by quoting specified Numerical Calculation for Output of Robot Coordinates. The concept of setting is described below for each application. Since not all patterns are covered, make settings by correctly combining them.

■ **Pattern 1**

When the work, after pickup, is measured with an upward fixed camera and placed at a predetermined position by making adjustments
<POSTGT(tgX,tgY,tgR,X,Y,R,N)>

| | |
|---|---|
| [tgX,tgY,tgR] | Enter a fixed value. If the value of System Register is quoted in this case, you can deal with a case where the fixed value is variable. |
| [X,Y,R] | Quote the results of checker detecting the work with an upward fixed camera. If the checker to be quoted for R is used for Smart Matching and Contour Matching in this case, pay attention to the following:<br>• The angle quoted for R must be an absolute angle. In Smart Matching and Contour Matching, however, the status at the time of template registration is specified to be zero degree so that a change from the status is output as an angle. Note that, in Smart Matching and Contour Matching, absolute angle can therefore be calculated only when the template is registered in the status where the angle of work is zero degree. |

When running: Before measuring with an upward fixed camera, notify the measurement instruction after the notification of robot position (XYR) at the time of measurement.

## ■ Pattern 2

When the work, after pickup, is measured with an upward fixed camera and is then adjusted and placed at a target position detected by the camera

▶ Note

With User-Defined used, at least 3 blocks are required.

Make measurements with an upward fixed camera, measure the target position, and then calculate the adjusted position for each block.

Assign blocks in such a manner that Measurement by upward fixed camera < Target position changes to Measurement < Calculation of adjusted position.

| | |
|---|---|
| [tgX,tgY,tgR] | Quote a checker that detects target position.<br>If the checker to be quoted for R is used for Smart Matching and Contour Matching in this case, pay attention to the following:<br>• The angle quoted for R must be an absolute angle. In Smart Matching and Contour Matching, however, the status at the time of template registration is specified to be zero degree so that a change from the status is output as an angle. Note that, in Smart Matching and Contour Matching, absolute angle can therefore be calculated only when the template is registered in the status where the angle of work is zero degree. A checker of block 1 is quoted as an example. |
| [X,Y,R] | Quote the results of checker detecting the work with an upward fixed camera.<br>If the checker to be quoted for R is used for Smart Matching and Contour Matching in this case, pay attention to the following:<br>• The angle quoted for R must be an absolute angle. In Smart Matching and Contour Matching, however, the status at the time of template registration is specified to be zero degree so that a change from the status is output as an angle. Note that, in Smart Matching and Contour Matching, absolute angle can therefore be calculated only when the template is registered in the status where the angle of work is zero degree. A checker of block 0 is quoted as an example. |
| [POSTGT (tgX, tgY, tgR, X, Y, R, N)] | Set an expression itself in block 2. |

When running:

1. Detect work with an upward fixed camera. (Block0)
2. Detect the target position with a camera. (Block1)
3. Notify the PV260 of the capture position (XYR) obtained with the work measured with an upward fixed camera.
4. Execute the re-measurement (RCAn, b). In this case, either No. for block 0 or No. for block 1 is available for the calibration No. (Block2)

## ■ Pattern 3

When the work picked up is measured with an upward fixed camera after the target position is measured with a camera and is then adjusted and placed at the target position

▶ Note

With User-Defined used, at least 2 blocks are required.

Measurement of target position and measurements with an upward fixed camera are made for each block.

Assign blocks in such a manner that Measurement of target position < Measurement by upward fixed camera can be selected.

| | |
|---|---|
| [tgX,tgY,tgR] | Quote a checker that detects target position. If the checker to be quoted for R is used for Smart Matching and Contour Matching in this case, pay attention to the following:<br>• The angle quoted for R must be an absolute angle. In Smart Matching and Contour Matching, however, the status at the time of template registration is specified to be zero degree so that a change from the status is output as an angle. Note that, in Smart Matching and Contour Matching, absolute angle can therefore be calculated only when the template is registered in the status where the angle of work is zero degree. Checker of block0 is quoted as an example. |

| | |
|---|---|
| [X,Y,R] | Quote the results of checker detecting the work with an upward fixed camera. If the checker to be quoted for R is used for Smart Matching and Contour Matching in this case, pay attention to the following:<br>• The angle quoted for R must be an absolute angle. In Smart Matching and Contour Matching, however, the status at the time of template registration is specified to be zero degree so that a change from the status is output as an angle. Note that, in Smart Matching and Contour Matching, absolute angle can therefore be calculated only when the template is registered in the status where the angle of work is zero degree. A checker of block 1 is quoted as an example. |
| [POSTGT (tgX, tgY, tgR, X, Y, R, N)] | Set an expression itself in block 1. |

When running:

1. Detect the target position with a camera. (Block0)
2. Notify the PV260 of the capture position (XYR) obtained with the work measured with an upward fixed camera.
3. Detect work with an upward fixed camera.

### ■ Pattern 4

POSTOL (X,Y,R,N,T) is also used when the work is placed at a determined target position (with TOOL) after the pickup position is detected with a camera.

▶ Note

With User-Defined used, at least 2 blocks are required.
Measure the pickup position and calculate the adjusted position for each block.
Assign blocks in such a manner that Measurement of pickup position < Measurement by calculating adjusted position can be selected.
<POSTOL(X,Y,R,N,T)>

| | |
|---|---|
| [X,Y,R] | Quote a checker that detects the position of work to be picked up.<br>If the checker to be quoted for R is used for Smart Matching and Contour Matching in this case, pay attention to the following:<br>• The angle quoted for R must be an absolute angle. In Smart Matching and Contour Matching, however, the status at the time of template registration is specified to be zero degree so that a change from the status is output as an angle. Note that, in Smart Matching and Contour Matching, absolute angle can therefore be calculated only when the template is registered in the status where the angle of work is zero degree. |
| [POSTOL(X,Y,R,N,T)] | As an example, set in block 0. < POSTGT(tgX,tgY,tgR,X,Y,R,N)> |
| [POSTGT (tgX, tgY, tgR, X, Y, R, N)] | Set an expression itself in block 1. |
| [tgX,tgY,tgR] | Enter a fixed value. If the value of System Register is quoted in this case, you can deal with a case where the fixed value is variable. |
| [X,Y,R] | In POSTOL(X,Y,R,N,T), quote the checker that was quoted for XYR. |
| [POSTGT (tgX, tgY, tgR, X, Y, R, N)] | Set an expression itself in block 1. |

When running:

1. Detect the target position with a camera. (Block0)
2. Notify the PV260 of the capture position (XYR) obtained with the work measured with an upward fixed camera.
3. Detect the work with an upward fixed camera.

## ■ Pattern 5

When the work is placed at a determined target position (without TOOL) after the pickup position is detected with a camera.

▶ Note

With User-Defined used, at least 2 blocks are required.
Measure the pickup position and calculate the adjusted position for each block.
Assign blocks in such a manner that Measurement of pickup position < Measurement by calculating adjusted position can be selected.
< POSTGT(tgX,tgY,tgR,X,Y,R,N)>

| | |
|---|---|
| [tgX,tgY,tgR] | Enter a fixed value. If the value of System Register is quoted in this case, you can deal with a case where the fixed value is variable. |
| [X,Y,R] | Quote a checker detected at the time of pickup. If the checker to be quoted for R is used for Smart Matching and Contour Matching in this case, pay attention to the following:<br>• The angle quoted for R must be an absolute angle. In Smart Matching and Contour Matching, however, the status at the time of template registration is specified to be zero degree so that a change from the status is output as an angle. Note that, in Smart Matching and Contour Matching, absolute angle can therefore be calculated only when the template is registered in the status where the angle of work is zero degree. |
| [POSTGT(tgX,tgY,tgR,X-,Y,R,N)] | Set an expression itself in block 1. |

When running:

1. Detect the pickup position with a camera. (Block0)
2. Notify* the PV260 of the robot position (XYR) to be used for pickup of work.
3. Execute the re-measurement (RCAn, b). The calibration No. used at this time is that for block0. (Block1)

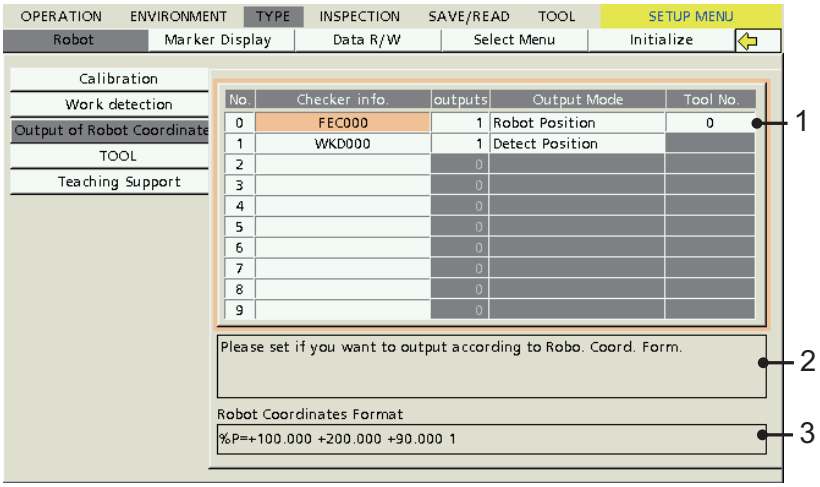
* This is performed when the robot position at which tool meets work is calculated on the robot side. If the robot position at which tool meets work cannot be calculated on the robot side, use TOOL.

# 4.6 Output of Robot Coordinates

Output of Robot Coordinates is a function that inspects the results of detection via checkers, Work Detection, and Numerical Calculation, and then outputs them in the Robot Coordinates Format*.

* For the Robot Coordinates Format, refer to “3.2 Robot Coordinates Format Setting” on page 20.

## How to Use the Output of Robot Coordinates Screen



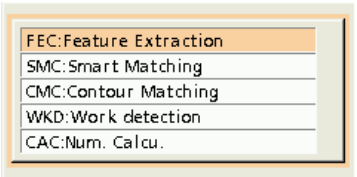

| | | |
|---|---|---|
| 1 | Robo. Coord. output setting | Register checker information to be output as robot coordinates. Up to 10 pieces of information can be registered per type. |
| 2 | Message field | Displays messages related to Output of Robot Coordinates. |
| 3 | Robot Coordinates Format display | Displays example sentences in the Robot Coordinates Format currently registered. |

## Setting Procedure

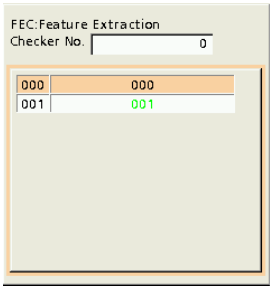
***1.*** Display the "Output of Robot Coordinates" screen from "TYPE" > "Robot".

***2.*** Move the cursor to "Checker info" and press the ENTER key.

The checker selection screen appears. Checkers not registered are displayed in gray.

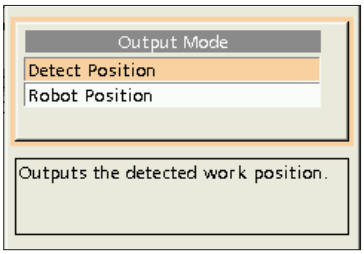



***3.*** Press the ENTER key in the checker field in which you want to set a checker, and then select a desired checker.

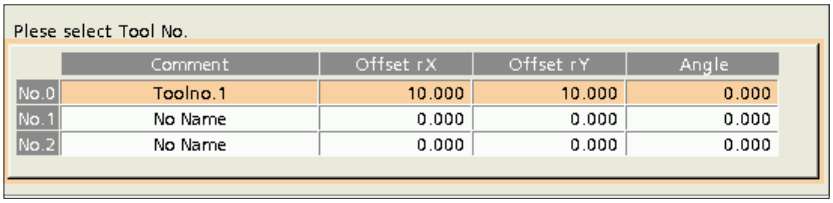


**4.** Select "Detect Position" or "Robot Position" as the output mode.

| | |
|---|---|
| Detect Position | Outputs the robot coordinates of work detected. |
| Robot Position | Output the robot position at which the robot coordinates of work detected match the tool position. |

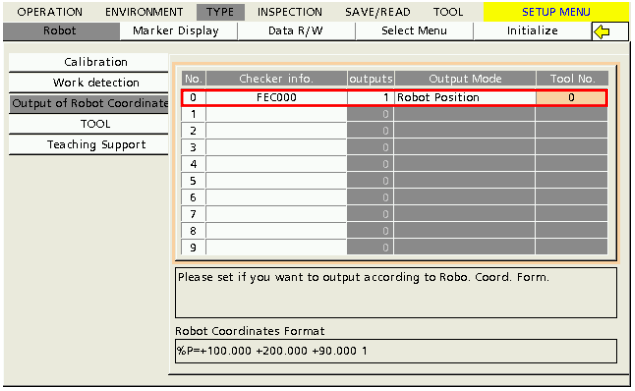



**5.** Press the Enter key in the Tool No. field to set the tool (when "Robot Position" is selected for output mode).




**6.** The settings of Output of Robot Coordinates are thus completed.

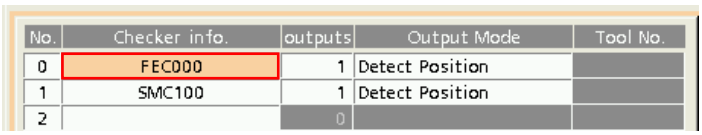
The results of checker information set at the time of inspection execution are output in the Robot Coordinates Format to external devices.



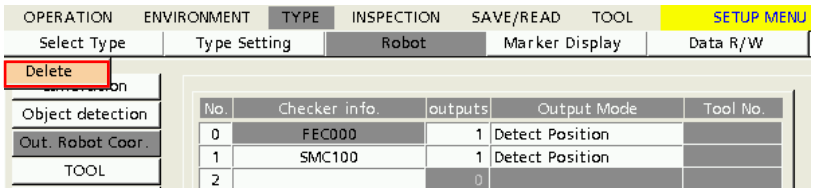

## Delete the Setting of Output of Robot Coordinates

**1.** Display the "Output of Robot Coordinates" screen from "TYPE" > "Robot".

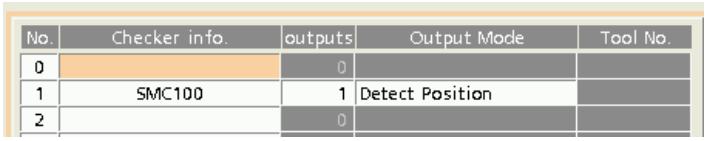
**2.** Move the cursor to the line of Output of Robot Coordinates you want to delete, and press the FUNC key.



