MITSUBISHI
ELECTRIC

FA Sensor

MELSENSOR

Vision Sensor Setting Guide (Spreadsheet)

-VS70M-600
-VS70M-600-R
-VS70M-800
-VS70M-800-R
-VS70M-802
-VS70M-802-R
-VS70C-600-R
-VS70C-800-R
-VS70C-802-R
-VS80M-100
-VS80M-200
-VS80M-200-R
-VS80M-400
-VS80M-400-R
-VS80M-202
-VS80M-202-R
-VS80M-402
-VS80M-402-R
-VS80C-100
-VS80C-200-R
-VS80C-400-R
-VS80C-202-R
-VS80C-402-R

Powered by
COGNEX

This product is designed and manufactured by Cognex Corporation.
*Note that the warranty and general specifications of this product differ from that of programmable controller products.

COGNEX

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.

The precautions given in this manual are concerned with this product only. For the safety precautions for the entire programmable controller system, refer to the user's manuals of the respective modules.

In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.

Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Installation Precautions]

⚠WARNING

- Before touching the vision sensor, be sure to touch an electric conductor such as grounded metal to discharge the static electricity from your body. Otherwise, damage or faulty operation of the vision sensor may occur.
- Be sure to install an I/O connector module to the main module. If not installed, dust or water-proof performance may not be obtained.

[Installation Precautions]

⚠CAUTION

- IP protection rating is guaranteed only when all the connectors are connected with cables or sealed with sealing caps.
- The cable is designed to connect with its key aligned with the keyway of the connector on the Vision Sensor. Do not force the connections or damage may occur.

[Wiring Precautions]

⚠CAUTION

- Use only 24 VDC and observe the indicated polarity. Otherwise, fire or damage may result.
- The frame ground terminal of the I/O module and the shield ground of each connector (RS232 OUT port and SENSOR port) are internally conducting. The system ground is designed on the condition that a ground connection is provided. The ground potential may affect the vision sensor and peripheral devices such as programmable controllers via cables. For safe operation, it is recommended to connect all the ground connections securely.

[Startup and Maintenance Precautions]

⚠CAUTION

- Do not clean the vision sensor with highly irritating or corrosive solvent such as caustic alkali solution, methyl ethyl ketone (MEK), and gasoline. Doing so may cause a fault.

PRECAUTIONS FOR USE

For details on the precautions for use, refer to the following:

📖Vision Sensor VS70 User's Manual

📖Vision Sensor VS80 User's Manual

CONDITIONS OF USE FOR THE PRODUCT

(1) This vision sensor shall be used in conditions;

i) where any problem, fault or failure occurring in the vision sensor, if any, shall not lead to any major or serious accident; and

ii) where the backup and fail-safe function are systematically or automatically provided outside of the vision sensor for the case of any problem, fault or failure occurring in the vision sensor.

(2) This vision sensor has been designed and manufactured for the purpose of being used in general industries.

MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY THIS VISION SENSOR THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the VISION SENSOR.

("Prohibited Application")

Prohibited Applications include, but not limited to, the use of the vision sensor in;

- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the vision sensor.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the vision sensor in one or more of the Prohibited Applications, provided that the usage of the vision sensor is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the vision sensors are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric FA sensor, MELSENSOR.

This manual describes programming using a spreadsheet.

Before using the product, please read this manual and relevant manuals carefully, and develop familiarity with the functions and performance of the MELSENSOR vision sensor to handle the product correctly.

Please make sure that the end users read this manual.

Available vision sensors

Product name	Model
VS70	VS70M-600, VS70M-600-R, VS70M-800, VS70M-800-R, VS70M-802, VS70M-802-R, VS70C-600-R, VS70C-800-R, VS70C-802-R
VS80	VS80M-100, VS80M-200, VS80M-200-R, VS80M-400, VS80M-400-R, VS80M-202, VS80M-202-R, VS80M-402, VS80M-402-R, VS80C-100, VS80C-200-R, VS80C-400-R, VS80C-202-R, VS80C-402-R

Installation

To connect a vision sensor, the following must be installed on a networked personal computer.

■In-Sight Explorer

For information on how to obtain In-Sight Explorer, please consult your local Mitsubishi representative.

■Engineering tool

Install any of the following engineering software, depending on the programmable controller system used.

- GX Works3
- GX Works2

■Profile

To establish communication between a programmable controller and a vision sensor by configuring communication settings, registering a profile to an engineering tool is required.

A profile is data that stores information of a connected device (such as a model name.)

By registering the profile of a vision sensor to an engineering tool, the vision sensor is added in the "Ethernet Configuration" window or the "CC-Link IEF Basic Configuration" window.

For details on how to register a profile, refer to the following manual.

📖GX Works2 Version 1 Operating Manual (Common)

📖GX Works3 Operating Manual

For information on how to obtain a profile, please contact your local Mitsubishi Electric sales office or representative.

CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
Vision Sensor Setting Guide (Spreadsheet) [BCN-P5999-1072] (this manual)	Operating and job creation methods, etc. for using a spreadsheet in In-Sight Explorer	e-Manual PDF
Vision Sensor VS Series Setting Guide [BCN-P5999-1065]	Functions of In-Sight Explorer and procedures for creating and executing a job, etc.	e-Manual PDF
Vision Sensor Connection Guide [BCN-P5999-0861]	Procedures for connecting a vision sensor to a MELSEC programmable controller to control a vision system through a CC-Link IE Field Network Basic connection, an SLMP connection, or an I/O connection	e-Manual PDF
Vision Sensor VS70 User's Manual [SH-081889ENG]	Functions, installation methods, system configuration, and required hardware components, etc. of the vision sensor VS70	Print book e-Manual PDF
Vision Sensor VS80 User's Manual [SH-081891ENG]	Functions, installation methods, system configuration, and required hardware components, etc. of the vision sensor VS80	Print book e-Manual PDF

Point

e-Manual refers to the Mitsubishi Electric FA electronic book manuals that can be browsed using a dedicated tool.

e-Manual has the following features:

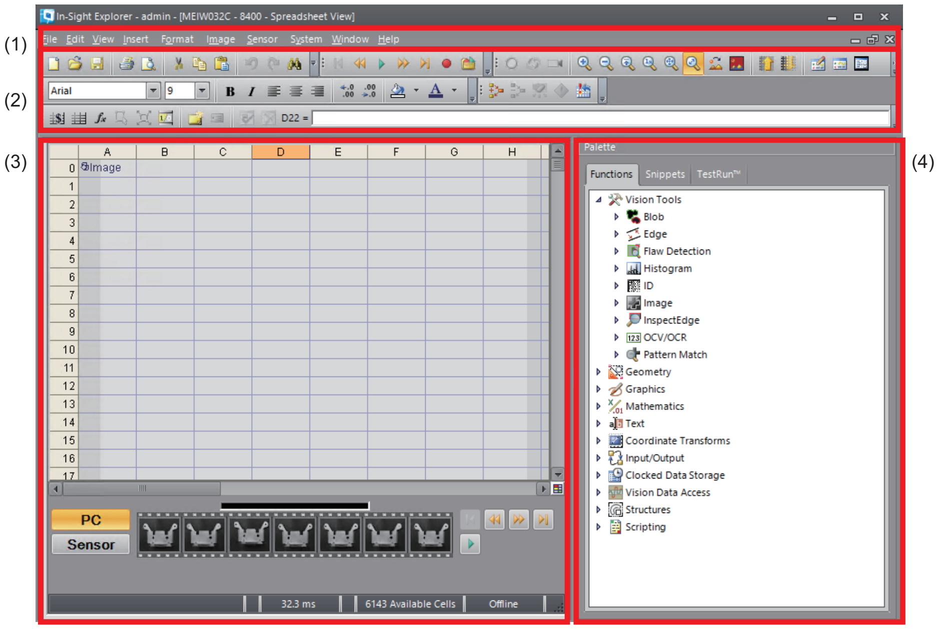
- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- Hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.
- Sample programs can be copied to an engineering tool.

1 OVERVIEW

This manual describes the method for basic operations and creating a job to guide a user unfamiliar with the operations of a spreadsheet.
Spreadsheet is a programming interface of In-Sight Explorer that maximizes the functions of a vision sensor.
A job can be created according to the application steps in EasyBuilder, whereas in a spreadsheet, a job can be created by placing functions.
A job which is created in a spreadsheet uses less memories compared to a job created in EasyBuilder; therefore it is suitable for creating a multi-functional job.

1.1 Screen Configuration

The following shows the screen configuration on a spreadsheet.



(1) Menu bar

(2) Toolbar

(3) Spreadsheet

(4) Palette window

1.2 Execution Order of Functions

The execution order of functions on a spreadsheet is automatically optimized.

When creating a job, the execution order is not needed to be considered.

For the method for checking execution order, refer to the following section.

☞ Page 36 Checking an execution time of each function

2 BASIC OPERATIONS FOR SPREADSHEET

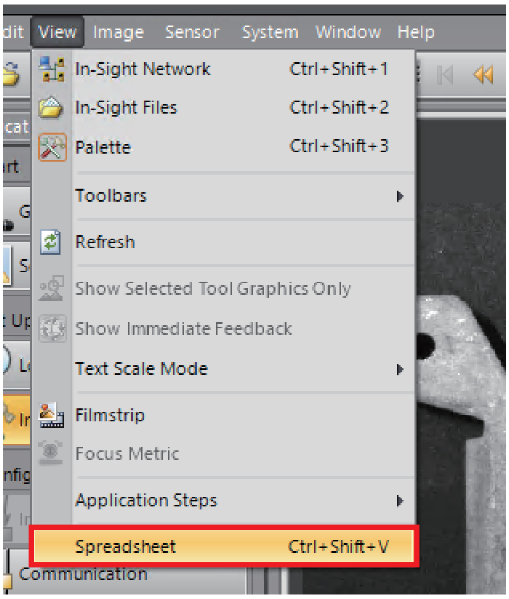
2.1 Spreadsheet

Switching EasyBuilder to a spreadsheet

The following shows the procedure for switching EasyBuilder to a spreadsheet.

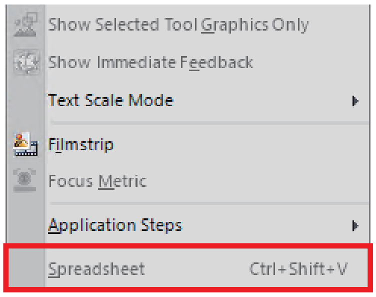
Operating procedure

Select [View] ⇨ [Spreadsheet].



Precautions

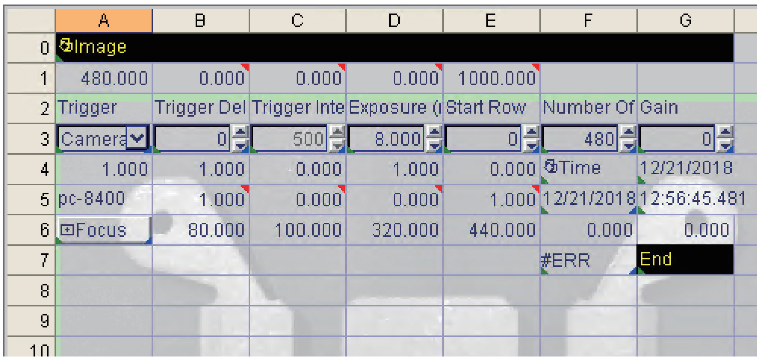
For a model which does not support the spreadsheet function, the menu will be grayed out.



Point

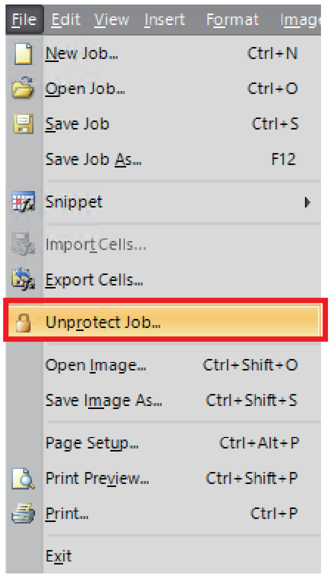
● A job created in EasyBuilder

A cell where a job created in EasyBuilder is placed is protected and therefore the "Property Sheet" screen is not displayed.



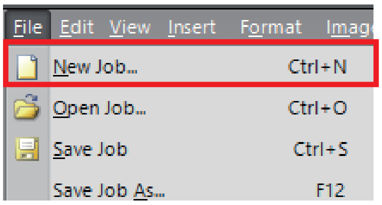
	A	B	C	D	E	F	G
0	Image						
1	480.000	0.000	0.000	0.000	1000.000		
2	Trigger	Trigger Del	Trigger Inte	Exposure (i	Start Row	Number Of	Gain
3	Camera	0	500	8.000	0	480	0
4	1.000	1.000	0.000	1.000	0.000	Time	12/21/2018
5	pc-8400	1.000	0.000	0.000	1.000	12/21/2018	12:56:45.481
6	Focus	80.000	100.000	320.000	440.000	0.000	0.000
7						#ERR	End
8							
9							
10							

The "Property Sheet" screen can be displayed by selecting [File] ⇨ [Unprotect Job].



● Creating a new job for a spreadsheet

A new job can be created in a spreadsheet by selecting [File] ⇨ [New Job] (📄).

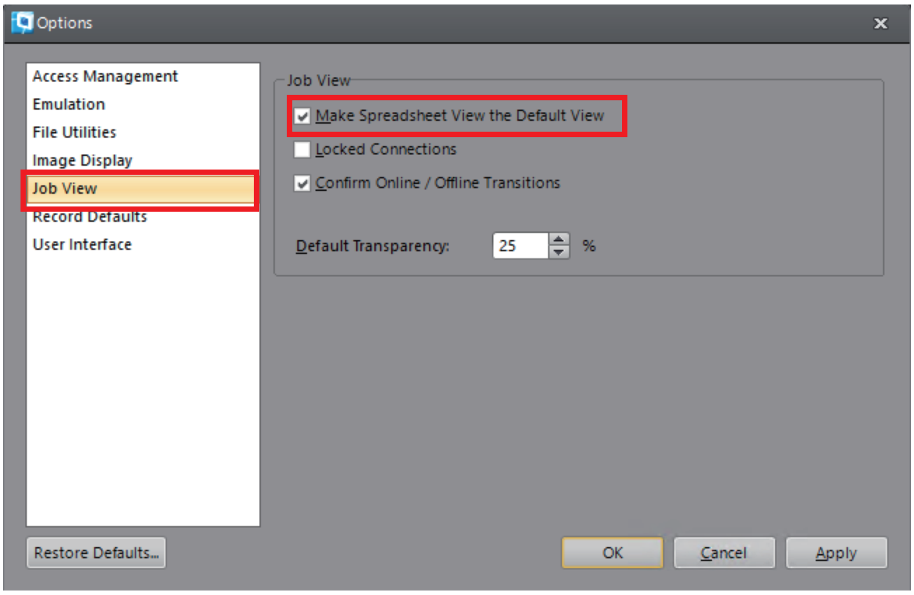


Displaying a spreadsheet in default

A spreadsheet can be displayed in default by setting an option.

Operating procedure

Select the checkbox of "Make Spreadsheet View the Default View" in [System] ⇨ [Options] ⇨ "Job View".



Job View

☑ Make Spreadsheet View the Default View

□ Locked Connections

☑ Confirm Online / Offline Transitions

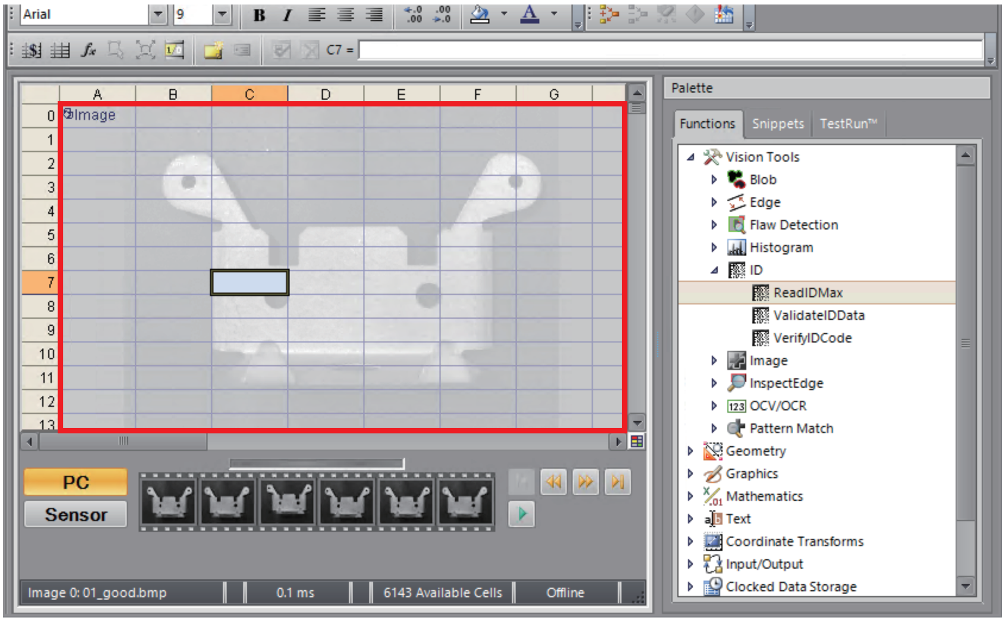
Default Transparency: 25 %

Adjusting transparency

To make an image clear, increase the brightness of the spreadsheet. Conversely, by decreasing the brightness, the image will be blurry.

(The default transparency of a spreadsheet is 25%.)

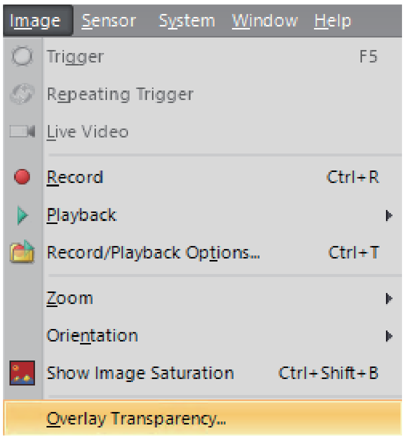
It can be adjusted in the menu or icon on the toolbar.



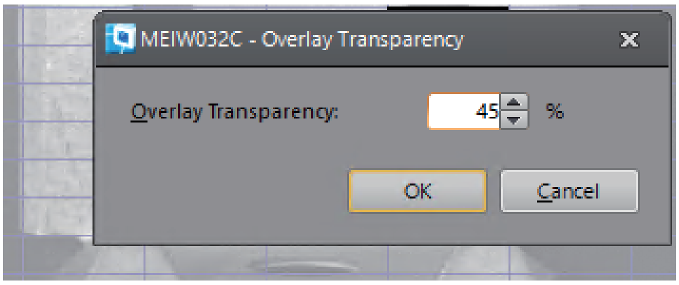
Adjusting transparency using the menu

Operating procedure

1. Select [Image] ⇨ [Overlay Transparency].

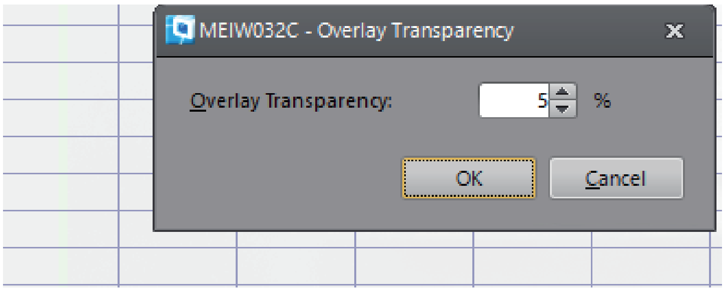


2. Adjust the transparency in the "Overlay Transparency" screen.


MEIW032C - Overlay Transparency

Overlay Transparency: 45 %

The degree of the transparency can be checked by pressing the [Tab] key.


MEIW032C - Overlay Transparency

Overlay Transparency: 5 %

Adjusting transparency using the icon on the toolbar

Operating procedure

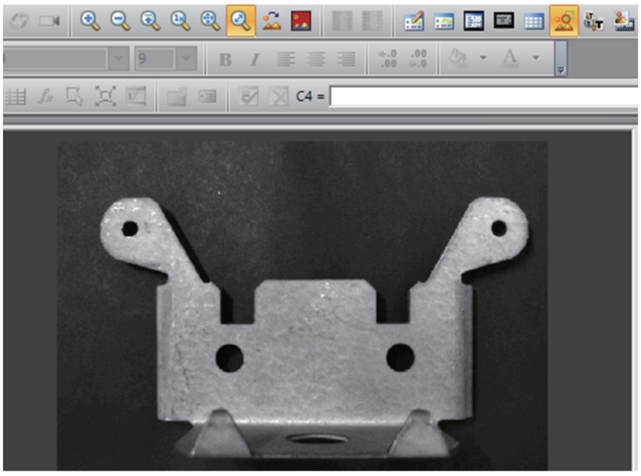
Click ⇧/▥ on the toolbar.

Icon	Description
⇧	To increase the transparency of the spreadsheet. As the spreadsheet becomes transparent, the image becomes clearly visible.
▥	To decrease the transparency of the spreadsheet. As the spreadsheet becomes opaque, the image becomes obscure.

Hiding a spreadsheet temporarily

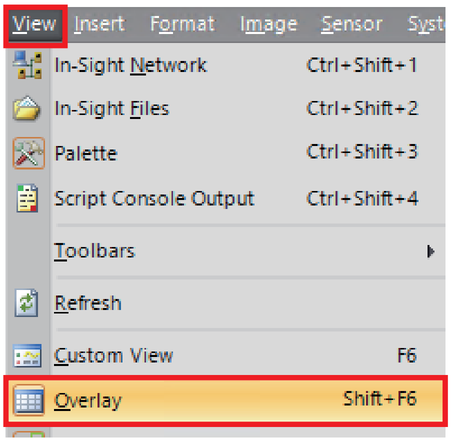
Bring an image to front by temporarily hiding a spreadsheet using the menu or icon on the toolbar.

In the following screen, the spreadsheet is hidden.



Operating procedure

Select [View] ⇨ [Overlay] (▦).



2.2 Placing a Function

A function can be placed in a spreadsheet by either of the following methods.

☞ Page 18 Dragging and dropping a function from the Palette window

☞ Page 21 Entering a function directly in a cell

Precautions

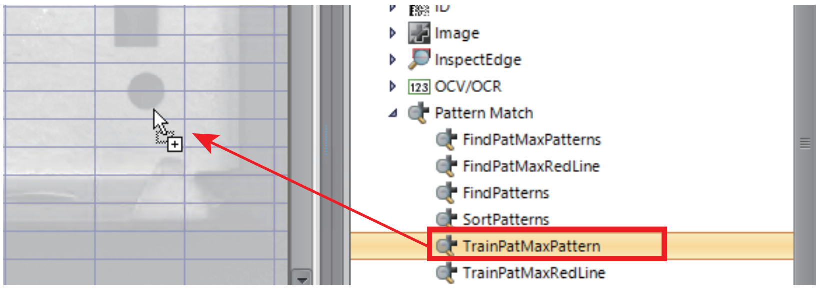
Depending on a function, a vision data access function is automatically added to the cell next to the function. The cell will be overwritten with the vision data access function[*1]; therefore, avoid placing the function close to another data.

[*1] Vision data access function acquires data from a structure.

Dragging and dropping a function from the Palette window

Operating procedure

1. Drag and drop a function from the [Functions] tab in the Palette window to a spreadsheet.



2. Configure the function.

The "Property Sheet" screen is displayed depending on the function. (☞ Page 19 When the Property Sheet screen is displayed)

For a function with no property sheet, arguments can be entered. (☞ Page 20 When arguments can be entered)

When the Property Sheet screen is displayed

Operating procedure

1. Set the details of the items.

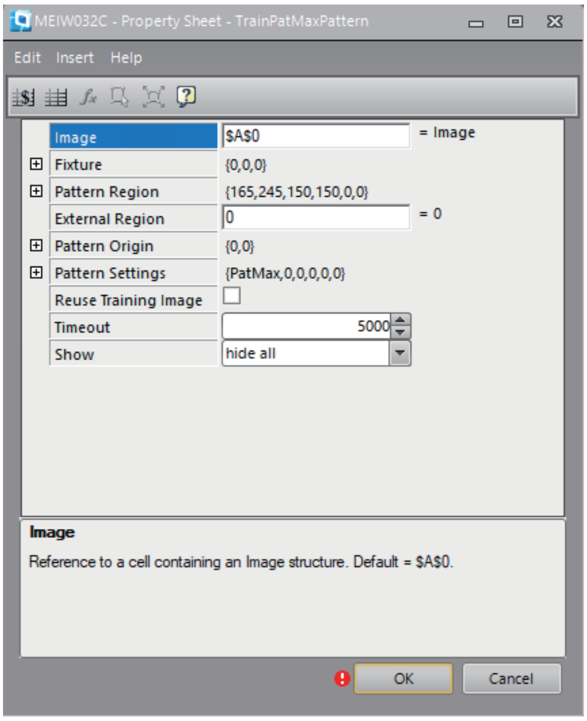


Image	A0	= Image
⊞ Fixture	{0,0,0}	
⊞ Pattern Region	{165,245,150,150,0,0}	
External Region	0	= 0
⊞ Pattern Origin	{0,0}	
⊞ Pattern Settings	{PatMax,0,0,0,0,0}	
Reuse Training Image	□	
Timeout	5000	
Show	hide all	

Image

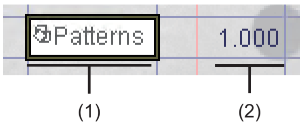
Reference to a cell containing an Image structure. Default = A0.

2. Click the [OK] button.

The function is placed to the spreadsheet.

A vision data access function[*1] is automatically added.

[*1] Information such as status, measurement result value or its label, and parameters of a vision data access function



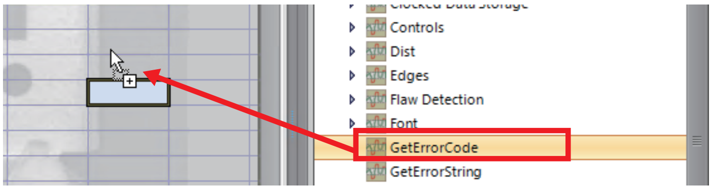
(1) Placed function

(2) A vision data access function that is automatically added

When arguments can be entered

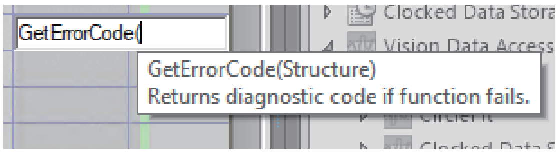
Operating procedure

Enter arguments.



