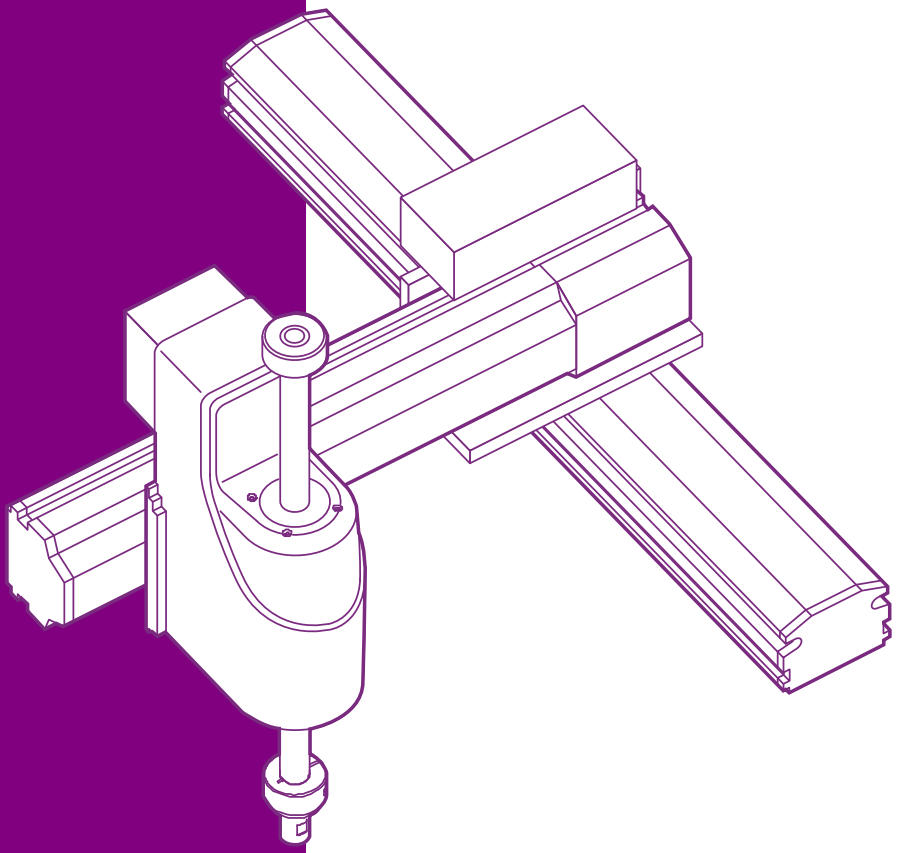
Vision System I/F Function

Instruction Manual Ninth Edition

X-SEL Controller P/Q/R/S

Tabletop Robot TTA

MSEL Controller PC/PG



IAI America, Inc.

Please Read Before Use

Thank you for purchasing our product.

This Instruction Manual describes all necessary information to operate this product safely such as the operation procedure, structure and maintenance procedure.

Before operation, read this manual carefully and fully understand it to operate this product safely. The enclosed CD or DVD in this product package includes the Instruction Manual for this product. For the operation of this product, print out the necessary sections in the Instruction Manual or display them using the personal computer.

After reading through this manual, keep this Instruction Manual at hand so that the operator of this product can read it whenever necessary.

[Important]

- This Instruction Manual is original.
- The product cannot be operated in any way unless expressly specified in this Instruction Manual.
  IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Instruction Manual is subject to change without notice for the purpose of product improvement.
- If you have any question or comment regarding the content of this manual, please contact the IAI sales office near you.
- Using or copying all or part of this Instruction Manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.
- CV-2000, CV-3000, CV-5000 and XG-7000 are the registered trademarks of Keyence Corporation.
- F210-CIO, FZ3 are the registered trademarks of OMRON Corporation.
- In-Sight 5000 Series and In-Sight Explorer are the registered trademarks of Cognex Corporation.

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Safety Guide

"Safety Guide" has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	● This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) ● Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. ● Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact ● For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	● When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. ● Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the instruction manual for each model. ● Do not step or sit on the package. ● Do not put any heavy thing that can deform the package, on it. ● When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. ● When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. ● Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. ● Do not get on the load that is hung on a crane. ● Do not leave a load hung up with a crane. ● Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. ● Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.
		(3) Grounding ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm^2 (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	● Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. ● Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. ● Make sure to operate automatic operation start from outside of the safety protection fence. ● In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. ● When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the Instruction Manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. ● The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. ● Pay attention not to lose the cover or untightened screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When removing the actuator for disposal, pay attention to drop of components when detaching screws. ● Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	● Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. ● See Overseas Specifications Compliance Manual to check whether complies if necessary. ● For the handling of actuators and controllers, follow the dedicated instruction manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the Instruction Manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	 Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	 Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	 Notice

Precautions in Handling

- The number of work pieces that the camera can detect in 1 shot of image capturing is as described below:

  Cognex In-Sight EZ110　8 pieces at max.
  Cognex In-Sight 5000　12 pieces at max.
  Keyence CV-2000　7 pieces at max.
  Vision systems of Keyence other than CV-2000 and I/F applicable vision systems　12 pieces at max.
  OMRON vision systems　12 pieces at max.
- Build the system with care so that the work after being captured would not get moved off the position by an external force (vibration, air blow, crash of another work, etc.).
- If the image-capturing conditions, such as the light (diffusers), focus, diaphragm, shutter speed, etc., are inefficient, such problems like the work not being detected or inaccurate position detection may occur. (Please refer to the Instruction Manual for Vision System to have the appropriate adjustments.)
- Please ask each vision system supplier for the adjustment of Vision System (detection settings, format settings indicated for our products [refer to Section 8.1], etc.).
  When using Cognex In-Sight EZ110, the sample job data is available to download from the enclosed CD or IAI homepage. (* Please ask the distributor to have the detection settings done for you so it suits to the work that you will use.)
- Tabletop Robot TTA and MSEL is not applicable for Vision System manufactured by OMRON or vision system (CV2000) manufactured by Keyence.

1. Overview

Vision System I/F Function is a function to store the coordinate data(Note 1) (Note 2) sent from the work directly to the position data.

When using the vision system, the specialized window in the PC software always backups the adjustment (calibration) of coordinates of the necessary camera and robot(Note 3).

(Note 1) In the existing systems, the data from Vision System needs to be treated as characters and the user needs to convert the values to store the position data. In Vision System I/F Function, the user does not need to convert the values, and the coordinates are directly stored to the position data.

(Note 2) It is necessary to send the data in the format indicated by our products.

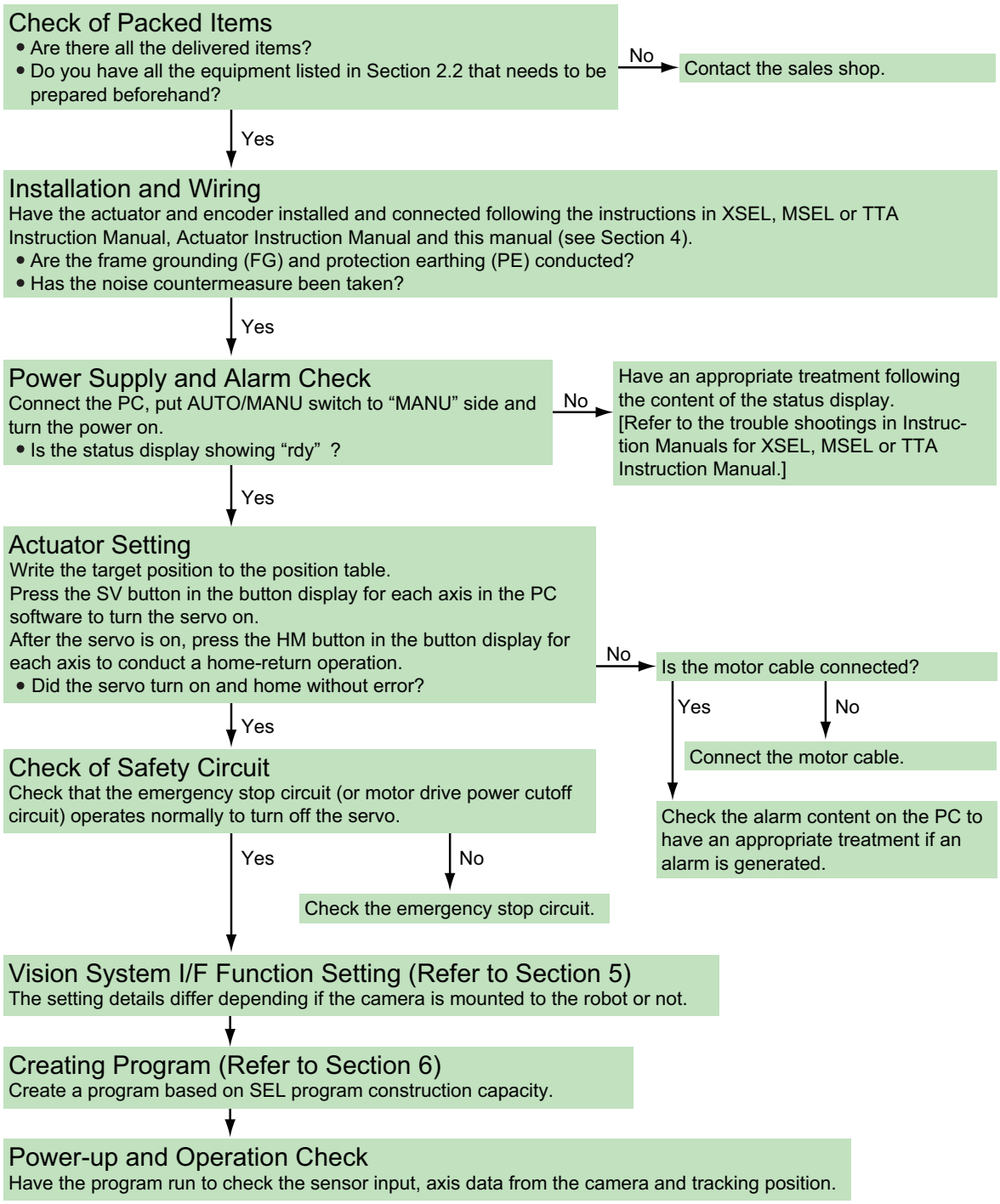
(Note 3) If conducting the dedicated calibration with EZ-110XL, the procedure of manual alignment of the work to the robot which is necessary for the existing models will be dramatically reduced.

This manual explains how to set up the system to utilize Vision System I/F Function.

2. Work Flow before Operation Start

> ⚠ Note
>
> Make sure to have the settings of the vision system such as the work detection setting and communication setting done before having the vision system I/F function settings.

2.1 Starting Procedures



Now, the operation adjustment is complete.

Conduct an adjustment by the system.

2.2 Items to Prepare Beforehand

The Vision System explained in this manual is in regard to the equipment's operation and its program. The equipment and components that construct the system need to be prepared separately.

1) Vision System
Corresponding Product

Examples of Vision System Models					
Supplier	Model				Interface
Cognex	In-Sight EZ-110 (EZ-110XL) In-Sight 5000 Series				Ethernet
OMRON	F210-C10		FZ3		RS232C
Keyence	CV2000	CV3000	CV5000	XG-7000	Ethernet RS232C

Note 1 Please ask each vision system supplier to have the settings on Vision System such as the work detection setting and the output communication format indicated by our products [refer to Section 8.1].

Note 2 Vision System manufactured by OMRON or vision system CV2000 manufactured by Keyence cannot be connected to Tabletop Actuator TTA and MSEL Controller.

- PIO Cable
  (There are some cases that the dedicated accessary is required. Please refer to the Instruction Manual for each Vision System.
  e.g. FZ-VP, Parallel I/O cable dedicated for OMRON FZ3)
- For Ethernet Connection
  LAN cable (Category 5 or higher)
  Hub
- For RS232C Connection (Note: Not applicable for TTA and MSEL.)
  Apply a cable that has a connector suitable for the camera controller on one end and D-sub 9-pin connector (female) on the other end (XSEL end).
  [Refer to the Instruction Manual for each Vision System for the wiring on the camera controller side.]
  [Refer to the Appendix at the end for the wiring on XSEL side.]
- If Using Work Detection Sensor
  Photoelectric sensor

2) Other Requirement of IAI Products

- XSEL Controller, or Tabletop Robot TTA (hereafter so-called SEL Controller)
  (Main application Version XSEL-P/Q : V1.05 or later
  XSEL-R/S : V1.04 or later
  TTA : V1.00 or later
  MSEL-PC/PG : V1.00 or later)
- Ethernet Board
  (Option … If Ethernet is used for communication between XSEL-P/Q and the vision system)
- Ethernet/IP Board
  (Option …Mandatory for TTA and MSEL. If Ethernet is used for communication between XSEL-R/S and the vision system)
- XSEL controller PC software
  (If the vision system is In-Sight EZ110 (EZ-110XL);
  - XSEL-P/Q : Version V7.07.08.00 or later
  - XSEL-R/S : Version V9.0.0.0 or later
  - TTA : Version V10.0.0.0 or later
  - MSEL : Version V12.00.00.00 or later)

  (If the vision system is not In-Sight EZ110 (EZ-110XL);
  - XSEL-P/Q : Version V7.06.08.00 or later
  - XSEL-R/S : Version V9.0.0.0 or later
  - TTA : Version V10.0.0.0 or later
  - MSEL : Version V12.00.00.00 or later)

⚠ Note

When using the conveyor tracking function and the vision system I/F function at the same time, it is not possible to have Ethernet to both of the functions as the communication interface. Connect one of them with RS232C.

Note: Not applicable for TTA and MSEL.

Available interface combination when using vision system					
Interface		Conveyer Tracking		Vision System I/F	
		Ethernet	Standard SIO (RS232C)	Ethernet	Standard SIO (RS232C)
Conveyer Tracking	Ethernet			×	○
	Standard SIO (RS232C)			○	○
Vision System I/F	Ethernet	×	○		
	Standard SIO (RS232C)	○	○		

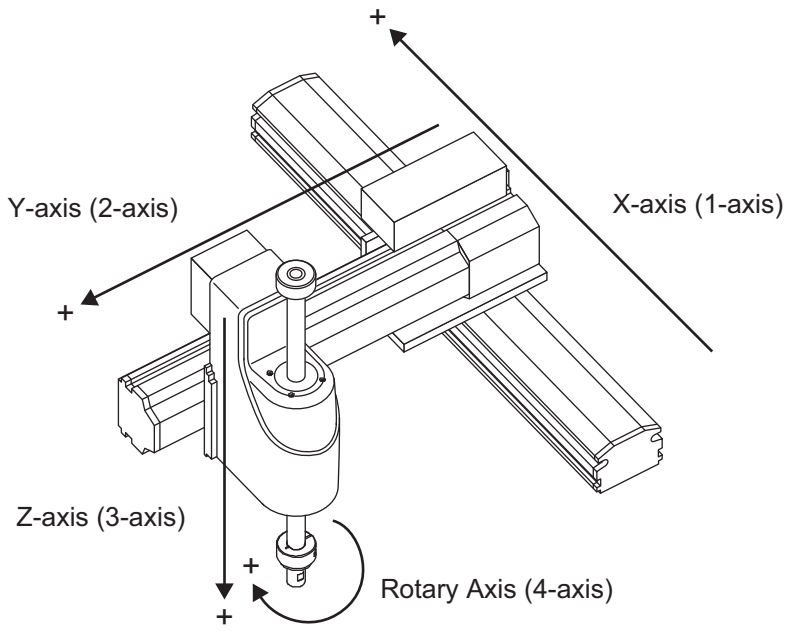
If the vision system is EZ-110XL and the dedicated software is used, the simple adjustment function that enables to reduce the procedure of manual alignment in the matching process of the robot and the vision system coordinates can be used.
When using the simple adjustment function, the work to be used in the adjustment process and a tool to hold the work (chuck, grip, etc.) are necessary for the settings.

3. Coordinates

3.1 Coordinate Axes for Orthogonal Robot

Vision System I/F Function is a system to be used with all or any of the coordinates (X, Y and θ) of the vision system assigned to each axis on the Cartesian robot. The assigned axis operates following the coordinate information gained from the vision system.

The assignment of coordinate axes of the vision system to those on the Cartesian robot and the directions in the initial setting are as shown in the figure below. [For more details, refer to 5.6 Setting of Relations between Vision System Coordinate Settings and Each Robot Axis]



The work coordinates data received from the vision system (position information) is saved to the position data as shown below.

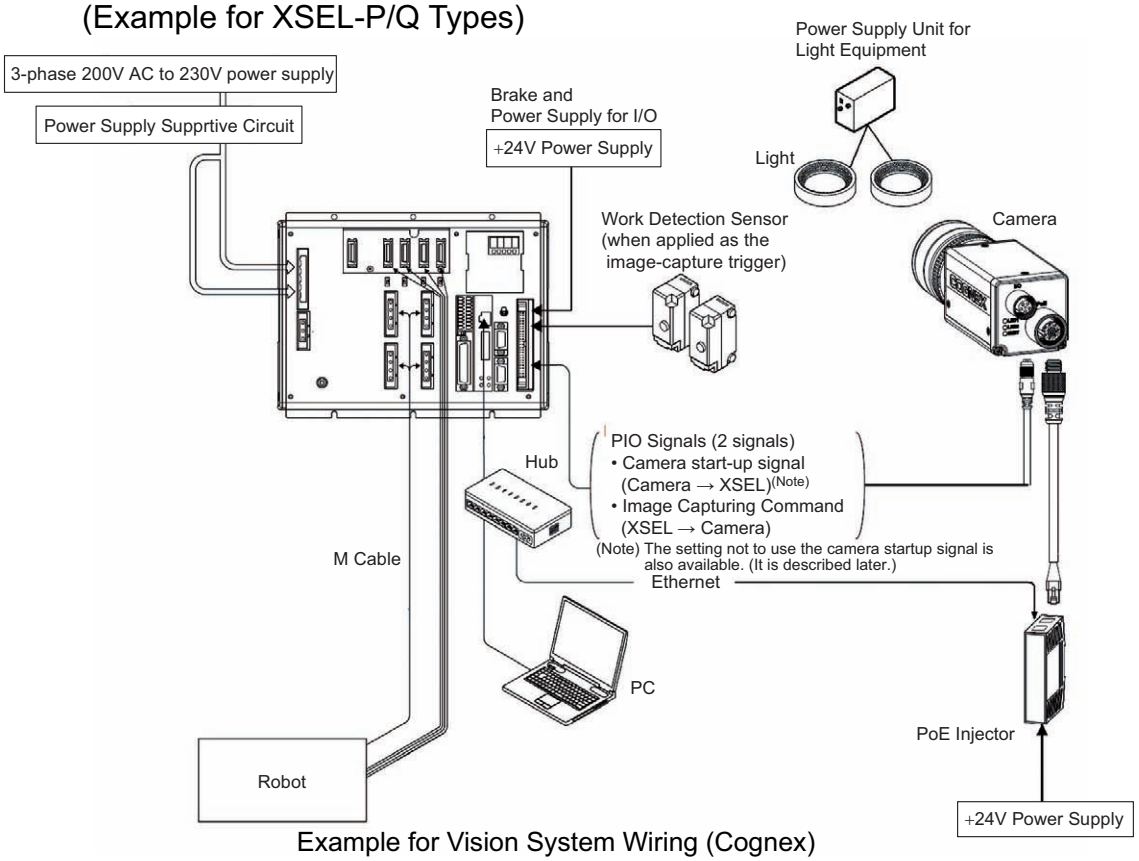
	Work X Coordinate ↓	Work Y Coordinate ↓		Work θ Coordinate ↓		
No. (Name)	Axis1 (1-axis)	Axis2 (2-axis)	Axis3 (3-axis)	Axis4 (4-axis)	Axis5	Axis6
* ( )	10.000	0.000		45.000		

4. Installation

4.1 Wiring

Shown below is an example of the vision system wiring layout when each camera controller is connected.

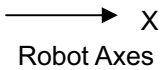
4.1.1 Example of wiring layout when connecting Cognex camera (Example for XSEL-P/Q Types)



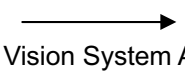
Example for Vision System Wiring (Cognex)

⚠ Note:

- 24V I/O signal (PIO) is used for the capture command to the camera. Use the dedicated I/O cable for the vision systems if it is equipped with a dedicated cable.
- For EZ-110XL
  Set the robot axes and the vision system X-axes so they are orienting the same directions.

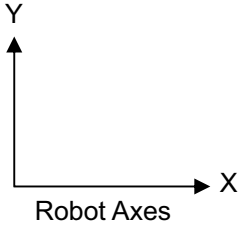


Robot Axes

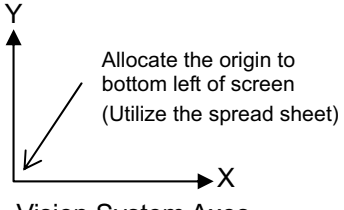


Vision System Axes

- For those other than In-Sight EZ110
  Set the robot axes and the vision system axes so they are orienting the same directions.
  Also, allocate the vision system origin to the bottom left of the screen.

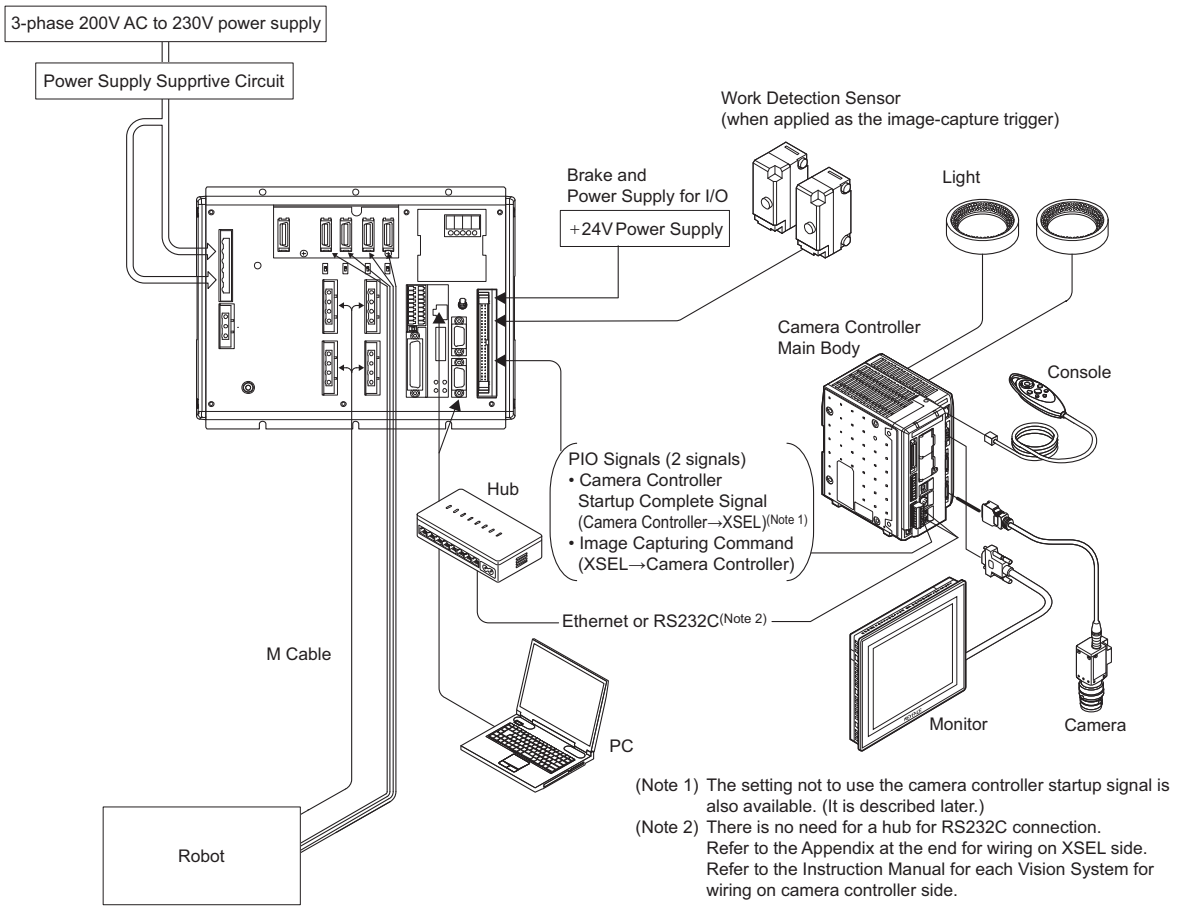


Robot Axes



Vision System Axes

4.1.2 Example of wiring layout when connecting Keyence camera (Example for XSEL-P/Q Types)

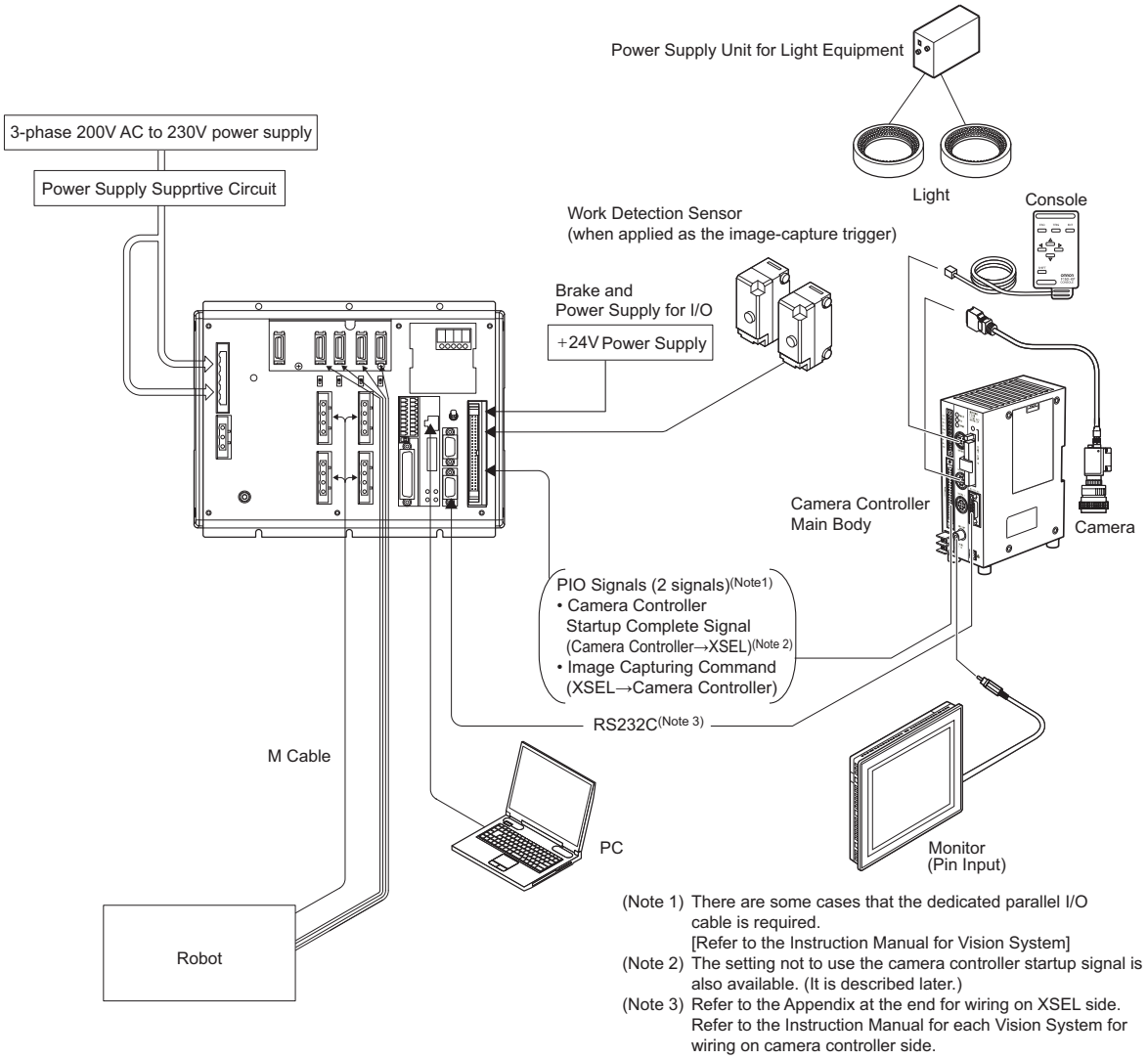


Example for Vision System Wiring (Keyence)

⚠ Note:

- 24V I/O signal (PIO) is used for the capture command to the camera. Use the dedicated I/O cable for the vision systems if it is equipped with a dedicated cable.
- Set the robot axis and the vision system axes directions so the X-axes are orienting the same direction and Y-axes the opposite. Also, allocate the vision system origin to the top left of the screen.

4.1.3 Example of wiring layout when connecting OMRON camera (Example for XSEL-P/Q Types)

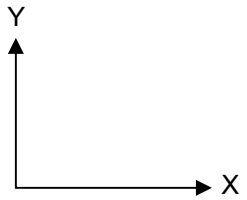


(Note 1) There are some cases that the dedicated parallel I/O cable is required.
[Refer to the Instruction Manual for Vision System]
(Note 2) The setting not to use the camera controller startup signal is also available. (It is described later.)
(Note 3) Refer to the Appendix at the end for wiring on XSEL side. Refer to the Instruction Manual for each Vision System for wiring on camera controller side.

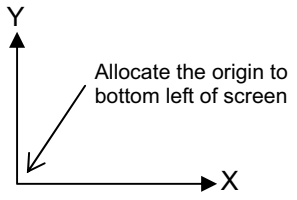
Example for Vision System Wiring (OMRON)

⚠ Note:

- 24V I/O signal (PIO) is used for the capture command to the camera. Use the dedicated I/O cable for the vision systems if it is equipped with a dedicated cable.
- Set the robot axes and the vision system axes so they are orienting the same directions. Also, allocate the vision system origin to the bottom left of the screen.



Robot Axes



Vision System Axes

4.2 Installing XSEL Controller PC Software

Refer to the Instruction Manual for XSEL Controller PC Software for how to install XSEL Controller PC Software and how to implement the initial settings.

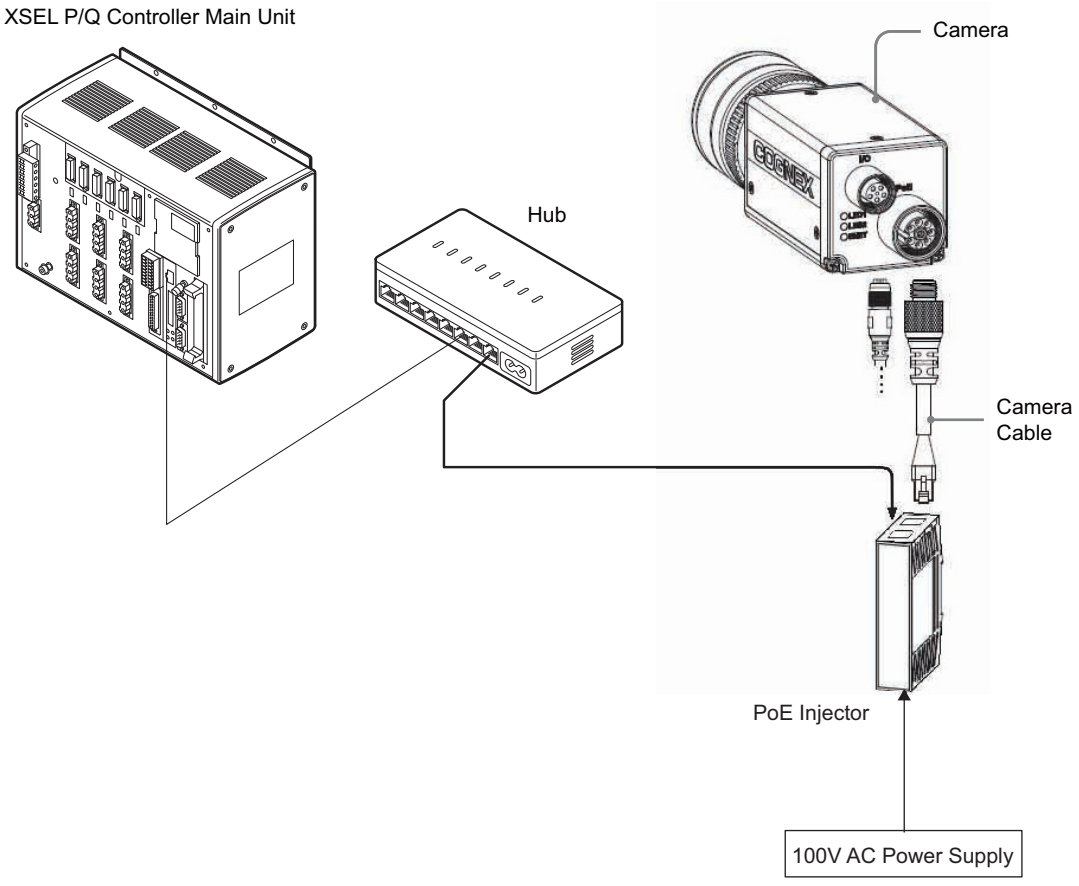
4.3 Installing the Camera

4.3.1 Cognex Camera

The camera products of Cognex Corporation applicable to the vision system are limited only to “In-Sight EZ110 (EZ110-XL)” and “In-Sight 5000 Series”.
The way to install the camera can be selected from mounting on the robot and fixing on the equipment.
Install the camera considering how to use it.
Lighting equipment is separately required when capturing an image with the camera.
It is possible to identify the following numbers of work pieces in 1 shot of image capturing.
• In-Sight EZ110 (EZ110-XL) : 8 pieces at max.
• In-Sight 5000 Series : 12 pieces at max.

Refer to the following Cognex instruction manuals for the details of how to connect the devices.
• In-Sight EZ110 (EZ110-XL) : “In-Sight EZ Series Vision System Installation Guide”
• In-Sight 5000 Series : “In-Sight 5000 Series Vision System Installation Guide”
“CIO-1400C I/O Expansion Module Instruction Manual”

Shown below is an example of the basic construction (example for XSEL-P/Q types) of Vision System with one unit of camera connected.



Example for Cognex Camera Controller Basic Construction

4.3.2 Keyence Camera

The camera manufactured by Keyence Corporation that is applicable for Vision System is “In-CV-2000/CV-3000/CV-5000/XG-7000” only.

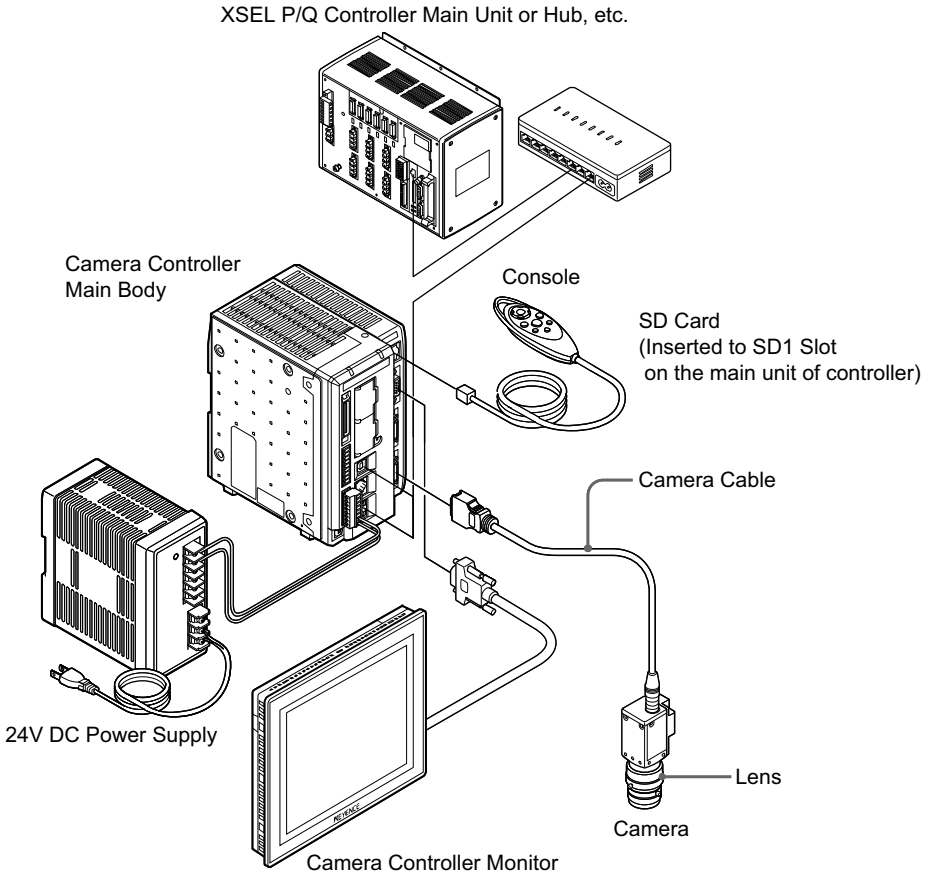
The way to install the camera can be selected from mounting on the robot and fixing on the equipment.

Install the camera considering how to use it.

Lighting equipment is separately required when capturing an image with the camera.

12 pieces (0 to 7 pieces for CV-2000) of works can be identified at maximum in 1 shot.

Shown below is an example of the basic construction (example for XSEL-P/Q types) of Vision System with one unit of camera connected.



Example for Keyence Camera Controller Basic Construction

4.3.3 OMRON Camera

The camera manufactured by OMRON Corporation that is applicable for Vision System is OMRON Camera Controller “F210-C10 or FZ3” only.

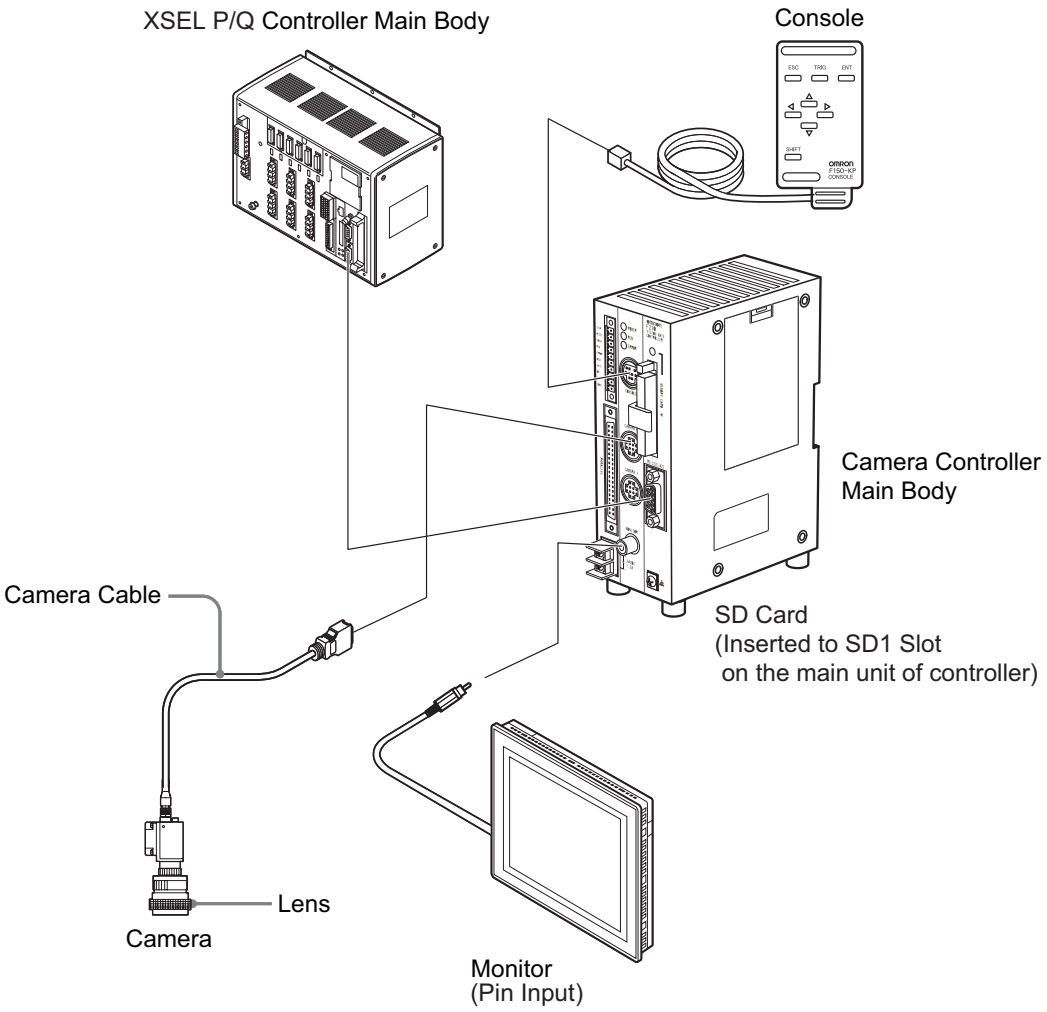
The way to install the camera can be selected from mounting on the robot and fixing on the equipment.

Install the camera considering how to use it.

Lighting equipment is separately required when capturing an image with the camera.

12 pieces of works can be identified at maximum in 1 shot.

Shown below is an example of the basic construction (example for XSEL-P/Q types) of Vision System with one unit of camera connected.



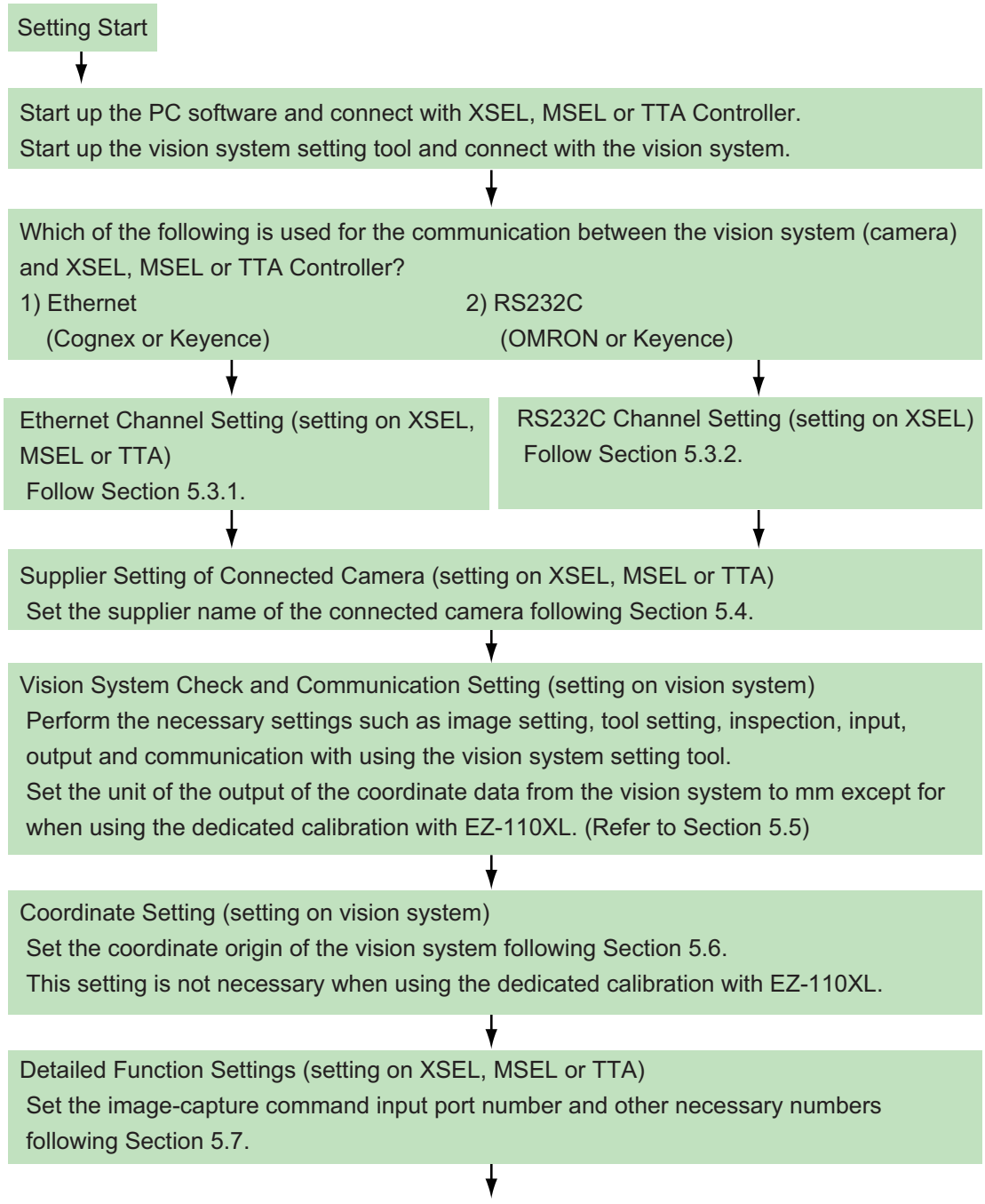
Example for OMRON Camera Controller Construction (for F210-C10)

> ⚠ Note:
> USB and Ethernet are not supported for the camera connection.