**3.** When "Delete" menu appears, press the ENTER key.




**4.** Output of Robot Coordinates has been deleted completely.



# 4.6.1 Output of Robot Coordinates When Running

The results of checker quoted for Output of Robot Coordinates are output to the robot (PLC) by General Output. This section describes the execution method, detection results, and makers since the behaviors at the time of output differ depending on them.

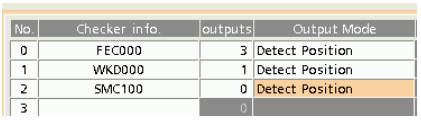
## When Execute All is Selected

### ■ When "Maker" = YAMAHA is selected

When YAMAHA is selected for Maker, coordinates are output by handshake on a one by one basis without Output of Robot Coordinates via the general result. For details, refer to Chapter 5 “Sequence” on page 175.

When measurement start instruction is sent to the PV260 at the time of Execute All, the PV260 executes the measurement. When the measurement is complete, response (%CA$m,m,m,) is returned. In this section, m represents the number of results detected by the checker quoted in the Setting of Output of Robot Coordinates. However, it is less than "Outputs". In addition, separation with commas (",") depends on the number of checkers quoted in the Setting of Output of Robot Coordinates.

| | | |
|---|---|---|
| Example: | No.0 | Output of a maximum of three results of feature extraction |
| | No.1 | Output of a maximum of one result of work detection |
| | No.2 | Output of a maximum of 0 result of Smart Matching |



| No. | Checker info. | outputs | Output Mode |
|---|---|---|---|
| 0 | FEC000 | 3 | Detect Position |
| 1 | WKD000 | 1 | Detect Position |
| 2 | SMC100 | 0 | Detect Position |
| 3 | | 0 | |

If you detect ten results of feature extraction, detect one result of work detection, and three results of Smart Matching when running, the response is as follows:

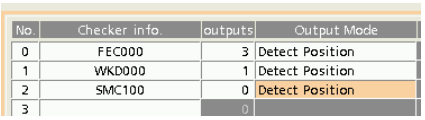
```
%CA$3,1,0
```

If %DONE0 is sent in response to this response, the PV260 outputs robot coordinates according to the Coordinate Format.

### ■ When "Maker" = Other than YAMAHA is selected

If other than YAMAHA is selected for Maker, general result is used for Output of Robot Coordinates. In this case, the results are output for the number of outputs specified in Output of Robot Coordinates regardless of whether or not results are detected.

| | | |
|---|---|---|
| Example: | No.0 | Output of a maximum of 3 results of feature extraction |
| | No.1 | Output of a maximum of one result of work detection |
| | No.2 | Output of a maximum of 0 result of Smart Matching |



| No. | Checker info. | outputs | Output Mode |
|---|---|---|---|
| 0 | FEC000 | 3 | Detect Position |
| 1 | WKD000 | 1 | Detect Position |
| 2 | SMC100 | 0 | Detect Position |
| 3 | | 0 | |

If you detect two results of feature extraction, detect one result of work detection, and three results of Smart Matching when running,
the general output is as follows:

```
%P=10.00 20.00 90.00 1,%P=11.00 21.00 91.00 1,%P=0.00 0.00 0.00 1,%P=30.00 40.00 100.00 1
```

Be sure to output the results for the number of outputs specified in the Output of Robot Coordinates. If no result is detected, output the result with all "X" and "Y" and "R" regarded to be 0. This also applies to the case of output to PLC.

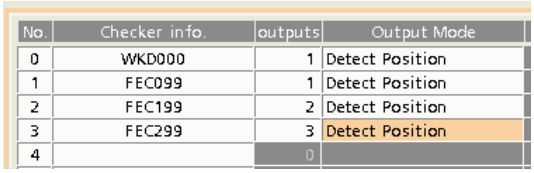
## When User Defined Selected

### ■ When "Maker" = YAMAHA is selected

When YAMAHA is selected for Maker, coordinates are output by handshake on a one by one basis without Output of Robot Coordinates via the general result. For details, refer to Chapter 5 “Sequence” on page 175.

When measurement start instruction is sent to the PV260 at the time of User Defined, the PV260 executes the measurement. When the measurement is complete, response (%CA$m,m,m,) is returned. In this section, m represents the number of results detected by the checker quoted in the Setting of Output of Robot Coordinates. However, it is less than "Outputs". In addition, separation with commas (",") depends on the number of checkers quoted and the block No. specified in the Setting of Output of Robot Coordinates.

| | | |
|---|---|---|
| Example: | No.0 | Output of a maximum of one result of work detection (one of two fields of view is assigned to each of block 0 and block 1) |
| | No.1 | Output of a maximum of one result of feature extraction (block 0) |
| | No.2 | Output of a maximum of two results of feature extraction (block 1) |
| | No.3 | Output of a maximum of three results of feature extraction (block 2) |



| No. | Checker info. | outputs | Output Mode |
|---|---|---|---|
| 0 | WKD000 | 1 | Detect Position |
| 1 | FEC099 | 1 | Detect Position |
| 2 | FEC199 | 2 | Detect Position |
| 3 | FEC299 | 3 | Detect Position |
| 4 | | 0 | |

4. Execution in block 0: %CA$0,1
   Since the results of work detection are complete, zero is output. In addition, only block 0 is included in the response.

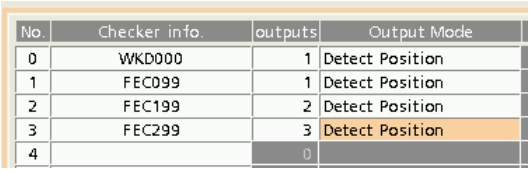
5. Execution in block 2: %CA$3
   Since work detection is made up of blocks 0 and 1, it is not included in the response at the time of execution in block 2. It is not included in the response at the time of execution in other than block 2, either.

6. Execution in block 1: %CA$1,2
   Since the results of work detection are not complete, one is output. In addition, only block 1 is included in the response.
   If %DONE0 is sent in response to each response, the PV260 outputs robot coordinates according to the Coordinate Format.

## ■ When "Maker" = Other than YAMAHA is selected

If other than YAMAHA is selected for Maker, general result is used for Output of Robot Coordinates. In this case, the results are output for the number of outputs specified in the Output of Robot Coordinates according to the block No. specified, regardless of whether or not results are detected by the checker corresponding to the block.

| | | |
|---|---|---|
| Example: | No.0 | Output of a maximum of one result of work detection (one of two fields of view is assigned to each of block 0 and block 1) |
| | No.1 | Output of a maximum of one result of feature extraction (block 0) |
| | No.2 | Output of a maximum of two results of feature extraction (block 1) |
| | No.3 | Output of a maximum of three results of feature extraction (block 2) |



| No. | Checker info. | outputs | Output Mode |
|---|---|---|---|
| 0 | WKD000 | 1 | Detect Position |
| 1 | FEC099 | 1 | Detect Position |
| 2 | FEC199 | 2 | Detect Position |
| 3 | FEC299 | 3 | Detect Position |
| 4 | | 0 | |

1. Execution in block 0
   Since the results of work detection (WKD000) are not complete, zero is output. One result of feature extraction (FEC099) is assumed to have been detected.
   %P=0.00 0.00 0.00 1, %P=10.00 20.00 90.00 1

2. Execution in block 2
   One result of feature extraction (FEC299) is assumed to have been detected.
   %P=10.00 20.00 90.00 1, %P=0.00 0.00 0.00 1, %P=0.00 0.00 0.00 1

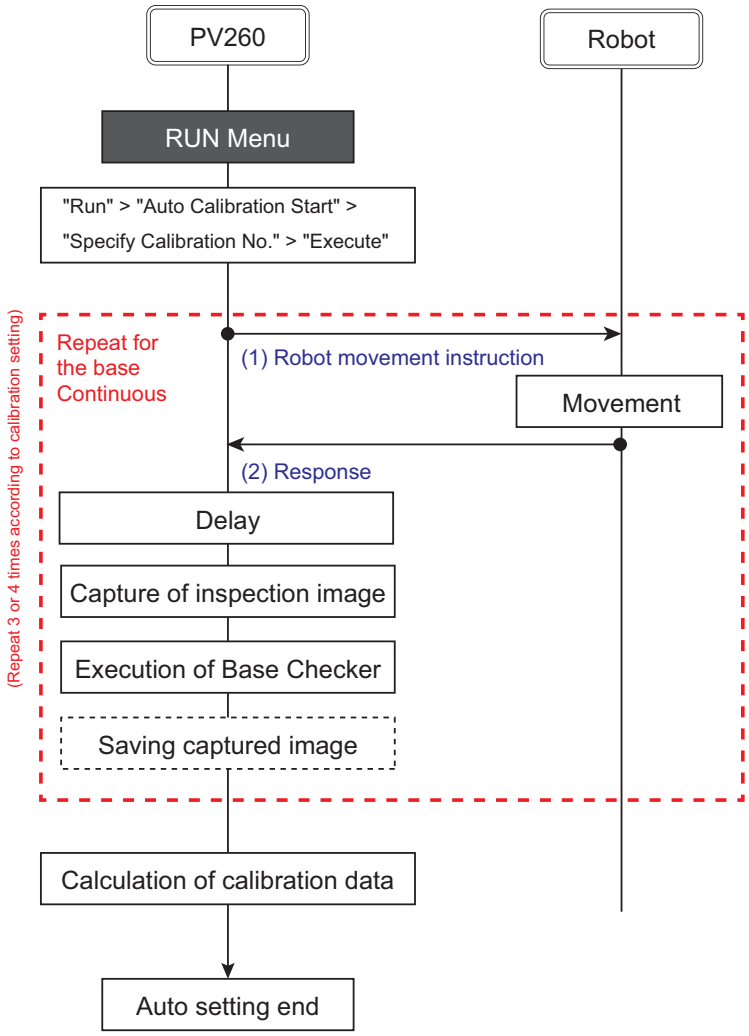
3. Execution in block 1
   Since the results of work detection (WKD000) are complete, the results are output. Two results of feature extraction (FEC199) are assumed to have been detected.
   %P=40.00 50.00 10.00 1, %P=10.00 20.00 90.00 1,%P=11.00 21.00 90.00 1

# Chapter 5

## Sequence

# 5.1 Sequence of Auto Calibration

## 5.1.1 General Communication With Robot Control Command




| | | Communication data |
|---|---|---|
| (1) | PV260 → Robot | Movement Instruction (Absolute Position) set in Robot Control Command Format |
| (2) | PV260 ← Robot | Movement Instruction (response to absolute position) set in Robot Control Command Format |

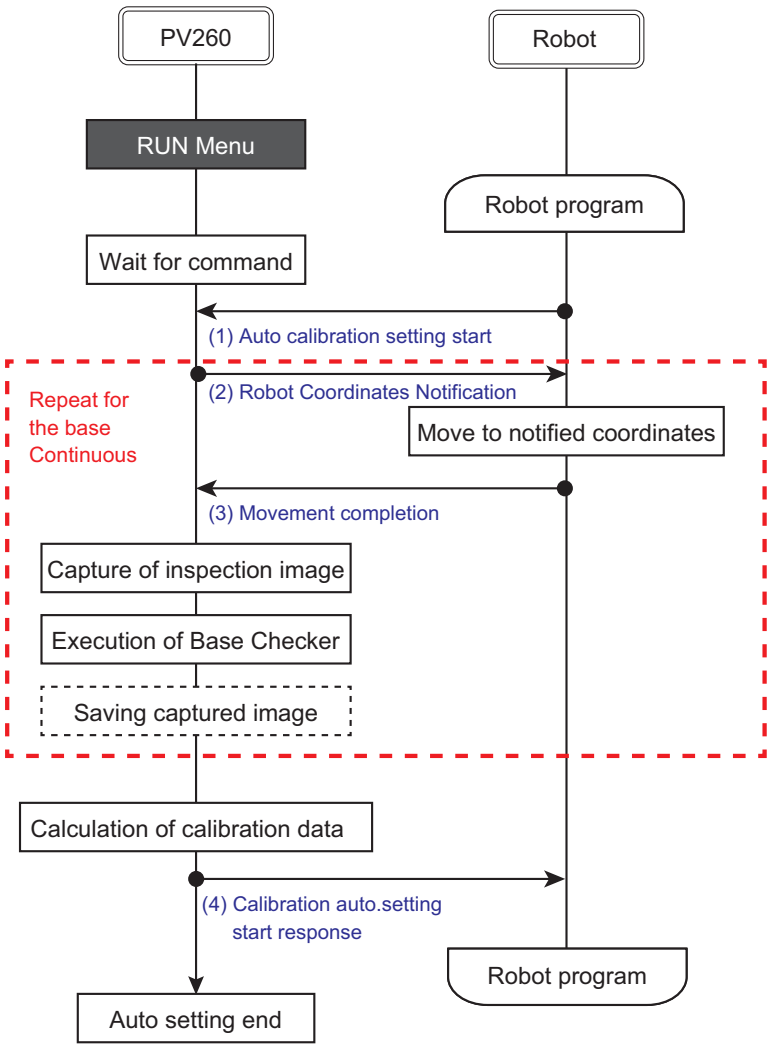
▶Caution

Note that the robot operates during calibration execution.

▶ Note

- If the response in (2) is not replied within the timeout period after (1), the auto calibration sequence ends as a timeout error. In this case, an error is not issued to the robot.
- Even if the robot issues a command (error, etc.) other than the response in (2) when the operation in (1) is performed, the PV260 keeps waiting for a normal response within the timeout period without detecting it.
- "Save captured image" depends on the settings of the PV260.