Point

By placing the mouse cursor, the description of the function is displayed on the tooltip.



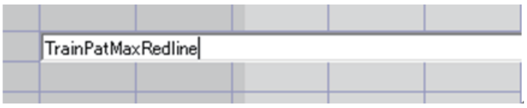
GetErrorCode(Structure)
Returns diagnostic code if function fails.

Entering a function directly in a cell

Operating procedure

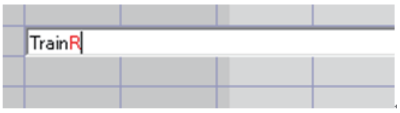
Enter a function in the cell of a spreadsheet.

When a correct function name is entered, the "Property Sheet" screen appears. Alternatively, arguments can be entered.



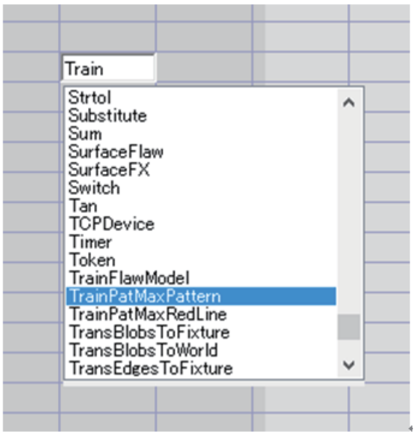
TrainPatMaxRedline

If incorrect function name is entered, the incorrect letter and subsequent letters are displayed in red.



TrainR

By pressing the ↓ key in the middle of entering a function name, a function list appears and the cursor moves to a function name start with the entered letter. (A function can be selected by pressing the ↑ key or ↓ key.)



Train

2.3 Referencing Cells

A cell can refer to another cell by specifying a row and a column.

When data in the source cell changes, the data in the destination cell (the cell contains the reference) updates automatically.

When the destination cell is moved, the column and row to be referenced changes as follows depending on the reference type.

Reference type	Result of the source cell after the destination cell is moved	Examples of the source cell placed in the destination cell [*1]	
		Before (Destination cell: C18)	After (Destination cell: D19)
Relative reference	Both the column and the row are changed according to the distance (the number of columns and rows) from the original cell.	B4	C5
Absolute reference	The source cell is not changed.	$B$4	$B$4
Mixed reference	The column is not changed, but the row is changed according to the distance (number of rows) from the original cell.	$B4	$B5
	The column is changed according to the distance (number of columns) from the original cell, but the row is not changed.	B$4	C$4

*1 The dollar marks "$" indicate an absolute reference that are placed in front of the column and row number.

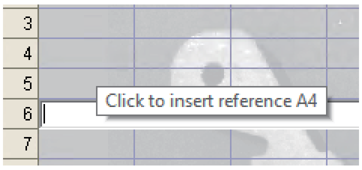
Inserting a reference

The following shows the procedure for inserting a reference.

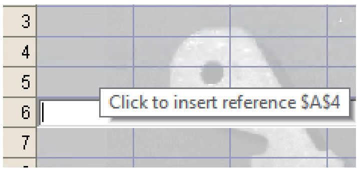
Operating procedure

1. Double-click a cell.
Alternatively, select a cell and press the [F2] key.

2. Move the cursor to another cell.
The appearance of the cursor is changed for a cell reference.



3. To insert a relative reference, click a cell.
To insert an absolute reference, click a cell while holding down the [Shift] key.



A reference can also be inserted by clicking the icon on the toolbar (absolute reference: ▦$, relative reference: ▦) after a cell where a reference is to be inserted is selected.
Take A4 cell for example, "$A$4" is inserted as an absolute reference, and "A4" is inserted as a relative reference.

2.4 Switching Cell Statuses (Enable/Disable)

A cell status (enable/disable) can be changed for each cell.

It can be switched for a cell (function) that operates only on a specific condition.

This section explains how to switch the cell status using an example of a cell where a TrainPatMaxPattern function is placed.

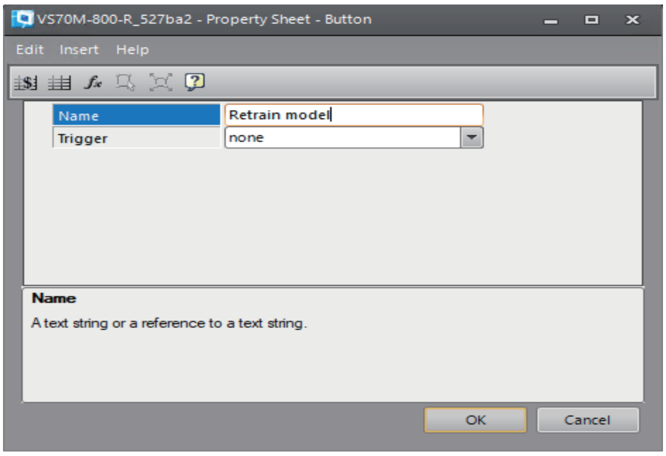
In the following operation procedure, a model can be newly trained by using the Button function and making a cell of the TrainPatMaxPattern function enable[*1] without opening the "Property Sheet" screen.

[*1] The TrainPatMaxPattern function makes the cell automatically disable after a model is trained and the "Property Sheet" screen is closed. Without disabling the cell, a new model will be trained every time when the spreadsheet is updated.

Operating procedure

1. Enter "Button" in a blank cell.
   Alternatively, select [Functions] tab ⇨ "Graphics" ⇨ "Controls" ⇨ "Button" in the Palette window, and drag and drop it to a spreadsheet.

2. Enter a name in the "Property Sheet" screen.



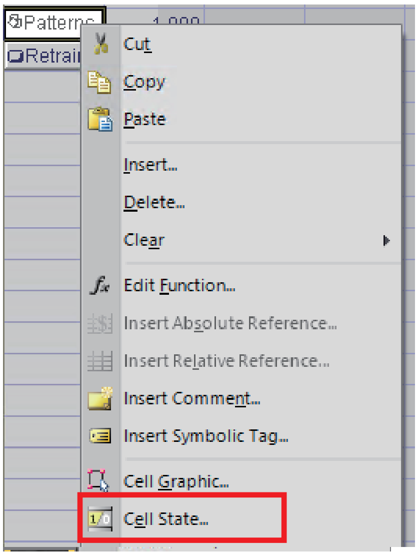
VS70M-800-R_527ba2 - Property Sheet - Button

Name	Retrain model
Trigger	none

Name

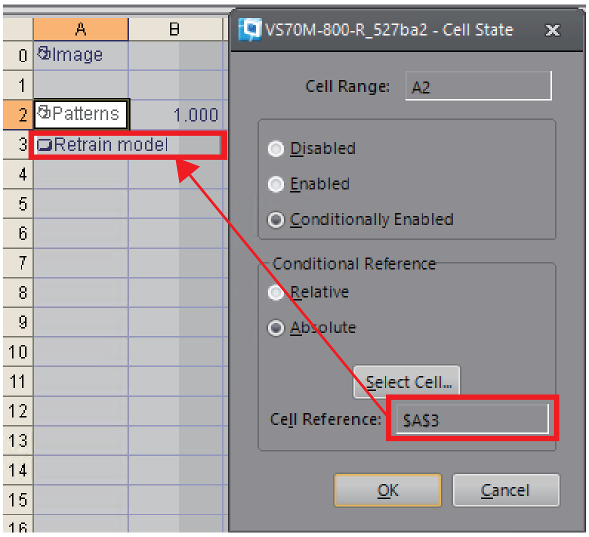
A text string or a reference to a text string.

3. Select and right-click the cell where the TrainPatMaxPattern function is placed, and select [Cell State] in the shortcut menu.



4. Select "Conditionally Enabled" in the "Cell State" screen.

5. Click the [Select Cell] button, select the cell where the Button function is placed, and press the Enter key.



VS70M-800-R_527ba2 - Cell State

Cell Range: A2

○ Disabled

○ Enabled

● Conditionally Enabled

Conditional Reference

○ Relative

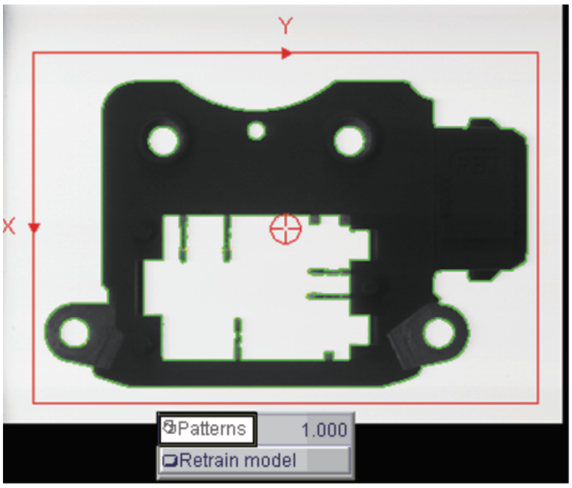
● Absolute

Cell Reference: $A$3

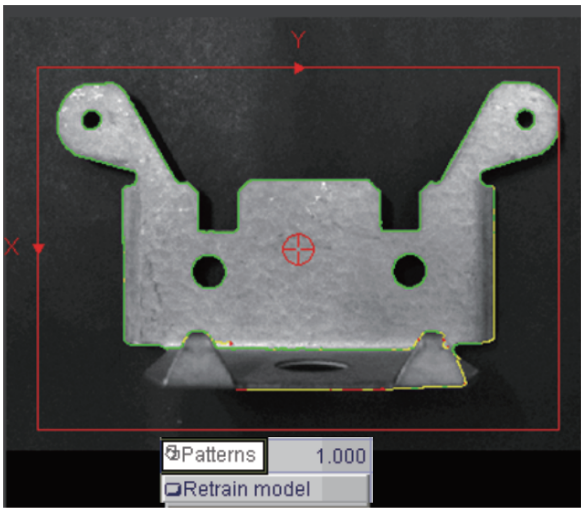
6. Select another image than the one trained when the TrainPatMaxPattern function was placed, and click the cell of the Button function placed in the step 1.

A model is newly trained.

- A model trained when the TrainPatMaxPattern function was placed



- A model newly trained (By clicking the cell where the TrainPatMaxPattern function is placed, a green border appears around the model.)



2.5 Using Functions

This section explains how to use functions with examples described in the following sections.

☞ Page 26 Using the PatMax pattern function

☞ Page 31 Synchronizing a region to feature position

Using the PatMax pattern function

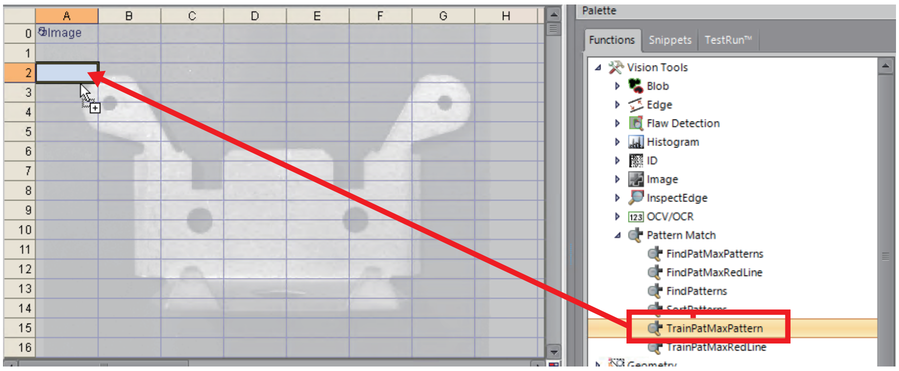
The following shows the procedure for searching the shape of a work using the PatMax pattern function.

1. Place the TrainPatMaxPattern function and train a model to be searched. (☞ Page 26 Placing the TrainPatMaxPattern function)
2. Place the FindPatMaxPatterns function, and specify a search region. (☞ Page 28 Placing the FindPatMaxPatterns function)

Placing the TrainPatMaxPattern function

Operating procedure

1. Select [Functions] tab ⇨ "Vision Tools" ⇨ "Pattern Match" ⇨ "TrainPatMaxPattern" in the Palette window, and drag and drop it to a spreadsheet.



2. Select and double-click "Pattern Region" in the "Property Sheet" screen.
Alternatively, click the icon ().

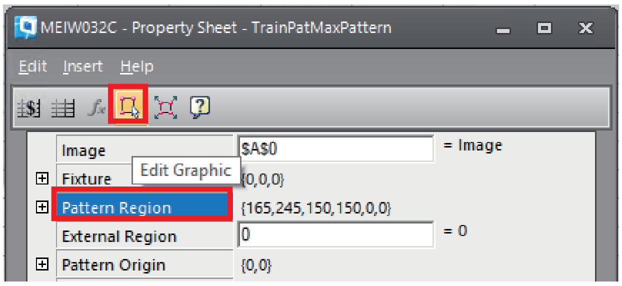
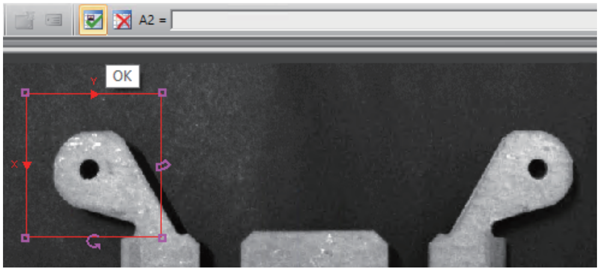


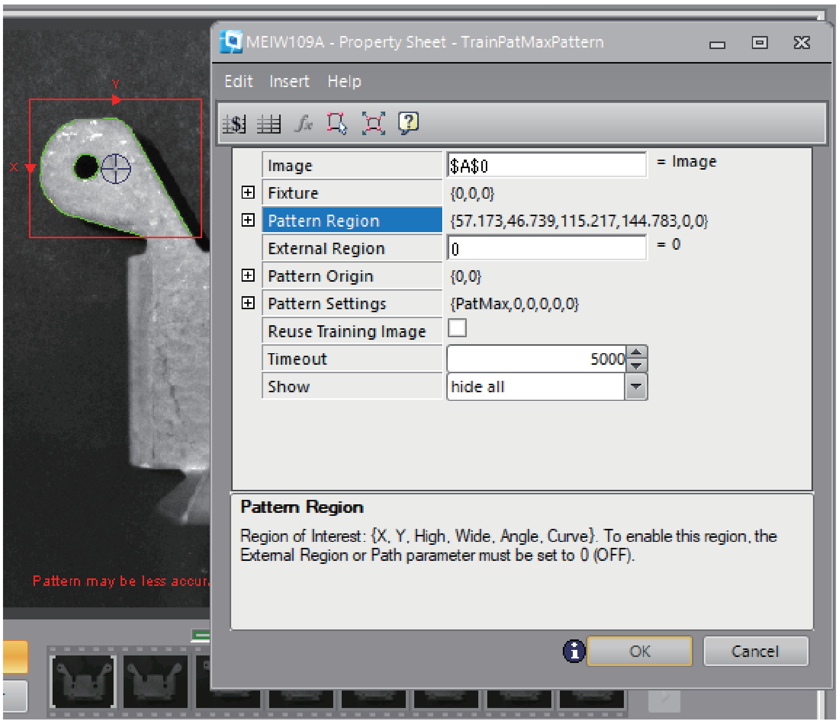
Image	A0	= Image
Fixture	{0,0,0}	
Pattern Region	{165,245,150,150,0,0}	
External Region	0	= 0
Pattern Origin	{0,0}	

3. In the screen to edit model regions, select a region on the work to detect a pattern by dragging the mouse, and press the Enter key.

Alternatively, click the icon (☑) on the toolbar.



4. A model is trained. Check that a green border appears around the trained region.



MEIW109A - Property Sheet - TrainPatMaxPattern

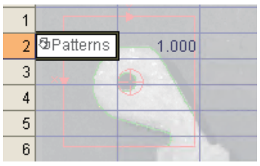
Image	A0	= Image
⊞ Fixture	{0,0,0}	
⊞ Pattern Region	{57.173,46.739,115.217,144.783,0,0}	
External Region	0	= 0
⊞ Pattern Origin	{0,0}	
⊞ Pattern Settings	{PatMax,0,0,0,0,0}	
Reuse Training Image	□	
Timeout	5000	
Show	hide all	

Pattern Region

Region of Interest: {X, Y, High, Wide, Angle, Curve}. To enable this region, the External Region or Path parameter must be set to 0 (OFF).

Point

After the completion of the training, '1.000' is displayed in a cell of the GetTrained (vision data access function), which was automatically added to the TrainPatMaxPattern function.

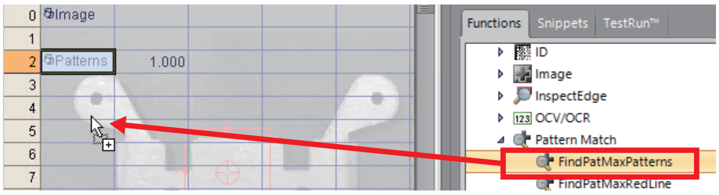


Patterns 1.000

Placing the FindPatMaxPatterns function

Operating procedure

1. Select [Functions] tab ⇨ "Vision Tools" ⇨ "Pattern Match" ⇨ "FindPatMaxPatterns" in the Palette window, and drag and drop it to a spreadsheet.



2. Double-click[*1] "Pattern" in the "Property Sheet" screen.
Alternatively, select "Pattern" and click the icon ($).

[*1] By double-clicking "Pattern", a cell can be selected as an absolute reference.

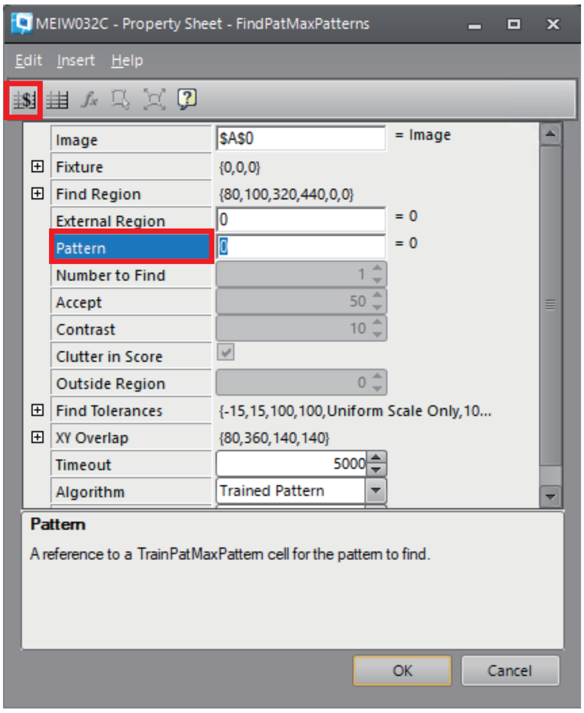
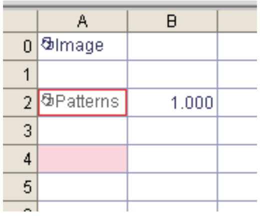


Image	A0	= Image
Fixture	{0,0,0}	
Find Region	{80,100,320,440,0,0}	
External Region	0	= 0
Pattern	0	= 0
Number to Find	1	
Accept	50	
Contrast	10	
Clutter in Score	☑	
Outside Region	0	
Find Tolerances	{-15,15,100,100,Uniform Scale Only,10...	
XY Overlap	{80,360,140,140}	
Timeout	5000	
Algorithm	Trained Pattern	

Pattern

A reference to a TrainPatMaxPattern cell for the pattern to find.

3. Select the cell where the TrainPatMaxPattern is placed, and press the Enter key.



	A	B
0	Image	
1		
2	Patterns	1.000
3		
4		
5		

4. Double-click "Find Region" in the "Property Sheet" screen.
Alternatively, select "Find Region" and click the icon ( ).

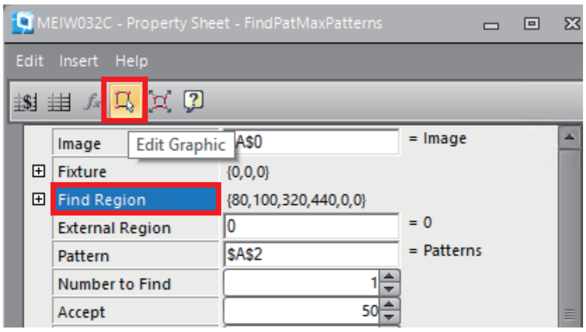
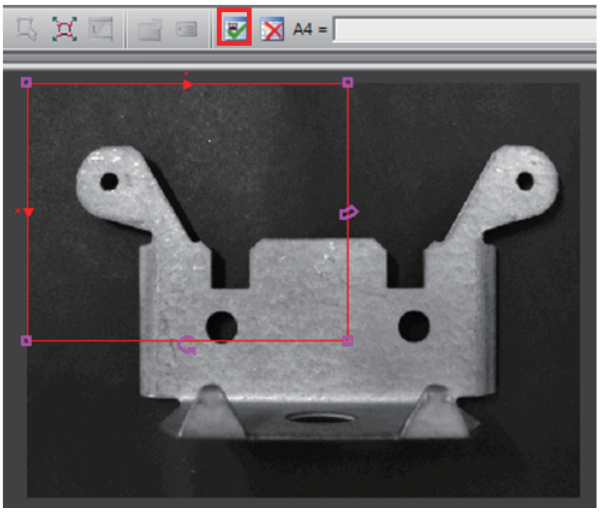


Image	A$0	= Image
⊞ Fixture	{0,0,0}	
⊞ Find Region	{80,100,320,440,0,0}	
External Region	0	= 0
Pattern	$A$2	= Patterns
Number to Find	1	
Accept	50	

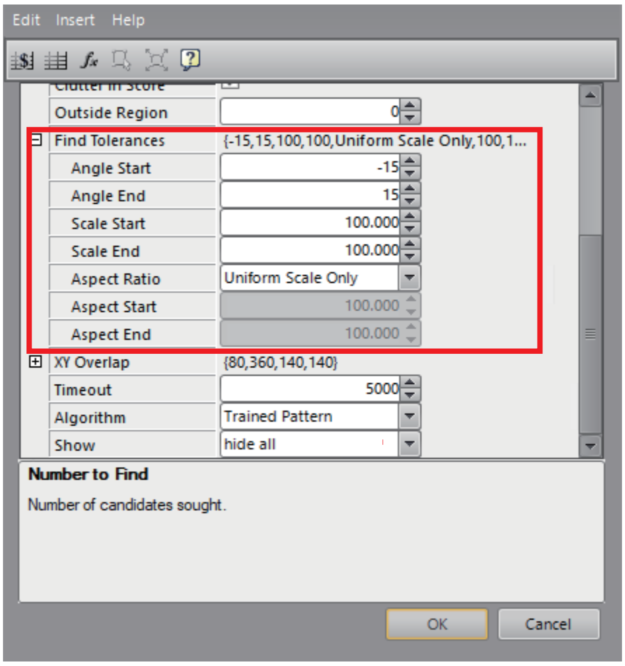
5. Select an area where the pattern of a detection target will appear by dragging the mouse, and press the Enter key.
Alternatively, click the icon ( ) on the toolbar.



6. Set a tolerance rate for the detection target in the trained pattern.

The screen below shows the default tolerance rate.

In the default, ±15° of angle change is allowed, and a scale change is not allowed.



Clutter in Score	
Outside Region	0
⊟ Find Tolerances	{-15,15,100,100,Uniform Scale Only,100,1...
Angle Start	-15
Angle End	15
Scale Start	100.000
Scale End	100.000
Aspect Ratio	Uniform Scale Only
Aspect Start	100.000
Aspect End	100.000
⊞ XY Overlap	{80,360,140,140}
Timeout	5000
Algorithm	Trained Pattern
Show	hide all

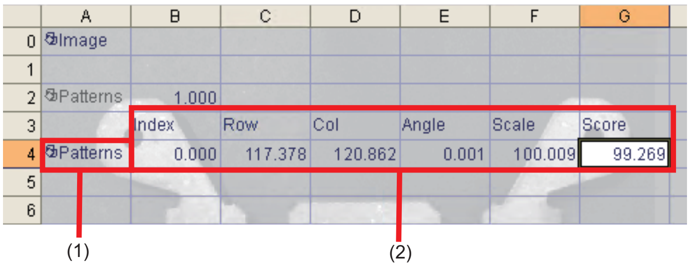
Number to Find

Number of candidates sought.

The tolerance rate should be changed depending on the detection target or installation environment of a vision sensor.

For details, refer to [Help] (?) in the "Property Sheet" screen.

The items are displayed in the spreadsheet as follows.



	A	B	C	D	E	F	G
0	Image						
1							
2	Patterns	1.000					
3		Index	Row	Col	Angle	Scale	Score
4	Patterns	0.000	117.378	120.862	0.001	100.009	99.269
5							
6							

(1) Vision tool function

(2) Vision data access function

Point

When using a coordinate detected in the FindPatMaxPatterns function as a fixture for another function, apply values of row, column, and angle of a vision data access function.

(A fixture detects the feature of an object, and focuses an area to inspect in other vision tool functions.)

Synchronizing a region to feature position

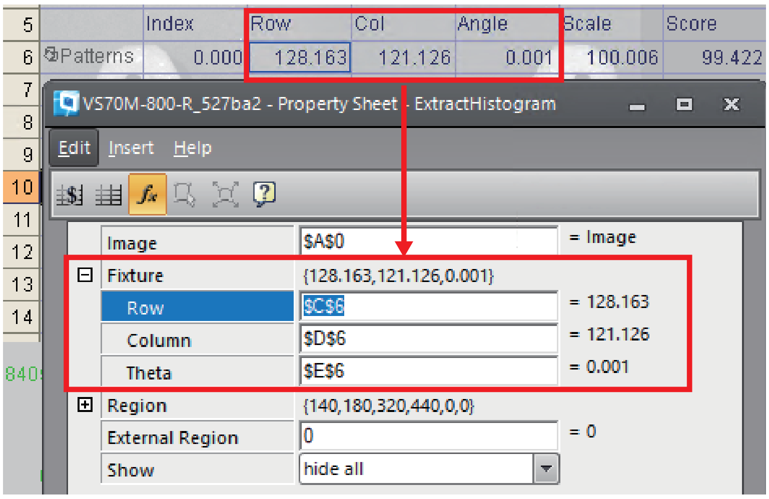
When the feature of an inspection target moves within the field of vision, creating a fixture is required.
Specify a coordinate of the original feature in the "Fixture" parameter of a vision tool function.

