DX100 OPTIONS
INSTRUCTIONS

FOR VISION FUNCTION

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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR'S MANUAL
DX100 MAINTENACE MANUAL

The DX100 operator's manual above corresponds to specific usage.
Be sure to use the appropriate manual.

Part Number: 169282-1CD
Revision: 0

YASKAWA
MOTOMAN ROBOTICS

MANUAL NO.
HW1482123◈0

MANDATORY

- This manual explains the vision function of the DX100. Read this manual carefully and be sure to understand its contents before handling the DX100.
- General items related to safety are listed in Chapter 1: Safety of the DX100 INSTRUCTIONS. To ensure correct and safe operation, carefully read the DX100 Instructions before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX100.

In this manual, the Notes for Safe Operation are classified as “WARNING”, “CAUTION”, “MANDATORY”, or ”PROHIBITED”.

WARNING — Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

CAUTION — Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

MANDATORY — Always be sure to follow explicitly the items listed under this heading.

PROHIBITED — Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations. At any rate, be sure to follow these important items

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.

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WARNING

- Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX100 and the programming pendant.
  When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

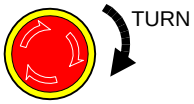
Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

Figure 1: Emergency Stop Button

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Figure 2: Release of Emergency Stop



- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Keep in mind the emergency response measures against the manipulator's unexpected motion toward you.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning ON the power for the DX100.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the DX100 and the programming pendant.

CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the DX100 cabinet after use.

The programming pendant can be damaged if it is left in the P-point maximum envelope of the manipulator, on the floor, or near fixtures.

- Read and understand the Explanation of Warning Labels in the DX100 Instructions before operating the manipulator.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

Equipment	**Manual Designation**
DX100 Controller	DX100
DX100 Programming Pendant	Programming Pendant
Cable between the manipulator and DX100	Manipulator Cable

Descriptions of the programming pendant keys, buttons, and displays are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. page key  The cursor key is an exception, and a picture is not shown.
	Axis Keys Number Keys	“Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

Registered Trademark

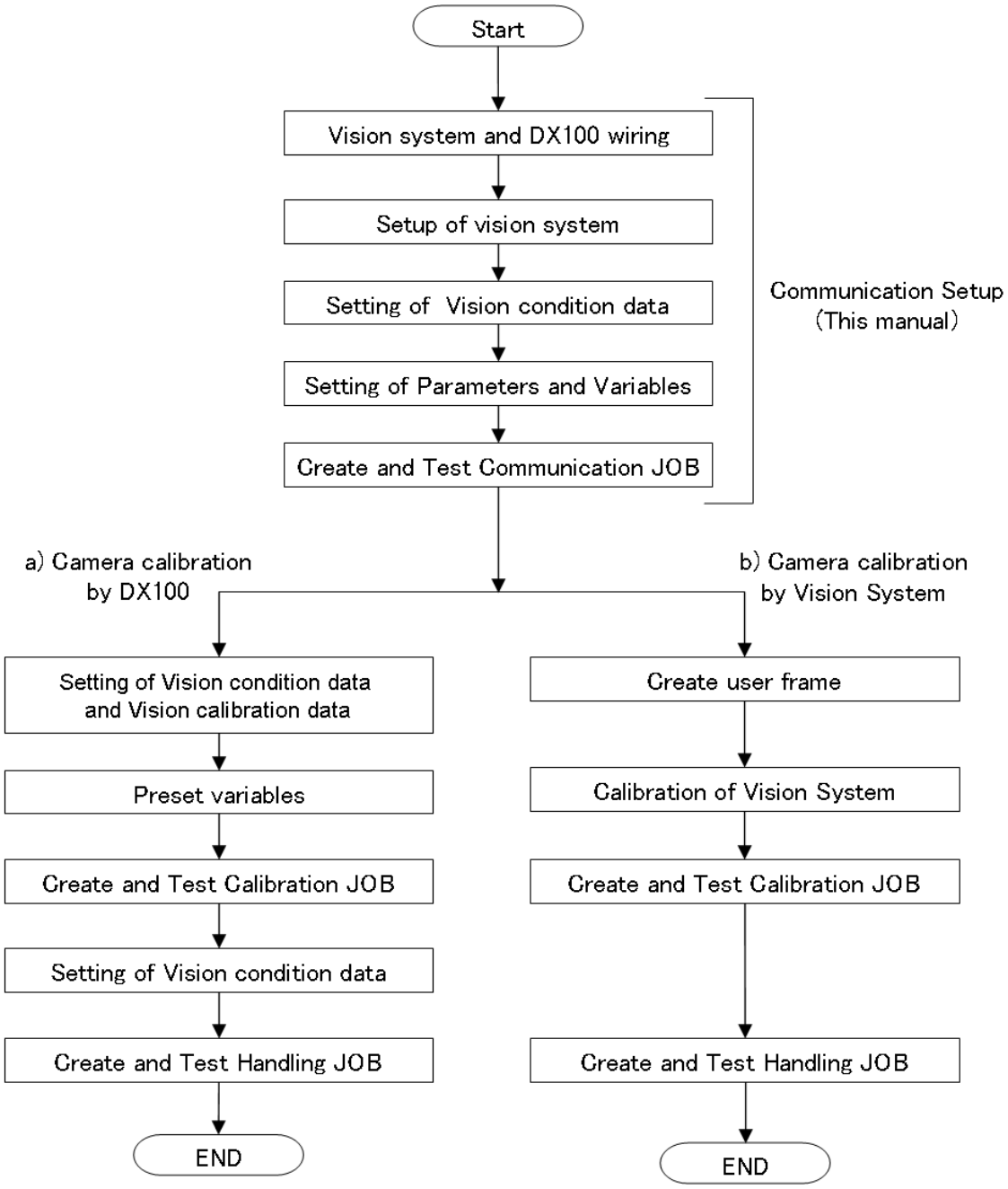
In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and ^{TM} are omitted.

Table of Contents

1 Outline

The vision function communicates with the image processing device (vision system) to control the robot according to image processing results.

The vision function operation procedures are as follows.



2 Communications Settings

2.1 Connecting the Vision System to the DX100

2.1.1 DX100 System Version

The vision function in this manual needs the following DX100 system version.

System version	DS3.40-00[1)]

1 Inquire seperately about the earlier versions than DS3.40-00.

2.1.2 List of Connectable Vision Systems

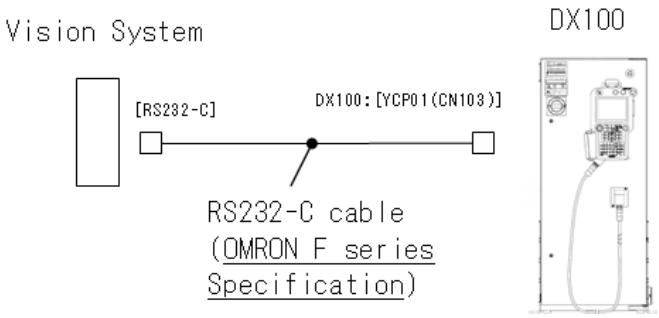
The connectable vision systems to use with the vision function are as follows.

Maker	Model	Communication method	Note
OMRON	F160/250 FZ2 series FZ3 series FZ4 series	RS232-C	• A special specification serial cable is used
COGNEX	In-Sight series In-Sight Micro series	Ethernet	• Yaskawa's proprietary camera job is used • The EasyBuilder function is not supported
KEYENCE	CV-5000/3000 series	Ethernet	
	XG-7000 series	Ethernet	
SHARP	IV-S200 series	Ethernet	

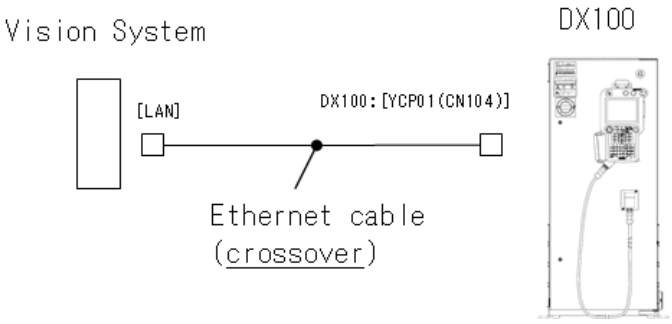
2.1.3 System Configuration

An example of the system configuration that performs communication for the vision function is shown below. For the machine configuration of each vision system, refer to the system's documentation.

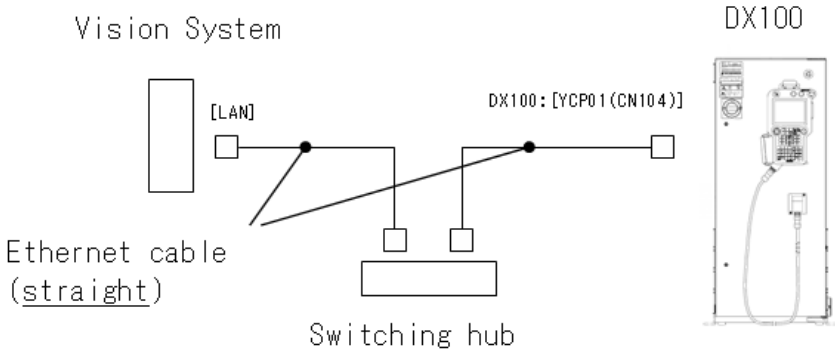
(1) Serial communication (RS-232C) configuration



(2) For serial communication/Telnet (Ethernet)



(3) For serial communication (Ethernet) via a switching hub



2.2 Vision System Settings

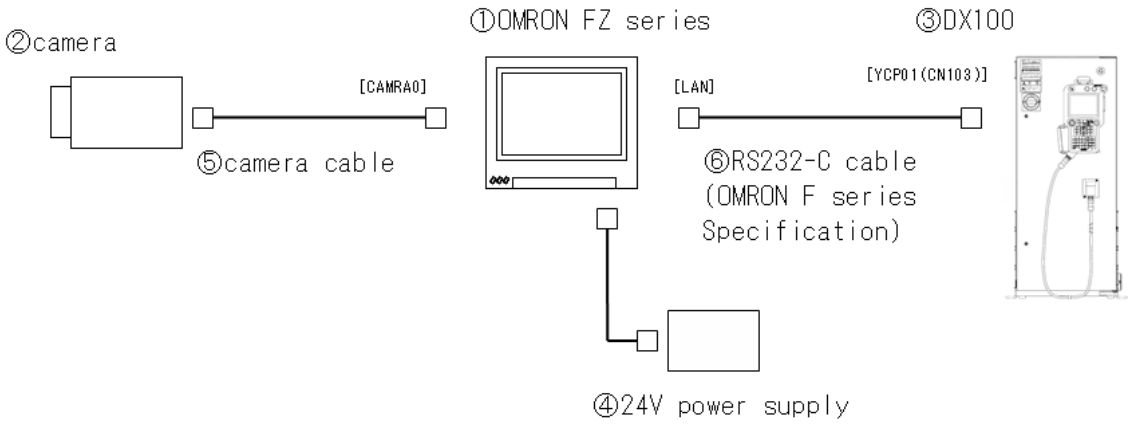
Perform vision system settings so that communication can occur between the DX100 and the vision system. Perform the settings according to the communication specification as follows. After setting, follow the vision system's operation manual to save the settings, and then use them.

2.2.1 OMRON F/FZ Serial Communication (RS-232C)

An example of the basic system configuration for Omron F/FZ serial communication (RS-232C) for the DX100 vision function is shown below.

SUPPLE-MENT The Omron FZ series is used for the examples below.

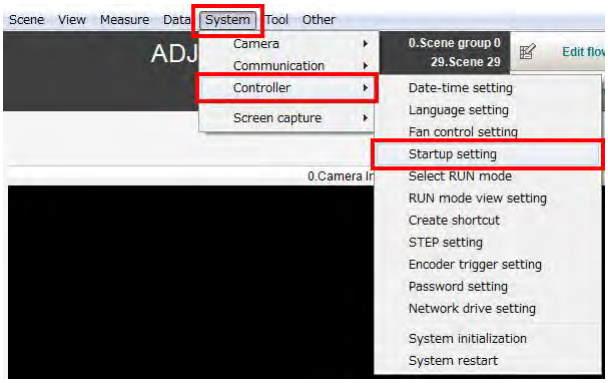
No.	Required device	No. of items
①	Omron FZ series (liquid crystal integrated)	1
②	FZ-compatible camera	1 to 4
③	DX100	1
④	24V power supply unit	1
⑤	FZ camera cable (regular/flex-resistant)	1 to 4
⑥	Special specification RS-232C cable: HS0370666	1



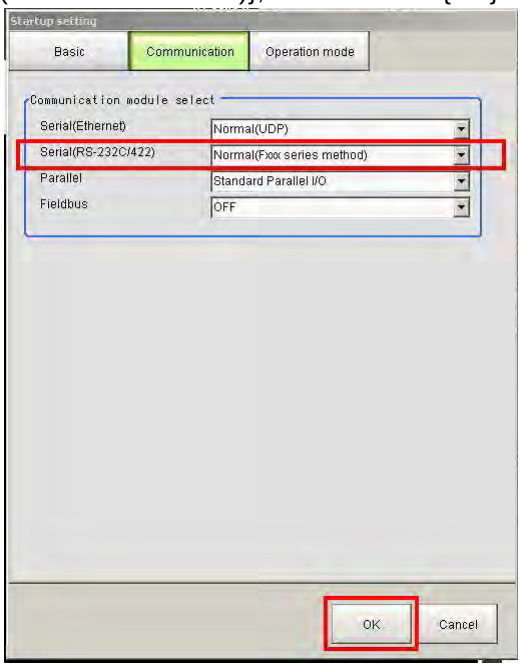
2.2.1.1 System Settings

Perform settings on the vision system only after returning its settings to the default factory values.

1. On the adjustment window, select {System} → {Controller} → {Startup setting}.

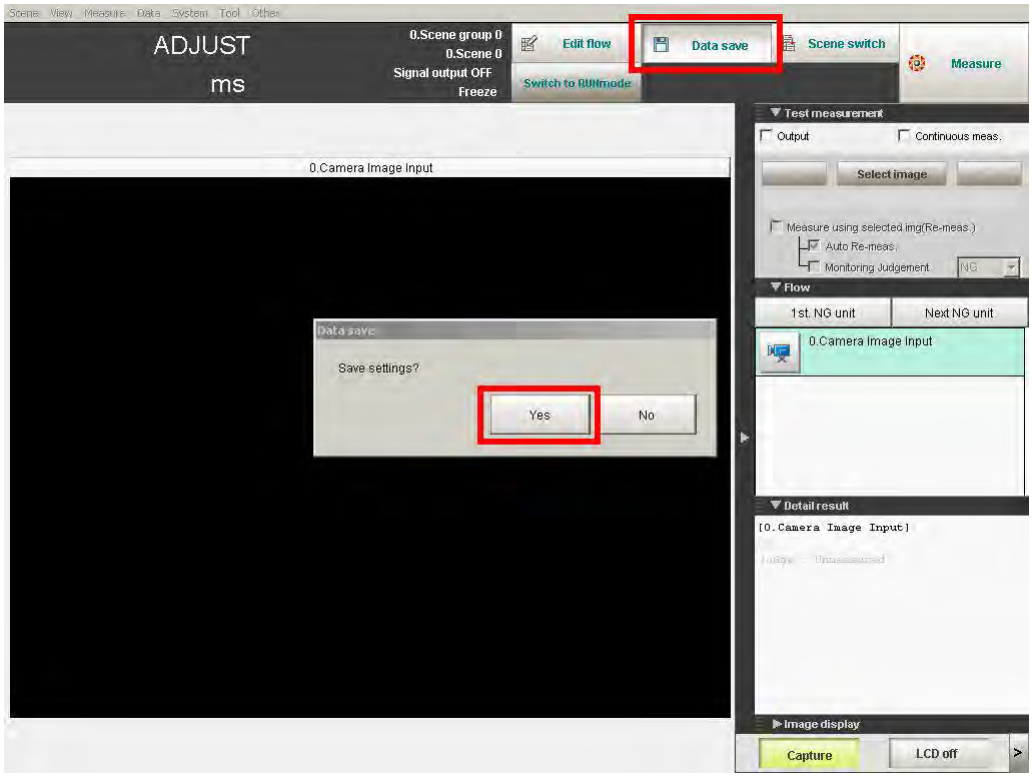


2. Select the {Communication} tab, and change {Serial (RS-232C/422)} to {Normal (Fxxx series method)}, and then click {OK}.



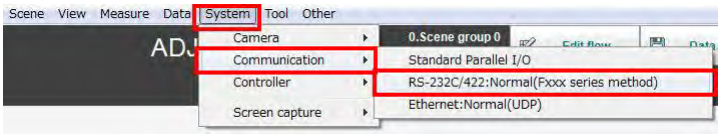
3. "Setting is applied after save data and reboot." is displayed. Click {OK}.

4. On the adjustment window, click {Data save}, and then click {Yes}.

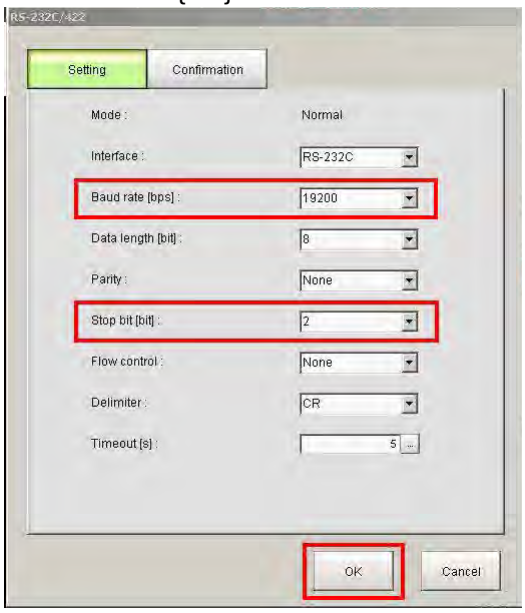


5. Turn OFF the device power and restart it.

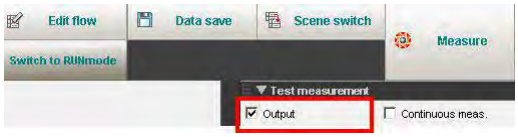
6. On the adjustment window, select {System} → {Communication} → {RS-232C/422:Normal(Fxxx series method)}.



7. On the {Setting} tab, set {Baud rate [bps]} to “19200” and set {Stop bit [bit]} to “2”, and then click {OK}.



8. Open the adjustment window's {Test measurement} tab, and check the box for “Output”.



9. On the adjustment window, click {Data save}, and then click {Yes}.

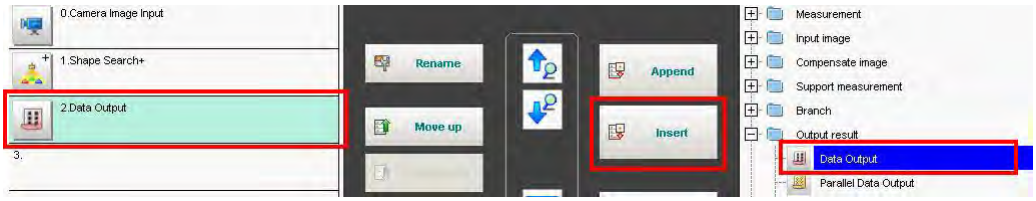
SUPPLE-MENT

If communication is not stable, change {Baud rate [bps]} to “9600”, and in the parameter settings in *Section 2.4.1 “Setting Parameters and Variables” on page 2-41*, set the value for {RS103} to “7”.

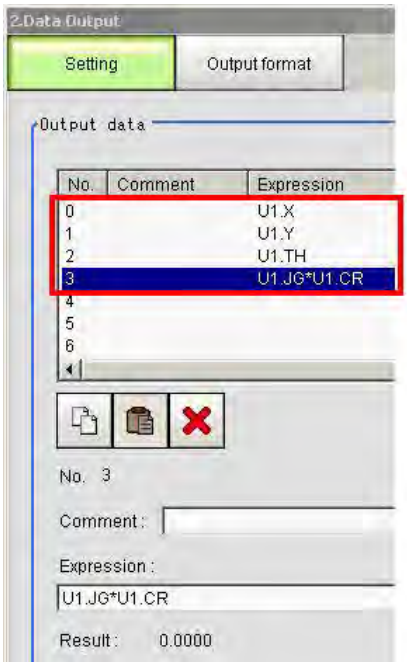
2.2.1.2 Detection Scene Settings

Perform settings for each detection scene.

1. Create detection processing.
2. On the adjustment window, select {Edit flow} to open the edit flow window.
3. On the edit flow window, at the end of the flow, add a {Data Output} unit.



4. Select the {Data Output} icon to open the edit window.
5. For each workpiece, set the following 4 data items in sequence. By adding serial data output units, up to 8 workpieces with 32 data items can be specified.