## 5.1.2 General Communication without Robot Control Command




| | | Communication data |
|---|---|---|
| (1) | PV260 ← Robot | %CASn<Error Correction><Termination> |
| (2) | PV260 → Robot | Coordinate format that is set<Error Correction><Termination> |
| (3) | PV260 ← Robot | %MVE<Error Correction><Termination> |
| (4) | PV260 → Robot | %CAS$<Error Correction><Termination>*Normal response |
| | | %CAS!eee<Error Correction><Termination>*Abnormal response |

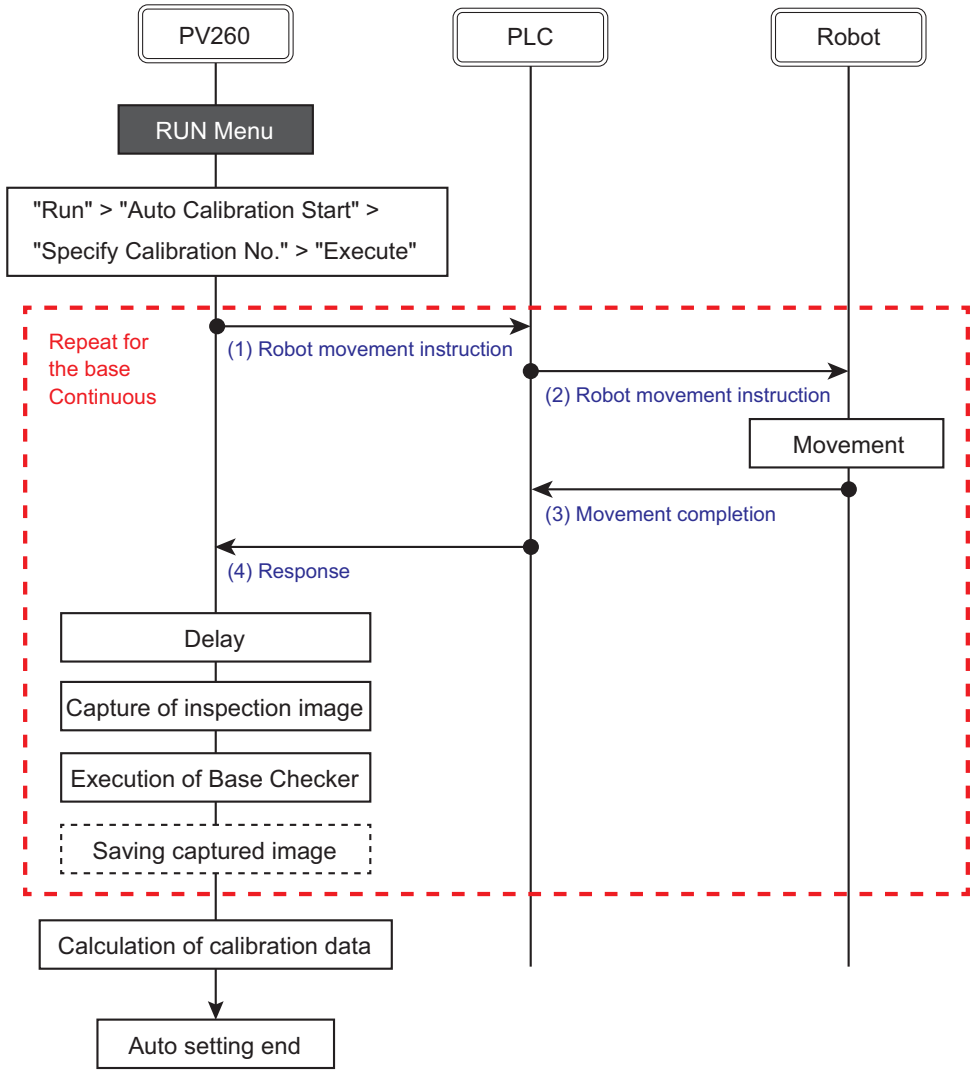
▶Caution

Note that the robot operates during calibration execution.

▶ Note

- If the response in (3) is not replied within the timeout period after (2), the auto calibration sequence ends as a timeout error. In this case, an error is issued to the robot. (%CAS!311)
- "Save captured image" depends on the settings of the PV260.
- Providing the communication above requires you to prepare a robot program on the robot side.

## 5.1.3 PLC Communication With Robot Control Command

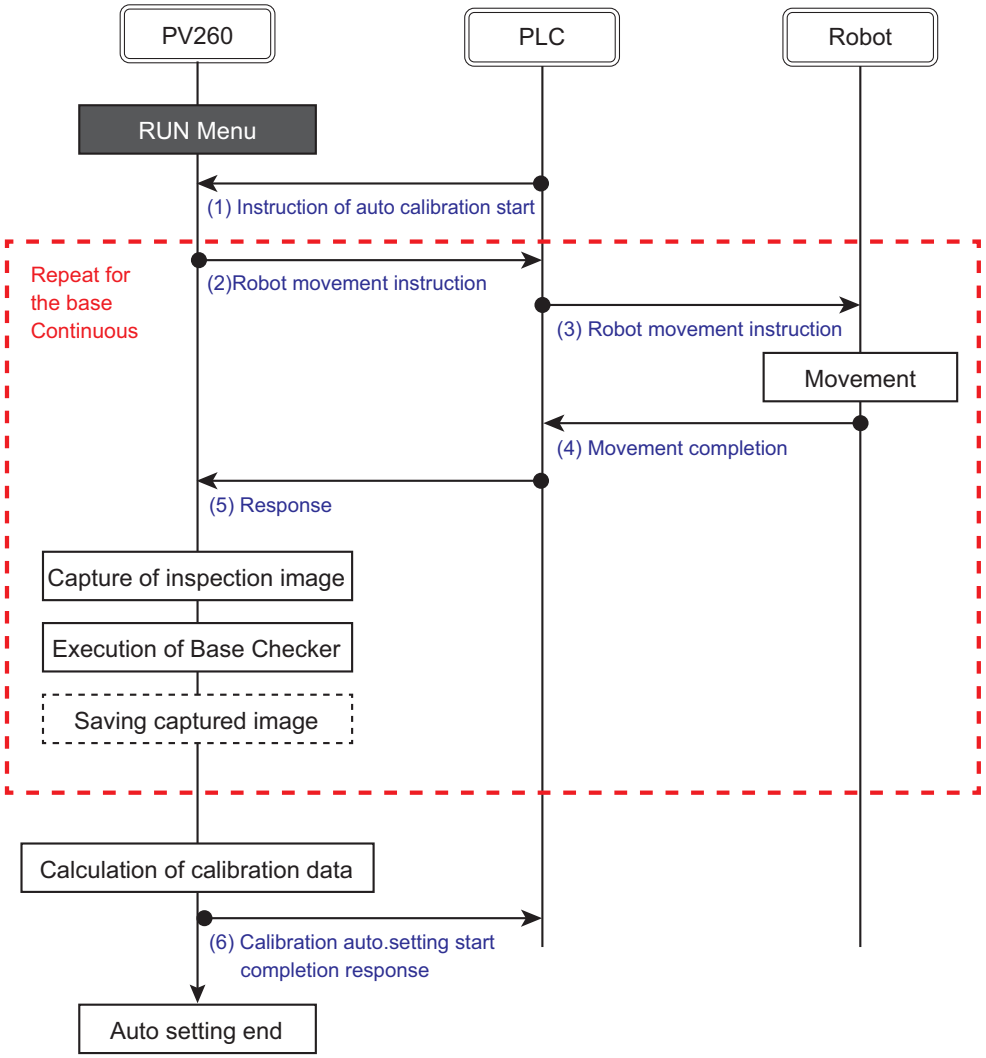



| | | Communication data |
|---|---|---|
| (1) | PV260 → PLC | Conform to the command in Chapter 3.9.6 "Absolute position movement instruction" on page 99 |
| (2) | PLC → Robot | Movement instruction (Absolute Position) |
| (3) | PLC ← Robot | Movement completion response |
| (4) | PV260 ← PLC | Conform to the command in Chapter 3.9.6 "Absolute position movement instruction" on page 99 |

▶Caution

Note that the robot operates during calibration execution.

## 5.1.4 PLC Communication Without Robot Control Command

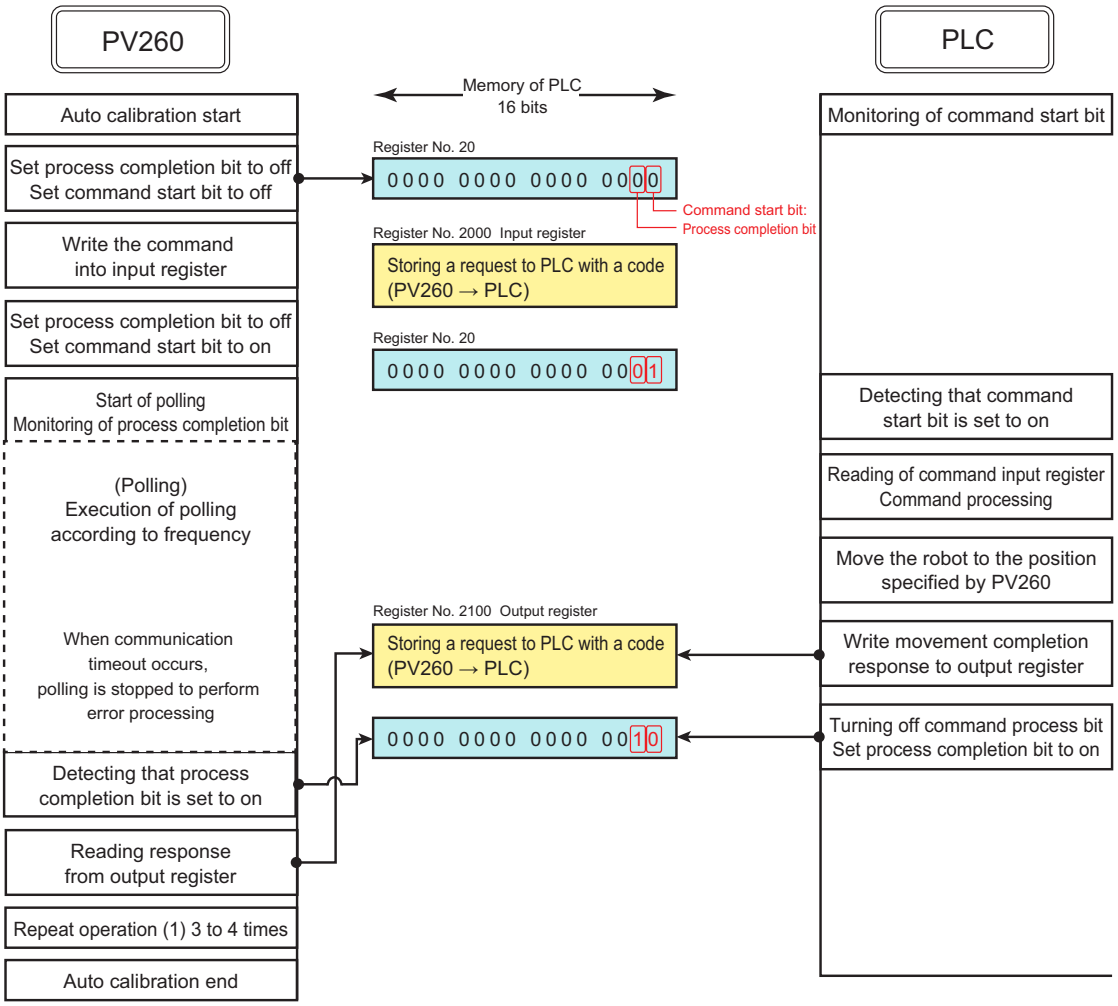



| | | Communication data |
|---|---|---|
| (1) | PV260 ← PLC | Conform to the command in Chapter 3.9.6 "Auto Calibration Setting Start" (Page 96) |
| (2) | PV260 → PLC | Conform to the response in Chapter 3.9.6 "Auto Calibration Setting Start" (Page 96) |
| (3) | PLC → Robot | Movement instruction (Absolute coordinates) |
| (4) | PLC ← Robot | Conform to the command in Chapter 3.9.6 "Movement completion" (Page 98) |
| (5) | PV260 ← PLC | Conform to the completion response in Chapter 3.9.6 "Auto Calibration Setting Start" (Page 96) |

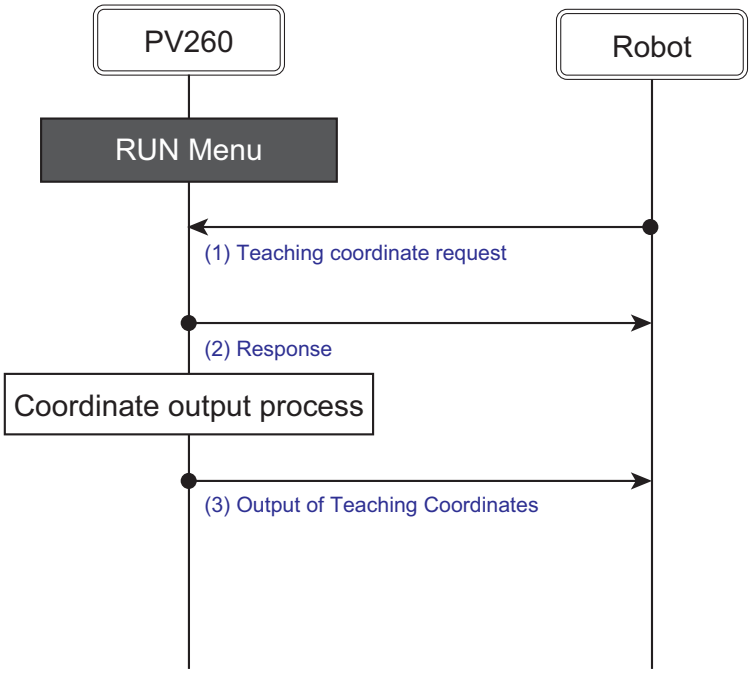
▶Caution

Note that the robot operates during calibration execution.