Operating procedure

1. Double-click a function to be synchronized to display the "Property Sheet" screen.
2. Double-click "Row", "Col", and "Angle", and then specify a cell where a coordinate output from a function used for locationing is entered.

(Example)

A coordinate value output from the FindPatMaxPatterns function can be used as a fixture by specifying the cells (row, column, and angle) of a vision data access function.



		Index	Row	Col	Angle	Scale	Score
5		Index	Row	Col	Angle	Scale	Score
6	Patterns	0.000	128.163	121.126	0.001	100.006	99.422

VS70M-800-R_527ba2 - Property Sheet - ExtractHistogram

Image	A0	= Image
⊟ Fixture	{128.163,121.126,0.001}	
Row	$C$6	= 128.163
Column	$D$6	= 121.126
Theta	$E$6	= 0.001
⊞ Region	{140,180,320,440,0,0}	
External Region	0	= 0
Show	hide all	

Point

A coordinate output from a function such as ID, Edge, InspectEdge, and Blob can be used as a fixture.

2.6 Debugging a Spreadsheet

Checking cell dependency

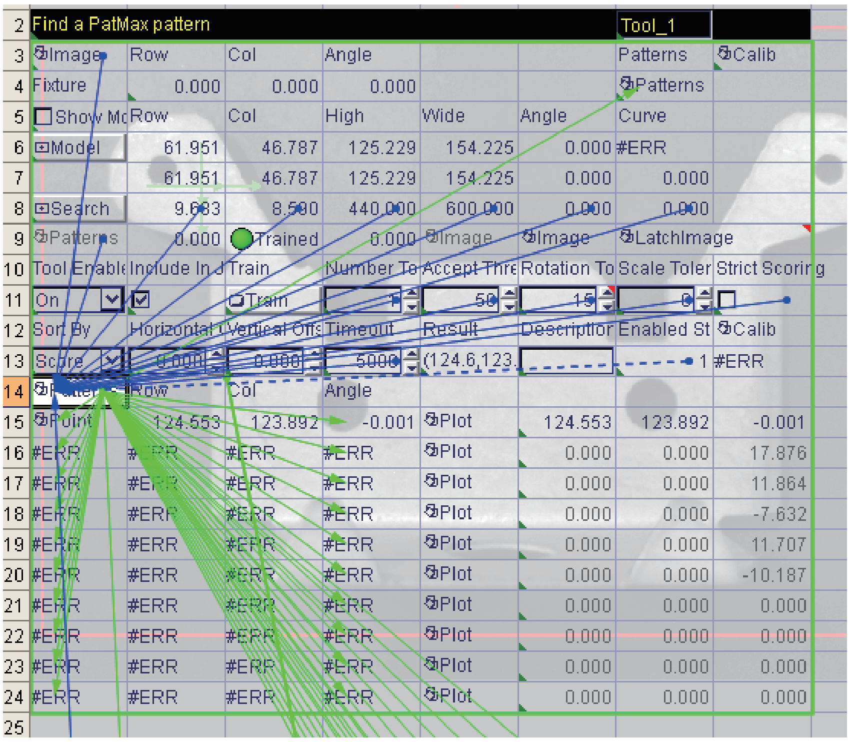
The recognition of cell dependency (precedent and dependent) can be difficult as a job becomes larger.

The source cell (precedent cell) and the destination cell (dependent cell) are indicated by lines by using a job auditing function; therefore the cell dependency can be visually checked when an error occurred in the target cell caused by the error occurred in another cell.

Operating procedure

1. Select a cell to check the dependency.
2. Select [View] ⇨ [Job Auditing] ⇨ [Increase Dependency Levels].

Reference lines are displayed. (☞ Page 34 Reference lines)



2	Find a PatMax pattern						Tool_1	
3	Image	Row	Col	Angle			Patterns	Calib
4	Fixture	0.000	0.000	0.000			Patterns	
5	□ Show Mo	Row	Col	High	Wide	Angle	Curve	
6	Model	61.951	46.787	125.229	154.225	0.000	#ERR	
7		61.951	46.787	125.229	154.225	0.000	0.000	
8	Search	9.683	8.500	440.000	600.000	0.000	0.000	
9	Patterns	0.000	● Trained	0.000	Image	Image	LatchImage	
10	Tool Enable	Include In J	Train	Number To	Accept Thre	Rotation To	Scale Toler	Strict Scoring
11	On	☑	Train	1	50	15	0	□
12	Sort By	Horizontal	Vertical Offs	Timeout	Result	Descriptior	Enabled St	Calib
13	Score	0.000	0.000	5000	(124.6,123.		1	#ERR
14	Patterns	Row	Col	Angle				
15	Point	124.553	123.892	-0.001	Plot	124.553	123.892	-0.001
16	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	17.876
17	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	11.864
18	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	-7.632
19	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	11.707
20	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	-10.187
21	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	0.000
22	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	0.000
23	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	0.000
24	#ERR	#ERR	#ERR	#ERR	Plot	0.000	0.000	0.000
25								

Increasing dependency levels

The number of arrows increases one level by raising the cell dependency level.

Operating procedure

Select [View] ⇨ [Job Auditing] ⇨ [Increase Dependency Levels].

Decreasing dependency levels

The number of arrows decreases one level at a time.

Operating procedure

Select [View] ⇨ [Job Auditing] ⇨ [Decrease Dependency Levels].

Point

The cell dependency can be changed using the icons on the toolbar.

: Increase the dependency level.

: Decrease the dependency level.

: Reset the dependency level.

: Display dependency which includes error (red or yellow lines) only.

: Move the cursor to an error source cell.

Reference lines

A reference line indicates one dependency which is constituted by one precedent and one dependent.

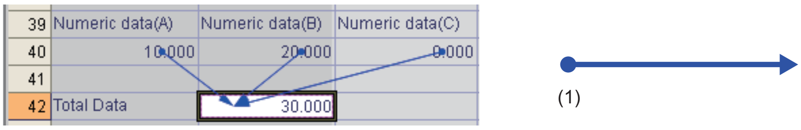
A small circle at the end of the arrow indicates the precedent cell, and the ▲ part of the arrow indicates the destination cell.

Blue: Normal precedents

Red: Precedents in error

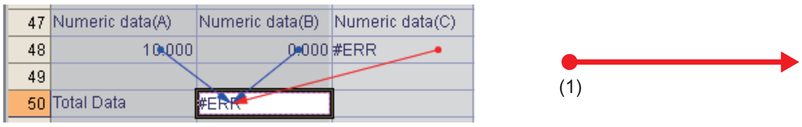
Green: Normal dependents

Yellow: Dependents in error



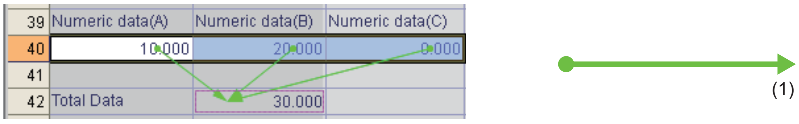
39	Numeric data(A)	Numeric data(B)	Numeric data(C)
40	10.000	20.000	0.000
41			
42	Total Data	30.000	

(1) Precedent cell



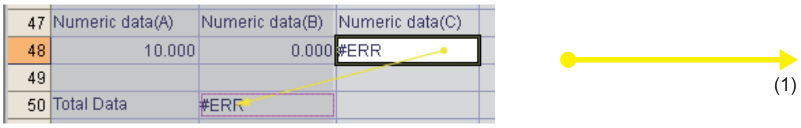
47	Numeric data(A)	Numeric data(B)	Numeric data(C)
48	10.000	0.000	#ERR
49			
50	Total Data	#ERR	

(1) Precedent cell (with error)



39	Numeric data(A)	Numeric data(B)	Numeric data(C)
40	10.000	20.000	0.000
41			
42	Total Data	30.000	

(1) Dependent cell

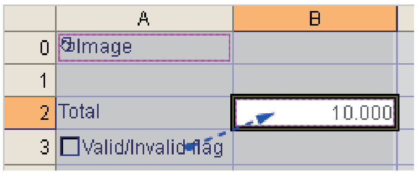


47	Numeric data(A)	Numeric data(B)	Numeric data(C)
48	10.000	0.000	#ERR
49			
50	Total Data	#ERR	

(1) Dependent cell (with error)

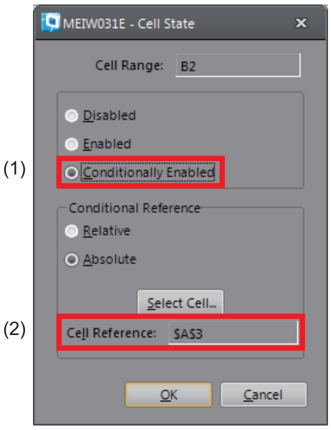
When a reference line is displayed in a dashed line, a precedent cell (a small circle at the end of the arrow) is used for switching the cell status (enable/disable) of a dependent cell (the ▲ part of the arrow).

In the following example, A3 cell is set to enable/disable the cell status of B2 cell [*1].



	A	B
0	Image	
1		
2	Total	10.000
3	□Valid/Invalid flag	

*1 The following shows the setting of cell status in B2 cell.



MEIW031E - Cell State

Cell Range: B2

○ Disabled

○ Enabled

● Conditionally Enabled

Conditional Reference

○ Relative

○ Absolute

Cell Reference: $A$3

(1) "Conditionally Enabled" is selected.

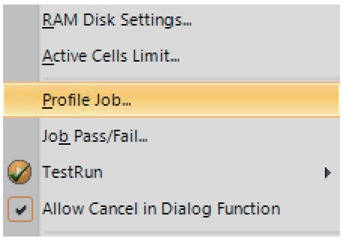
(2) A3 cell is selected for "Cell Reference". By doing so, the cell status of B2 cell is enabled when the value of A3 cell is 1 or more.

Checking an execution time of each function

An execution time of each function can be checked by using the profile function of each job.
A bottleneck function, which is included in a job, can be found to reduce its execution time.

Operating procedure

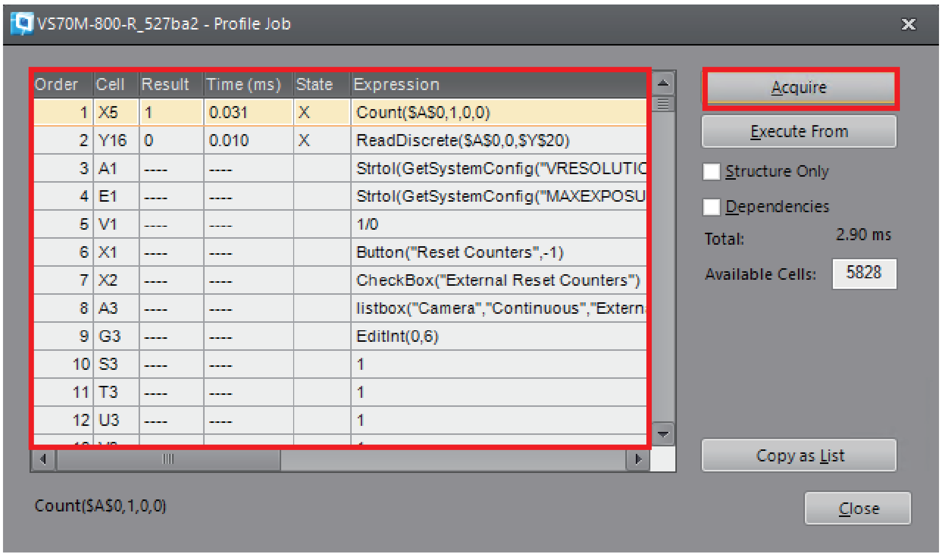
1. Select [Sensor] ⇨ [Profile Job].



2. Click the [Acquire] button.

The functions are executed in the displayed order.

After the execution is completed, values are displayed in the "Result" and "Time (ms)" column.



VS70M-800-R_527ba2 - Profile Job

Order	Cell	Result	Time (ms)	State	Expression
1	X5	1	0.031	X	Count(A0,1,0,0)
2	Y16	0	0.010	X	ReadDiscrete(A0,0,$Y$20)
3	A1	----	----		Strtol(GetSystemConfig("VRESOLUTIC
4	E1	----	----		Strtol(GetSystemConfig("MAXEXPOSU
5	V1	----	----		1/0
6	X1	----	----		Button("Reset Counters",-1)
7	X2	----	----		CheckBox("External Reset Counters")
8	A3	----	----		listbox("Camera","Continuous","Extern
9	G3	----	----		EditInt(0,6)
10	S3	----	----		1
11	T3	----	----		1
12	U3	----	----		1

□ Structure Only
□ Dependencies
Total: 2.90 ms
Available Cells: 5828

Count(A0,1,0,0)

Each execution time can easily be checked by changing the order in the "Profile Job" screen.

☞ Page 37 Sorting functions by execution time

☞ Page 37 Executing profile functions in a part of job

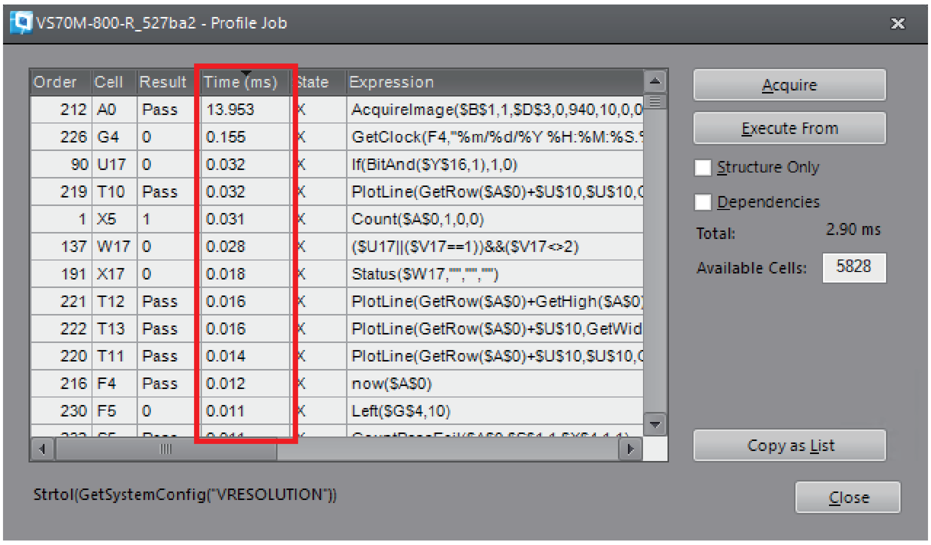
☞ Page 38 Displaying cells including a structure

Sorting functions by execution time

When sorting functions in the execution time order, the functions which take time to execute can be identified easily.

Operating procedure

Click "Time (ms)".



VS70M-800-R_527ba2 - Profile Job

Order	Cell	Result	Time (ms)	State	Expression
212	A0	Pass	13.953	X	AcquireImage($B$1,1,$D$3,0,940,10,0,0
226	G4	0	0.155	X	GetClock(F4,"%m/%d/%Y %H:%M:%S.%
90	U17	0	0.032	X	If(BitAnd($Y$16,1),1,0)
219	T10	Pass	0.032	X	PlotLine(GetRow(A0)+$U$10,$U$10,(
1	X5	1	0.031	X	Count(A0,1,0,0)
137	W17	0	0.028	X	($U17\|\|($V17==1))&&($V17<>2)
191	X17	0	0.018	X	Status($W17,"","","")
221	T12	Pass	0.016	X	PlotLine(GetRow(A0)+GetHigh(A0)
222	T13	Pass	0.016	X	PlotLine(GetRow(A0)+$U$10,GetWid
220	T11	Pass	0.014	X	PlotLine(GetRow(A0)+$U$10,$U$10,(
216	F4	Pass	0.012	X	now(A0)
230	F5	0	0.011	X	Left($G$4,10)

Total: 2.90 ms

Available Cells: 5828

Strtol(GetSystemConfig("VRESOLUTION"))

Point

Clicking the header of each column can sort items.

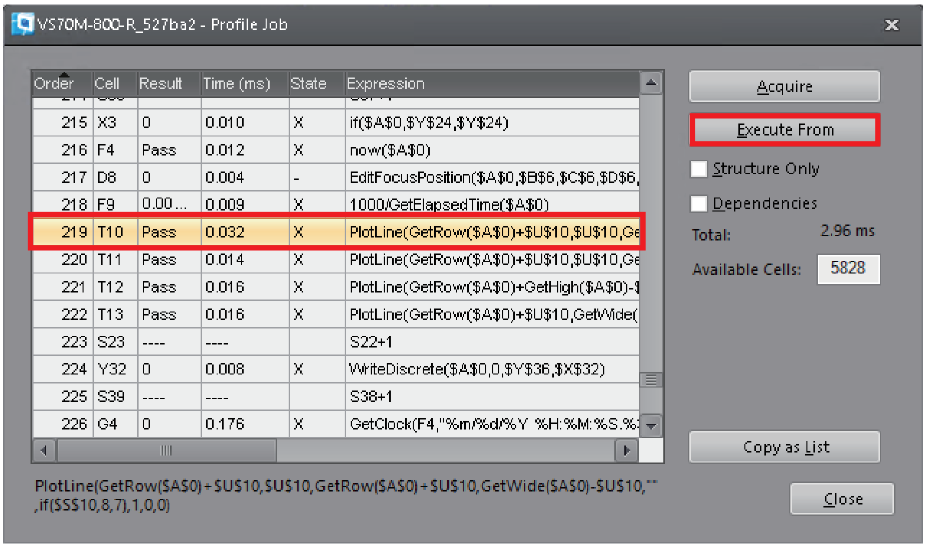
Executing profile functions in a part of job

Only the job of cells which have dependency can be executed without acquiring an image.

The execution status can be checked on the same image condition and can be obtained while opening an image file.

Operating procedure

Select the cell of a job to be executed, and click the [Execute From] button.



VS70M-800-R_527ba2 - Profile Job

Order	Cell	Result	Time (ms)	State	Expression
215	X3	0	0.010	X	if(A0,$Y$24,$Y$24)
216	F4	Pass	0.012	X	now(A0)
217	D8	0	0.004	-	EditFocusPosition(A0,$B$6,$C$6,$D$6,
218	F9	0.00...	0.009	X	1000/GetElapsedTime(A0)
219	T10	Pass	0.032	X	PlotLine(GetRow(A0)+$U$10,$U$10,Ge
220	T11	Pass	0.014	X	PlotLine(GetRow(A0)+$U$10,$U$10,Ge
221	T12	Pass	0.016	X	PlotLine(GetRow(A0)+GetHigh(A0)-$
222	T13	Pass	0.016	X	PlotLine(GetRow(A0)+$U$10,GetWide(
223	S23	----	----		S22+1
224	Y32	0	0.008	X	WriteDiscrete(A0,0,$Y$36,$X$32)
225	S39	----	----		S38+1
226	G4	0	0.176	X	GetClock(F4,"%m/%d/%Y %H:%M:%S.%:

Total: 2.96 ms

Available Cells: 5828

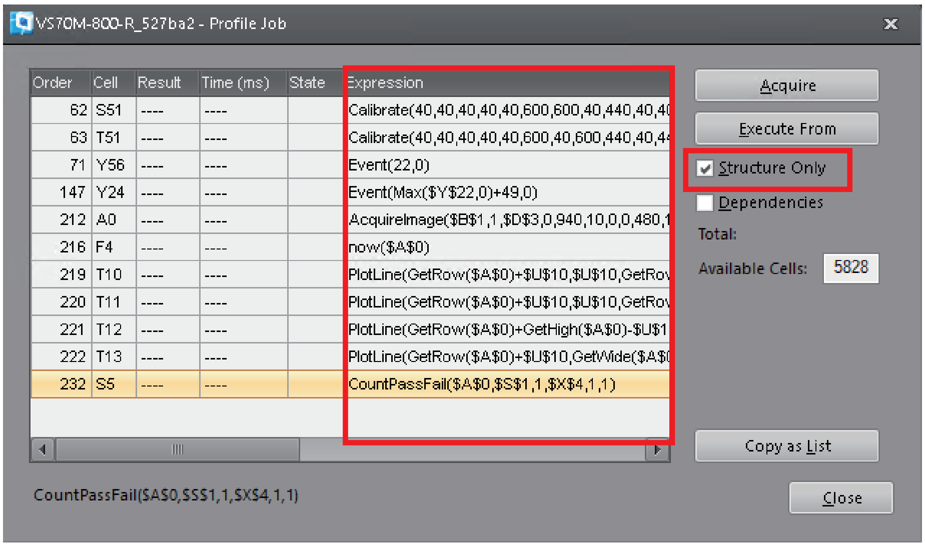
PlotLine(GetRow(A0)+$U$10,$U$10,GetRow(A0)+$U$10,GetWide(A0)-$U$10,""
,if($S$10,8,7),1,0,0)

Displaying cells including a structure

The execution time of the main processing can be checked by displaying only cells containing a structure.

Operating procedure

Select the checkbox of "Structure Only".



VS70M-800-R_527ba2 - Profile Job

Order	Cell	Result	Time (ms)	State	Expression
62	S51	----	----		Calibrate(40,40,40,40,40,600,600,40,440,40,40
63	T51	----	----		Calibrate(40,40,40,40,40,600,40,600,440,40,44
71	Y56	----	----		Event(22,0)
147	Y24	----	----		Event(Max($Y$22,0)+49,0)
212	A0	----	----		AcquireImage($B$1,1,$D$3,0,940,10,0,0,480,1
216	F4	----	----		now(A0)
219	T10	----	----		PlotLine(GetRow(A0)+$U$10,$U$10,GetRov
220	T11	----	----		PlotLine(GetRow(A0)+$U$10,$U$10,GetRov
221	T12	----	----		PlotLine(GetRow(A0)+GetHigh(A0)-$U$1
222	T13	----	----		PlotLine(GetRow(A0)+$U$10,GetWide(A0
232	S5	----	----		CountPassFail(A0,$S$1,1,$X$4,1,1)

☑ Structure Only

□ Dependencies

Total:

Available Cells: 5828

CountPassFail(A0,$S$1,1,$X$4,1,1)

2.7 Setting an Interface

By setting an interface, a vision sensor can be monitored in In-Sight Explorer and VisionView.

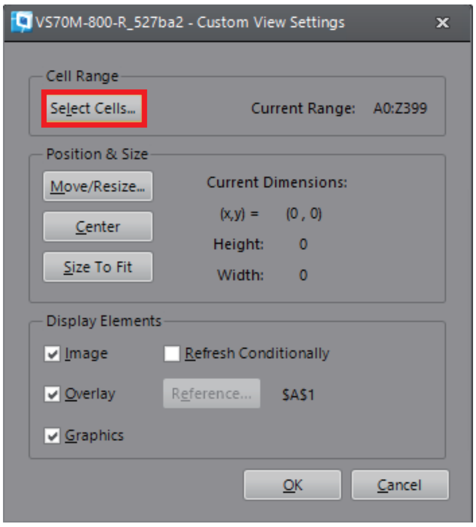
Displaying a custom view

The custom view displays the interface created in a spreadsheet using values and a control function.
The screen which is suitable to monitor in In-Sight Explorer and VisionView can be configured and displayed.
For details on the control function and the custom view, refer to the help of In-Sight Explorer.

Operating procedure

1. Select [Edit] ⇨ [Custom View Settings] ( ).

2. Click the [Select Cells] button.



VS70M-800-R_527ba2 - Custom View Settings

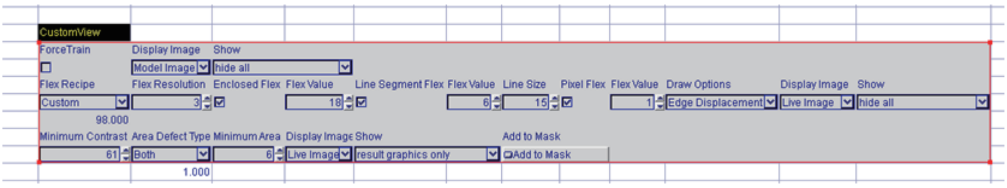
Cell Range
Select Cells... Current Range: A0:Z399

Position & Size
Move/Resize... Current Dimensions:
Center (x,y) = (0 , 0)
Size To Fit Height: 0
Width: 0

Display Elements
☑ Image □ Refresh Conditionally
☑ Overlay Reference... $A$1
☑ Graphics

OK Cancel

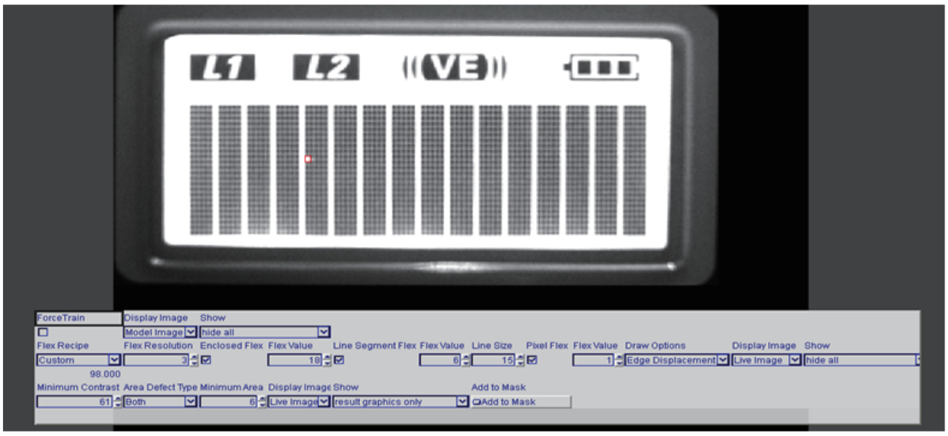
3. Select cells to display in the custom view.