1st unit (for the 1st workpiece)

No.	Expression	DX100 storage destination variable	Settable data range
0	Any (recommended: measurement coordinate X0)	P [a] (1)	Real number: -1.7E - 308 - +1.7E + 308
1	Any (recommended: measurement coordinate Y0)	P [a] (2)	
2	Any (recommended: measurement angle TH0)	R [a]	Real number: ±3.4E - 38 - ±3.4E + 38
3	Any (recommended: judgment value JG0 × correlation value CR0)	I [a]	Integer: -32, 768 - 32, 767

2nd unit (for the 2nd workpiece)

No.	Expression	DX100 storage destination variable	Settable data range
0	Any (recommended: measurement coordinate X1)	P [a + 1] (1)	Real number: -1.7E - 308 - +1.7E + 308
1	Any (recommended: measurement coordinate Y1)	P [a + 1] (2)	
2	Any (recommended: measurement angle TH1)	R [a + 1]	Real number: ±3.4E - 38 - ±3.4E + 38
3	Any (recommended: judgment value JG1 × correlation value CR1)	I [a + 1]	Integer: -32, 768 - 32, 767

“n” th unit (for the “n” th Workpiece)

No.	Expression	DX100 storage destination variable	Settable data range
0	Any (recommended: measurement coordinate X (n - 1))	P [a + n - 1] (1)	Real number: -1.7E - 308 - +1.7E + 308
1	Any (recommended: measurement coordinate Y (n - 1))	P [a + n - 1] (2)	
2	Any (recommended: measurement angle TH (n - 1))	R [a + n - 1]	Real number: ±3.4E - 38 - ±3.4E + 38
3	Any (recommended: judgment value JG (n - 1) × correlation value CR (n - 1))	I [a + n - 1]	Integer: -32, 768 - 32, 767

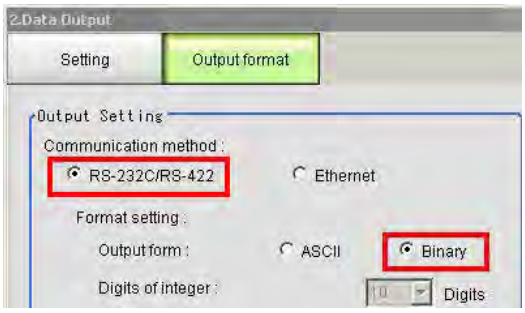
The storage destination variable number's [a] is set in the vision condition file.

NOTE

- No. 0 to 3 must all be set. Do not set No. 4 to 7.
- If the value set for No. 3 is a positive value, the corresponding bit for storage destination variable B [a] becomes 1.
- If the value set for No. 3 is a negative value, the corresponding bit for storage destination variable B [a] becomes 0,and then the value converted to a positive number is stored to I [a].

→ For details, refer to the usage examples in *Section 4.1.1 “Usage Example” on page 4-2*.

6. Select the {Output format} tab, and select {RS-232C/RS-422} for {Communication method} and {Binary} in {Format setting}.

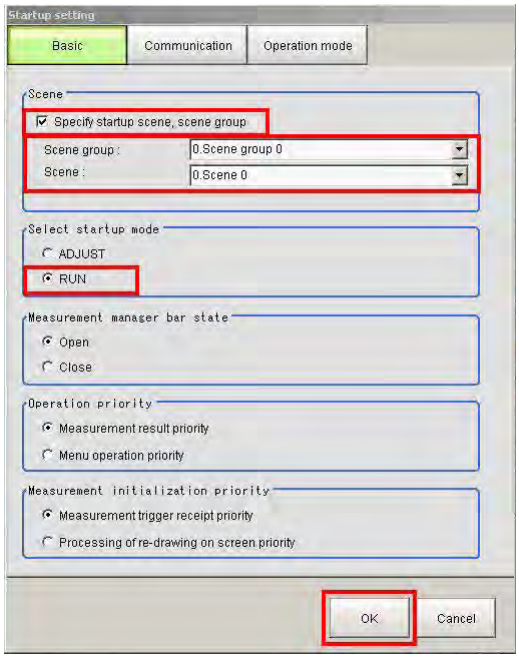


7. Return to the adjustment window, click {Data save}, and then click {Yes}.

2.2.1.3 Settings During Operation

Perform settings for automatic operation following powering up.

1. On the adjustment window, select {System} → {Controller} → {Startup setting}.
2. Select the {Basic} tab, and change {Select startup mode} to {RUN}.
3. To startup with a specific detection scene and scene group, check {Specify startup scene, scene group} in {Scene}, and then select a scene group and scene.
4. Click {OK}.



5. On the adjustment window, click {Data save}, and then click {Yes}.

SUPPLE-MENT If a startup scene is not set, the scene that was open when {Data save} was clicked will be used for startup.

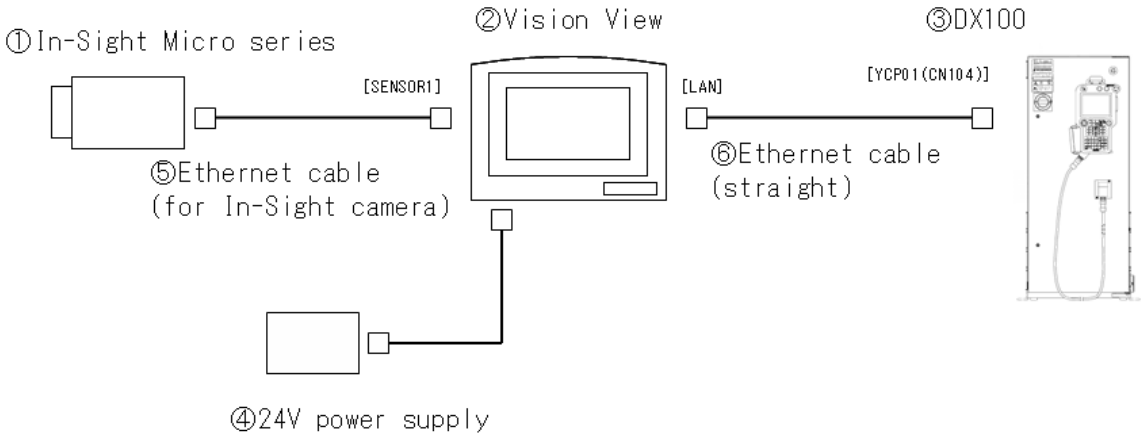
2.2.2 COGNEX In-Sight Telnet (Ethernet)

A basic system configuration example for the DX100 vision function (In-Sight) is shown below.

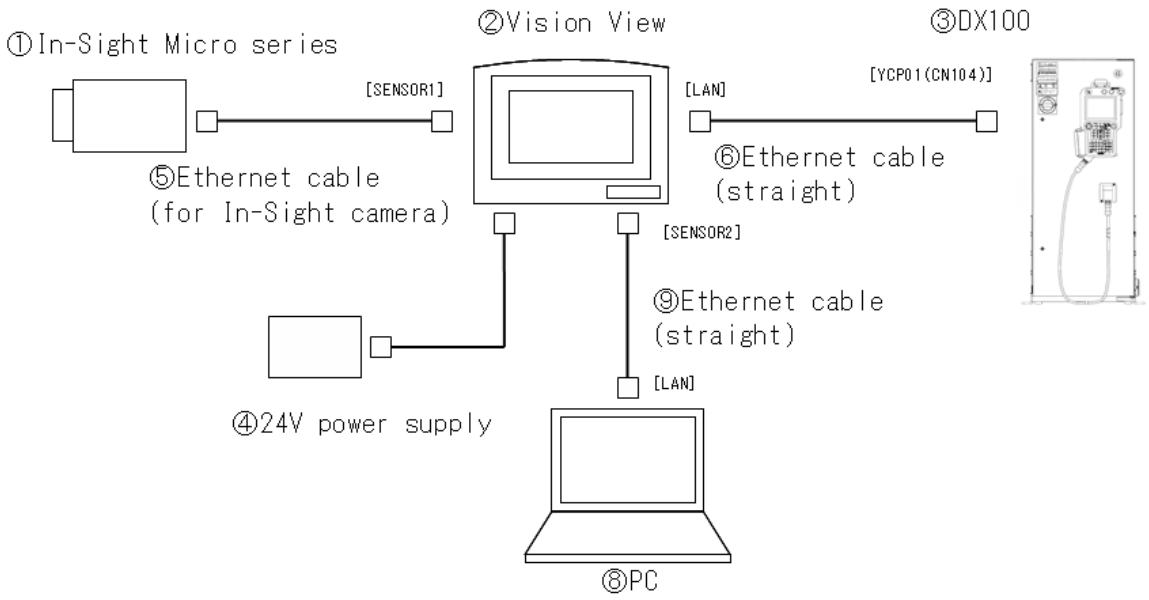
NOTE The below shows the In-Sight Micro series as an example.

No.	Required device	No. of items
①	In-Sight/In-Sight Micro series	1
②	Vision View	1
③	DX100	1
④	24V power supply unit	1
⑤	In-Sight proprietary Ethernet cable	1
⑥	Ethernet cable (straight)/for PC connection	1
⑦	In-Sight proprietary power cable (For In-Sight 5000 series only)	1
⑧	PC with In-Sight Explorer installed	1
⑨	Ethernet cable (straight)/for PC connection	1

(1) During system operation



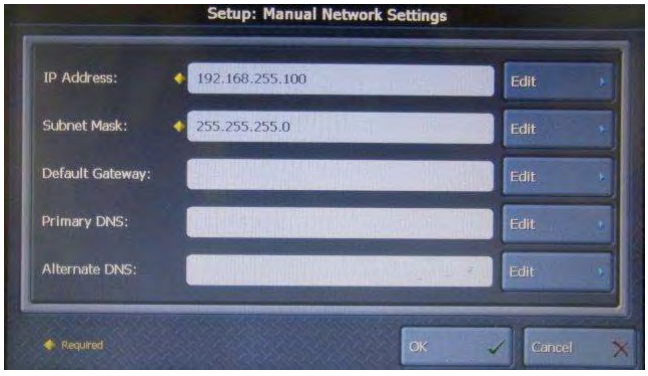
(2) During setup



2.2.2.1 VisionView Settings

Perform these settings to use VisionView.

1. On the interface window click {Options} and select {VIsionView Setup}.
2. Click {Settings}, and select {Network Settings}.
3. Click {Set IP Address Manually}, and select {Edit Settings}.
4. Click {Edit}, and set the IP address and subnet mask.
5. Select {OK}.



Setting item	Setting value
IP address	192.168.255.100 (Recommended)
Subnet mask	255.255.255. 0

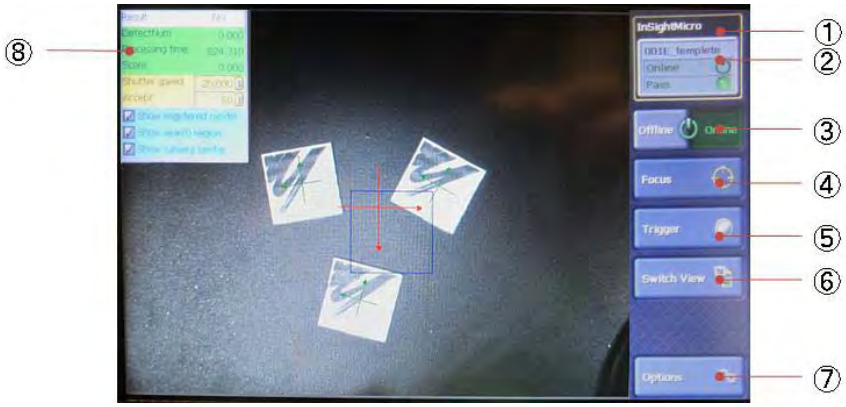
NOTE Set different addresses on the same network for the PC, Vision View, the robot controller, and In-Sight.

6. On the interface window click {Options} and select {VIsionView Setup}.
7. Select {Manually Select Sensors}.

8. Select the In-Sight connected to a detected sensor, and then select {Add}.
9. Line up the cursor with the In-Sight to use, and then select {OK}.

SUPPLE-MENT If a sensor is not detected, set up the system first.

<Explanation of Interface>



① Displays the currently opened job name.
② Displays the current status.
③ Switches between Online and Offline. To perform communication, set to Online.
④ {Focus}: Displays the live image. Use when setting the lens focus and exposure.
⑤ {Trigger}: Performs image reading and detection processing.
⑥ {Switch View}: Switches between the image display, image + detection result display, and image + detection result + custom view display.
⑦ {Options}: Change Vision View settings and switch/save jobs.
⑧ {Custom View}: The interface that is set for the camera job. Simple vision adjustments, such as recognition thresholds, can be performed.

2.2.2.2 System Settings

Perform settings on the vision system only after returning its settings to the default factory values.

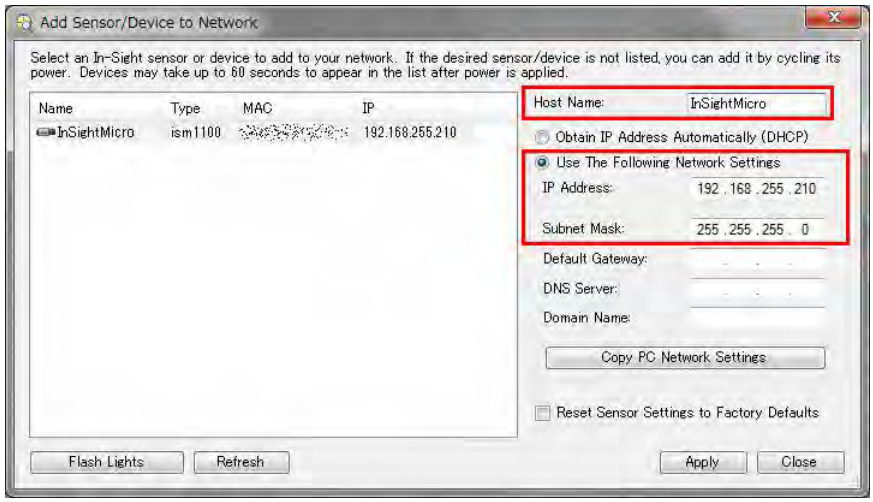
NOTE

- Vision function camera jobs used for the vision function (In-Sight) are made using the following firmware version. If the camera's version is lower than the version below, camera jobs may not be read correctly.

In-Sight firmware version	4.05.00

- The Windows application "In-Sight Explorer" by Cognex is used to set up the vision function (In-Sight). Download the Cognex In-Sight Software 4.5.0.exe from the Cognex web site, and install it onto the PC.

1. Start In-Sight Explorer on the PC. From the menu bar, select {System}, and then select {Add Sensor/Device to Network}.
2. Select a connected In-Sight, and perform the settings as follows in the right side of the window.



Setting item	Setting value
Host name	InSightMicro
IP address	192.168.255.210
Subnet mask	255.255.255. 0

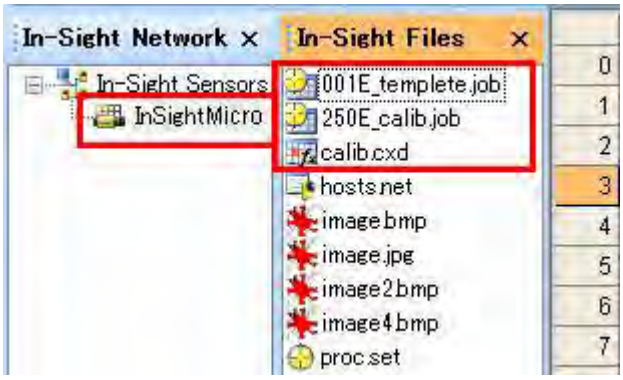
3. Click {Apply} to set the sensor and restart it.

- If a connected In-Sight is not displayed in the list, click {Refresh} to refresh the list display.
- To perform changes for a sensor that has already been set, select the sensor's name in the In-Sight Network window, and then change the settings from {Sensor} - {Network Settings} on the menu bar.
- After changing a sensor's IP address change the PC's IP address so that it is on the same network as the sensor."

SUPPLE-MENT

Device	IP address (ex.)
In-Sight	192.168.255.210
DX100	192.168.255.211
PC	192.168.255.212
VisionView	192.168.255.100

4. In the [In-Sight Network] window, double-click the host name of the In-Sight to use, log ON, and open the spreadsheet.
5. From the PC's Explorer window, drag-and-drop the required camera jobs into the {In-Sight Files} window.



<To perform calibration using In-Sight>

File type	File name
Detection job (for calibration)	001_templete.job
Job for calibration	250_calib.job
Calibration data file	calib.cxd

<To perform calibration using the robot controller>

File type	File name
Detection job (no calibration)	002_without_calib.job

NOTE The calibration data file has temporary value already entered. Be sure to perform calibration to refresh the data.

SUPPLE-MENT

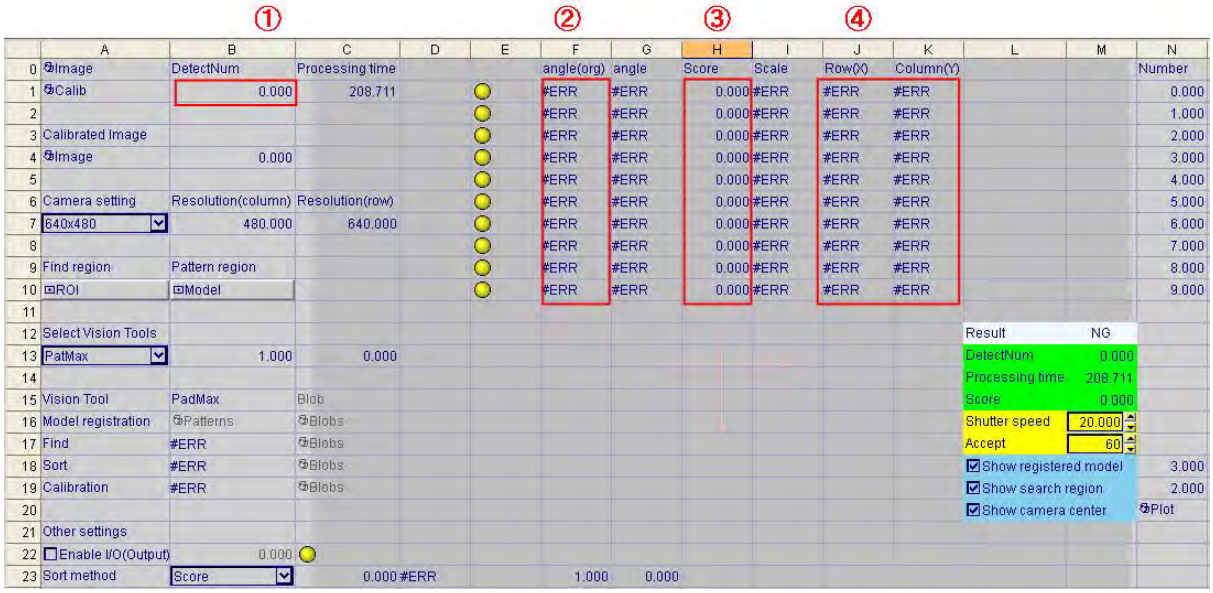
- If the window shows Easy Builder, in the {In-Sight Network} window, right-click the host name of the In-Sight to use, and then select {View}→{Show Spreadsheet View} to open the spreadsheet.
- If the {In-Sight Files} tab is not displayed, enable {In-Sight Files} from {View} on the menu bar.

6. From the menu bar, select {Sensor} → {Startup}.
7. Check the box for {Online}, and in {Job}, select the job to open when the power is turned ON, and then click {OK}.

2.2.2.3 Camera Job Specifications

A proprietary camera job is used for communication between the robot controller and In-Sight. Other jobs, and jobs created in EasyBuilder may not be correctly transmitted to the robot.

When vision system receives a command from the robot controller, the data in the cells of the spreadsheet are overwritten. The position of the cells that are referenced during writing are as follows.



① Cell B1, "DetectNum": Displays the number of workpieces detected in 1 trigger. A maximum of 10 items can be detected.
→ Variable B (default setting: B090)

② Cells F1 to F10 "angle(org)": Displays the amount of offset angle for the detected workpiece against the registered model.
→ Variable R (default setting: R090 to 099)

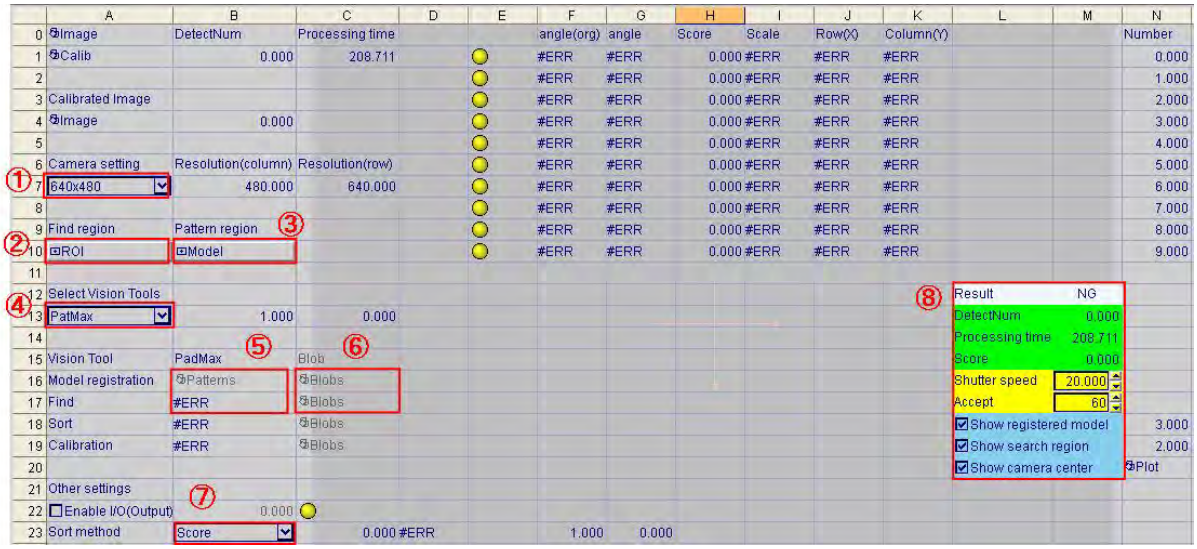
③ Cells H1 to H10 "Score": Displays the score (correlation value) for the detected workpiece against the registered model.
→ Variable I (default setting: I090 to 099)

④ Cells J1 to J10/K1 to K10 "Row(X)"/"Column(Y)": Displays the position (X, Y) of the detected workpiece. If calibration is performed for In-Sight, X and Y correspond to the user's input coordinates. Without calibration, the camera's pixel coordinates are output.
→ Variable P (default setting: P110 to 119)

The storage destination variable number's [a] is set in the vision condition file.