## Control sequence of PLC Com. at the time of auto calibration by robot control command



# 5.2 Teaching Coordinate Request Sequence




| | | Communication data |
|---|---|---|
| (1) | PV260 ← Robot (PLC) | General: %TCD<Error Correction><Termination><br>PLC: Conform to command 3.9.6 "Teaching coordinate request" (Page 98) |
| (2) | PV260 → PLC | General: %TCD$<Error Correction><Termination><br>PLC: Conform to response 3.9.6 "Teaching coordinate request"(Page 98)) |
| (3) | PLC → Robot | General : Coordinate format that is set --- <Error Correction><Termination><br>PLC: Conform to the robot coordinates 3.9.3 "Example of General Output" (Page 85) |

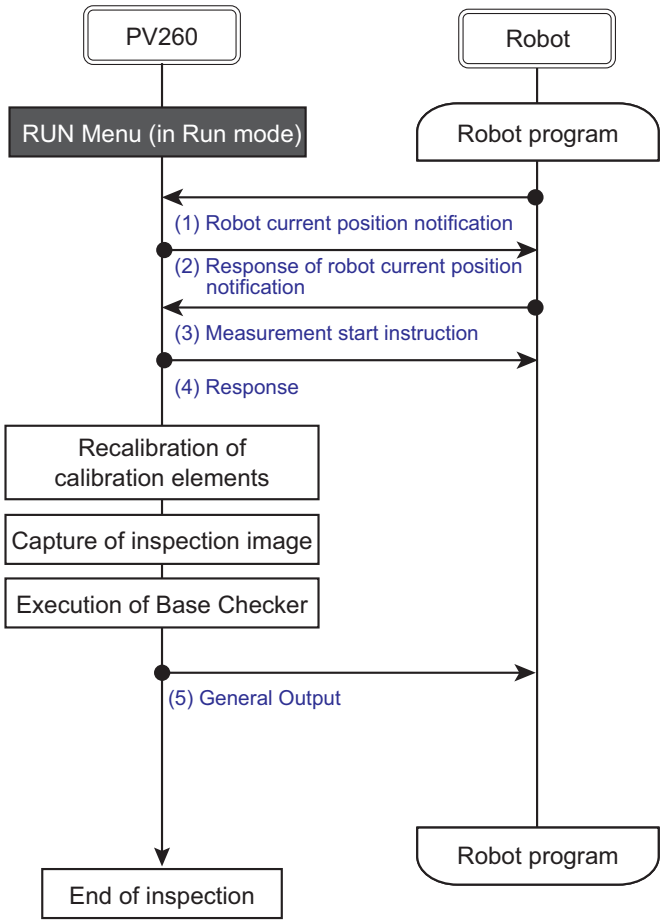
■ Destination to send teaching coordinate output data to

| Input source | Protocol | Data output destination | Remarks |
|---|---|---|---|
| Serial | General communication command | Output of data in general format in serial | Output data according to the format that is set |
| | PLC Communication Command | Output of data in PLC format in serial | Output to the Data Output Register of PLC communication result output |
| Ethernet | General communication command (8604) | Output of data in general format to Ethernet (8601) | When no connection exists in 8601, whether or not an error exists is determined according to the error output setting in General Output to perform output according to the format that is set. |
| | General communication command (8650) | | |
| | PLC communication command (set port*) | Output of data in PLC format to Ethernet (set port*) | • Output to the Data Output Register of PLC communication result output<br>• An error is output in case of failure in writing the register (E0111). |

* Set port --- Port No. that is set in "PLC Com." from "ENVIRONMENT" > "Input/Output/Robot"

# 5.3 Execution Sequence (View Field 1)

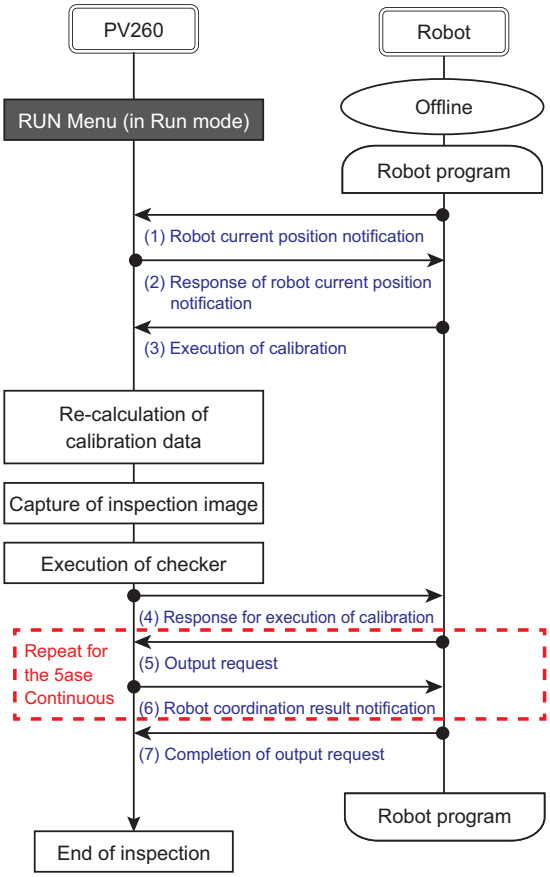
## 5.3.1 General Communication




| | | Communication data |
|---|---|---|
| (1) | PV260 ← Robot | Coordinate format that is set<Error Correction><Termination> |
| (2) | PV260 → Robot | %P$<Error Correction><Termination>*Normal response |
| | | %P!eee<Error Correction><Termination>*Abnormal response |
| (3) | PV260 ← Robot | %CAn<Error Correction><Termination> n: Calibration No. (0 to 5) |
| (4) | PV260 → Robot | %CA$<Error Correction><Termination>*Normal response |
| | | %CA!eee<Error Correction><Termination>*Abnormal response |
| (5) | PV260 → Robot | Output according to the setting of General Output |

# 5.3.2 When YAMAHA is selected by "Maker"

## Sequence to Obtain the Position of Work Measured



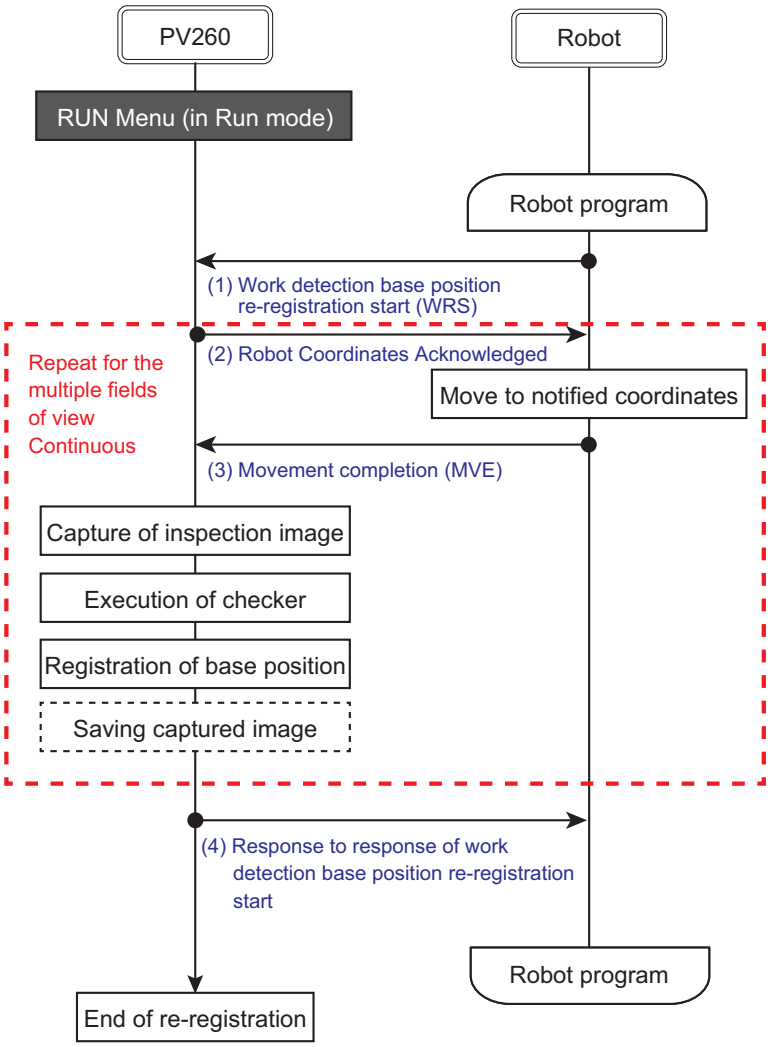

| | | Communication data |
|---|---|---|
| (1) | PV260 ← Robot | Pnnnn△=△+x.xx△+y.yy△+z.zz△+r.rr△+a.aa△+b.bb△t<CR><br>△: Space |
| (2) | PV260 → Robot | Normal %P$<CR> / Abnormal %P!eee<CR> |
| (3) | PV260 ← Robot | Execute All %CAn<CR> / User Defined %CAn,b<CR> |
| (4) | PV260 → Robot | Normal %CA$m,m,m • • • <CR> / Abnormal %CA!eee<CR> |
| (5) | PV260 ← Robot | %DONEnnnn<CR><br>▶ Note<br>If there are no outputs as shown in, for example, %CA$ or %CA$0,0, do not send %DONEnnnn. |
| (6) | PV260 → Robot | Pnnnn=+x.xx△+y.yy△+0.00△+r.rr△+0.00△+0.00△t<CR><br>Return with nnnn specified in (5). |
| (7) | PV260 ← Robot | %DONE<CR><br>▶ Note<br>If there are no outputs as shown in, for example, %CA$ or %CA$0,0, do not send %DONE. |

▶ Note

- In the case of fixed camera, neither (1) nor (2) is required. However, if the position of work picked up is measured by using an upward camera, (1) and (2) are required. Specify offline for the YAMAHA robot mode. Wait for "Result output request" only for the time specified in "Timeout" from "ENVIRONMENT" > "Input/Output/Robot" > "Robot communication". If there is no "Result output request" within the "Timeout" period, the sequence ends.
- For the error codes, refer to “3.8.5 Details on General Communication Command” on page 61.

# 5.4 Base Position Re-registration Sequence (With captured image)

## 5.4.1 General Communication

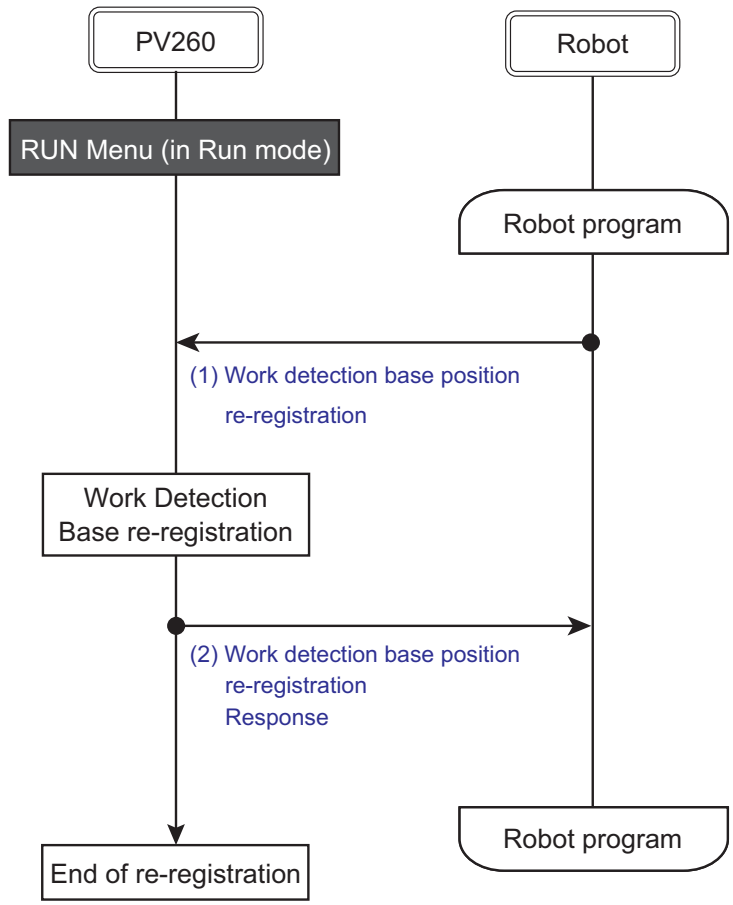



| | | Communication data |
|---|---|---|
| (1) | PV260 ← Robot | %WRSn<Error Correction><Termination>n: Work detection No. (0 to 15) |
| (2) | PV260 → Robot | Coordinate format that is set<Error Correction><Termination>* Normal response |
| | | * Notifies robot position information obtained at the time of registration of the base for work detection |
| (3) | PV260 ← Robot | %MVE<Error Correction><Termination> |
| (4) | PV260 → Robot | %WRS$<Error Correction><Termination>*Normal response |
| | | %WRS!eee<Error Correction><Termination>*Abnormal response |

# 5.5 Base Position Re-registration Sequence (Without Captured Image)

## 5.5.1 General Communication

If calibration data used at the time of registration of the base position for work detection is changed after the registration, this command is available to recalculate/reregister the base position. However, since work is not captured during the execution of this command, it should be used only when the base position of the work itself remains unchanged.




| | | Communication data |
|---|---|---|
| (1) | PV260 ← Robot | %WCS<Error Correction><Termination> |
| (2) | PV260 → Robot | %WCS$<Error Correction><Termination>*Normal response |
| | | %WCS!eee<Error Correction><Termination>*Abnormal response |

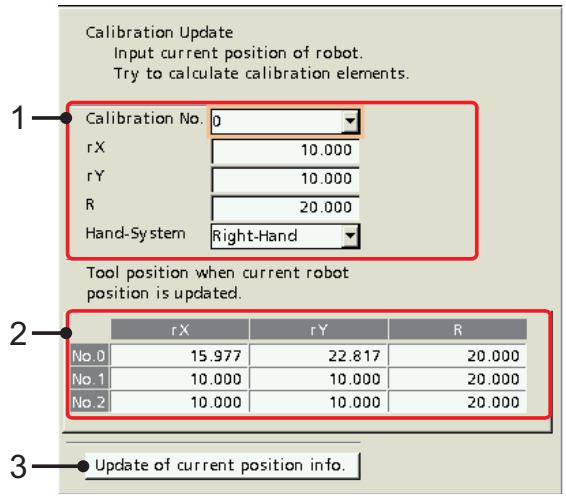
# Chapter 6

## Other Functions

# 6.1 Other Functions

## 6.1.1 Calibration Update

Calibration Update is a function that can confirm the position of work detected by the PV260 or the position of a robot placed at the front position of a tool without providing actual communication with the robot.
If calibration update is performed by entering the current robot position, the calibration settings are adjusted according to the current position. In addition, the coordinates of the robot at the tool front are displayed for each tool No.