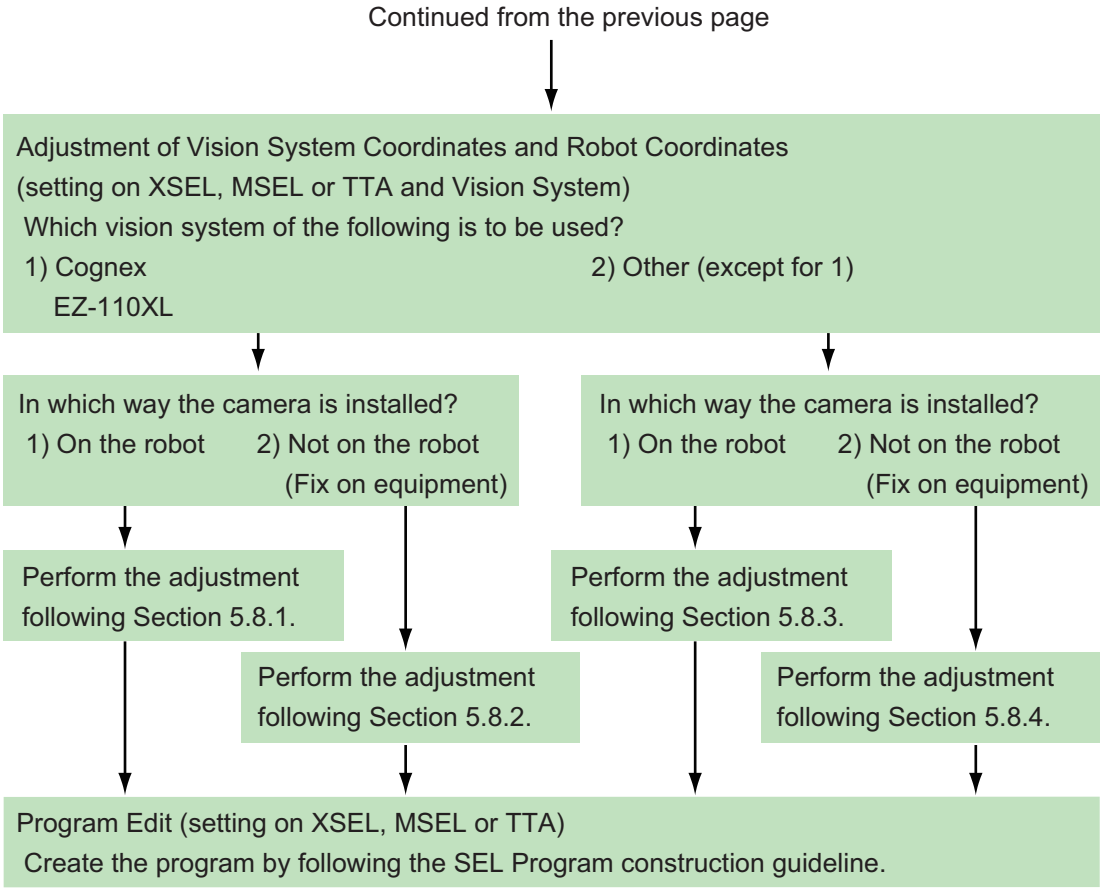
5. Vision System I/F Function Setting

Refer to the materials such as the Instruction Manual for the connected camera controller for the details of how to set up on the camera controller side.
This manual explains how to set up the system to utilize the vision system I/F function.
The setting is to be conducted using XSEL Controller PC software and the setting tool of each vision system.

5.1 Setting Procedure



Continues to the next page


Continued from the previous page
Adjustment of Vision System Coordinates and Robot Coordinates
(setting on XSEL, MSEL or TTA and Vision System)
Which vision system of the following is to be used?
1) Cognex
EZ-110XL
2) Other (except for 1)
In which way the camera is installed?
1) On the robot
2) Not on the robot
(Fix on equipment)
In which way the camera is installed?
1) On the robot
2) Not on the robot
(Fix on equipment)
Perform the adjustment following Section 5.8.1.
Perform the adjustment following Section 5.8.2.
Perform the adjustment following Section 5.8.3.
Perform the adjustment following Section 5.8.4.
Program Edit (setting on XSEL, MSEL or TTA)
Create the program by following the SEL Program construction guideline.

5.2 About Parameter Change

5.2.1 Regarding to Value Setting

If the last digit of the set value is H, set with hexadecimal number.

Refer to the following.
Input the value of hexadecimal number transformed from the binary number.

5.2.1.1 Binary Number

Binary number expresses a numeral gure with using 2 numbers, 0 and 1.
The number increases in the order of 0, 1, and then the number of digit increases, and goes 10, 11 …

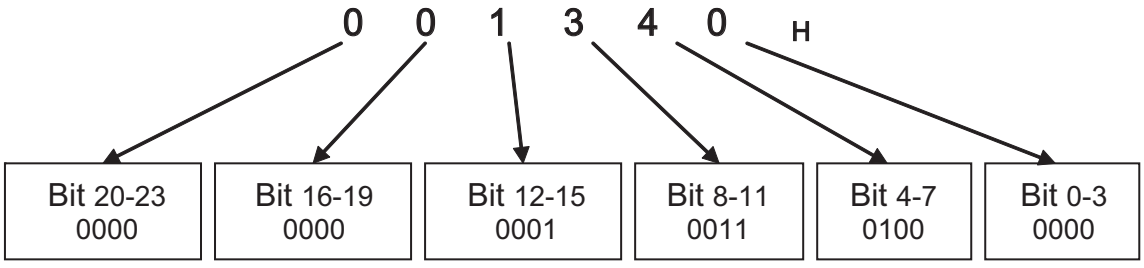
Decimal Number	0	1	2	3	4	5	6	7	8	9	10
Binary Number	0	1	10	11	100	101	110	111	1000	1001	1010

5.2.1.2 Hexadecimal Number

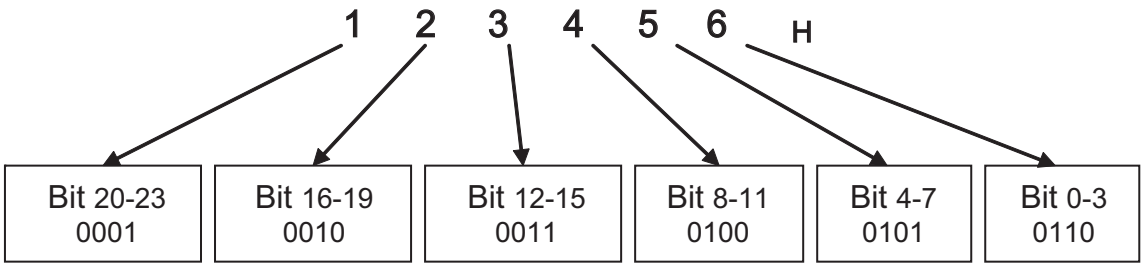
Hexadecimal number expresses a numeral gure with using numbers from 0 to 9 and alphabets from A to F. The number increases in the order of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B,C, D, E, F, and then the number of digit increases, and goes 10, 11, …

Decimal Number	0 to 9 (Same for decimal and hexadecimal numbers)	10	11	12	13	14	15	16
Hexadecimal Number		A	B	C	D	E	F	10

Example 1 : 001340_H



Example 2 : 123456_H



5.3 Communication Channel Setting

Either RS232C (standard for XSEL), Ethernet Communication Board(*1) (option for XSEL-P/Q type) or EtherNet/IP Communication Board (option for XSEL-R/S type, MSEL or TTA option) is used for the vision system I/F function.

*1 Not applicable for TTA and MSEL.

*2 Not applicable for XSEL-R/S, MSEL and TTA.

If using Ethernet, follow the instructions in Section 5.3.1 to perform the settings.
If using RS232C, follow the instructions in Section 5.3.2 to perform the settings.

5.3.1 When Ethernet TCP/IP Message Communication is Used

When using the Ethernet TCP/IP message communication (Cognex or Keyence), set the XSEL, MSEL or TTA parameters in the right order.

[Setting 1] Ethernet TCP/IP Message Communication Attribute [compulsory] (I/O Parameter No.124)

Set the Ethernet TCP/IP message communication attribute in I/O Parameter No.124. Select one channel from channels 31 to 34 and set it as the client (setting value = 1).

(Note) When using Cognex In-Sight EZ110 (EZ-110XL), set the parameter to;
I/O Parameter No.124 = 003100_H

I/O Parameters No.124					
Bit 20-23	Bit 16-19	Bit 12-15	Bit 8-11	Bit 4-7	Bit 0-3
Free-for-User Channel 34 Set Value=1	Free-for-User Channel 33 Set Value=1	Free-for-User Channel 32 Set Value=1	Free-for-User Channel 31 Set Value=1	Set Value=0	Set Value=0

Set Value = 0 : Channel not in use
Set Value = 1 : Set XSEL, MSEL or TTA as the client
Set Value = 3 : Set XSEL, MSEL or TTA as the server

(Example 1) When using the channel 31 for Vision System I/F
I/O Parameter No.124 = 000100_H

(Example 2) When using the channel 32 for Vision System I/F and 31 for another program (server) (and not using 33 and 34)
I/O Parameter No.124 = 001300_H

[Setting 2] Ethernet Operation Prescription [compulsory] (I/O Parameters No.129)

Set the Ethernet operation prescription in I/O Parameters No.129.

Set the bits 4-7 to “1”.

I/O Parameter No.129 = 10_H

I/O Parameters No.129	
Bit 4-7	Bit 0-3
TCP/IP Message Communication is Used Set Value=1	Set Value=0

[Setting 3] Controller Network Address Setting [compulsory]

(I/O Parameters No.132 to 143,146)

Set the I/O Parameters No.132 to 143 and 145 to 148 following the network environment.

I/O Parameters No.132 to 135	Self IP Address (IP address of X-SEL)	Set it in accordance with the network environment to be used
I/O Parameters No.136 to 139	Subnet Mask	
I/O Parameters No.140 to 143	Default Gateway	
I/O Parameters No.146	Free-for-User Channel 32 (TCP/IP) Self-Port Number (Note)	

(Note) Do not change I/O Parameter No.146 from “64513” (initial setting value) when using EZ-110XL.

[Setting 4] Vision System Network Address Setting [compulsory] (I/O Parameters No.160 to 164)

Set the parameters such as the network address of the vision system to be connected in I/O Parameters No.160 to 164.

Refer to the IP address settings on the controller side (I/O Parameters No.132 to 134) for the IP address to set it to have the controller and the vision system exist on the same network.

(Note) When setting the IP addresses, be sure not to duplicate the entire address.

(Example) IP address of Vision System 192.168. 0. 11 (I/O Parameter No.160 to 163)

IP address of XSEL, MSEL or TTA 192.168. 0. 12 (I/O Parameter No.132 to 135)

Avoid duplication

I/O Parameters No.160 to 163	Vision System I/F connected IP address	Input Vision System IP address setting value
I/O Parameters No.164	Vision System I/F Connected Port Number	(Example) Cognex :3000_H Keyence :8500_H

[Setting 5] Baud Rate Setting [Optional in XSEL-R/S, MSEL and TTA] (I/O Parameters No.227 and 238)

Establish the setting for the baud rate in I/O Parameter No. 227 for XSEL-R/S and either in I/O Parameter No. 227 or 238 for TTA in respond to the EtherNet/IP board mounting position. It is recommended to set the baud rate to the automatic negotiation.

I/O Parameters No.227（XSEL-R/S or TTA: When mounted on Extension I/O Slot 1, MSEL: When mounted on Extension I/O） I/O Parameters No.238（TTA: When mounted on Extension I/O Slot 2）
Bit 0-3
Baud rate select Set Value=0 : Automatic negotiation (Default value) Set Value=1 : 10Mbps (Half duplex) Set Value=2 : 10Mbps (Full duplex) Set Value=3 : 100Mbps (Half duplex) Set Value=4 : 100Mbps (Full duplex)

Set the baud rate to match with the baud rate (mode) on the switching hub and so on. Operation without matching the setting may lead to unstable communications.

Continue to Section 5.4 to complete the setting procedures.

5.3.2 When Standard SIO (RS232C) Channel Communication is Used

When using the standard SIO (RS232C) channel communication (OMRON or Keyence), set the parameters in the right order.

[Setting 1] Free-for-User SIO Channel Attribute 1 [compulsory] (I/O Parameters No.201 and 213)
Set the parameters in accordance with the application environment.

> ⚠ Note :
> - Do not fail to have the same communication setting as that on the camera controller side.
> - Set I/O Parameter No.201 if Channel 1 is used, and No.213 if Channel 2 is used.
> - Vision interface function in RS232C communication is not applicable for TTA and MSEL.

I/O Parameter No.201 (when Standard SIO Channel 1 is used) I/O Parameter No.213 (when Standard SIO Channel 2 is used)					
Bit 28-31	Bit 24-27	Bit 20-23	Bit 16-19	Bit 4-15	Bit 0-3
Baud Rate Type [kbps] Set Value=2 (Default) *Set Value Set Value=0 (9.6) Set Value=1 (19.2) Set Value=2 (38.4) Set Value=3 (57.6) Set Value=4 (76.8) Set Value=5 (115.2)	Data Length (7 to 8) Set Value=8 (Default)	Stop Bit Length (1 to 2) Set Value=1 (Default)	Parity Type Set Value=0 (Default) *Set Value Set Value=0 (None) Set Value=1 (Odd Number) Set Value=2 (Even Number)	For future extension Set Value=000 (Default)	Standard SIO Usage Selection Set Value=1 *Set Value Set Value=0 (Not used) Set Value=1 (Used)

(Example) Example of using the standard SIO channel 1 and establishing the communication with the following conditions:

<Conditions>

Communication Speed : 115.2kbps (Set Value 5)
Data Length : 8 (Set Value 8)
Stop Bit Length : 1 (Set Value 1)
Parity Type : None (Set Value 0)

<Set Value>

I/O Parameter No.201 = 58100001_H

5.4 Communication Format Setting

There are fixed formats for the communication format and can be set by I/O Parameters.

[Setting 1] Vision System I/F Function Selection 2 [compulsory] (I/O Parameters No.352)
Select the communication format to receive from the vision system on I/O Parameter No.352, Bits 0 to 7. The setting values differ depending on the vision system supplier.

I/O Parameters No.352
Bit 0-7
Communication Format Select Set Value=0：Vision System of Cognex (including EZ-110XL) Set Value=1：Vision System of OMROM Set Value=2：Vision System of Keyence

[Setting 2] Vision System I/F Function Selection 3 [compulsory] (I/O Parameters No.353)
Set the header and delimiter for the communication format to receive from the vision system.
The setting values differ depending on the vision system supplier.

I/O Parameters No.353		
Bit 16-31	Bit 8-15	Bit 0-7
Vision System I/F Communication Header 2 (Effective when Keyence is selected in Setting 1) Set Value=5431 (Default) Setting change is not necessary.	Vision System I/F Communication Header 1 (Effective when Cognex or OMRON is selected in Setting 1) Set Value=3C (Default) Cognex : 3C OMRON : 39	Vision System I/F Communication Delimiter Set Value=0D (Default) Setting change is not necessary.

[Setting 3] Vision System Settings [compulsory]

Perform the settings on the vision system so the specified communication format can be output.

(1) When using EZ-110XL and simple (dedicated) calibration (refer to Section 5.8)
⇒ Refer to [Setting 1] in 8.1 Appendix

(2) When using the vision system of Cognex or OMRON
⇒ Refer to [Setting 2] in 8.1 Appendix

(3) When using the Keyence vision system
⇒ Refer to [Setting 3] in 8.1 Appendix

(Note) Move to Section 5.7 if using Cognex In-Sight EZ110.

5.5 Unit Conversion (pixel ⇒ mm)

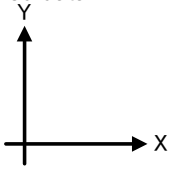
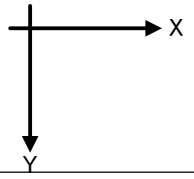
Provide a setting on the camera controller side to have the unit of the output coordinate data in [mm].
[Refer to the Instruction Manual for the Vision System to be connected for the details.]

(Note) The setting is not necessary when using the simple (dedicated) calibration with EZ-110XL since the setting is conducted in Section 5.8.

5.6 Setting of Relations between Vision System Coordinate Settings and Each Robot Axis

[Setting 1] Coordinate Setting in Vision System

The setting differs for each vision system supplier and the camera model. Refer to the table below to establish the settings. [Refer to such as an instruction manual of the vision system to connect for the details of the setting for the coordinate axes.]

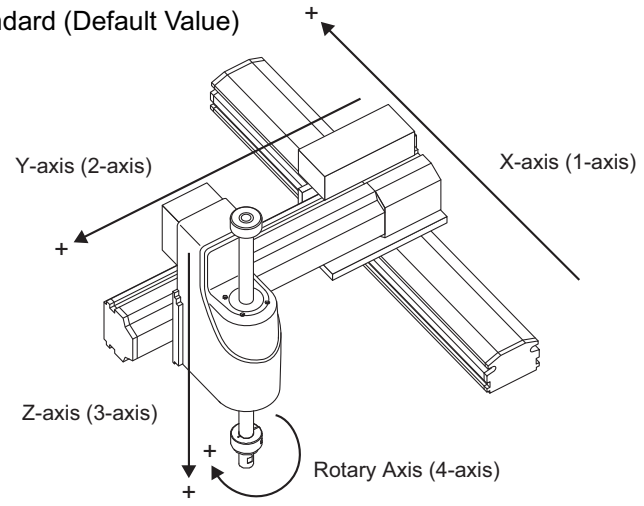
	Vision System to Use（Function）	Necessity of Setting and Contents
1	Use Cognex (EZ-110XL), and utilize simple (dedicated) calibration	It is unnecessary to set this.
2	Vision system of Cognex except for above (Item 1) or of OMRON	Conduct the setting to place the origin on the bottom left of the captured data. 
3	Vision system of Keyence	Conduct the setting to place the origin on the upper left of the captured data. 

[Setting 2] Setting of relations with each robot axis [compulsory] (All-Axes Parameter No.121)

For the relations of the coordinates (X, Y and θ) of the vision system and each robot axis, set in All Axis Parameter No. 121. Establish the setting to have the X-axes and Y-axes of the robot and the vision system in the same direction to each other as much as possible. In case the axes directions are not the same, the positive/negative of the coordinate may get reversed, or X and Y may get swapped.

All-Axes Parameter No.121			
Bit 12-15	Bit 8-11	Bit 4-7	Bit 0-3
Axis number of robot to relate to θ-axis on vision system Set Value = 4 (Default value)	Axis number of Z-axis on robot Set Value = 3 (Default value)	Axis number of robot to relate to Y-axis on vision system Set Value = 2 (Default value)	Axis number of robot to relate to Z-axis on vision system Set Value = 1 (Default value)

Example 1　For Standard (Default Value)

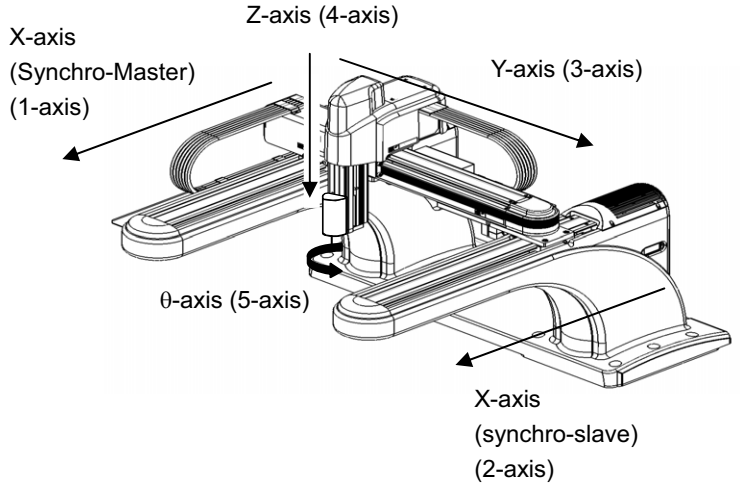


All-axes parameter No.121 = 4321（Initial setting）

The work coordinates data received from the vision system (position information) is saved to the position data as shown below.

	Work X Coordinate ↓	Work Y Coordinate ↓		Work θ Coordinate ↓	
No. (Name)	Axis1 (1-axis)	Axis2 (2-axis)	Axis3 (3-axis)	Axis4 (4-axis)	Axis5
* (　)	10.000	0.000		45.000	

Example 2　For Synchronizing System … High-Speed Cartesian Robot (CT4), etc.

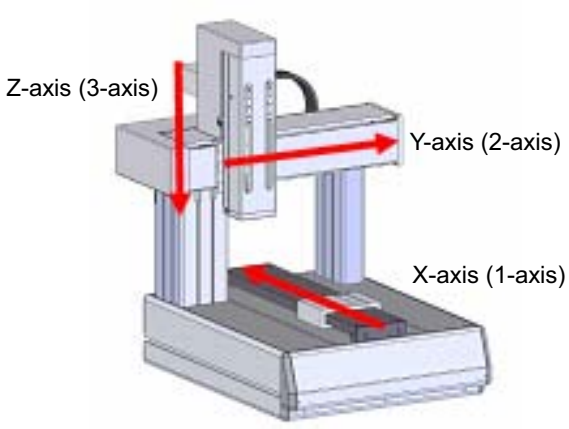


All-axes parameter No.121 = 5431

The work coordinates data received from the vision system (position information) is saved to the position data as shown below.

	Work X Coordinate ↓	Work Y Coordinate ↓		Work θ Coordinate ↓	
No. (Name)	Axis1 (1-axis)	Axis2 (2-axis)	Axis3 (3-axis)	Axis4 (4-axis)	Axis5
* (　)	10.000		0.000		45.000

Example 3　For TTA (with a tool mounted on 3rd axis)



All-axes parameter No.121 = 321

The work coordinates data received from the vision system (position information) is saved to the position data as shown below.

Work X Coordinate　Work Y Coordinate
↓　↓

No. (Name)	Axis1 (1-axis)	Axis2 (2-axis)	Axis3 (3-axis)	Axis4 (4-axis)	Axis5
* (　)	10.000	0.000			

⚠ Note :

- The position data would not be updated on the axis not indicated in the effective axis pattern (All-Axes Parameter No. 1).
- In case there is any axis not to be used, declare the axes to use the position data in GRP Command.
- Make sure to install the actuators orthogonally to each other. Not doing so may cause a concern that the appropriate work coordinate data may not be acquired.
- When indicating the coordinate system definition unit axes, set the unit X-axis and unit Y-axis to be in relation with the vision system X-axis and Y-axis.
  Also, when the unit R-axis is defined as well, relate it to the vision system R-axis.

5.7 Detailed Function Settings

To operate Vision System I/F Function properly, set the following parameters.

> ⚠ Note :
>
> Do not fail to set the following parameters.
>
> - Vision System I/F Function Selection 1(I/O Parameters No.351)
> - Setting of Vision System I/F Image-Capture Command Physical Output Number (I/O Parameters No.357)

[Setting 1] Vision System I/F Function Selection 1 [compulsory] (I/O Parameters No.351)
Set I/O Parameter No.351.

(Note) Set the Bit 4-7 to “2” when using EZ-110XL and simple (dedicated) calibration (refer to Section 5.8).

I/O Parameters No.351					
Bit 24-31	Bit 20-23	Bit 12-19	Bit 8-11	Bit 4-7	Bit 0-3
Number of tries for Image-Capture Command [times]	Image-Capture Delay Estimation Timer Value [msec]	Image-Capture Command Cutoff Extension Timer Value [msec]	Response timeout value [sec]	Communication Device Selection (Note1)	Function Usage Selection
No need to change Set Value=3 (Default)	No need to change Set Value=1 (Default)	No need to change Set Value=05 (Default)	No need to change Set Value=5 (Default)	Set Value=0 (Channel 1) Set Value=1 (Channel 2) Set Value=2 (Channel 31) Set Value=3 (Channel 32) Set Value=4 (Channel 33) Set Value=5 (Channel 34)	Set Value=1 (to use Vision System I/F) Set Value=0 (not to use Vision System I/F)

Note 1 : Match the setting to the channels that are set to Usage Selection (either one in Channels 31 to 34) in Parameter No.124 if the communication with Vision System is performed with Ethernet.
Set the channel (channel 1 or 2) to the selected one when the communication is established with the standard SIO (RS232C). (I/O Parameters No.201 = Channel 1, No.213 = Channel 2)
[Refer to Section 5.3]

[Setting 2] Setting of Vision System I/F Image-Capture Command Physical Output Number [compulsory] (I/O Parameters No.357)
Set the Output port number to be used as the image-capture trigger to the vision system.

I/O Parameters No.357
Set Value=Output Port No.

[Setting 3] Setting of Vision System I/F Initializing Complete Status Physical Input Port Number [Option] (I/O Parameters No.356)
By having I/O Parameter No.356 set, the operation complete judgment of the vision system becomes enabled.

⚠ Note :
If this parameter is used and the vision system is not switched on when SLVS command is executed, Return Code 23 (Vision System Initializing Incomplete Error) will be issued.

I/O Parameters No.356
Set Value=Input Port No. * Set the value to 0 when not to be used.

[Setting 4] Vision System I/F Control 1 [Option] (All-Axes Parameter No.129)
Set if the signal of rotary axis is to be reversed or not.

All-Axes Parameters No.129			
Bit 20-23	Bit 12-19	Bit 4-11	Bit 0-3
Rotary Axis Correction Direction Reverse (0 = no signal reverse 1 = signal to be reversed) Set Value=0 (Default)	System Reservation No need to change Set Value=00 (Default)	System Reservation No need to change Set Value=00 (Default)	System Reservation No need to change Set Value=0 (Default)

· In some conditions of the setting on the vision system side or the relation between the camera and the axis, the direction of the R ingredient to be obtained may be the opposite of the direction that the controller defines. (Refer in the figure below.)
In such a case, reverse the sign of the R ingredient data to be obtained from the vision system in the setting of Bit 20 to 23 in All Axes Parameter No. 129.

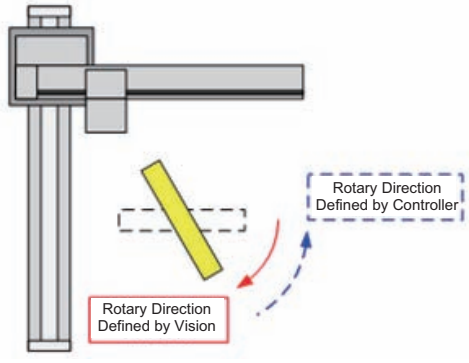


Figure: Example When Rotary Direction Unmatched

5.8 Vision System I/F adjustment

To make the relation to the robot coordinates and the vision system coordinates, adjustment (calibration) of the vision system I/F is required.

The method of Vision system I/F adjustment differs depending on the vision system model and the location of the camera installation.

If using EZ-110XL, “Simple Calibration” is available which enables you to reduce the steps of manual adjustment of positions of the robot tool tip and the work. [Refer to Section 5.8.1 to 5.8.3]

In the case of using a vision system other than those mentioned above, refer to Section 5.8.4 or Section 5.8.5.

⚠ Precautions

1) Vision system IF adjustment puts a relation of the robot X, Y and θ coordinates to the vision system coordinates. It is not applied when the center of the rotation and that of the tool to retain the work are offset.
2) Camera cannot be mounted on the robot rotation axis.
3) Make sure to execute the vision system I/F adjustment after parameter settings are completed.
4) For absolute type actuator, execute it after the absolute reset is completed.
5) Applicable PC software is required for the vision system I/F adjustment.
6) The vision system I/F adjustment includes steps to capture images of the work piece with the vision system. Register the work piece to the vision system in advance so it can be detected. Also, when using a vision system other than EZ-110XL, unit conversion (from pixel to mm) is to be conducted on the camera controller side.
7) When the coordinate system definition unit is a subject for adjustment, set the work coordinate system number and the tool coordinate system number of the applicable unit to “0” before performing adjustment of the vision system I/F.
8) The following parameters are updated automatically by executing the vision system I/F adjustment. It is no need to change them manually.

All-Axes Parameters	Description	
No.122	Vision System I/F 1 Coordinate Datum Point Offset X	Updated automatically by execution of “Vision System I/F adjustment”
No.123	Vision System I/F 1 Coordinate Datum Point Offset Y	
No.124	Vision System I/F 1 Coordinate Datum Point Offset Angle	
No.125	Vision System I/F 1 Robot Vision Mounted Z-axis Direction Vision Position Judgment Datum	
No.130	Vision System I/F 1 Control 2 Bits 8 to 11 Vision Installation Type (= 0 (Camera being installed on a position other than on the robot)) (=1 (Camera being installed on the robot))	

5.8.1 Initial Settings for Simple Calibration (When EZ-110XL camera is used)

Conduct the initial settings following the steps below with using the Cognex Setup software (In-Sight Explorer) or PC software for XSEL.

(Note) It is necessary to redo the initial settings (1) to (3) if the version of In-Sight Explorer is updated.

☆ Please contact us for the files necessary for the initial settings.

[Initial Setting 1]

Copy the file “IAIClassLibrary.dll” stored in the PC software installation CD and put it into the folder stated below:

¥Program Files¥Cognex¥In-Sight¥In-Sight Explorer *.*.*

(*.*.* indicates the software version: applied in 4.4.1)

[Initial Setting 2]

Copy the file “IAICalib_EN.cxd” stored in the PC software installation CD and put it into the folder stated below:

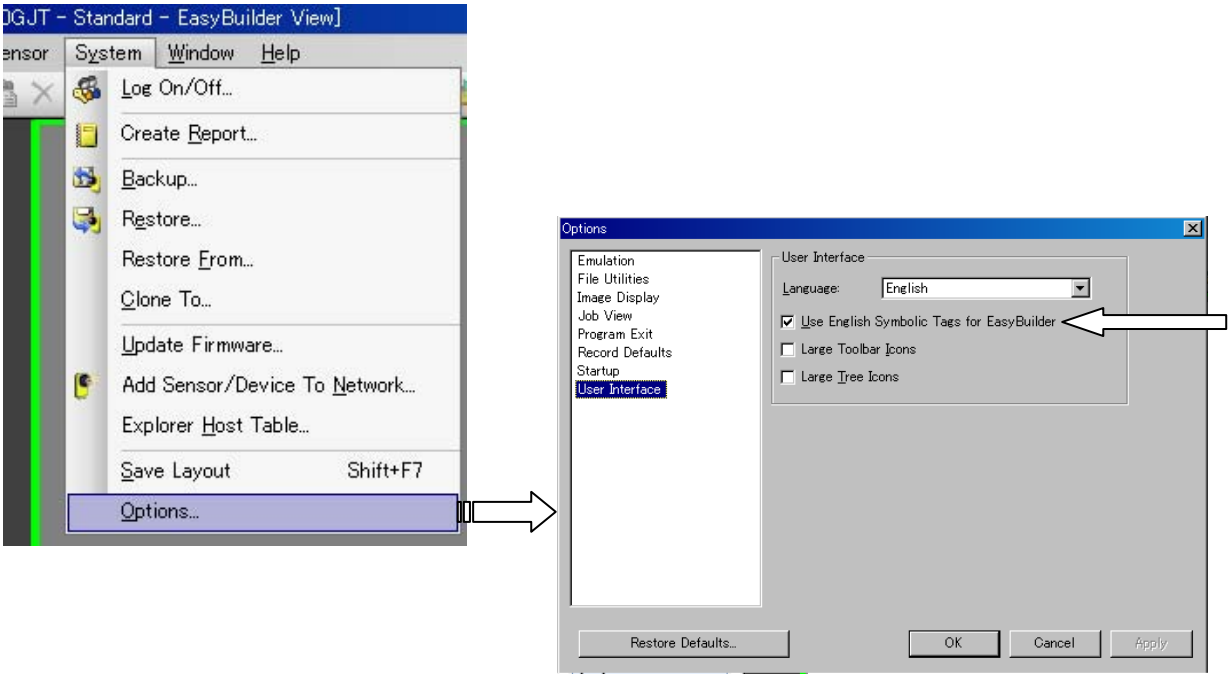
¥Program Files¥Cognex¥In-Sight¥In-Sight Explorer *.*.*¥Snippets¥EasyBuilder

(*.*.* indicates the software version: applied in 4.4.1)

[Initial Setting 3]

Start up In-Sight Explorer.

Select Options in In-Sight Explorer System Menu and tick on “Use English Symbolic Tags for EasyBuilder” in the User Interface items.



[Initial Setting 4]

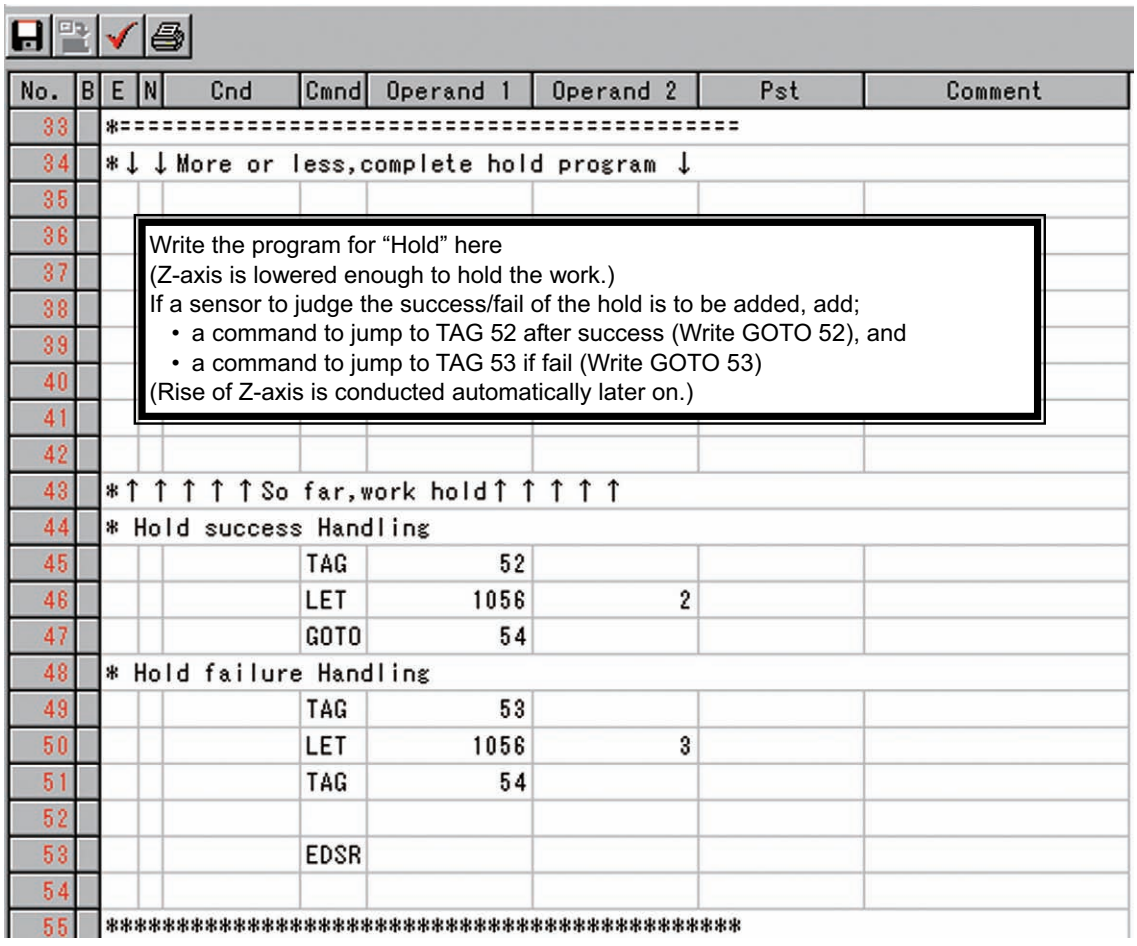
In this calibration, the adjustment is conducted by actually moving the work using the robot within the image capturing range of the camera.

Therefore, it is necessary to create a program considering the method of retaining the work (gripping, chucking, etc.). Please contact IAI for a program file you need.

Make sure to write the program for “Hold” and “Release” to the specified points.

(Note 1) The program can be edited even if the controller is not connected to the PC software (offline).

(Note 2) Make sure to conduct the relative interlock of Hold and Release in the SEL program that you edit.

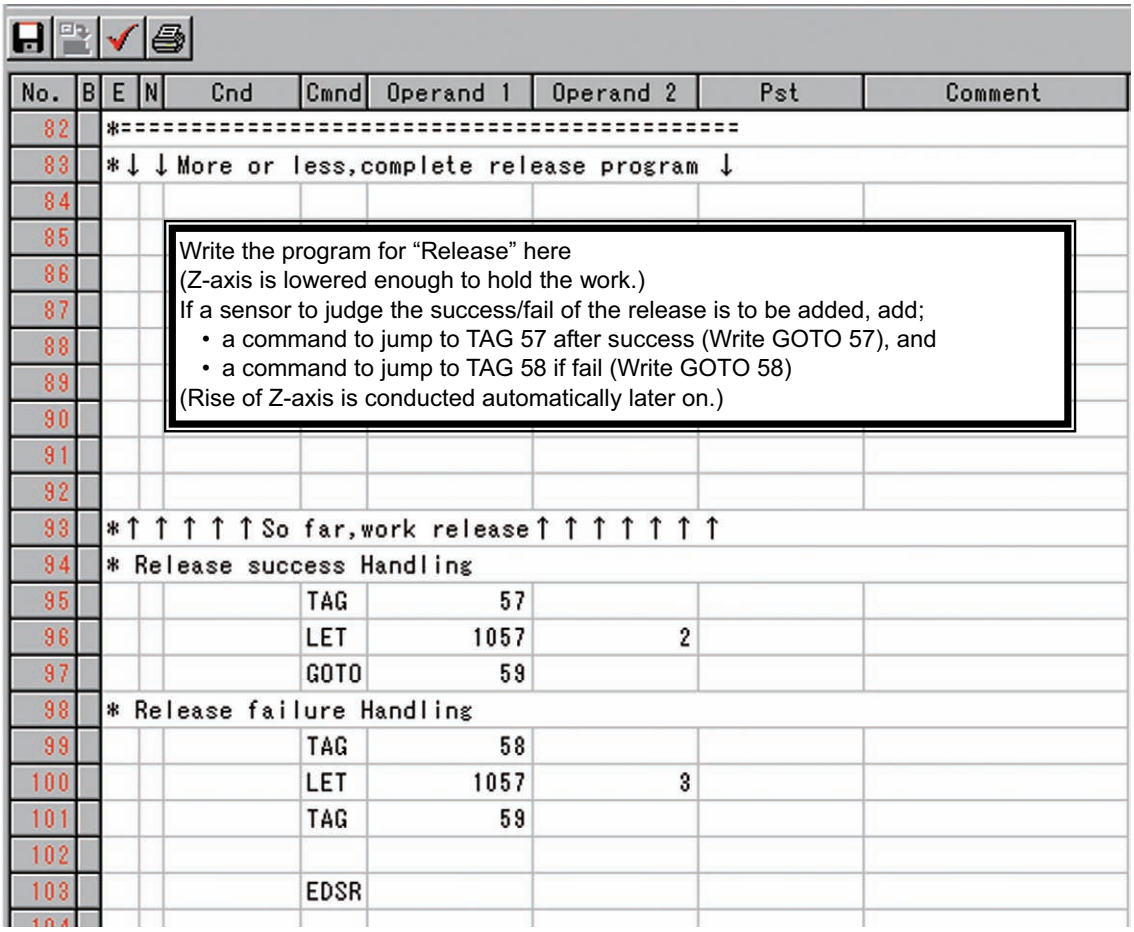


Example 1 : When holding with grip
(grip when I/O Port 314 is ON and release when 315 is ON)

```
BTOF (315) ←I/O Port No. (315) turns OFF
TIMW (0.1)  ←Keep time for electromagnetic valve to turn OFF
BTON (314) ←I/O Port No. (314) turns ON (grip)
TIMW (0.3)  ←Retain the gripping time
GOTO 52     ←To the process for work hold success
```

Example 2 : When holding with an electrical gripper connectable to XSEL (connected to the 4th axis)

```
GRP (1000)          ←Command to make only gripper available for operation
PAPR (10) (20)      ←Pressing(10) : approach distance
                                (20) : approach speed
PUSH (30) (900) ←  (30) : Position number of the pressing position
                    (900) : Turns ON when pressing succeeded
                            Turns OFF when failed
GRP (111)           ←Command to make all the operations available except for gripper
(900) GOTO 52       ←To the process for work hold success
N (900) GOTO 53     ←To the process of work hold fail
```



Example 1 : When holding with grip
(grip when I/O Port 314 is ON and release when 315 is ON)

BTOF (314) ←I/O Port No. (314) turns OFF
TIMW (0.1) ←Keep time for electromagnetic valve to turn OFF
BTON (315) ←I/O Port No. (315) turns ON (release)
TIMW (0.03) ←Retain the release time
BTOF (315) ←I/O Port No. (315) turns OFF
GOTO 57 ←To the process of work release success

Example 2 : When holding with an electrical gripper connectable to XSEL (connected to the 4th axis)

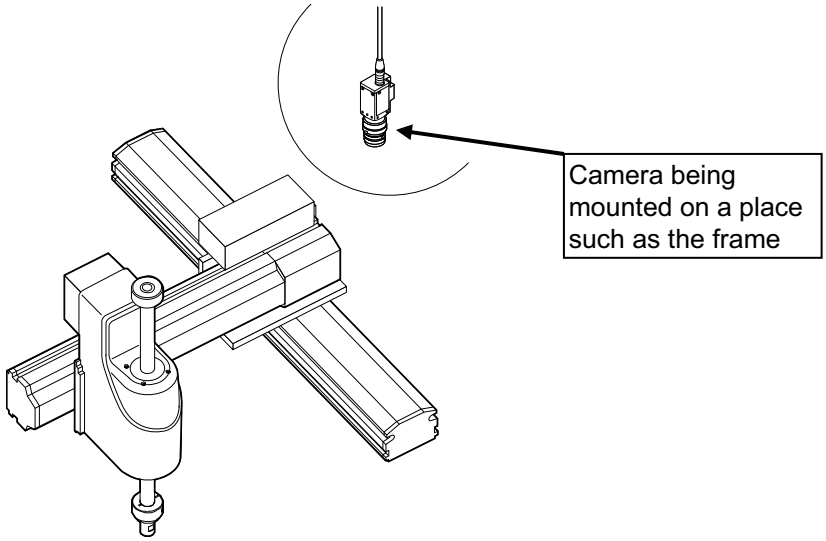
GRP (1000) ←Command to make only gripper available for operation
MOVP (30) ←Position number when the gripper is open
GRP (111) ←Command to make all the operations available except for gripper
GOTO 57 ←To the process of work release success

5.8.2 When Camera Not Mounted on Robot (When EZ-110XL is used)

This section explains how to setup when the camera is installed as shown in the picture below.