NOTE Do not change the referenced cells during writing. Communication may not be performed correctly.

<Detection job setting items>



① Cell A7 "Camera setting": Specifies the resolution used by the camera. Be sure to match this resolution before performing the setup.
→ Setting values: {640 × 480} (default)/{1024 × 768}/{1600 × 1200}

② Cell A10 "Find region": Specifies the region used for detection within the read image. A mask can also be used when setting the region.

③ Cell B10 "Pattern region": Specifies the region for models that used PatMax detection. The characteristics for within the region are registered for the model. A mask can also be used when setting the region.

④ Cell A13 "Select Vision Tools": Selects the method to detect the workpiece.
→ Setting values: {PatMax} (default)/{Blob}

⑤ Cells B16 to 17 "Model registration"/"Find": Sets PatMax workpiece detection settings.

⑥ Cells C16 to 17 "Model registration"/"Find": Sets Blob analysis workpiece detection settings.

⑦ Cell B23 "Sort method": Selects the sort setting for detected data.
→ Setting value: Score (default)/X/Y/Distance

⑧ Cells L12 to M20 "Custom review settings": Specifies the custom view that can be operated by VisionView. The following items can be adjusted.

(1) "Shutter speed": Sets the camera's shutter speed. The greater this value, the brighter the image will be.

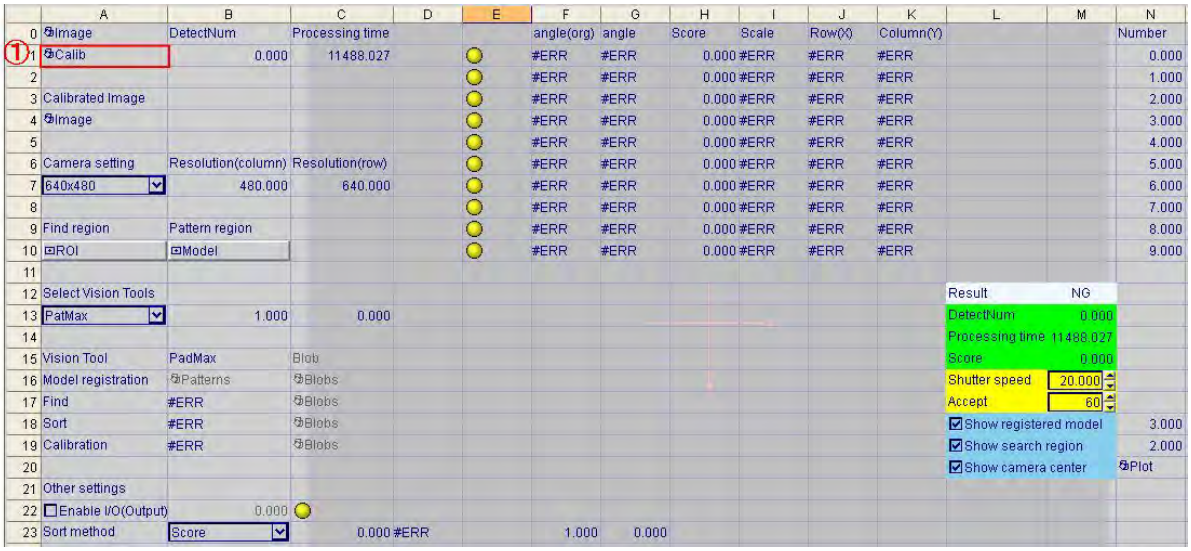
(2) "Accept": Sets the threshold value for detecting models. Only workpieces whose score is larger than this value will be detected. Reducing this value will increase the number of workpieces detected, but also increases the possibility of detection errors.

(3) "Show registered model": Checking this item will display lines that correspond to the characteristics of the registered workpiece model.

(4) "Show search region": Checking this item will display the ROI range set in (2).

(5) "Show camera center": Checking this item will display a crosshairs in the center of the window.

<Calibration job setting items>



① Cell A1 "Calib": Performs calibration. The detection job reads the calibration data saved in the camera, which is shown into this cell.

NOTE

- The file created during calibration called "calib.cxd" is set to be shared and used with all detection jobs. Before using, be sure to perform calibration, which will overwrite the data in this file.
- If the above file is not found in the camera, an error will occur, and detection may not be performed normally. Do not change the file name or delete the file.

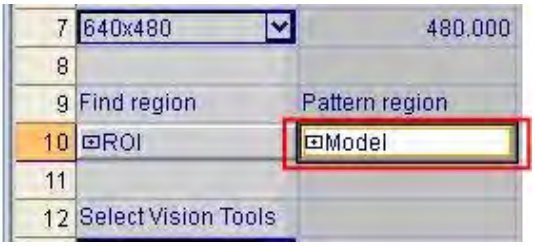
2.2.2.4 Object Type Settings

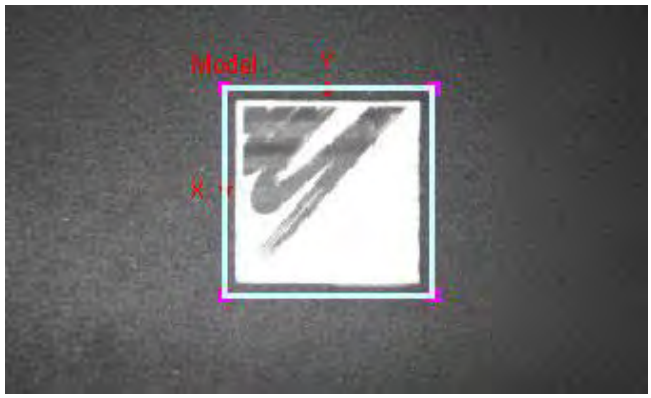
1. Start In-Sight Explorer on the PC.
2. In the {In-Sight Network} window, double-click the host name of the In-Sight to use and log ON.
3. Copy the existing camera job to the PC and modify the file name to {[registering object type (using 3-digit single-byte letters)]_[any character string]}". Then, copy it to the In-Sight.

NOTE

- The initial 3-digit number is the controller's detection model number.
- Do not create files with the same detection model number.
- It is recommended that the file name contains only single-byte letters and numbers.
- The In-Sight vision system requires at least 10 seconds to switch between camera jobs (when performing a calibration using cameras).

4. Open the added job on the {In-Sight Files} window.
5. Place the workpiece in the center of the camera's field-of-view, and then select {Image} → {Trigger} from the menu bar to read the image of the sample workpiece.
6. Select “Model” in cell B10 to set the part to detect. After setting is complete, double-click within the region to return to the previous window.

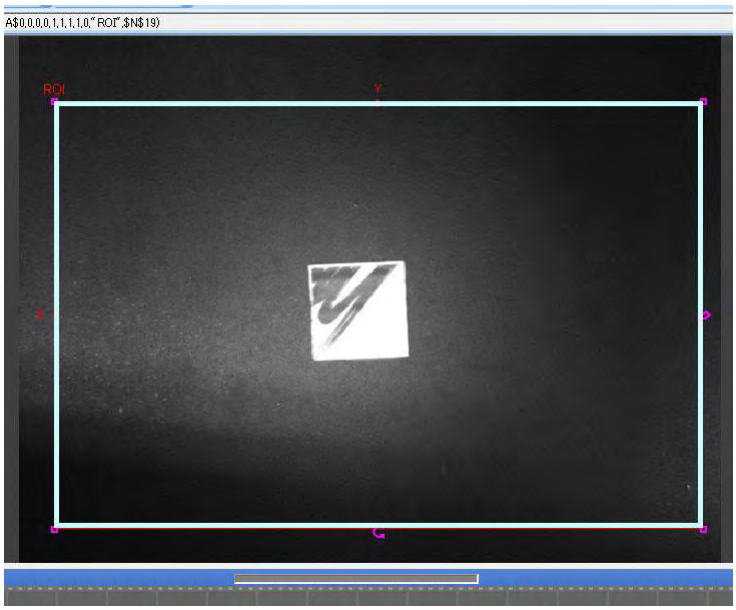




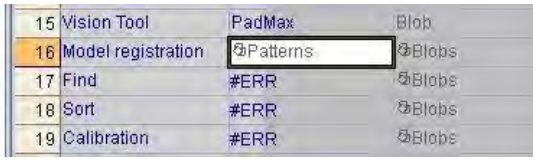
SUPPLE-MENT

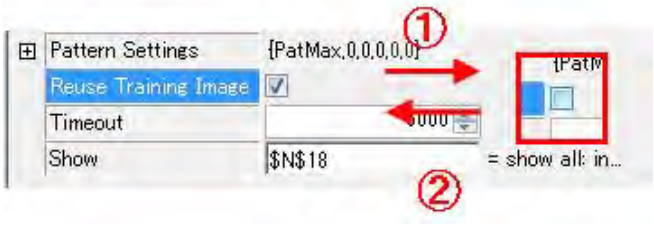
- Register a part within the region that includes as little of the background as possible. Showing too much of the background may cause incorrect detection.
- A mask can be used when setting the region. For details, refer to the In-Sight's help.

7. Select “ROI” in cell A10 to set the detection range. Workpiece detection will only be performed in the set range. After setting is complete, double-click within the region to return to the previous window.

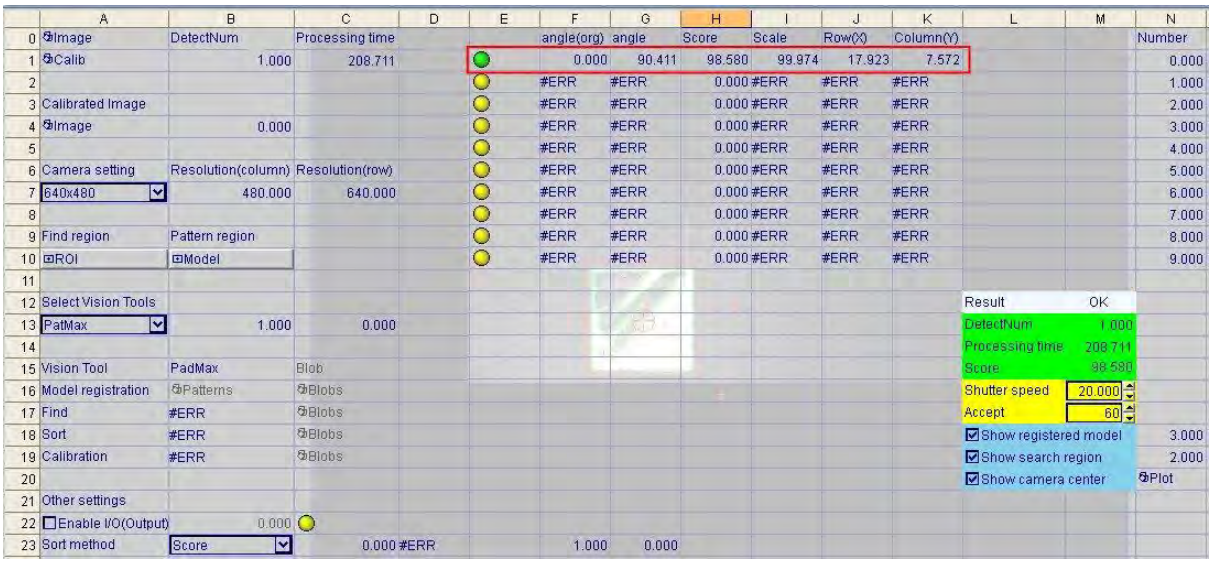


8. Double-click “Patterns” in cell B16 to open the properties sheet, and remove the check next to “Reuse Training Image”. Then, re-check the box, and then click {OK}.





9. Select {Image}→{Trigger} from the menu bar. When the trigger is executed, confirm that the workpiece is detected and that the information in the cells in the first row, such as F1 and G1, are refreshed with the workpiece's information.



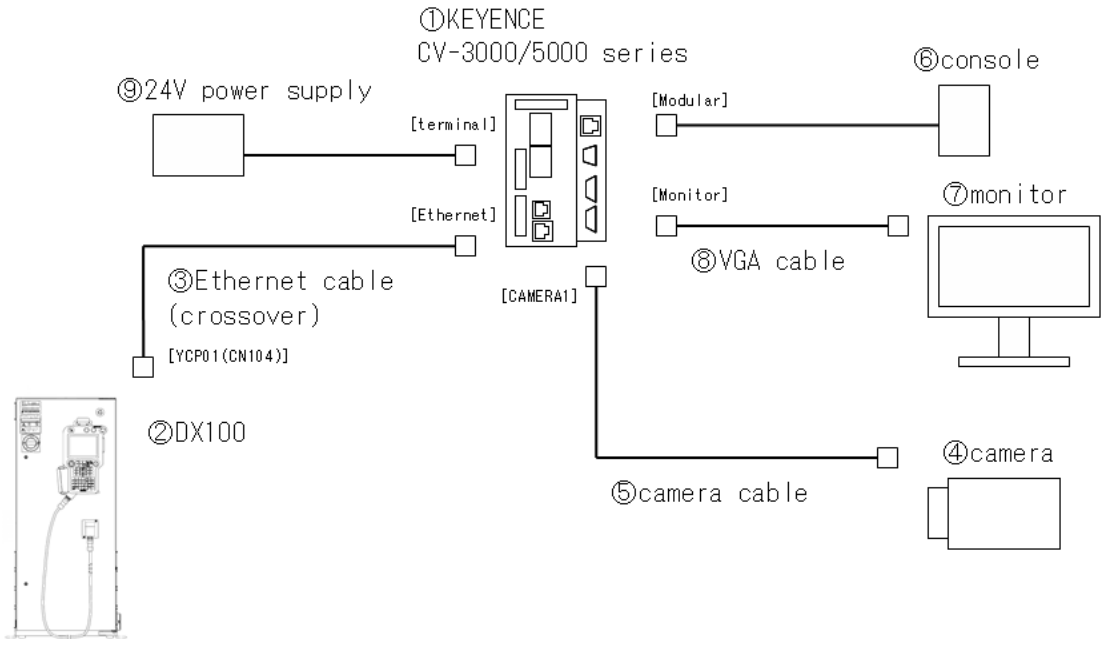
10. Select {File} → {Save Job} from the menu bar to save the job.

NOTE If another job is opened or In-Sight Explorer is closed before saving, any changes that were made will be lost.

2.2.3 KEYENCE CV Serial Communication (Ethernet)

An example of the basic system configuration for KEYENCE CV serial communication (Ethernet) for the DX100 vision function is shown below.

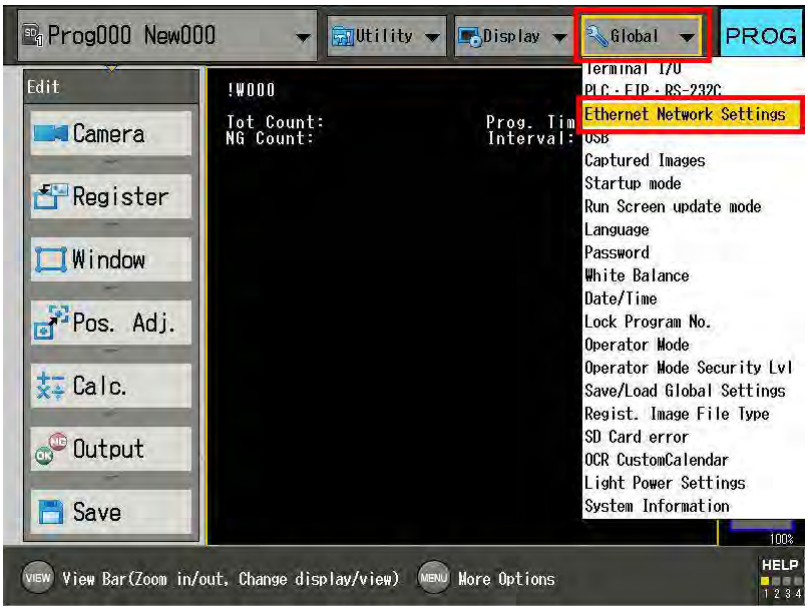
No.	Required device	No. of items
①	KEYENCE CV-3000/5000 series	1
②	DX100	1
③	Ethernet cable (cross)	1
④	CV-035M (camera for CV-3000)	1
⑤	CA-CN3 (camera cable for CV-3000)	1
⑥	Console (included with CV-3000)	1
⑦	Monitor	1
⑧	RGB image output cable	1
⑨	24V power source	1



2.2.3.1 System Settings

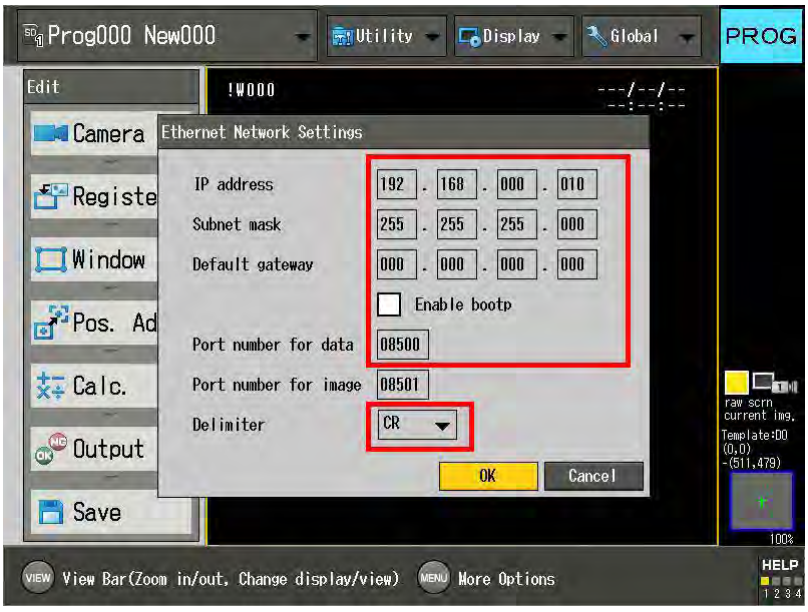
Perform settings on the vision system only after returning its settings to the default factory values.

1. If on the {RUN} window, switch to the {PROG} window using the console's {RUN/STOP} slider.
2. Select {Global} → {Ethernet Network Settings}.



3. Set the {Ethernet Network Settings} as shown below.

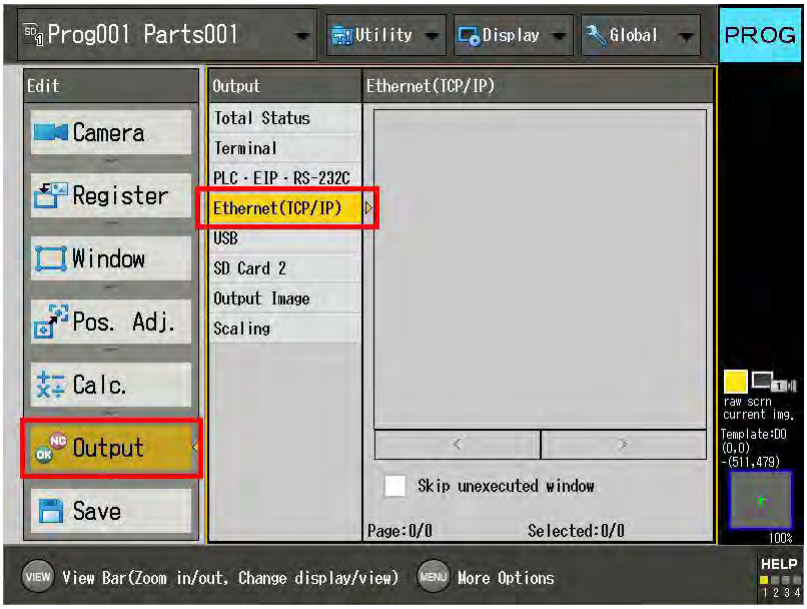
Setting item	Setting value
IP address	192.168.000.010 (system default value)
Subnet mask	255.255.255.000 (system default value)
Default gateway	000.000.000.000 (system default value)
Enable BOOTP	Unchecked (system default value)
Port number for data	08500 (system default value)
Delimiter	CR (system default value)



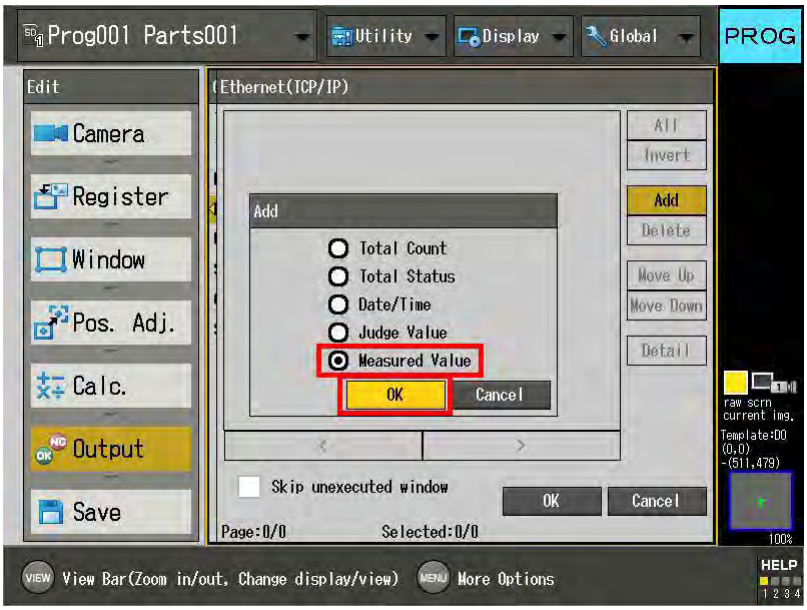
4. Select {OK} to return to the previous window.
5. Press the {FUNCTION} button on the console to open the {Function}. Select {Execute} for {Save settings}, and then {OK} to save the settings.