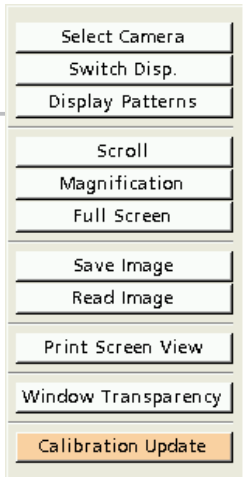



| | | |
|---|---|---|
| 1 | Robot current position input field | Enter the calibration No. you want to update and the current robot position. |
| 2 | Tool position | Position information of each tool after calibration update is displayed. |
| 3 | Update of current position info. button | Execute the update of current position information (Calibration Update). |

### Setting Procedure

***1.*** While SETUP menu is displayed, press the F1 key to display Image Menu.

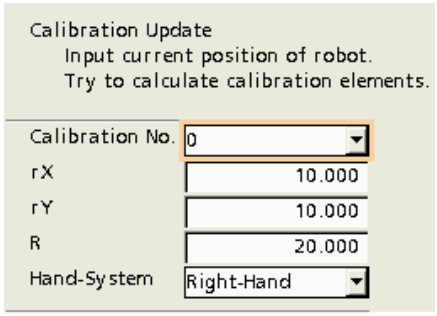
***2.*** Select "Calibration Update".



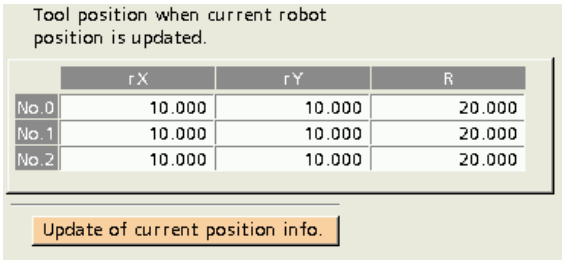
**3.** Enter Calibration No., Robot position information, and Hand-System.

▶ Note

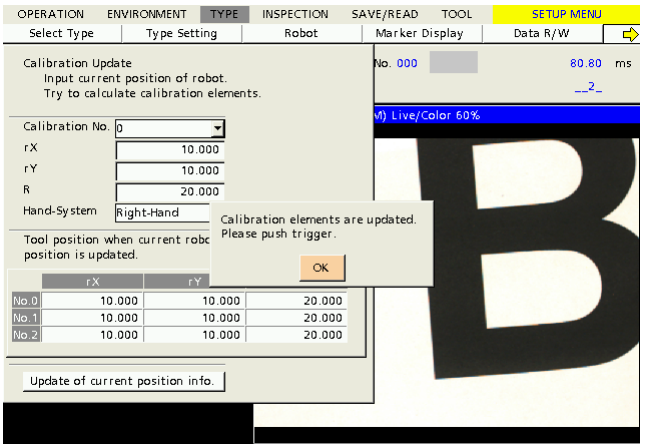
Robot control settings available for adjusting robot coordinates. For details, refer to “3.4 Robot Control Setting” on page 39.




**4.** Press the "Update of current position info." button.




**5.** The settings of tool position information and calibration are updated.



# 6.1.2 Command Communication Log

This is a function to display the communication logs (history) of the general communication and PLC communication, or to save the logs in SD cards.
This chapter outlines command communication logs in the PV260. For details on the operation method, refer to Section 11.4 " Command Communication Log" in the PV200 Manual.

## Outline of Command Communication Log

The PV260 can display and save the following communication data.
■ Control commands: Commands from external devices + Responses from PV260
Requests from PV260 to external devices + Responses from external devices
■ Result output: Outputs from PV260 + Responses from external devices
(Data set to "Output" from "ENVIRONMENT" > "Input/Output / Robot" > "General Output")

▶ Note

- As these communication logs belong to Environment settings, they will be initialized if "Initialize" is executed.
- The TRIG key and OPE/SET switches of the keypad cannot be used while the setting window for the command communication log is displayed. Therefore, inspection cannot be started with the keypad. However, as the inspection start signal from an external device can be accepted, the communication log can be confirmed during the ongoing inspection.

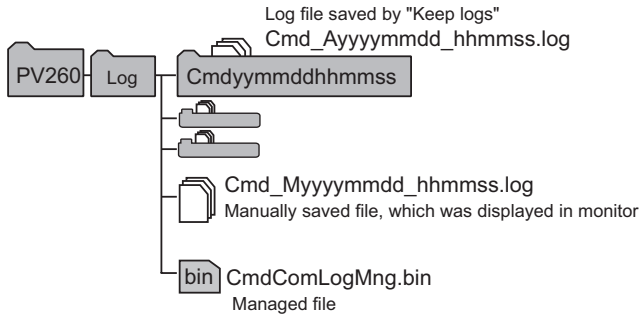
Interface
Available for RS232C interface and Ethernet interface. Confirm the table below. Two patterns that can be output are as follows.
Pattern 1 that can be output: Case where PLC communication is selected for RS232C interface.
Pattern 2 that can be output: Case where PLC communication is selected for Ethernet interface.

| | Control command | | | | Data output | | | |
|---|---|---|---|---|---|---|---|---|
| | RS232C | | Ethernet | | RS232C | | Ethernet | |
| | General Communication | PLC Communication | General Communication | PLC Communication | General Communication | PLC Communication | General Communication | PLC Communication |
| Pattern 1 | A | A | A | N/A | N/A | A | A | N/A |
| Pattern 2 | A | N/A | A | A | A | N/A | A | A |

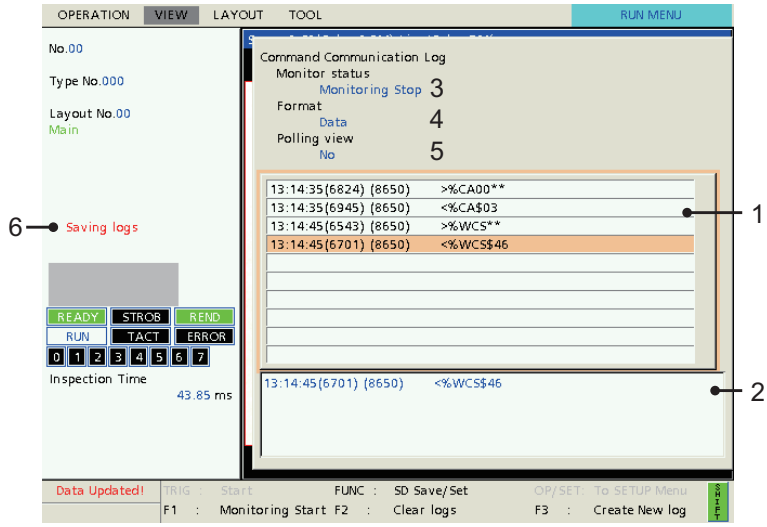
A: Available. It is also OK not to use. No: N/A

Log form
Communication logs are displayed and output by any one of the following forms; "Command" that is telegraphic data in PV260 or "Data" that is telegraphic data based on transmission formats of various manufacturers' PLC devices.

Save to
Communication logs can be saved in SD cards.
Logs saved in SD cards can be always output in RUN menu. Also, when the command communication log list* is displayed, the displayed log data can be saved manually. The folder and file names saved by "Keep logs" are different from those saved manually. The following figure shows the difference
(*: Refer to the next page.)



# Screen Structure of Command Communication Log




| | | |
|---|---|---|
| 1 | Log list | Displays communication logs. The list is updated every time communication is performed when the monitor status of the following item 3 is "Monitoring". The latest histories (128 lines) are displayed. |
| 2 | Highlighted log | The selected communication log for one line in the list is displayed. |
| 3 | Monitor status | Displays the monitor status. "Monitoring" or "Monitoring Stop" is displayed. The F1 key is used for switching them. Saving communication logs in an SD card does not depend on the monitor status. Therefore, saving logs in an SD card continues with "Keep logs" set to "Yes" even if the status is "Monitoring Stop". |
| 4 | Format | Displays the display format of communication logs.<br>(The setting window is switched between "Command" and "Data".) |
| 5 | Polling view | Selects whether or not polling data in PLC communication is displayed/saved. |
| 6 | Communication log in RUN menu<br>SD status | Displays the writing status of communication logs to an SD card in the status display area. It is displayed when "Keep logs" is set to "Yes". It is not displayed when logs are saved manually. |

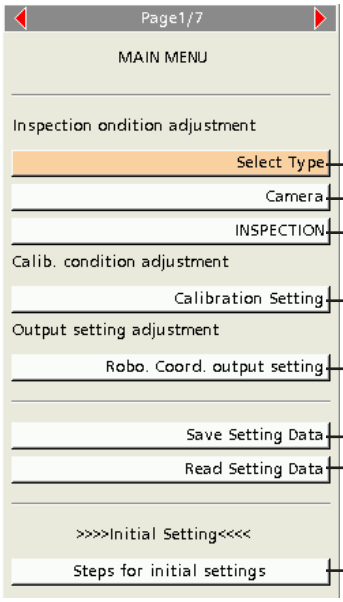
| | |
|---|---|
| Blank | Without "Keep logs" in SD |
| Saving logs | Logs are always saved. in SD |
| SD unfound | Logs cannot be saved as no SD card is inserted. |
| SD is full | Logs cannot be saved as the SD card is full. |
| SD is read-only | Logs cannot be saved as the SD card is read only. |
| SD cover is opened | Writing is not possible as the SD card cover is open.<br>(when "Write When Cover is Open" has been set to "Invalid" from "ENVIRONMENT" > "Input/Output / Robot" > "SD Card Setting".) |
| Overwriting is limited | Log output was cancelled as the number of log folders and the number of files reached the upper limit. (Log output can be performed by setting "Overwrite" to "Yes" or increasing the maximum number of folders.) |

# 6.1.3 Select Menu

Select Menu is a function that can register frequently used operations and/or setting items as buttons to create a customized menu. Creating a dedicated menu enables you to reduce set man-hours and limit the range of operations that an operator can perform.
For concrete procedure for setting Select Menu, and items that can be registered for the PV200 standards, refer to Chapter 9 "Select Menu" in the PV200 Manual.

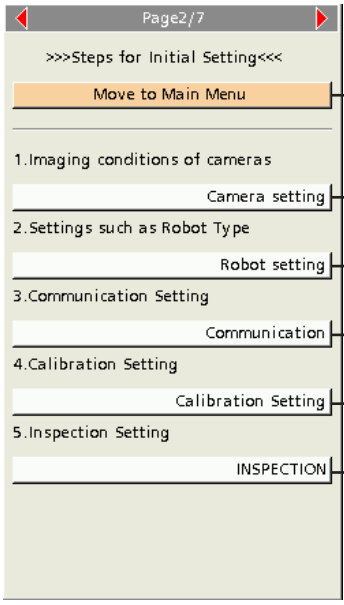
## Items of Select Menu (Preset)

### ■ Main Menu on page 1/7



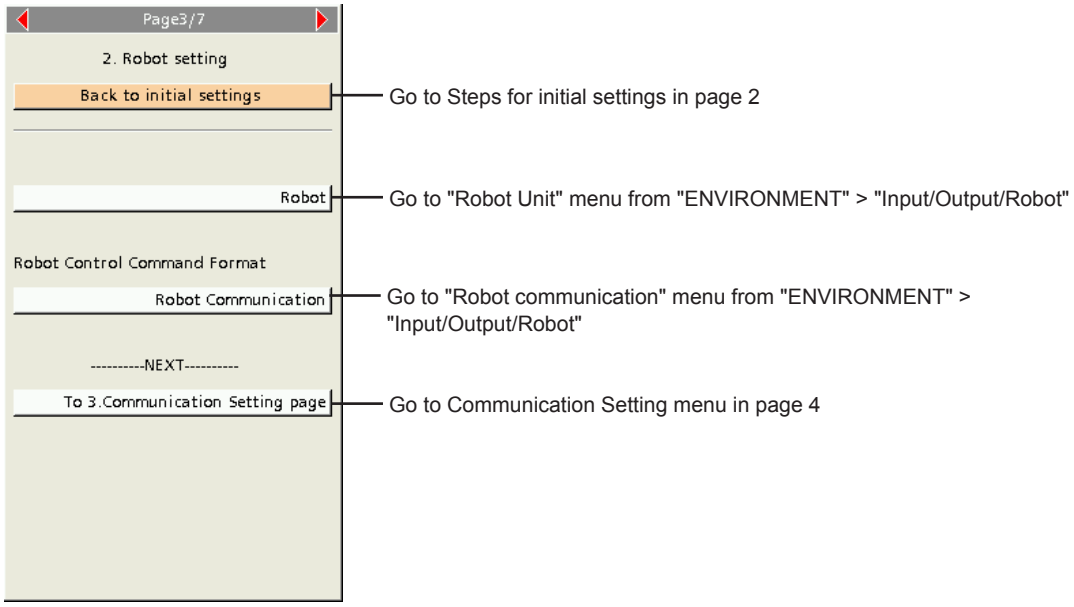

- Select Type → Go to the [Select Type] screen from "TYPE"
- Camera → Go to the [Select Type] screen from "TYPE"
- INSPECTION → Go to "INSPECTION 1" menu in page 6
- Calibration Setting → Go to "Calibration" from "TYPE" > "Robot"
- Robo. Coord. output setting → Go to "Output of Robot Coordinates" from "TYPE" > "Robot"
- Save Setting Data → Go to Save the setting data menu
- Read Setting Data → Go to Read the setting data menu
- Steps for initial settings → Go to Steps for initial settings in page 2