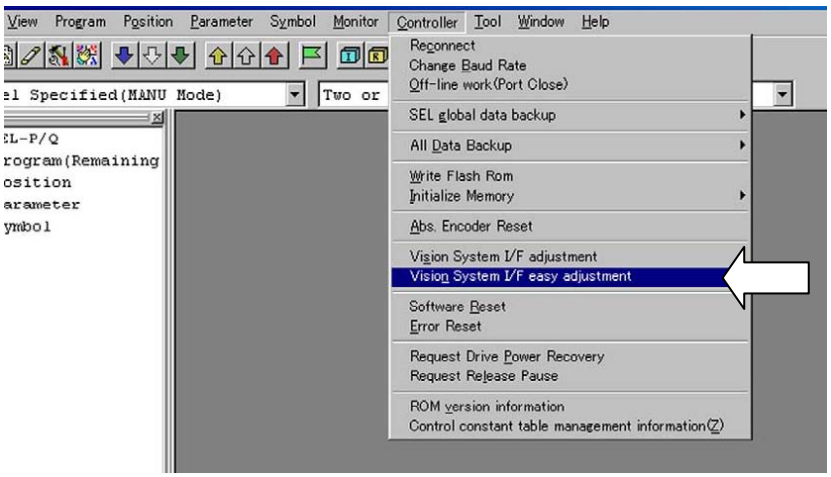
Conduct the home return of the incremental type robot in advance.

If the camera is to be mounted on the robot, refer to “5.8.3 When Camera Mounted on Robot”.



When Camera Not Mounted on Robot

[Procedure 1] Select Vision System I/F easy adjustment from the PC software.
A warning dialog box opens.



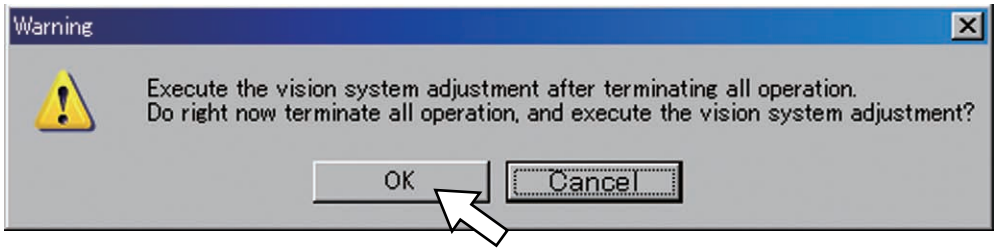
⚠ Note :

In the case “Vision System I/F easy adjustment” is not displayed in the main menu, check the version of the PC software and the settings of related I/O parameters.

PC software version for Vision System I/F Adjustment	
XSEL-P/Q	: V7.07.08.00 or later
XSEL-R/S	: V9.0.0.0 or later
TTA	: V10.0.0.0 or later
MSEL-PC/PG	: V12.0.0.0 or later

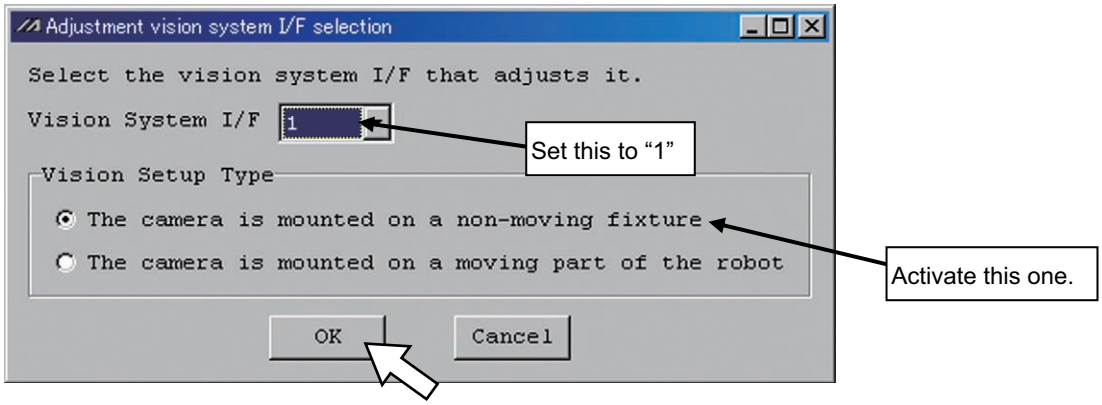
I/O Parameter
No.351 Bit 0-3=1

[Procedure 2] Finish all operations and click “OK” button.
Vision System I/F easy adjustment window opens.

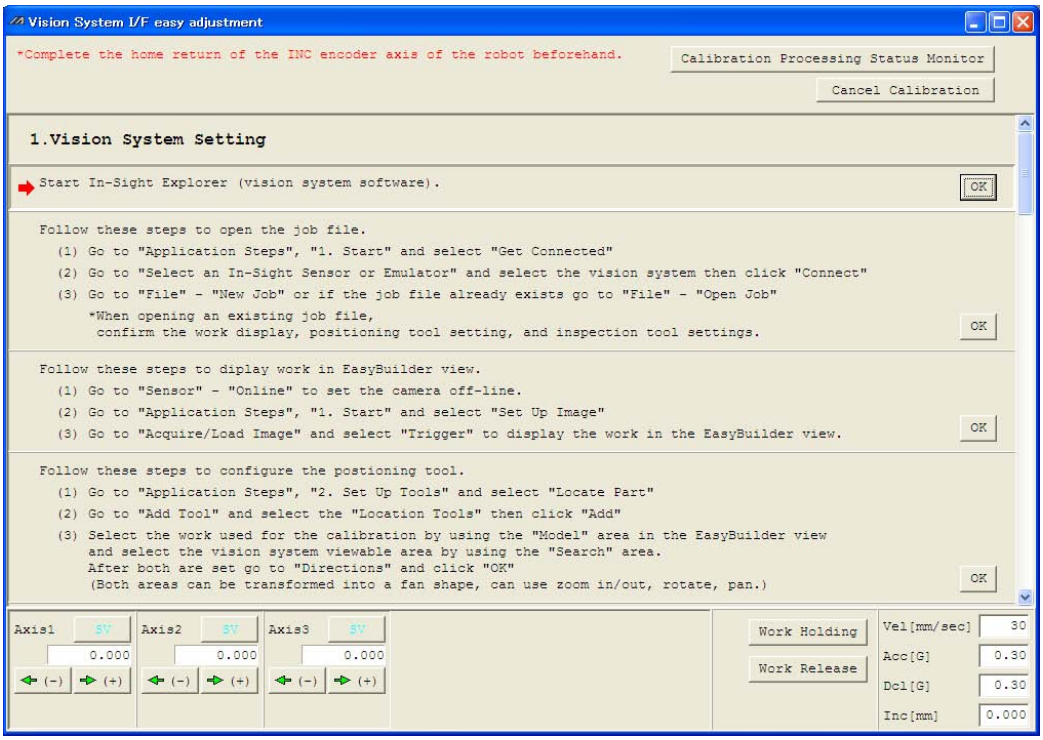


[Procedure 3] Click “OK” button.
Vision System I/F easy adjustment opens. [See the next page]

> ⚠ Note :
> If no vision system I/F number is displayed, check the parameter settings [5.7 Parameter Settings] on the controller.



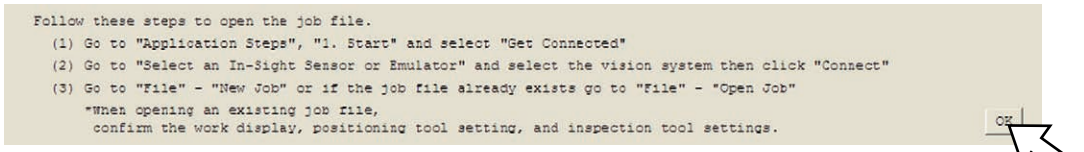
Vision System I/F easy adjustment Window



☆ For those items pointed with a red arrow, confirm the contents or acquire the necessary values and click the button on the right to proceed to the next one.

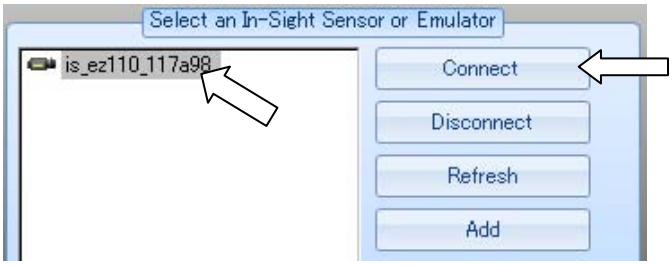
[Procedure 4] Start up the Cognex Setup Software (In-Sight Explorer).
After it is confirmed the software is open, click “OK” button.

[Procedure 5] Connect the camera and conduct the settings following the instructions (1) to (3) indicated below.
Click “OK” button.



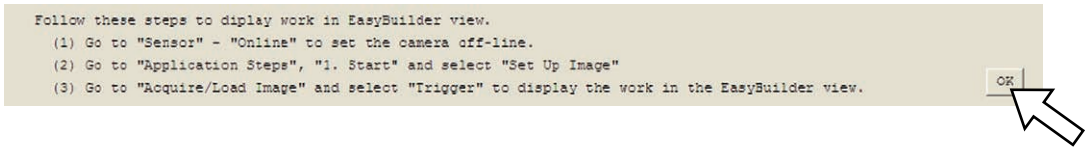
(1) In Application Step in In-Sight Explorer, select “Start” → “Get Connected”.

(2) In “Select an In-Sight Sensor or Emulator”, select “ez110” and then select “Connect”.

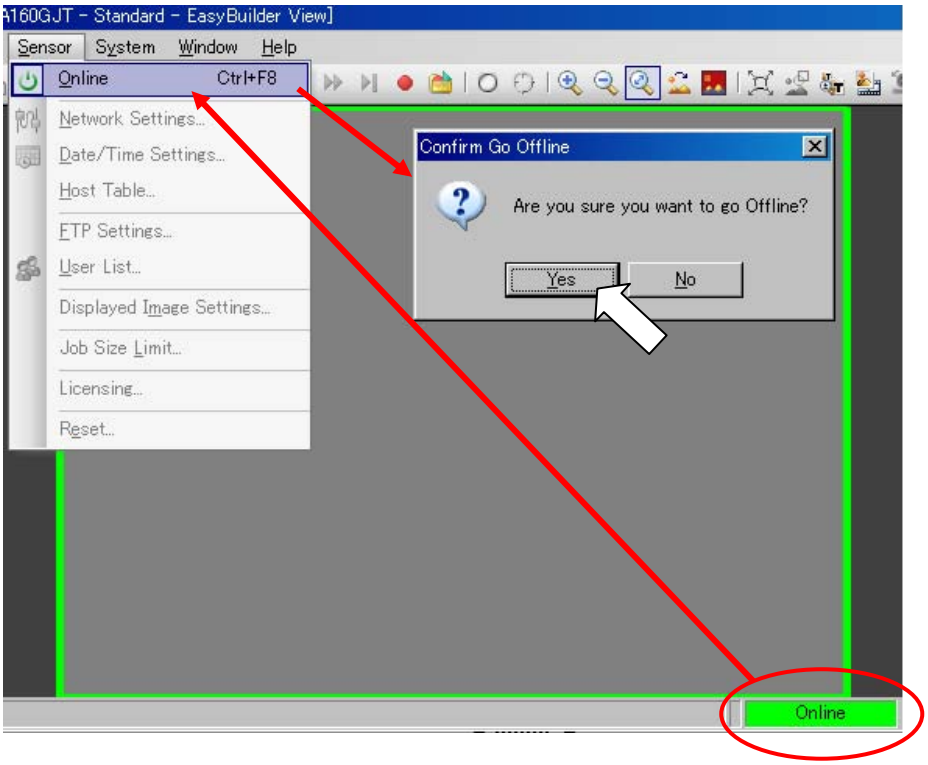


(3) Select “New Job…” from “File” in the menu bar or “Open Job…” if there is an existing job.

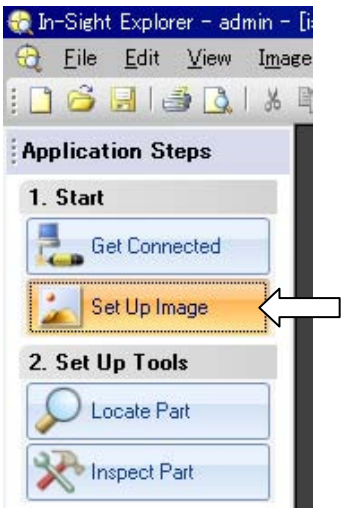
[Procedure 6] Conduct the settings following the instructions (1) to (3) indicated below.
Click “OK” button.



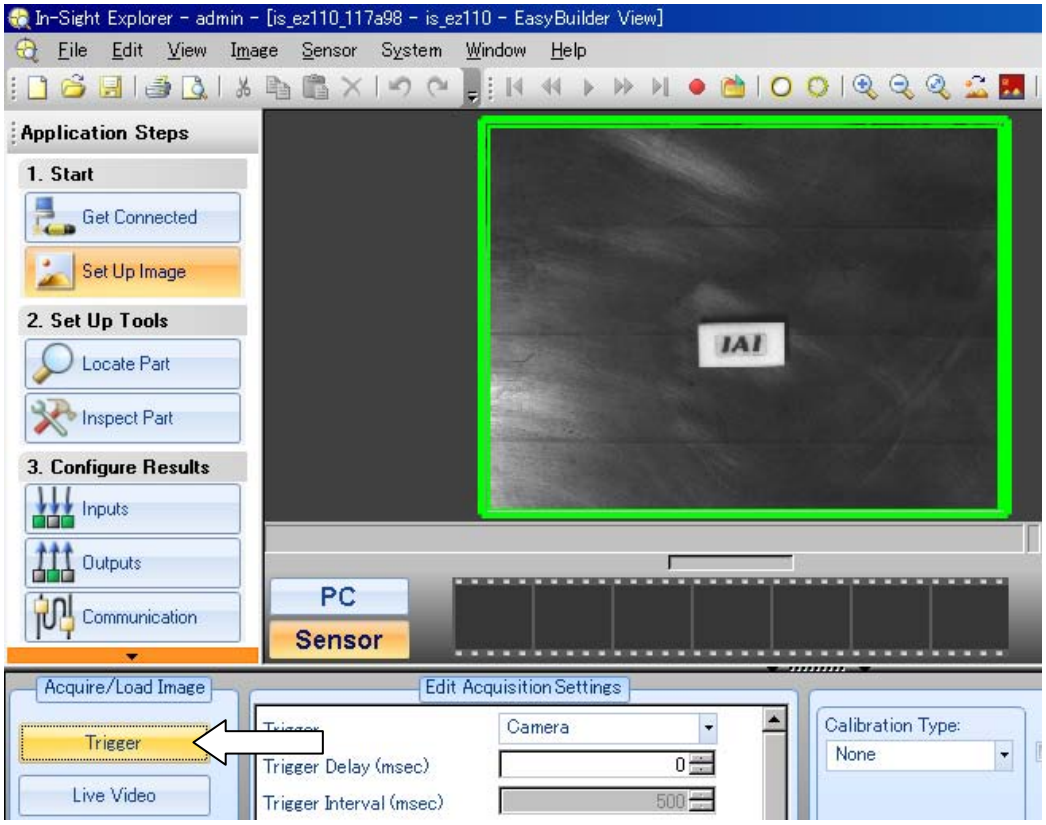
(1) Confirm “Online” shown at the bottom of the camera image display screen of In-Sight Explorer and then select “Sensor” → “Online” from the menu bar.
A message box asking “Are you sure you want to go Offline?”. Click “Yes” button.



(2) Select “Start” → “Set Up Image” in Application Steps.

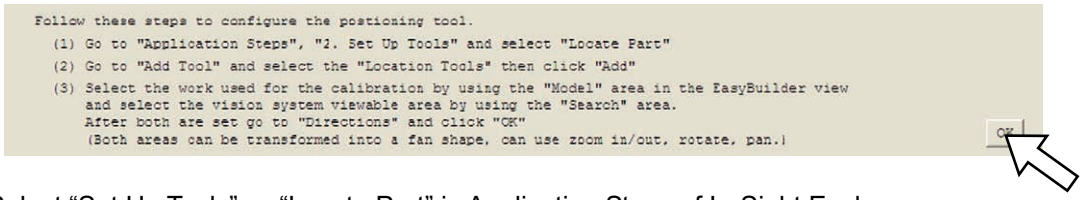


(3) In “Acquire/Load Image”, click “Trigger” to capture the image.

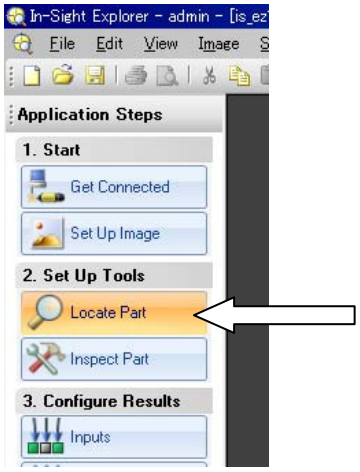


[Procedure 7] Select the necessary tools(Note) from the positioning or inspection of the tool setting.
(At this stage, do not select the IAI Robot Tool in the inspection.)
Click “OK” button.

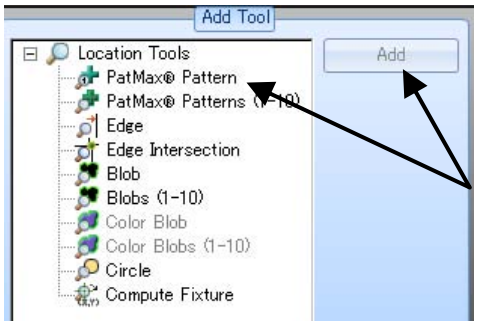
(Note) In this manual, explains with an example of when using PatMax pattern from the positioning tool. For other tools, refer to the instruction manual selected from Windows start menu → Program → Cognex → In-Sight → In-Sight Explorer*.*.* → “Document”.



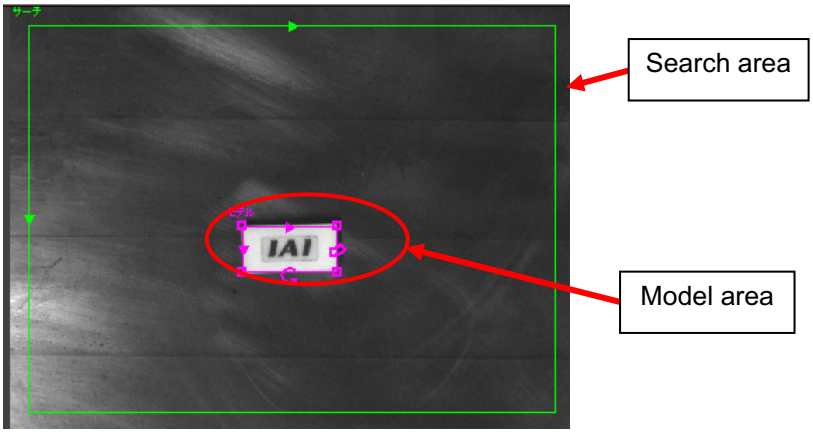
(1) Select “Set Up Tools” → “Locate Part” in Application Steps of In-Sight Explorer.



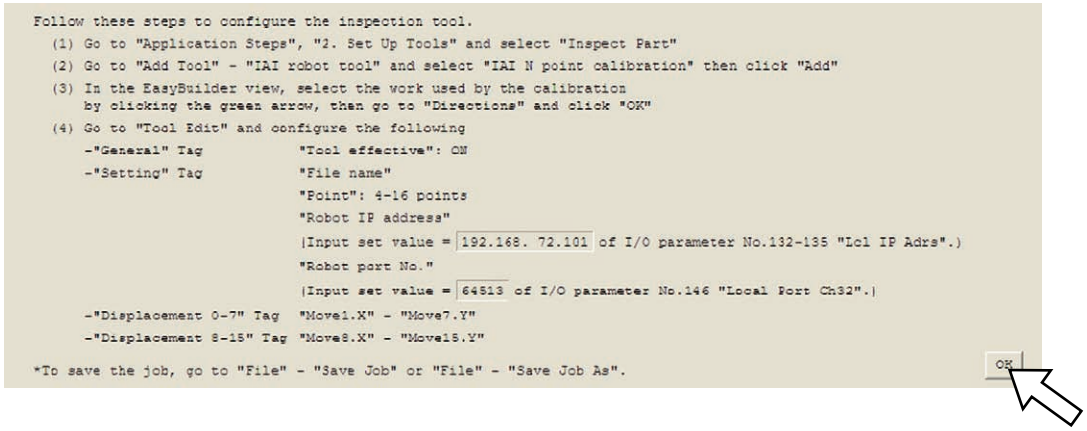
(2) In “Add Tool”, select “PatMax® Pattern” → “Add”.



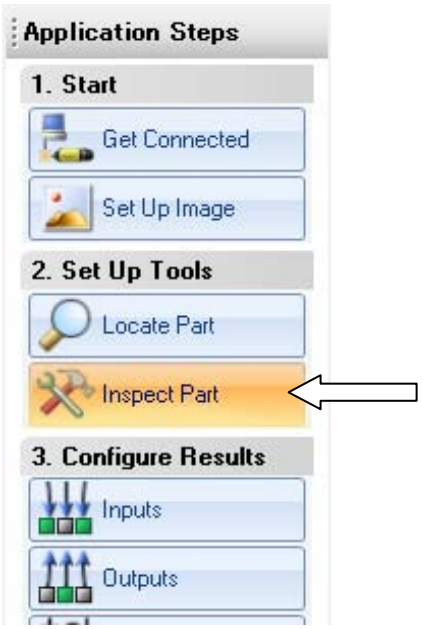
(3) Surround the area of the work that you wish to detect with the model area. Also, set the search area to the desired range. Click “OK” in Usage Method.



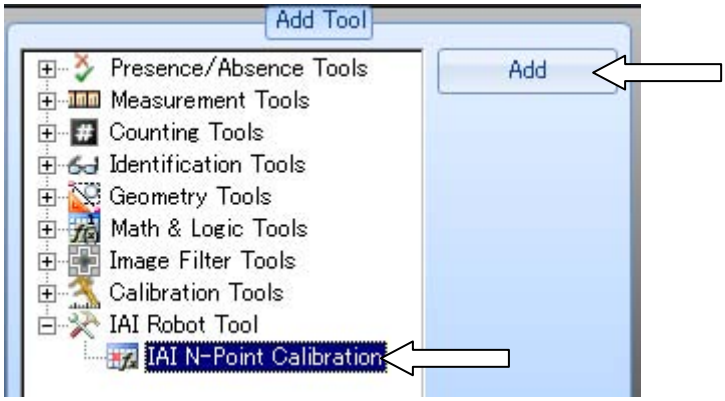
[Procedure 8] Now perform the settings for Inspection Tool. Follow the following instructions. After all the settings are complete, click “OK” button.



(1) In Application Steps in In-Sight Explorer, select “Set Up Tools” → “Inspect Part”.

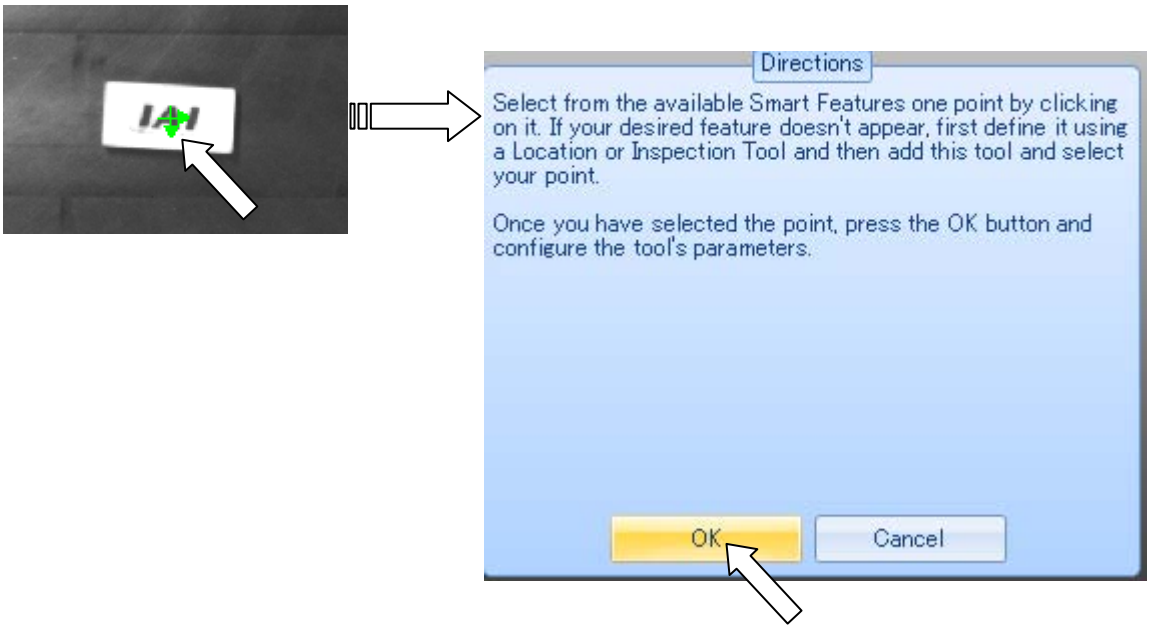


(2) From IAI Robot Tool in Tool Setting Inspection, select IAI N-Point Calibration and click “Add”.

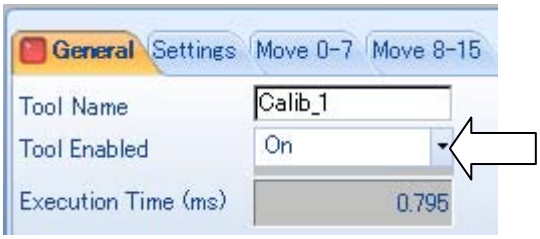


(3) Select the detection point set by either the positioning or the inspection tool and click “OK” in Usage.

(Example) When the detection point is set at the center of the work with using the positioning pattern tool PatMax, click on the cross cursor on the screen (the cursor color changes) and click “OK”.

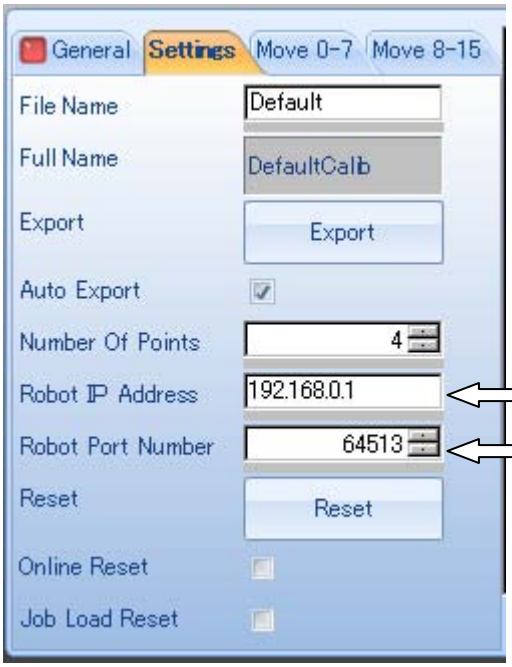


(4) In Calibration General window, confirm that Tool Enabled is On.



(5) Set the IP address and Port Number of XSEL in the Calibration Setting Window.
Input the value set in I/O Parameters No.132 to 135 for the IP address.
Input the value set in I/O Parameter No.146 for the Port Number.

(Note) The set value is displayed at the item that is currently set (it is displayed with an arrow →) in the Vision System I/F Simple Adjustment Window in the PC software.



Input the value set in I/O Parameters No.132 to 135 in XSEL

Input the value set in I/O Parameter No.146 in XSEL

(6) Set the number of points. It should basically be 4 points, however, in the case an improvement in the accuracy is required the number of point can be increased to 16 at the maximum. (Allocate the points evenly as much as possible in the range that the work can be detected and that for image capturing.)

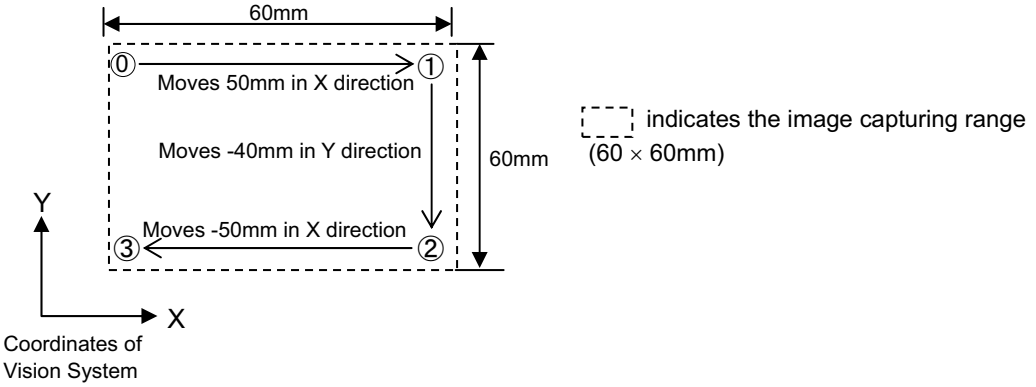
Input a number from 4 to 16

(7) Set the amount of robot movement(Note 1 and 2) considering the set points are in the image capturing range.

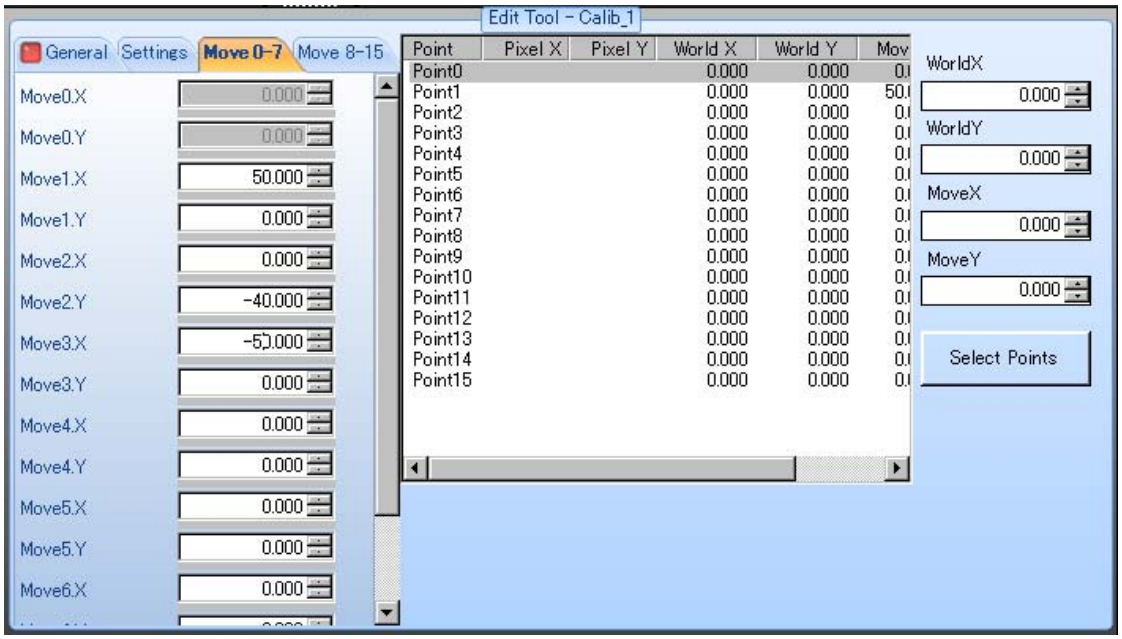
(Note 1) The movement is relative movement.

(Note 2) In the case the camera is mounted on the robot and the case not, the movement directions may be opposite in up/down, right/left directions.

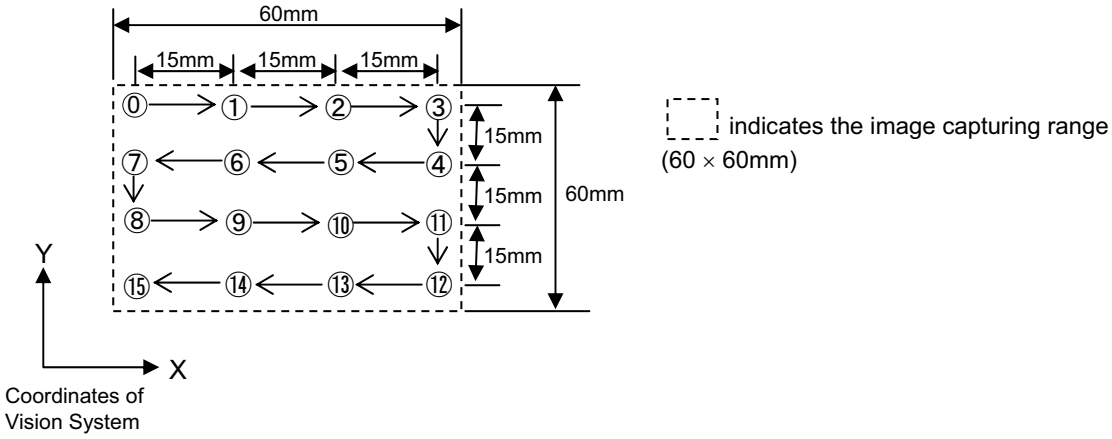
Example1 : Number of Calibration Points = 4 points (When Camera Not Mounted on Robot)



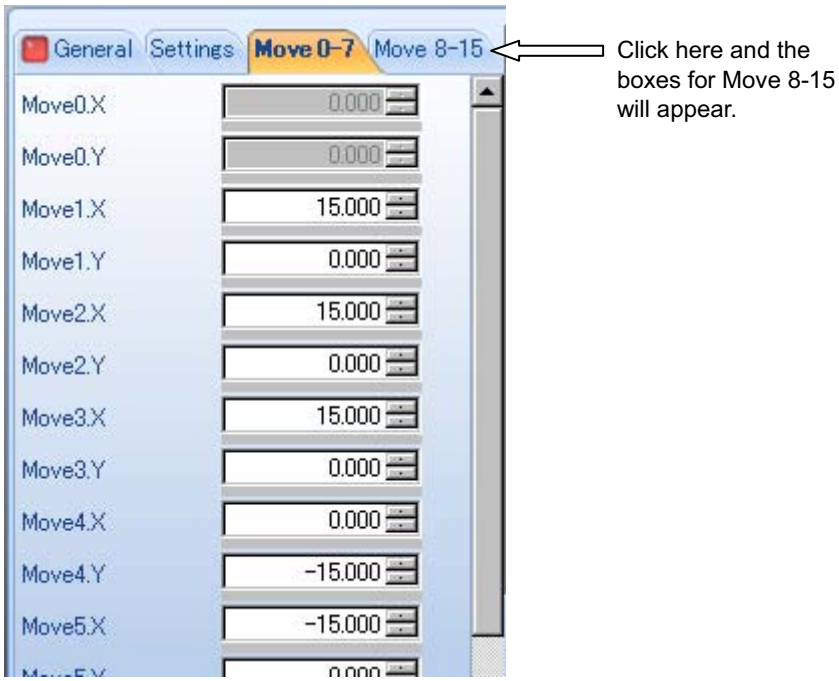
In this example, select the Move tag and set the values as shown below for Move1.X to Move3.Y in the right order.



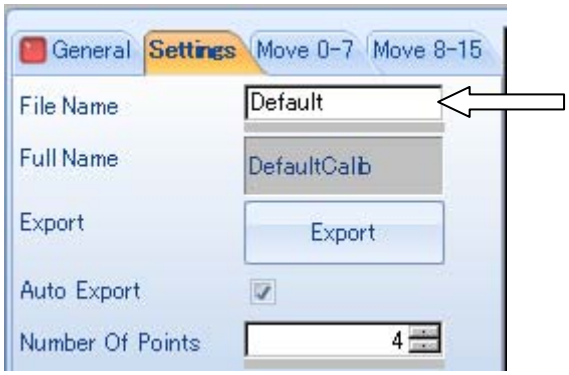
Example 2 : Number of Calibration Points = 16 points (When Camera Not Mounted on Robot)



In this example, select the Move tag and set the values as shown below for Move1.X to Move15.Y in the right order.

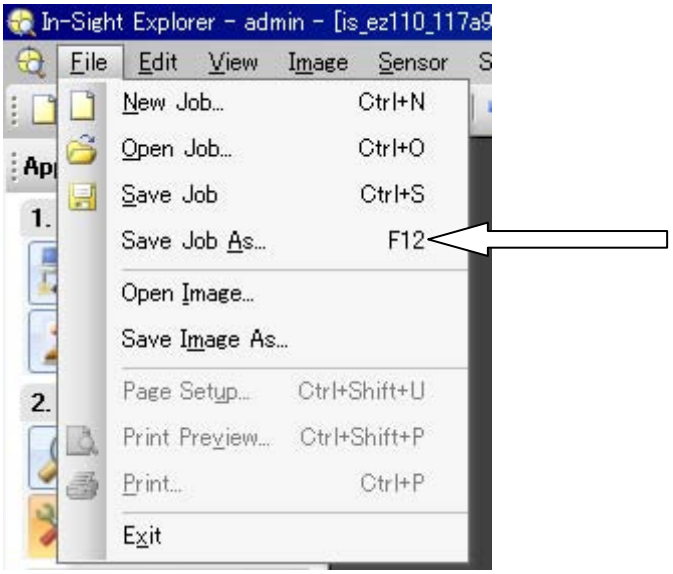


(8) Confirm that “Default” is shown in the file name on the top of the export window.
If a different name or nothing is shown, type it manually.

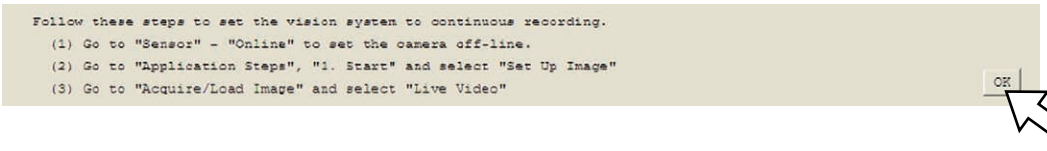


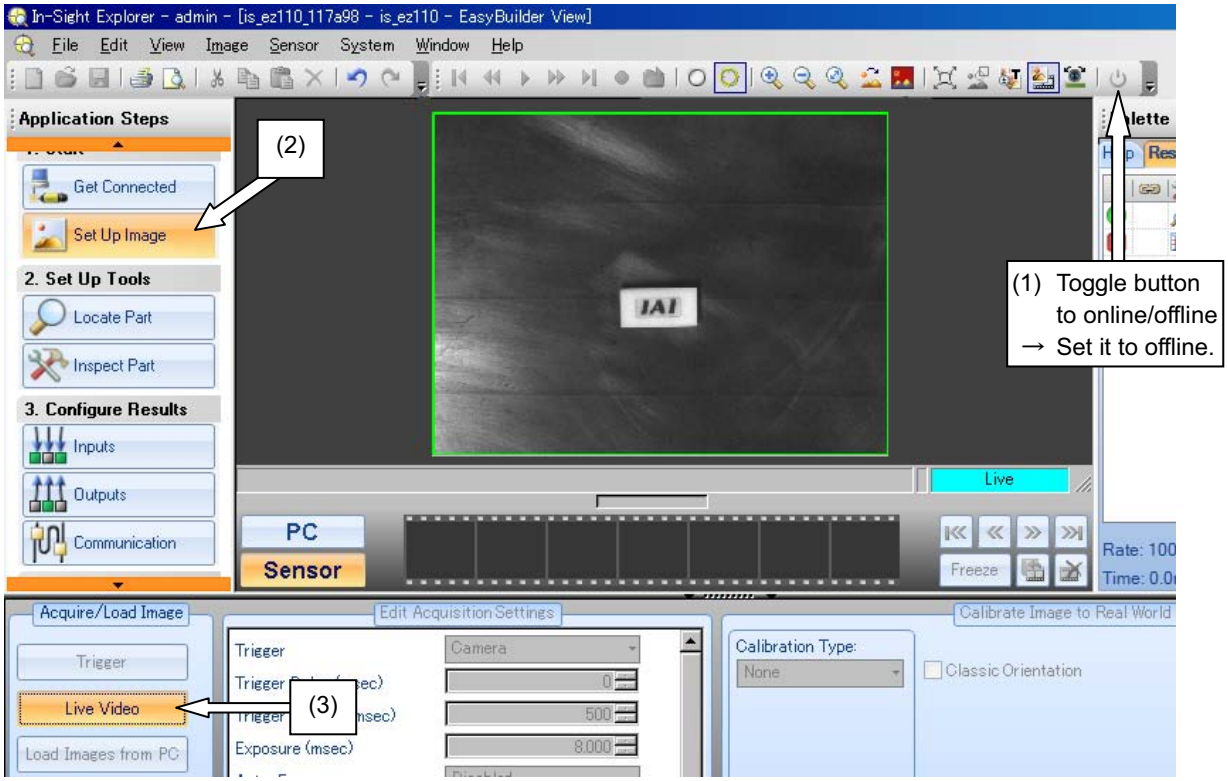
(9) Confirm a tick mark in the check box.
If not, put a tick mark in it.

(10) Select “File” → “Save Job” or “Save Job As…” from the menu bar.
Store the created job file to the camera and PC (for backup).

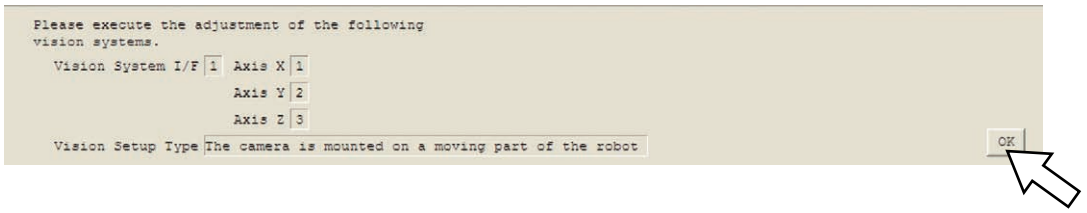


[Procedure 9] Set the vision system to the continuous capturing mode.
Select “Live Video” in Acquire/Load Image in In-Sight Explorer.
Click “OK” button.

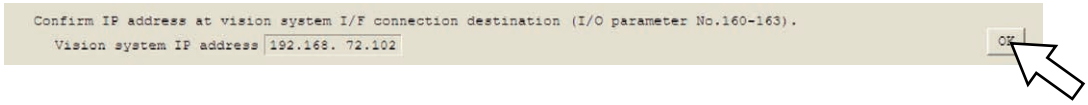




[Procedure 10] Click “OK” button.