2.2.3.2 Object Type Settings

1. If on the {RUN} window, switch to the {PROG} window using the console's {RUN/STOP} slider.
2. Select {PROGXXX (number of the object type opened)}, which will load the object type's settings so that settings can be performed.
3. Create detection settings.
4. In the {Edit} column, open {Output} → {Ethernet (TCP/IP)}.

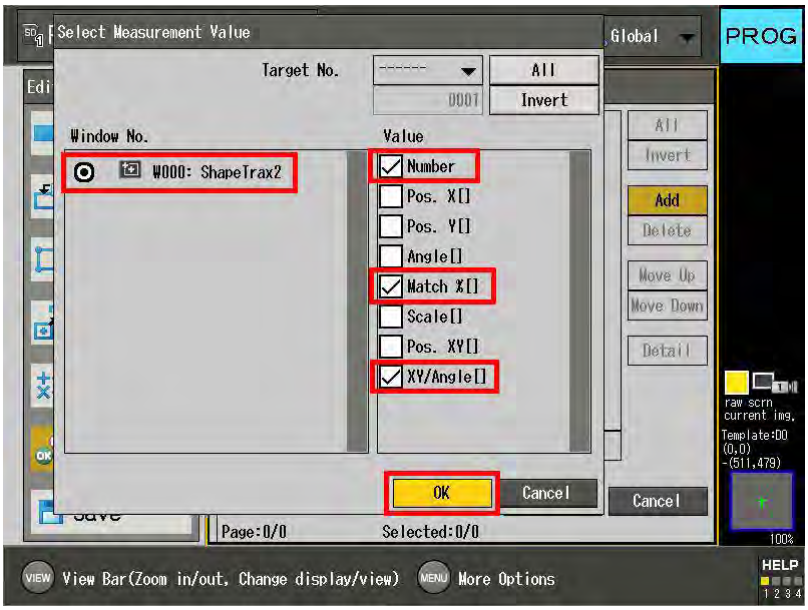


5. Select {Add} → {Measured Value}, and then select {OK}.

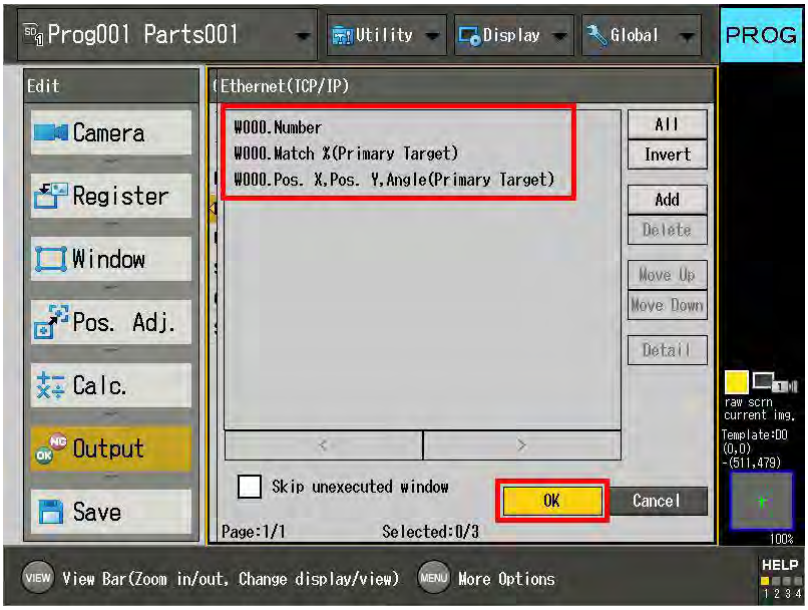


6. Select the number of the window to output in {Window No.}.
In {Value}, check the boxes for {Number}, {Match %}, and {XY/Angle}, and then select {OK}.

SUPPLE-MENT The window below shows "ShapeTrax2" as an example.



7. Check that the output order for {Ethernet (TCP/IP)} is {Number}, {Match %}, and {Pos. X,Pos.Y,Angle}, and then select {OK}.



The five following data items can be output in 1 window. Set all five for each window.

No.	Setting data	DX100 storage destination variable	Settable data range
0	Any (recommended: detection number)	B [a + 0]	Integer: 0 to 255
1	Any (recommended: correlation value)	I [a + 0]	Integer: -32, 768 - 32, 767
2	Any (recommended: X position)	P [a + 0] (1)	Real number: ±1.7E - 308 - +1.7E + 308
3	Any (recommended: Y position)	P [a + 0] (2)	
4	Any (recommended: angle)	R [a + 0]	Real number: ±3.4E - 38 - ±3.4E + 38

SUPPLE-MENT

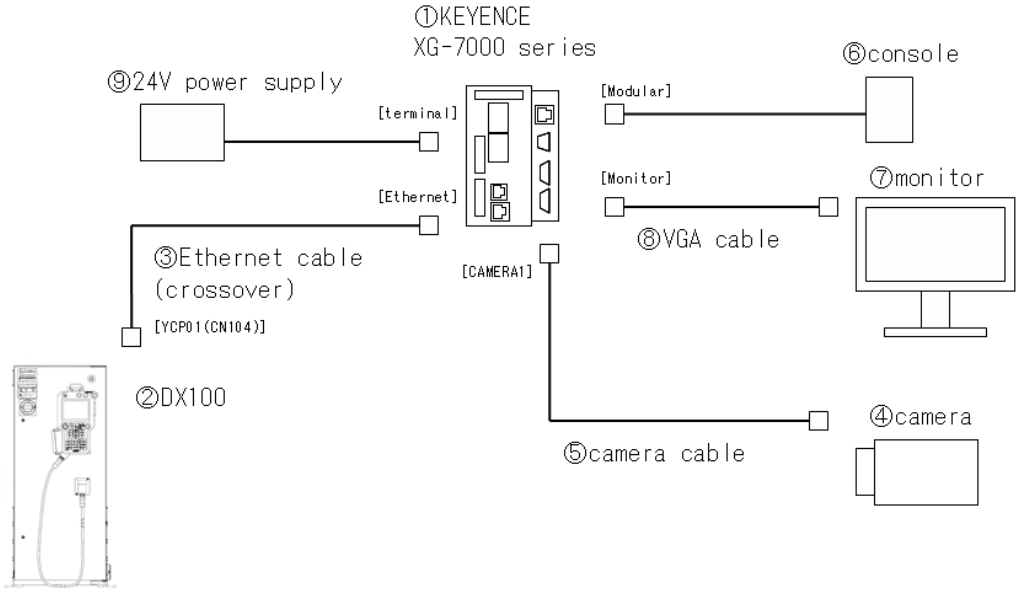
The storage destination variable number's [a] is set in the vision condition file.

8. In the {Edit} column, select {Save} and then {OK} to save the settings.

2.2.4 KEYENCE XG Serial Communication (Ethernet)

An example of the basic system configuration for KEYENCE XG serial communication (Ethernet) for the DX100 vision function is shown below.

No.	Required device	No. of items
①	KEYENCE XG-7000 series	1
②	DX100	1
③	Ethernet cable (cross)	1
④	XG-035M (camera for XG-7000)	1
⑤	CA-CN3 (camera cable for XG-7000)	1
⑥	OP-84231 (Console for XG-7000)	1
⑦	Monitor	1
⑧	RGB image output cable	1
⑨	24V power source	1

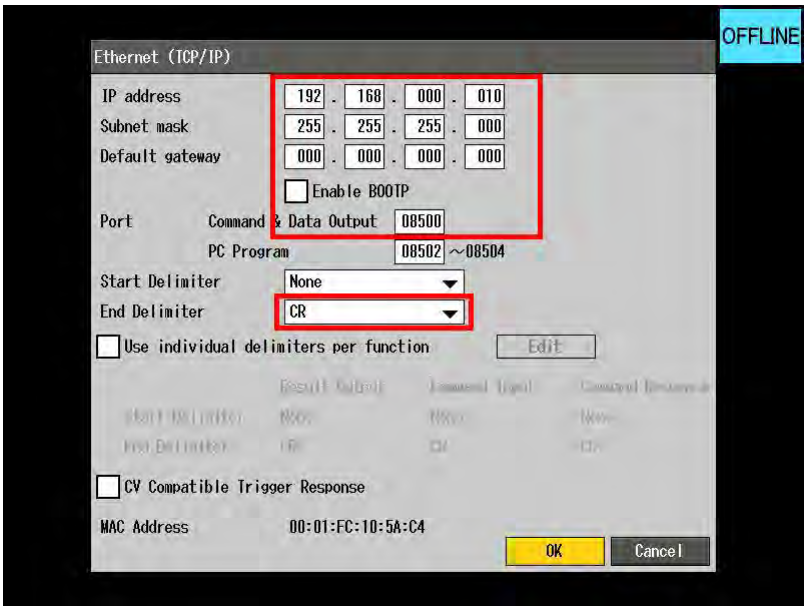


2.2.4.1 System Settings

Perform settings on the vision system only after returning its settings to the default factory values.

1. Select {Function} → {Go Offline}.
2. Select {System Configuration} → {Communications & I/O} → {Ethernet (TCP/IP)}.
3. Set the {Ethernet (TCP/IP)} as shown below.

Setting item	Setting value
IP address	192.168.000.010 (system default value)
Subnet mask	255.255.255.000 (system default value)
Default gateway	000.000.000.000 (system default value)
Enable BOOTP	Unchecked (system default value)
Port Command & Data Output	08500 (system default value)
Delimiter	CR (system default value)

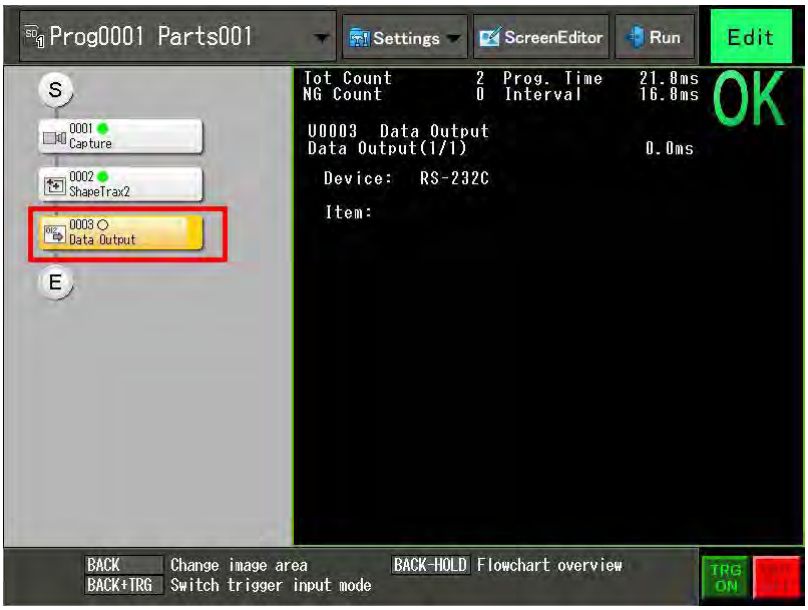


4. Select {OK} to return to the {System Configuration}.
5. Select {Go Online} → {Function} → {Save settings} to save the settings.

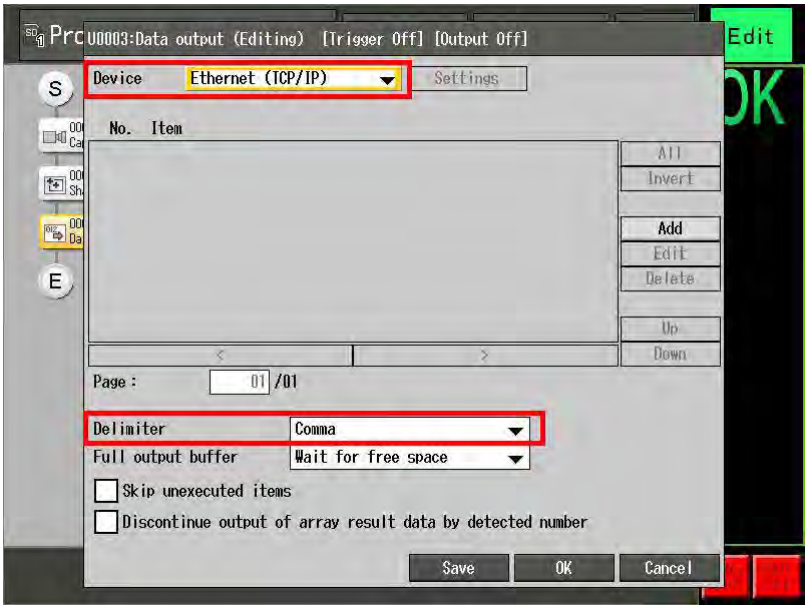
2.2.4.2 Setting the Inspection Test Number

Set the following for each inspection setting number.

1. Add 1 result output unit to the flow.



2. Select {Ethernet (TCP/IP)} for {Device}.
3. Select {Comma} for {Delimiter}.



4. Set the output data in {Item} in the following order.

The relationships between the output data and the variable's storage locations are as follows.

① Required data

No.	Expression	DX100 storage destination variable	Settable data range
0	Any (recommended: detection number)	B [a + 0]	Integer: 0 to 255
1	Any (recommended: correlation value 0)	I [a + 0]	Integer: -32, 768 - 32, 767
2	Any (recommended: X0 position)	P [a + 0] (1)	Real number: -1.7E - 308 - +1.7E + 308
3	Any (recommended: Y0 position)	P [a + 0] (2)	
4	Any (recommended: angle 0)	R [a + 0]	Real number: -3.4E - 38 - ±3.4E + 38

The [a] of the variable numbers are set in the "Vision condition file" which can be set using the programming pendant.

② Added data

No.	Expression	DX100 storage destination variable	Settable data range
5	Any (recommended: correlation value 1)	I [a + 1]	Integer: -32, 768 - 32, 767
6	Any (recommended: X1 position)	P [a + 1] (1)	Real number: -1.7E - 308 - +1.7E + 308
7	Any (recommended: Y1 position)	P [a + 1] (2)	
8	Any (recommended: angle 1)	R [a + 1]	Real number: -3.4E - 38 - ±3.4E + 38
…	…	…	…
4n + 1	Any (recommended: correlation value n)	I [a + n]	Integer: -32, 768 - 32, 767
4n + 2	Any (recommended: Xn position)	P [a + n] (1)	Real number: -1.7E - 308 - +1.7E + 308
4n + 3	Any (recommended: Yn position)	P [a + n] (2)	
4n + 4	Any (recommended: angle n)	P [a + n]	Real number: -3.4E - 38 - ±3.4E + 38

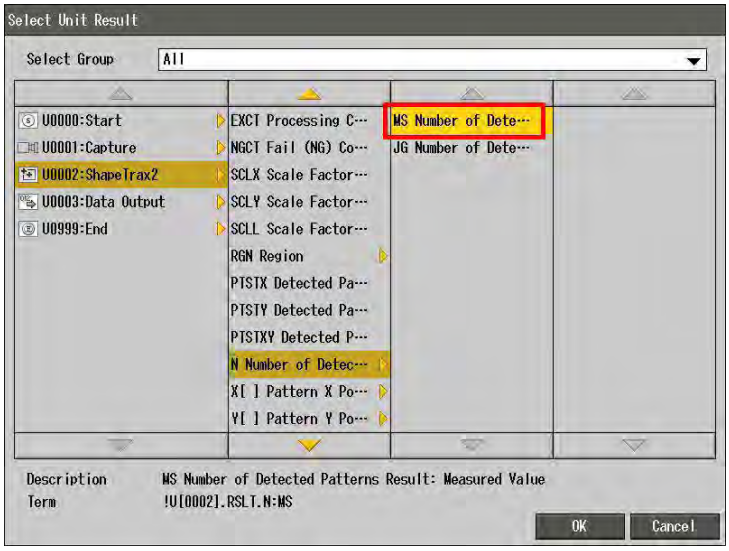
Setting is possible up to n=19 (equals detection results for 20 workpieces). When adding, be sure to add one workpiece (with 4 data items) at a time.

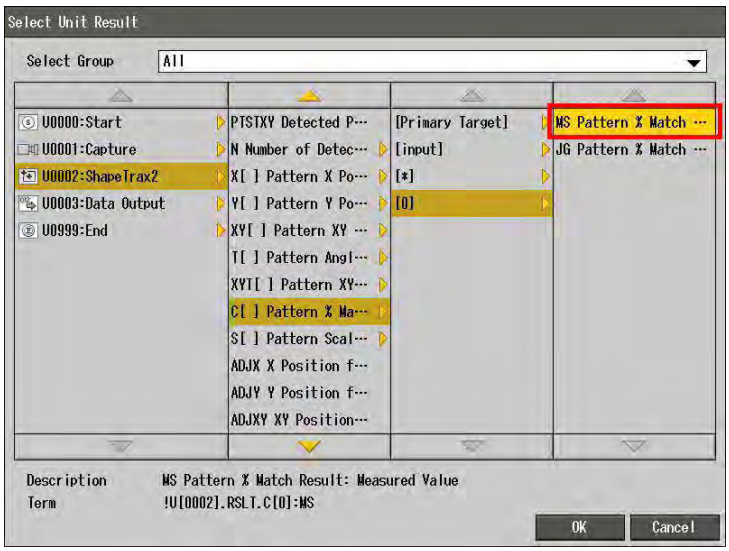
SUPPLE-MENT

- The output settings for the results of "ShapeTrax2" are shown as an example.

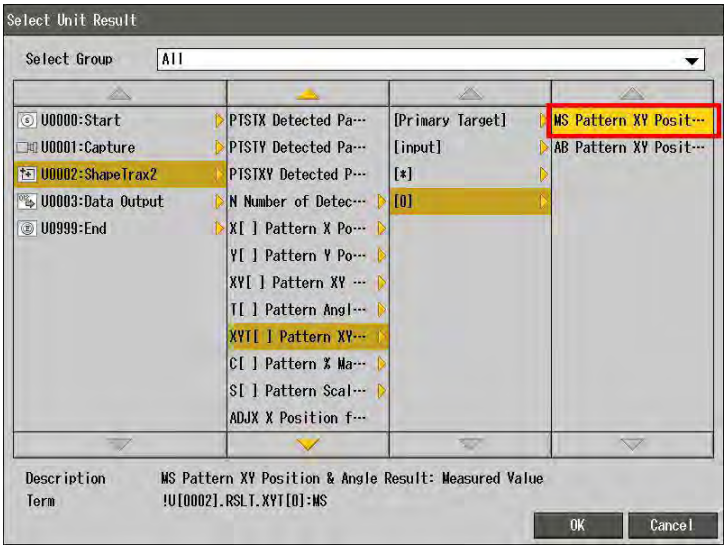
① Required data: perform the following settings.