### ■ Steps for initial settings in page 2/7

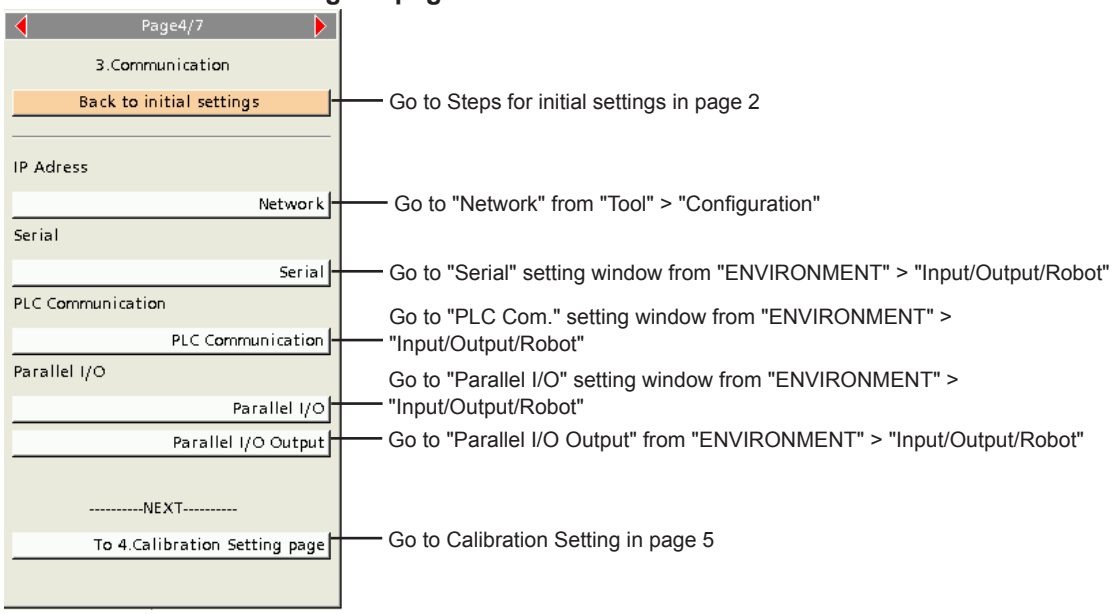



- Move to Main Menu → Go to MAIN MENU in page 1
- Camera setting → Go to "Camera" from "TYPE" > "Type Setting"
- Robot setting → Go to Robot Setting menu in page 3
- Communication → Go to Communication Setting menu in page 4
- Calibration Setting → Go to Calibration Setting menu in page 5
- INSPECTION → Go to INSPECTION menu in page 6

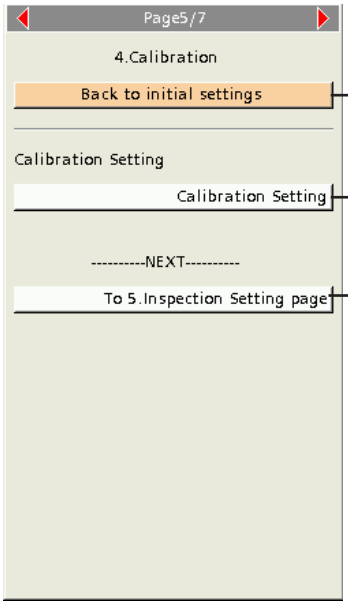
## ■ Robot Setting in page 3/7




## ■ Communication Settings in page 4/7



## ■ Calibration Setting in page 5/7

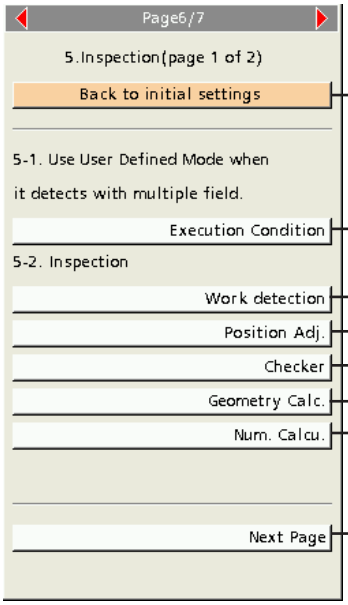



Go to Steps for initial settings in page 2

Go to "Calibration" menu from "TYPE" > "Robot"

Go to Inspection menu in page 6

## ■ INSPECTION 1 in page 6/7




Go to Steps for initial settings in page 2

Go to "Execution Condition" from "TYPE" > "Type Setting"

Go to "Work detection" from "TYPE" > "Robot"

Go to "Position Adjustment" from "Inspection"

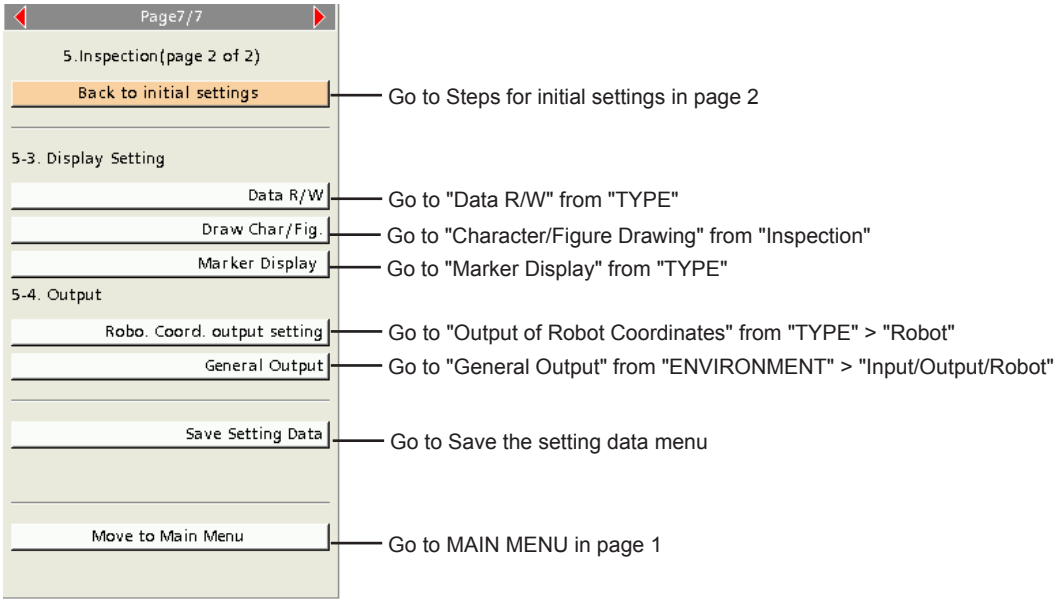
Go to "Checker" from "Inspection"

Go to "Geometry Calculation" from "Inspection"

Go to "Numerical Calculation" from "Inspection"

Go to INSPECTION 2 in page 7

## ■ INSPECTION 2 in page 7/7



## 6.1.4 Print Screen Function

The contents displayed on the entire screen can be copied and output to an SD card. The images are saved as bitmap (bmp). Destination can be changed to Ethernet to save the images directly into a PC.

File that can be displayed

File format: Bitmap
Image size: 640 x 480 pixels
Color depth: 24 bits
Source folder name: Arbitrary (Two-byte and one-byte characters are possible.)
Displayed file name: Arbitrary (Two-byte and one-byte characters are possible.)

About Save Folder of Image Files

For SD card: \Panasonic-ID SUNX Vision\PV260\Screen
For Ethernet: Specify with Image Receiver*.
*: For how to use Image Receiver, refer to Section 4.17.2 "Outputting Inspection Images to External Device" in the PV200 Manual.

### Display Print Screen on the Monitor

■ **SETUP menu**

***1.*** Press the F1 key and select "Print Screen View".

***2.*** Print screen images are displayed on the monitor.

■ **RUN Menu**

***1.*** If operation is in progress, stop the operation.

***2.*** Press the F1 key and select "Print Screen View".

***3.*** Print screen images are displayed on the monitor.

▶ Note

Procedure for Operating the Print Screen View

| | |
|---|---|
| F1 key | Auto play images and stop.<br>The time interval for auto play is two seconds. It will automatically stop after the last image is displayed. |
| F2 key or Right key | Go to the next image. |
| F3 key or Left key | Back to the previous image. |
| CANCEL key | Exit Print Screen View, and return to the "Select Folder" window. |

# Appendix

# About Format for Each Maker

"Coordinate Format" and "Robot Control Command Format" are automatically set by selecting "Maker" from "Robot communication" under "Input/Output/Robot". The following section describes the format for and processing developed by each maker, because some maker develops its processing except for format.
Even when a maker has been selected, you can edit "Coordinate Format" and "Robot Control Command Format".

# DENSO

Automatic calibration and obtaining of results can simply be performed by combining the provider function of Denso Wave's robot control RC8 with the PV260.

▶ Note

Available from RC8 Ver.1.11.

## Robot Coordinate Format

| %P | = | [+X] | △ | [+Y] | △ | [+R] | △ | [Hand-System] | BCC | CR |
|---|---|---|---|---|---|---|---|---|---|---|

*△: Space

Detail

| | |
|---|---|
| [+X] [+Y] [+R] | Digits of integer = 5, Decimal digits = 3, and plus sign added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 1, NONE (Cartesian) = 1 |

## Movement Instruction

Command

| %MOVE | , | [X] | , | [Y] | , | Z | , | [R] | , | [Hand-System] | , | [S] | BCC | CR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Response

| %MOVE$ | BCC | CR |
|---|---|---|

Detail

| | |
|---|---|
| [X] [Y] [R] [Z] | Decimal, Digits of integer = 5, Decimal digits = 3, and plus sign not added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 1, NONE(Cartesian) = 1 |
| [S] | Decimal, Digits of integer = 3, Decimal digits = 0, and plus sign not added |

## Get Current Robot Position

Command

| %GETPOS | BCC | CR |
|---|---|---|

Response

| %P= | [+X] | , | [+Y] | , | [+R] | , | [Hand-System] | BCC | CR |
|---|---|---|---|---|---|---|---|---|---|

Detail

| | |
|---|---|
| [+X] [+Y] [+R] | Digits of integer = 5, Decimal digits = 3, and plus sign added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 1, NONE(Cartesian) = 1 |

To control the robot (movement instruction and Get Current Robot Position) under the control of the PV260, a robot program must be created using the above format as a reference.

# EPSON

Available for the robot controller RC series manufactured by Epson.

## Robot Coordinate Format

| [X] | , | [Y] | , | 0.000 | , | [R] | , | [Hand-System] | CRLF |
|---|---|---|---|---|---|---|---|---|---|

Detail

| | |
|---|---|
| [X][Y][R] | Digits of integer = 5, Decimal digits = 3, and plus sign not added |
| 0.000 | Digits of integer = 5, Decimal digits = 3, and plus sign not added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 2, NONE(Cartesian) = 0 |

## Movement Instruction

Command

| %MOVE | , | [X] | , | [Y] | , | Z | , | [R] | , | [Hand-System] | , | [S] | CRLF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Response

| %MOVE$ | CRLF |
|---|---|

Detail

| | |
|---|---|
| [X] [Y] [R] [Z] | Decimal, Digits of integer = 5, Decimal digits = 3, and plus sign not added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 2, NONE(Cartesian) = 0 |
| [S] | Decimal, Digits of integer = 3, Decimal digits = 0, and plus sign not added |

## Get Current Robot Position

Command

| %GETPOS | CRLF |
|---|---|

Response

| %P= | [+X] | , | [+Y] | , | [+R] | , | [Hand-System] | CRLF |
|---|---|---|---|---|---|---|---|---|

Detail

| | |
|---|---|
| [+X] [+Y] [+R] | Digits of integer = 5, Decimal digits = 3, and plus sign added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 2, NONE(Cartesian) = 0 |

To control the robot (movement instruction and Get Current Robot Position) under the control of the PV260, a robot program must be created using the above format as a reference.

# IAI

Available for Robot Controller XSEL/MSEL Series manufactured by IAI. The command that directly controls XSEL/MSEL controller is called IAI protocol B. The PV260 support IAI protocol B commands that are used for (SCARA) absolute position specification movement and (SCARA) axis status inquiry.

## How to Use IAI Protocol B

■ When using Ethernet (TCP/IP)

Set I/O parameter by X-SEL PC software.

1. Enter 153 into I/O parameter No. 91 (User release SIO channel 1 station code).
2. Enter 10 into I/O parameter No. 124 (network attribute 5).
3. Enter 10 into I/O parameter No. 129 (network attribute 10).
4. Enter the IP address of the robot controller into I/O parameter Nos. 132 to 135.
5. Enter the Subnet Mask of the robot controller into I/O parameter Nos. 136 to 139.
6. Enter the Default Gateway of the robot controller into I/O parameter Nos. 140 to 143.
7. Enter the IP address of the PV260 into I/O parameter Nos. 149 to 152.
8. Enter 8650 into I/O parameter No. 153.
9. Enter the IP address of the PV260 into I/O parameter Nos. 154 to 157.
10. Enter 8650 into I/O parameter No. 158.
11. If TP (teaching pendant) is connected to the robot controller, pull out the cable.
12. Send the I/O parameter to the robot controller.
13. Close X-SEL PC software and pull out the cable between the PC and the robot control.
14. Connect the PV260 and the robot control via a cross cable.
15. Switch the robot mode to AUTO.

■ When using the serial (RS232C)

Set I/O parameter by X-SEL PC software.

1. Enter 2 into I/O parameter No. 90 (method of using user release SIO channel xx)
2. Enter 153 into I/O parameter No. 91 (User release SIO channel xx station code).
3. Enter baud rate, data (bit) length, stop bit, and parity into I/O parameter Nos. 92 to 95.
4. If TP (teaching pendant) is connected to the robot controller, pull out the cable.
5. Send the I/O parameter to the robot controller.
6. Close X-SEL PC software and pull out the cable between the PC and the robot control.
7. Connect wire between the PV260 and the robot control.
8. Switch the robot mode to AUTO.