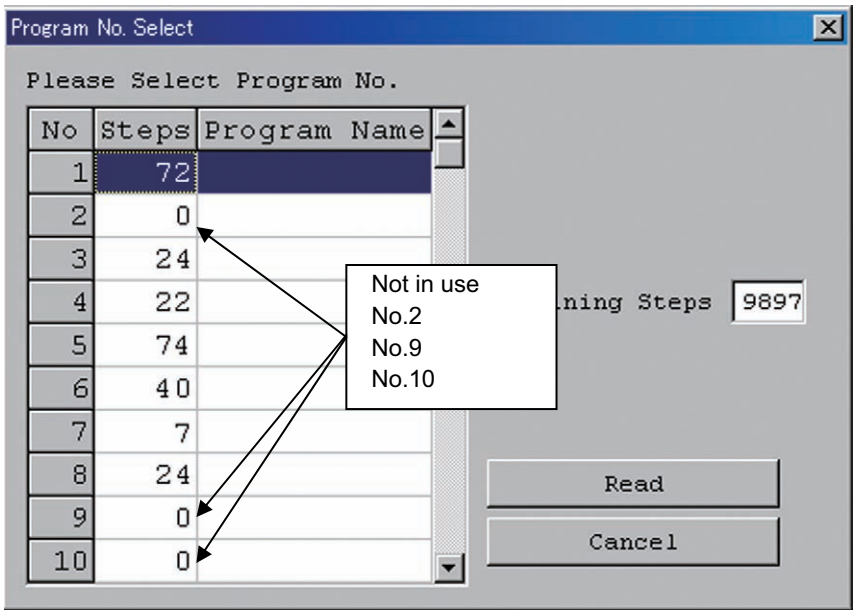


[Procedure 11] Click “OK” button if the IP addresses of the vision system are correct.
If incorrect, set the right IP addresses to XSEL I/O Parameters No.160 to 163.

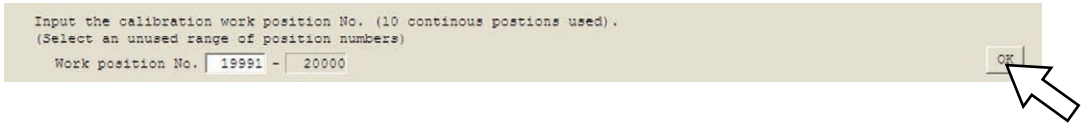


[Procedure 12] Input the program number that is not used in XSEL to the forwarding program number.
After inputting, click “OK” button.

The programs not in use can be found with the method stated below.
From the menu of XSEL PC software, select “Program” → “Edit”.
Program Number Select Window opens. In the list, the numbers with 0 in Step Number column are not in use. If all the lines are occupied, make a backup to the PC temporarily to ensure an empty program field.



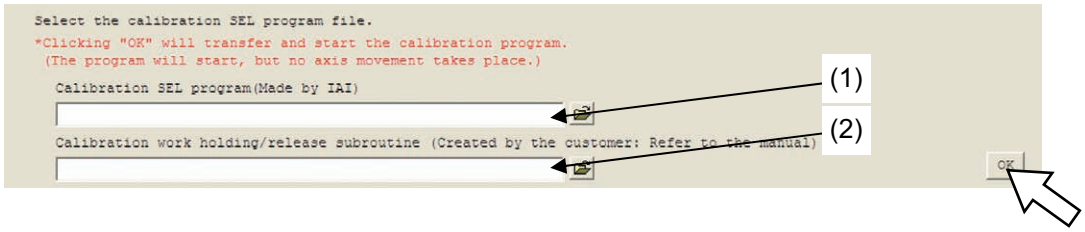
[Procedure 13] Input the position number not in use. (Select a position number that 10 positions in a row can be ensured.)
After inputting, click “OK” button.



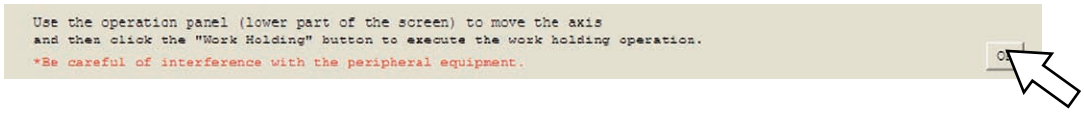
If all the lines are occupied, make a backup to the PC temporarily to ensure an empty program field.

[Procedure 14] (1) Please contact IAI for a program file you need.
(2) Select the file (X-SEL-P/Q: cognex_worksub.x2pg2, X-SEL-R/S: cognex_worksub.x4pg) as the work hold/release sub-routine for the calibration (please prepare separately) from the data downloaded in (1) in Procedure 14. (It is necessary to create a program which suits to the work in advance. Refer to Section 5.8.1.)

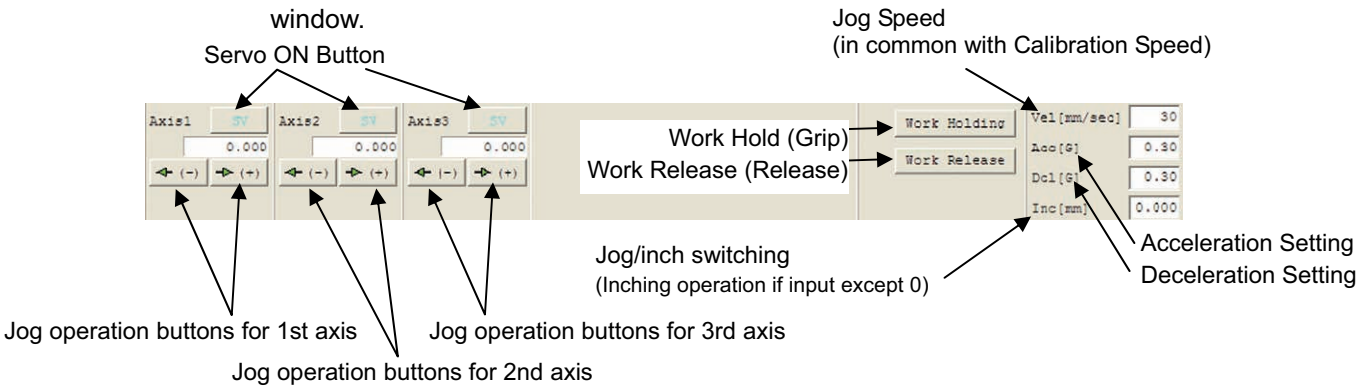
After selecting the file, click “OK” button.



[Procedure 15] Move the robot to the position where it can hold (grip) the work.
Press the “Work Holding” button in the jog movement screen shown below to hold the work.
(Note) Watch for the interference to the peripheral equipment.

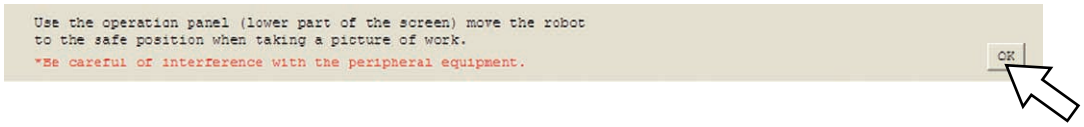


Perform the moving operation with the jog buttons at the bottom of the calibration window.

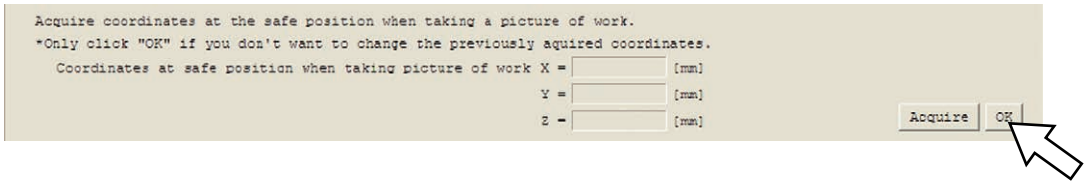


[Procedure 16] Move the robot to a position out of image capturing range of the camera and click “OK” button.

(Note) Watch for the interference to the peripheral equipment. [Refer to Procedure 15 for how to operate.]

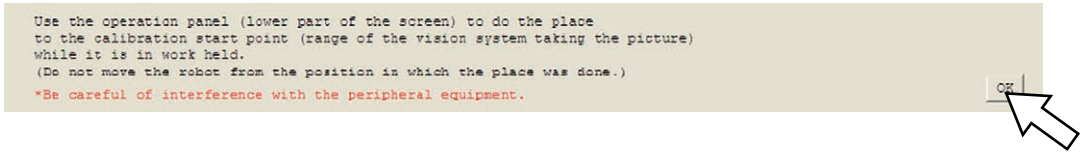


[Procedure 17] Click the “Acquire” button to read the current robot coordinates information. Confirm that the current coordinates are shown as the position out of image capturing range coordinates and click “OK” button.



[Procedure 18] With the work held on the robot, transport it to a position near the calibration start point (point above the position 0 set in Procedure 8 (5)). Do not move the robot from where it released the work.

Click “OK” button.

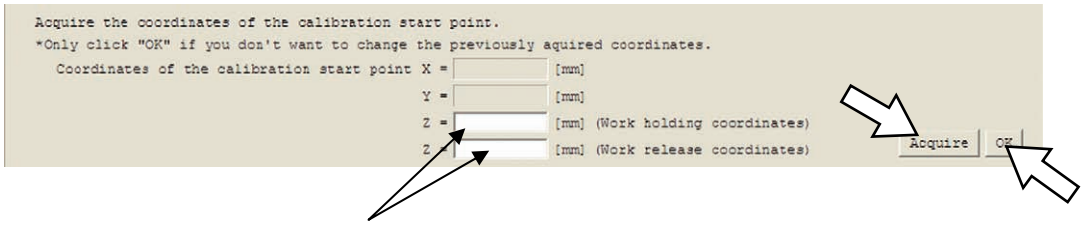


Perform the moving operation with the jog buttons at the bottom of the calibration window. [Refer to Procedure 15]

[Procedure 19] Click the “Acquire” button to read the current robot coordinates information. Confirm that the coordinates where released is displayed as the coordinates for the calibration start point.

When fine-tuning is required for the height of Z-axis for holding or that of Z-axis for releasing, input values directly to the Z-axis boxes.

Click “OK” button.



Put values directly when a fine-tuning is required for the Z-axis height.

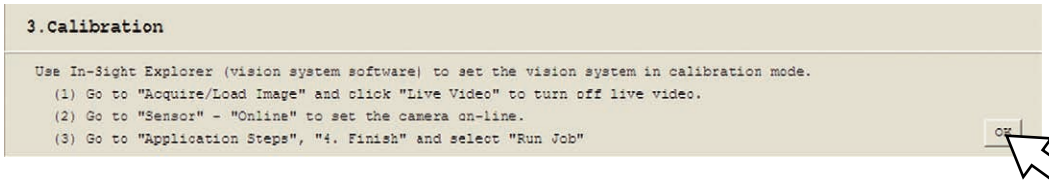
(Note) Do not click the “Acquire” button if putting the values directly.

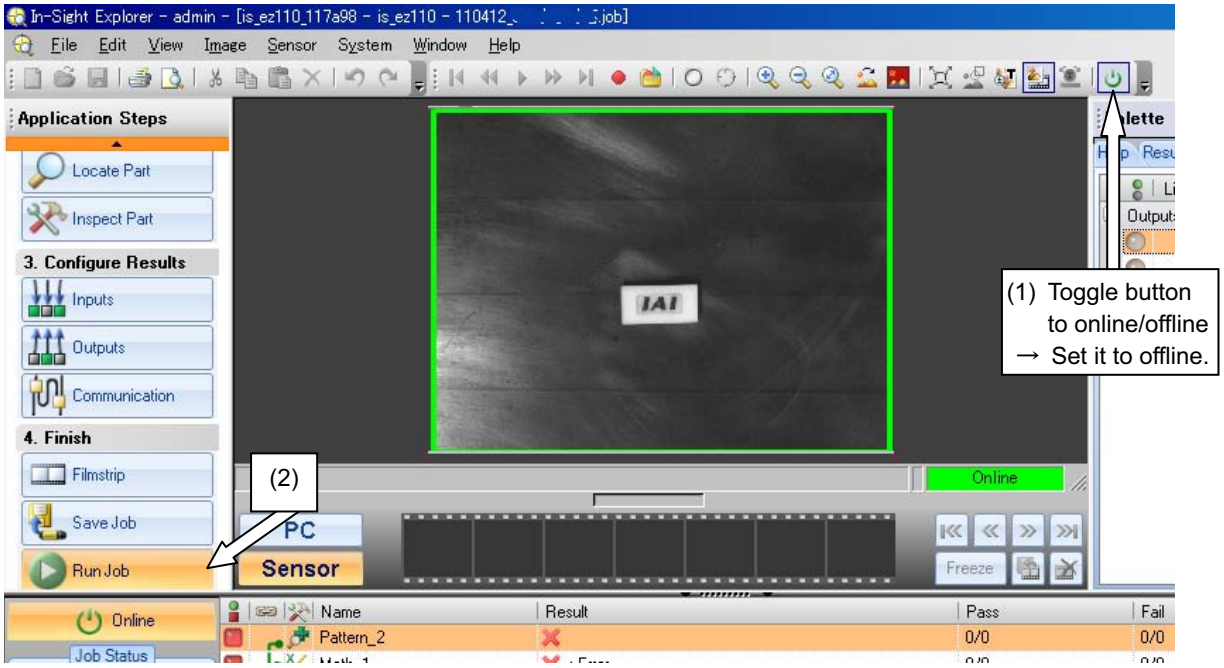
[Procedure 20] Perform the following settings to make the camera condition to wait for calibration execution.

(1) Click on Live Video at “Import/Load Image” in Application Step to release the Live Video condition.

(2) Make the camera online.

(3) Select “Finish” → “Run Job” in Application Steps.
Click “OK” button.

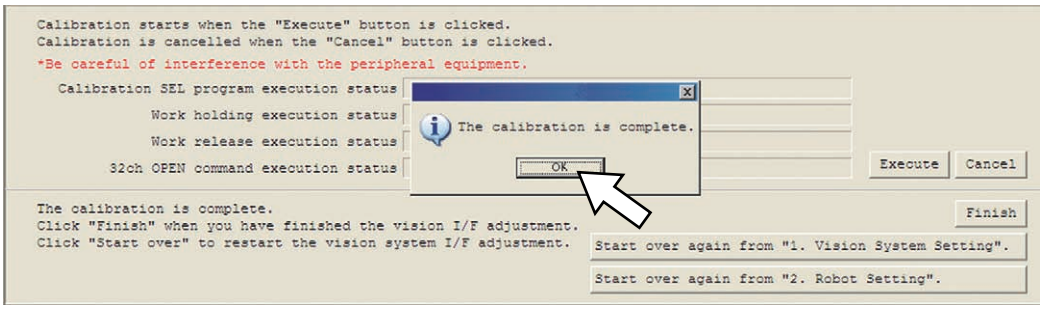




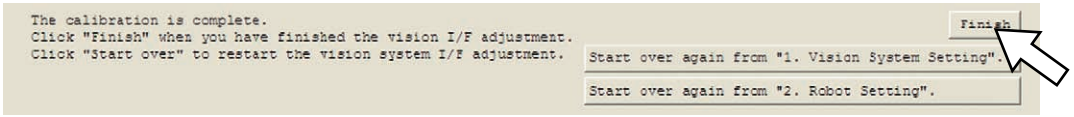
[Procedure 21] Click “Execute” button. The calibration starts.

⚠ Warning : The calibration work includes the robot operation. Make sure to be away from the robot operation range before executing the work.

[Procedure 22] The calibration is complete in normal condition after the adjustment of specified point number is conducted.
Click “OK” to close the information window.

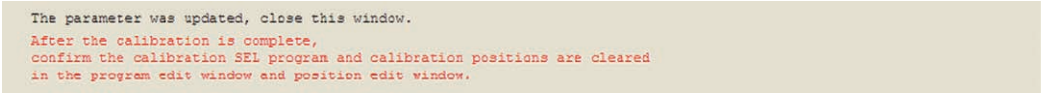


[Procedure 23] If desired to finish the calibration, click the “Finish” button.
If an error occurred, refer to Section 7.2 to solve the problem and retry the calibration.



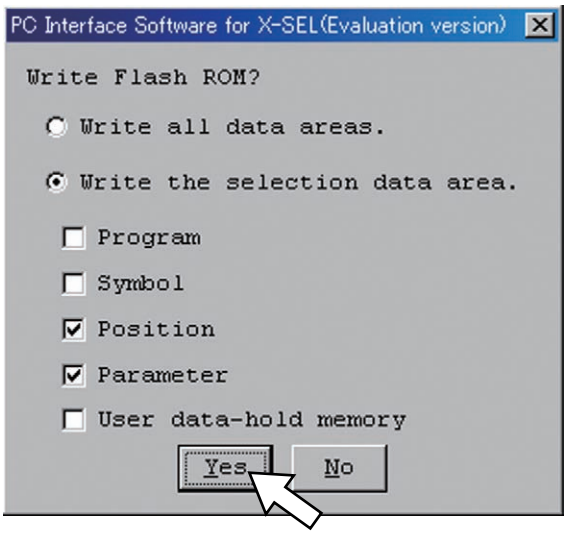
[Procedure 24] Click the “Update” button.

[Procedure 25] After closing this window (Vision System Settings), write to the flash ROM and reboot the system, confirm that the contents in the program numbers and the position numbers selected in [Procedure 12] and [Procedure 13] are all cleared up. If the data was stored in the PC temporarily, put them back to where they originally were.



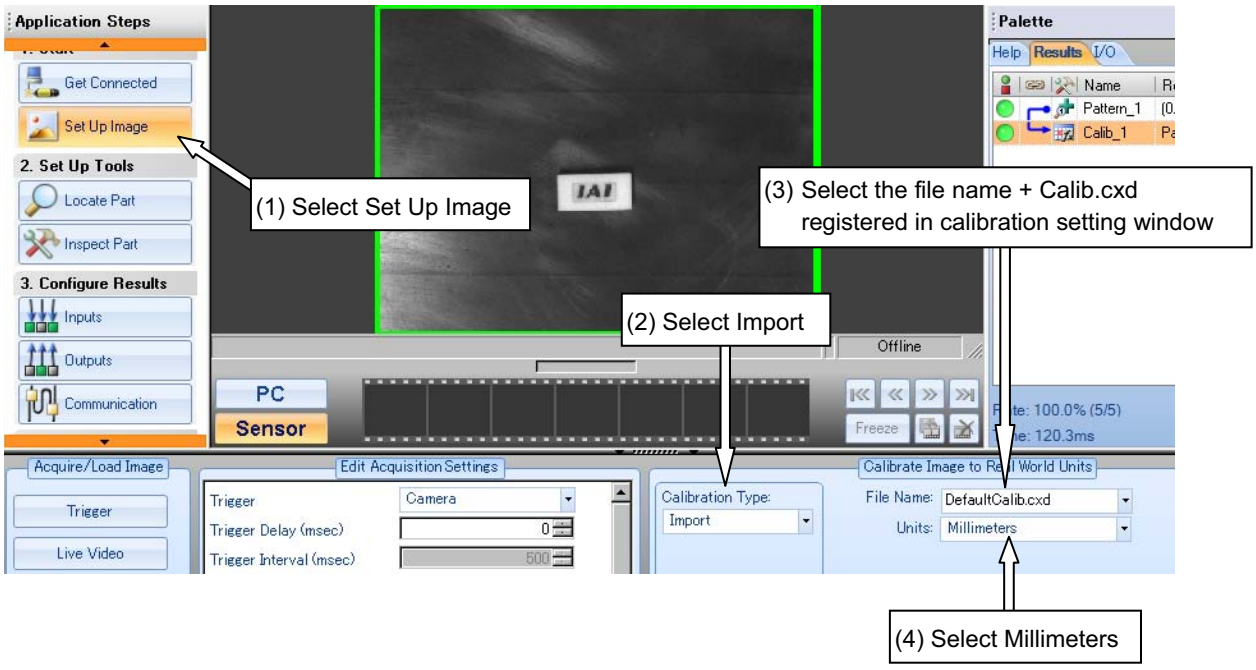
[Procedure 26] Close the window by clicking the “×” button on the top right corner of the window.

[Procedure 27] The window shown below will appear. Click the “Yes” button.
Confirmation window for the controller reboot appears next. Click the “Yes” button to reboot the controller.



[Procedure 28] After setting the camera to offline, select the settings of In-Sight Explorer images and set Calibration Type to Import. Select “DefaultCalib.cxd”(Note) from the selectable file names.
Select “File” → “Save Job” or “Save Job As…” from the menu bar.

(Note) Select the file name that includes “Calib.cxd” in it that was set in [Procedure 8] (6).

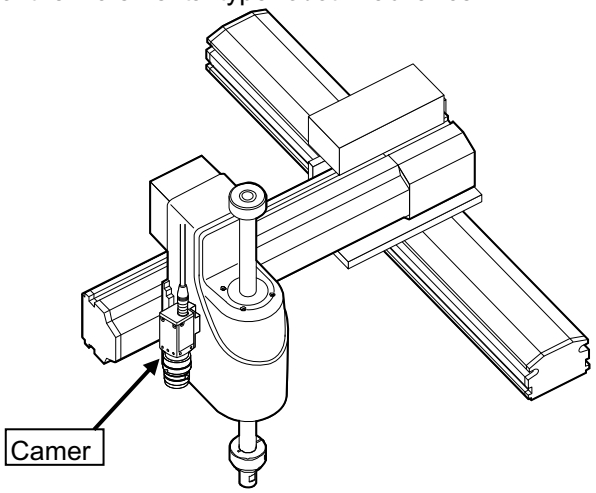


⚠ Note :
The job file created here is for the calibration use only. It is necessary to create another job file for the ordinary operation, or otherwise ask the distributor to create one for you.

5.8.3 When Camera Mounted on Robot (When EZ-110XL is used)

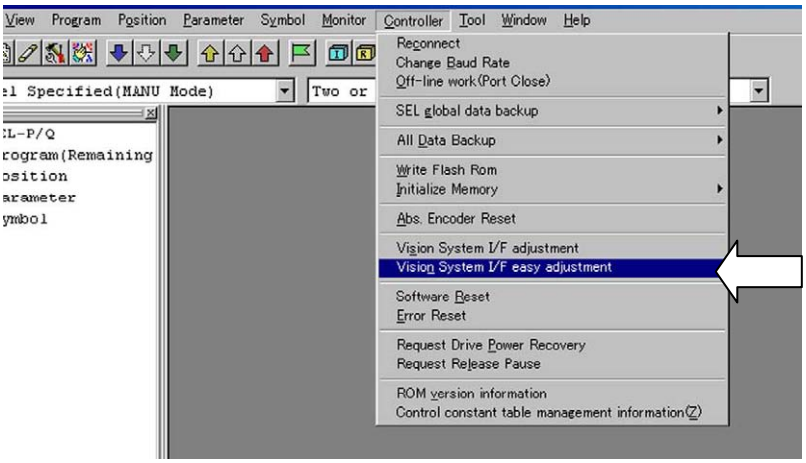
This section explains how to setup when the camera is installed on the camera as shown in the picture below.

Conduct the home return of the incremental type robot in advance.



When Camera Mounted on Robot

[Procedure 1] Select Vision System I/F easy adjustment from the PC software.
A warning dialog box opens.



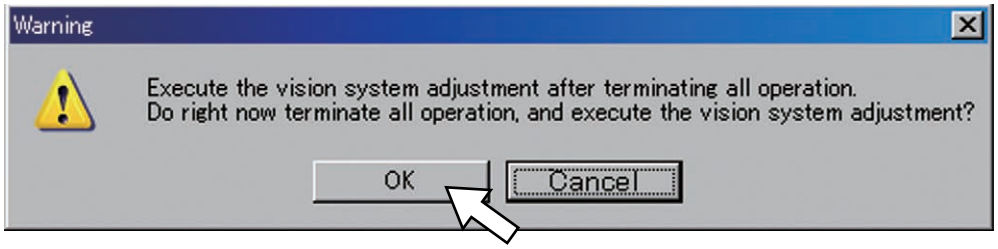
⚠ Note :

In the case “Vision System I/F easy adjustment” is not displayed in the main menu, check the version of the PC software and the settings of related I/O parameters.

PC software version for Vision System I/F Adjustment	
XSEL-P/Q	: V7.07.08.00 or later
XSEL-R/S	: V9.0.0.0 or later
TTA	: V10.0.0.0 or later
MSEL-PC/PG	: V12.0.0.0 or later

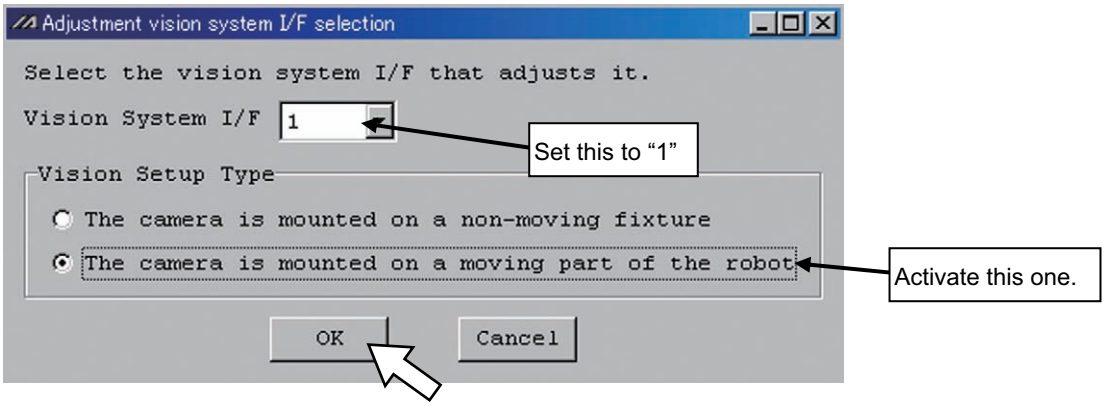
I/O Parameter
No.351 Bit 0-3=1

[Procedure 2] Finish all operations and click “OK” button.
Vision System I/F easy adjustment window opens.

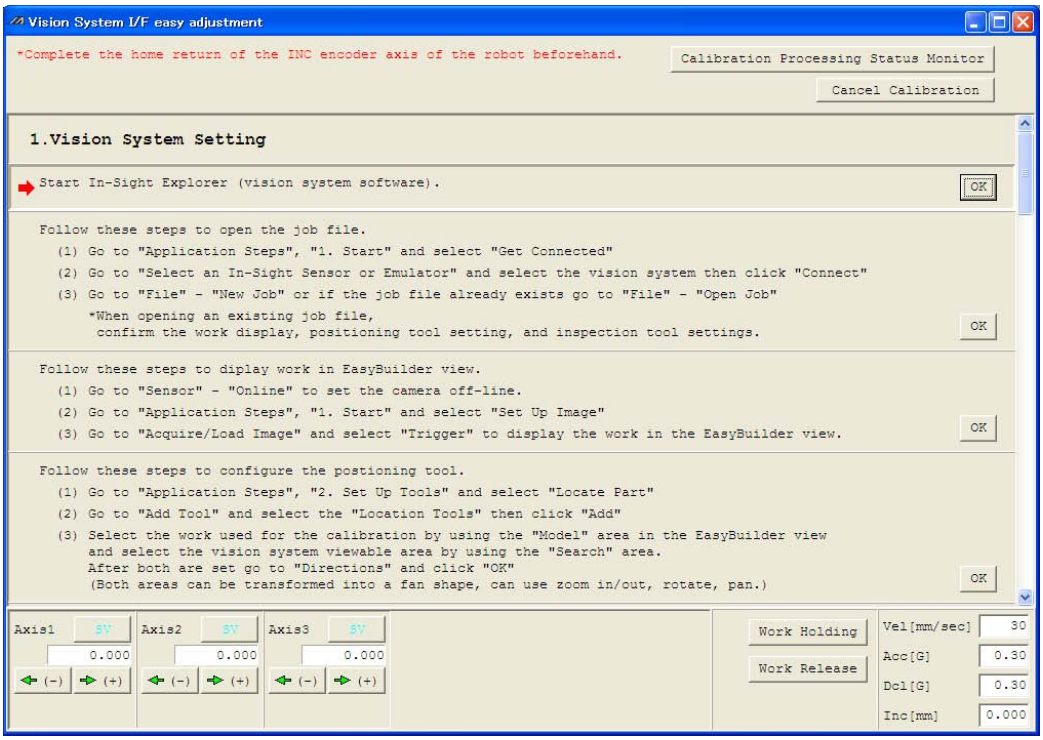


[Procedure 3] Click “OK” button.
Vision System I/F easy adjustment window appears. [See the next page]

> ⚠ Note :
> If no vision system I/F number is displayed, check the parameter settings [5.7 Parameter Settings] on the controller.



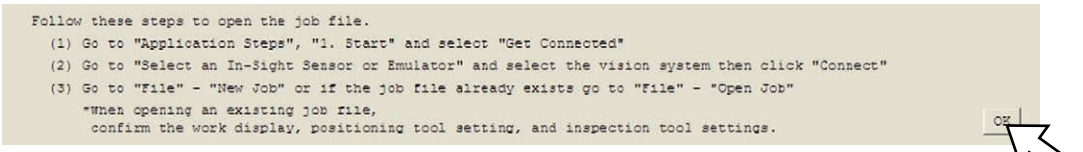
Vision System I/F easy adjustment Window



☆ For those items pointed with a red arrow, confirm the contents or acquire the necessary values and click the button on the right to proceed to the next one.

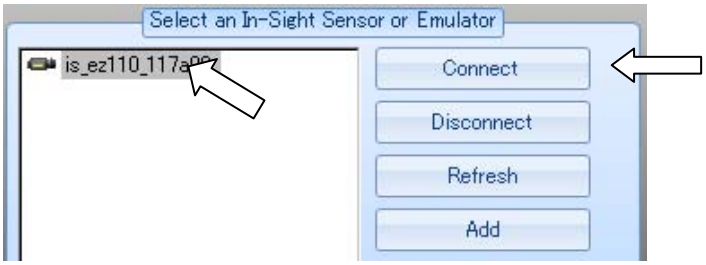
[Procedure 4] Start up the Cognex Setup Software (In-Sight Explorer).
After it is confirmed the software is open, click “OK” button.

[Procedure 5] Connect the camera and conduct the settings following the instructions (1) to (3) indicated below.
Click “OK” button.

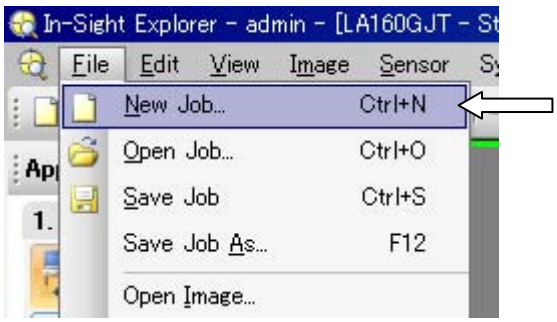


(1) In Application Step in In-Sight Explorer, select “Start” → “Get Connected”.

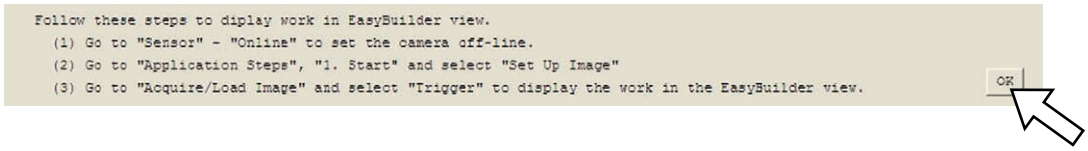
(2) In “Select In-Sight Sensor or Emulator”, select “ez110” and then select “Connect”.



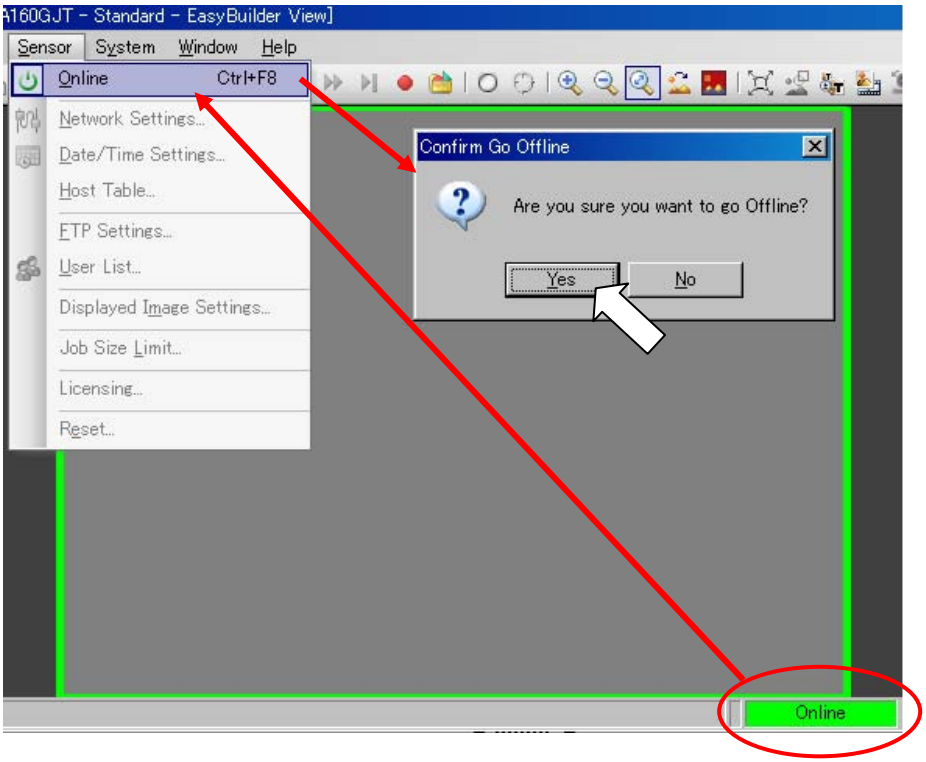
(3) Select “New Job…” from “File” in the menu bar or “Open Job…” if there is an existing job.



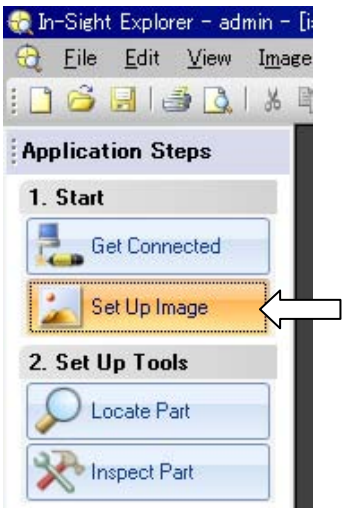
[Procedure 6] Conduct the settings following the instructions (1) to (3) indicated below.
Click “OK” button.



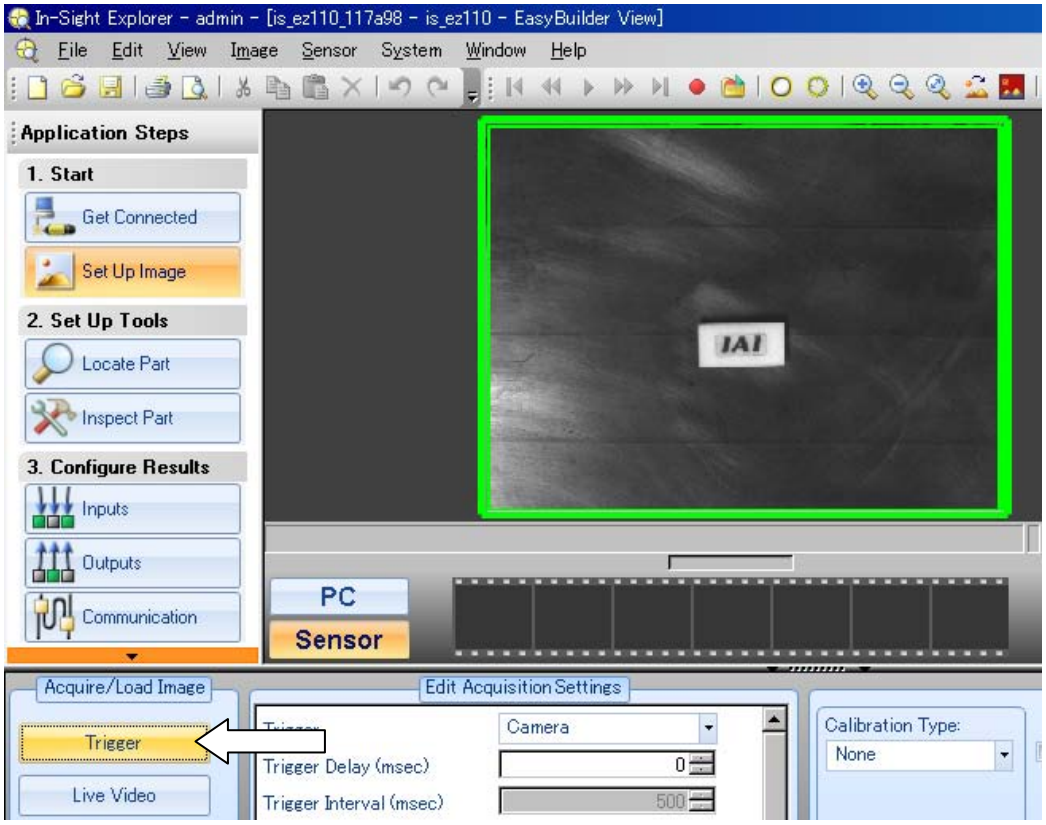
(1) Confirm “Online” shown at the bottom of the camera image display screen of In-Sight Explorer and then select “Sensor” → “Online” from the menu bar.
A message box asking “Are you sure you want to go Offline?”. Click “Yes” button.



(2) Select “Start” → “Set Up Image” in Application Steps.

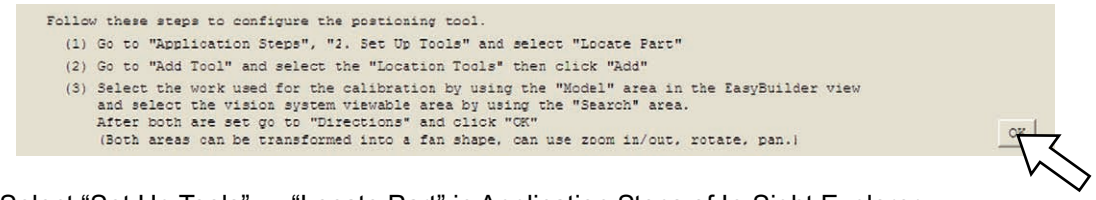


(3) In “Acquire/Load Image”, click “Trigger” to capture the image.

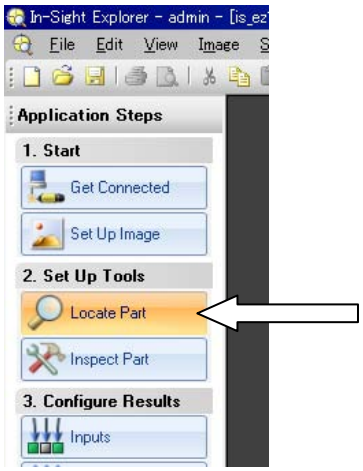


[Procedure 7] Select the necessary tools(Note) from the positioning or inspection of the tool setting. (At this stage, do not select the IAI Robot Tool in the inspection.)
Click “OK” button.

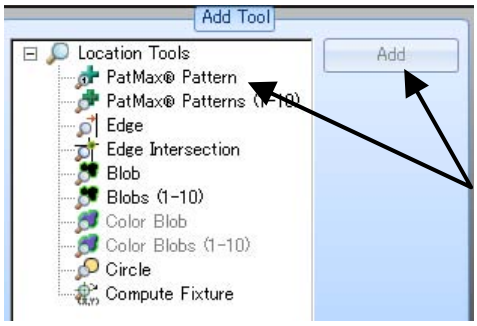
(Note) In this manual, explains with an example of when using PatMax pattern from the positioning tool. For other tools, refer to the instruction manual selected from Windows start menu → Program → Cognex → In-Sight → In-Sight Explorer*.*.* → “Document”.



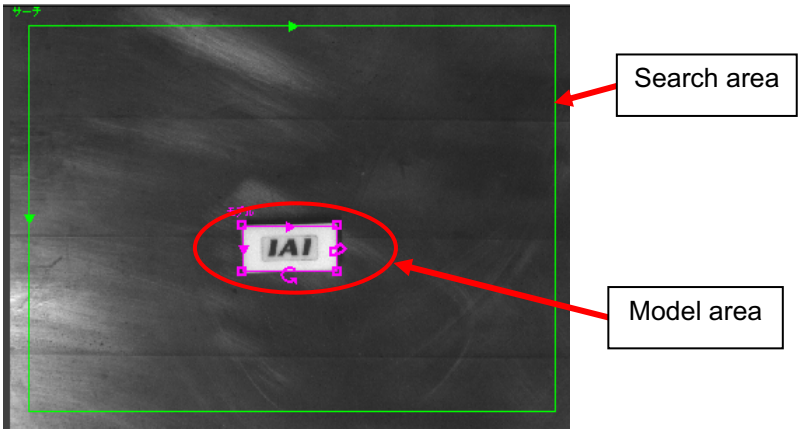
(1) Select “Set Up Tools” → “Locate Part” in Application Steps of In-Sight Explorer.



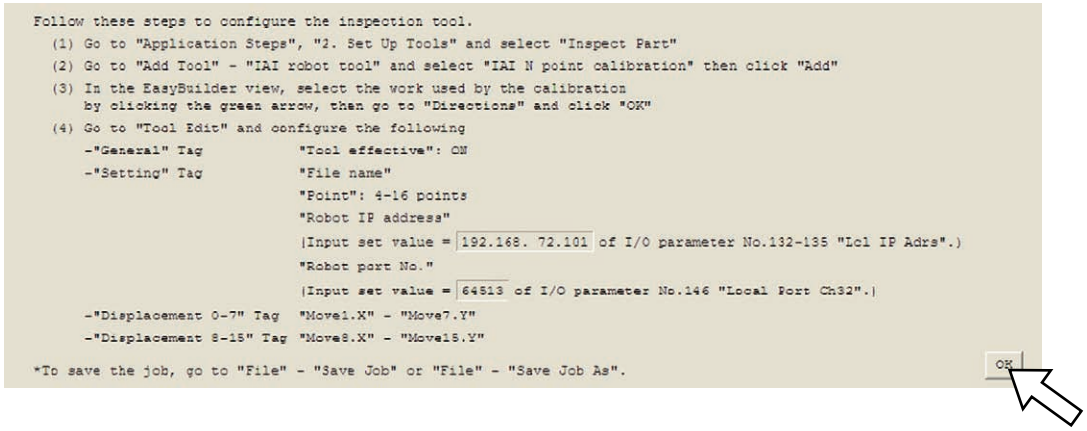
(2) In “Add Tool”, select “PatMax® Pattern” → “Add”.



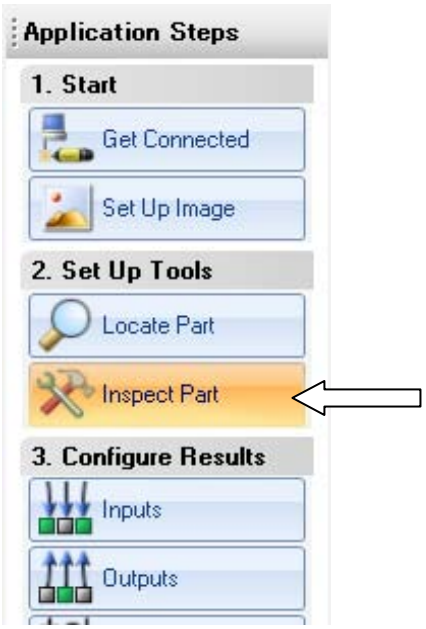
(3) Surround the area of the work that you wish to detect with the model area. Also, set the search area to the desired range. Click “OK” in Usage Method.