CustomView											
ForceTrain	Display Image	Show									
□	Model Image	hide all									
Flex Recipe	Flex Resolution	Enclosed Flex	Flex Value	Line Segment Flex	Flex Value	Line Size	Pixel Flex	Flex Value	Draw Options	Display Image	Show
Custom	3	☑	18	☑	6	15	☑	1	Edge Displacement	Live Image	hide all
98.000											
Minimum Contrast	Area Defect Type	Minimum Area	Display Image	Show		Add to Mask					
61	Both	6	Live Image	result graphics only		Add to Mask					
	1.000										

4. Select [View] ⇨ [Custom View] ( ).

The custom view is displayed.



ForceTrain	Display Image	Show									
□	Model Image	hide all									
Flex Recipe	Flex Resolution	Enclosed Flex	Flex Value	Line Segment Flex	Flex Value	Line Size	Pixel Flex	Flex Value	Draw Options	Display Image	Show
Custom	3	☑	18	☑	6	15	☑	1	Edge Displacement	Live Image	hide all
98.000											
Minimum Contrast	Area Defect Type	Minimum Area	Display Image	Show		Add to Mask					
61	Both	6	Live Image	result graphics only		Add to Mask					

2.8 Establishing Communication

Communication can be established by the following methods.

☞Page 40 In CC-Link IE Field Network Basic

☞Page 50 In SLMP scanner

☞Page 59 In I/Os

In CC-Link IE Field Network Basic

CC-Link IE Field Network Basic is a factory automation network using standard Ethernet.

A programmable controller with a built-in Ethernet port will be the master station and communicates with slave stations.

This section shows the procedure for connecting with CC-Link IE Field Network Basic to input and out data in the following configuration.

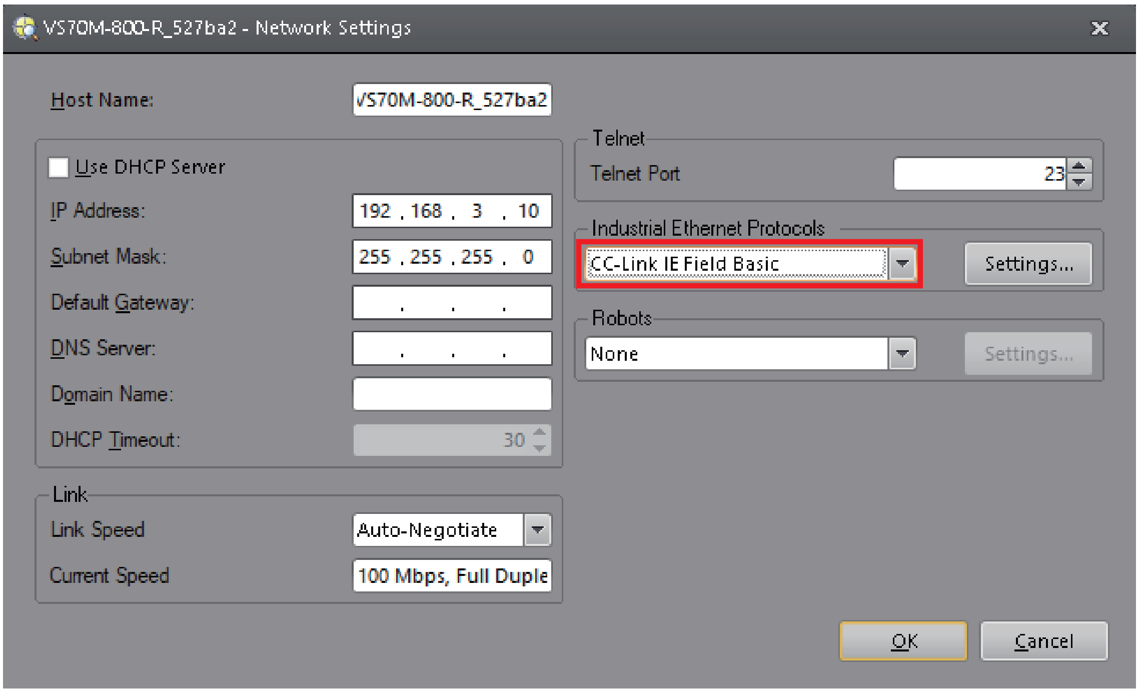
- MELSEC iQ-R series programmable controller
- GX Works3
- Vision sensor VS70
- In-Sight Explorer

Connecting CC-Link IE Field Network Basic

Operating procedure

1. Select [Sensor] ⇨ [Network Settings] in In-Sight Explorer.

2. In the "Network Settings" screen, select "CC-Link IE Field Basic" in "Industrial Ethernet Protocols".



VS70M-800-R_527ba2 - Network Settings

Host Name: VS70M-800-R_527ba2

☐ Use DHCP Server

IP Address: 192 . 168 . 3 . 10

Subnet Mask: 255 . 255 . 255 . 0

Default Gateway: . . .

DNS Server: . . .

Domain Name:

DHCP Timeout: 30

Link

Link Speed: Auto-Negotiate

Current Speed: 100 Mbps, Full Duple

Telnet

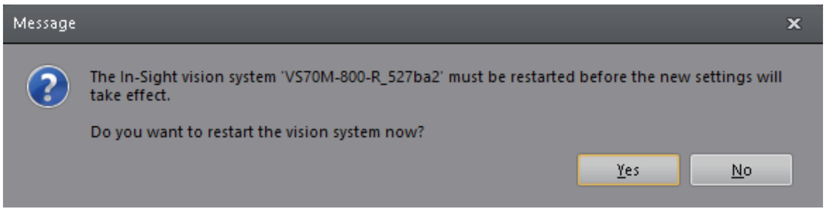
Telnet Port: 23

Industrial Ethernet Protocols: CC-Link IE Field Basic

Robots: None

3. Click the [OK] button.

When the following message appears, click the [Yes] button to restart the vision system.



Message

The In-Sight vision system 'VS70M-800-R_527ba2' must be restarted before the new settings will take effect.

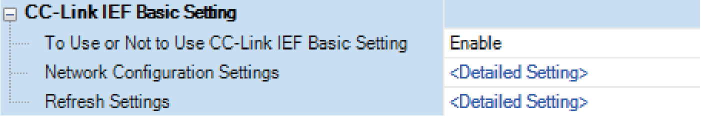
Do you want to restart the vision system now?

4. Set the following items in GX Works3.

● Set a module parameter.

Select [Parameter] ⇨ "(module name)" ⇨ [Module Parameter] in the "Navigation" window, and set the following items in [Basic Settings] ⇨ [CC-Link IEF Basic Settings].

- IP address
- To Use or Not to Use CC-Link IEF Basic Setting: Enable

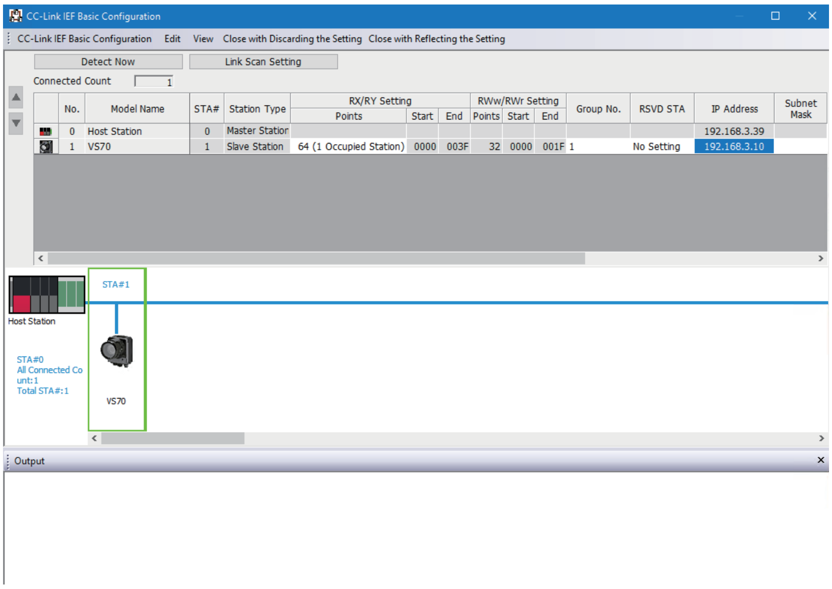


CC-Link IEF Basic Setting	
To Use or Not to Use CC-Link IEF Basic Setting	Enable
Network Configuration Settings	<Detailed Setting>
Refresh Settings	<Detailed Setting>

● Configure the CC-Link IEF Basic configuration.

Select [Parameter] ⇨ "(module name)" ⇨ [Module Parameter] in the "Navigation" window, and set the following items in [Basic Settings] ⇨ [CC-Link IEF Basic Settings] ⇨"Network Configuration Settings" ⇨ "<Detailed Setting>".

Click the [Detect Now] button to configure the settings.



CC-Link IEF Basic Configuration
CC-Link IEF Basic Configuration
Edit
View
Close with Discarding the Setting
Close with Reflecting the Setting
Detect Now
Link Scan Setting

Connected Count 1

No.	Model Name	STA#	Station Type	RX/RY Setting			RWw/RWr Setting			Group No.	RSVD STA	IP Address	Subnet Mask
				Points	Start	End	Points	Start	End				
0	Host Station	0	Master Station									192.168.3.39	
1	VS70	1	Slave Station	64 (1 Occupied Station)	0000	003F	32	0000	001F	1	No Setting	192.168.3.10	

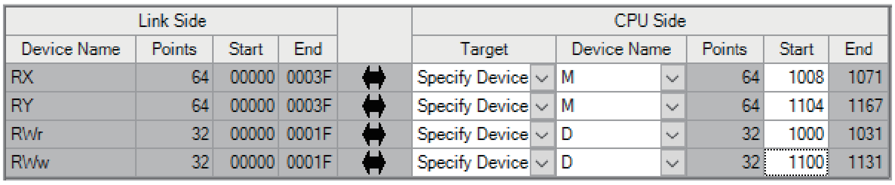
STA#1
Host Station
STA#0
All Connected Count:1
Total STA#:1
VS70
Output

For details on the automatic detection function of connected devices, refer to the following manual.

📖iQ Sensor Solution Reference Manual

● Configure refresh settings.

Select [Parameter] ⇨ "(module name)" ⇨ [Module Parameter] in the "Navigation" window, and set the following items in [Basic Settings] ⇨ [CC-Link IEF Basic Settings] ⇨"Refresh Settings" ⇨ "<Detailed Setting>".



Link Side					CPU Side				
Device Name	Points	Start	End		Target	Device Name	Points	Start	End
RX	64	00000	0003F	⇔	Specify Device	M	64	1008	1071
RY	64	00000	0003F	⇔	Specify Device	M	64	1104	1167
RWr	32	00000	0001F	⇔	Specify Device	D	32	1000	1031
RWw	32	00000	0001F	⇔	Specify Device	D	32	1100	1131

Link side	CPU side				
Device name	Target	Device name	Points	Start	End
RX	Specify Device	M	64	1008	1071
RY	Specify Device	M	64	1104	1167
RWr	Specify Device	D	32	1000	1031
RWw	Specify Device	D	32	1100	1131

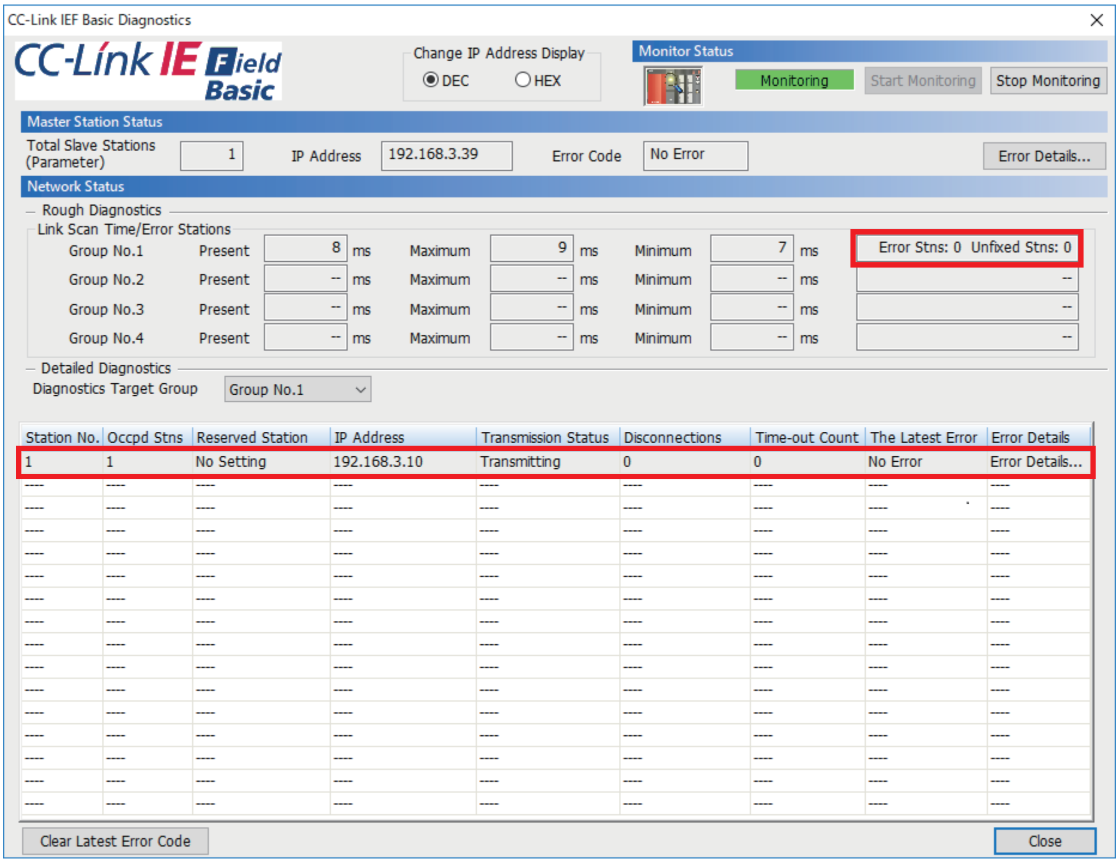
For details on the remote I/O signals, refer to the following:

📖Vision Sensor Connection Guide

5. Write the parameters to a programmable controller.

6. Select [Diagnostics] ⇨ [CC-Link IEF Basic Diagnostics] in GX Works3.

Check that the CC-Link IE Field Network Basic works properly.



Change IP Address Display: ● DEC ○ HEX

Monitor Status: Monitoring

Master Station Status

Total Slave Stations (Parameter): 1 IP Address: 192.168.3.39 Error Code: No Error

Network Status

Rough Diagnostics

Link Scan Time/Error Stations

Group No.1	Present	8	ms	Maximum	9	ms	Minimum	7	ms	Error Stns: 0 Unfixed Stns: 0
Group No.2	Present	--	ms	Maximum	--	ms	Minimum	--	ms	--
Group No.3	Present	--	ms	Maximum	--	ms	Minimum	--	ms	--
Group No.4	Present	--	ms	Maximum	--	ms	Minimum	--	ms	--

Detailed Diagnostics

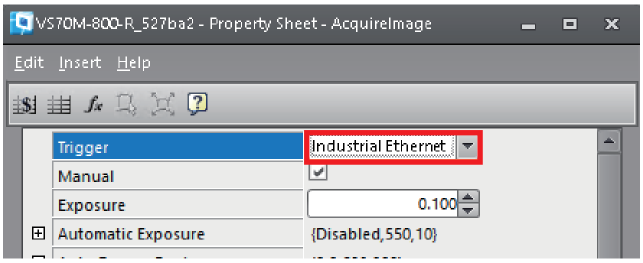
Diagnostics Target Group: Group No.1

Station No.	Occpd Stns	Reserved Station	IP Address	Transmission Status	Disconnections	Time-out Count	The Latest Error	Error Details
1	1	No Setting	192.168.3.10	Transmitting	0	0	No Error	Error Details...
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----

7. Double-click the A0 cell (AcquireImage function) in In-Sight Explorer.

8. Set "Industrial Ethernet" for "Trigger" in the "Property Sheet" screen.

The setting above enables the programmable controller to control the triggers of a vision sensor.



Trigger: Industrial Ethernet
Manual: ☑
Exposure: 0.100
Automatic Exposure: {Disabled,550,10}

9. Make a vision sensor online.

10. Select [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch Monitor] in GX Works3.

Perform the following operations.

❶ Turn ON 'Trigger Enable' (M1104) of remote output (RY).

Check that 'Trigger Ready' (M1008) of remote input (RX) is turned ON.

❷ Turn ON 'Trigger' (M1105) of remote output (RY).

After the trigger is started executing, 'Inspection Completed' (M1017) of the remote input (RX) is changed (toggled).

Outputting data

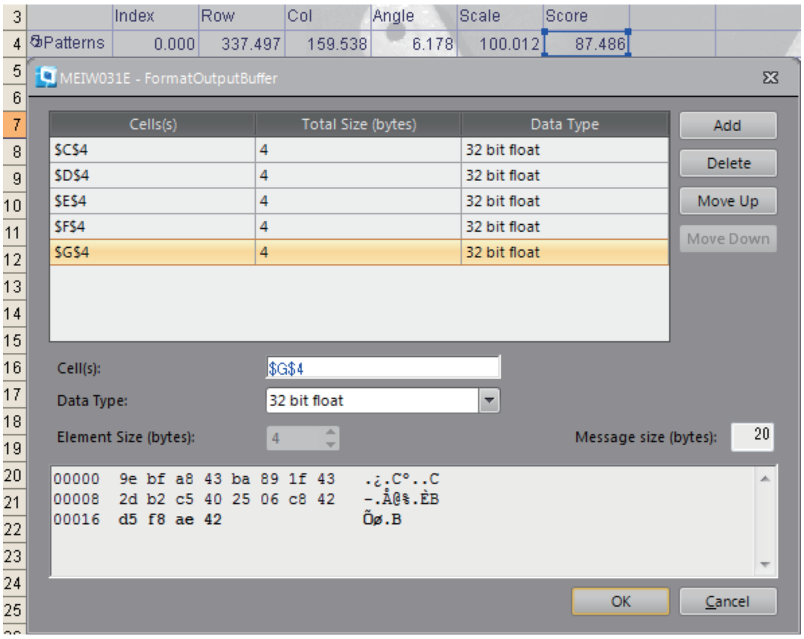
Output data from a vision sensor to a programmable controller.

Operating procedure

1. Select [Functions] tab ⇨ "Input/Output" ⇨ "FormatOutputBuffer" in the Palette window of In-Sight Explorer, and drag and drop it to a spreadsheet.

2. Click the [Add] button in the "FormatOutputBuffer" screen, and double-click a cell where a value to be output is entered.

Select one cell for each value. When multiple cells are selected simultaneously, they are added as one data and therefore the intended data may not be obtained.



		Index	Row	Col	Angle	Scale	Score
3		Index	Row	Col	Angle	Scale	Score
4	Patterns	0.000	337.497	159.538	6.178	100.012	87.486

MEIW031E - FormatOutputBuffer

Cells(s)	Total Size (bytes)	Data Type
$C$4	4	32 bit float
$D$4	4	32 bit float
$E$4	4	32 bit float
$F$4	4	32 bit float
$G$4	4	32 bit float

Cell(s): $G$4

Data Type: 32 bit float

Element Size (bytes): 4

Message size (bytes): 20

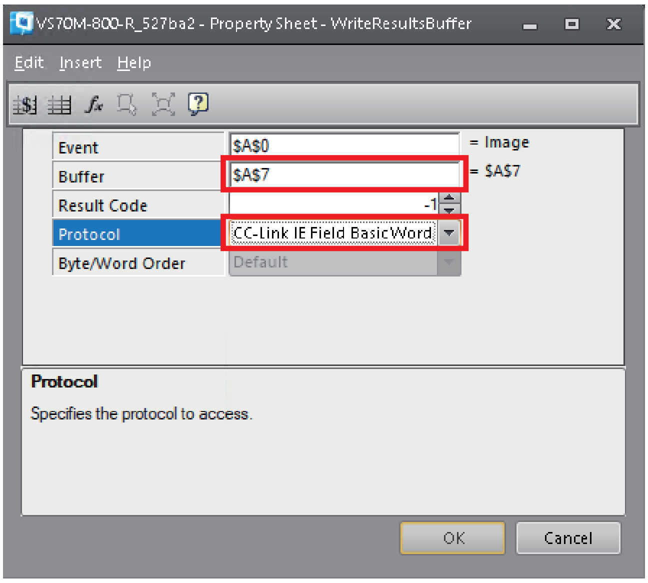
```
00000  9e bf a8 43 ba 89 1f 43   .¿.C°..C
00008  2d b2 c5 40 25 06 c8 42   –.Å@%.ÈB
00016  d5 f8 ae 42               Õø.B
```

3. Select [Functions] tab ⇨ "Input/Output" ⇨ "Network" ⇨ "WriteResultsBuffer" in the Palette window, and drag and drop it to the spreadsheet.

4. Set the items in the "Property Sheet" screen as follows.

Buffer: The cell where the FormatOutputBuffer function is placed in the step 1

Protocol: CC-Link IE Field Basic Word Area



VS70M-800-R_527ba2 - Property Sheet - WriteResultsBuffer

Event	A0	= Image
Buffer	$A$7	= $A$7
Result Code	-1	
Protocol	CC-Link IE Field Basic Word	
Byte/Word Order	Default	

Protocol

Specifies the protocol to access.

5. Make a vision sensor online.

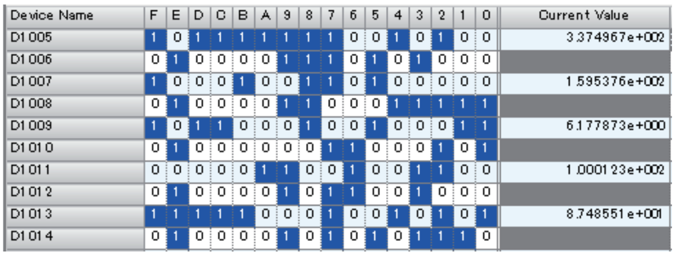
6. Select [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch Monitor] in GX Works3.

Perform the following operations to check the output operations.

❶ Turn ON 'Trigger Enable' (M1104) of remote output (RY).

❷ Turn ON 'Trigger' (M1105) of remote output (RY).

The data from the vision sensor is displayed in 'Inspection Results' (D1005 to D1013) of a remote register (RWr).



Device Name	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	Current Value
D1005	1	0	1	1	1	1	1	1	1	0	0	1	0	1	0	0	3.374967e+002
D1006	0	1	0	0	0	0	1	1	1	0	1	0	1	0	0	0	
D1007	1	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1.595376e+002
D1008	0	1	0	0	0	0	1	1	0	0	0	1	1	1	1	1	
D1009	1	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	6.177873e+000
D1010	0	1	0	0	0	0	0	0	1	1	0	0	0	1	0	1	
D1011	0	0	0	0	0	1	1	0	0	1	0	0	1	1	0	0	1.000123e+002
D1012	0	1	0	0	0	0	1	0	1	1	0	0	1	0	0	0	
D1013	1	1	1	1	1	0	0	0	1	0	0	1	0	1	0	1	8.748551e+001
D1014	0	1	0	0	0	0	1	0	1	0	1	0	1	1	1	0	

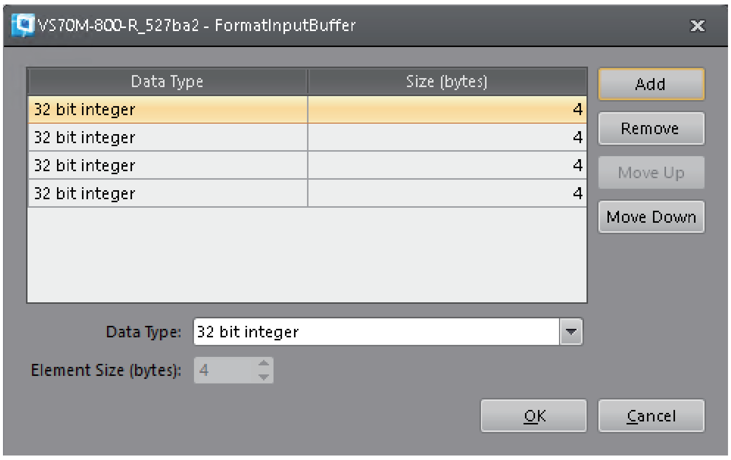
Inputting data

Input data from a programmable controller to a vision sensor.

Operating procedure

1. Select [Functions] tab ⇨ "Input/Output" ⇨ "FormatInputBuffer" in the Palette window, and drag and drop it to a spreadsheet.

2. Click the [Add] button in the "FormatInputBuffer" screen to add storage destination for the number of units of data.



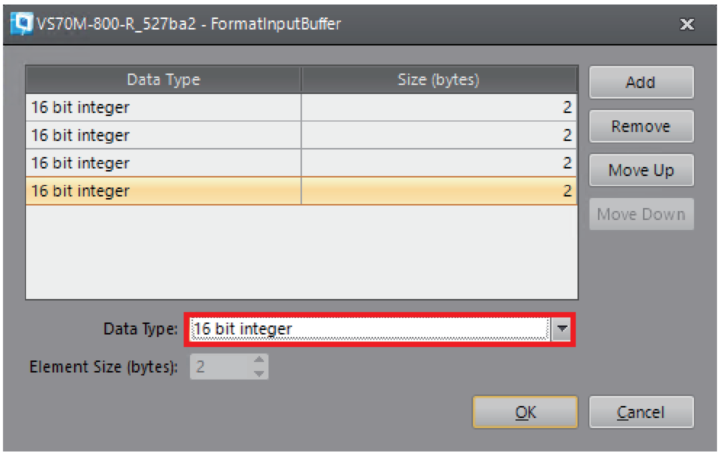
VS70M-800-R_527ba2 - FormatInputBuffer

Data Type	Size (bytes)
32 bit integer	4
32 bit integer	4
32 bit integer	4
32 bit integer	4

Data Type: 32 bit integer

Element Size (bytes): 4

3. Select a data type in "Data Type" according to the data.



VS70M-800-R_527ba2 - FormatInputBuffer

Data Type	Size (bytes)
16 bit integer	2
16 bit integer	2
16 bit integer	2
16 bit integer	2

Data Type: 16 bit integer

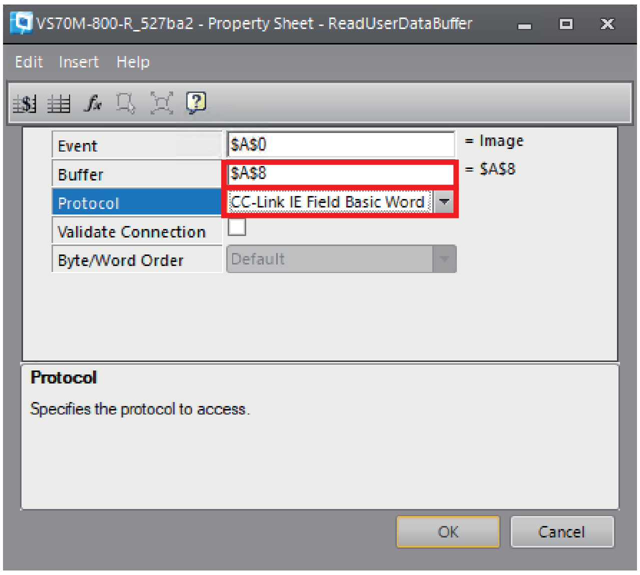
Element Size (bytes): 2

4. Select [Functions] tab ⇨ "Input/Output" ⇨ "Network" ⇨ "ReadUserDataBuffer" in the Palette window, and drag and drop it to the spreadsheet.