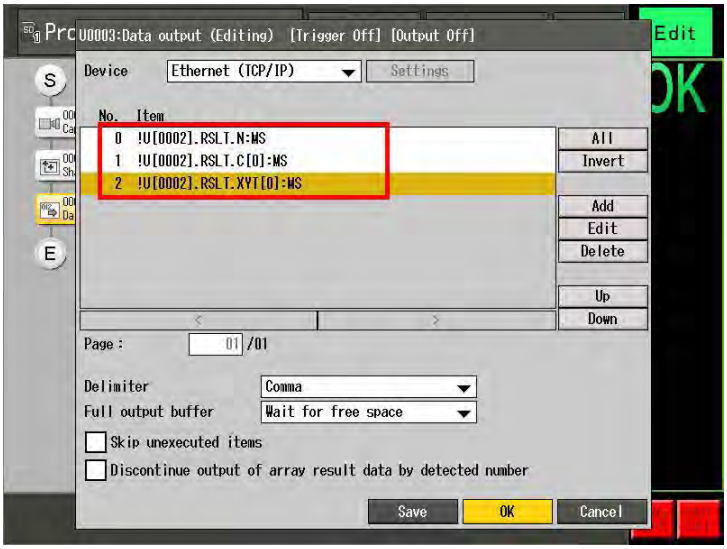
No.	Expression		Remarks
0	RSLT. N: MS		Number of detections
1	RSLT. C [0]		Workpiece 0: Correlation value
2	RSLT. X [0]: MS	*The below format is also permitted RSLT. XYT [0]: MS	Workpiece 0: X coordinate
3	RSLT. Y [0]: MS		Workpiece 0: Y coordinate
4	RSLT. T [0]: MS		Workpiece 0: Rotation offset amount





SUPPLE-MENT





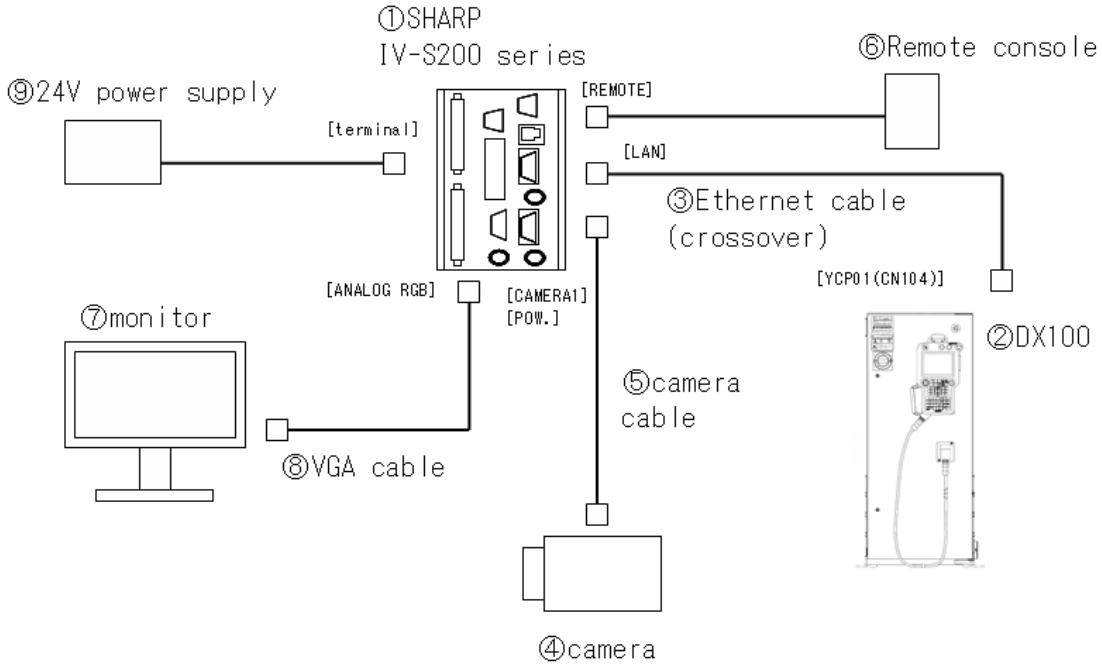
② Added data: perform the following settings when 2 or more workpieces are to be detected.

No.	Expression		Remarks
5	RSLT. C [1]		Workpiece 1: Correlation value
6	RSLT. X [1]: MS	*The below format is also permitted RSLT. XYT [1]: MS	Workpiece 1: X coordinate
7	RSLT. Y [1]: MS		Workpiece 1: Y coordinate
8	RSLT. T [1]: MS		Workpiece 1: Rotation offset amount
…	…		…
4n + 1	RSLT. C [n]		Workpiece n: Correlation value
4n + 2	RSLT. X [n]: MS	*The below format is also permitted RSLT. XYT [n]: MS	Workpiece n: X coordinate
4n + 3	RSLT. Y [n]: MS		Workpiece n: Y coordinate
4n + 4	RSLT. T [n]: MS		Workpiece n: Rotation offset amount

2.2.5 SHARP IV-S200 Serial Communication (Ethernet)

An example of the basic system configuration for SHARP IV-S200 serial communication (Ethernet) for the DX100 vision function is shown below.

No.	Required device	No. of items
①	SHARP IV-S200 series	1
②	DX100	1
③	Ethernet cable (cross)	1
④	IV-S200C6 (camera for IV-S200)	1
⑤	IV-S200K3 (camera cable for IV-S200)	1
⑥	IV-S200RK (Remote setting key for IV-S200RK)	1
⑦	Monitor	1
⑧	RGB image output cable	1
⑨	24V power source	1

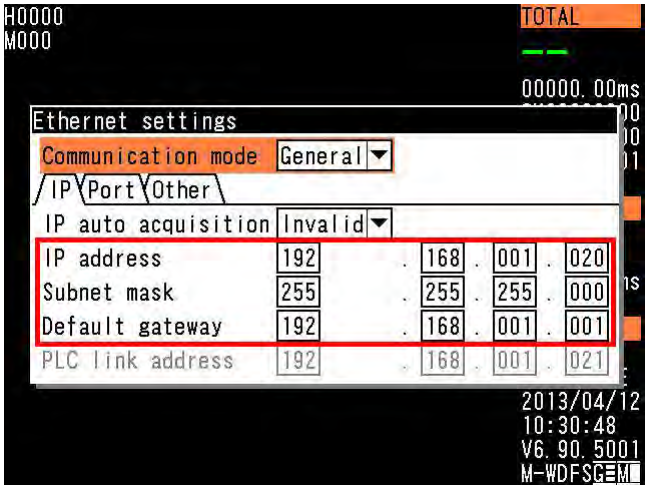


2.2.5.1 System Settings

Perform settings on the vision system only after returning its settings to the default factory values.

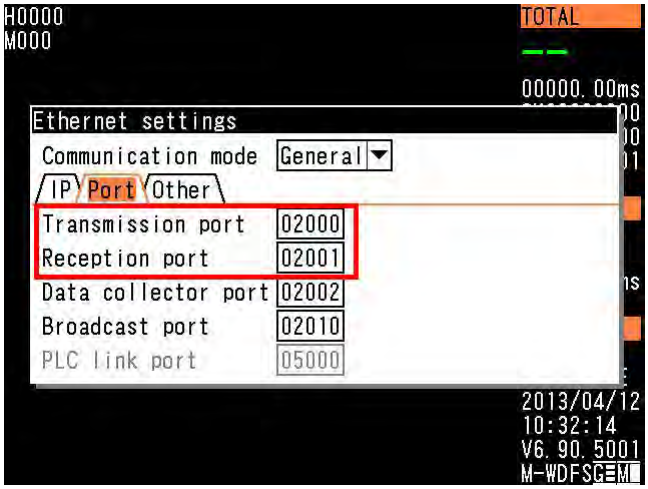
1. Press [MODE] button of the remote setting key to open the mode switching window, and then select {Settings}.
2. Press [SET] button of the remote setting key, and then in the settings window, select {System settings} → {Ethernet settings}.
3. Set the following in the {IP} tab.

Setting item	Setting value
IP Address	192.168.001.020 (system default value)
Subnet mask	255.255.255.000 (system default value)
Default gateway	192.168.001.001 (system default value)



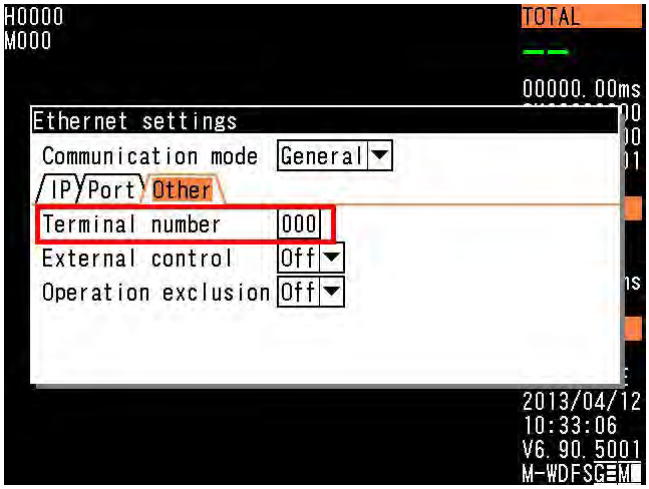
4. Set the following in the {Port} tab.

Setting item	Setting value
Transmission port	2000 (system default value)
Reception port	2001 (system default value)



5. Set the following in the {Other} tab.

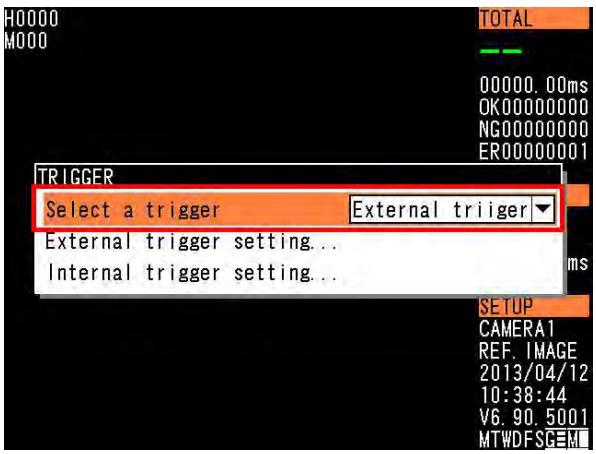
Setting item	Setting value
Terminal number	000 (system default value)



2.2.5.2 Setting the Object Type Setting Number

Perform settings for each object type setting number.

1. Press [SET] button of the remote setting key to open the settings windows, and select {Object type setting} → {Object selection. . . } → {BLOCK0X (select a block)} → {H0XXX (the object type to set)}.
2. Return to {Object type setting}, and then select {Module setting}.
3. Select {M000(trigger)}, set {Select a trigger} to {External trigger}, and then check the box for {Ethernet} in {External trigger setting...}.

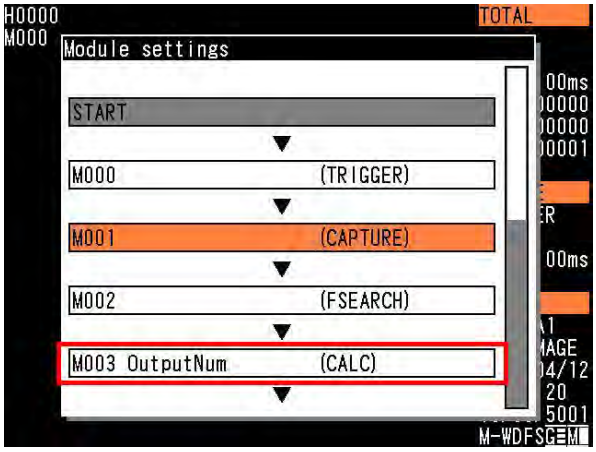


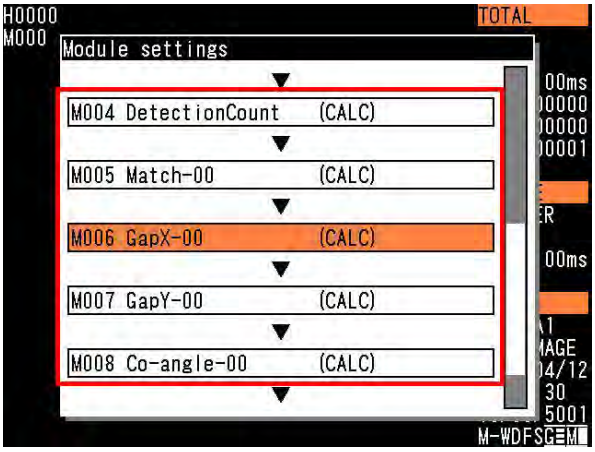
4. Create detection processing.

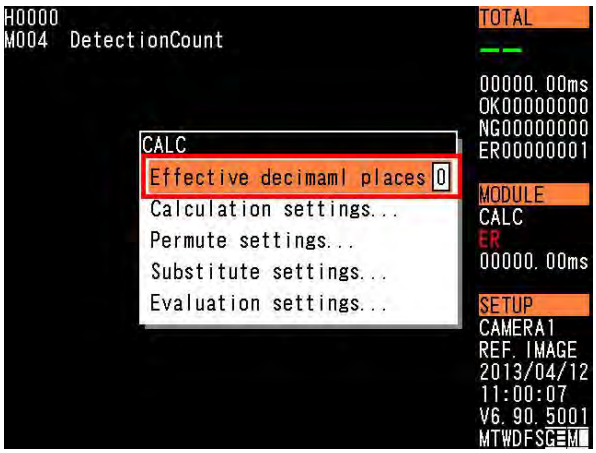
5. On the module selection window, just before {END}, create and select the necessary number of {CALC} units, and then perform the following settings.

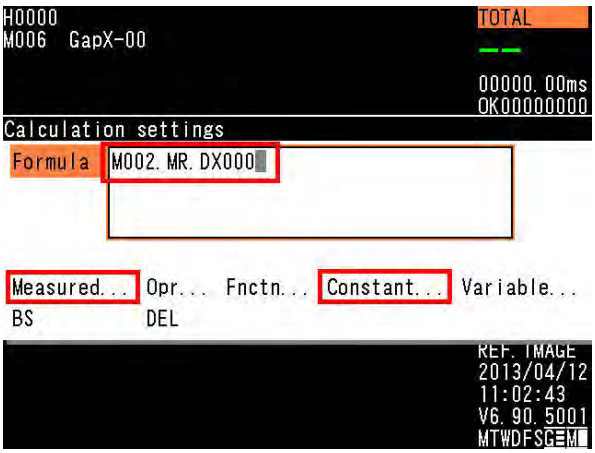
Placement order	**{Calculation setting... } → {Formula}**	**{Effective decimal places}**	**Settable data range**	**DX100 storage destination variable**
1	{Constant. . . } → {N(The same number set for maximum detections in the vision file)}	0	1 to 18	- (No storage destination)
2	Any (recommended: detection number)	0	Integer: 0 to 255	B [a]
	The following are settings for each of the number of units specified in placement order 1.			
3	Any (recommended: matching to workpiece 0)	0	Integer: -32, 768 - 32, 767	I [a]
4	Any (recommended: matching to workpiece 1)	0	Integer: -32, 768 - 32, 767	I [a + 1]
…	…			…
N+2	Any (recommended: matching to workpiece N-1)			I [a + n]
N+3	Any (recommended: offset X workpiece 0)	3	Real number: ±3.4E - 38 - ±3.4E + 38	P [a] (1)
…	…			…
N+3	Any (recommended: offset X workpiece N-1)			P [a] (1)
2N+3	Any (recommended: offset Y workpiece 0)	3	Real number: ±3.4E - 38 - ±3.4E + 38	P [a] (2)
…	…			…
2N+3	Any (recommended: offset Y workpiece N-1)			P [a] (2)
3N+3	Any (recommended: relative angle workpiece 0)	3	Real number: ±1.7E - 308 - ±1.7E + 308	R [a]
…	…			…
4N+2	Any (recommended: relative angle workpiece N-1)			R [a + n]

The storage destination variable number's [a] is set in the vision condition file.









NOTE

The maximum number of detections is 18. Decide the number of labels according to the number of set output items.

As a reference, the output settings for data for frame search for 1 workpiece ①, and 3 workpieces ② are shown below. Variable storage destinations are set to their defaults.

① Data output settings for 1 workpiece

Order	Name	{Effective decimal places}	{Calculation setting... } → {Formula}	DX100 storage destination
1	Number output	0	{Constant}→{1}	- (No storage destination)
2	Number of detections	0	{Measured value}→{(frame search)}→ {Measured value}→{Detection number}	B090
3	Matching to workpiece 0	0	{Measured value}→{(frame search)}→ {Measured value}→{Matching level}→ {Label 0}	I090
4	Offset X workpiece 0	3	{Measured value}→{(frame search)}→ {Measured value}→{X offset}→{Label 0}	P110 (1)
5	Offset Y workpiece 0	3	{Measured value}→{(frame search)}→ {Measured value}→{Y offset}→{Label 0}	P110 (2)
6	Relative angle workpiece 0	3	{Measured value}→{(frame search)}→ {Measured value}→{Relative angle}→ {Label 0}	R090

SUPPLE-MENT

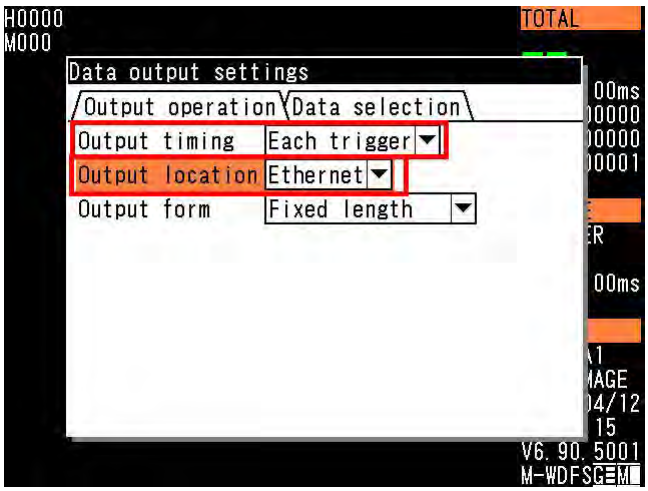
② Data output settings for 3 workpiece

Order	Name	[Effective decimal places]	{Calculation setting... } → {Formula}	DX100 storage destination
1	Number output	0	{Constant}→{10}	- (No storage destination)
2	Number of detections	0	{Measured value}→{(frame search)}→ {Measured value}→{Detection number}	B090
3	Matching to workpiece 0	0	{Measured value}→{(frame search)}→ {Measured value}→{Matching level}→ {Label 0}	I090
4	Matching to workpiece 1	0	{Measured value}→{(frame search)}→ {Measured value}→{Matching level}→ {Label 1}	I091
5	Matching to workpiece 2	0	{Measured value}→{(frame search)}→ {Measured value}→{Matching level}→ {Label 2}	I092
6	Offset X workpiece 0	3	{Measured value}→{(frame search)}→ {Measured value}→{X offset}→{Label 0}	P110 (1)
7	Offset X workpiece 1	3	{Measured value}→{(frame search)}→ {Measured value}→{X offset}→{Label 1}	P111 (1)
8	Offset X workpiece 2	3	{Measured value}→{(frame search)}→ {Measured value}→{X offset}→{Label 2}	P112 (1)
9	Offset Y workpiece 0	3	{Measured value}→{(frame search)}→ {Measured value}→{Y offset}→{Label 0}	P110 (2)
10	Offset Y workpiece 1	3	{Measured value}→{(frame search)}→ {Measured value}→{Y offset}→{Label 1}	P111 (2)
11	Offset Y workpiece 2	3	{Measured value}→{(frame search)}→ {Measured value}→{Y offset}→{Label 2}	P112 (2)
12	Relative angle workpiece 0	3	{Measured value}→{(frame search)}→ {Measured value}→{Relative angle}→ {Label 0}	R090
13	Relative angle workpiece 1	3	{Measured value}→{(frame search)}→ {Measured value}→{Relative angle}→ {Label 1}	R091
14	Relative angle workpiece 2	3	{Measured value}→{(frame search)}→ {Measured value}→{Relative angle}→ {Label 2}	R092

6. Return to {Object type setting}, and then select {Output settings... } → {Data output settings}.

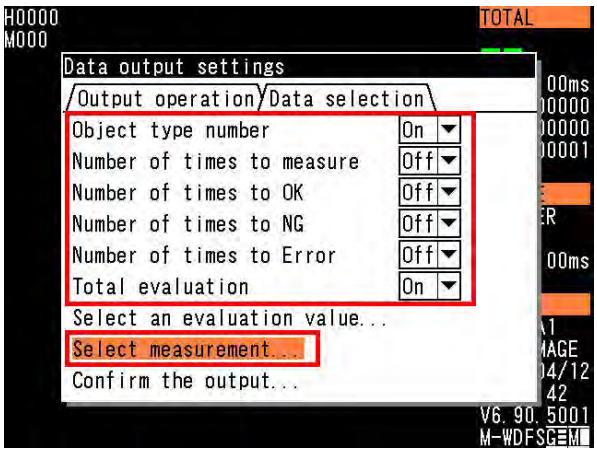
7. Set the following in the {Output operation} tab.