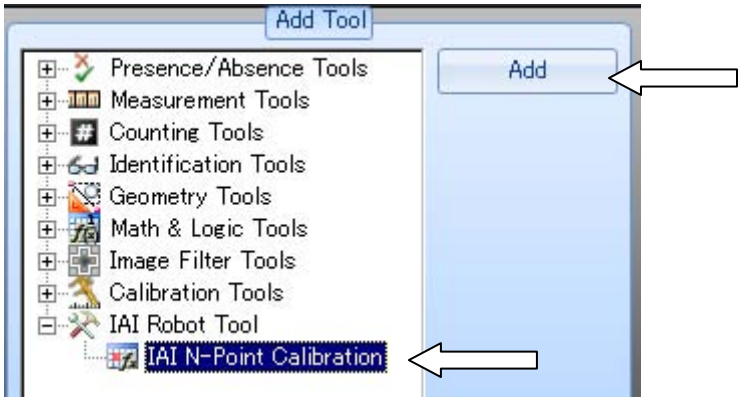
[Procedure 8] Now perform the settings for Inspection Tool. Follow the following instructions. After all the settings are complete, click “OK” button.



(1) In Application Steps in In-Sight Explorer, select “Set Up Tools” → “Inspect Part”.

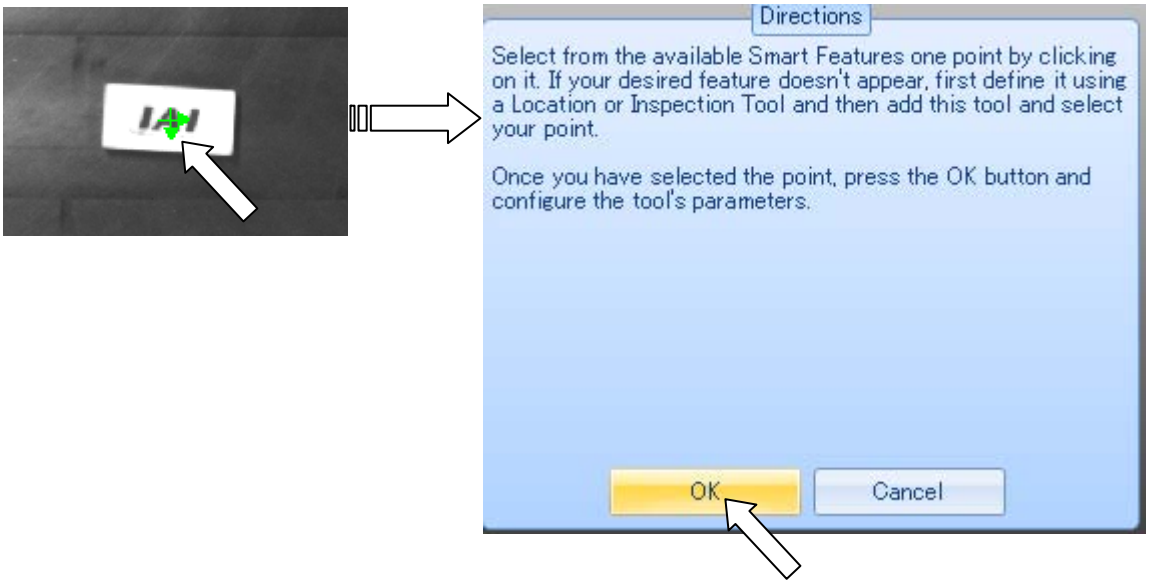


(2) From IAI Robot Tool in Tool Setting Inspection, select IAI N-Point Calibration and click “Add”.

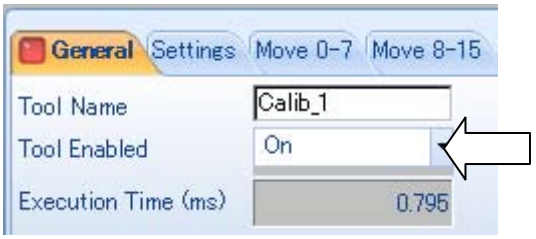


(3) Select the detection point set by either the positioning or the inspection tool and click “OK” in Usage.

(Example) When the detection point is set at the center of the work with using the positioning pattern tool PatMax, click on the cross cursor on the screen (the cursor color changes) and click “OK”.

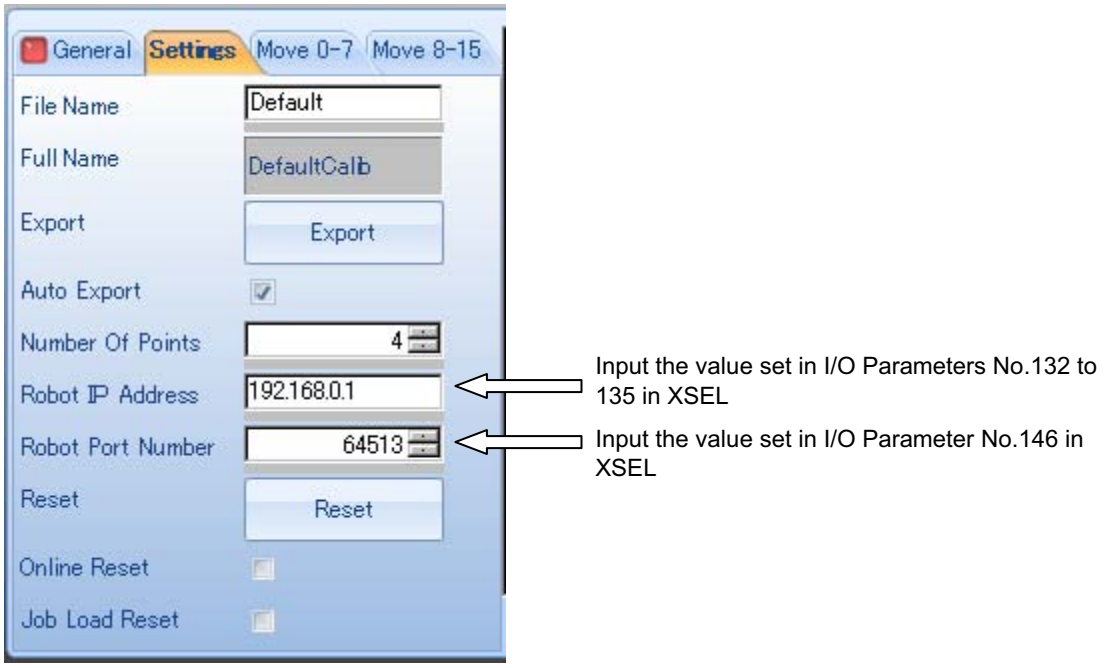


(4) In Calibration General window, confirm that Tool Enabled is On.

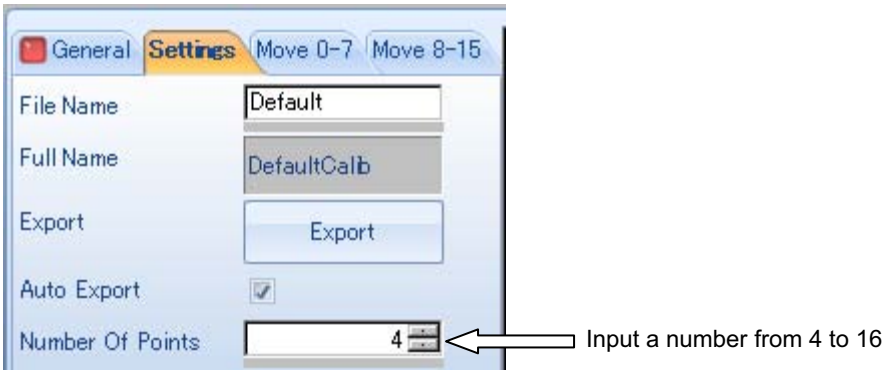


(5) Set the IP address and Port Number of XSEL in the Calibration Setting Window.
Input the value set in I/O Parameters No.132 to 135 for the IP address.
Input the value set in I/O Parameter No.146 for the Port Number.

(Note) The set value is displayed at the item that is currently set (it is displayed with an arrow →) in the Vision System I/F Simple Adjustment Window in the PC software.



(6) Set the number of points. It should basically be 4 points, however, in the case an improvement in the accuracy is required the number of point can be increased to 16 at the maximum. (Allocate the points evenly as much as possible in the range that the work can be detected and that for image capturing.)

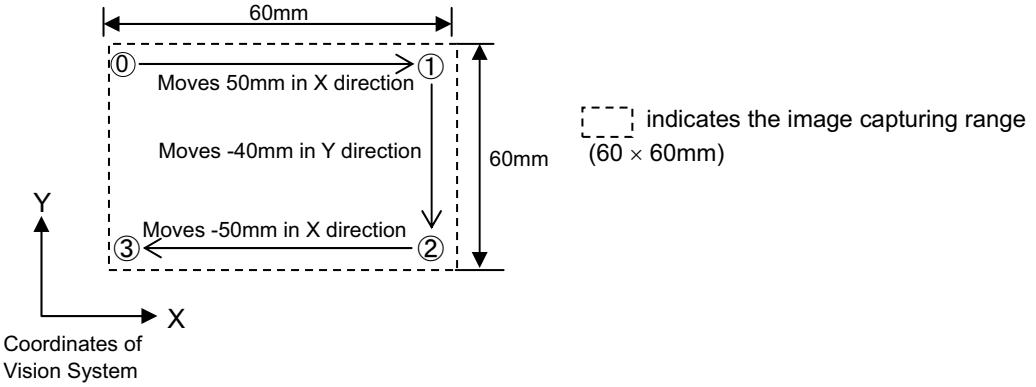


(7) Set the amount of robot movement(Note 1 and 2) considering the set points are in the image capturing range.

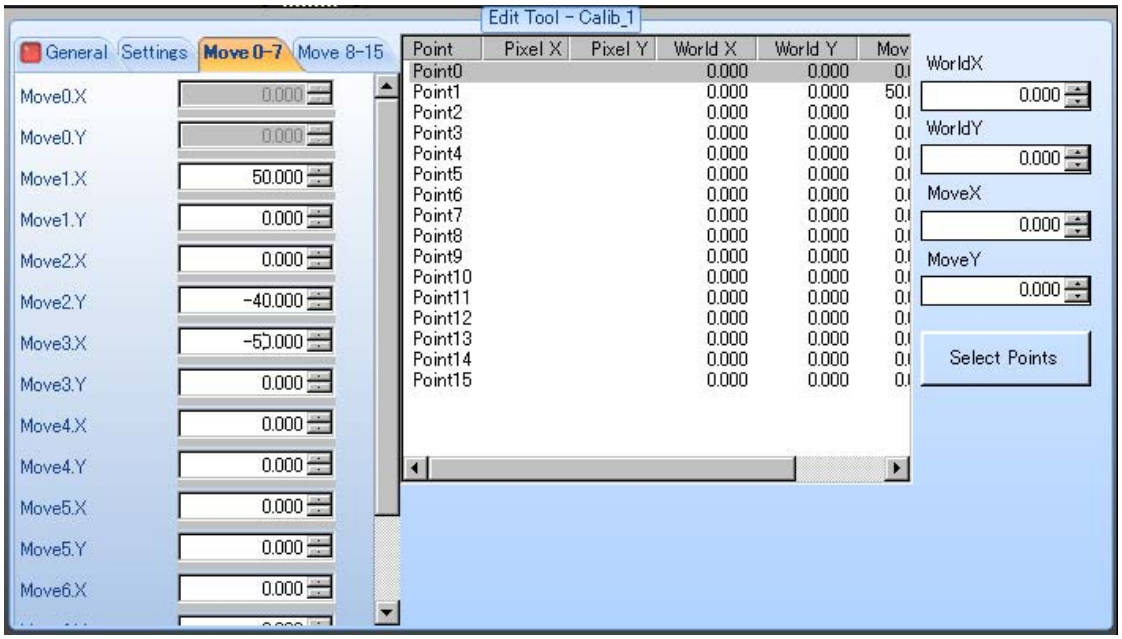
(Note 1) The movement is relative movement.

(Note 2) In the case the camera is mounted on the robot and the case not, the movement directions may be opposite in up/down, right/left directions.

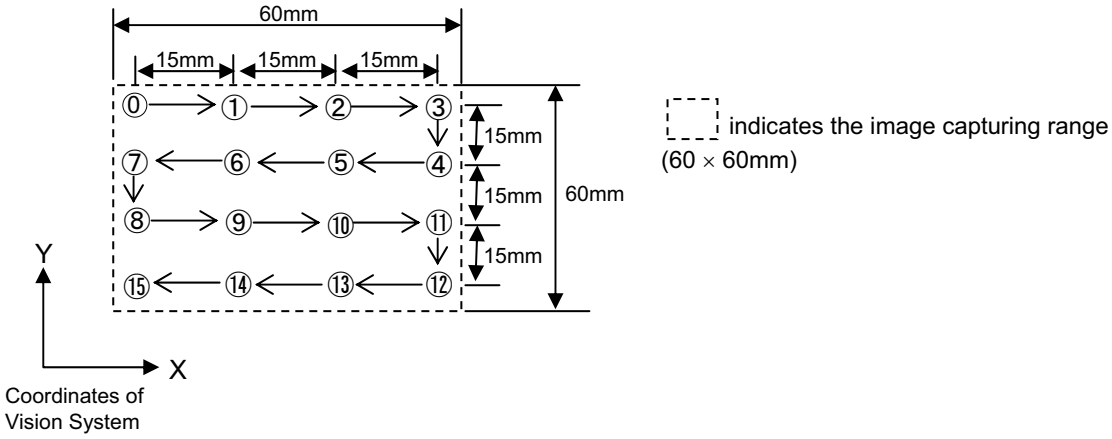
Example1 : Number of Calibration Points = 4 points (When Camera Not Mounted on Robot)



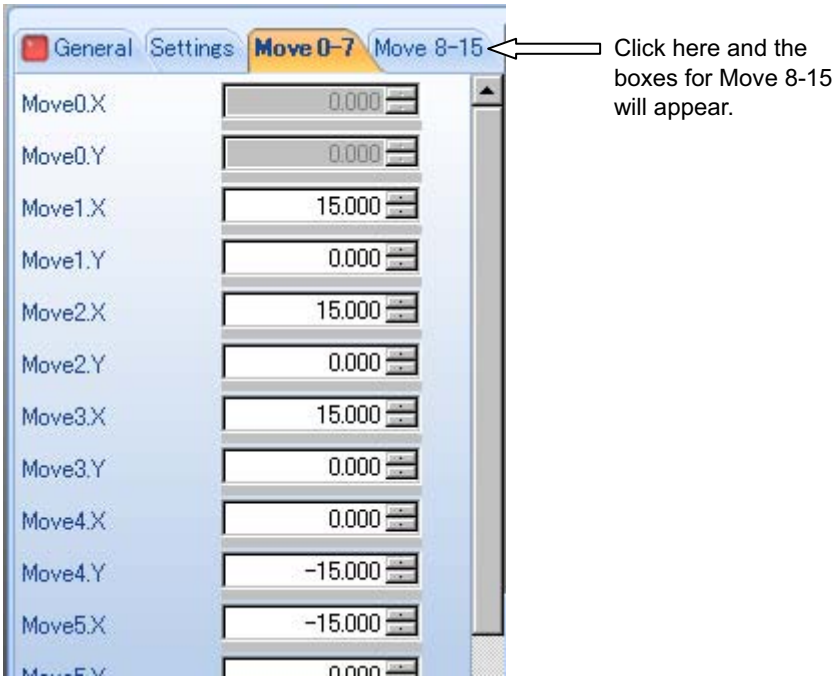
In this example, select the Move tag and set the values as shown below for Move1.X to Move3.Y in the right order.



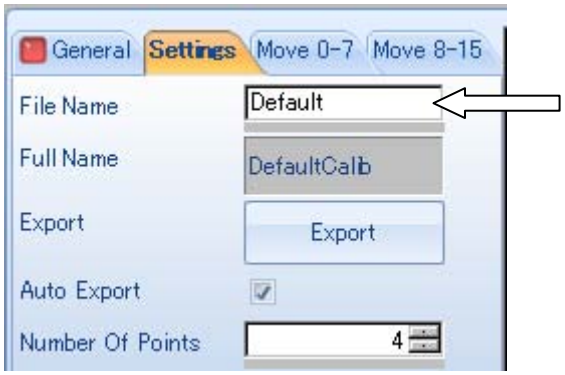
Example 2 : Number of Calibration Points = 16 points (When Camera Not Mounted on Robot)



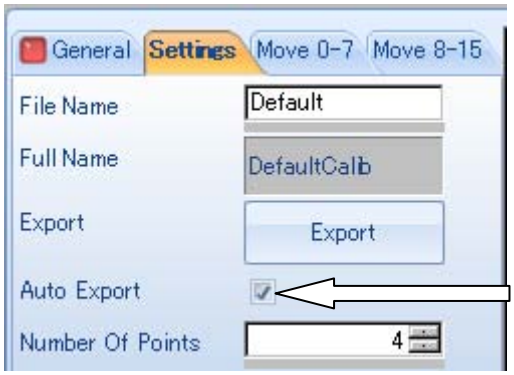
In this example, select the Move tag and set the values as shown below for Move1.X to Move15.Y in the right order.



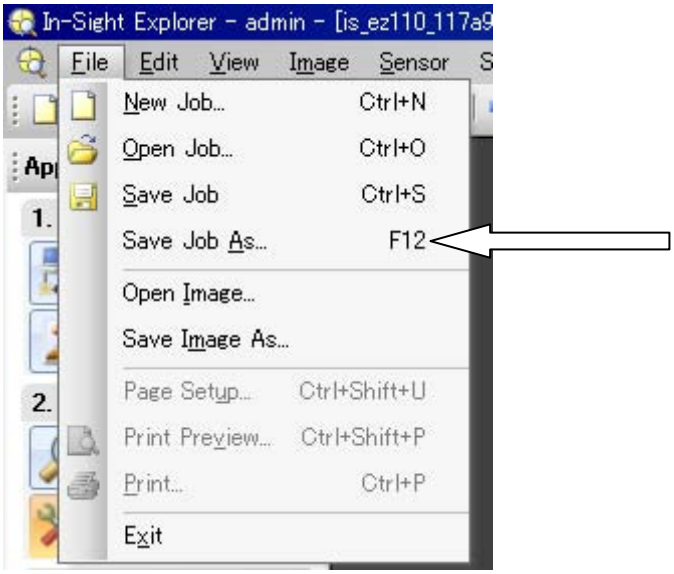
(8) Confirm that “Default” is shown in the file name on the top of the export window.
If a different name or nothing is shown, type it manually.



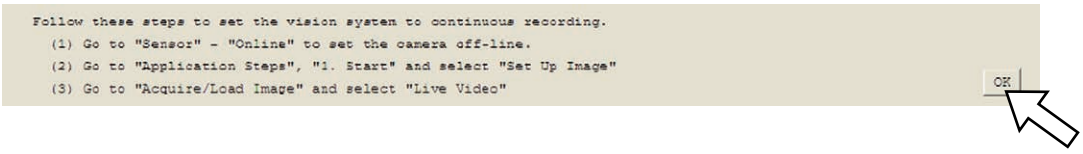
(9) Confirm a tick mark in the check box.
If not, put a tick mark in it.

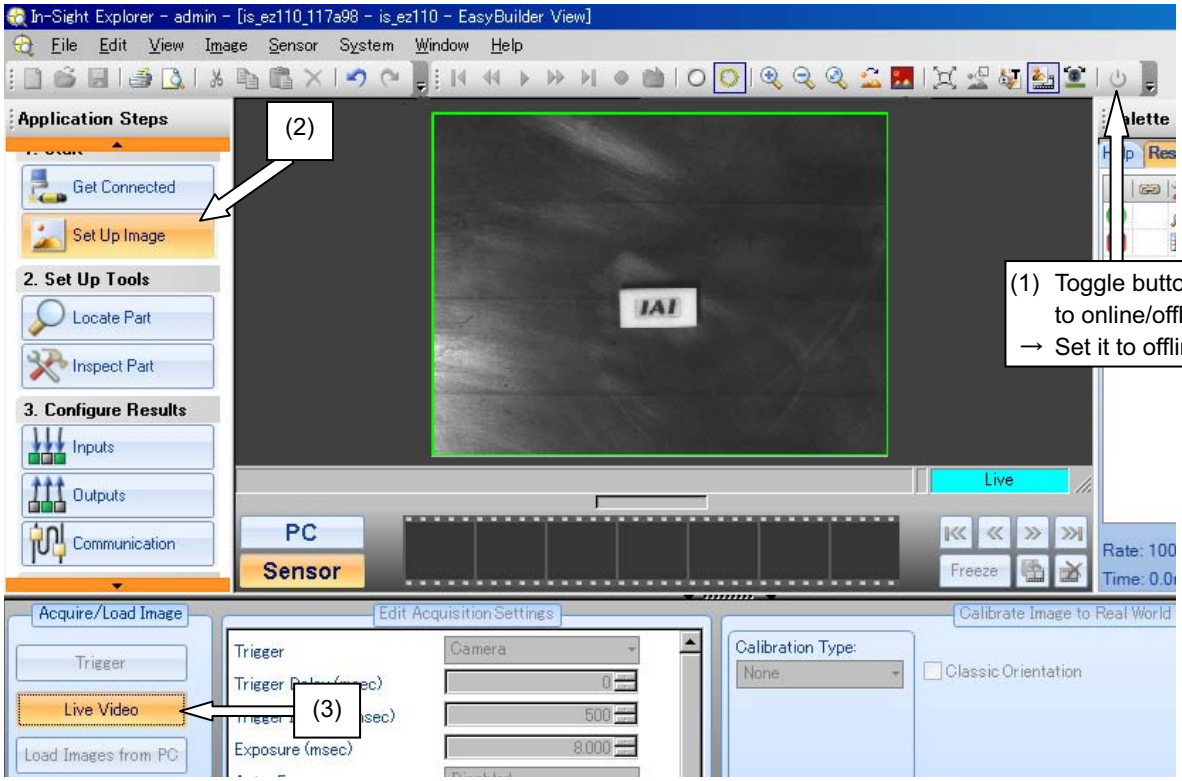


(10) Select “File” → “Save Job” or “Save Job As…” from the menu bar.
Store the created job file to the camera and PC (for backup).

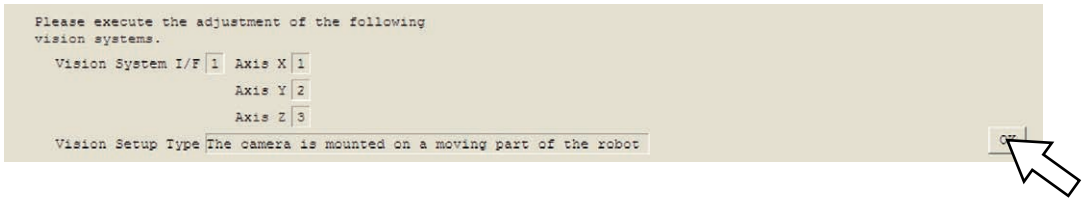


[Procedure 9] Set the vision system to the continuous capturing mode.
Select “Live Video” in Acquire/Load Image in In-Sight Explorer.
Click “OK” button.

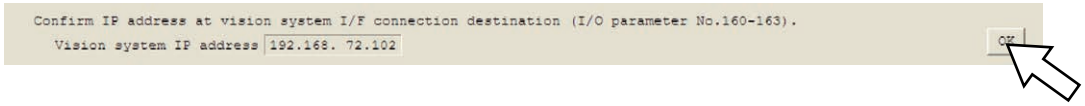




[Procedure 10] Click “OK” button.

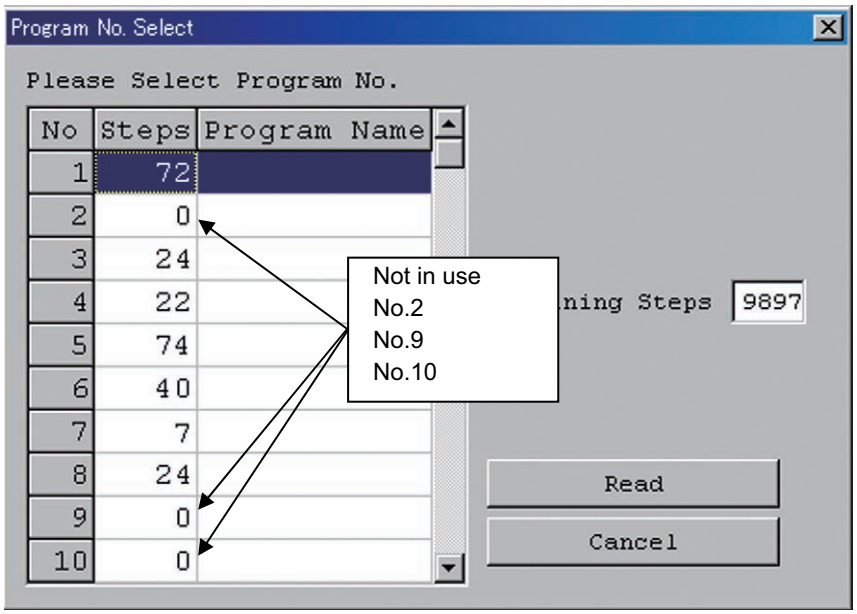


[Procedure 11] Click the “OK” button if the IP addresses of the vision system are correct.
If incorrect, set the right IP addresses to XSEL I/O Parameters No.160 to 163.

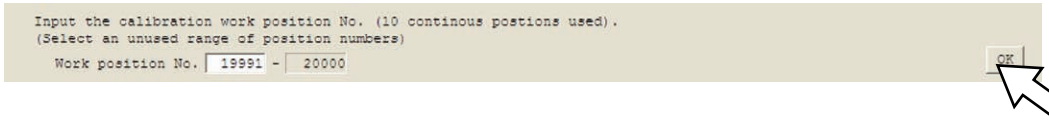


[Procedure 12] Input the program number that is not used in XSEL to the forwarding program number.
After inputting, click “OK” button.

The programs not in use can be found with the method stated below.
From the menu of XSEL PC software, select “Program” → “Edit”.
Program Number Select Window opens. In the list, the numbers with 0 in Step Number column are not in use. If all the lines are occupied, make a backup to the PC temporarily to ensure an empty program field.

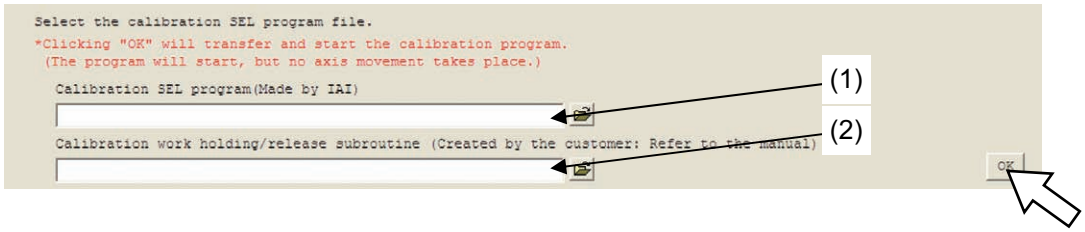


[Procedure 13] Input the position number not in use. (Select a position number that 10 positions in a row can be ensured.)
After inputting, click “OK” button.

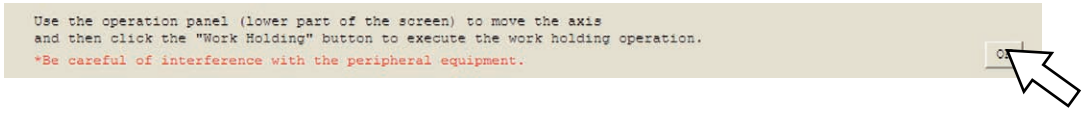


If all the lines are occupied, make a backup to the PC temporarily to ensure an empty program field.

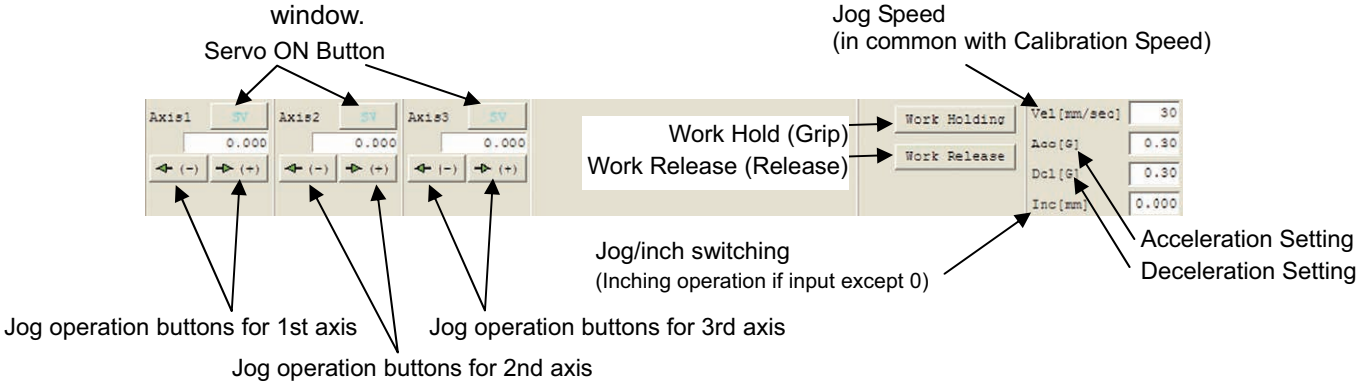
[Procedure 14] (1) Please contact IAI for a program file you need.
(2) Select the file (X-SEL-P/Q: cognex_worksub.x2pg2, X-SEL-R/S: cognex_worksub.x4pg) as the work hold/release sub-routine for the calibration (please prepare separately) from the data downloaded in (1) in Procedure 14. (It is necessary to create a program which suits to the work in advance. Refer to Section 5.8.1.)
After selecting the file, click “OK” button.



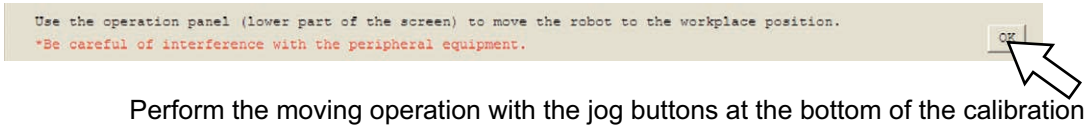
[Procedure 15] Move the robot to the position where it can hold (grip) the work.
Press the “Work Holding” button in the jog movement screen shown below to hold the work.
(Note) Watch for the interference to the peripheral equipment.



Perform the moving operation with the jog buttons at the bottom of the calibration window.

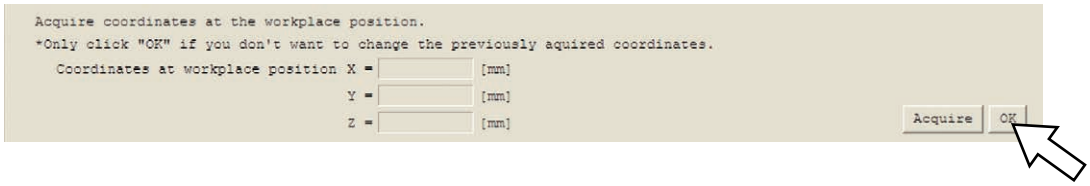


[Procedure 16] With the work held on the robot, transport it to a position near the calibration start point (point above the position 0 set in Procedure 8 (5)).
Keep the work at the height of Z-axis where it is to be released. (Keep the work with being held.)
Click “OK” button.

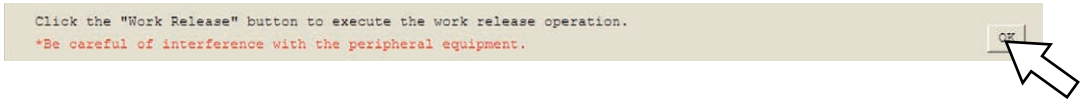


Perform the moving operation with the jog buttons at the bottom of the calibration window. [Refer to Procedure 15]
(Note) Watch for the interference to the peripheral equipment.

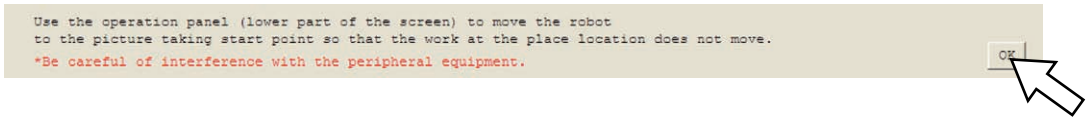
[Procedure 17] Click the “Acquire” button to read the current robot coordinates.
Confirm that the current coordinates are displayed as the work placing position coordinates and click the “OK” button.



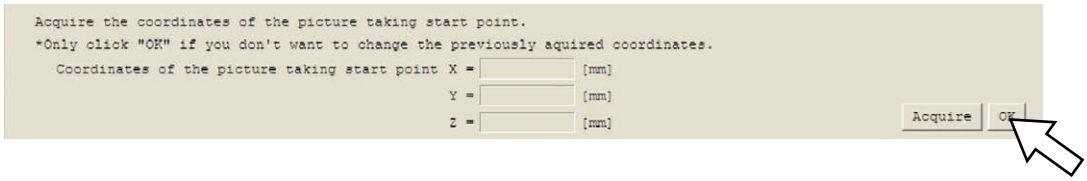
[Procedure 18] Click the “Work Release” button to release the work.
Click “OK” button.



[Procedure 19] Move the robot to a point near the calibration start point set in Procedure 8 (5) where the work can be captured.
Click “OK” button.



[Procedure 20] Click the “Acquire” button to read the current robot coordinates.
Confirm the current coordinates are displayed at the image capturing start point coordinates and click the “OK” button.

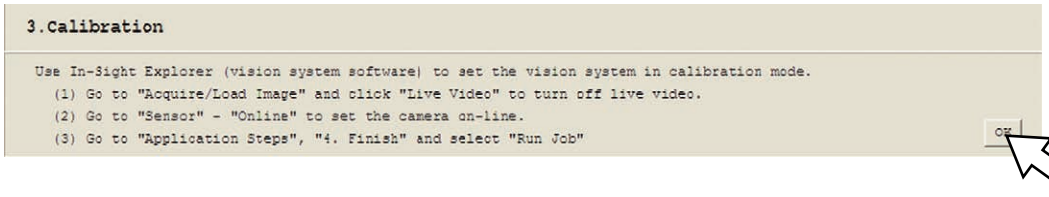


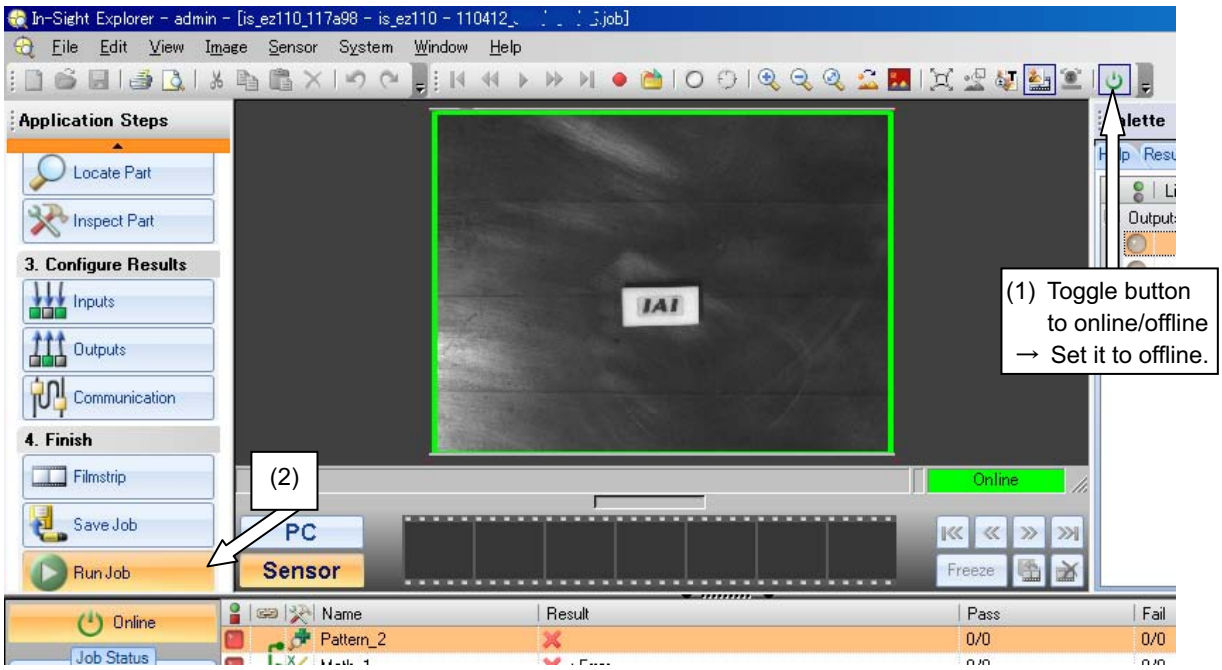
[Procedure 21] Perform the following settings to make the camera condition to wait for calibration execution.

(1) Click on Live Video at “Import/Load Image” in Application Step to release the Live Video condition.

(2) Make the camera online.

(3) Select “Finish” → “Run Job” in Application Steps.
Click “OK” button.

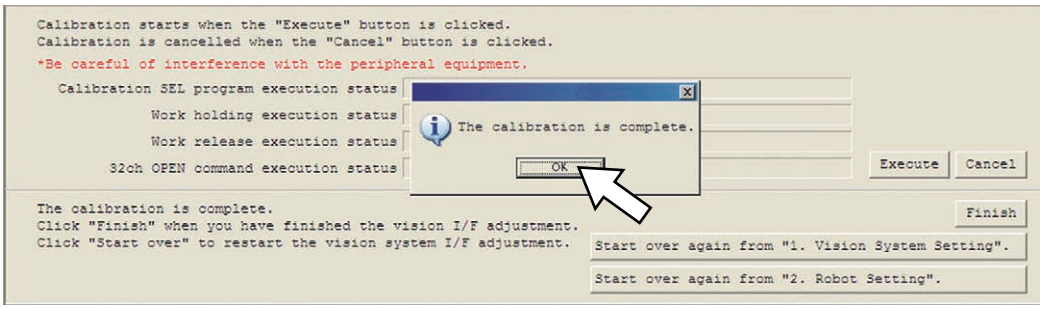




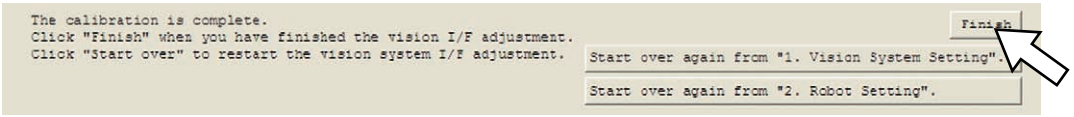
[Procedure 22] Click “Execute” button. The calibration starts.

> ⚠ Warning :The calibration work includes the robot operation. Make sure to be away from the robot operation range before executing the work.

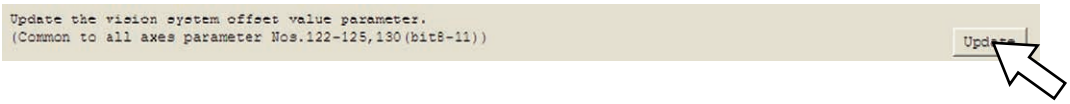
[Procedure 23] The calibration is complete in normal condition after the adjustment of specified point number is conducted.
Click “OK” to close the information window.



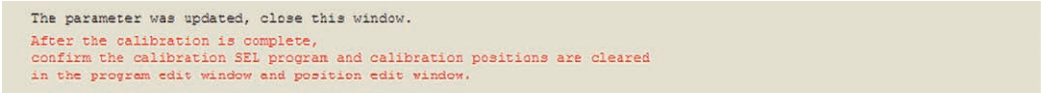
[Procedure 24] If desired to finish the calibration, click the “Finish” button.
If an error occurred, refer to Section 7.2 to solve the problem and retry the calibration.



[Procedure 25] Click the “Update” button.

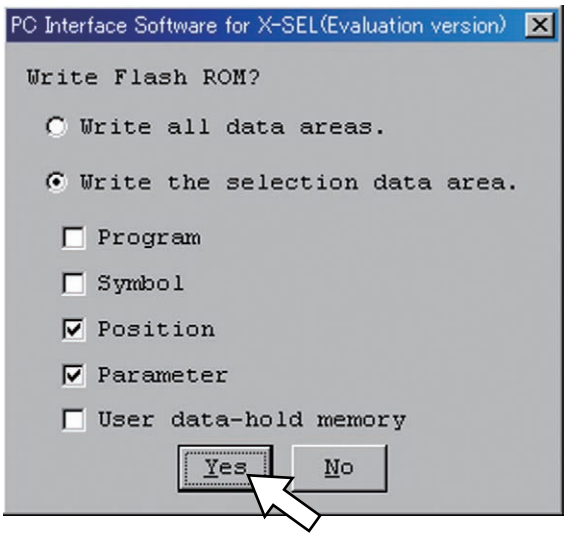


[Procedure 26] After closing this window (Vision System Settings), write to the flash ROM and reboot the system, confirm that the contents in the program numbers and the position numbers selected in [Procedure 12] and [Procedure 13] are all cleared up. If the data was stored in the PC temporarily, put them back to where they originally were.

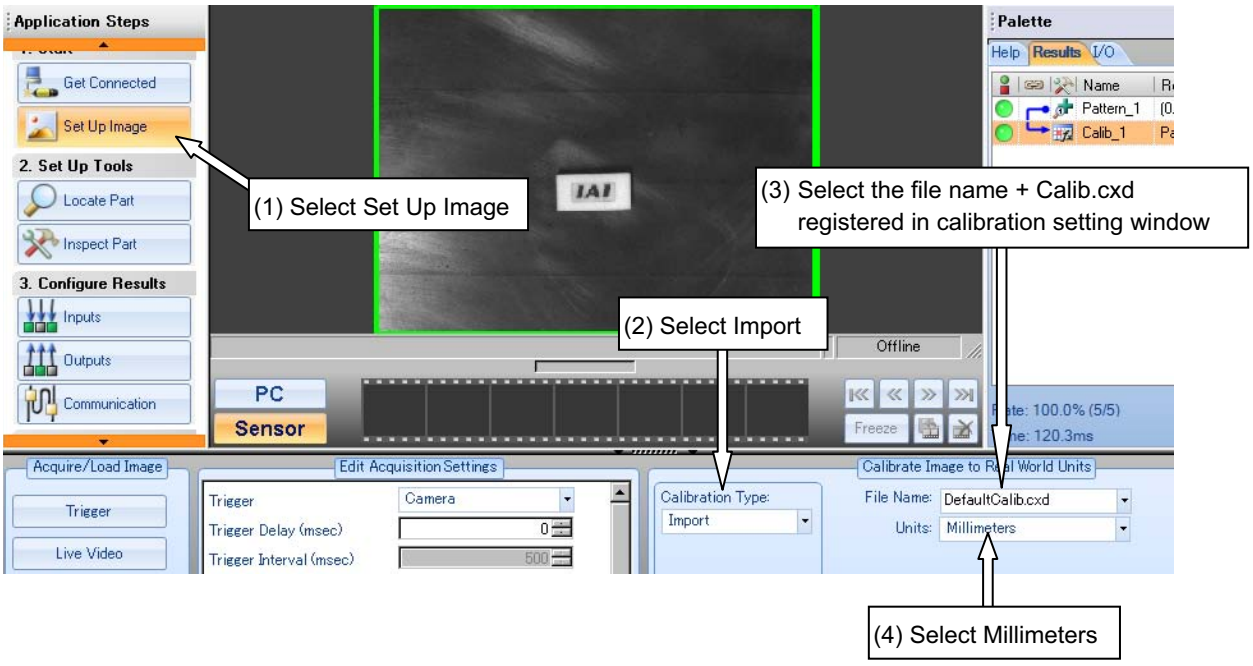


[Procedure 27] Close the window by clicking the “×” button on the top right corner of the window.