5. Set the items in the "Property Sheet" screen as follows.

Buffer: The cell where the FormatInputBuffer function is placed in the step 1

Protocol: CC-Link IE Field Basic Word Area



VS70M-800-R_527ba2 - Property Sheet - ReadUserDataBuffer

Event	A0	= Image
Buffer	$A$8	= $A$8
Protocol	CC-Link IE Field Basic Word	
Validate Connection	□	
Byte/Word Order	Default	

Protocol

Specifies the protocol to access.

6. Select [Functions] tab ⇨ "Vision Data Access" ⇨ "Input/Output" ⇨ "GetBufferData" in the Palette window, and drag and drop it to the spreadsheet.

The GetBufferData function that displays data in a programmable controller is placed in the spreadsheet.

7. Set the function as follows.

GetBufferData (ReadBuffer, index)

For 'ReadBuffer', specify the cell where the ReadUserDataBuffer function is placed.

For 'Index', specify a value within 0 to (the number of units of data add in the FormatInputBuffer function - 1).

8. Repeat the step 6 and step 7 for the number of units of data added in the step 2.

9. Select [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch Monitor] in GX Works3, and set the data to be input to a vision sensor as a remote register (RWw).

Set data from 'User Data' (D1101) to 'User Data' (D1104)

10. Perform the following operations in the "Device/Buffer Memory Batch Monitor" window.

❶ Turn ON 'Set User Data' (M1120) of remote output (RY).

Check that 'Set User Data Ack' (M1024) of remote input (RX) is turned ON.

❷ Turn OFF 'Set User Data' (M1120) of remote output (RY).

11. Make a vision sensor online.

12. Select [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch Monitor] in GX Works3.

Perform the following operations to check the input operations.

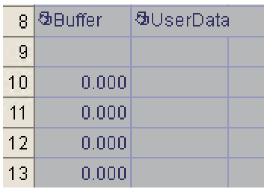
❶ Turn ON 'Trigger Enable' (M1104) of remote output (RY).

Check that 'Trigger Ready' (M1008) of remote input (RX) is turned ON.

❷ Turn ON 'Trigger' (M1105) of remote output (RY).

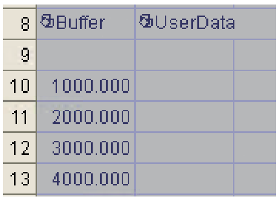
Data in the programmable controller is displayed in the cell where the GetBufferData function of In-Sight Explorer is placed.

- Before triggering



8	Buffer	UserData
9		
10	0.000	
11	0.000	
12	0.000	
13	0.000	

- After triggering



8	Buffer	UserData
9		
10	1000.000	
11	2000.000	
12	3000.000	
13	4000.000	

In SLMP scanner

SLMP protocol is used for SLMP scanner communication.

Device values in a programmable controller can be read and written from a vision sensor.

A vision sensor and programmable controller synchronize with a poll interval set in the SLMP scanner setting of In-Sight Explorer.

This section shows the procedure for connecting with SLMP scanner to input and out data in the following configuration.

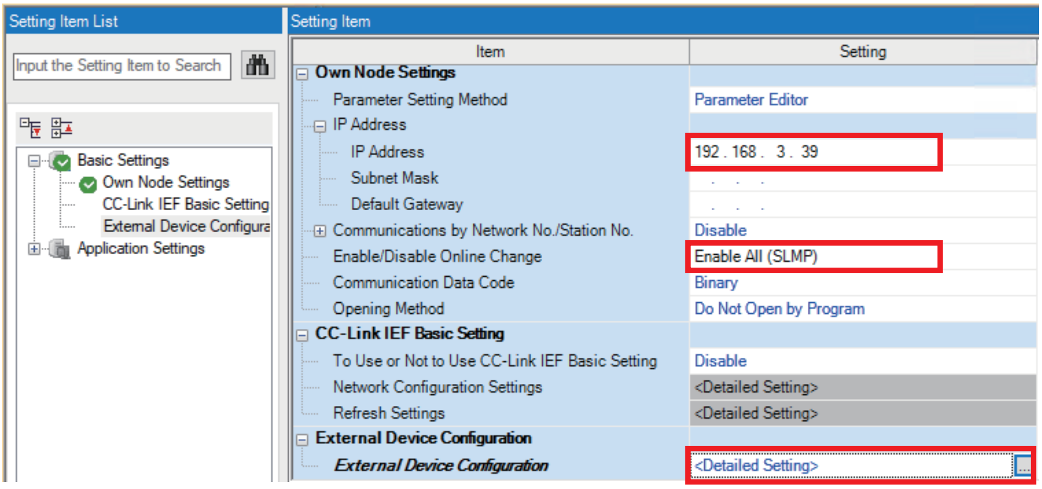
- MELSEC iQ-R series programmable controller
- GX Works3
- Vision sensor VS70
- In-Sight Explorer

Connecting SLMP scanner

Operating procedure

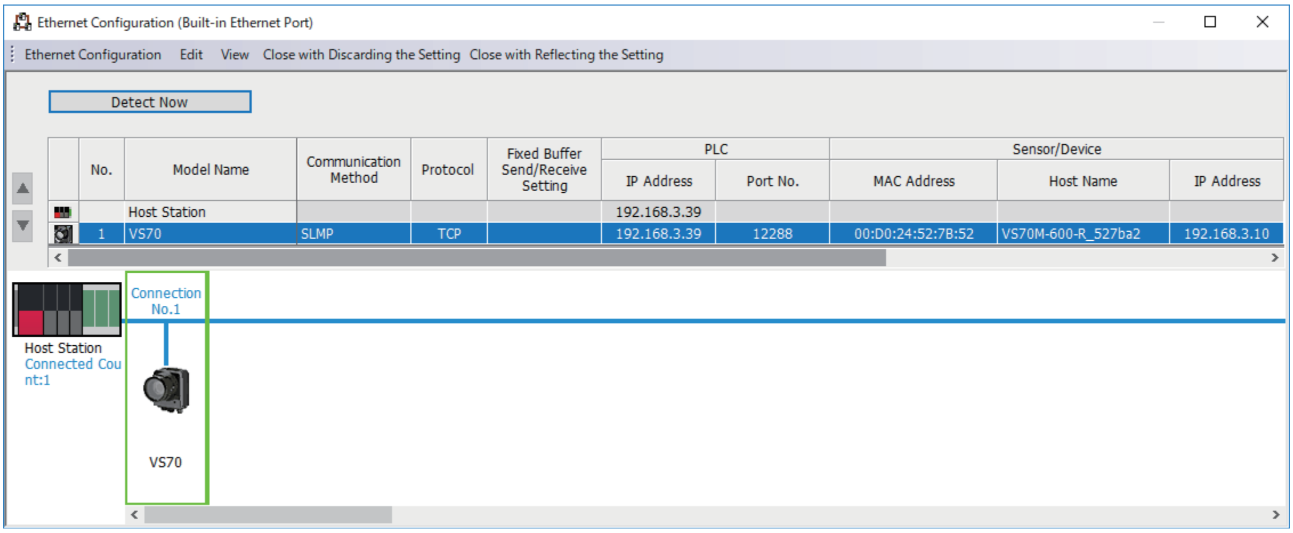
1. Select [Parameter] ⇨ "(module name)" ⇨ [Module Parameter] in the "Navigation" window of GX Works3, and set the following items in [Basic Settings] ⇨ [Own Node Settings].

- IP Address
- Enable/Disable Online Change: "Enable All (SLMP)"
- External Device Configuration: "<Detailed Settings>" *1


Setting Item List
Input the Setting Item to Search
Basic Settings
Own Node Settings
CC-Link IEF Basic Setting
External Device Configura
Application Settings
Setting Item

Item	Setting
Own Node Settings	
Parameter Setting Method	Parameter Editor
IP Address	
IP Address	192 . 168 . 3 . 39
Subnet Mask	. . .
Default Gateway	. . .
Communications by Network No./Station No.	Disable
Enable/Disable Online Change	Enable All (SLMP)
Communication Data Code	Binary
Opening Method	Do Not Open by Program
CC-Link IEF Basic Setting	
To Use or Not to Use CC-Link IEF Basic Setting	Disable
Network Configuration Settings	<Detailed Setting>
Refresh Settings	<Detailed Setting>
External Device Configuration	
External Device Configuration	<Detailed Setting>

*1 Click the [Detect Now] button to configure the settings.

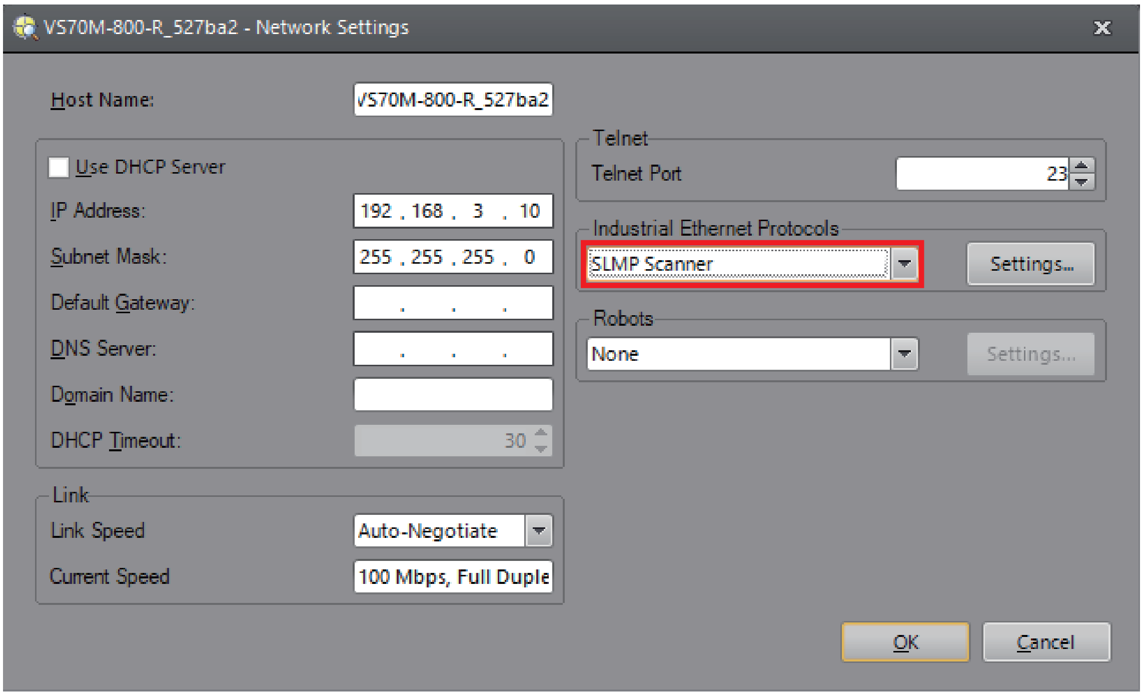

Ethernet Configuration (Built-in Ethernet Port)
Ethernet Configuration
Edit
View
Close with Discarding the Setting
Close with Reflecting the Setting
Detect Now
Host Station
Connected Count:1
Connection No.1
VS70

	No.	Model Name	Communication Method	Protocol	Fixed Buffer Send/Receive Setting	PLC		Sensor/Device		
						IP Address	Port No.	MAC Address	Host Name	IP Address
		Host Station				192.168.3.39				
	1	VS70	SLMP	TCP		192.168.3.39	12288	00:D0:24:52:7B:52	VS70M-600-R_527ba2	192.168.3.10

2. Write the parameters to a programmable controller.

3. Select [Sensor] ⇨ [Network Settings] in In-Sight Explorer.

4. In the "Network Settings" screen, select "SLMP Scanner" in "Industrial Ethernet Protocols".



VS70M-800-R_527ba2 - Network Settings

Host Name: VS70M-800-R_527ba2

□ Use DHCP Server

IP Address: 192 . 168 . 3 . 10

Subnet Mask: 255 . 255 . 255 . 0

Default Gateway: . . .

DNS Server: . . .

Domain Name:

DHCP Timeout: 30

Link

Link Speed: Auto-Negotiate

Current Speed: 100 Mbps, Full Duple

Telnet

Telnet Port: 23

Industrial Ethernet Protocols: SLMP Scanner

Robots: None

5. Select the [Settings] button under "Industrial Ethernet Protocols".

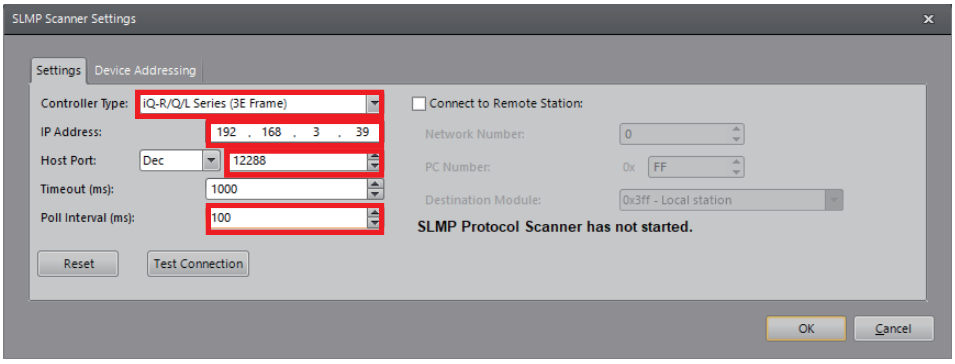
6. Set the following items in the [Settings] tab in the "SLMP Scanner Settings" screen.

Controller Type: PLC series of the programmable controller

IP Address: IP address of the programmable controller

Host Port: Port number of the programmable controller

Poll Interval: Applicable value (100 ms in the following screen)



SLMP Scanner Settings

Controller Type: iQ-R/Q/L Series (3E Frame)

IP Address: 192 . 168 . 3 . 39

Host Port: Dec 12288

Timeout (ms): 1000

Poll Interval (ms): 100

□ Connect to Remote Station:

Network Number: 0

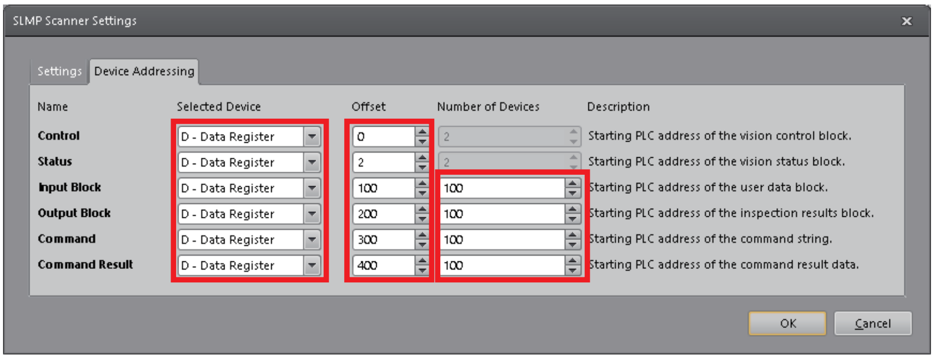
PC Number: 0x FF

Destination Module: 0x3ff - Local station

SLMP Protocol Scanner has not started.

7. In the [Device Addressing] tab, set the devices, offsets*1, and number of devices for each data block as follows.

*1 A start address of the device to be used.



Name	Selected Device	Offset	Number of Devices	Description
Control	D - Data Register	0	2	Starting PLC address of the vision control block.
Status	D - Data Register	2	2	Starting PLC address of the vision status block.
Input Block	D - Data Register	100	100	Starting PLC address of the user data block.
Output Block	D - Data Register	200	100	Starting PLC address of the inspection results block.
Command	D - Data Register	300	100	Starting PLC address of the command string.
Command Result	D - Data Register	400	100	Starting PLC address of the command result data.

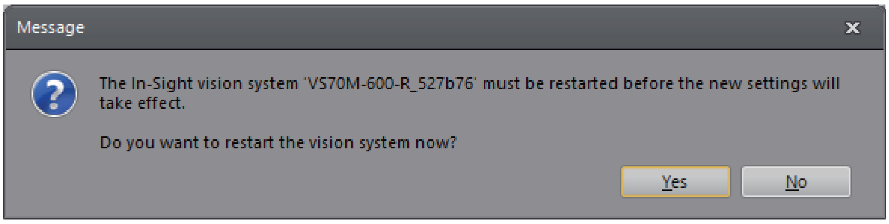
Name	Selected device	Offset	Number of devices
Control	D - Data Register	0	—
Status	D - Data Register	2	—
Input Block	D - Data Register	100	100
Output Block	D - Data Register	200	100
Command	D - Data Register	300	100
Command Result	D - Data Register	400	100

For details on the data block, refer to the following manual.

📖Vision Sensor Connection Guide

8. Click the [OK] button.

When the following message appears, click the [Yes] button to restart the vision system.



The In-Sight vision system 'VS70M-600-R_527b76' must be restarted before the new settings will take effect.

Do you want to restart the vision system now?

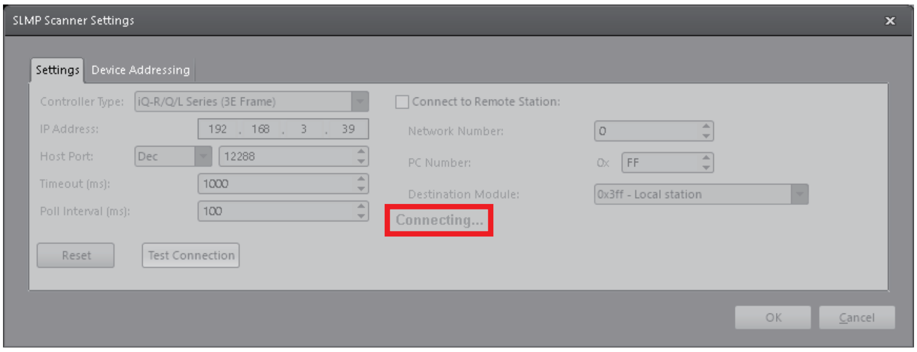
9. Select [Sensor] ⇨ [Network Settings].

10. Check that "SLMP Scanner" is selected in the "Industrial Ethernet Protocols" in the "Network Settings" screen, click the [Settings] button.

11. Click the [Test Connection] button in the [Settings] tab in the "SLMP Scanner Settings" screen.

Check if the vision sensor and programmable controller are successfully connected.

The red frame shown below is displayed as "Connecting" and the whole screen is turned to gray.



Controller Type: iQ-R/Q/L Series (3E Frame)

IP Address: 192 . 168 . 3 . 39

Host Port: Dec 12288

Timeout (ms): 1000

Poll Interval (ms): 100

□ Connect to Remote Station:

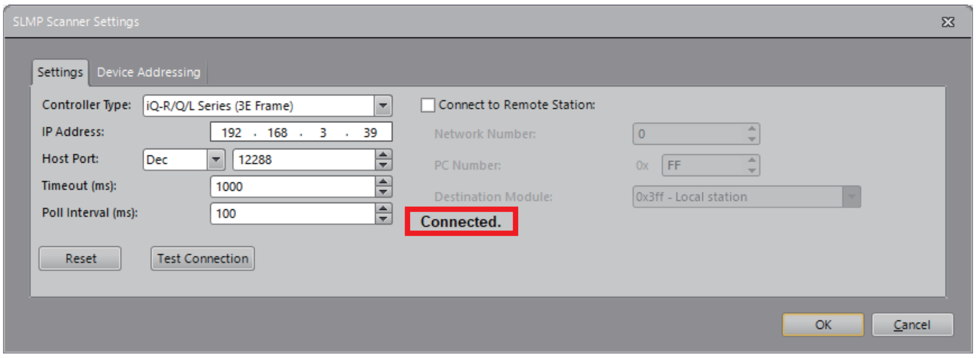
Network Number: 0

PC Number: 0x FF

Destination Module: 0x3ff - Local station

Connecting...

When connected, "Connected" is displayed.



Controller Type: iQ-R/Q/L Series (3E Frame)

IP Address: 192 . 168 . 3 . 39

Host Port: Dec 12288

Timeout (ms): 1000

Poll Interval (ms): 100

□ Connect to Remote Station:

Network Number: 0

PC Number: 0x FF

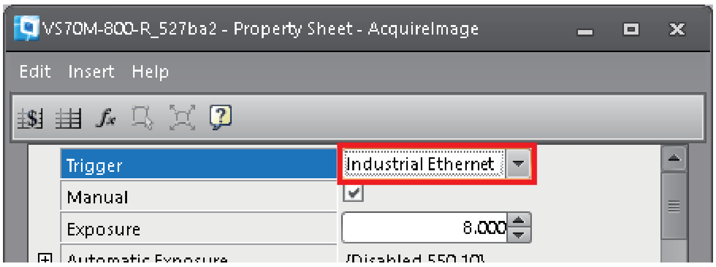
Destination Module: 0x3ff - Local station

Connected.

12. Double-click the A0 cell (AcquireImage function).

13. Set "Industrial Ethernet" for "Trigger" in the "Property Sheet" screen.

The setting above enables the programmable controller to control the triggers of a vision sensor.



Trigger: Industrial Ethernet

Manual: ☑

Exposure: 8.000

Automatic Exposure: (Disabled 550,10)

14. Make a vision sensor online.

15. Select [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch Monitor] in GX Works3.

Perform the following operations.

❶ Turn ON 'Trigger Enable' (D0.0) of a control bit block.

Check that 'Trigger Ready' (D2.0) of the status bit block is turned ON.

❷ Turn ON 'Trigger' (D0.1) of a control bit block.

After the trigger is started executing, 'Inspection Completed' (D2.9) of the status bit block is changed (toggled).

Outputting data

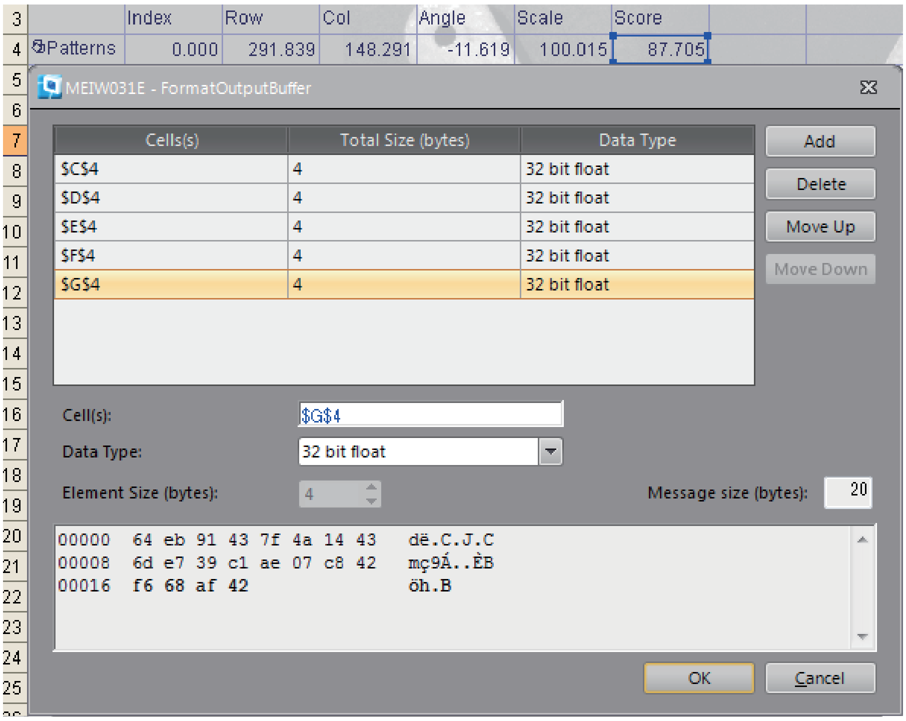
Output data from a vision sensor to a programmable controller.

Operating procedure

1. Select [Functions] tab ⇨ "Input/Output" ⇨ "FormatOutputBuffer" in the Palette window of In-Sight Explorer, and drag and drop it to a spreadsheet.

2. Click the [Add] button in the "FormatOutputBuffer" screen, and double-click a cell where a value to be output is entered.

Select one cell for each value. When multiple cells are selected simultaneously, they are added as one data and therefore the intended data may not be obtained.



		Index	Row	Col	Angle	Scale	Score
3							
4	Patterns	0.000	291.839	148.291	-11.619	100.015	87.705

MEIW031E - FormatOutputBuffer

Cells(s)	Total Size (bytes)	Data Type
$C$4	4	32 bit float
$D$4	4	32 bit float
$E$4	4	32 bit float
$F$4	4	32 bit float
$G$4	4	32 bit float

Cell(s): $G$4

Data Type: 32 bit float

Element Size (bytes): 4

Message size (bytes): 20

```
00000  64 eb 91 43 7f 4a 14 43   dë.C.J.C
00008  6d e7 39 c1 ae 07 c8 42   mç9Á..ÈB
00016  f6 68 af 42               öh.B
```

Point

The maximum length of output data varies depending on programmable controller series selected by "Controller Type" in the [Settings] tab in the "SLMP Scanner Settings" screen.

- iQ-R/Q/L series, iQ-F series: 1920 bytes
- FX series: 128 bytes

Data for up to 140 bytes can be used in the FormatOutputBuffer function.