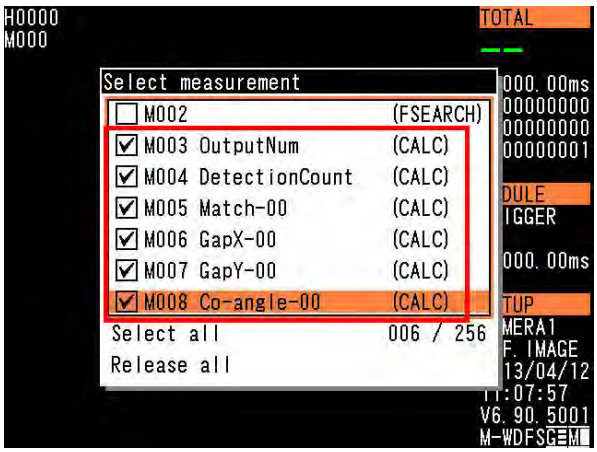
Setting item	Setting value
Output timing	Each trigger
Output location	Ethernet

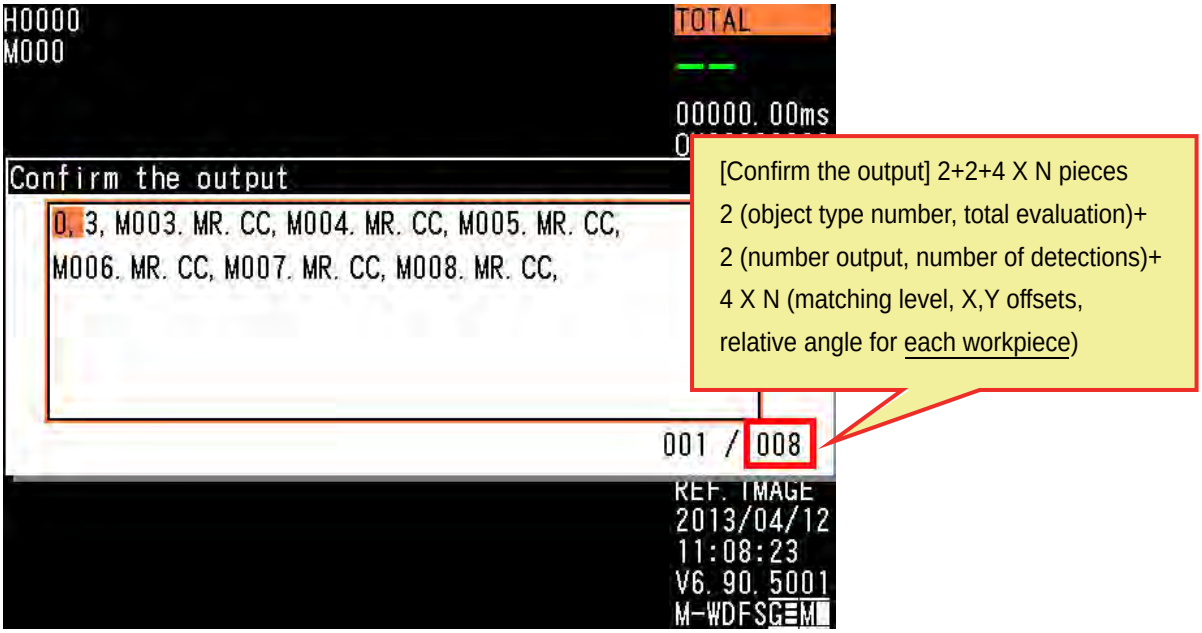


8. Set the following in the {Data selection} tab.

Setting item	Setting value
Object type number	On
Number of times to measure	Off
Number of times to OK	Off
Number of times to NG	Off
Number of times to Error	Off
Total evaluation	On
Select measurement...	Check all value calculation units ("OutputNum" to "Co-angleN")



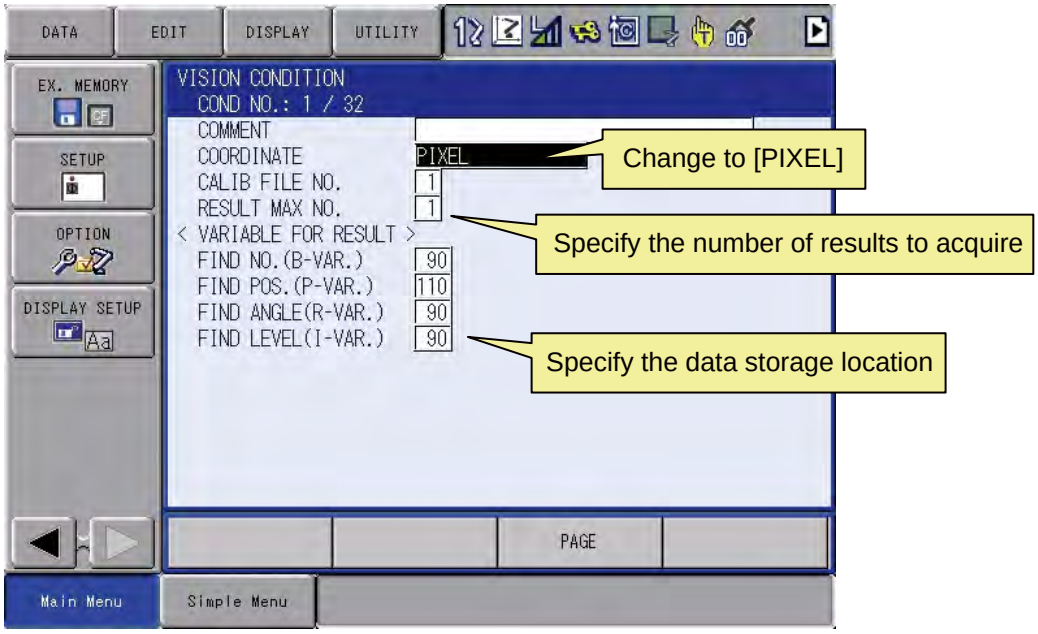



H0000
M000
TOTAL
00000.00ms
Confirm the output
0, 3, M003. MR. CC, M004. MR. CC, M005. MR. CC,
M006. MR. CC, M007. MR. CC, M008. MR. CC,
001 / 008
REF. IMAGE
2013/04/12
11:08:23
V6.90.5001
M-WDFSGEM
[Confirm the output] 2+2+4 X N pieces
2 (object type number, total evaluation)+
2 (number output, number of detections)+
4 X N (matching level, X,Y offsets,
relative angle for each workpiece)

2.3 Vision Condition File Settings

Perform settings for vision condition files used for detection jobs. Vision condition files specify the variable numbers stored for the offsets detected by the camera.

1. Select {VISION CONDITION} in {OPTION}.
2. Change the page to select the number of the file to use, and change {COORDINATE} from {ROBOT} to {PIXEL}.
3. Input the number of data that are output by the vision system as set in {RESULT MAX NO.}.
4. Specify a variable number in {VARIABLE FOR RESULT}. Numbers for variables other than B will be stored up the number specified in {RESULT MAX NO.}. The maximum value for {RESULT MAX NO.} depends on the communication configuration.



NOTE

If variables that are stored as data exceed the defined ranges of the system, during vision command execution the alarm: WRONG EXECUTION OF VISION INST [2] occurs. In such cases, set {VARIABLE FOR RESULT} and {RESULT MAX NO.} correctly.

SUPPLE-MENT

For vision condition file details, refer to *Section 5.1 "Vision Condition Files" on page 5-1*.

2.4 Setting Parameters and Variables

2.4.1 Setting Parameters

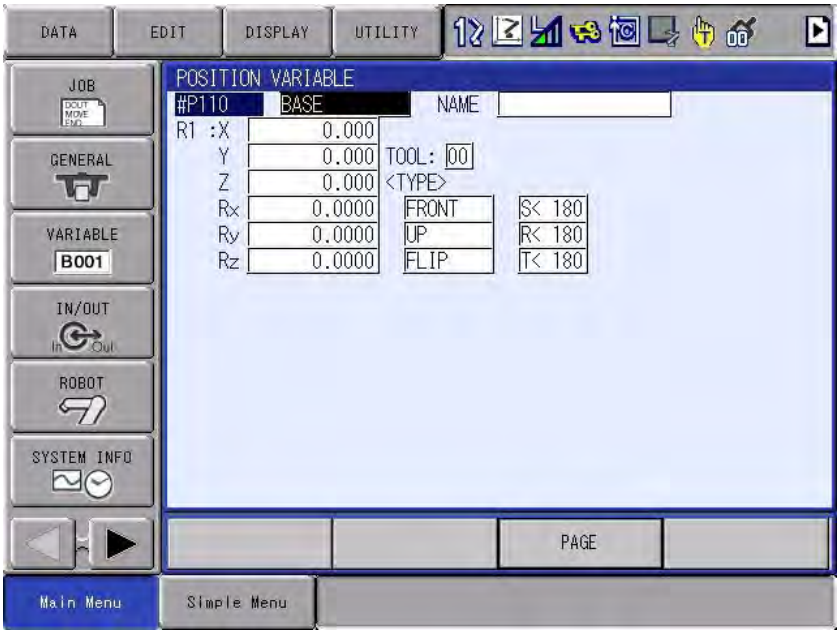
Set RS parameters for each communication configuration, as shown below.

Connection method	Parameter	Setting value
OMRON serial communication (RS-232C)	RS100	8
	RS101	2
	RS102	0
	RS103	8
	RS109	5
OMRON serial communication (Ethernet)	RS109	16
COGNEX In-sight Telnet (Ethernet)	RS104	255
	RS109	12
KEYENCE CV serial communication (Ethernet)	RS109	13
KEYENCE XG serial communication (Ethernet)	RS109	17
SHARP IV-S serial communication (Ethernet)	RS109	11

SUPPLE-MENT For parameter details, refer to *Chapter 7 "Parameter List"*.

2.4.2 Setting Variables

Initialize with the data storage destination P variable type set to anything except {PULSE}. Set the number of variable specified in {RESULT MAX NO.} in order from the position variable number specified in the vision condition file (default value for P: 110).



(Example) When the vision condition file specification for {FIND POS. (P -VAR.)} is 110, P[110 to P119] is initialized.

NOTE If the type specification is undefined, during vision command execution the alarm: WRONG EXECUTION OF VISION INST [9] occurs.

3 Detection Job Creation and Execution

3.1 Job for Detection Result Storage

Create a detection job for performing communication with the vision system.

NOTE

- The VSTART function differs for each communicating vision system's settings. For details, refer to *Section 4.1 "OMRON F/FZ Serial Communication (RS-232C)" on page 4-2* onwards.
- To perform robot operation adjustments using the results received, additional calibration and calculation is required.

Detection job examples are shown below.

```
JOB:VS_FIND
0000     NOP
0001    '***************
0002    'SEARCH SETTINGS
0003    '//VISION CONDITION FILE
0004     SET B000 1
0005    '//RESULT MAX NO.
0006     SET B001 1
0007    '//VARIABLE FOR RESULT
0008    '//FIND NO.(B-VAR.)
0009     SET B002 90
0010    '//FIND POS.(P-VAR.)
0011     SET B003 110
0012    '//FIND ANGLE(R-VAR.)
0013     SET B004 90
0014    '//FIND LEVEL(I-VAR.)
0015     SET B005 90
0016    '//RETRY NUM.
0017     SET B006 3
0018    '
0019    '***************
0020    'INITIALIZE
0021     SET B[B002] 0
0022    '<TOOL23>
0023 001 REFP 1
0024     GETS LPX000 $PX011
0025     CNVRT LPX000 LPX000 BF
0026     SUB LP000 LP000
0027     SET LB000 0
0028    *VFLOOP
0029     SET P[B003] LP000
0030     SET R[B004] 0
0031     SET I[B005] 0
0032     INC B003
0033     INC B004
0034     INC B005
0035     INC LB000
0036     JUMP *VFLOOP IF LB000<B001
0037    '
```

The initialization of variable ranges used for the VSTART command are carried out in the job, so input the setting values into the vision file.

Specifies the number of retries.

Executes the initialization of the variable ranges used for the VSTART command.

TOOL23 is used as a vision tool for storing detection results.

```
0038    '***************
0039    'CAMERA TRIGGER AND RECEIVE RESULT
0040    '
0041     SET LB001 0
0042    *RETRY
0043     ADD LB001 1
0044    '//***CHECK TAGS***
0045     VSTART FIND FT=0 MD=0 VF#(B000)
0046     VWAIT
0047    '//RETRY SETTINGS
0048    'CHECK1 FIND NO.
0049     JUMP *OK1 IF B[B002]>=1
0050     JUMP *RETRY IF LB001<=B006
0051    '
0052    *OK1
0053     END
```

Executes a "trigger+store results" command. Set the FT and MD tags after confirming the functions of each vision system. The detection results are stored to the vision condition file's specified variables.

Sets the retry conditions.

3.2 Job for Part Type Changing

```
JOB:VS_SELCND
0000     NOP
0001    '***************
0002    'SEACH SETTINGS
0003    '//PARTS NO.
0004     SET B000 1
0005    '
0006    '***************
0007    'LOAD CAMERA JOB
0008    '//***CHECK TAG***
0009     VSTART SELCND CND=B000
0010     VWAIT
0011     END
```

Executes a "part type change" command. Set the CND tags after confirming the functions of each vision system.

4 List of Robot Language (INFORM III) Commands

VSTART	**Function**	Executes processing for the related vision function.	
	Appended item	FIND	
		FT = <Detection type> MD = <Detection model number> VF# (<Vision condition file number>)	FT: 0 to 255 MD: 0 to 7 VF#: 1 to 32
		SELCND	
		CND = <Detection scene number>	CND: 0 to 255
		CALIB	
		CALF# (<Calibration file number>)	CALF#: 1 to 16
	Usage example	VSART FIND FT = 0 MD = 0 VF# (1) VWAIT	
VWAIT	**Function**	Waits for the end of processing related to vision functions.	
	Appended item	None	
	Usage example	VSART FIND FT = 0 MD = 0 VF# (1) VWAIT	

NOTE

- The VSTART function differs for each communicating vision system's settings. For details, refer to *Section 4.1 “OMRON F/FZ Serial Communication (RS-232C)” on page 4-2* onwards.
- After the execution of VSTART FIND, and until the execution of VWAIT, do not under any circumstances load or write to the storage variables specified by the vision file. Doing so can cause an operational error.

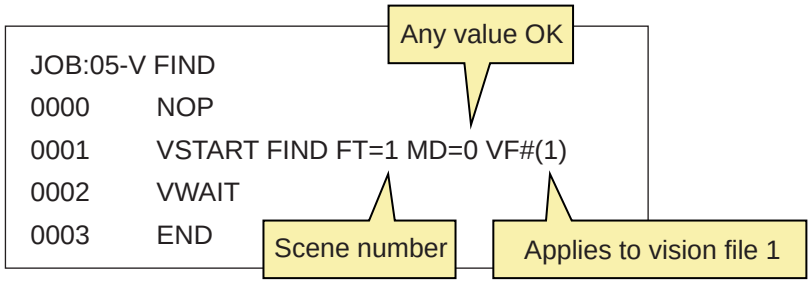
4.1 OMRON F/FZ Serial Communication (RS-232C)

Function designation	Additional parameters			Function
FIND	FT: Detection type number	MD: Detection model number	VF# (): Vision file number	
	0 to 31[1)]	* [2)]	1 to 32	After switching to the {FT} scene number, the image and detection results are acquired. * Maximum 8 individual detection results
SELCND	CND: Detection scene number			
	0 to 31[1)]			Switch to the {CND} scene group number
CALIB	CALF# (): Calibration file number			
	1 to 16			{CALF#} data is used to perform camera calibration

1 Do not set 32 to 255.
2 It is possible to execute with any values for disabled parameters not related to processing.

4.1.1 Usage Example

(1) Scene switch → image → data acquisition



• Explanation
The scene number specified in {FT} is loaded and video capture is performed. Then, the first vision file {VARIABLE FOR RESULT} B, I, R, and P variable data is stored.

Variable	Contents
B [0]	Detection judgment for each workpiece (8-bit)
I [0]	Workpiece 0: Correlation value
R [0]	Workpiece 0: Rotation offset amount
P [0] (1): (X coordinate)	Workpiece 0: X coordinate
P [0] (2): (Y coordinate)	Workpiece 0: Y coordinate
…	…

SUPPLE-MENT

• Each bit of B [0] is determined as shown below.

Bit	Contents
0000 000X	0: Data sent to I [0] is less than 0 1: Data sent to I [0] is greater than 0
0000 00X0	0: Data sent to I [1] is less than 0, or not set 1: Data sent to I [1] is greater than 0
0000 0X00	0: Data sent to I [2] is less than 0, or not set 1: Data sent to I [2] is greater than 0
0000 X000	0: Data sent to I [3] is less than 0, or not set 1: Data sent to I [3] is greater than 0
000X 0000	0: Data sent to I [4] is less than 0, or not set 1: Data sent to I [4] is greater than 0
00X0 0000	0: Data sent to I [5] is less than 0, or not set 1: Data sent to I [5] is greater than 0
0X00 0000	0: Data sent to I [6] is less than 0, or not set 1: Data sent to I [6] is greater than 0
X000 0000	0: Data sent to I [7] is less than 0, or not set 1: Data sent to I [7] is greater than 0

• If the data sent to I[0] to [7] is negative, it will be automatically corrected to be positive. If negative, the corresponding bit for B[0] above will be set to 0.

(2) Scene group switching

Scene group 0

```
JOB:05-V SELCND
0000      NOP
0001      VSTART SELCND CND=0
0002      VWAIT
0003      END
```

• Explanation
Loads the scene group number specified in {CND}.

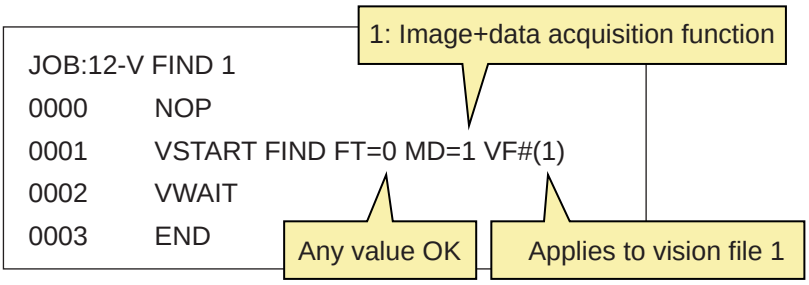
4.2 COGNEX In-Sight Telnet (Ethernet)

Function designation	Additional parameters			Function
FIND	FT: Detection type number	MD:[1] Detection model number	VF# (): Vision file number	
	0 to 255	0	1 to 32	After switching to the {FT} camera job number, the image and detection results are acquired.[2] * Maximum 10 individual detection results
	* [3]	1	1 to 32	Acquire image and detection results [2] * Maximum 10 individual detection results
	* [3]	4	1 to 32	Acquire the open camera job number
	* [3]	5	1 to 32	Acquire the camera's online status
	* [3]	6	1 to 32	Switch the camera to be online
	* [3]	7	1 to 32	Only acquire detection results [2] * Maximum 10 individual detection results
SELCND	CND: Detection scene number			
	0 to 255			Switch to the {CND} camera job number
CALIB	CALF# (): Calibration file number			
	1 to 16			{CALF#} data is used to perform camera calibration

1 Do not set the parameter No. between 2 and 3.
2 Be sure to execute only after loading the proprietary camera job.
3 It is possible to execute with any values for disabled parameters not related to processing.

4.2.1 Usage example

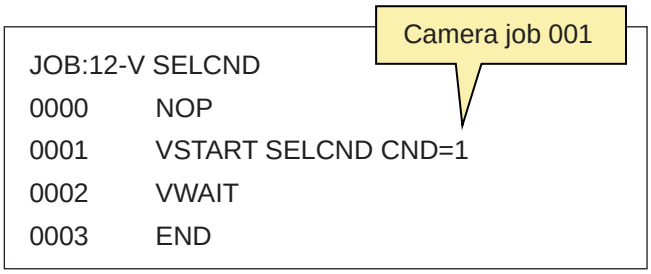
(1) Acquire image → acquire data



• Explanation
Acquires the image with the currently open camera job. Then, the first vision file {VARIABLE FOR RESULT} B, I, R, and P variable data is stored.

Variable	Contents
B [0]	Number of detections
I [0]	Workpiece 0: Score
R [0]	Workpiece 0: Rotation offset amount
P [0] (1): (X coordinate)	Workpiece 0: X coordinate
P [0] (2): (Y coordinate)	Workpiece 0: Y coordinate
…	…

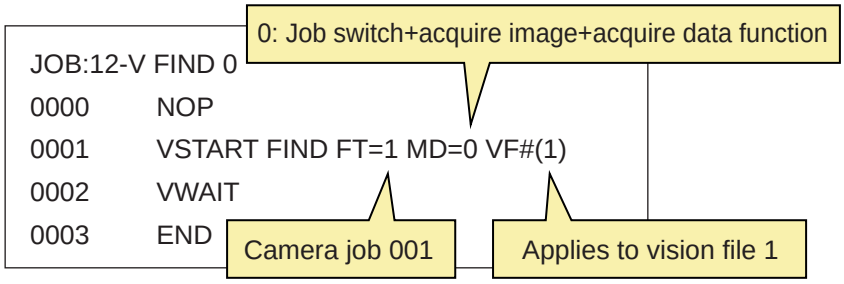
(2) Camera job switching



• Explanation
Open In-Sight camera job 001

SUPPLE-MENT If perform calibration using an In-Sight camera job, switching the camera job may require several tens of seconds.

(3) Camera job switch → acquire image → acquire data

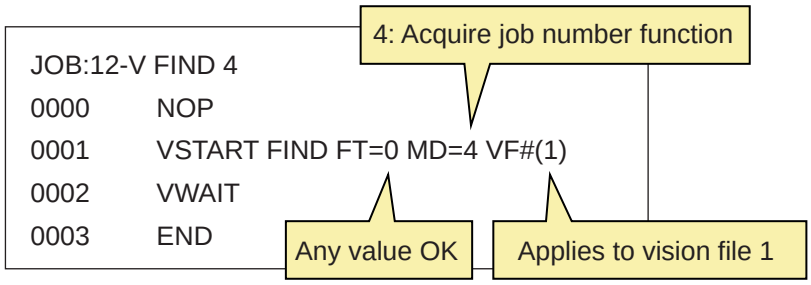


• Explanation
Acquires the image after In-Sight camera job 001 is opened. Then, the first vision file {VARIABLE FOR RESULT} B, I, R, and P variable data is stored.