[Procedure 28] The window shown below will appear. Click the “Yes” button.
Confirmation window for the controller reboot appears next. Click the “Yes” button to reboot the controller.



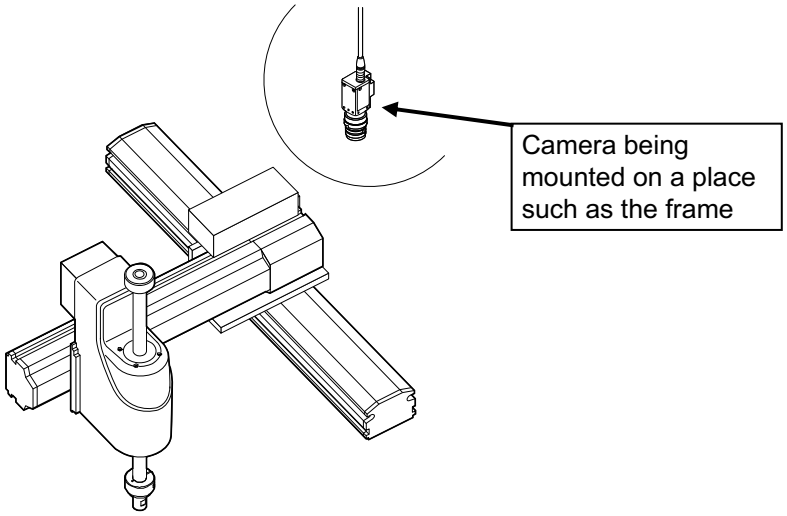
[Procedure 29] After setting the camera to offline, select the settings of In-Sight Explorer images and set Calibration Type to Import. Select “DefaultCalib.cxd”(Note) from the selectable file names.
Select “File” → “Save Job” or “Save Job As…” from the menu bar.
(Note) Select the file name that includes “Calib.cxd” in it that was set in [Procedure 8] (6).



⚠ Note :
The job file created here is for the calibration use only. It is necessary to create another job file for the ordinary operation, or otherwise ask the distributor to create one for you.

5.8.4 When Camera Not Mounted on Robot (When camera other than EZ-110XL is used)

This section explains how to setup when the camera is installed as shown in the picture below.
If the camera is to be mounted on the robot, refer to “5.8.5 When Camera Mounted on Robot”.



When Camera Not Mounted on Robot

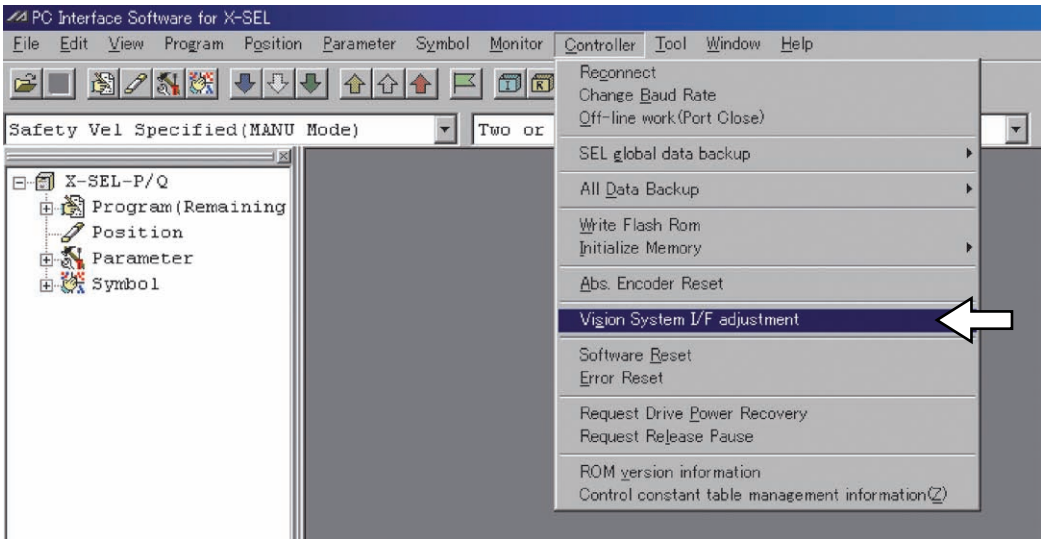
[Procedure 1] Select Vision System I/F adjustment from the PC software.
A warning dialog box opens.

⚠ Note :

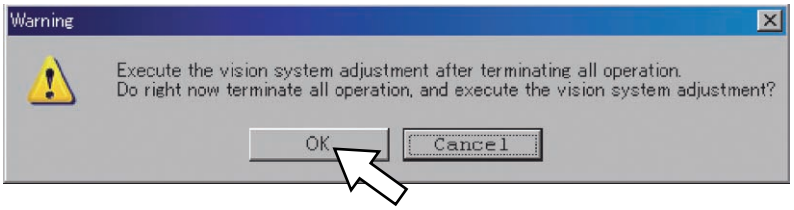
If “Vision System I/F adjustment” is not shown in the main menu, check the version of PC software or the related I/O parameter settings.

PC Software Version Capable for Vision System I/F adjustment	
XSEL-P/Q	: V7.06.08.00 or later
XSEL-R/S	: V9.0.0.0 or later
TTA	: V10.0.0.0 or later
MSEL-PC/PG	: V12.0.0.0 or later

I/O Parameter
No.351 Bit 0-3=1

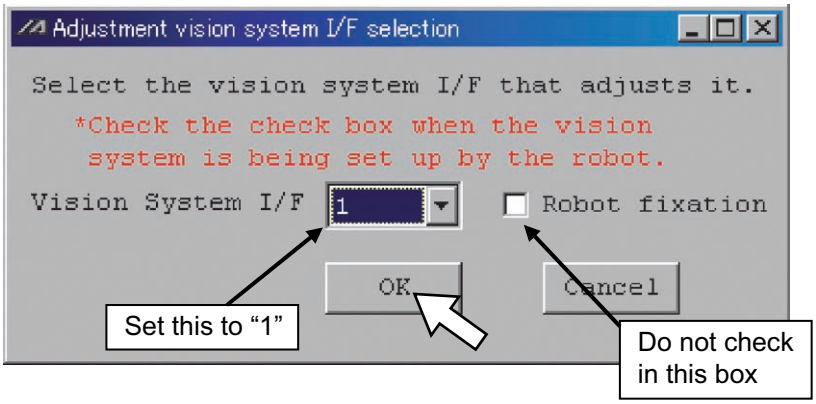


[Procedure 2] Finish all operations and click “OK” button.
Adjustment vision system I/F selection window appears.

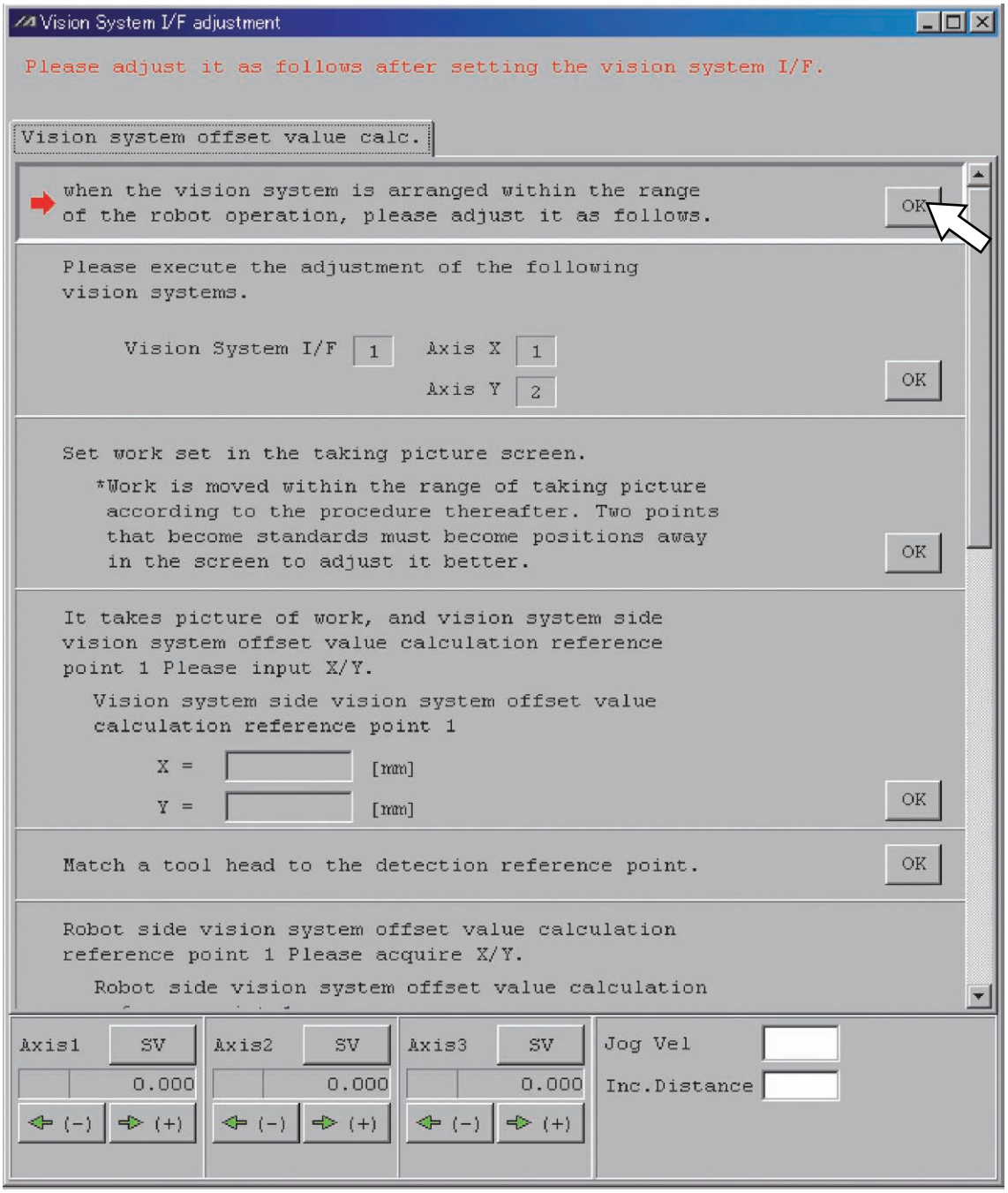


[Procedure 3] Click “OK” button.
Vision System I/F adjustment window opens. [See the next page]

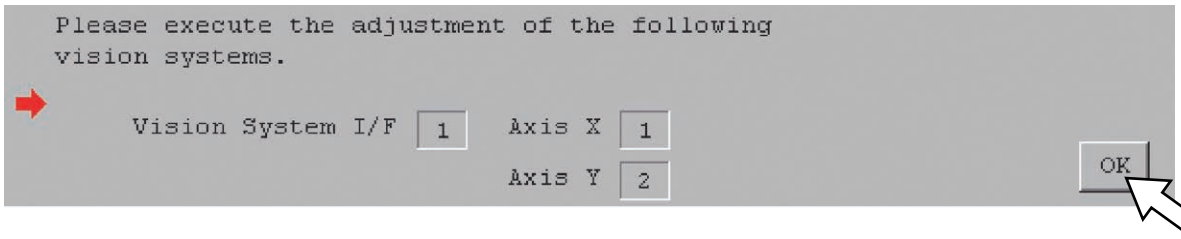
> ⚠ Note :
> If no vision system I/F number is displayed, check the parameter settings [5.7 Parameter Settings] on the controller.



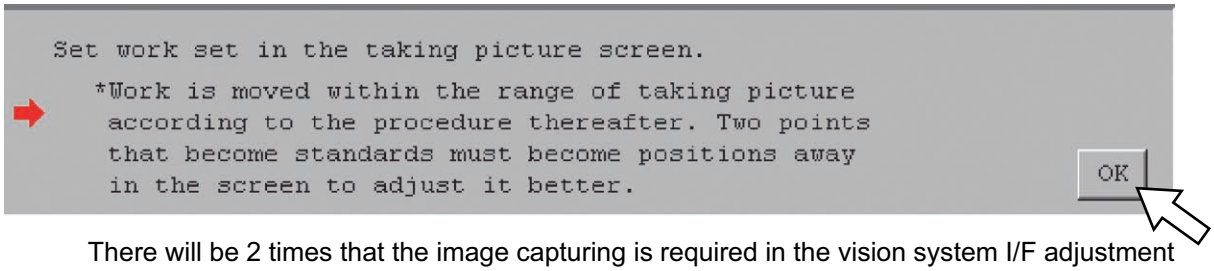
[Procedure 4] Confirm that the vision system is installed within the range of the robot operation and click “OK” button.



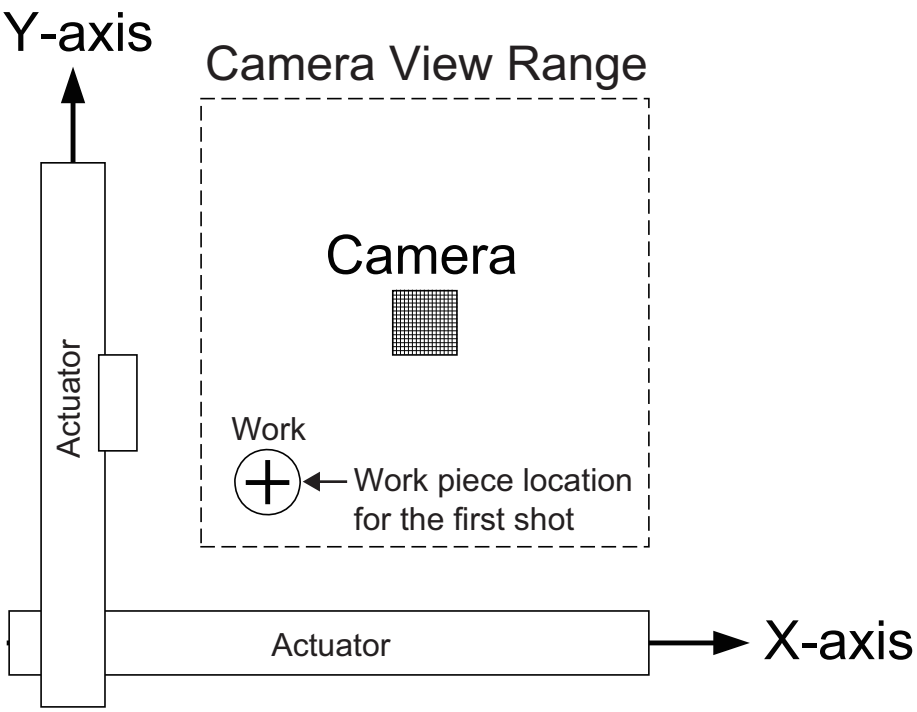
[Procedure 5] Click “OK” button.



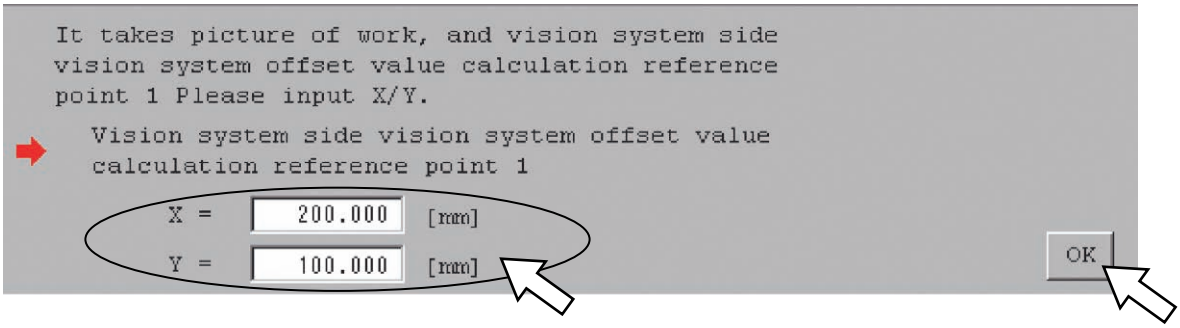
[Procedure 6] Set a work piece in the range of robot operation and also the bottom left (refer to the diagram below) of the image capture range.
After the setting is complete, click “OK” button.



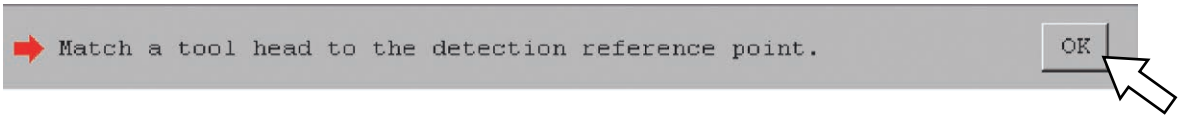
There will be 2 times that the image capturing is required in the vision system I/F adjustment procedure. Set the work piece within the image capture range considering it is placed as far as possible from the camera as shown in the following diagram.

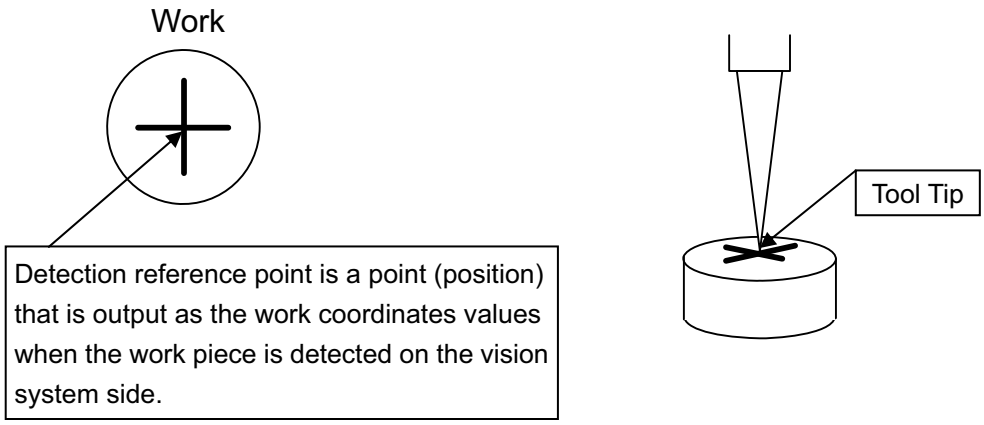


[Procedure 7] Capture an image of the work piece and input the vision system coordinates (X coordinate and Y coordinate) detected on the vision system side. After inputting, click “OK” button.



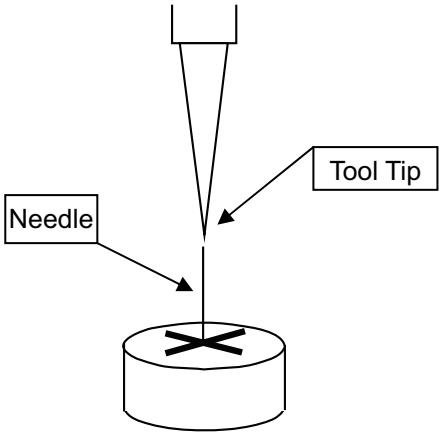
[Procedure 8] Match a tool head to the detection reference point.
Click “OK” button.



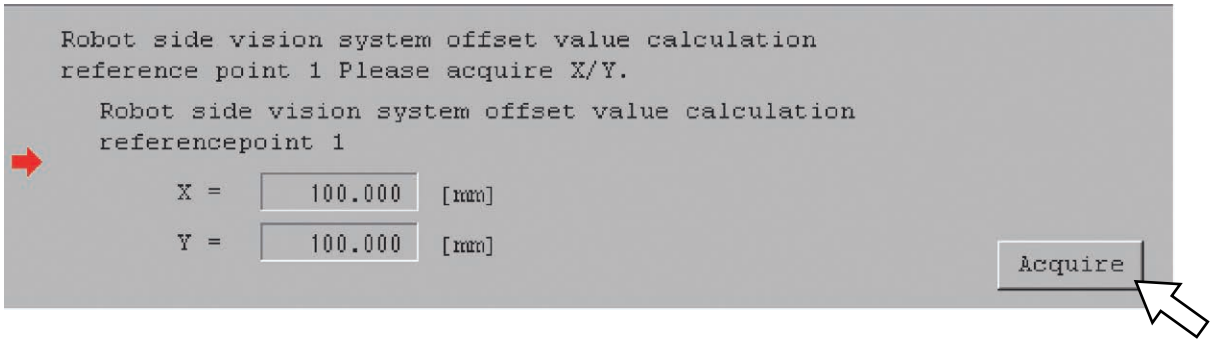


[Reference]

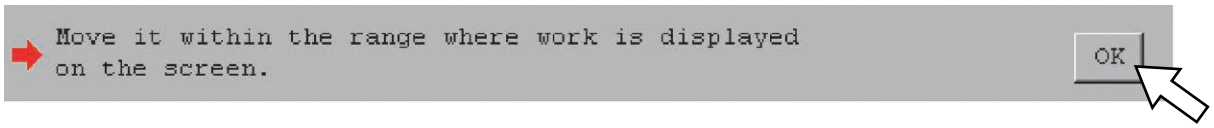
It will be able to make the variance small if putting up a needle on the detection reference point on the work piece and have a sharp tip on the tool.

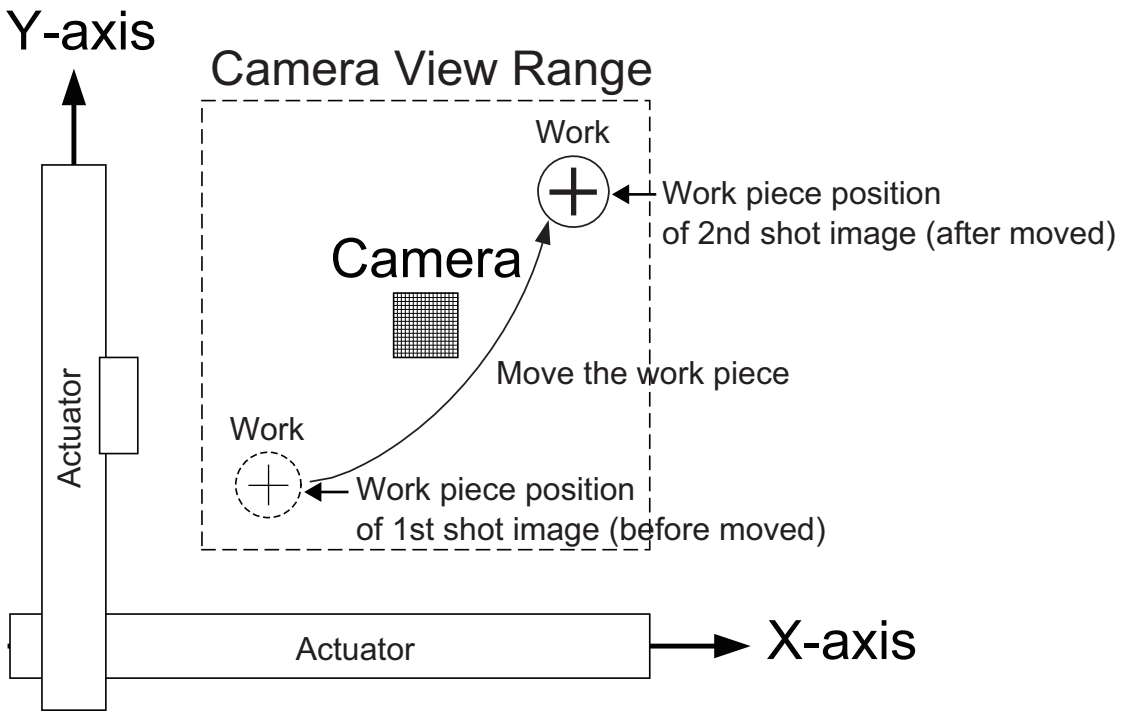


[Procedure 9] Click “Acquire” button.
The current robot coordinates (X coordinate and Y coordinate) are acquired.

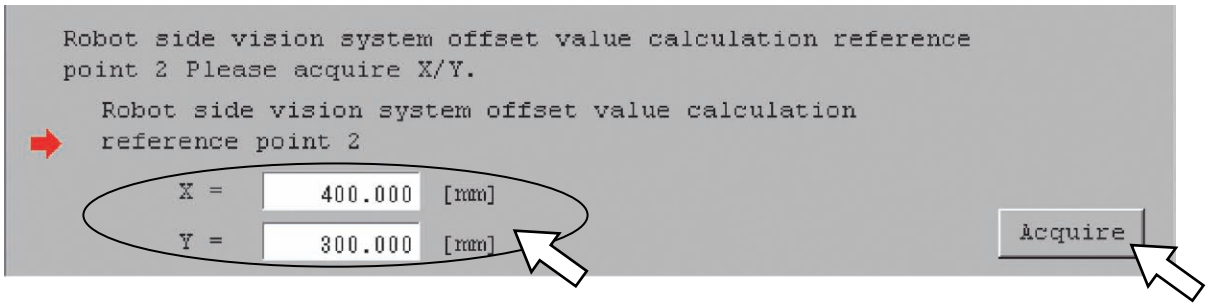


[Procedure 10] Set a work piece in the range of robot operation and also the top right (refer to the diagram below) of the image capture range, and then click “OK” button.

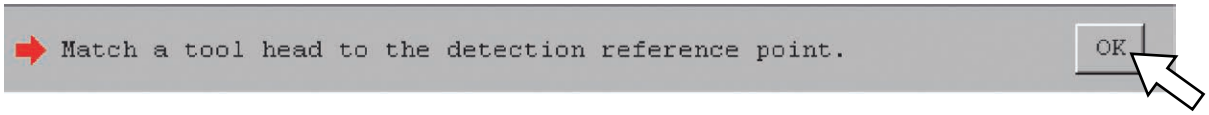




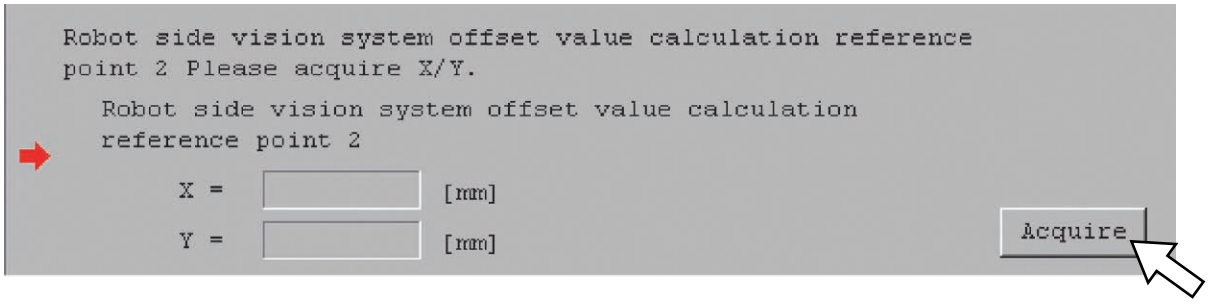
[Procedure 11] Capture an image of the work piece and input the vision system coordinates (X coordinate and Y coordinate) detected on the vision system side. After inputting, click “Acquire” button.



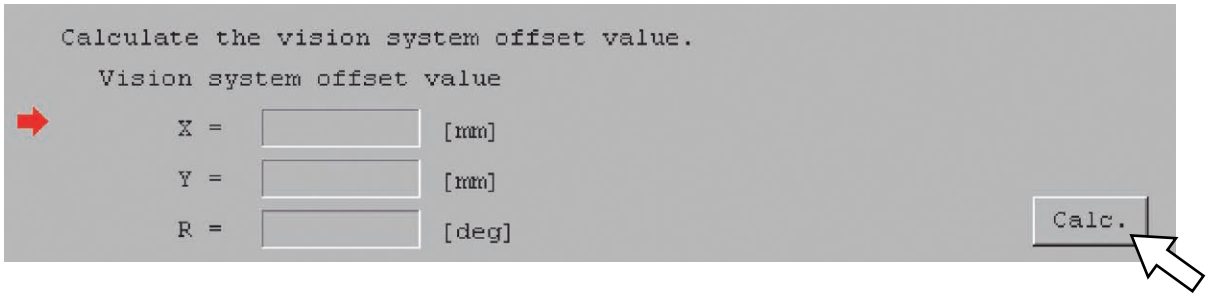
[Procedure 12] Match a tool head to the detection reference point.
Click “OK” button.



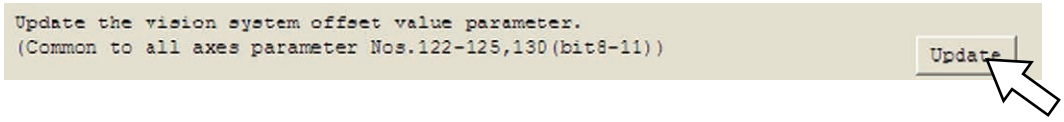
[Procedure 13] Click “Acquire” button.
The current robot coordinates (X coordinate and Y coordinate) are acquired.



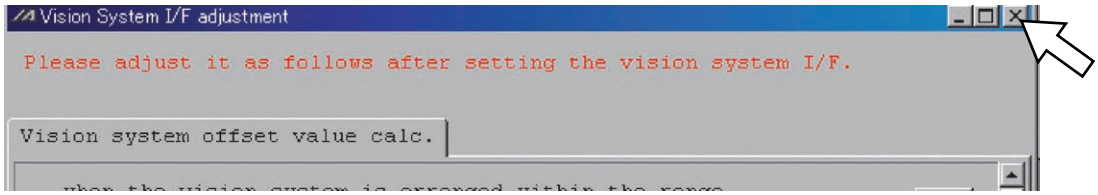
[Procedure 14] Click “Calc.” button.
The result of the vision system offset value calculation is displayed.



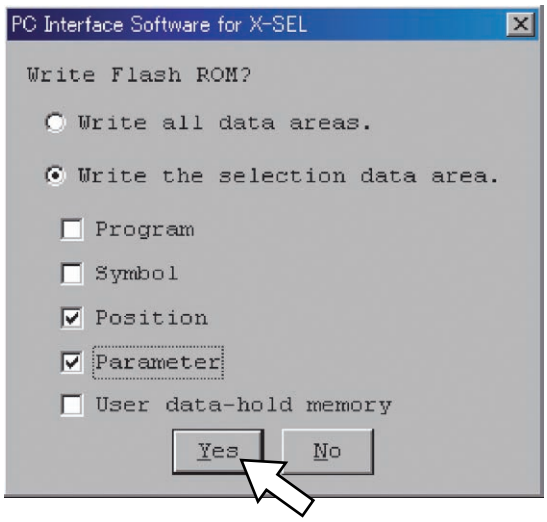
[Procedure 15] Click “Update” button.
Parameters related to the vision system I/F to be adjusted will be updated.



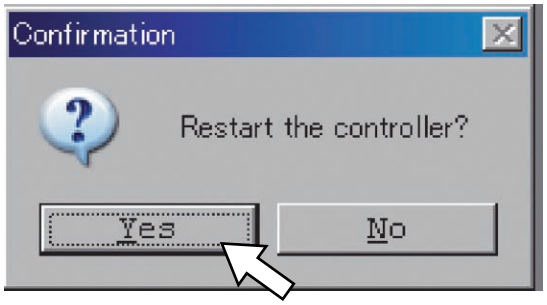
[Procedure 16] Close the window by clicking the “×” button on the top right corner of the window.



[Procedure 17] If the vision system adjustment is implemented, the following dialog box appears after Vision System I/F adjustment window is closed. Click “Yes” button.

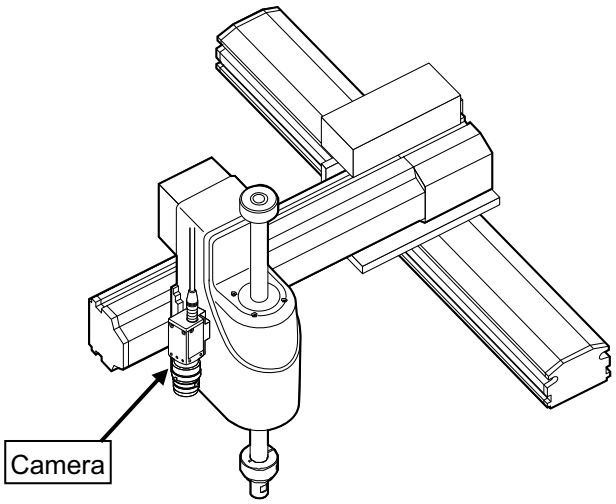


[Procedure 18] A confirmation dialog box appears after the flash ROM writing is complete. Click “Yes” button.



5.8.5 When Camera Mounted on Robot (When camera other than EZ-110XL is used)

This section explains how to setup when the camera is installed on the camera as shown in the picture below.



When Camera Mounted on Robot

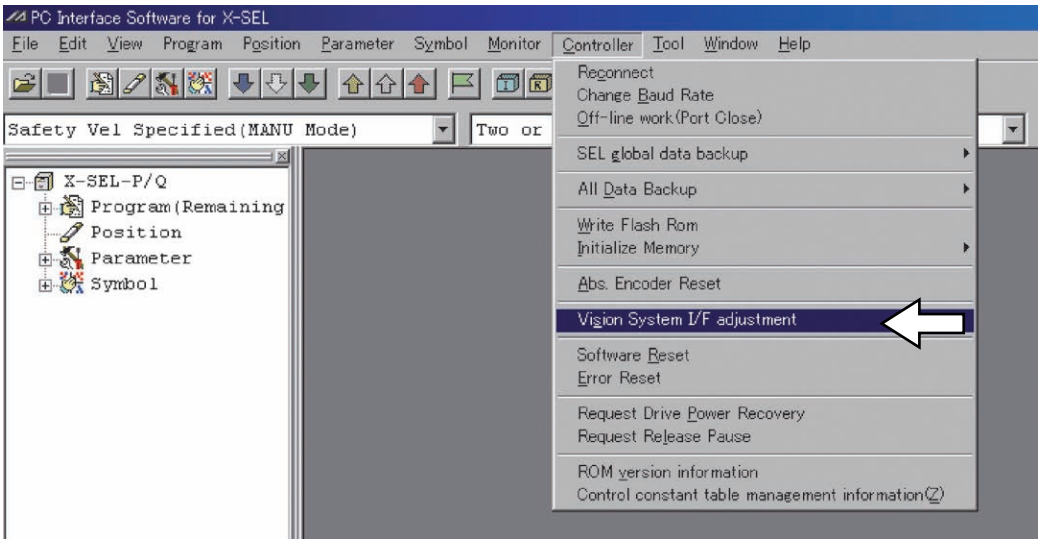
[Procedure 1] Open the Vision System I/F adjustment window from the PC software.
A warning dialog box opens.

⚠ Note :

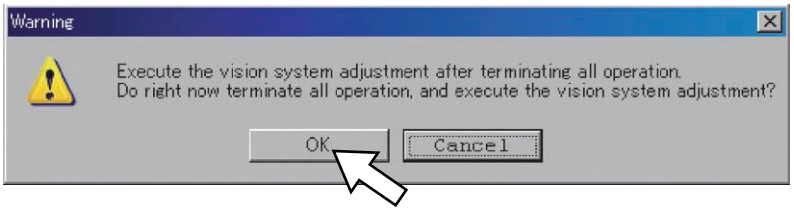
If “Vision System I/F adjustment” is not shown in the main menu, check the version of PC software or the related I/O parameter settings.

PC Software Version Capable for Vision System I/F adjustment	
XSEL-P/Q	: V7.06.08.00 or later
XSEL-R/S	: V9.0.0.0 or later
TTA	: V10.0.0.0 or later
MSEL-PC/PG	: V12.0.0.0 or later

I/O Parameter
No.351 Bit 0-3=1

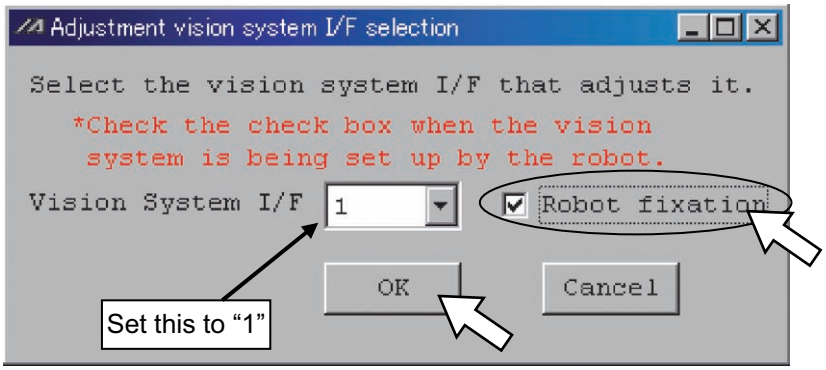


[Procedure 2] Finish all operations and click “OK” button.
Adjustment vision system I/F selection window appears.

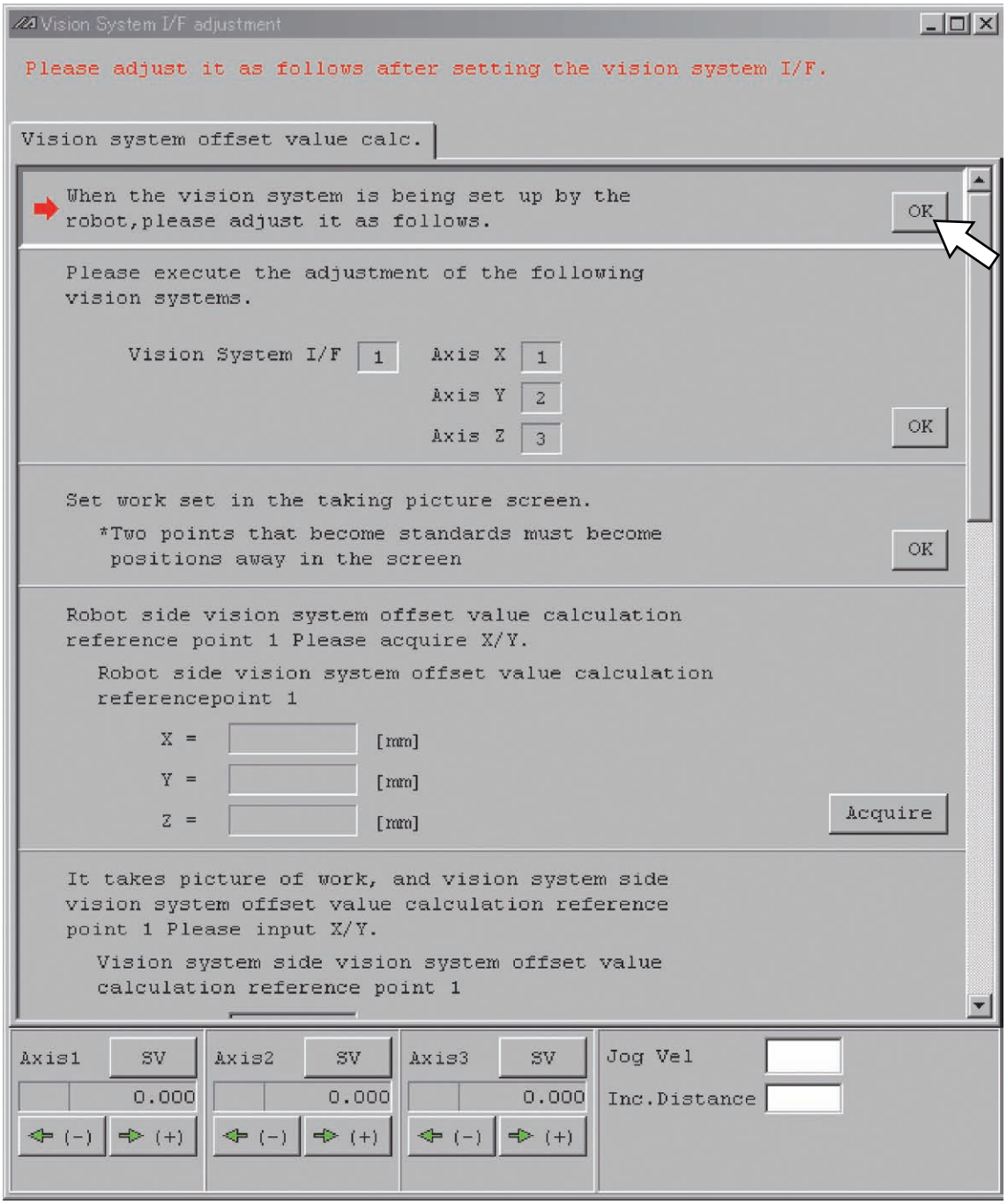


[Procedure 3] Place a tick mark on the check box beside “Robot fixation” and click “OK” button.
Vision System I/F adjustment window opens.

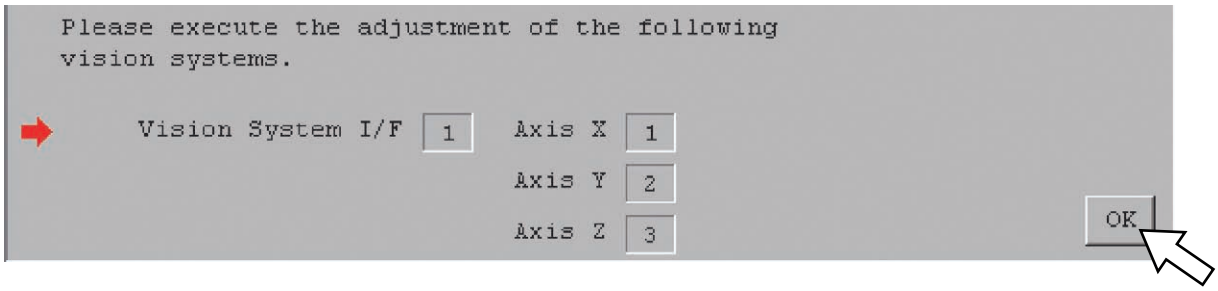
> ⚠ Note :
> If no vision system I/F number is displayed, check the parameter settings [5.7 Parameter Settings] on the controller.



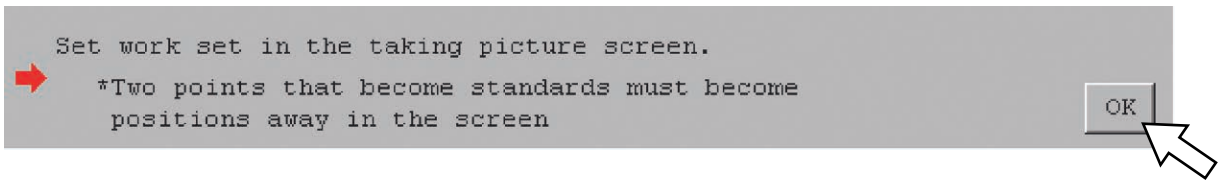
[Procedure 4]　Confirm the vision system is installed on the camera and click “OK” button.