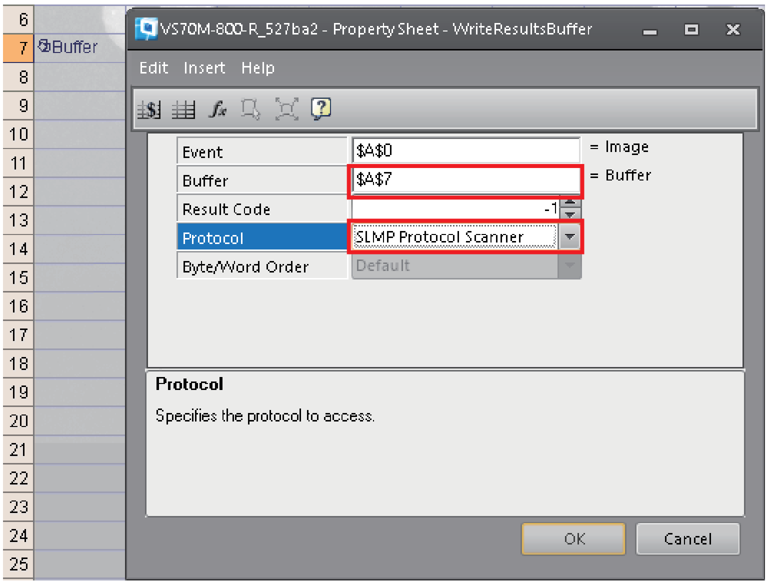
When outputting data over 140 bytes, set more than one FormatOutputBuffer function and combine with CombineOutputBuffers functions.

3. Select [Functions] tab ⇨ "Input/Output" ⇨ "Network" ⇨ "WriteResultsBuffer" in the Palette window, and drag and drop it to the spreadsheet.

4. Set the items in the "Property Sheet" screen as follows.

Buffer: The cell where the FormatOutputBuffer function is placed in the step 1

Protocol: SLMP protocol scanner



7 Buffer

Event A0 = Image

Buffer $A$7 = Buffer

Result Code -1

Protocol SLMP Protocol Scanner

Byte/Word Order Default

Protocol

Specifies the protocol to access.

5. Make a vision sensor online.

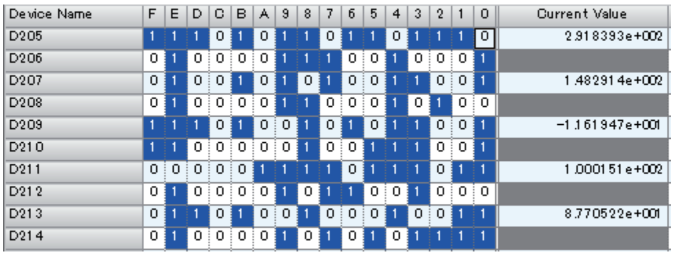
6. Select [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch Monitor] in GX Works3.

Perform the following operations to check the output operations.

❶ Turn ON 'Trigger Enable' (D0.0) of a control bit block.

❷ Turn ON 'Trigger' (D0.1) of a control bit block.

The data from the vision sensor is displayed in 'Inspection Results' (D205 to D213) of an output word block.



Device Name	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	Current Value
D205	1	1	1	0	1	0	1	1	0	1	1	0	1	1	1	0	2.918393e+002
D206	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	1	
D207	0	1	0	0	1	0	1	0	1	0	0	1	1	0	0	1	1.482914e+002
D208	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	
D209	1	1	1	0	1	0	0	1	0	1	0	1	1	0	0	1	-1.161947e+001
D210	1	1	0	0	0	0	0	1	0	0	1	1	1	0	0	1	
D211	0	0	0	0	0	1	1	1	1	0	1	1	1	0	1	1	1.000151e+002
D212	0	1	0	0	0	0	1	0	1	1	0	0	1	0	0	0	
D213	0	1	1	0	1	0	0	1	0	0	0	1	0	0	1	1	8.770522e+001
D214	0	1	0	0	0	0	1	0	1	0	1	0	1	1	1	1	

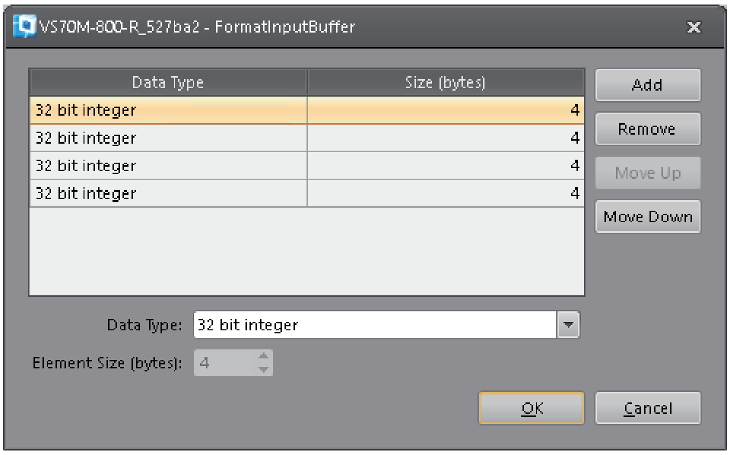
Inputting data

Input data from a programmable controller to a vision sensor.

Operating procedure

1. Select [Functions] tab ⇨ "Input/Output" ⇨ "FormatInputBuffer" in the Palette window, and drag and drop it to a spreadsheet.

2. Click the [Add] button in the "FormatInputBuffer" screen to add storage destination for the number of units of data.

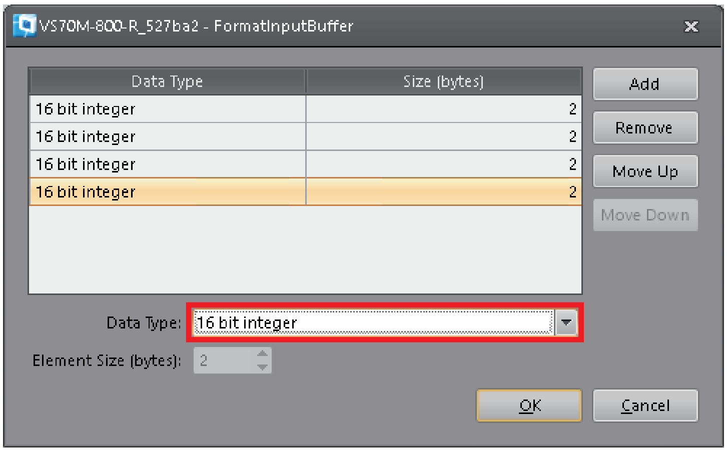


Data Type	Size (bytes)
32 bit integer	4
32 bit integer	4
32 bit integer	4
32 bit integer	4

Data Type: 32 bit integer

Element Size (bytes): 4

3. Select a data type in "Data Type" according to the data.



Data Type	Size (bytes)
16 bit integer	2
16 bit integer	2
16 bit integer	2
16 bit integer	2

Data Type: 16 bit integer

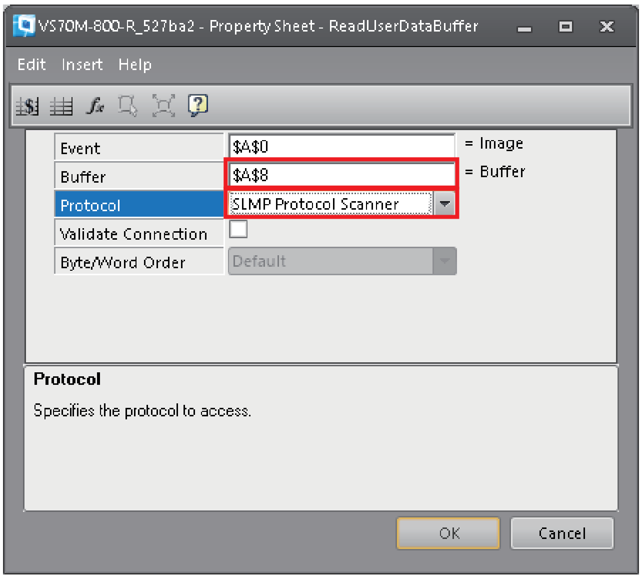
Element Size (bytes): 2

4. Select [Functions] tab ⇨ "Input/Output" ⇨ "Network" ⇨ "ReadUserDataBuffer" in the Palette window, and drag and drop it to the spreadsheet.

5. Set the items in the "Property Sheet" screen as follows.

Buffer: The cell where the FormatInputBuffer function is placed in the step 1

Protocol: SLMP protocol scanner



Event	A0	= Image
Buffer	$A$8	= Buffer
Protocol	SLMP Protocol Scanner	
Validate Connection	□	
Byte/Word Order	Default	

Protocol

Specifies the protocol to access.

6. Select [Functions] tab ⇨ "Vision Data Access" ⇨ "Input/Output" ⇨ "GetBufferData" in the Palette window, and drag and drop it to the spreadsheet.

The GetBufferData function that displays data in a programmable controller is placed in the spreadsheet.

7. Set the function as follows.

GetBufferData (ReadBuffer, index)

For 'ReadBuffer', specify the cell where the ReadUserDataBuffer function is placed.

For 'Index', specify a value within 0 to (the number of units of data add in the FormatInputBuffer function - 1).

8. Repeat the step 6 and step 7 for the number of units of data added in the step 2.

9. Set the data to be input to a vision sensor in a Watch window of GX Works3.

❶ Select [Online] ⇨ [Watch] ⇨ [Register to Watch Window] ⇨ [Watch 1] to [Watch 4].

❷ Enter 'D102' to 'D105' ('User Data' of input word blocks) in the "Name" column in the Watch window, press the Enter key.

❸ Select [Online] ⇨ [Watch] ⇨ [Start Watching].

❹ Enter a value for "Current Value" column where D102 to D105 are entered in a Watch window, and press the Enter key.

10. Select [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch Monitor] in GX Works3, and perform the following operations.

❶ Turn ON 'Set User Data' (D1.0) of a control bit block.

Check that 'Set User Data Ack' (D3.0) of the status bit block is turned ON.

❷ Turn OFF 'Set User Data' (D1.0) of a control bit block.

11. Make a vision sensor online.

12. Select [Online] ⇨ [Monitor] ⇨ [Device/Buffer Memory Batch Monitor] in GX Works3.

Perform the following operations to check the input operations.

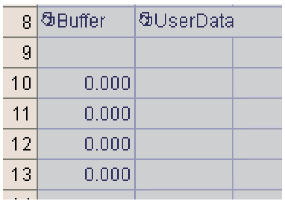
❶ Turn ON 'Trigger Enable' (D0.0) of a control bit block.

Check that 'Trigger Ready' (D2.0) of the status bit block is turned ON.

❷ Turn ON 'Trigger' (D0.1) of a control bit block.

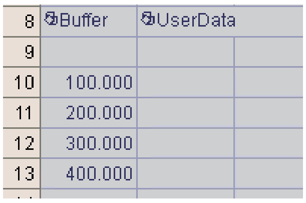
Data in the programmable controller is displayed in the cell where the GetBufferData function of In-Sight Explorer is placed.

- Before triggering



8	Buffer	UserData
9		
10	0.000	
11	0.000	
12	0.000	
13	0.000	

- After triggering



8	Buffer	UserData
9		
10	100.000	
11	200.000	
12	300.000	
13	400.000	

In I/Os

A vision sensor can be controlled and can control other devices by using the inputs and outputs of a built-in I/O and an I/O module.

Controlling a vision sensor by the I/Os are shown below.

I/O	Control
Input to a vision sensor	Event driven in a spreadsheet
	Job switching by a job ID number
	Online or offline control
	Image acquisition trigger control
Output from a vision sensor	Camera status output
	Strobe signal output
	Error output
	Status output (offline or online)
	Image acquisition output (start and complete)
	Output from a spreadsheet

For details on the connection with a vision sensor, refer to the "Connection of a Breakout Cable" and "Connection of an I/O Module" in the following manuals of the vision sensor used.

📖Vision Sensor VS70 User's Manual

📖Vision Sensor VS80 User's Manual

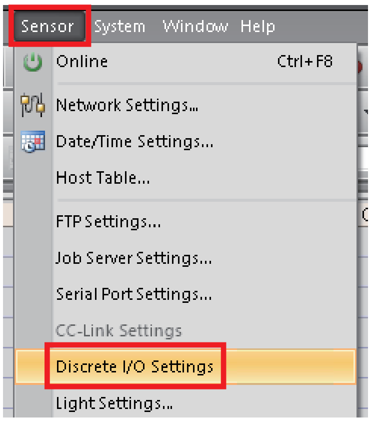
This section shows the procedure for controlling a vision sensor by the inputs and outputs of a built-in I/O using the following device and application.

- Vision sensor VS70
- In-Sight Explorer

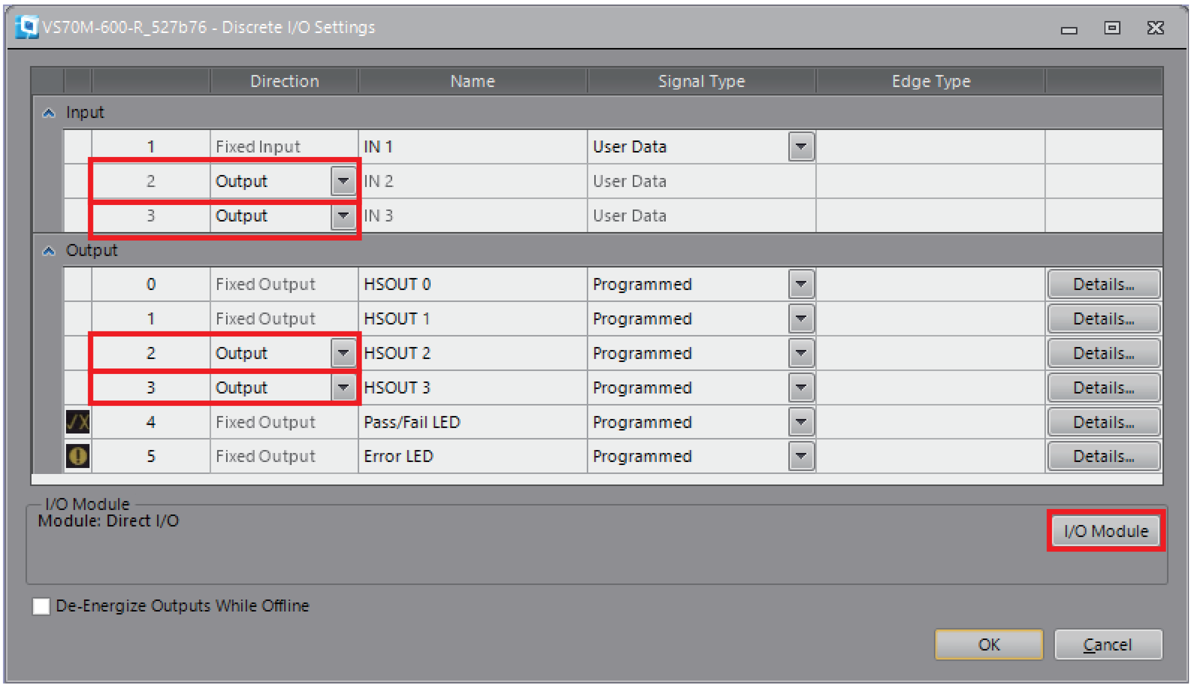
Connecting a vision sensor

Operating procedure

1. Select [Sensor] ⇨ [Discrete I/O Settings] in In-Sight Explorer.



2. Set the items according to the actual wiring in the "Discrete I/O Settings" screen.



		Direction	Name	Signal Type	Edge Type	
Input						
	1	Fixed Input	IN 1	User Data		
	2	Output	IN 2	User Data		
	3	Output	IN 3	User Data		
Output						
	0	Fixed Output	HSOUT 0	Programmed		Details...
	1	Fixed Output	HSOUT 1	Programmed		Details...
	2	Output	HSOUT 2	Programmed		Details...
	3	Output	HSOUT 3	Programmed		Details...
	4	Fixed Output	Pass/Fail LED	Programmed		Details...
	5	Fixed Output	Error LED	Programmed		Details...

I/O Module
Module: Direct I/O

□ De-Energize Outputs While Offline

Point

● A built-in I/O line in a vision sensor VS70 contains some common lines used for inputs and outputs.

• Input 2 and output 2

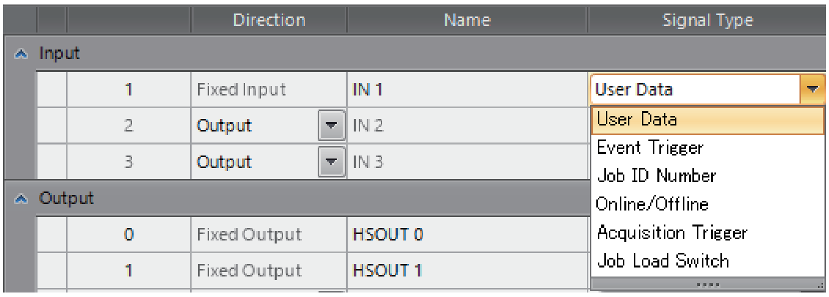
• Input 3 and output 3

● When using an extension I/O module

Click the [I/O Module] button and select an extension I/O module to be connected.

3. Select "User Data" for "Signal Type" in the row of "1" in "Input".

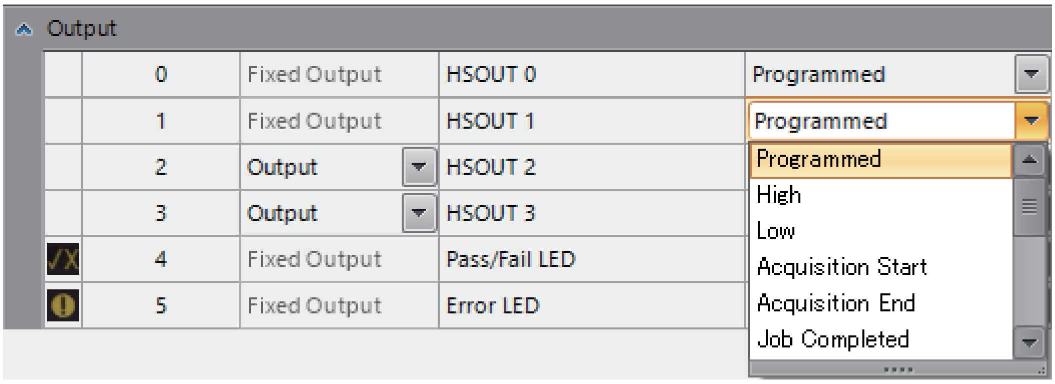
Cell statuses (Enable/Disable) can be controlled by inputting a built-in I/O.



		Direction	Name	Signal Type
Input				
	1	Fixed Input	IN 1	User Data
	2	Output	IN 2	
	3	Output	IN 3	
Output				
	0	Fixed Output	HSOUT 0	
	1	Fixed Output	HSOUT 1	

4. Select "Programmed" for "Signal Type" in the row of "1" in "Output".

Data can be output depending on the execution result of a function in the spreadsheet.



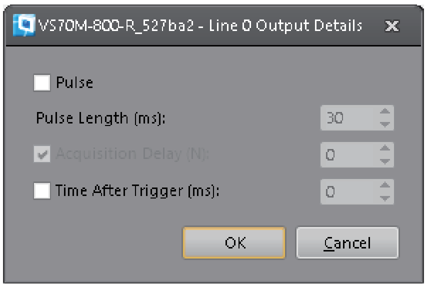
Output				
	0	Fixed Output	HSOUT 0	Programmed
	1	Fixed Output	HSOUT 1	Programmed
	2	Output	HSOUT 2	
	3	Output	HSOUT 3	
✓X	4	Fixed Output	Pass/Fail LED	
!	5	Fixed Output	Error LED	

Point

The details of an output signal can be set in the screen displayed after clicking the [Details] button.

Depending on the signal type, items that can be set differ.

For the setting items for each signal type, refer to the help of In-Sight Explorer.



VS70M-800-R_527ba2 - Line 0 Output Details

□ Pulse

Pulse Length (ms): 30

☑ Acquisition Delay (N): 0

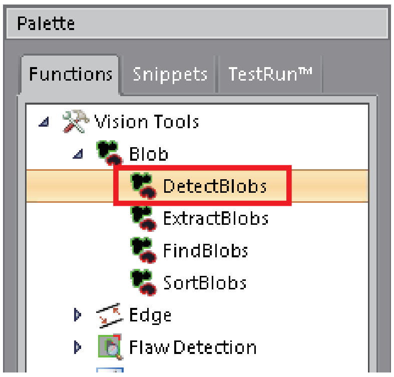
□ Time After Trigger (ms): 0

Switching a cell status (enable/disable)

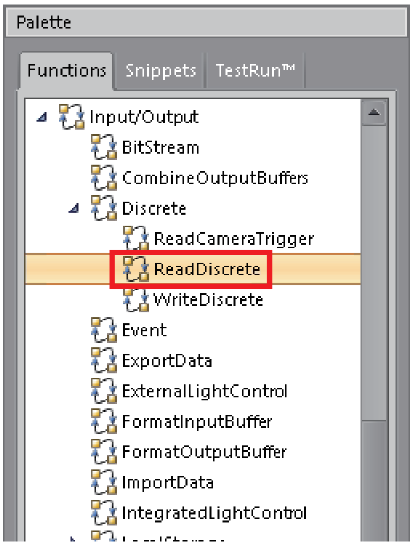
The following shows the procedure for switching the status of a cell (enable/disable) for each input of a built-in I/O.
A cell where the DetectBlobs function is placed is used as an example.

Operating procedure

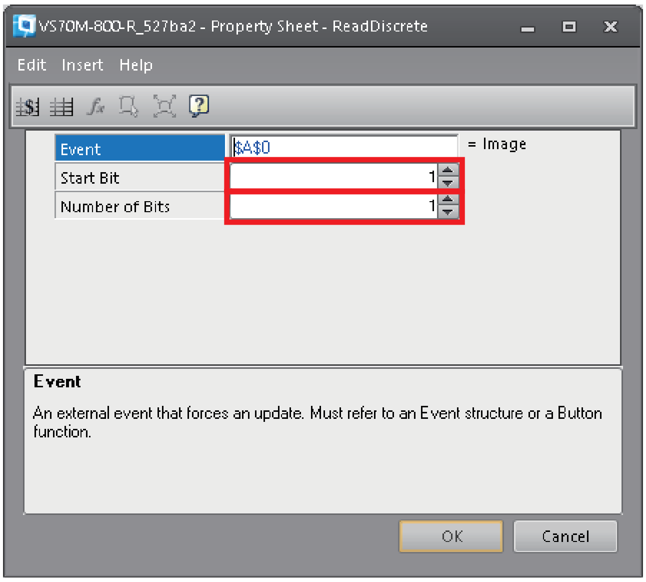
1. Select [Functions] tab ⇨ "Vision Tools" ⇨ "Blob" ⇨ "DetectBlobs" in the Palette window, and drag and drop it to the A8 cell in the spreadsheet.



2. Select [Functions] tab ⇨ "Input/Output" ⇨ "Discrete" ⇨ "ReadDiscrete" in the Palette window, and drag and drop it to a blank cell in the spreadsheet (example: A10).



3. To use the input 1, set the items in the "Property Sheet" screen as follows.
Start Bit: 1
Number of Bits: 1



Event	A0	= Image
Start Bit	1	
Number of Bits	1	

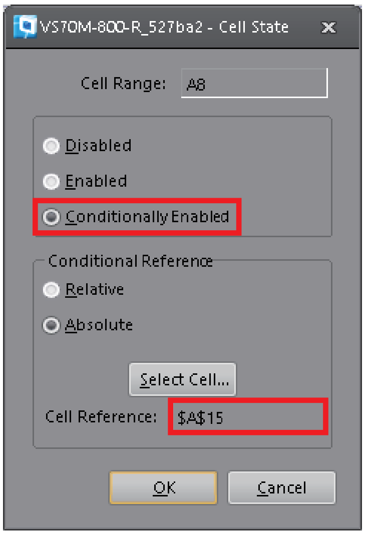
Event

An external event that forces an update. Must refer to an Event structure or a Button function.

When the ReadDiscrete function is placed, the MultiStatus function for visualizing input statuses is placed as well.

4. Right-click the A8 cell and select [Cell State] in the shortcut menu.

5. Select "Conditionally Enabled" in the "Cell State" screen.



Cell Range: A8

○ Disabled
○ Enabled
● Conditionally Enabled

Conditional Reference
○ Relative
● Absolute

Cell Reference: $A$15

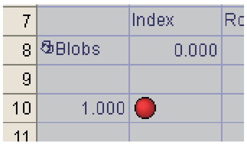
6. Click the [Select Cell] button, select the cell where the ReadDiscrete function is placed, and press the [Enter] key.
At this point, the DetectBlobs function is disabled as the vision sensor is offline and there is no data input.

7. Select [Sensor] ⇨ [Online] to make the vision sensor online.

8. Input a signal to the input 1.

9. Input a trigger.

The value of the ReadDiscrete function is changed from '0.000' to '1.000' in the spreadsheet, and at the same time the color of the lamp for the MultiStatus function is changed from yellow to red[*1].



7		Index	Rc
8	Blobs	0.000	
9			
10	1.000	●	
11			

[*1] In the default, the color of a lamp is displayed as follows.
Yellow: The bit is '0'.
Red: The bit is '1'.

Controlling outputs of a built-in I/O

The following shows the procedure for controlling output 0 and output 1 depending on the blob dimension (☞ Page 62 Switching a cell status (enable/disable)) calculated by the DetectBlobs function.