Variable	Contents
B [0]	Number of detections
I [0]	Workpiece 0: Score
R [0]	Workpiece 0: Rotation offset amount
P [0] (1): (X coordinate)	Workpiece 0: X coordinate
P [0] (2): (Y coordinate)	Workpiece 0: Y coordinate
…	…

SUPPLE-MENT If perform calibration using an In-Sight camera job, switching the camera job may require several tens of seconds.

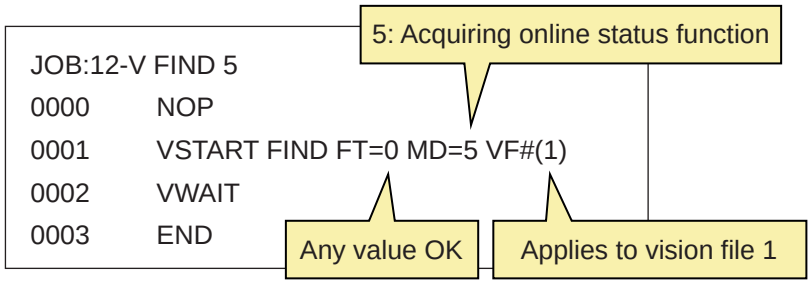
(4) Acquire job number



• Explanation
Stores the currently opened camera job number. If the job name currently opened by In-Sight does not begin with a number, or the number is less than 0 or more than 256, alarm: WRONG EXECUTION OF VISION INST [7] occurs.

Variable	Contents
B [0]	Currently opened camera job number

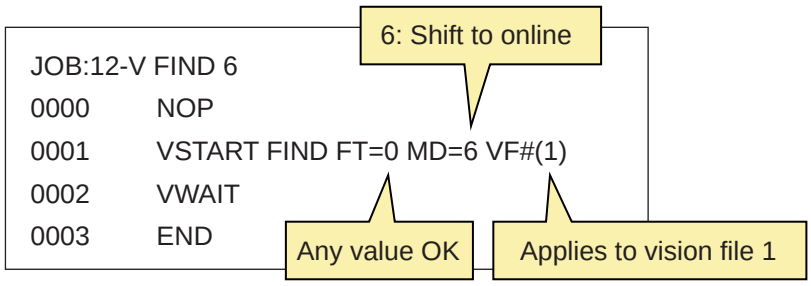
(5) Acquiring online status



• Explanation
Stores the online status of a connected camera.

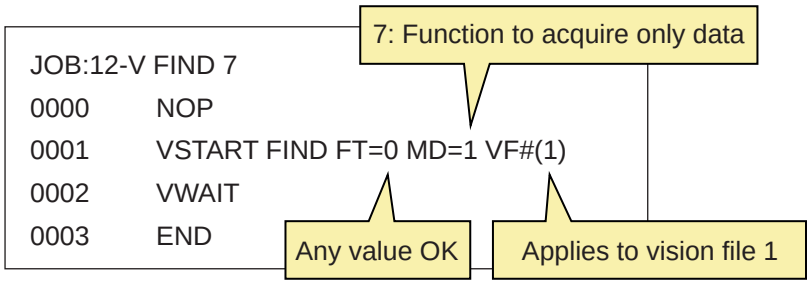
Variable	Contents
B [0]	0: Offline status 1: Online status

(6) Shift to online



• Explanation
Shifts a connected camera to be online.

(7) Acquire only data



• Explanation
Stores the first vision file {VARIABLE FOR RESULT} B, I, R, and P variable data from the currently open camera job. Trigger refresh is not performed.

Variable	Contents
B [0]	Number of detections
I [0]	Workpiece 0: Score
R [0]	Workpiece 0: Rotation offset amount
P [0] (1): (X coordinate)	Workpiece 0: X coordinate
P [0] (2): (Y coordinate)	Workpiece 0: Y coordinate
…	…

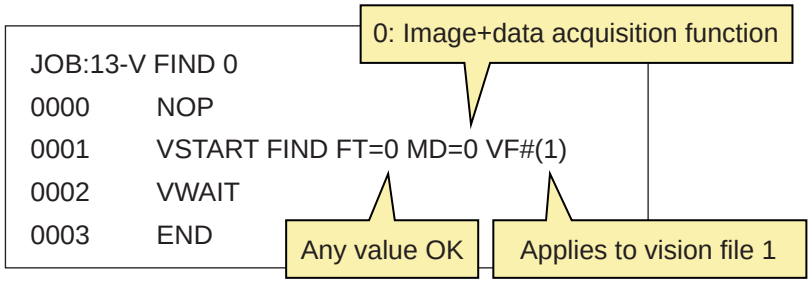
4.3 KEYENCE CV Serial Communication (Ethernet)

Function designation	Additional parameters			Function
FIND	FT: Detection type number	MD:[1] Detection model number	VF# (): Vision file number	
	* [2]	0	1 to 32	Acquire image + output data * Maximum 1 individual detection results
	0 to 127 [3]	1	* [3]	Switches the window No. to {FT}
	* [3]	2	* [3]	Switches to operation mode
	* [3]	3	* [3]	Switches to setting mode
SELCND	CND: Setting No.			
	0 to 255			Switches the setting No. to {CND}
CALIB	CALF# (): Calibration file number			
	1 to 16			{CALF#} data is used to perform camera calibration

1 Do not set the parameter No. between 4 and 7.
2 It is possible to execute with any values for disabled parameters not related to processing.
3 Do not set the parameter No. between127 and 255.

4.3.1 Usage example

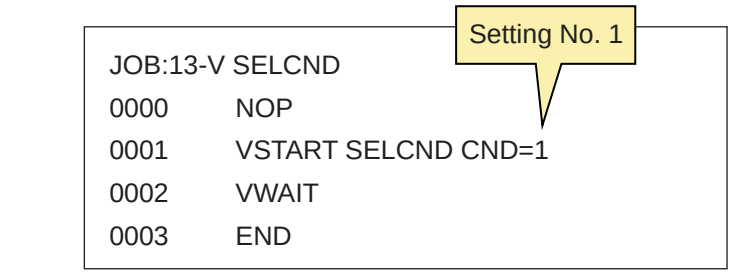
(1) Acquire image → acquire data



• Explanation
Acquires the image with the currently open setting number. Then, the first vision file {VARIABLE FOR RESULT} B, I, R, and P variable data is stored.

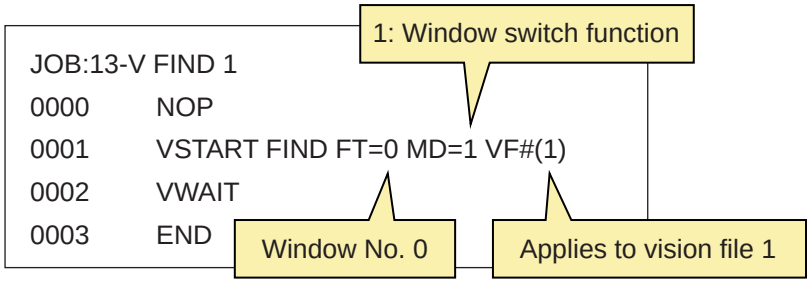
Variable	Contents
B [0]	Number of detections
I [0]	Workpiece 0: Correlation value
R [0]	Workpiece 0: Rotation offset amount
P [0] (1): (X coordinate)	Workpiece 0: X coordinate
P [0] (2): (Y coordinate)	Workpiece 0: Y coordinate

(2) Load setting No.



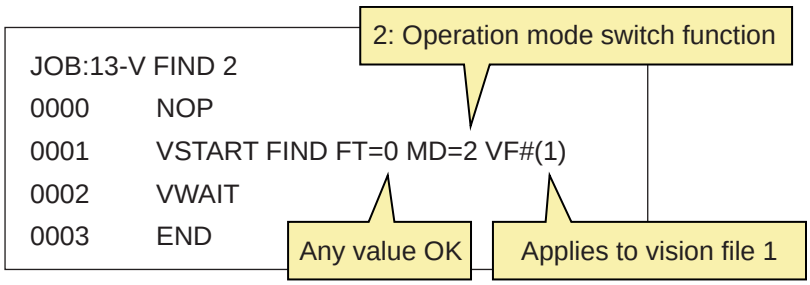
• Explanation
Loads Setting No. 1, which has already been set for the CV series.

(3) Window switch



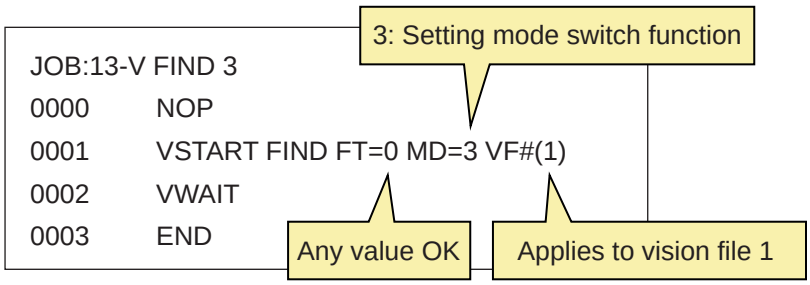
• Explanation
Switches to Window No. 0 of the currently open setting number.

(4) Operation mode switch



• Explanation
Switches to operation mode. If already in operation mode, the command resolves as is.

(5) Setting mode switch



• Explanation
Switches to setting mode. If already in setting mode, the command resolves as is.

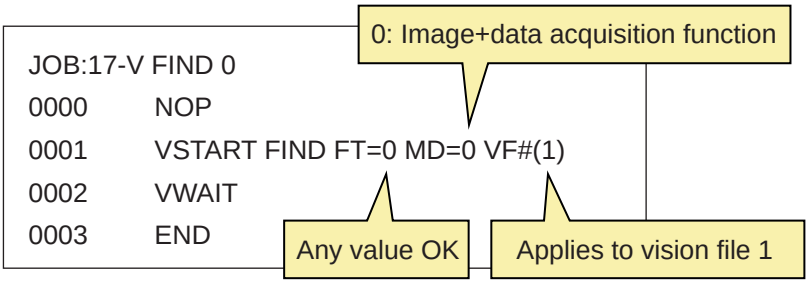
4.4 KEYENCE XG Serial Communication (Ethernet)

Function designation	Additional parameters			Function
FIND	FT: Detection type number	MD:[1] Detection model number	VF# (): Vision file number	
	* [2]	0	1 to 32	Acquire image + output data * Maximum 20 individual detection results
	0 to 127[3]	1	* [3]	Executes an {FT} custom command
	* [3]	2	* [3]	Switches to operation mode
	* [3]	3	* [3]	Switches to stop mode
SELCND	CND: Detection scene number			
	0 to 255			Switches the inspection setting number to {CND}
CALIB	CALF# (): Calibration file number			
	1 to 16			{CALF#} data is used to perform camera calibration

1 If executed using the parameter between 4 to 7, an alarm: WRONG EXECUTION OF VISION INST 11 will occur.
2 It is possible to execute with any values for disabled parameters not related to processing.
3 If executed using the parameter between 128 to 255, an alarm: WRONG EXECUTION OF VISION INST 11 will occur.

4.4.1 Usage example

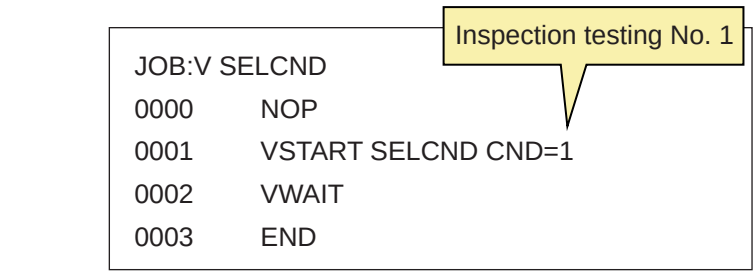
(1) Acquire image → acquire data



• Explanation
Acquires the image with the currently open inspection setting number. Then, the first vision file {VARIABLE FOR RESULT} B, I, R, and P variable data is stored.

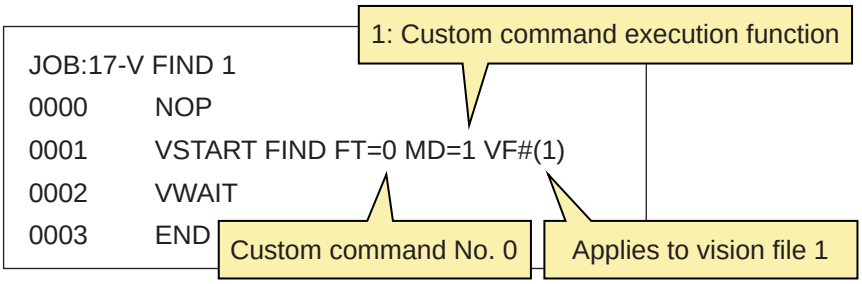
Variable	Contents
B [0]	Number of detections
I [0]	Workpiece 0: Correlation value
R [0]	Workpiece 0: Rotation offset amount
P [0] (1): (X coordinate)	Workpiece 0: X coordinate
P [0] (2): (Y coordinate)	Workpiece 0: Y coordinate
…	…

(2) Load inspection testing No.



• Explanation
Loads inspection testing No. 1, which has already been set for the XG series.

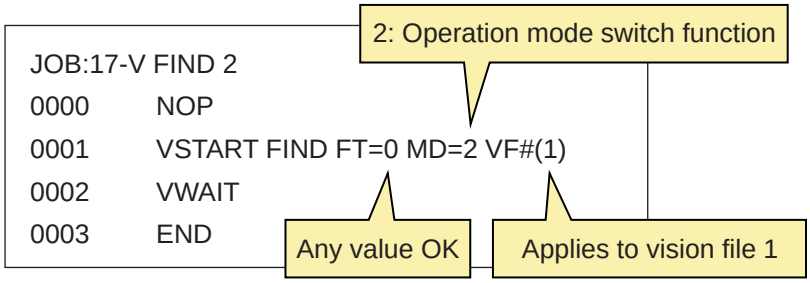
(3) Custom command execution



• Explanation
Executes the registered custom command No. 0.

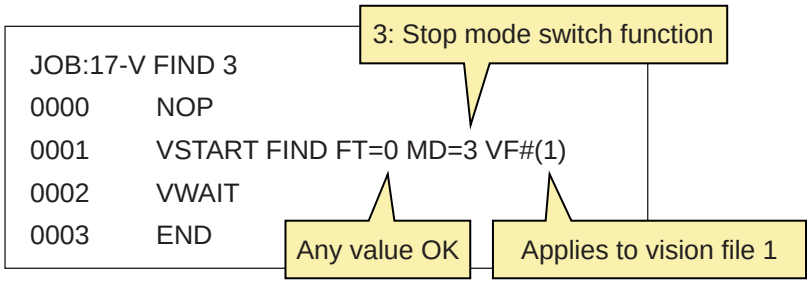
NOTE It is possible to execute the command only. Do not set a command with a set return value.

(4) Operation mode switch



• Explanation
Switches to operation mode. If already in operation mode, the command resolves as is.

(5) Stop mode switch



• Explanation
Switches to stop mode. If already in stop mode, the command resolves as is.

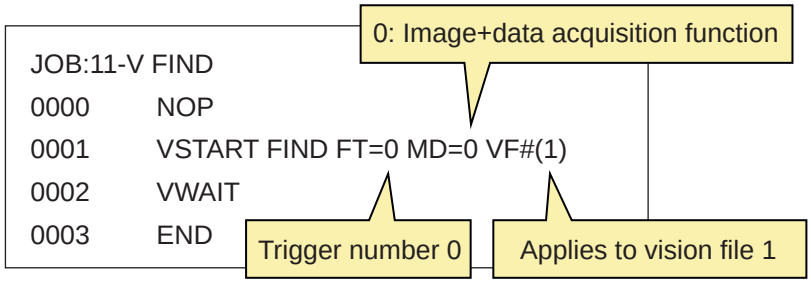
4.5 SHARP IV-S200 Serial Communication (Ethernet)

Function designation	Additional parameters			Function
FIND	FT:[1] Detection type number	MD:[2] Detection model number	VF# (): Vision file number	
	0	0 to 3	1 to 32	Acquire image + output data from the {MD} trigger number * Maximum 18 individual detection results
SELCND	CND: Detection scene number			
	0 to 255			Switches the inspection setting number to {CND}
CALIB	CALF# (): Calibration file number			
	1 to 16			{CALF#} data is used to perform camera calibration

1 Do not set the parameter between 1 and 255.
2 Do not set the parameter between 4 and 7.

4.5.1 Usage example

(1) Acquire image → acquire data



• Explanation
Acquires the image with the currently open model type setting number. Then, the first vision file {VARIABLE FOR RESULT} B, I, R, and P variable data is stored.

Variable	Contents
B [0]	Number of detections
I [0]	Workpiece 0: Correlation value
R [0]	Workpiece 0: Rotation offset amount
P [0] (1): (X coordinate)	Workpiece 0: X coordinate
P [0] (2): (Y coordinate)	Workpiece 0: Y coordinate
…	…

(2) Load part type setting No.

```
JOB:11-V SELCND
0000      NOP
0001      VSTART SELCND CND=1
0002      VWAIT
0003      END
```

Part type setting No. 1

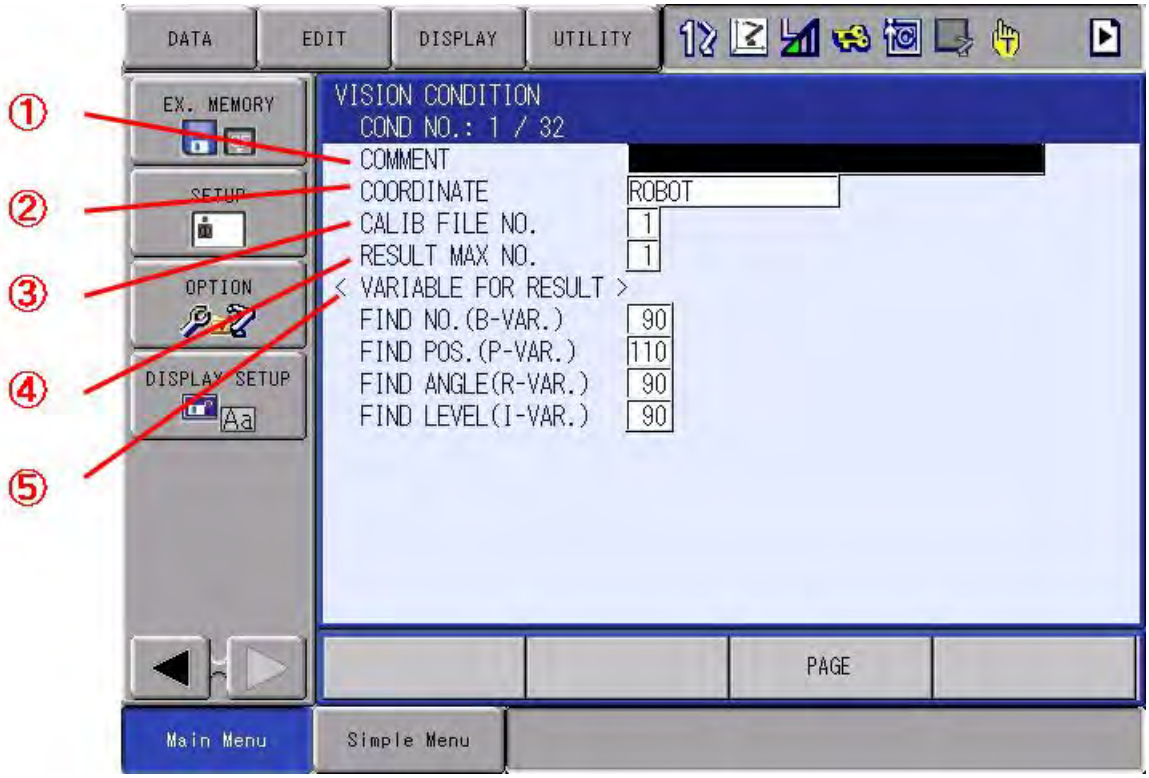
• Explanation
Loads part type setting No. 1.

NOTE To execute VSTART FIND - VWAIT following VSTART SELCND - VWAIT, be sure to insert a timer between VWAIT and VSTART. If there is no timer or the timer is too short, an alarm: WRONG EXECUTION OF VISION INST may occur.

5 Miscellaneous Functions

5.1 Vision Condition Files

This file sets the VSTART FIND detection conditions.



No.	Name	Explanation
①	COMMENT	Comments can be added for the vision condition file.
②	COORDINATE	Sets the detection result processing method.
	{ROBOT} (default value)	Uses the calibration data of the calibration file to convert detection results into robot coordinates and stores them as P variables. Be sure to use only after creating calibration data.
	{PIXEL}	The vision device detection results are stored as they are to P variables. This is set when performing vision device-side calibration, etc.
③	CALIB FILE NO.	Specifies the calibration file number for when the coordinate system is {ROBOT}.
④	RESULT MAX NO.	Sets the maximum number of data to store.
⑤	VARIABLE FOR RESULT	Specifies the variable number for storing a detection result. Starting from the specified number, the number of results equal to that specified in {RESULT MAX NO.} is used. The maximum for {RESULT MAX NO.} is 10.