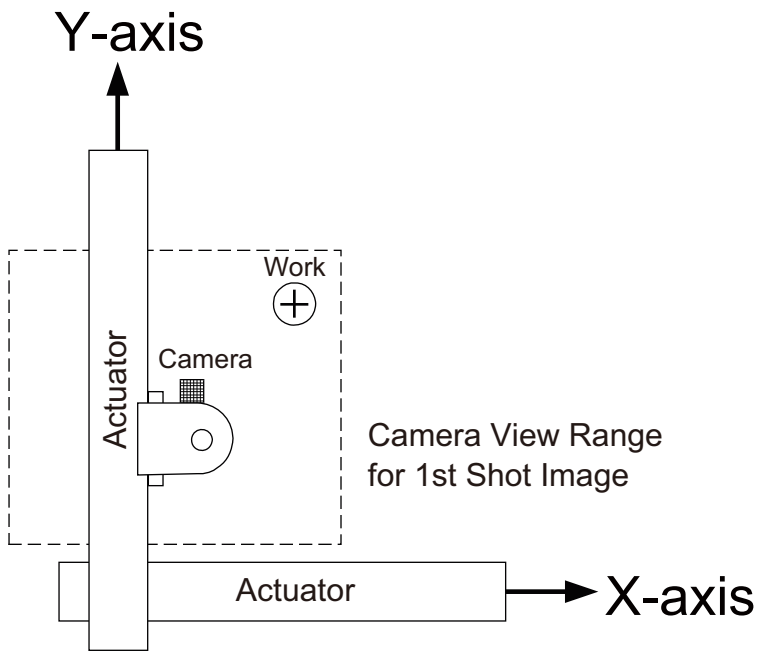


[Procedure 5] Click “OK” button.

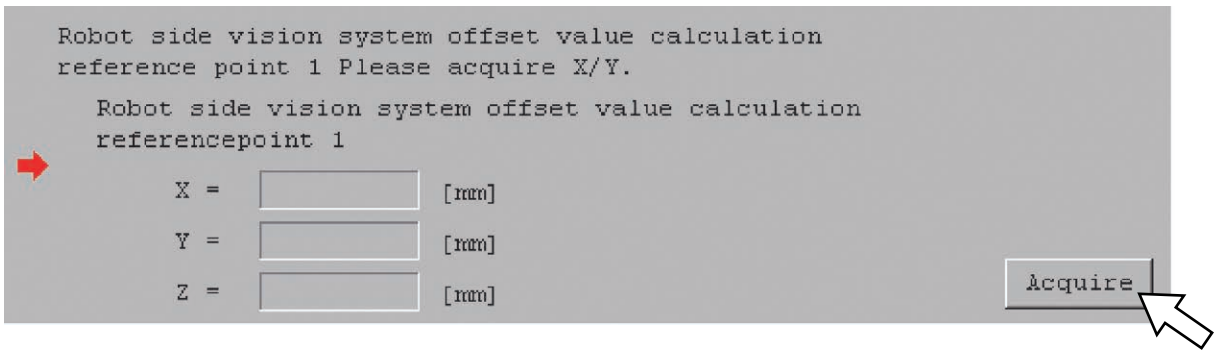


[Procedure 6] Move the robot to a position closest to the origin within the operation range. Set the work piece on the top left corner of the image capture range. Click “OK” button after the setting is complete.

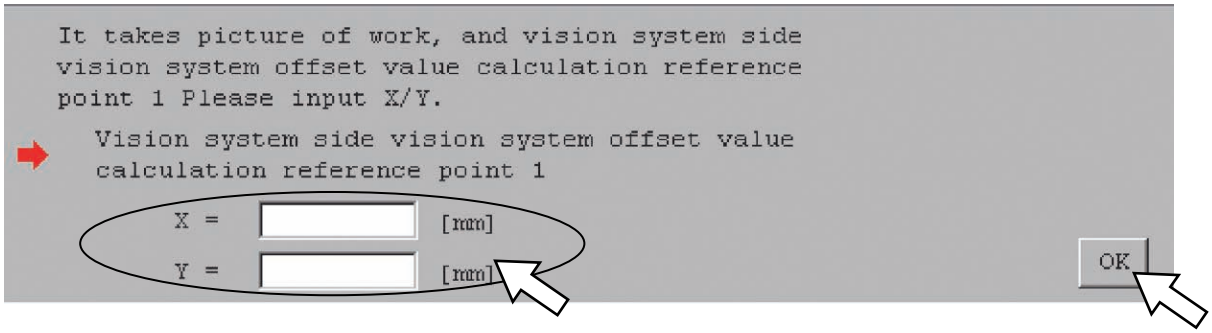




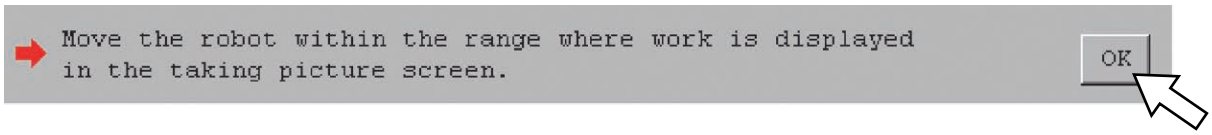
[Procedure 7] Click “Acquire” button.
The current robot coordinates (X, Y and Z coordinates) are acquired.

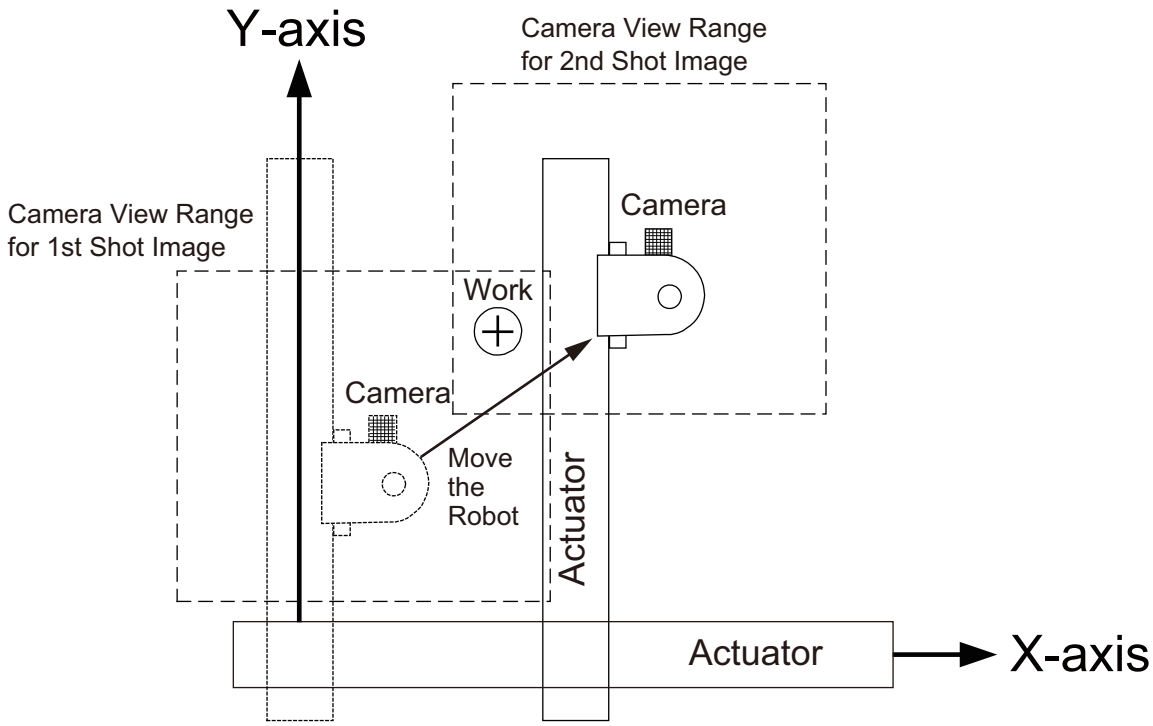


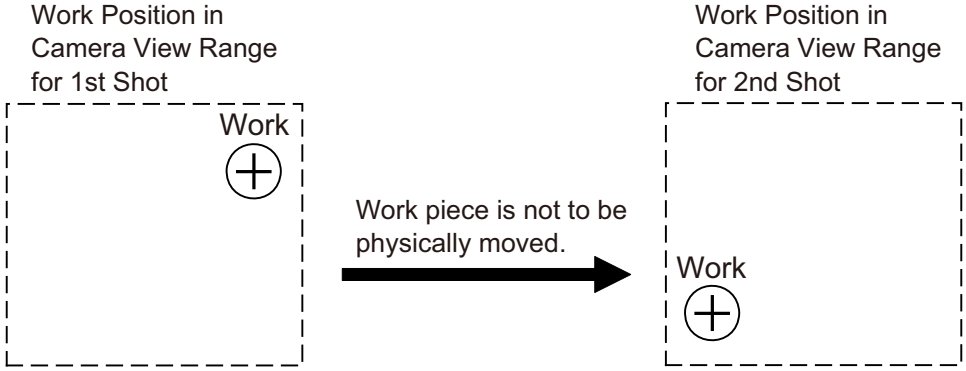
[Procedure 8] Capture an image of the work piece and input the vision system coordinates (X coordinate and Y coordinate) detected on the vision system side. After inputting, click “OK” button.



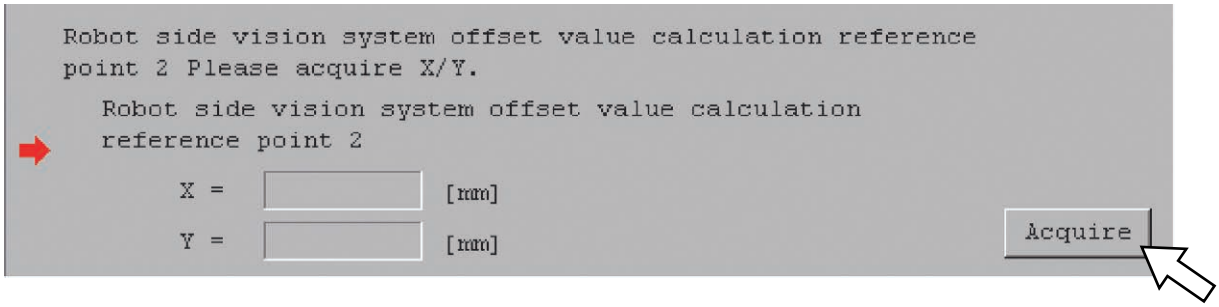
[Procedure 9] Move the robot so the work piece is placed on the bottom right corner of the image capture range.
Click “OK” button after it is moved.



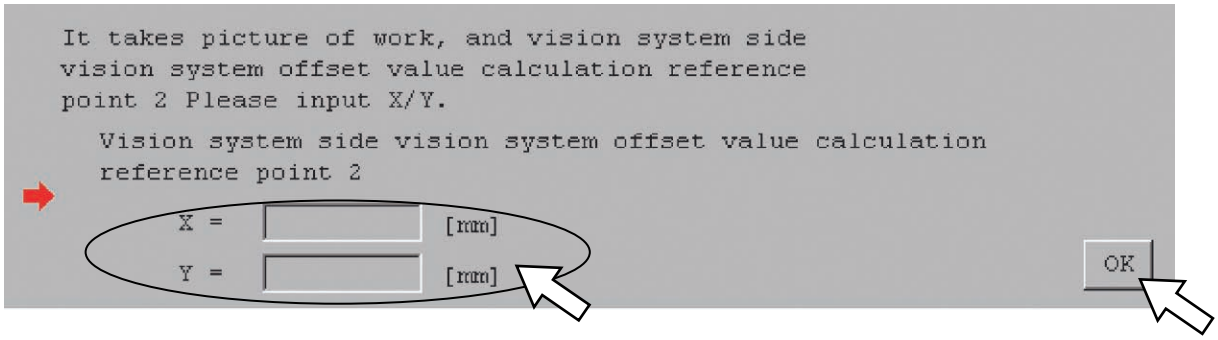




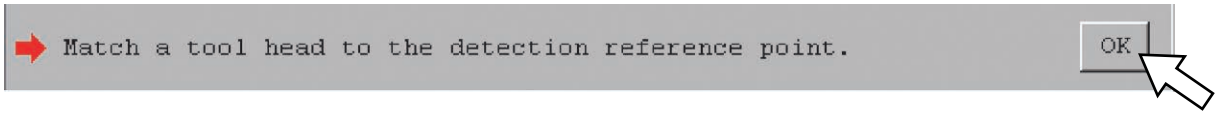
[Procedure 10] Click “Acquire” button.
The current robot coordinates (X coordinate and Y coordinate) are acquired.



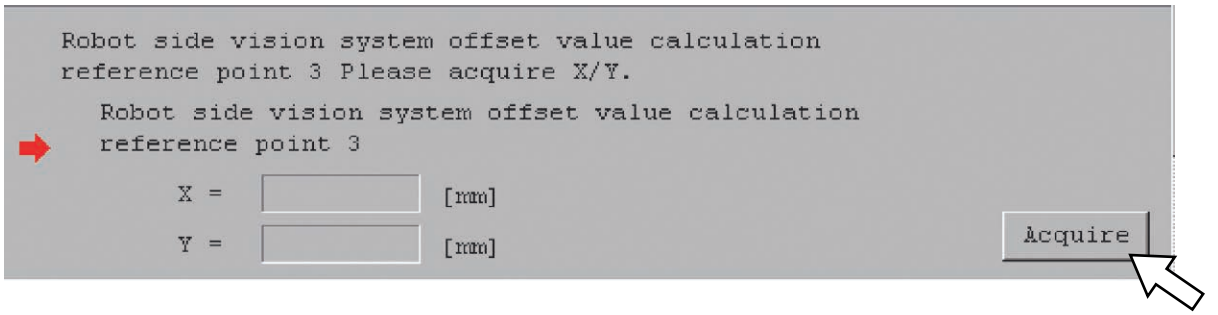
[Procedure 11] Capture an image of the work piece and input the vision system coordinates (X coordinate and Y coordinate) detected on the vision system side. After inputting, click “OK” button.



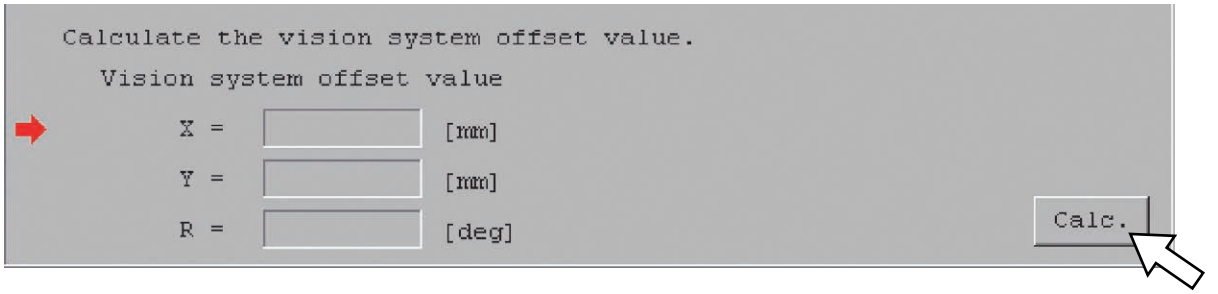
[Procedure 12] Match a tool head to the detection reference point. [Refer to [Procedure 8] in Section 5.8.4] Click “OK” button.



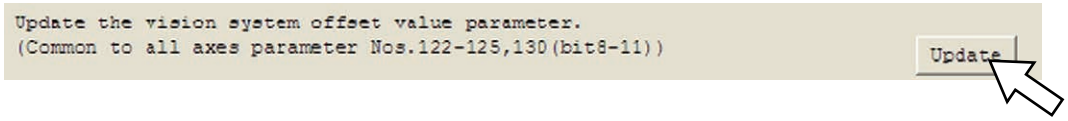
[Procedure 13] Click “Acquire” button.
The current robot coordinates (X coordinate and Y coordinate) are acquired.



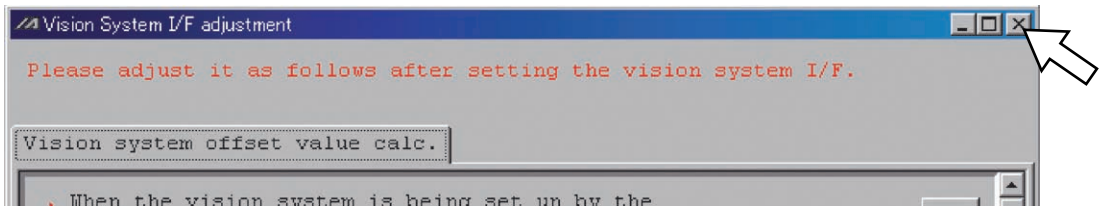
[Procedure 14] Click “Calc.” button.
The result of the vision system offset value calculation is displayed.



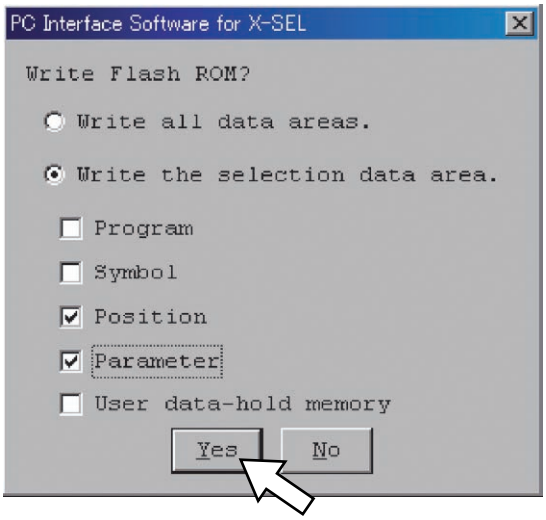
[Procedure 15] Click “Update” button.
Parameters related to the vision system I/F to be adjusted will be updated.



[Procedure 16] Close the window by clicking the “×” button on the top right corner of the window.



[Procedure 17] If the vision system adjustment is implemented, the following dialog box appears after Vision System I/F adjustment window is closed. Click “Yes” button.

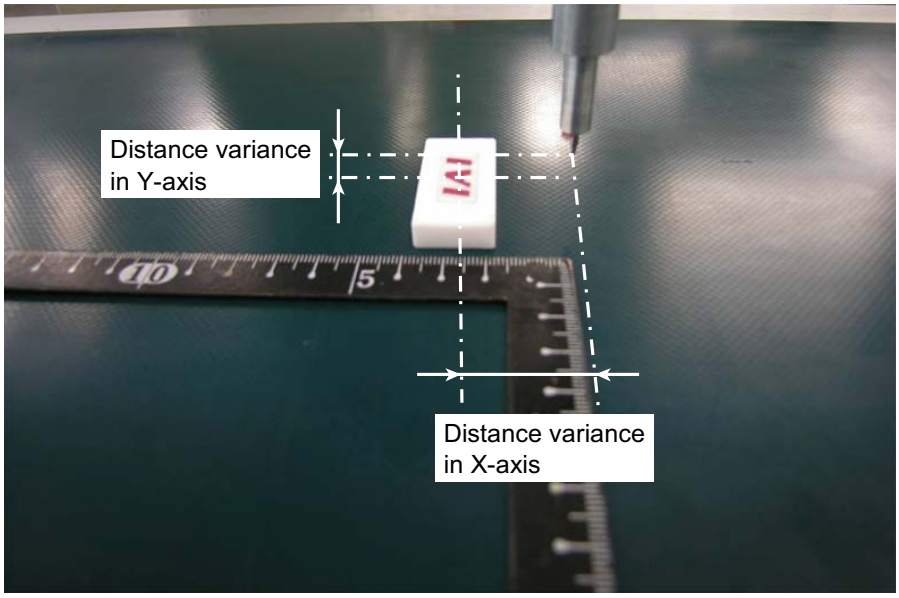


[Procedure 18] A confirmation dialog box appears after the flash ROM writing is complete. Click “Yes” button.

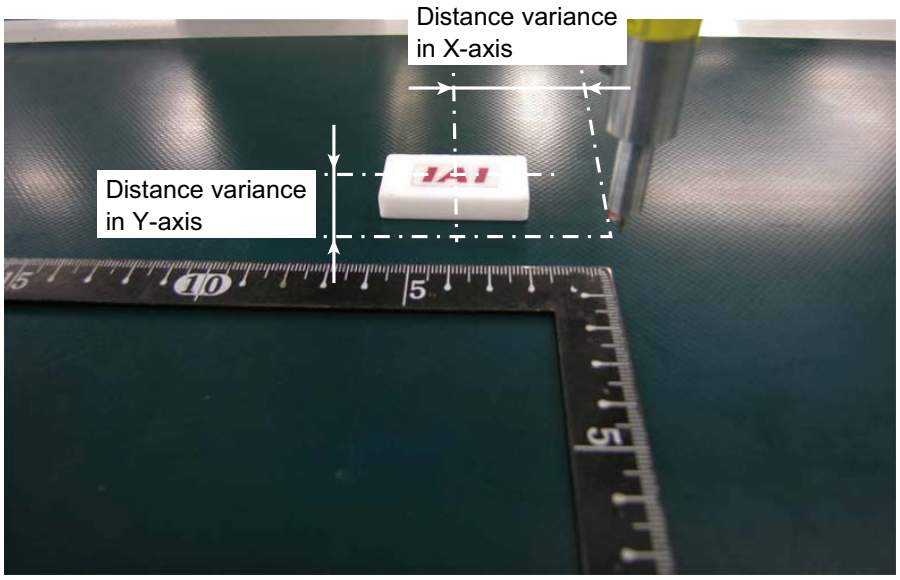
5.9 Variance Adjustment

Perform the following procedure if the robot is OFF the position in large amount after the movement to the point above the work piece, and then reboot the system.

1) Set the work piece and perform an operation.
2) Stop the operation once the robot reaches the point above the work piece (Input ABPG Command after the command to move above the work piece to stop the program), and measure the distance variance in X-axis and Y-axis directions from the datum point on the work piece to the robot (and write the values down).

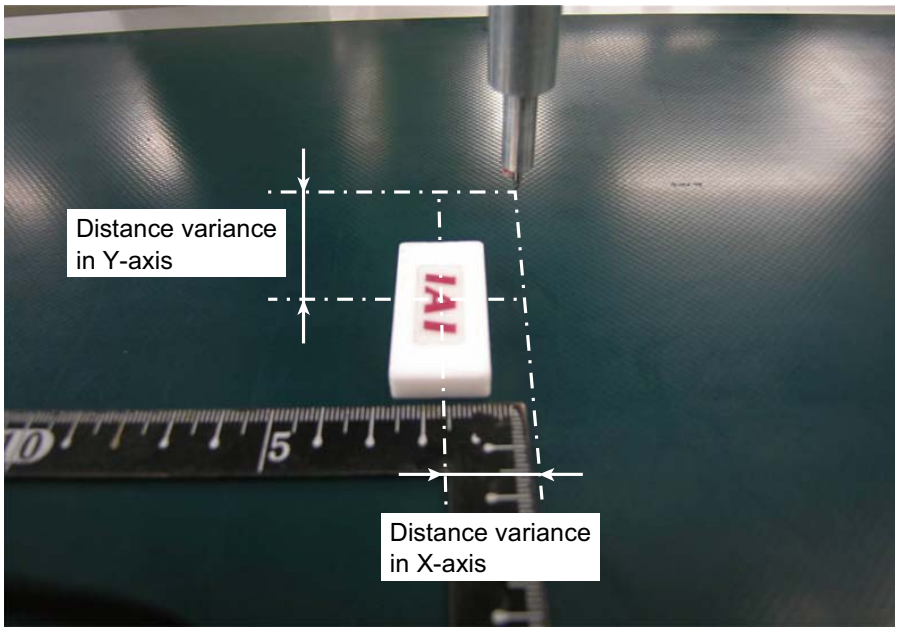


3) Rotate the work piece in 90° from the posture in Step 1) and execute an operation.
4) Stop the operation once the robot reaches the point above the work piece and measure the distance variance in X-axis and Y-axis directions from the datum point on the work piece to the robot (and write the values down).



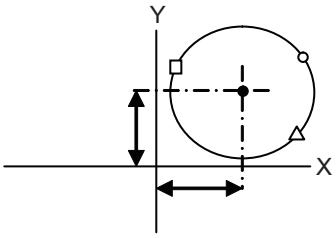
5) Rotate the work piece in 180° from the posture in Step 1) and execute an operation.

6) Stop the operation once the robot reaches the point above the work piece and measure the distance variance in X-axis and Y-axis directions from the datum point on the work piece to the robot (and write the values down).



7) Draw a circle that goes through the points of the values noted in Steps 1) to 6) an find the center of the circle.
It will be very easy if using CAD.

8) Figure out the difference [mm] from the origin to the center of the circle in X-axis direction and Y-axis direction of the robot coordinates.



○, △ and □ are the points of variance obtained in Steps 1) to 3).

9) Put the value figured in Step 8) multiplied by 1000 in the parameter.
X-axes : All-Axes Parameters No.126
Y-axes : All-Axes Parameters No.127

10) Rotation axis adjustment is to be conducted by putting values to the following parameters.
Rotation axis : All-Axes Parameters No.128

6. Program Construction for Operation

6.1 SEL Command

Vision System I/F Function supports 2 types of the dedicated SEL commands listed below.

SEL Command	Description
SLVS	Selects Vision System I/F to be used
GTVD	Acquires the captured image data (Stores the work data to the variables and positions)

* [XSEL-P/Q]
Applicable PC soft version: V7.06.08.00 or later (Except for Cognex In-Sight EZ110)
Applicable PC soft version: V7.07.08.00 or later (For EZ-110XL)
[XSEL-R/S]
Applicable PC soft version: V9.0.0.0 or later
[TTA]
Applicable PC soft version: V10.0.0.0 or later
[MSEL]
Applicable PC soft version: V12.0.0.0 or later

6.1.1 SLVS (Select Vision System I/F) Command

●SLVS (Select Vision System)

Expansion Condition (LD,A,O,AB,OB)	Input Condition (I/O • Flag)	Command and Declaration			Output section (Output • Flag)
		Command and Declaration	Operation 1	Operation 2	
Free	Free	SLVS	Select Vision System I/F	(Timeout time)	CC

[Function] Select whether using Vision System I/F in this command (GTVD Command).

Operation 1 : Select Vision System I/F

0 : To use Vision System I/F

1 : Not to use Vision System I/F

Operation 2 : Operation 1=Invalid when set to “0”.····· Prohibited

Operation 1=Except for “0”····· Timeout time (sec) when GTVD Command is executed
The setting range for the timeout time is from 0.01 to 99.00 sec.
When no indication (Operation 2 = blank) is defined, the timeout setting is not established and is set to no limitation.

- Return Code in SLVS Command (Variable 99 (Local Space))
  The result in SLVS execution is stored in Variable 99 as a return code.
  * No return code will be obtained (no change will occur to Variable 99) when Operation 1=0.
  * The return codes not listed below are in common with OPEN Command (for Ethernet connection). Refer to “OPEN Command” in EtherNet Instruction Manual provided separately.

  0 : Completed in normal condition

  1 : Timeout
  (Related Parameters: I/O Parameter No.127, Network Attribute 8, Bits 0 to 7)

  2 : Timer cancelled (condition that the waiting status is cancelled by TIMC Command)

  6 : Task Complete (Program complete request, etc.) (Unable to identify from SEL Command)

  23: Vision System Initializing Incomplete Error

⚠ Note :

- SLVS and GTVD Commands can be executed only on the same program (task).
- Executing SLVS Command with Operation 1 = 1 is indicated opens the communication channel that is specified in I/O Parameter No.351, Bits 4 to 7.
  And also, executing SLVS Command with Operation 1 = 0 is indicated closes the communication channel that is specified in I/O Parameter No.351, Bits 4 to 7.
- When the Vision System I/F is used with Ethernet, message communication attribute is fixed to client.

[Example 1]

```
SLVS    1       Select Vision System I/F Usage
 ▪              (GTVD Command Timeout Value = None)
 ▪
SLVS    0       Cancel Vision System I/F Selection
```

[Example 2]

```
SLVS    1   60  Select Vision System I/F Usage
 ▪              (GTVD Command Timeout Value = 60sec is indicated)
 ▪
SLVS    0       Cancel Vision System I/F Selection
```

6.1.2 GTVD (Vision System I/F Image-Capture Data Acquirement) Command

●GTVD (Get Vision Data)

Expansion Condition (LD,A,O,AB,OB)	Input Condition (I/O • Flag)	Command and Declaration			Output section (Output • Flag)
		Command and Declaration	Operation 1	Operation 2	
E	N. Cnd	Cmnd	Operand 1	Operand 2	Pst
Free	Free	GTVD	Capturing Trigger Classification	Variable No.	CC

[Function] This outputs the image-capture command to the Vision System I/F selected by SLVS Command and stores the received image data to the variables and indicated data. With one time of execution of this command, one image data can be obtained.

Operation 1 : Capturing Trigger Classification

1 : Immediate Image-Capture Command Output

2 : Image-Capture Command Input when Image-Capture Trigger Port (Input Port and Flag) is on
(When conducting capturing image command with the detection sensor input, etc.)

Operation 2 : Variable No.(Note 1)

Assuming the variable number set in Operation 2 is “n”, set the following contents to the continuous 8 variables after “n”.

Variable No.n : Top data number for image data work coordinates storage (Note 3)

Variable No.n+1 : Variable number for image data work attribute storage

[Note] Make sure the continuous 12 variables after the top variable number are not in use. (Note 2)

Variable No.n+2 : Variable number for image data work quantity storage

Variable No.n+3 : Image-capture trigger input port number / global flags number (Valid only when Operation 1 = 2 is input)

Variable No.n+4 : Data type for image data work quantity storage
0 : Position data
1 : Work coordinate system offset data (Note 4)

Variable No.n+5 : Reserved (to be fixed to 0)

Variable No.n+6 : Reserved (to be fixed to 0)

Variable No.n+7 : Reserved (to be fixed to 0)

(Note 1) Select from the range of integral variables in the local or global field.
Local field : 1 to 91, 1001 to 1092
Global field : 200 to 292, 1200 to 1292

(Note 2) Select from the range of integral variables in the local or global field.
Local field : 1 to 87, 1001 to 1088
Global field : 200 to 288, 1200 to 1288

(Note 3) The variable set to this data number should be as shown below in response to the indication of Variable No. n+4.

Variable No.n+4 = 0 : Top position No.
1st to 12nd…Center of Work Piece Gravity Posiiton 1 to 12
1 : Top work coordinate system No.
No. 1 to 12 …1 to 12 sets of center of work piece gravity offset

(Note) In either case, confirm 12 sets of data from the top data number are kept unused in a row.

(Note 4) Supported only by TTA or MSEL-PC/PG Application V2.00 and later

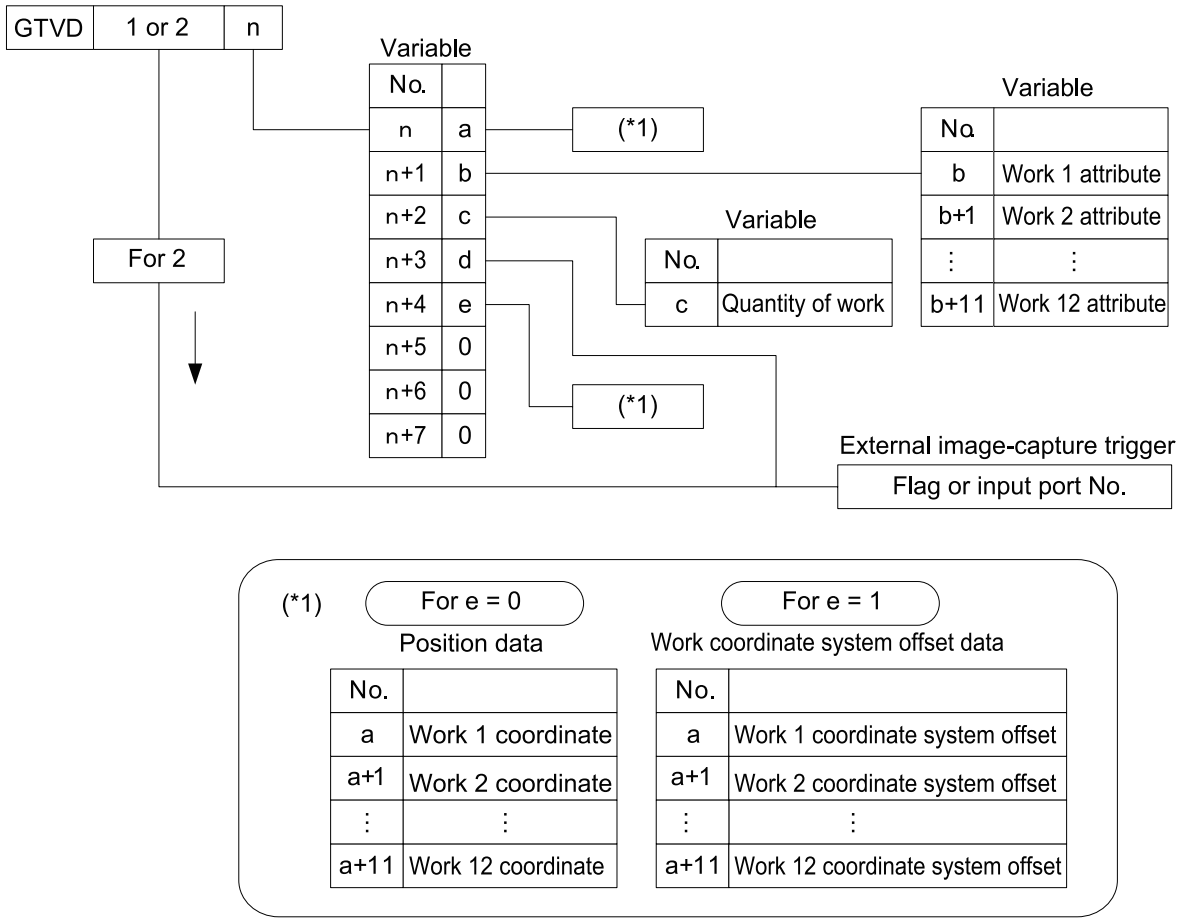
●Return Code in GTVD Command (Variable 99 (Local Space))

The result in GTVD execution is stored in Variable 99 as a return code.

0 : Completed in normal condition
1 : Work Information Acquirement WAIT Timeout
2 : GTVD Timer cancelled (condition that the waiting status is cancelled by TIMC Command)
3 : Vision System Unset Detection (SLVS Command not executed, etc.))
4 : Work Detection Cancel Status Detection (errors, etc.)

⚠ Note :

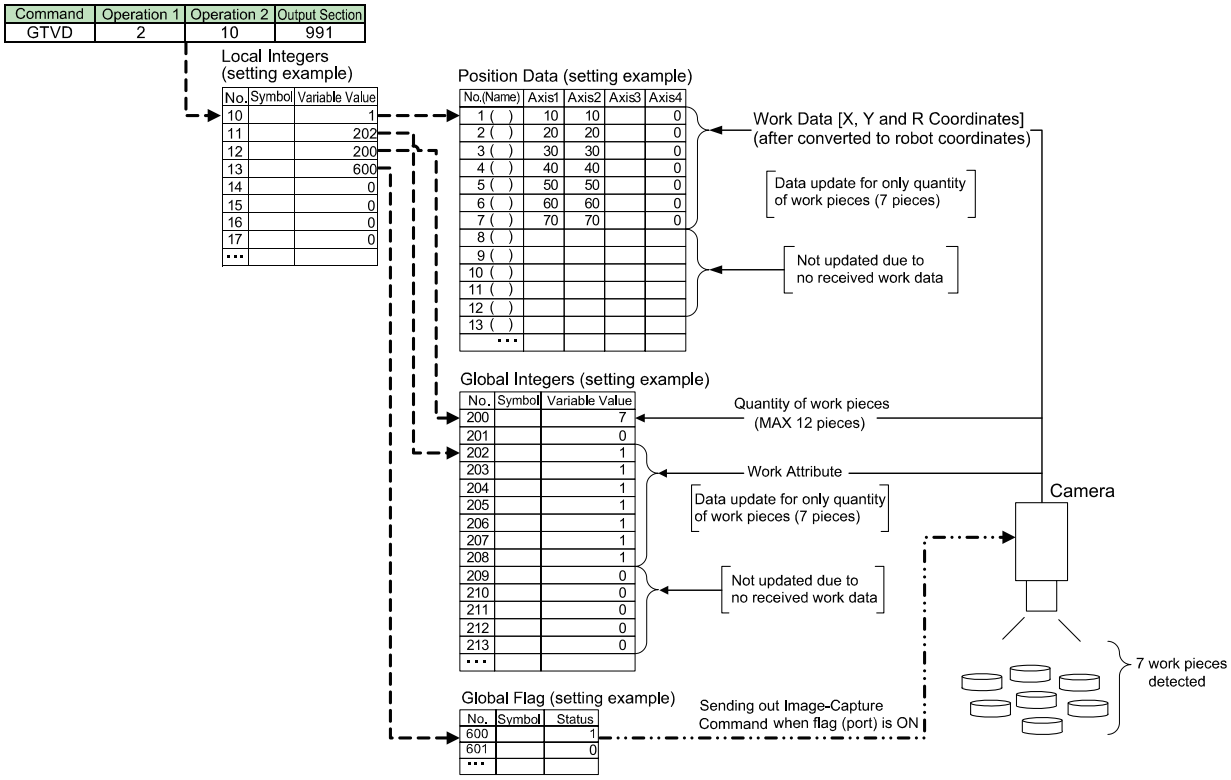
- SLVS and GTVD Commands can be executed only on the same program (task)
- Receivable communication formats can be switched in I/O Parameter No.352, Bits 0 to 7.
- The system is capable to obtain the work data (coordinates and attributes) of 12 work pieces in 1 shot of image capturing.
  Error No.417 is issued when 13 or more work pieces are detected in 1 shot, and “4: Work Detection Cancel Status Detection (error, etc.)” is set to the return code.
  For the specified vision systems, the maximum value may differ. [Refer to the cautions for use at the beginning of this manual.]
- Error No.416 (Received Message Error) is issued when there is an error in the received message during SLVS Command execution.
  Check the communication format selection parameter (I/O Parameter No.352 or Bits 0 to 7) settings and the output communication format on Vision System side.
- There will be no change in the variables for work attribute storage and the position data when the quantity of detected work piece in the received image data is 0. Check the value of the integer variable for the image-capturing data work number storage, and have a treatment.
- It is prohibited to capture an image during the movement of the robot if the camera is mounted on the robot.
  Make sure to capture an image in the stop condition.
  An accurate work data cannot be acquired if a capturing is conducted during the robot movement.
- Positions of the coordinate system definition unit axes when the data classification for capturing data storage is indicated as the position data. The data will be converted to the position on the work coordinate system that has been selected while this command is executed.
- When the data classification for capturing data storage is indicated as the work coordinate system offset data, “Error No. B73 Coordinate System Data Change Forbidden during Servo in Use Error” will occur if the applicable axis is in operation when this command is executed.
- When the data classification for capturing data storage is indicated as the work coordinate system offset data, the result will be set in the offset data of the coordinate system definition unit X, Y and R-axes related to the vision system X, Y and R-axes in “All Axes Parameter No. 121 Vision System I/F 1 Coordinate Axes Definition”.


GTVD
1 or 2
n
For 2
Variable
No.
n a
n+1 b
n+2 c
n+3 d
n+4 e
n+5 0
n+6 0
n+7 0
(*1)
(*1)
Variable
No.
c Quantity of work
Variable
No.
b Work 1 attribute
b+1 Work 2 attribute
b+11 Work 12 attribute
External image-capture trigger
Flag or input port No.
(*1)
For e = 0
Position data
No.
a Work 1 coordinate
a+1 Work 2 coordinate
a+11 Work 12 coordinate
For e = 1
Work coordinate system offset data
No.
a Work 1 coordinate system offset
a+1 Work 2 coordinate system offset
a+11 Work 12 coordinate system offset

6.2 Outline for SEL Program Construction (Basic Frame)

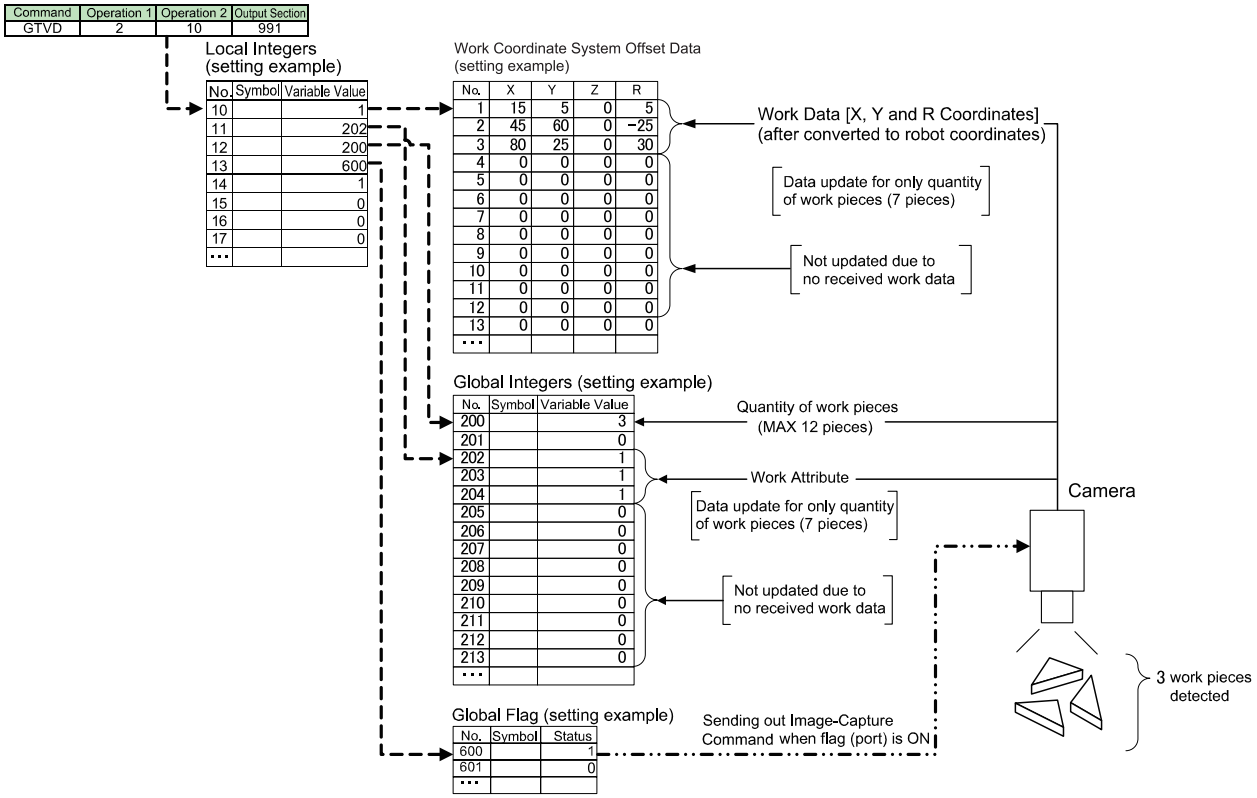
[Example 1]

		• • •				
		SLVS	1	60	990	Indicate Vision System I/F (Indicate GTVD Command Timeout Value = 60sec)
N	990	GOTO	91			To “Treatment for SLVS Command Error”
		TAG	90			
		• • •				
		LET	10	1		Indicate Work Data Storage Position No.1 to Variable 10 (Ensure the continuous 12 position numbers in order are available)
		LET	11	202		Indicate Work Attribute Storage Top Variable No.202 to Variable 11 (Ensure the continuous 12 variable numbers in order are available)
		LET	12	200		Indicate Work Piece Quantity Storage Variable No.200 to Variable 12
		LET	13	600		Indicate Image-Capture Trigger Port No.600 to Variable 13
		LET	14	0		Indicate Storage Data Classification = Work Coordinate System Offset Data (0) in Variable 14
		GTVD	2	10	991	Waiting for Image-Capture Trigger Port (Flag 600) to turn ON
N	991	GOTO	92			To “Treatment for GTVD Command Error”
		• • •				
		(Treatment in accordance with received work piece quantity)				
		MOVL	1			Move to point above work 1
		• • •				
		GOTO	90			Complete with no problem, back to GTVD Command
		• • •				
		TAG	91			“Treatment for SLVS Command Error”
		• • •				
		(Treatment in accordance with return code (Variable 99))				
		• • •				
		TAG	92			“Treatment for GTVD Command Error”
		• • •				
		(Treatment in accordance with return code (Variable 99))				
		• • •				


Command
Operation 1
Operation 2
Output Section
GTVD
2
10
991
Local Integers
(setting example)
No.
Symbol
Variable Value
Position Data (setting example)
No.(Name)
Axis1
Axis2
Axis3
Axis4
Work Data [X, Y and R Coordinates]
(after converted to robot coordinates)
Data update for only quantity
of work pieces (7 pieces)
Not updated due to
no received work data
Global Integers (setting example)
Quantity of work pieces
(MAX 12 pieces)
Work Attribute
Data update for only quantity
of work pieces (7 pieces)
Not updated due to
no received work data
Camera
7 work pieces
detected
Global Flag (setting example)
Status
Sending out Image-Capture
Command when flag (port) is ON

[Example 2]

```
                • • •
                SLVS    1    60    990   Indicate Vision System I/F
                                         (Indicate GTVD Command Timeout Value =
                                         60sec)
N   990         GOTO    91              To “Treatment for SLVS Command Error”
                TAG     90
                • • •
                LET     10   1          Indicate Work Data Storage Position No.1
                                         to Variable 10
                                         (Ensure the continuous 12 position
                                         numbers in order are available)
                LET     11   202        Indicate Work Attribute Storage Top
                                         Variable No.202 to Variable 11
                                         (Ensure the continuous 12 variable
                                         numbers in order are available)
                LET     12   200        Indicate Work Piece Quantity Storage
                                         Variable No.200 to Variable 12
                LET     13   600        Indicate Image-Capture Trigger Port
                                         No.600 to Variable 13
                LET     14   0          Indicate Storage Data Classification = Work
                                         Coordinate System Offset Data (1) in
                                         Variable 14
                GTVD    2    10   991   Waiting for Image-Capture Trigger Port
                                         (Flag 600) to turn ON
N   991         GOTO    92              To “Treatment for GTVD Command Error”
                • • •
                (Treatment in accordance with received work piece quantity)
                SLWK    1               Select the Coordinate System of difined by
                                        Work1 Offset
                • • •
                GOTO    90              Complete with no problem, back to GTVD
                                        Command
                • • •
                TAG     91              “Treatment for SLVS Command Error”
                • • •
                (Treatment in accordance with return code (Variable 99))
                • • •
                TAG     92              “Treatment for GTVD Command Error”
                • • •
                (Treatment in accordance with return code (Variable 99))
                • • •
```


Command
Operation 1
Operation 2
Output Section
GTVD
2
10
991
Local Integers
(setting example)
No.
Symbol
Variable Value
10
1
11
202
12
200
13
600
14
1
15
0
16
0
17
0
Work Coordinate System Offset Data
(setting example)
No.
X
Y
Z
R
1
15
5
0
5
2
45
60
0
−25
3
80
25
0
30
4
0
0
0
0
5
0
0
0
0
6
0
0
0
0
7
0
0
0
0
8
0
0
0
0
9
0
0
0
0
10
0
0
0
0
11
0
0
0
0
12
0
0
0
0
13
0
0
0
0
Work Data [X, Y and R Coordinates]
(after converted to robot coordinates)
Data update for only quantity
of work pieces (7 pieces)
Not updated due to
no received work data
Global Integers (setting example)
No.
Symbol
Variable Value
200
3
201
0
202
1
203
1
204
1
205
0
206
0
207
0
208
0
209
0
210
0
211
0
212
0
213
0
Quantity of work pieces
(MAX 12 pieces)
Work Attribute
Data update for only quantity
of work pieces (7 pieces)
Not updated due to
no received work data
Camera
3 work pieces
detected
Global Flag (setting example)
No.
Symbol
Status
600
1
601
0
Sending out Image-Capture
Command when flag (port) is ON

7. Error Treatment

7.1 Common Errors for All Vision Systems

Following explains the details of the errors and how to deal with it when an error number is displayed.