Blob dimension	Output 0	Output 1
Less than 30000 pixels	Output	Do not output
30000 pixels or larger	Do not output	Output
Not detected	Do not output	Do not output

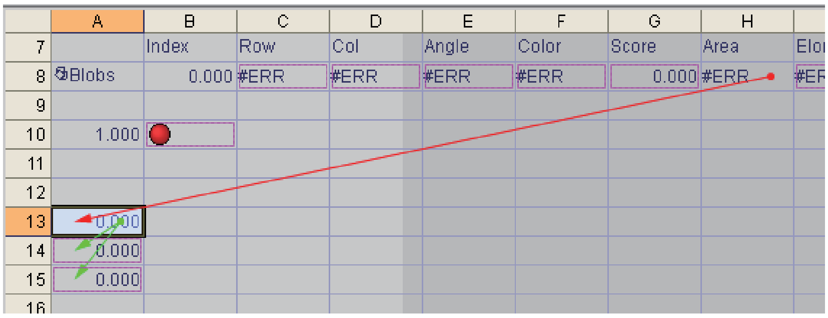
Operating procedure

1. Enter the following formulas in each cell.

A13: ErrFree(H8)*1*2

A14: If(A13 < 30000, If(A13 = 0, 0, 1), 0)*3

A15: If(A13 >= 30000, 1, 0)*4



	A	B	C	D	E	F	G	H	
7		Index	Row	Col	Angle	Color	Score	Area	Elo
8	Blobs	0.000	#ERR	#ERR	#ERR	#ERR	0.000	#ERR	#EF
9									
10	1.000	●							
11									
12									
13	0.000								
14	0.000								
15	0.000								
16									

*1 Select [Functions] tab ⇨ "Mathematics" ⇨ "Lookup" ⇨ "ErrFree" in the Palette window, and drag and drop it to the H8 cell in the spreadsheet.

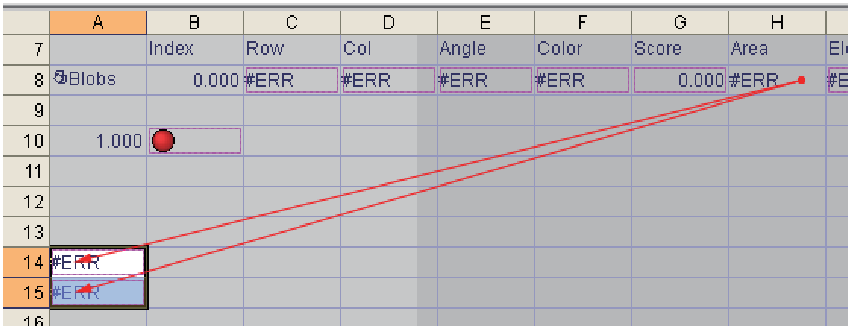
*2 Blob dimension

*3 A formula for the output 0

*4 A formula for the output 1

Point

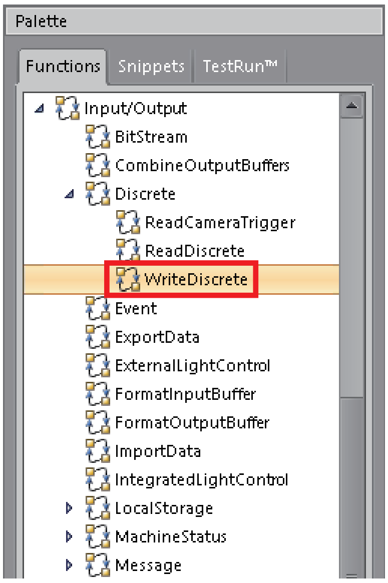
If a blob is not detected, '#ERR' will be displayed as a dimension value (in the H8 cell).
In that case, when the H8 cell is directly specified, the error affects the WriteDiscrete function (the A14 cell and A15 cell)



	A	B	C	D	E	F	G	H	
7		Index	Row	Col	Angle	Color	Score	Area	El
8	Blobs	0.000	#ERR	#ERR	#ERR	#ERR	0.000	#ERR	#E
9									
10	1.000	●							
11									
12									
13									
14	#ERR								
15	#ERR								
16									

By using the ErrFree function, the error propagation can be prevented.
The formula in the step 1 prevents error propagation by replacing the cell where a blob dimension is referenced from H8 to A13.

2. Select [Functions] tab ⇨ "Input/Output" ⇨ "Discrete" ⇨ "WriteDiscrete" in the Palette window, and drag and drop it to the B14 cell in the spreadsheet.

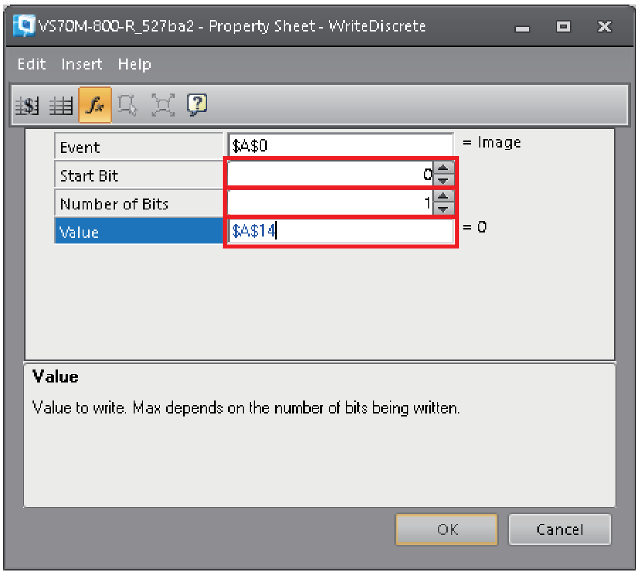


3. Set the items in the "Property Sheet" screen as follows.

Start Bit: 0

Number of Bits: 1

Value: $A$14



Event	$A$0	= Image
Start Bit	0	
Number of Bits	1	
Value	$A$14	= 0

Value

Value to write. Max depends on the number of bits being written.

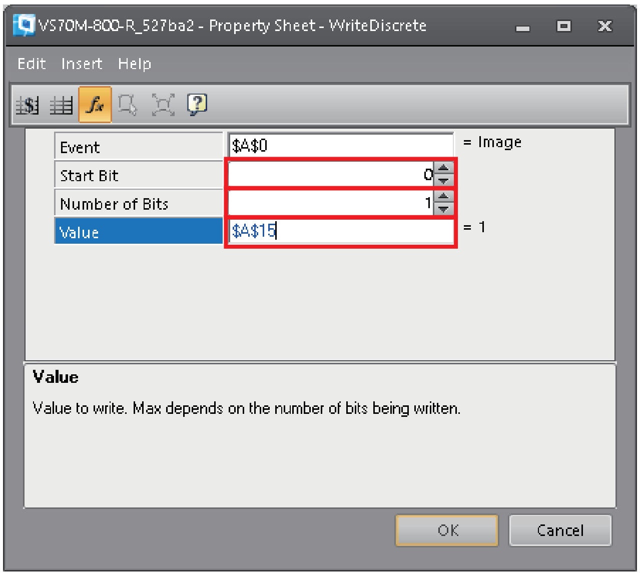
4. Select [Functions] tab ⇨ "Input/Output" ⇨ "Discrete" ⇨ "WriteDiscrete" in the Palette window, and drag and drop it to the B15 cell in the spreadsheet.

5. Set the items in the "Property Sheet" screen as follows.

Start Bit: 1

Number of Bits: 1

Value: $A$15

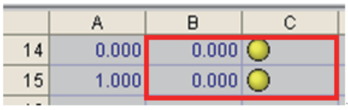


Event	$A$0	= Image
Start Bit	0	
Number of Bits	1	
Value	$A$15	= 1

Value

Value to write. Max depends on the number of bits being written.

When the WriteDiscrete function is placed, the MultiStatus function for visualizing output statuses is placed as well.

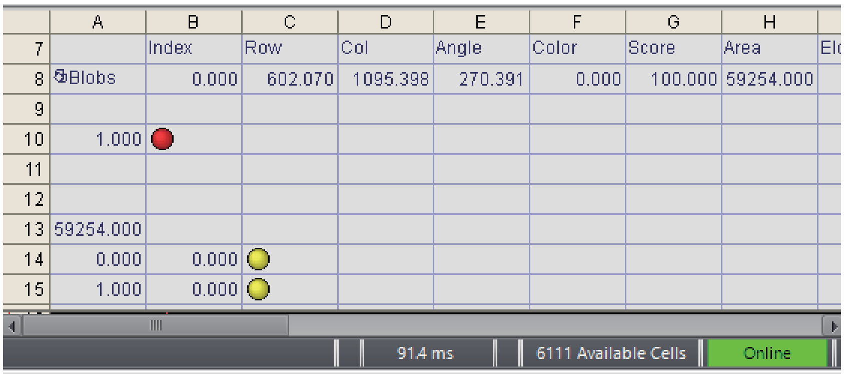


	A	B	C
14	0.000	0.000	●
15	1.000	0.000	●

At this point, the DetectBlobs function is disabled as the vision sensor is offline and there is no data input.

■Appearance in a spreadsheet

When making the vision sensor online the items are displayed in the spreadsheet as follows.

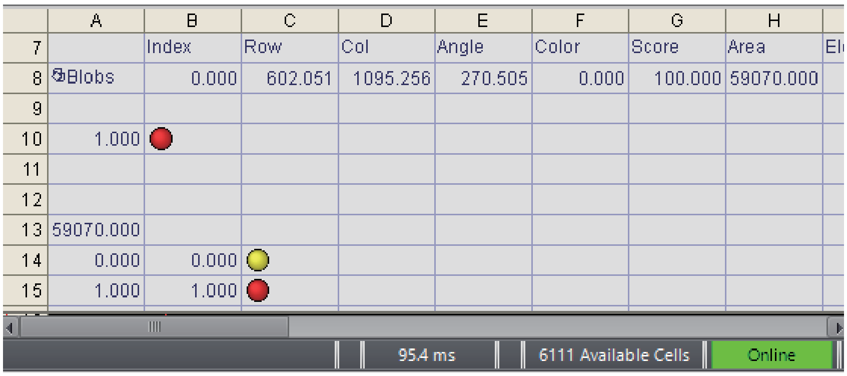


	A	B	C	D	E	F	G	H	El
7		Index	Row	Col	Angle	Color	Score	Area	El
8	Blobs	0.000	602.070	1095.398	270.391	0.000	100.000	59254.000	
9									
10	1.000	🔴							
11									
12									
13	59254.000								
14	0.000	0.000	🟡						
15	1.000	0.000	🟡						

91.4 ms | 6111 Available Cells | Online

When inputting a trigger, the WriteDiscrete function and MultiStatus function are changed.

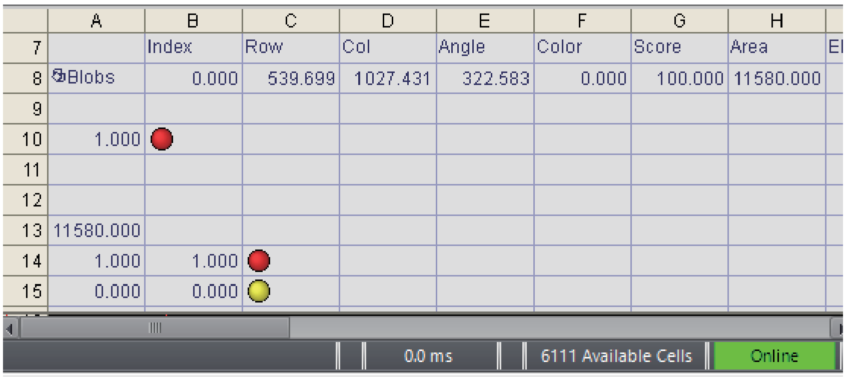
When the blob dimension is 30000 pixels or larger, the inspection result is as follows.



	A	B	C	D	E	F	G	H	El
7		Index	Row	Col	Angle	Color	Score	Area	El
8	Blobs	0.000	602.051	1095.256	270.505	0.000	100.000	59070.000	
9									
10	1.000	🔴							
11									
12									
13	59070.000								
14	0.000	0.000	🟡						
15	1.000	1.000	🔴						

95.4 ms | 6111 Available Cells | Online

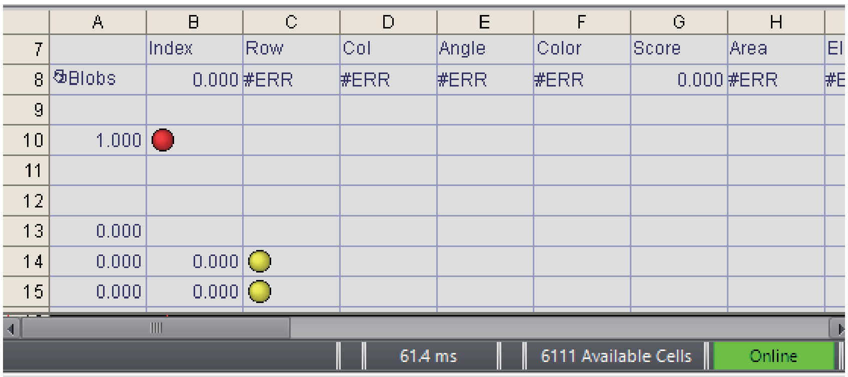
When the blob dimension is less than 30000 pixels, the inspection result is as follows.



	A	B	C	D	E	F	G	H	El
7		Index	Row	Col	Angle	Color	Score	Area	El
8	Blobs	0.000	539.699	1027.431	322.583	0.000	100.000	11580.000	
9									
10	1.000	🔴							
11									
12									
13	11580.000								
14	1.000	1.000	🔴						
15	0.000	0.000	🟡						

0.0 ms | 6111 Available Cells | Online

When a blob is not detected, the inspection result is as follows.



	A	B	C	D	E	F	G	H	El
7		Index	Row	Col	Angle	Color	Score	Area	El
8	Blobs	0.000	#ERR	#ERR	#ERR	#ERR	0.000	#ERR	#E
9									
10	1.000	🔴							
11									
12									
13	0.000								
14	0.000	0.000	🟡						
15	0.000	0.000	🟡						

61.4 ms | 6111 Available Cells | Online

3 CREATING JOBS

This chapter explains the settings required for creating a job as necessary.

☞ Page 70 Acquiring Images

☞ Page 71 Setting Regions

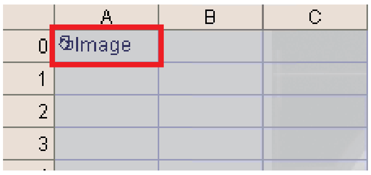
☞ Page 79 Performing Calibration

☞ Page 90 Procedure for Setting Commonly Used Functions

3.1 Acquiring Images

This section explains about image acquisition.

A function to acquire an image (AcquireImage function) is predefined in the A0 cell of a spreadsheet. It cannot be deleted and moved.



When a function which requires an image structure is added in the spreadsheet, the A0 cell is automatically referenced from the function.

This means that an image captured by a vision sensor can be utilized.

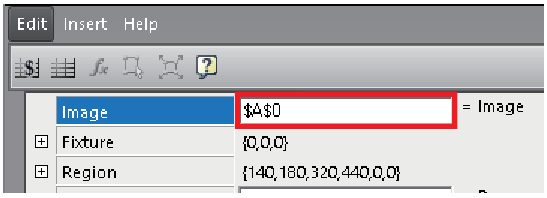
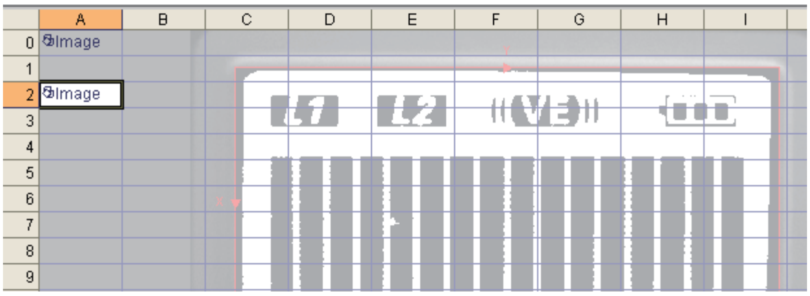


Image	A0	= Image
⊞ Fixture	{0,0,0}	
⊞ Region	{140,180,320,440,0,0}	

The following shows an example for the reference when an image filtering function is added.



Other than the cell explained above, a function that returns an image structure (such as an image filtering function and the LatchImage function) can be referenced.

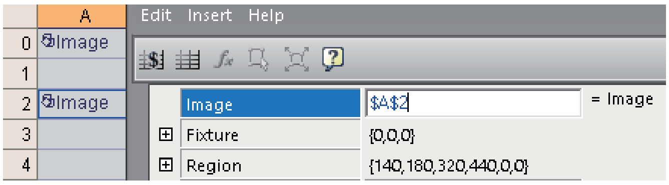


Image	$A$2	= Image
⊞ Fixture	{0,0,0}	
⊞ Region	{140,180,320,440,0,0}	

3.2 Setting Regions

This section explains a region[*1] that is required to be set for a vision tool function.

[*1] A region for training the model of a pattern, searching for a feature, and inspecting a feature.

☞ Page 71 Selecting a rectangular region

☞ Page 73 Setting a complex region

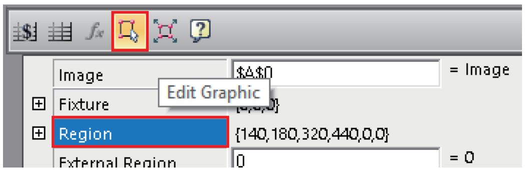
Selecting a rectangular region

The following shows the procedure for selecting a rectangular region.

Operating procedure

1. Double-click the cell where a function is placed to display the "Property Sheet" screen.

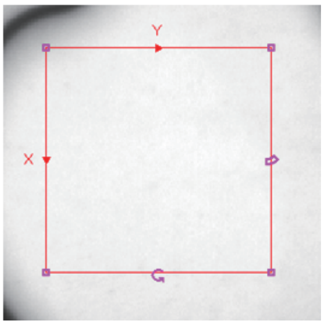
2. Double-click "Pattern Region", "Model Region", or "Region".
Alternatively, select "Pattern Region", "Model Region", or "Region", and click the icon (⬚).



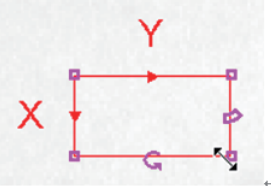
Edit Graphic

Image	A0	= Image
⊞ Fixture	{0,0,0}	
⊞ Region	{140,180,320,440,0,0}	
External Region	0	= 0

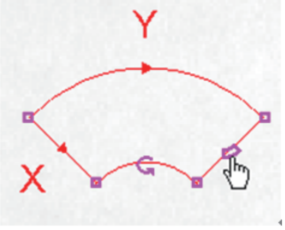
3. Select a rectangular region.



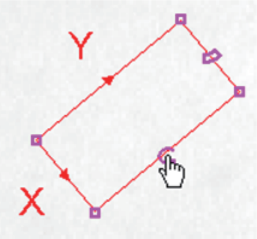
To resize the region: drag a size handle on the four corners. (▣).



To bend the region: drag the curve handle (⇨).



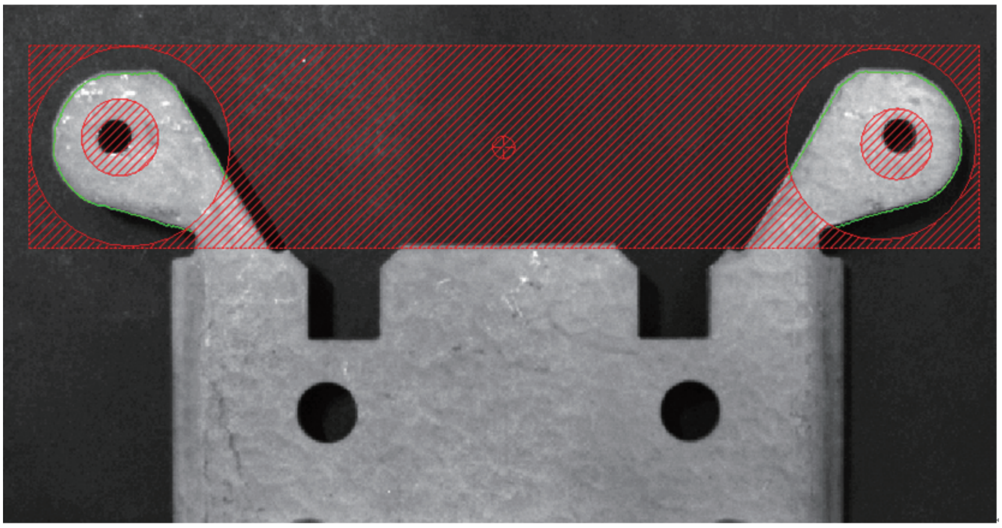
To rotate the region: drag the rotation handle (↻).



Setting a complex region

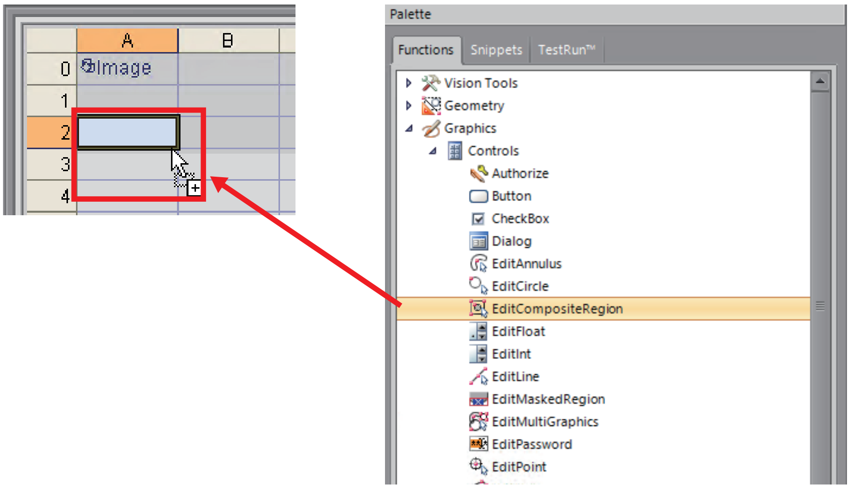
The EditCompositeRegion function is suitable for detecting the work of an inspection target which compose a complex figure using a vision tool function.

In this section, the procedure for selecting regions on the complex figure as shown below is described.



Operating procedure

1. Select [Functions] tab ⇨ "Graphics" ⇨ "Controls" ⇨ "EditCompositeRegion" in the Palette window, and drag and drop it to a spreadsheet.



2. Check the items in the "Property Sheet" screen, and click the [OK] button.

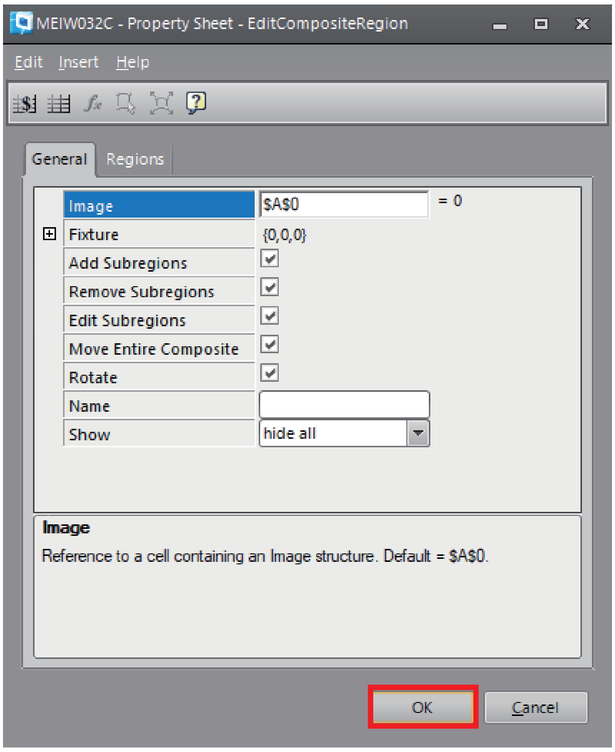
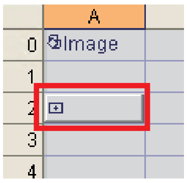


Image	A0	= 0
⊞ Fixture	{0,0,0}	
Add Subregions	☑	
Remove Subregions	☑	
Edit Subregions	☑	
Move Entire Composite	☑	
Rotate	☑	
Name		
Show	hide all	

Image

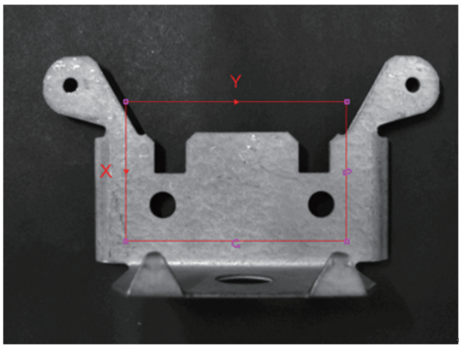
Reference to a cell containing an Image structure. Default = A0.

3. Click the button in the cell where the EditCompositeRegion function is placed to make the region selectable.

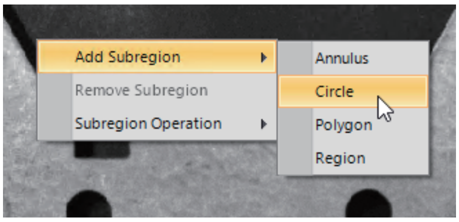


	A
0	Image
1	
2	⊞
3	
4	

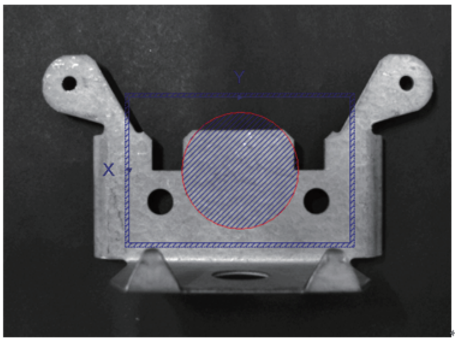
In the default, a region is selected in rectangular shape.



4. Right-click any space in the screen, and select [Add Subregion] ⇨ [Circle] in the shortcut menu.

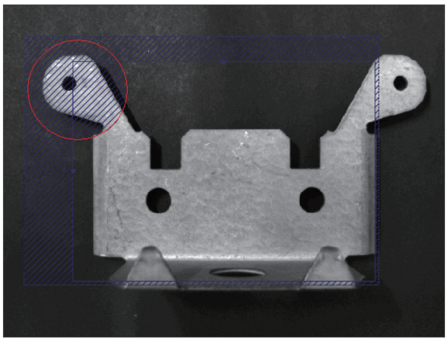


A region that will be 'subtracted'[*1] is added.



*1 A region which is not used for the function.