# Format

For Cartesian(Table Top) robot

## Robot Coordinate Format

| [X] | , | [Y] | , | [R] | CRLF |
|---|---|---|---|---|---|

Detail

| | |
|---|---|
| [X][Y][R] | Digits of integer = 5, Decimal digits = 3, and plus sign not added |

## Movement Instruction

Command

| ! | 99(h) | 234(h) | 0F(h) | 0000(h) | 0000(h) | [S(h)] | [X(h)] | [Y(h)] | [Z(h)] | [R(h)] | SUM | CRLF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Response

| # | 99(h) | 234(h) | SUM | CRLF |
|---|---|---|---|---|

Detail

| | |
|---|---|
| 99 (h) | Station No. of XSEL/MSEL. It is set to the default value of 153(99(h)).<br>The station No. is a value set in IO parameter No. 91 of XSEL/MSEL. If parameter No. 91 has been changed, change 99(h) as well. |
| 234 (h) | Represents absolute coordinate specification movement. It does not have to be changed. |
| 0F(h) | Represents an axis pattern to be operated.<br>4-axis: 1 or 0 / 3-axis: 1 or 0 / 2-axis: 1 or 0 / 1-axis: 1 or 0<br>* Controls the axis for which 1 is specified. Set 7(h) for 3-axis robot. |
| 0000(h) | Represents acceleration. When it is set to 0, the value set in XSEL/MSEL is referred to.<br>Change the value if you want to change acceleration. |
| 0000(h) | Represents deceleration. When it is set to 0, the value set in XSEL/MSEL is referred to.<br>Change the value if you want to change deceleration. |
| [S(h)] | Number of digits = 4 |
| [X(h)][Y(h)]<br>[Z(h)][R(h)] | Number of digits = 8, Expression = "Coordinate" *1000<br>Delete [R(h)] for 3-axis robot. Change the order according to the operation axes (X to R) available for the axes (1- to 4- axis).<br>In this setting, the axes are used as follows: 1-axis = X axis, 2-axis = Y axis, 3-axis = Z axis, 4-axis = R axis. |

## Get Current Robot Position

Command

| | | | | | |
|---|---|---|---|---|---|
| ! | 99(h) | 212(h) | 0F(h) | SUM | CRLF |

Response

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| # | 99(h) | 212(h) | 0F(h) | 1C(h) | 0(h) | 000(h) | 00(h) | [X(h)] | |
| 1C(h) | 0(h) | 000(h) | 00(h) | [Y(h)] | 1C(h) | 0(h) | 000(h) | 00(h) | [Z(h)] |
| 1C(h) | 0(h) | 000(h) | 00(h) | [R(h)] | SUM | CRLF | | | |

Detail

| | |
|---|---|
| 99 (h) | Station No. of XSEL/MSEL. It is set to the default value of 153(99(h)).<br>The station No. is a value set in IO parameter No. 91 of XSEL/MSEL.<br>If parameter No. 91 has been changed, change 99(h) as well. |
| 212 (h) | Represents axis status inquiry. It does not have to be changed. |
| 0F(h) | The obtained axis is specified.<br>4-axis: 1 or 0 / 3-axis: 1 or 0 / 2-axis: 1 or 0 / 1-axis: 1 or 0<br>* Obtains information of the axis for which 1 is specified. Set 7(h) for 3-axis robot. |
| [X(h)][Y(h)][Z(h)][R(h)] | Number of digits = 8, Expression = [Coordinate]/1000<br>For a 3-axis robot, delete [1C(h)][0(h)][000(h)][00(h)][R(h)].<br>Change the order according to the operation axes (X to R) available for the axes (1- to 4- axis).<br>In this setting, the axes are used as follows: 1-axis = X axis, 2-axis = Y axis, 3-axis = Z axis, 4-axis = R axis. |
| About response<br>Except for #[X(h)][Y(h)][Z(h)][R(h)] | Since only the number of digits is checked, no change is required. |

For SCARA robot

## Robot Coordinate Format

| [X] | , | [Y] | , | [R] | , | [Hand-System] | CRLF |
|---|---|---|---|---|---|---|---|

Detail

| | |
|---|---|
| [X][Y][R] | Digits of integer = 5, Decimal digits = 3, and plus sign not added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 0, NONE(Cartesian)=0 |

## Movement Instruction

Command

| ! | 99(h) | 2D4(h) | 0F(h) | 0000(h) | 0000(h) | [S(h)] | 12(h) | [X(h)] | [Y(h)] | [Z(h)] | [R(h)] | SUM | CRLF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Response

| # | 99(h) | 2D4(h) | SUM | CRLF |
|---|---|---|---|---|

Detail

<table>
<tr><td>99(h)</td><td>Station No. of XSEL/MSEL. It is set to the default value of 153(99(h)).<br>The station No. is a value set in IO parameter No. 91 of XSEL/MSEL.<br>If parameter No. 91 has been changed, change 99(h) as well.</td></tr>
<tr><td>2D4(h)</td><td>Represents SCARA absolute coordinate specification movement. It does not have to be changed.</td></tr>
<tr><td>0F(h)</td><td>Represents an axis pattern to be operated.
<table>
<tr><td>4-axis</td><td>3-axis</td><td>2-axis</td><td>1-axis</td></tr>
<tr><td>1 or 0</td><td>1 or 0</td><td>1 or 0</td><td>1 or 0</td></tr>
</table>
* Controls the axis for which 1 is specified.</td></tr>
<tr><td>0000(h)</td><td>Represents acceleration. When it is set to 0, the value set in XSEL/MSEL is referred to.<br>Change the value if you want to change acceleration.</td></tr>
<tr><td>0000(h)</td><td>Represents deceleration. When it is set to 0, the value set in XSEL/MSEL is referred to.<br>Change the value if you want to change deceleration.</td></tr>
<tr><td>[S(h)]</td><td>Number of digits = 4</td></tr>
<tr><td>12(h)</td><td>Right-Hand = 18(12(h)) Left-Hand = 26(1A(h))<br>Specify the type for operation with a bit.
<table>
<tr><td>Bit7</td><td>Bit6</td><td>Bit5</td><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr>
<tr><td colspan="3">System reservation</td><td colspan="2">Hand-System: 2 = Right-Hand<br>3 = Left-Hand</td><td colspan="2">1 = Selected work coordinates</td><td>0=PTP<br>1=CP</td></tr>
<tr><td>Always 0</td><td>Always 0</td><td>Always 0</td><td>1 or 0</td><td>1 or 0</td><td>1 or 0</td><td>1 or 0</td><td>1 or 0</td></tr>
</table></td></tr>
<tr><td>[X(h)][Y(h)]<br>[Z(h)][R(h)]</td><td>Number of digits = 8, Expression = [Coordinate] *1000<br>Change the order according to the operation axes (X to R) available for the axes (1- to 4- axis).<br>In this setting, the axes are used as follows: 1-axis = X axis, 2-axis = Y axis, 3-axis = Z axis, 4-axis = R axis.</td></tr>
</table>

## Get Current Robot Position

Command

| ! | 99(h) | 2A1(h) | 0F(h) | 0(h) | SUM | CRLF |
|---|---|---|---|---|---|---|

Response

| # | 99(h) | 2A1(h) | 00(h) | 00(h) | [Hand-System] | 0F(h) | 1C(h) | 0(h) | 000(h) | 00(h) | [X(h)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1C(h) | 0(h) | 000(h) | 00(h) | [Y(h)] | 1C(h) | 0(h) | 000(h) | 00(h) | [Z(h)] | | |
| 1C(h) | 0(h) | 000(h) | 00(h) | [R(h)] | SUM | CRLF) | | | | | |

Detail

| | |
|---|---|
| 99(h) | Station No. of XSEL/MSEL. It is set to the default value of 153(99(h)).<br>The station No. is a value set in IO parameter No. 91 of XSEL/MSEL.<br>If parameter No. 91 has been changed, change 99(h) as well. |
| 2D4(h) | Represents SCARA axis status inquiry. It does not have to be changed. |
| 0F(h) | The obtained axis is specified.<br>4-axis \| 3-axis \| 2-axis \| 1-axis<br>1 or 0 \| 1 or 0 \| 1 or 0 \| 1 or 0<br>* Obtains information of the axis for which 1 is specified. |
| 0(h) | 0(h) = Base coordinate<br>1(h) = Work coordinate<br>To obtain coordinates in work coordinate system, change to 1(h). |
| [Hand-System] | Number of digits = 2, Right-Hand = 0, Left-Hand = 1 |
| [X(h)][Y(h)][Z(h)][R(h)] | Number of digits = 8, Expression = "Coordinate"/1000<br>Change the order according to the operation axes (X to R) available for the axes (1- to 4- axis).<br>In this setting, the axes are used as follows: 1-axis = X axis, 2-axis = Y axis, 3-axis = Z axis, 4-axis = R axis. |
| About response<br>Other than [X(h)][Y(h)][Z(h)][R(h)][Hand-System] | Since only the number of digits is checked, no change is required. |

# JANOME: JR2000/JS Series

Available for Robot Controller JR2000/JS Series manufactured by Janome Sewing Machine. The direct control of the controller of JR2000/JS Series is called external control.
The PV260 supports the external control, which is used for PTP drive control and arm position request.
To use the external control, make a straight wire connection with COM1.
To provide communication for actual measurements, make a straight connection with other than COM1.

## Robot Coordinate Format

| %P= | [+X] | △ | [+Y] | △ | [+R] | △ | [Hand-System] | BCC | CR |
|---|---|---|---|---|---|---|---|---|---|

*△: Space

Detail

| | |
|---|---|
| [+X][+Y][+R] | Digits of integer = 5, Decimal digits = 3, and plus sign added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 1, NONE(Cartesian) = 1 |

## Movement Instruction

Command

| $M1 | [X(h)] | [Y(h)] | Z(h) | [R(h)] | SUM | CR |
|---|---|---|---|---|---|---|

Response

| $m1000 | SUM | CR |
|---|---|---|

Detail

| | |
|---|---|
| [X(h)] | Hexadecimal, Number of Digits = 6, Right-Hand = "X" * 2000, Left-Hand = "X" * 2000+1 |
| [Y(h)][Z(h)] | Hexadecimal, Number of Digits = 6, Expression = "Coordinate"*2000 |
| [R(h)] | Hexadecimal, Number of Digits = 6, Expression = "R(h)"*200 |

## Get Current Robot Position

Command

| $N0 | SUM | CR |
|---|---|---|

Response

| $n0 | [X(h)] | [Y(h)] | Z(h) | [R(h)] | SUM | CR |
|---|---|---|---|---|---|---|

Detail

| | |
|---|---|
| [X(h)] | Hexadecimal, Number of Digits = 6, Expression = "X"/2000<br>Convert X(h), sent from the robot, into the decimal. If the converted value is an odd number, it is judged to be Left-Hand System.<br>If an even number, it is judged to be Right-Hand System. In the case of Left-Hand System, subtract 1 from the converted value and calculate according to the expression. In the case of Right-Hand System, calculate according to the expression. |
| [Y(h)][Z(h)] | Hexadecimal, Number of Digits = 6, Expression = "Coordinate"*2000 |
| [R(h)] | Hexadecimal, Number of Digits = 6, Expression = "R(h)"*200 |

▶ Note

- When the movement instruction is executed, the Z axis movement is similar to up and down movement, as specified by JR2000/JS Series.
- Since the Z axis is moved to the origin and then to a specified position, the movement of the Z axis is similar to up and down movement.
- With respect to the movement instruction, the PV260 is not allowed to control the speed. To change the speed, change the setting on the robot side.
- Header($) is excluded from the calculation of movement instruction and Get Current Robot Position checksum (SUM).

# JANOME: JR3000 Series

Available for Robot Controller JR3000 Series manufactured by Janome Sewing Machine. The direct control of the controller of JR3000 Series is called communication control.
The PV260 supports the communication control, which is used for PTP drive control and axis position request. To use the communication control, make a straight wire connection with COM1. To provide communication for actual measurements, make a straight connection with other than COM1. Note that the PV260 does not support communication with JR3000 Series via Ethernet.

## Robot Coordinate Format

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| %P= | [+X] | △ | [+Y] | △ | [+R] | △ | [Hand-System] | BCC | CR |

*△: Space

Detail

| | |
|---|---|
| [+X][+Y][+R] | Digits of integer = 5, Decimal digits = 3, and plus sign added |
| [Hand-System] | Right-Hand = 1, Left-Hand = 1, NONE(Cartesian) = 1 |

## Movement Instruction

Command

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $M1 | 00000001(h) | [X(h)] | [Y(h)] | Z(h) | [R(h)] | 00000000(h) | 00000000(h) | SUM | CR |

Response

| | | |
|---|---|---|
| $m1000 | SUM | CR |

Detail

| | |
|---|---|
| 00000001(h) | Hexadecimal, Number of digits = 8, Right-Hand = 1, Left-Hand = -1 |
| [X(h)][Y(h)]<br>[Z(h)][R(h)] | Hexadecimal, Number of Digits = 8, Expression = [Coordinate]*2000 |
| 00000000(h) | Hexadecimal, Number of Digits = 8, Constant = 0<br>Represents a value of the M1 axis. The M1 axis is used. If some problem is caused by 0, change the setting.<br>In such a case, enter an integer value multiplied by 2000.<br>Example: To set M1 axis = 123.456, enter 246912(123.456*2000) as the value. |
| 00000000(h) | Hexadecimal, Number of Digits = 8, Constant = 0<br>Represents the value of the M2 axis. When changing the setting, make the setting based on the same concept as that of the M1 axis. |

## Get Current Robot Position

Command

| | | |
|---|---|---|
| $N0 | SUM | CR |

Response

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $n0 | [Hand-System] | [X(h)] | [Y(h)] | Z(h) | [R(h)] | SUM | CR |

Detail

| | |
|---|---|
| [Hand-System] | Hexadecimal, Number of digits = 8, Right-Hand = 1, Left-Hand = -1 |
| [X(h)][Y(h)]<br>[Z(h)][R(h)] | Hexadecimal, Number of Digits = 8, Expression = [Coordinate]*2000 |
| 00000000(h) | Hexadecimal, Number of Digits = 8, Constant = 0 * No change is required. |
| 00000000(h) | Hexadecimal, Number of Digits = 8, Constant = 0 * No change is required. |

▶ Note

- When the movement instruction is executed, the Z axis movement is similar to up and down movement, as specified by JR2000/JS Series.
- Since the Z axis is moved to the origin and then to a specified position, the movement of the Z

axis is similar to up and down movement.
- With respect to the movement instruction, the PV260 is not allowed to control the speed. To change the speed, change the setting on the robot side.
- Header($) is excluded from the calculation of movement instruction and Get Current Robot Position checksum (SUM).