Refer to the corresponding error number to have an appropriate treatment when an error is issued.

(Note) Refer to Section 7.2 if an error is generated while in the simple (dedicated) calibration with using EX-110XL.

Error No.	415
Name	Unsupported Identification Code Received Error (Tracking and Vision System I/F data communication)
Description	An error is detected in the identification code of a message received from the vision system.
Treatment	Identification code is a fixed value. 8.1 Check and correct the communication format settings.

Error No.	416
Name	Received Message Error(Tracking and Vision System I/F data communication)
Description	An error is detected in the message received from the vision system.
Treatment	Select “Monitor” → “Error Detail” from the menu in X-SEL PC Software. The cause of the error is displayed in Info 1 and Info 2 in Error Detail. Check the message settings on the Vision System side following the table below.

Info1	Info2	Cause	Treatment Detail
1h	-	Header	The received message header is wrong. Check the following parameter settings. * The setting differs depending on the vision system supplier. • I/O Parameter No.352, Bits 0 to 7: when set to 0 or 1 →Check the settings in I/O Parameter No.353, Bits 8 to 15. (Cognex : $3C_H$, OMRON : 39_H) • I/O Parameter No.352, Bits 2 to 7: when set to 0 →Check the settings in I/O Parameter No.353, Bits 16 to 31. (Keyence : 5431_H)
2h	-	Identification Code	There is no identification code in the received message, or a character other than 0 to 9 (ASCII value) is set to the identification code. Check the identification code setting for the message. [Refer to 8.1 Communication Format Setting Values]
3h	-	Work piece	There is no work piece quantity data in the received message, or a character other than 0 to 9 (ASCII value) is set to the work piece quantity. Check the work piece quantity data setting for the message. [Refer to 8.1 Communication Format Setting Values]

Treatment (Error No.416 Continued)

Info1	Info2	Cause	Treatment Detail
4h	-	Received Message Length	A message longer than the specified message length is received. Check the length of the output message on the vision side. [Refer to 8.1 Communication Format Setting Values]
5h	-	Attribute	There is no attribute data in the received message, or a character other than 0 to 9 (ASCII value) is set to the attribute data. Check the attribute data for the message. [Refer to 8.1 Communication Format Setting Values]
6h	-	Work Data Integer	There is no work data integer in the received message, or a character other than 0 to 9 (ASCII value) is set to the integer. Check the work data integer setting for the message. [Refer to 8.1 Communication Format Setting Values]
7h	-	Work Data Decimal Point Position	There is no decimal point in the position specified in the format. [Refer to 8.1 Communication Format Setting Values]
8h	-	Work Data Decimal	There is no work data decimals in the received message, or a character other than 0 to 9 (ASCII value) is set to the decimal area. Check the work data decimals for the message. [Refer to 8.1 Communication Format Setting Values]
9h	-	Comma Position	(For the setting I/O Parameter No.352, Bits 0 to 7 = 2) There is an error in the comma (,) position in the received message. Check each data size for the message. [Refer to 8.1 Communication Format Setting Values]
Ah	-	Coordinate Data	(For the setting I/O Parameter No.352, Bits 0 to 7 = 2) There is an error in the coordinate data format in the received message. Check each coordinate data for the message. [Refer to 8.1 Communication Format Setting Values]
-	1h	Ethernet Read Standby Timeout	There is a possibility that a message is sent from the Vision System side before the controller issues Image-Capture Command. Check the settings on Vision System Side. (Timeout Value = 5sec (fixed))

Error No.	417
Name	Number of Received Works Error (Tracking and Vision System I/F data communication)
Description	There is an error in the quantity of the work pieces in the message received from Vision System.
Treatment	The quantity of work pieces that can be received in 1 shot of image capture is 12. Revise the setting on the Vision System side so it detects no more than 12 pieces in 1 shot.

Error No.	425
Name	Mount SIO Communication Mode Error
Description	It is an error in Mount SIO Communication Mode.
Treatment	The channel used for Vision System I/F cannot be used for other programs. Select another channel.

<table>
<tr><td>Error No.</td><td>426</td></tr>
<tr><td>Name</td><td>Number of Retries for Vision System Image Capturing Command Issue Exceeded Error</td></tr>
<tr><td>Description</td><td>The number of retries to send out Image-Capture Command exceeded the limitation.</td></tr>
<tr><td>Treatment</td><td>The following causes are considered.
<table>
<tr><th>No.</th><th>Cause</th><th>Treatment Detail</th></tr>
<tr><td>1</td><td>Output I/O Wiring</td><td>Check if the connection between the output port set in I/O Parameter No.357 or I/O power supply and the controller vision system has no abnormality. If no abnormality is detected, check also if;
• the output port set in I/O Parameter No.357 at GTVD Command execution is turned on, and
• the image-capture trigger port on the Vision System side at GTVD execution identifies the “ON” signal. Also check if the Vision System side outputs a message.</td></tr>
<tr><td>2</td><td>RS232 Cable Wiring
(for only when RS232C is applied for connection between Camera Controller and X-SEL)</td><td>Check the wiring for RS232C cable if;
• it is connected to Vision System,
• its destination on the controller side is correct,
e.g. The cable is connected to Mount SIO Channel 2 even thought the setting specifies Mount SIO Channel 1, and
• it is a cross cable.</td></tr>
<tr><td>3</td><td>Communication Setting</td><td>In the case Errors No.81B, 81C, etc. are issued at the same time, there is a possibility that the settings such for the baud rate, parity, stop bit do not match between the controller vision systems. Check the following parameter settings.
[5.3.2 Refer to When Standard SIO (RS232C) Channel Communication is Used]
• When Standard SIO Channel 1 is used:
I/O Parameter No.201
• When Standard SIO Channel 2 is used:
I/O Parameter No.213</td></tr>
<tr><td>4</td><td>Noise</td><td>Check if the earthing is properly conducted.
Also, have a countermeasure for noise prevention if necessary.</td></tr>
</table></td></tr>
</table>

Error No.	B26
Name	Ethernet Communication Mode Error
Description	There is an error in Ethernet Communication Mode.
Treatment	The channel used for Vision System I/F cannot be used for other programs. Select another channel.

Error No.	B27
Name	Vision System Specifying Error
Description	There is a difference between the Vision System I/F used currently and the Vision System I/F newly specified in SLVS Command.
Treatment	Specify Operation 1 =0 in SLVS Command and close the channel used in Vision System I/F, and then specify a new Vision System I/F in SLVS Command.

Error No.	B28
Name	Vision System I/F Initializing Incomplete Error
Description	The initializing for the specified vision system I/F is not completed.
Treatment	The following causes are considered.

No.	Cause	Treatment Detail
1	Vision System I/F Use Not Permitted	Check if the use of Vision System I/F is permitted in the parameter setting. I/O Parameter No.351 Bit0-3=0 (To use Vision System I/F) Bit0-3=1 (Not to use Vision System I/F)
2	Parameter Setting Error	No improvement is made on the parameter setting error. Refer to how to deal with Error No.D8C.

Error No.	B29
Name	Vision System I/F Used in Other Task Error
Description	The specified Vision System I/F is used in another program.
Treatment	It is not allowed to indicate a vision system I/F that is being used by another program. Revise the program.

Error No.	D8C
Name	Vision System I/F Parameter Error
Description	There is an error in a Vision System I/F related parameter settings.
Treatment	Select “Monitor” → “Error Detail” from the menu in X-SEL PC Software. The parameter numbers that are the cause of the error are displayed in Info 1 and Info 2 in Error Detail. Check the settings for the displayed parameters.

Info1	Info2	Corresponding Parameter	Treatment Detail
1h		Each Axis Parameter No.1	A rotation movement axis is specified to X, Y or Z-axis, or a linear movement axis is specified to R-axis. It is able to specify the linear movement axis to X, Y and Z-axis, and the rotation movement axis to R-axis. Check the settings.
3Dh	-	All Axis Parameter No.61 [Refer to Conveyer Tracking Instruction Manual provided separately]	The setting is made to use Ethernet on both Vision System I/F and Tracking Function. Change one of them to RS232C communication.
		I/O Parameter No.351 Bit4-7 [Refer to 5.7 Parameter Setting]	
38h	-	All Axis Parameter No.56	An inappropriate setting was established when the coordinate system definition unit axes are indicated for the vision system coordinate axis definition. Establish the setting as follows. ・Indicate the coordinate system definition unit X and Y-axes to the vision system X and Y-axes. ・When there is the coordinate system definition unit R-axis, indicate it to the vision system R-axis.
41h	-	Each Axis Parameter No.65	An axis specified for the coordinate axes definition is specified as the synchro-slave axis. A synchro-slave axis cannot be specified in Vision System I/F Function. Set Each Axis Parameter No.65 = 0.

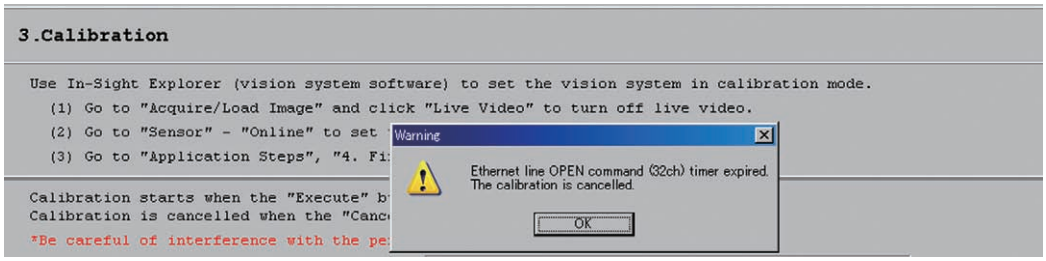
Treatment
(Error No. D8C
Continued)

Info1	Info2	Cause	Treatment Detail
68h	-	Each Axis Parameter No.104	Multi-Slider Function is set to 2 axes in those specified for the coordinate axes definition. Vision system I/F Function cannot be used together with Multi-Slider Function. Set Each Axis Parameter No.104 = 0.
79h	-	-	*Please contact us.
15Fh	-	I/O Parameter No.351 Bit4-7	There is an error in the communication device setting. Set a value within the range of 0 to 5. [Refer to 5.7 Parameter Setting]
160h	-	I/O Parameter No.352 Bit0-7	There is an error in the communication format. Set a value within the range of 0 to 2. [Refer to 5.4 Communication Format Setting]
164h	-	I/O Parameter No.356	There is an error in Initializing Complete Status Physical Input Port Number. Specify the port number within the specifiable range.
165h	-	I/O Parameter No.357	Either the Image-Capture Trigger Output Port Number is duplicated with another function, or a port number out of the range is specified. Check the port number.

7.2 Simple Calibration Execution Error for EZ-110XL

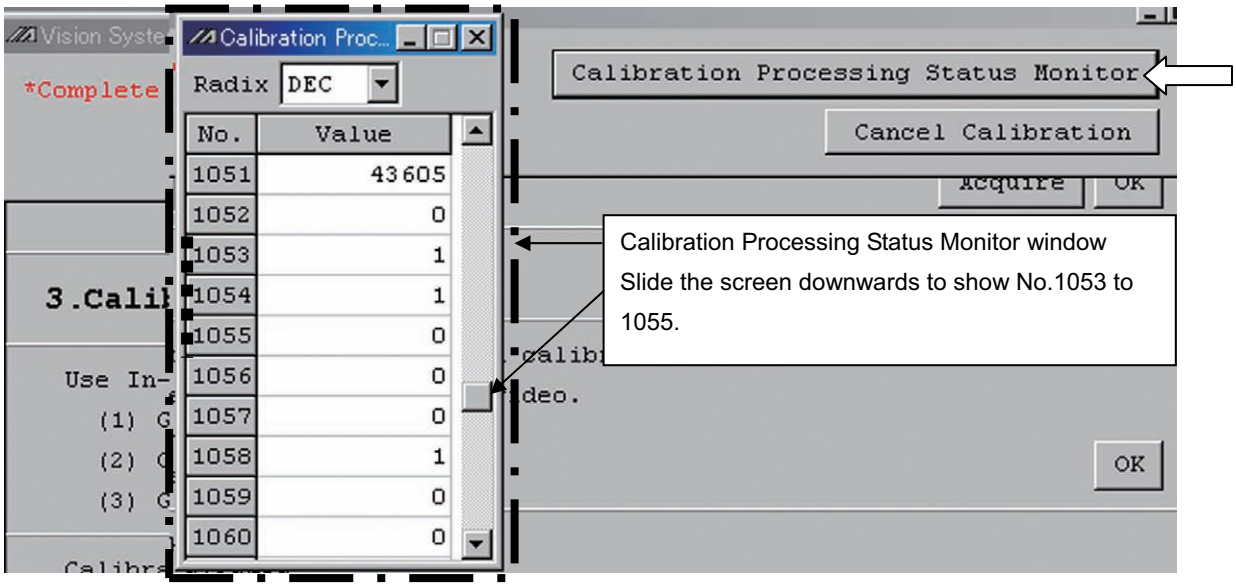
In this section, explains the details of error content and how to deal with if in the case when an error number is displayed during the simple calibration.

A window as shown below would appear when an error is generated.



Click the “Calibration Processing Status Monitor” button on the top right of the Simple Calibration Adjustment window.

The Calibration Processing Status Monitor window opens. Make the window show from No.1053 to 1055.



Check the value in No.1053 and find the corresponding error number to take an appropriate counteraction.

Value in No.1053	51
Name	31ch (TELNET) Non-Open Error
Description	Channel 31 could not open.
Treatment	Check the vision system power supply and Ethernet cable layout.

Value in No.1053	52
Name	32ch (Robot Movement Command Port) Non-Open Error
Description	Channel 32 could not open.
Treatment	Check the vision system power supply and Ethernet cable layout.

Value in No.1053	53
Name	TELNET Login Process Message Error
Description	A normal value was not returned from the vision system
Treatment	Check the vision system power supply, Ethernet cable layout and also the status of the vision system if it is online and in the process of a job.

Value in No.1053	54
Name	TELNET Login Process Read Error
Description	The returned value from the vision system was not received.
Treatment	Check the vision system power supply and Ethernet cable layout. Check the value in No.1055 shown in the calibration process status monitor window, confirm the details of the error in Section 7.3 and take an appropriate counteraction.

Value in No.1053	55
Name	Vision System Reset Command Error
Description	A normal value was not returned from the vision system
Treatment	Check the vision system power supply, Ethernet cable layout and also the status of the vision system if it is online and in the process of a job.

Value in No.1053	56
Name	Vision System Reset Read Error
Description	The returned value from the vision system was not received.
Treatment	Check the vision system power supply and Ethernet cable layout. Check the value in No.1055 shown in the calibration process status monitor window, confirm the details of the error in Section 7.3 and take an appropriate counteraction.

Value in No.1053	57
Name	Trigger Command Error
Description	A normal value was not returned from the vision system
Treatment	Check the vision system power supply, Ethernet cable layout and also the status of the vision system if it is online and in the process of a job.

Value in No.1053	58
Name	Trigger Read Error
Description	The returned value from the vision system was not received.
Treatment	Check the vision system power supply and Ethernet cable layout. Check the value in No.1055 shown in the calibration process status monitor window, confirm the details of the error in Section 7.3 and take an appropriate counteraction.

Value in No.1053	59
Name	Robot Coordinates Command Error
Description	Normal coordinate values were not returned from the vision system.
Treatment	Check the vision system power supply, Ethernet cable layout and also the status of the vision system if it is online and in the process of a job.

Value in No.1053	60
Name	
Description	The returned value from the vision system was not received.
Treatment	Check the vision system power supply and Ethernet cable layout. Check the value in No.1055 shown in the calibration process status monitor window, confirm the details of the error in Section 7.3 and take an appropriate counteraction.

Value in No.1053	61
Name	Robot Movement Command Message Error
Description	Normal coordinate values were not returned from the vision system.
Treatment	Check the vision system power supply, Ethernet cable layout and also the status of the vision system if it is online and in the process of a job.

Value in No.1053	62
Name	Robot Movement Command Read Error
Description	The returned value from the vision system was not received.
Treatment	Check the vision system power supply and Ethernet cable layout. Check the value in No.1055 shown in the calibration process status monitor window, confirm the details of the error in Section 7.3 and take an appropriate counteraction.

Value in No.1053	63
Name	Vision System Detection Error
Description	Vision system could not detect the work.
Treatment	Confirm the work is within the image capturing range. Confirm that the job set to detect the work is executed. Confirm the vision system is online. Confirm the lights are on if there are. Confirm the lens cover on the camera is removed.

Value in No.1053	64
Name	Vision System Formula Creation Error
Description	Adjustment data could not be created since there was a problem in the data acquired in the calibration.
Treatment	Confirm the movement amount setting (refer to Section 5.8.2, 5.8.3 [Procedure 8] (5)) is evenly allocated within the image capturing range and retry the calibration. If the same error occurs again, please contact us.

Value in No.1053	65
Name	Vision System Error Code Failure Error
Description	There is an error in the returned value from the vision system.
Treatment	Turn OFF the power to the vision system and reboot. If the same error occurs again, please contact us.

7.3 Return Code List in READ Command (SEL Language) Execution

If an error is occurred during the READ Command, the return code is stored to the Calibration Process Status Monitor No.1055.
The return codes are listed below. Check the detail to take an appropriate counteraction.

Return Code	Description and Treatment
0	READ Command completed in normal condition
1	Reception Time Out The timeout duration is determined in TMRD or TMRW Command. The reception will continue even though the return code is not returned.
2	Reception Timer Cancel The condition in waiting is cancelled in the timer duration determined in TMRD or TMRW Command.
3	Reception Overrun The process of sending data was not made in time. Increase the process time by such way as reducing the communication speed.
4	Framing Error or Parity Error Framing Error : Data other than the specified format was received. Check the settings of such parameters as parity and data bit length. If the problem cannot be solved, also consider the influence of noise. Check the cable wires and their shield treatment. Parity Error : There was an error in the sent data. Influence of noise can be considered. Check the cable wires and their shield treatment.
5	Read Factor Error The communication circuit was compulsorily shut down. Reboot the XSEL power. Please contact us if the problem is not solved with this action.
6	Lead Task Complete Program stopped while READ Command was executed.
7	Receive Error There was an error in the receiving process for some reason. Reboot the XSEL power. Please contact us if the problem is not solved with this action.
8	These numbers are not in use.
9	
10	
11	
12	
13	Ethernet Related Error Close the circuit once and reopen it. Please contact us if the problem is not solved with this action.
14	
15	
16	
17	
18	
19	
20	
21	Temporary QUE Overflow An overflow was occurred in the communication circuit memory. Reboot the XSEL power. Please contact us if the problem is not solved with this action.
22	Receive QUE Overflow An overflow was occurred in the received data storage area. Try to reduce the communication speed.
50 to	Please contact us.

8. Appendix

8.1 Communication Format Setting Values

Perform the settings to the vision system to output in the order shown in the list below. [Refer to the instruction manual of each vision system and Section 5.7 Detailed Function Settings for more details.]

[Setting 1] For EZ-110XL [I/O Parameter No.352=0]

Communication Format 1				
Data Name		Number of Bytes	ASCII value (Example)	Remarks
Header		1	<	I/O Parameter No.353 Bit 8-15 Default 3Ch ('<')
Identification Code		2	00	'00' Fixed
Work Piece Quantity in 1 Shot		2	00 to 08	8 pieces maximum
Repeats for Number of Work Piece Quantity in 1 Shot (8 pieces maximum)	(Work 1) Captured Work Attribute	2	00 to 99	Data area free to the user
	(Work 1) Work Y-axis when Captured [mm]	9	-9999.999 to 99999.999	(Note) Put 0 or blank (space) to make the number in the specified number of digits. (Example) 111.000 [mm] ↓ 00111.000 [mm]
	(Work 1) Work X-axis when Captured [mm]	9	-9999.999 to 99999.999	
	(Work 1) Work θ-axis when Captured [deg]	9	-9999.999 to 99999.999	
	…			
	(Work 8) Captured Work Attribute	2	00 to 99	Data area free to the user
	(Work 8) Work Y-axis when Captured [mm]	9	-9999.999 to 99999.999	(Note) Put 0 or blank (space) to make the number in the specified number of digits. (Example) 111.000 [mm] ↓ 00111.000 [mm]
	(Work 8) Work X-axis when Captured [mm]	9	-9999.999 to 99999.999	
	(Work 8) Work θ-axis when Captured [deg]	9	-9999.999 to 99999.999	
Delimiter		1	CR	I/O Parameter No.353 Bit 0-7 Default 0Dh ('CR')

⚠ Note

The order to send the captured work coordinate information is Y ⇒ X ⇒ θ.
Put the values for the coordinates (X, Y, and θ) of 1 work in the order on In-Sight Explorer. [See the next page]
Send the number of bytes for 1 work (Y, X, and θ) even if there is a coordinate not in use.
(Example) Put 0 to the 9 bytes for θ even if the rotation axis is not in use.

- Method to put the coordinate data in order on In-Sight Explorer and output as a result
  (Note) For the details, refer to Cognex Instruction Manual or the enclosed data (Sample.job).
  ☆Please contact IAI for a program file you need.

  (1) Select Application Steps ⇒ Inspect Pact in In-Sight Explorer.

  (2) Select Math from Add Tool and click the “Add” button.

  (3) From the function select under the formula, select Text ⇒ Stringf and click “Insert”.

  (4) For the content of the formula, fill in as shown below, or select the detection coordinates to insert.
  Stringf (“%+09.3f%+09.3f%+09.3f, Detection coordinate nY, Detection coordinate nX, Detection coordinate nθ)

  (5) Repeat the steps 3) and 4) for the number of times for the number of the maximum detectable n (8 pieces at maximum) of the used device.

  (Example) When PatMax (1 – 10) is used for detection

  Math_1:

  Stringf(“%+09.3f%+09.3f%+09.3f,Pattern_2.Fixture.Y, Pattern_2.Fixture.X, Pattern_2.Fixture.Angle)

  Math_2:

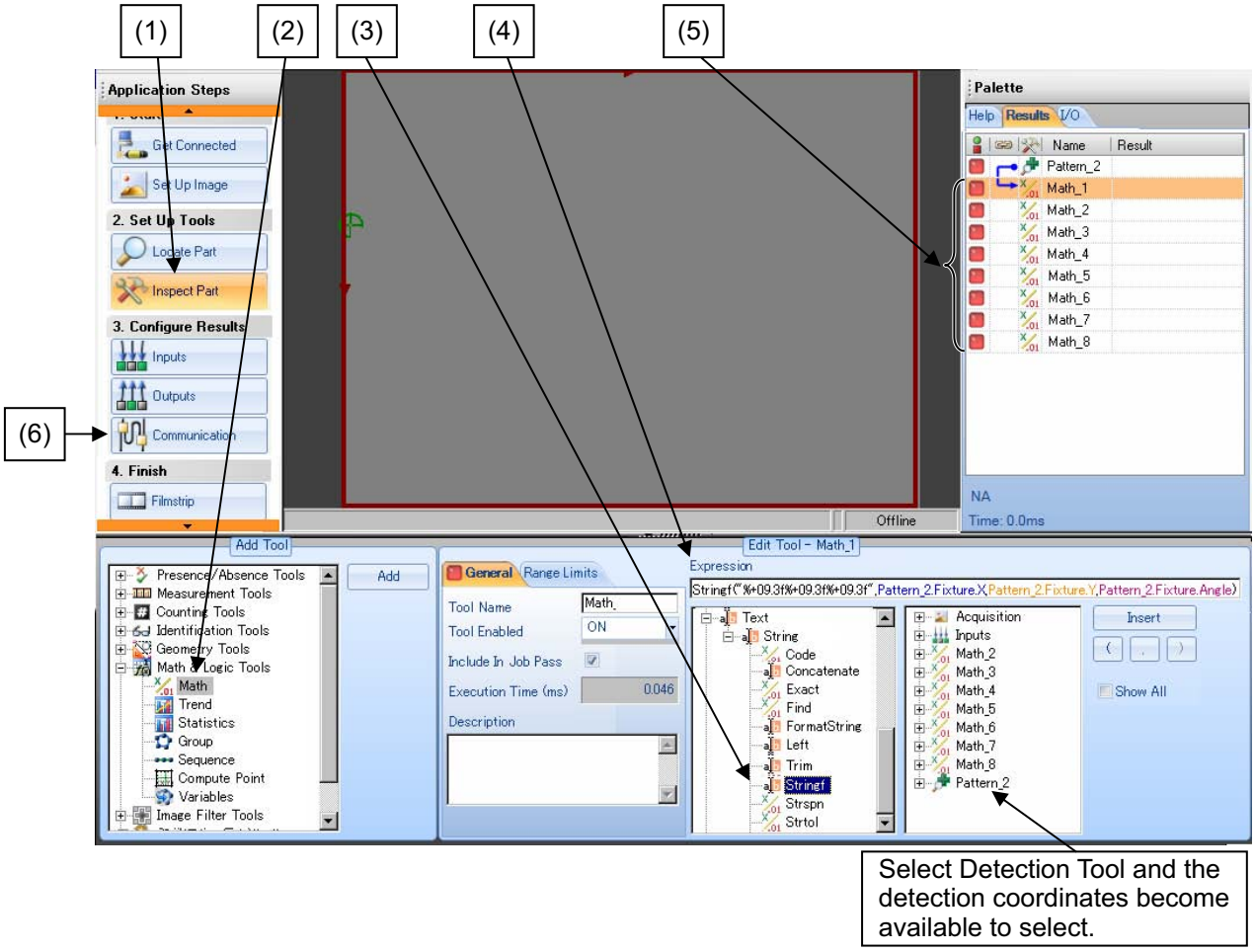
  Stringf(“%+09.3f%+09.3f%+09.3f,Pattern_2.Fixture1.Y, Pattern_2.Fixture1.X, Pattern_2.Fixture1.Angle)

  Math_3:

  Stringf(“%+09.3f%+09.3f%+09.3f,Pattern_2.Fixture2.Y, Pattern_2.Fixture2.X, Pattern_2.Fixture2.Angle)

  •

  •

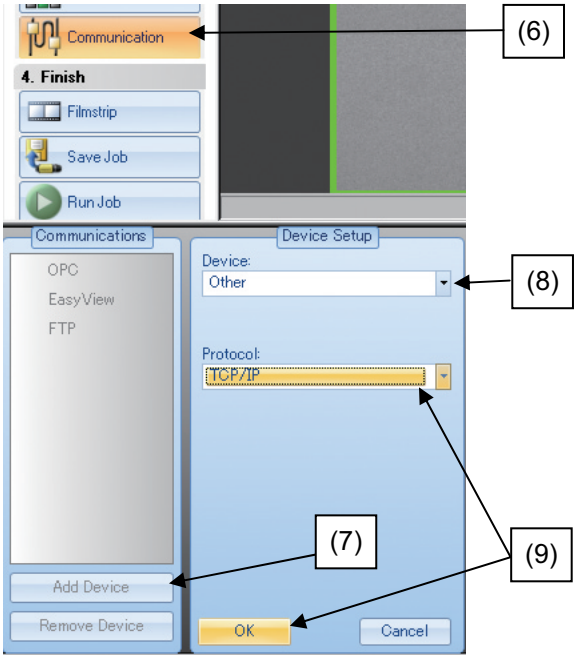


(6) Select Application Steps ⇒ Communication in In-Sight Explorer and conduct settings for the result output.

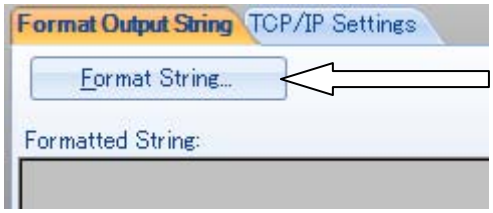
(7) Click Add Device from Communication.

(8) Set the device in the Device Setup to Other.

(9) Set Protocol of the Device Setup to TCP/IP and click “OK”.

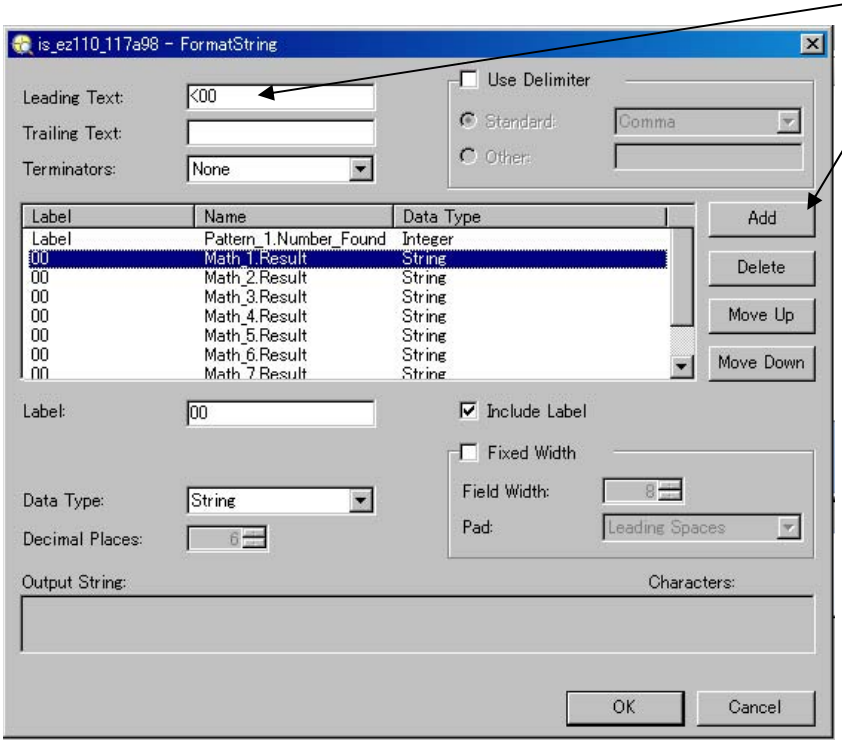


(10) Click Format String… on Format Output String tag in TCP/IP Setting window.



(11) Following the table for EZ-110XL settings in Section 8.1, input and select the necessary data.

(Note) For the details, refer to Cognex Instruction Manual or the enclosed data (Sample.job).
Click “OK”.



Click Add and the values available for output can be selected as the result of the detection tool and calculation tool.

(1) Select the number of detection from the detection tool and set it.
- Label to be excluded (put no tick mark)
- Data Type is Integer
- Tick in Fixed Width box and put 2 to Field Width and the top 0 to Pad.

(2) Select the calculation result from the calculation tool and set it.
- Label to be excluded (put no tick mark)
- Data Type is Integer
- Tick in Fixed Width box and put 2 to Field Width and the top 0 to Pad.

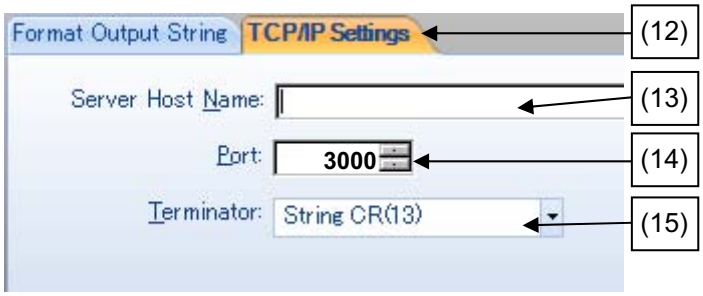
* For the label, input 2 characters for the capturing work attribute. (If there is none, input 00.)

(12) Select TCP/IP Settings tag in TCP/IP Setting window.

(13) It is not necessary to input the Server Host Name.

(14) Put the same value to Port as the one input to XSEL or TTA I/O Parameter No. 164.

(15) Select CR(13) for Terminator.



[Setting 2] For Cognex and OMRON (except for EZ-110XL) [I/O Parameter No.352=0 or 1]

Communication Format 2				
Data Name		Number of Bytes	ASCII value (Example)	Remarks
Header		1	<	I/O Parameter No.353 Bit 8-15 Default 3Ch ('<') Cognex : 3C OMRON : 39
Identification Code		2	00	'00' Fixed
Work Piece Quantity in 1 Shot		2	00 to 12	12 pieces maximum
Repeats for Number of Work Piece Quantity in 1 Shot (12 pieces maximum)	(Work 1) Captured Work Attribute	2	00 to 99	Data area free to the user
	(Work 1) Work Y-axis when Captured [mm]	9	-9999.999 to 99999.999	(Note) Put 0 or blank (space) to make the number in the specified number of digits. (Example) 111.000 [mm] ↓ 00111.000 [mm]
	(Work 1) Work X-axis when Captured [mm]	9	-9999.999 to 99999.999	
	(Work 1) Work θ-axis when Captured [deg]	9	-9999.999 to 99999.999	
	…			
	(Work 12) Captured Work Attribute	2	00 to 99	Data area free to the user
	(Work 12) Work Y-axis when Captured [mm]	9	-9999.999 to 99999.999	(Note) Put 0 or blank (space) to make the number in the specified number of digits. (Example) 111.000 [mm] ↓ 00111.000 [mm]
	(Work 12) Work X-axis when Captured [mm]	9	-9999.999 to 99999.999	
	(Work 12) Work θ-axis when Captured [deg]	9	-9999.999 to 99999.999	
Delimiter		1	CR	I/O Parameter No.353 Bit 0-7 Default 0Dh ('CR')

⚠ Note

The order to send the captured work coordinate information is X ⇒ Y ⇒ θ.
Send the number of bytes for 1 work (X, Y, and θ) even if there is a coordinate not in use.
(Example) Put 0 to the 9 bytes for θ even if the rotation axis is not in use.

[Setting 3] For Keyence [I/O Parameter No.352=2]

Communication Format 3 (1/2)				
Data Name		Number of Bytes	ASCII value (Example)	Remarks
Header		2	T1	I/O Parameter No.353 Bit 16-31 Default 5431h ('T1')
Comma		1	,	
Identification Code		12	+0000003.000	Fixed Value, for XG7000, CV 5000 and CV 3000
			+0000005.000	Fixed Value, for CV 2000
Comma		1	,	
Work Piece Quantity in 1 Shot		12	+0000000.000 to +0000012.000	12 pieces maximum
Comma		1	,	
Repeats for Number of Work Piece Quantity in 1 Shot (12 pieces maximum)	(Work 1) Captured Work Attribute	12	+0000000.000 to +0000099.000	Data area free to the user
	Comma	1	,	(Note) Put 0 or blank (space) to make the number in the specified number of digits. (Example) 111.000 [mm] ↓ 00111.000 [mm]
	(Work 1) Work X-axis when Captured [mm]	12	-0099999.999 to +0099999.999	
	Comma	1	,	
	(Work 1) Work Y-axis when Captured [mm]	12	-0099999.999 to +0099999.999	
	Comma	1	,	
	(Work 1) Work θ-axis when Captured [deg]	12	-0099999.999 to +0099999.999	
	Comma	1	,	
	… (* To the next page)			

⚠ Note

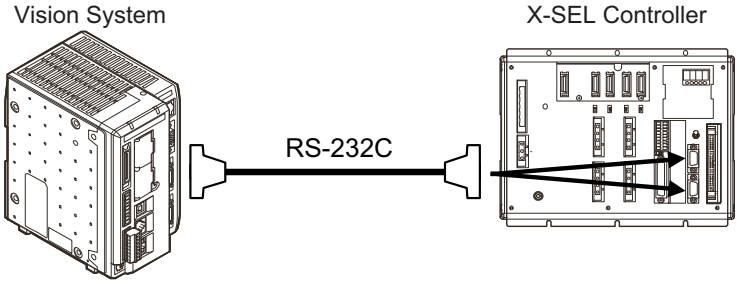
The order to send the captured work coordinate information is X ⇒ Y ⇒ θ.
Send the number of bytes for 1 work (X, Y, and θ) even if there is a coordinate not in use.
(Example) Put 0 to the 12 bytes for θ even if the rotation axis is not in use.

Communication Format 3 (2/2)				
Data Name		Number of Bytes	ASCII value (Example)	Remarks
Repeats for Number of Work Piece Quantity in 1 Shot (12 pieces maximum)	(* Continued from previous page) …			
	(Work 12) Captured Work Attribute	2	+0000000.000 to +0000099.000	Data area free to the user
	Comma	1	,	(Note) Put 0 or blank (space) to make the number in the specified number of digits. (Example) 111.000 [mm] ↓ 00111.000 [mm]
	(Work 12) Work X-axis when Captured [mm]	12	-0099999.999 to +0099999.999	
	Comma	1	,	
	(Work 12) Work Y-axis when Captured [mm]	12	-0099999.999 to +0099999.999	
	Comma	1	,	* No comma to be put between θ-axis at image capturing and the delimiter for the last work piece
	(Work 12) Work θ-axis when Captured [deg]	12	-0099999.999 to +0099999.999	
Delimiter		1	CR	I/O Parameter No.353 Bit 0-7 Default 0Dh ('CR')

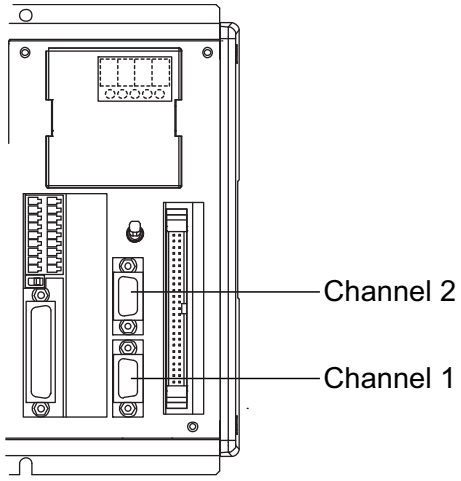
⚠ Note

The order to send the captured work coordinate information is X ⇒ Y ⇒ θ.
Send the number of bytes for 1 work (X, Y, and θ) even if there is a coordinate not in use.
(Example) Put 0 to the 12 bytes for θ even if the rotation axis is not in use.

8.2 General-purpose RS232C Port



RS232C Connector Specifications

Applicable Connector	D-sub 9-pin (DTE)	XM2C-0942-502L (OMRON)
Connector Name	S1/S2	
Max. Connectable Distance	10m	at 38400bps
Number of Channels	2	General-purpose RS232C Port Connectors 1 and 2 

	Pin No.	Direction	Signal Name	Description
Terminal Assignment	1	In	(CD)	(Carrier Detection : Not Used)
	2	In	RD	Received Data (RXD)
	3	Out	SD	Sent Data (TXD)
	4	Out	ER	Equipment Ready (DTR)
	5	In	SG	Signal Ground
	6	In	DR	Data-Set Ready (DSR)
	7	Out	(RS)	(Request for Sending (RTS) : Not Used)
	8	In	(CS)	(Sending Available (CTS) : Not Used)
	9	Out	GV or NC	Channel 1: NC Channel 2: GV (power supply to the converter unit) when RC Gateway function is used NC when RC Gateway function is not used.

9. Change History

Revision Date	Revision Description	
2010.08	First Edition	
2010.11	Second Edition	
2011.06	Third A Edition	Corresponded to EZ-110XL
2011.12	Third B Edition	Contents changed in Safety Guide Caution notes added for when working with two or more persons Note Corrected
2012.08	Fourth Edition	CT4 added
2012.09	Fifth Edition	XSEL-R/S added
2013.02	Sixth Edition	Modification made from “copy from PC software” to “download from HP and contact us” for the related file data
2013.12	Seventh Edition	Complied with TTA
2014.09	Eighth Edition	Made applicable for MSEL Cartesian Type
2016.02	Ninth Edition	Contents added for work coordinate system, support of tool coordinate system (GTVD command)

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