5.2 Calibration File

This file displays the VSTART CALIB calibration conditions and results.

No.	Name	Explanation
①	COMMENT	Comments can be entered for the vision calibration file.
②	TYPE	Select either {STANDARD} or {LASER} for the calibration type.
	{STANDARD} (default value)	Use for standard workpiece detection.
	{LASER}	Use for workpiece detection that uses laser slit light. When using the laser slit light, a separate proprietary job is required.
③	MODE	Select {FIXED CAMERA} or {MOVE CAMERA} as the calculation method used during calibration.
	{FIXED CAMERA} (default value)	Performs calibration using a calculation method with the camera fixed during calibration.
	{MOVE CAMERA}	Performs calibration using a calculation method with a camera held by the robot during calibration.
④	VAR. FOR ROBOT POS.	Specifies the robot position variable number referenced when creating calibration data.
⑤	VAR. FOR PIXEL POS.	Specifies the referenced variable number for storing the pixel data of the detection result from the vision device when creating calibration data.
⑥	CAL. DAT	Displays the margin of error for each point after calibration data is created.
⑦	PIXEL SIZE	Displays the size {mm/pixel} of the robot coordinates for the pixel data of the vision device after calibration data is created.

5.3 Loading and Saving Vision Files

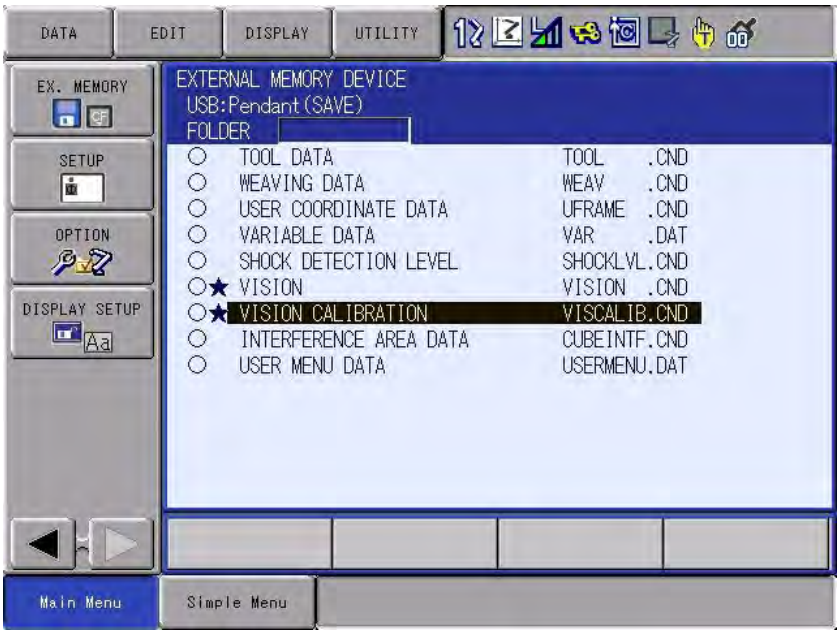
Files used for vision functions can be saved to or loaded from external memory devices.

For details about using external memory devices, refer to the DX100 OPERATOR'S MANUAL.

Data that can be saved	File name after saving
Vision condition data	VISION. CND
Vision calibration data	VISCALIB. CND

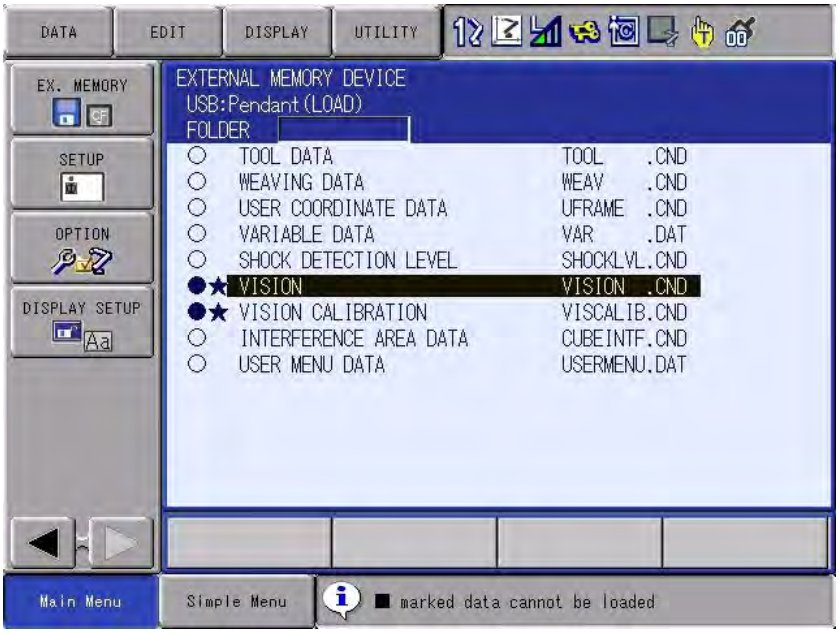
5.3.1 Saving Files

1. Select {EX. MEMORY} from the top menu, and then select {SAVE}.
2. Select {FILE/GENERAL DATA}, add checks to the items {VISION} and {VISION CALIBRATION}, and then press [ENTER].
3. Select {YES} to save the data.



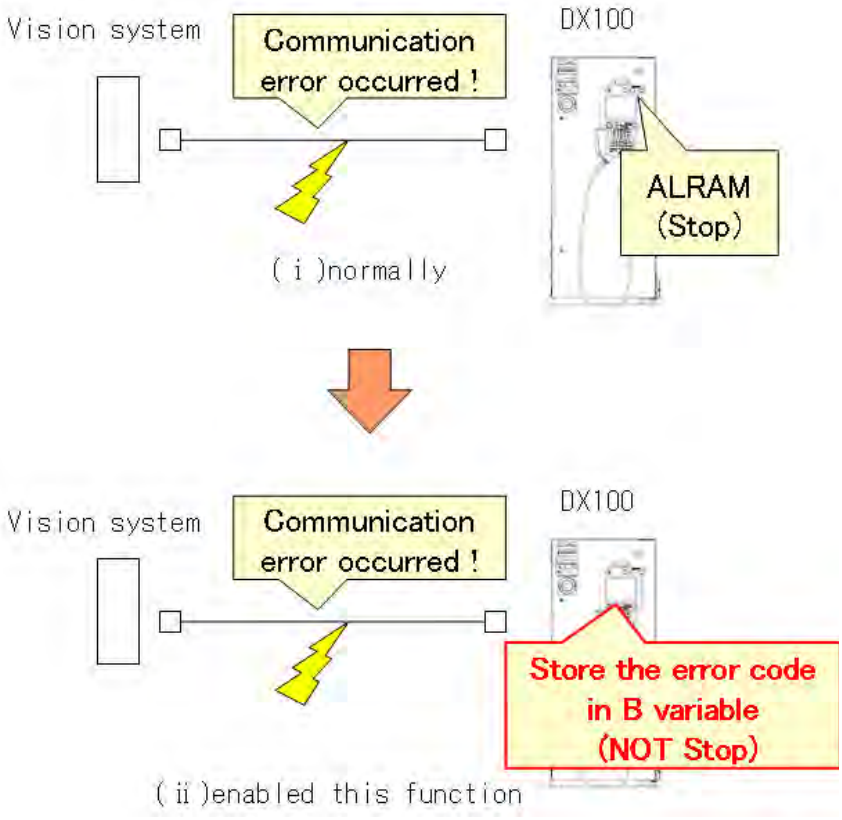
5.3.2 Saving Files

1. Select {EX. MEMORY} from the top menu, and then select {LOAD}.
2. Select {FILE/GENERAL DATA}, add checks to the items {VISION} and {VISION CALIBRATION}, and then press [ENTER].
3. Select {YES} to load the data.



5.4 Alarm B Variable Output Function

If a communication error occurs, no alarm and resulting stop occurs, and instead a subcode of alarm 4124 "WRONG EXECUTION OF VISION INST" is written to the specified B variable. If a line is stopped due to a communication error alarm, in some cases a job can be created to perform communication retries, etc. to improve uptime efficiency.



The alarm B variable output function settings are determined by the following parameters.

Parameter	Major item	Minor item	Remarks	Default value
RS486	Vision communication error response function	Alarm storage B variable specification	0: Function disabled Alarm if a value outside of the range is specified	0

The values written to the VSTART execution result and B variable are as follows.

Communication status	When function disabled	When function enabled
Normal	Detection result stored	Detection result stored + B [RS486] = 0
Communication error occurred	Alarm 4124 WRONG EXECUTION OF VISION INST[5]	B [RS486] = 5
	Alarm 4124 WRONG EXECUTION OF VISION INST [6]	B [RS486] = 6
	Alarm 4124 WRONG EXECUTION OF VISION INST [7]	B [RS486] = 7
Miscellaneous Alarms	Includes sub-codes other than those described above Alarm 4124 WRONG EXECUTION OF VISION INST [7]	Alarms shown to the left + B [RS486] = 0

NOTE

- If this function is enabled, be sure to use a robot job to add communication error processing.
- If a B variable number is input that is outside of the defined system range for RS parameters, upon vision command execution the alarm: WRONG EXECUTION OF VISION INST [11] occurs.

5.4.1 Setting Procedure

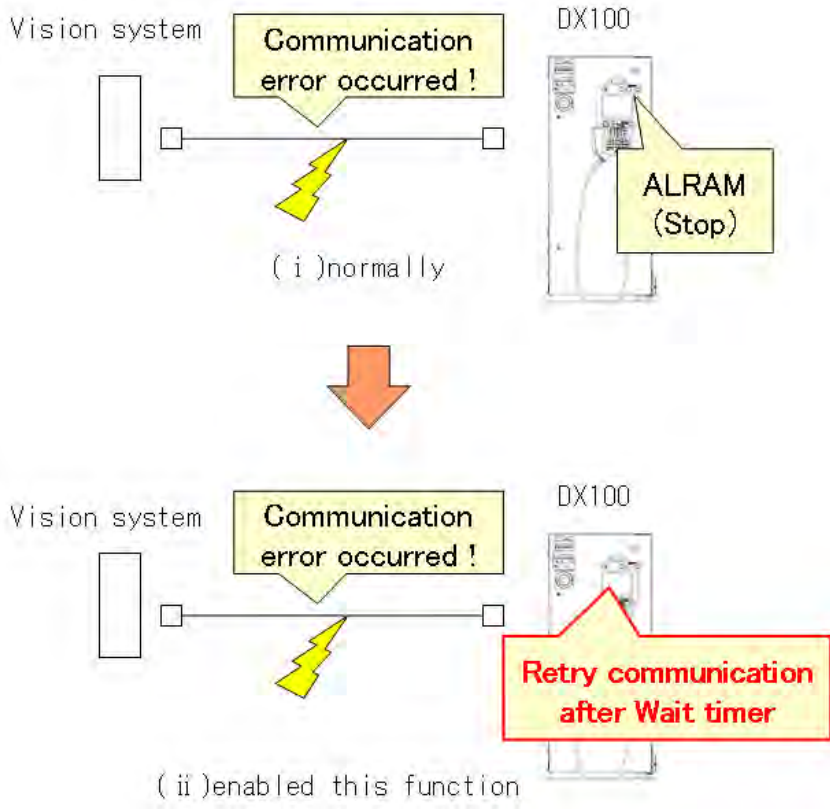
1. In manager mode, set the B variable number of the alarm storage destination for the robot controller parameter {RS486}.
2. Add communication error processing to the robot job.

An example for adding a process to retry during a communication error is shown below.


```
JOB: VFIND_RETRY
0000        NOP
0001       '-Setting-
0002       'maximum try num
0003        SET B088 3
0004       '
0005       '-Initialization-
0006       'try count
0007        SET B087 0
0008       '
0009       '-Detection
0010       *TRY
0011        INC B087
0012       'Stop if try num over
0013        JUMP *STOP IF B087>B088
0014        VSTART FIND FT=0 MD=0 VF#(1)
0015        VWAIT
0016       'Retry if communication err
0017        JUMP *TRY IF B089<>0
0018       *OK
0019        RET
0020       '
0021       *STOP
0022        PAUSE
0023       '-Communication err-
0024        END
```

5.5 Communication Retry Function

When a communication error occurs, the system software automatically retries communication. When there are line stops due to communication error alarms, enabling this function can reduce the alarm occurrence rate and improve uptime efficiency.



SUPPLE-MENT

Communication retry processing can also be created for the *Section 5.4 "Alarm B Variable Output Function" on page 5-5*. The main differences are as follows.

- B variable output → It is possible to see the detailed status such as the number of retries through job settings
- Communication retry function → Only the retry function can be set without changing existing jobs

NOTE

- If a large number of retry attempts is set, when a cable breaks, etc. there may be 5 minutes or more until the line stops. For systems where cable breakage is possible, the number of retries should be reduced, or Alarm B variable output function should be used for communication retries.
- If the retry timer value is close to 0 [ms] communication upon the execution of a retry may not be performed correctly. Set an appropriate value.

The alarm B variable output function settings are determined by the following parameters.

Parameter	Major item	Minor item	Remarks	Default value
RS487	Vision communication error response function	Communication retry number		0
RS488		Communication retry sleep timer	Units of 0.01 sec	0

5.5.1 Setting Procedure

1. In manager mode, set robot controller parameter {RS487} to the number of communication retries, and {RS488} to the value for the retry timer.

5.6 Vision System IP Address Modification

The IP address used to communicate over Ethernet with the vision device can be freely set using RS parameters. If the RS parameter is not set, the vision device will use the default IP address settings to connect.

The IP address settings are determined by the following parameters.

Parameter	Major item	Minor item	Remarks	Default value
RS460	Vision IP address	IP address 1	Specify the xxx part Ex.) xxx.168.0.1	0
RS461		IP address 2	Ex.) 192.xxx.0.1	0
RS462		IP address 3	Ex.) 192.168.xxx.1	0
RS463		IP address 4	Ex.) 192.168.0.xxx	0

Set the IP address within the private IP address range shown below.

IP address range	Remarks
192.168.0.1 - 192.168.255.254	Do not use the same address as the DX100

Set an appropriate value for the subnet mask for the private IP address range that is used.

IP address range	subnet mask
192.168.0.1 - 192.168.255.254	255.255.0.0
192.168.0.1 - 192.168. 0.254	255.255.255.0

To change the robot controller's own IP address and subnet mask, contact your Yaskawa service representative.

The default IP address settings for vision devices are as follows.

Communication method	Default set IP address
COGNEX In-Sight Telnet (Ethernet)	192.168.255.210
KEYENCE CV Serial Communication (Ethernet)	192.168. 0. 10
KEYENCE XG Serial Communication (Ethernet)	192.168. 0. 10
SHARP IV-S200 Serial Communication (Ethernet)	192.168. 1. 20

5.6.1 Setting Procedure

1. Change the vision device's IP address. Check the respective manual for the operation method.
2. In manager mode, set the robot controller parameters {RS460-463} to the above IP address that was set.

NOTE

- If "Alarm 4124: WRONG EXECUTION OF VISION INST [6]" occurs, check the parameter settings and the IP address values set for the vision device and the robot controller.
- If the above alarm continues to occur, change the IP address of either the vision device or the robot controller, and check their communication.

5.7 Changing the Ethernet Communication Port Number of the Vision Device

The communication port used to communicate over Ethernet with the vision device can be freely set using RS parameters. If the RS parameter is not set, the vision device will use the default communication port settings to connect.

The communication port number settings are determined by the following parameters.

Parameter	Major item	Minor item	Remarks	Default value
S4C0325	Vision function	Communication port number	0: Protocol default setting	0

SUPPLE-MENT

The default communication port number settings for vision devices are as follows.

Communication method	Default setting communication port number
COGNEX In-Sight Telnet (Ethernet)	23
KEYENCE CV Serial Communication (Ethernet)	8500
KEYENCE XG Serial Communication (Ethernet)	8500
SHARP IV-S200 Serial Communication (Ethernet)	2001

5.7.1 Setting Procedure

1. Change the vision system port number. Refer to the maker's manuals for the operation procedure.
2. In manager mode, set the robot controller parameters {S4C0325} to the above port number that was set.

NOTE

- If "Alarm 4124: WRONG EXECUTION OF VISION INST [6]" occurs, re-check the parameter and vision devices settings.
- If the above alarm continues to occur, change the port number and check their communication.

6 Alarm List

Alarm Number	Message	Meaning	Cause	Response
4124	WRONG EXECUTION OF VISION INST [1]	There is a mistake in the specified file's numbers.	Setting error	(1) Check the following settings. • File number
	WRONG EXECUTION OF VISION INST [2]	There is a mistake in the specified file's setting values.	Setting error	(1) Check the following settings. • File setting values
	WRONG EXECUTION OF VISION INST [3]	Calibration could not be executed.	Setting error	(1) Check the following settings. • Robot coordinate values or pixel coordinate values used for calibration • User variable numbers in the calibration file Set the robot coordinate values or pixel coordinate values used for calibration to user variables. Correctly set the user variable numbers in the calibration file.
	WRONG EXECUTION OF VISION INST [4]	The communication port for the vision system could not be initialized.	Setting error	(1) Check the following settings. • Communication port parameters
	WRONG EXECUTION OF VISION INST [5]	During data sending, a timeout occurred.	Setting error	(1) Check the following settings. • Vision system communication settings
			Connection error	(1) Reset the alarm. (2) If the alarm occurs again, check the connection status of the following cables. • Cable between the vision system and the controller
	WRONG EXECUTION OF VISION INST [6]	During data receiving, a timeout occurred.	Setting error	(1) Check the following settings. • Vision system communication settings
			Connection error	(1) Reset the alarm. (2) If the alarm occurs again, check the connection status of the following cables. • Cable between the vision system and the controller
	WRONG EXECUTION OF VISION INST [7]	There is a mistake in the data received by the vision system.	Setting error	(1) Check the following settings. • Vision system communication settings • Vision system detection settings
		There is a mistake in the data received by the vision system.	Connection error	(1) Reset the alarm. (2) If the alarm occurs again, check the connection status of the following cables. • Cable between the vision system and the controller

Alarm Number	Message	Meaning	Cause	Response
4124	WRONG EXECUTION OF VISION INST [8]	Pixel coordinate values could not be converted to robot coordinate values.	Setting error	(1) Check the following settings. • Vision system communication settings • The calibration file used
	WRONG EXECUTION OF VISION INST [9]	Position-type variables (P variables) could not be loaded or saved.	Setting error	(1) Check the following settings. • Specified position-type variable usage status. Do not use the specified position-type variables with another job at the same time.
	WRONG EXECUTION OF VISION INST [10]	Memory was insufficient and the attempt to secure a range of memory failed.	Operation error	(1) Reset the alarm, and execute the job again. (2) If the alarm occurs again, save COMS.BIN in maintenance mode and contact your Yaskawa service representative with information of the machine status (operation procedures, etc.) at the time the error occurred.
	WRONG EXECUTION OF VISION INST [11]	Measurement items (FT, MD, CND, RS parameters) setting error.	Setting error	Revise the measurement item setting values.
	WRONG EXECUTION OF VISION INST [12]	Vision execution command data error.	Operation error	(1) Reset the alarm, and execute the job again.

7 Parameter List

Parameter	Major item	Minor item	Remarks	Default value
RS100	Individual VISION Function parameters	Data bit number	7: 7 bit 8: 8 bit	8
RS101		Stop bit number	0: 1 bit 1: 1.5 bit 2: 2 bit	2
RS102		Parity specification	0: None 1: odd numbers 2. even numbers	0
RS103		Transfer speed specification	Baud rate 7: 9600, 8: 19200	8
RS104		Response wait timer 1 (SELCND)	0.1 sec	100
RS105		Response wait timer 2 (FIND)	0.1 sec	20
RS106		Response wait timer 3 (FIND)	0.1 sec	100
RS107		Data resend retry number		3
RS108	Programming pendant VISION menu operation function	Data send interval	0.001 sec	100
RS109	Individual VISION Function parameters	Protocol type	5: OMRON RS232-C 11: SHARP IV-S 12: COGNEX 13: KEYENCE CV 16: OMRON Ethernet 17: KEYENCE XG	-
RS460	Vision IP address	IP address 1	Specify the xxx part Ex.) xxx.168.0.1	0
RS461		IP address 2	Ex.) 192.xxx.0.1	0
RS462		IP address 3	Ex.) 192.168.xxx.1	0
RS463		IP address 4	Ex.) 192.168.0.xxx	0
RS486	Vision communication error response function	Alarm storage B variable specification	0: Function disabled Alarm if a value outside of the range is specified	0
RS487		Communication retry number		0
RS488		Communication retry sleep timer	0.01 sec	0
S4C0325	Vision function	Communication port number	0: Protocol default setting	0

8 Revision History

Date	CEN / ECN	Revision No.	Reason For Revision	Initials
3/26/2014	46925	0	Original Release	JFC

DX100 OPTIONS
INSTRUCTIONS

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