# TOSHIBA

Available for Robot Controller TS3000 manufactured by Toshiba Machine. The direct control of the controller of TS3000 Series is called simple procedure communication.
In the simple procedure communication, the PV260 supports PTP drive using DO statement. Since Get Current Robot Position is not supported, "Robot Control Setting" is not available.

## How to Use Simple Procedure Communication

■ When using Ethernet (TCP/IP)

Set the Ethernet parameters as follows:

1. In [E00]Open mode, set IP0 to 2.
2. In [E01]Robot controller IP address, set the IP address of the robot controller.
3. In [E03]Subnet mask, set the Subnet Mask of the network to be connected.
4. In [E04]Default gateway, set a default gateway.
5. In [E05]Own port no, set the port No. of IP0 of the robot controller.
   When setting, prevent the port Nos. of IP0 to IP3 from overlapping each other.
6. In [E06]Port number of destination, set IP0 to 8650.
7. In [E07]IP address of destination, set IP0 to the IP address of the PV260.
8. Switch the power supply to robot controller from off to on.
9. Connect the PV260 and the robot controller via a cross cable.

■ When using the serial (RS232C)

Set the user parameter file as follows:

1. In the [U06]Serial port setting, specify speed (baud rate), character length (bit length), parity (parity check), and stop bit length (stop bit) under [HOST]. The name in the PV260 is put in parentheses.
2. Connect the PV260 and the robot controller via a cross cable.

## Format

### Robot Coordinate Format

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [X] | , | [Y] | , | 0.000 | , | [R] | , | 0.000 | , | [Hand-System] | CR |

Detail

| | |
|---|---|
| [X][Y] | Digits of integer = 4, Decimal digits = 3, and plus sign not added |
| 0.000 | Digits of integer = 4, Decimal digits = 3, Plus sign not added, Value = 0<br>Represents Z axis. In particular, no change is required. |
| [R] | Digits of integer = 3, Decimal digits = 3, and plus sign not added |
| 0.000 | Digits of integer = 4, Decimal digits = 3, Plus sign not added, Value = 0<br>Represents T axis In particular, no change is required. |
| [Hand-System] | Right-Hand = 2, Left-Hand = 1 |

## Movement Instruction

Command

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <STX> | DO,MOVE△ | POINT( | [X] | , | [Y] | , | Z | , | [R] | , | 0.000 | , | [Hand-System] | )△WITH△SPEED= | [S] | CR | <ETX> |

Response

| | | | |
|---|---|---|---|
| <STX> | OK | CR | <ETX> |

Detail

| | |
|---|---|
| <STX> | Header of simple communication command. When TOSHIBA is selected for Maker, <STX> is automatically added to the robot control command. |
| [X][Y][Z][R] | Digits of integer = 4, Decimal digits = 3 |
| 0.000 | Digits of integer = 4, Decimal digits = 3, Value = 0<br>Represents the values of 6 axes. Change the value when 0 is not acceptable at the time of movement instruction with 6 axes used. |
| [Hand-System] | Right-Hand = 2, Left-Hand = 1 |
| [S] | Digits of integer = 3, Decimal digits = 0 |
| <ETX> | Termination of simple communication command. When TOSHIBA is selected for Maker, <ETX> is automatically added to the termination of the robot control command. |

▶ Note

- When auto calibration starts, servo on is issued to the robot controller. When auto calibration ends, servo off is issued to the robot controller.

# Precautions for Use

In the format of TOSHIBA, a response to movement instruction represents not a response indicating the completion of movement but the reception of a command. The auto calibration of the PV260 receives a response to movement completion, detects a mark after "DELAY for Robot Control Command", and then issues a command to move the robot to the next capture position.
"DELAY for Robot Control Command" selected from "TYPE" > "Robot" > "Calibration" should be made slightly longer, because short "DELAY for Robot Control Command" makes an image captured during movement of the robot.

# YAMAHA

Available for RCX240 manufactured by Yamaha Motor. The RCX240 calls the direct control of controller online commands.
Of the online commands, the PV260 supports the MOVE command and the acquisition of main current position (XY coordinate).
Using a cross cable, connect the PV260 and the RCX240 via RS232C. When using an online command (robot control command), select "Online" for robot mode.

## Robot Coordinate Format

| P0= | [X] | △ | [Y] | △ | 0.00 | △ | [R] | △ | 0.00 | △ | 0.00 | △ | [Hand-System] | CRLF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Detail

| | |
|---|---|
| P0= | P0 represents a point data No.<br>It represents the output of all measurement results of the PV260 by point No. 0.<br>Change it if the output requires other than point No. 0. |
| [X][Y] | Digits of integer = 5, Decimal digits = 2, and plus sign not added |
| 0.00 | Digits of integer = 5, Decimal digits = 2, Plus sign not added, Value = 0<br>Represents Z axis. In particular, no change is required. |
| [R] | Digits of integer = 3, Decimal digits = 2, and plus sign not added |
| 0.00 | Digits of integer = 5, Decimal digits = 3, Plus sign not added, Value = 0<br>Represents A axis and B axis. In particular, no change is required. |
| 0.00 | |
| [Hand-System] | Right-Hand = 1, Left-Hand = -2 |

## Movement Instruction

Command

| @MOVE△P, | [X] | △ | [Y] | △ | Z | △ | [R] | △ | 0.00 | △ | 0.00 | △ | [Hand-System] | ,S= | [S] | CRLF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Response

| OK | CR |
|---|---|

Detail

| | |
|---|---|
| [X][Y][Z] | Digits of integer = 5, Decimal digits = 2, and plus sign not added |
| [R] | Digits of integer = 3, Decimal digits = 2, and plus sign not added |
| 0.00 | Digits of integer = 5, Decimal digits = 2, Value = 0<br>Represents the value of A axis or B axis. Change the value when 0 is not acceptable at the time of movement instruction with A axis and B axis used. |
| 0.00 | |
| [Hand-System] | Right-Hand = 1, Left-Hand = 2 |
| [S] | Digits of integer = 3, Decimal digits = 0 |

## Get Current Robot Position

Command

| @?WHRXY | CRLF |
|---|---|

Response

| [POS] | [X] | [X] | △ | [Y] | △ | [Z] | △ | [R] | △ | 0.00 | △ | 0.00 | CR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Detail

| | |
|---|---|
| [X][Y][Z] | Digits of integer = 5, Decimal digits = 2, and plus sign not added |
| [R] | Digits of integer = 3, Decimal digits = 2, and plus sign not added |
| 0.00 | Digits of integer = 5, Decimal digits = 2, Value = 0<br>Represents the value of A axis or B axis. Change the value when 0 is not acceptable at the time of movement instruction with A axis and B axis used. |
| 0.00 | |

▶ Note

- In Get Current Robot Position, Hand-System cannot be acquired. For Hand-System, direct setting with the keypad is required.

## Precautions for Use

Note that when YAMAHA is selected for "Maker", a command is required to acquire results of measurements made by the PV260 and the sequence differs from those of other makers. For command and sequence, refer to “5.3.2 When YAMAHA is selected by "Maker"” on page 183.

# ASCII Code Table

## ■ ASCII Code to Decimal Conversion Table

▶ Note

When characters of judgement result are registered for Numerical Calculation, values converted from ASCII codes of characters are entered into expressions.

| Label | ASCII | Value |
|---|---|---|
| 0 | 30 | 48 |
| 1 | 31 | 49 |
| 2 | 32 | 50 |
| 3 | 33 | 51 |
| 4 | 34 | 52 |
| 5 | 35 | 53 |
| 6 | 36 | 54 |
| 7 | 37 | 55 |
| 8 | 38 | 56 |
| 9 | 39 | 57 |
| A | 41 | 65 |
| B | 42 | 66 |
| C | 43 | 67 |
| D | 44 | 68 |
| E | 45 | 69 |
| F | 46 | 70 |
| G | 47 | 71 |
| H | 48 | 72 |
| I | 49 | 73 |
| J | 4A | 74 |
| K | 4B | 75 |
| L | 4C | 76 |
| M | 4D | 77 |
| N | 4E | 78 |
| O | 4F | 79 |

| Label | ASCII | Value |
|---|---|---|
| P | 50 | 80 |
| Q | 51 | 81 |
| R | 52 | 82 |
| S | 53 | 83 |
| T | 54 | 84 |
| U | 55 | 85 |
| V | 56 | 86 |
| W | 57 | 87 |
| X | 58 | 88 |
| Y | 59 | 89 |
| Z | 5A | 90 |
| a | 61 | 97 |
| b | 62 | 98 |
| c | 63 | 99 |
| d | 64 | 100 |
| e | 65 | 101 |
| f | 66 | 102 |
| g | 67 | 103 |
| h | 68 | 104 |
| i | 69 | 105 |
| j | 6A | 106 |
| k | 6B | 107 |
| L | 6C | 108 |
| m | 6D | 109 |
| n | 6E | 110 |

| Label | ASCII | Value |
|---|---|---|
| o | 6F | 111 |
| p | 70 | 112 |
| q | 71 | 113 |
| r | 72 | 114 |
| s | 73 | 115 |
| t | 74 | 116 |
| u | 75 | 117 |
| v | 76 | 118 |
| w | 77 | 119 |
| x | 78 | 120 |
| y | 79 | 121 |
| z | 7A | 122 |
| - | 2D | 45 |
| / | 2F | 47 |
| . | 2E | 46 |
| * | 2A | 42 |
| ( | 28 | 40 |
| ) | 29 | 41 |
| < | 3C | 60 |
| > | 3E | 62 |
| & | 26 | 38 |
| $ | 24 | 36 |
| : | 3A | 58 |
| + | 2B | 43 |

## ■ ASCII code table

| | | | | bit7 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | bit6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | | | bit5 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| bit4 | bit3 | bit2 | bit1 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0 | 0 | 0 | 0 | 0(0) | NUL | DLE | SP | 0 | @ | P | ′ | p |
| 0 | 0 | 0 | 1 | 1(1) | SOH | DC1 | ! | 1 | A | Q | a | q |
| 0 | 0 | 1 | 0 | 2(2) | STX | DC2 | “ | 2 | B | R | b | r |
| 0 | 0 | 1 | 1 | 3(3) | ETX | DC3 | # | 3 | C | S | c | s |
| 0 | 1 | 0 | 0 | 4(4) | EOT | DC4 | $ | 4 | D | T | d | t |
| 0 | 1 | 0 | 1 | 5(5) | ENQ | NAC | % | 5 | E | U | e | u |
| 0 | 1 | 1 | 0 | 6(6) | ACK | SYN | & | 6 | F | V | f | v |
| 0 | 1 | 1 | 1 | 7(7) | BEL | ETB | ‘ | 7 | G | W | g | w |
| 1 | 0 | 0 | 0 | 8(8) | BS | CAN | ( | 8 | H | X | h | x |
| 1 | 0 | 0 | 1 | 9(9) | HT | EM | ) | 9 | I | Y | i | y |
| 1 | 0 | 1 | 0 | 10(A) | LF/NL | SUB | * | : | J | Z | j | z |
| 1 | 0 | 1 | 1 | 11(B) | VT | ESC | + | ; | K | [ | k | { |
| 1 | 1 | 0 | 0 | 12(C) | FF | FS | , | < | L | \ | l | \| |
| 1 | 1 | 0 | 1 | 13(D) | CR | GS | - | = | M | ] | m | } |
| 1 | 1 | 1 | 0 | 14(E) | SO | RS | . | > | N | ^ | n | ~ |
| 1 | 1 | 1 | 1 | 15(F) | SI | US | / | ? | O | _ | o | DEL |

# Index


Calibration
- Auto(1 point) ... 120
- Calibration Update ... 188
- Manual(3 point) ... 113
- Semi-Auto (1 point) ... 117
- Transformation of robot coordinate ... 110

Camera attachment ... 12

Command Communication Log ... 190

Robot Control Command Format
- Get Current Robot Position Format ... 36
- Movement Instruction(Absolute Position) Format 33

Communication Port and Protocol
- Ethernet Interface ... 47
- RS232C Interface ... 45

Data R/W ... 163

Display Global Coordinate function ... 112

General Com.
- General communication command ... 59

Hand-System ... 23, 27, 32

Method of calculating the R-Coordinates ... 107

Network ... 51

Number of field of view ... 143, 145, 148

Output of Robot Coordinates ... 168

PLC Com.
- List of PLC Communication Commands ... 90
- Setting of PLC Communication ... 76
- Usable PLCs for PLC Communication ... 70

Print screen ... 196

Robot Communication
- Control code setting list ... 26

Robot Control ... 37

Robot coordinate setting
- Base Angle axis ... 15
- Rotation direction ... 14

Robot Coordinates Format ... 20, 21

Robot Environment Setting
- Camera attachment ... 12

Robot Information ... 13

Robot Position ... 129

Select Menu ... 192

Sequence
- Auto calibration ... 176
- Base Position Re-registration Sequence (With captured image) ... 184
- Execution Sequence (1 Field of View) ... 182
- Teaching coordinate request ... 181

Serial Communication Setting ... 50

Teaching
- Output of Teaching Coordinates ... 128
- Robot Teaching ... 125
- Teaching point ... 125, 128

TOOL
- Tool Offset ... 103
- Tool Position ... 103

Work Detection
- Adjustment Amount of Work ... 140
- Gravity Coordinates of Work 135, 143, 147, 153

Working Pos ... 154

# Revision history

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|---|---|---|
| WME-PV260-OP-01 | June 2015 | First edition |

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