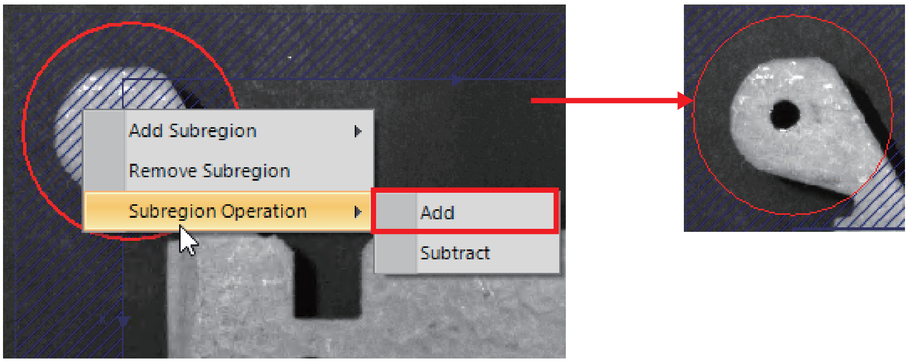
5. Drag and drop the region to the position in the following figure.



6. Right-click the region, and select [Subregion Operation] ⇨ [Add] in the shortcut menu.

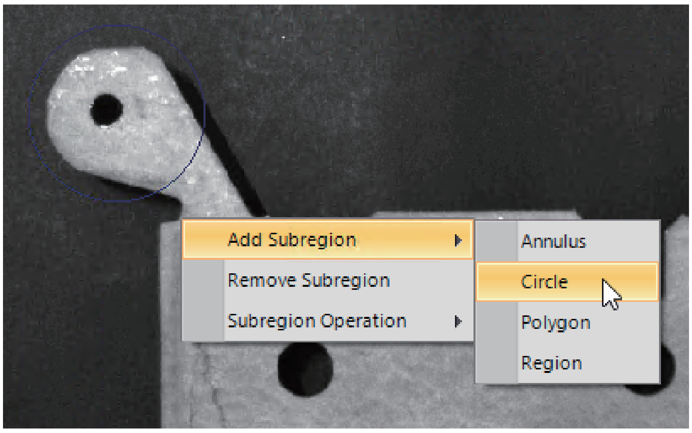
The region for 'subtract' is changed to 'add' [*1].

*1 A region which is used for the function.

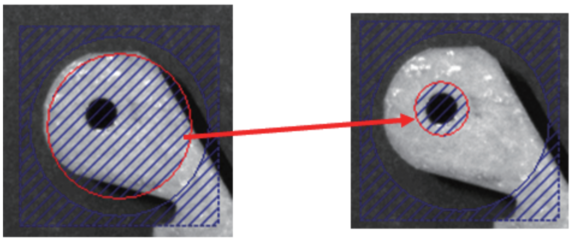


7. Right-click any space in the screen, and select [Add Subregion] ⇨ [Circle] in the shortcut menu.

To exclude the hole included in the region, add a sub-region to the circle.

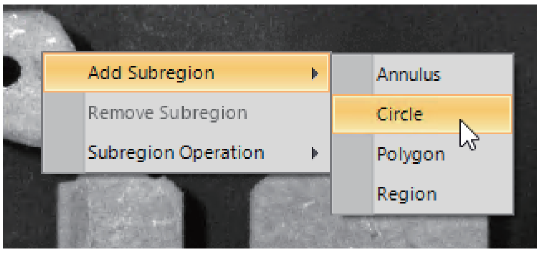


8. Move the sub-region, and adjust its size to match the hole.



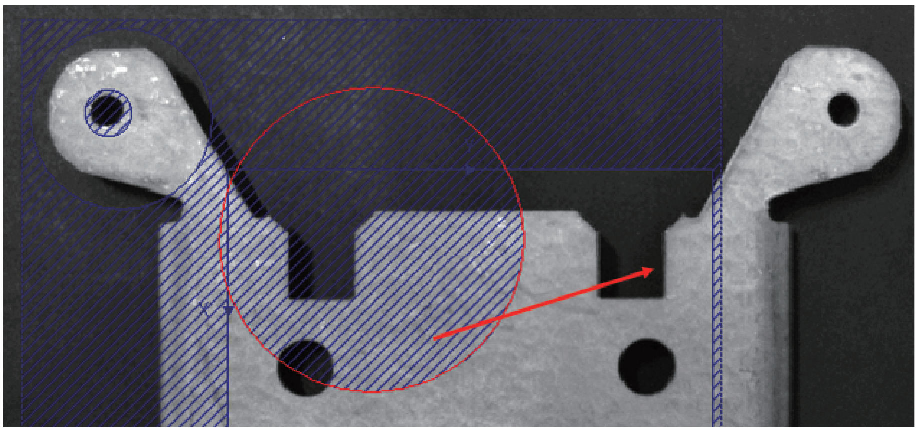
9. Right-click any space in the screen, and select [Add Subregion] ⇨ [Circle] in the shortcut menu.

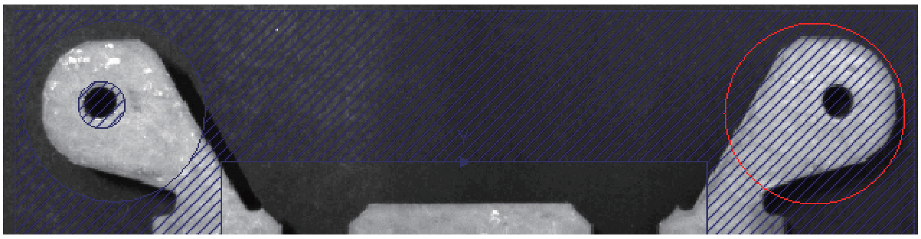
Add a region to the right-side of the feature as well.



A new region is added to the center of the region.

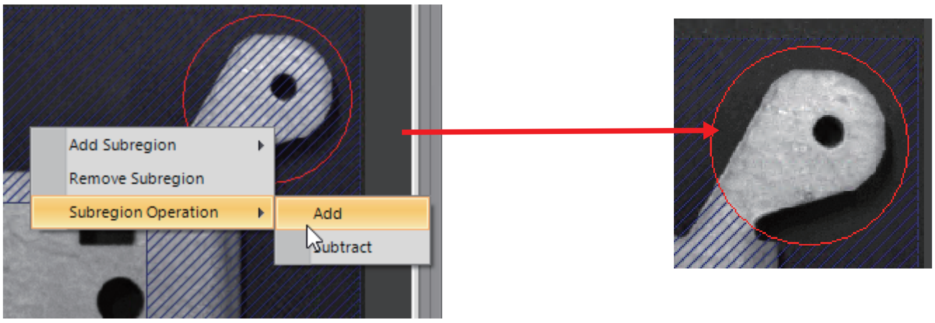
10. Drag the region to move to an appropriate position.





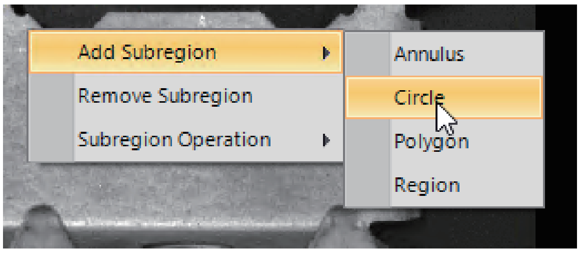
11. Right-click the region, and select [Subregion Operation] ⇨ [Add] in the shortcut menu.

The region for 'subtract' is changed to 'add'.

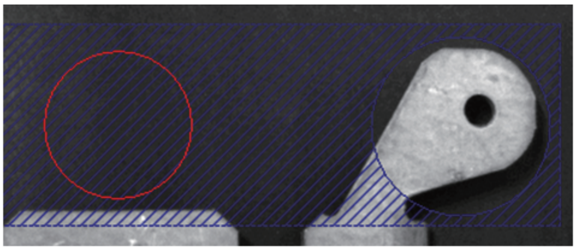


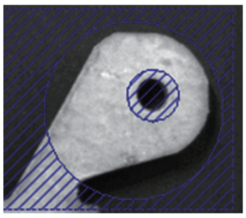
12. Right-click any space in the screen, and select [Add Subregion] ⇨ [Circle] in the shortcut menu.

To exclude the hole included in the region, add a sub-region to the circle.



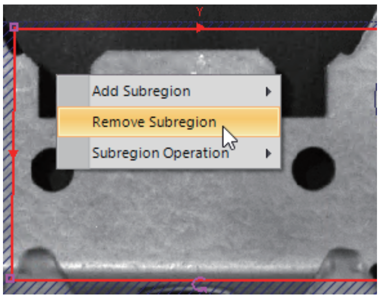
13. Move the sub-region, and adjust its size to match the hole.



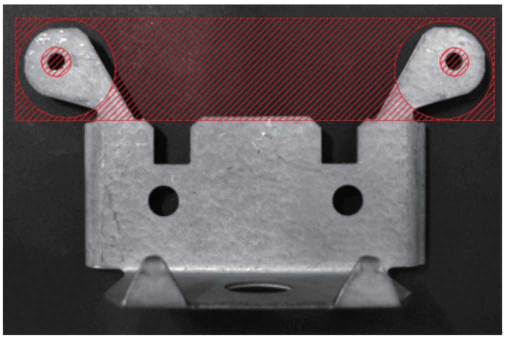


14. Select and right-click the region to be deleted, and select [Remove Subregion] in the shortcut menu.

Unnecessary region is deleted.

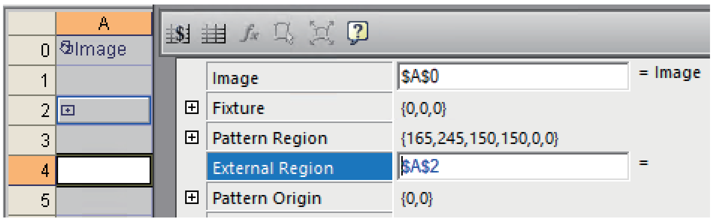


15. Press the Enter key to complete the setting.



16. When using the region using the EditCompositeRegion function for a vision tool function, specify the cell where the EditCompositeRegion function is placed for "External Region" in the "Property Sheet" screen.

The region set in a vision tool function is disabled, and the region set in the EditCompositeRegion function is applied.



	A
0	Image
1	
2	⊞
3	
4	
5	

	Image	A0	= Image
⊞	Fixture	{0,0,0}	
⊞	Pattern Region	{165,245,150,150,0,0}	
	External Region	$A$2	=
⊞	Pattern Origin	{0,0}	

3.3 Performing Calibration

This section shows how to perform a calibration[*1] and how to use its result.

*1 Lens radial distortion and inclination of a vision sensor can be adjusted.

1. Place the CalibrateGrid function, and perform calibration. (☞ Page 79 Performing a calibration)
2. Place the TransformImage function, and generate a calibrated image. (☞ Page 85 Generating a calibrated image)
3. Place the TransPatternsToWorld function, and convert the unit of a coordinate value from pixels to the actual units. (☞ Page 87 Converting a unit)

Performing a calibration

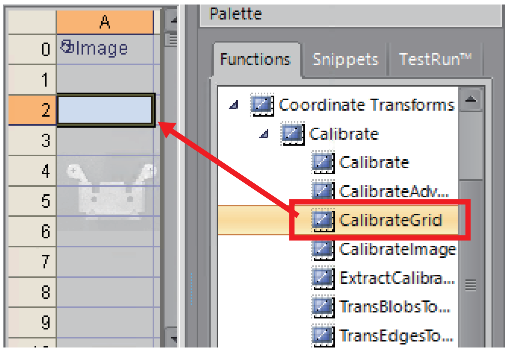
Before performing a calibration

- The setup of a vision sensor and lens, and the physical relationship between the sensor and the scene being acquired must be the same for both the calibration and run-time operation.
  If any of these items is altered, the system must be re-calibrated.
- Place the calibration grid on the same plane as the object being inspected. When examining the top of the 3D object, the calibration grid must be placed at the same height as the object.
- To improve the accuracy of a calibration, ensure that the image area is sufficiently covered by the grid pattern.
  At least 100 features are required to be input.

Operation procedure

Operating procedure

1. Select [Functions] tab ⇨ "Coordinate Transforms" ⇨ "Calibrate" ⇨ "CaribrateGrid" in the Palette window, and drag and drop it to a spreadsheet.



2. Set the items in the "Property Sheet" screen.

When using a calibration plate of 5 mm-square checkerboard with fiducial marks, set the items as follows.

Grid Type[*1]: Checkerboard, with fiducial

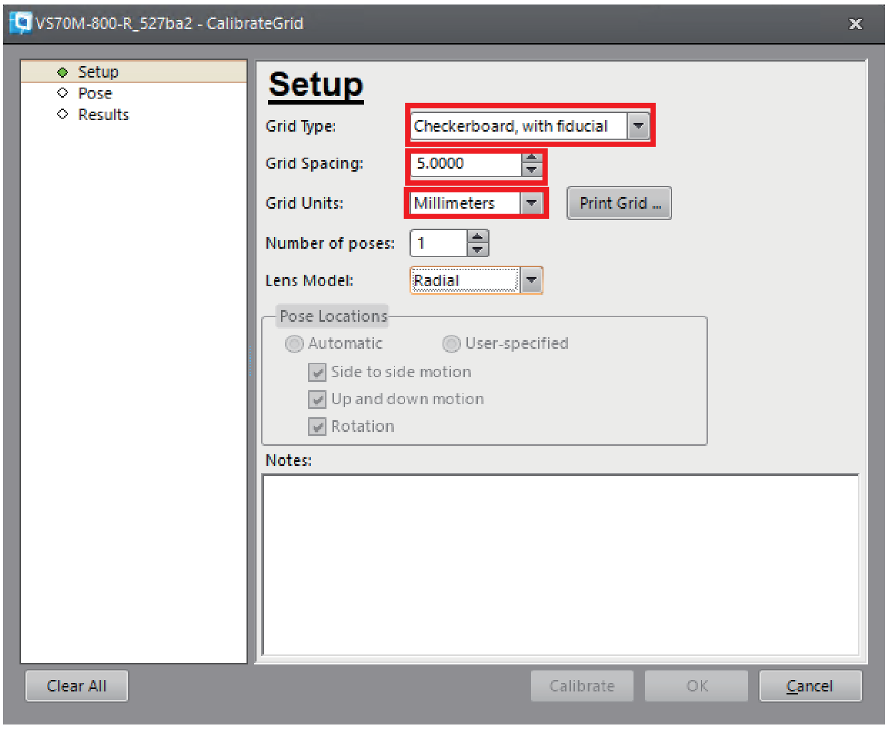
Grid Spacing: 5.0000

Grid Unit: Millimeters

Lens Model: Radial

[*1] For details on the grid types, refer to the following section.

☞ Page 84 Dot grid and checkerboard


VS70M-800-R_527ba2 - CalibrateGrid

◆ Setup
◇ Pose
◇ Results

Setup

Grid Type: Checkerboard, with fiducial

Grid Spacing: 5.0000

Grid Units: Millimeters

Number of poses: 1

Lens Model: Radial

Pose Locations

○ Automatic ○ User-specified

☑ Side to side motion

☑ Up and down motion

☑ Rotation

Notes:

Point

● Lens models

- To correct barrel distortion of a lens, set "Radial" for "Lens Model".
- When a vision sensor is inclined against the measuring surface, set "Projection" for "Lens Model".

● Grid printing

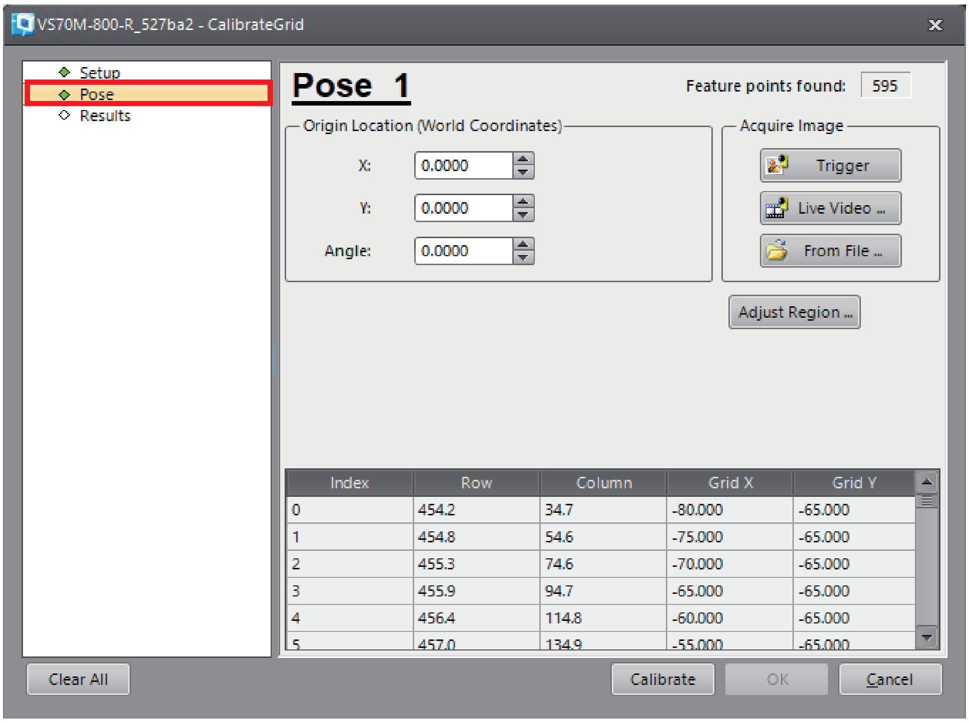
By clicking the [Print Grid] button, a grid to which the grid type, grid spacing, and grid units set in the screen are applied can be printed on a paper.

Restriction

A high-precision calibration plate cannot be printed out by clicking the [Print Grid] button.

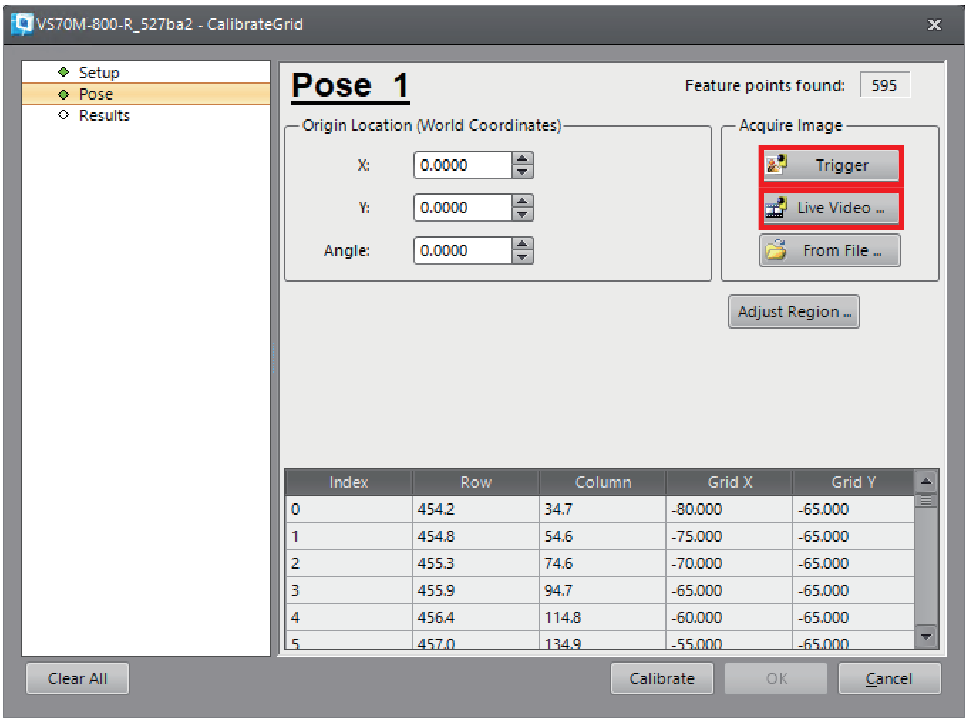
A calibration plate which is accurately created is required.

3. Select "Pose" in the tree on the left side of the "Property Sheet" screen.



Index	Row	Column	Grid X	Grid Y
0	454.2	34.7	-80.000	-65.000
1	454.8	54.6	-75.000	-65.000
2	455.3	74.6	-70.000	-65.000
3	455.9	94.7	-65.000	-65.000
4	456.4	114.8	-60.000	-65.000
5	457.0	134.9	-55.000	-65.000

4. Click the [Live Video] button or [Trigger] button to acquire an image to be calibrated.
Adjust the position of the calibration plate while checking the captured image.



Pose 1

Feature points found: 595

Origin Location (World Coordinates)

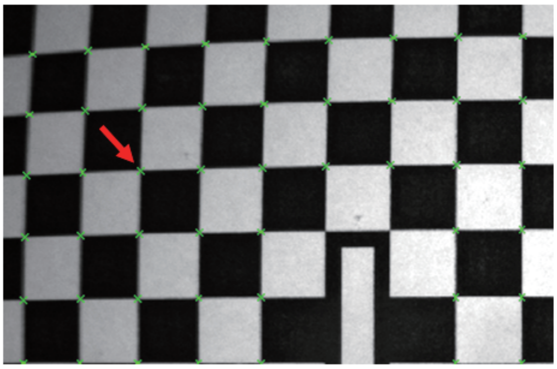
X: 0.0000

Y: 0.0000

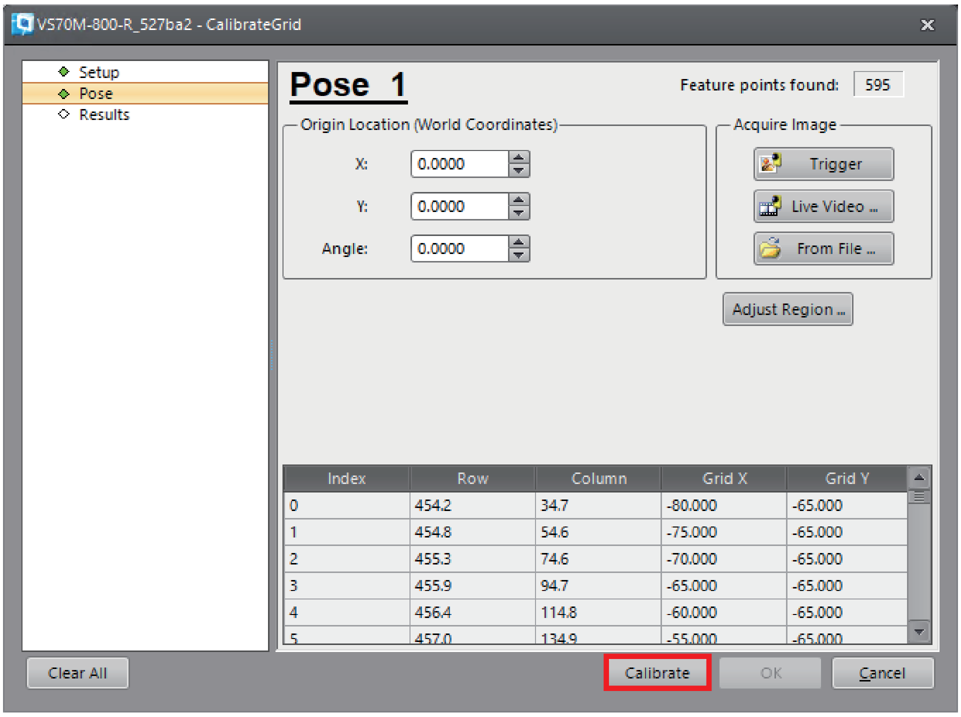
Angle: 0.0000

Index	Row	Column	Grid X	Grid Y
0	454.2	34.7	-80.000	-65.000
1	454.8	54.6	-75.000	-65.000
2	455.3	74.6	-70.000	-65.000
3	455.9	94.7	-65.000	-65.000
4	456.4	114.8	-60.000	-65.000
5	457.0	134.9	-55.000	-65.000

The calibration pattern is applied, and feature points are detected.



5. Click the [Calibrate] button.



Feature points found: 595

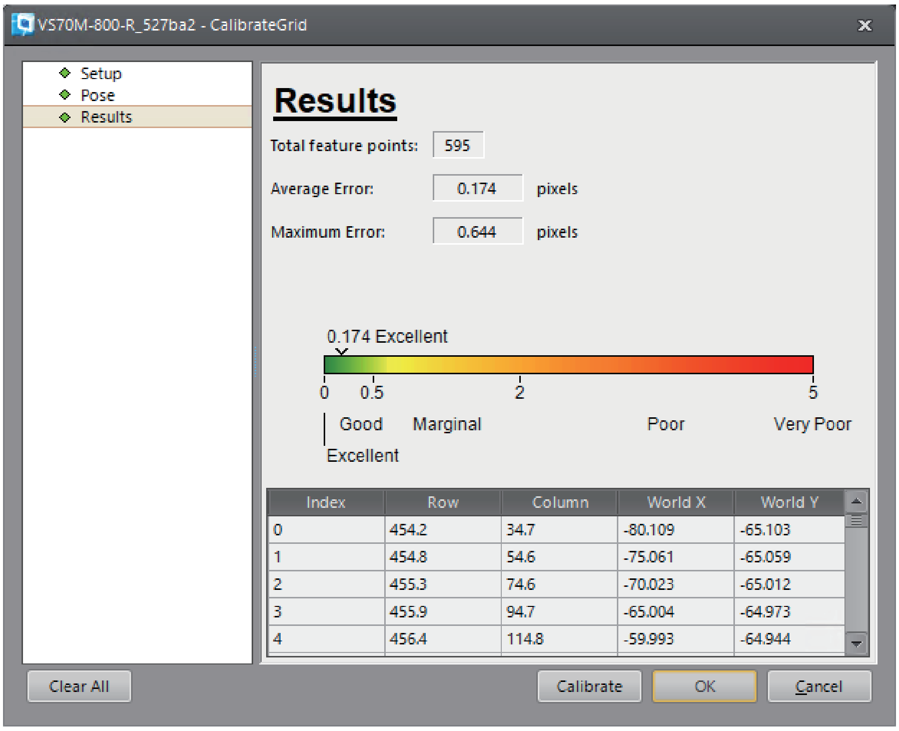
X: 0.0000

Y: 0.0000

Angle: 0.0000

Index	Row	Column	Grid X	Grid Y
0	454.2	34.7	-80.000	-65.000
1	454.8	54.6	-75.000	-65.000
2	455.3	74.6	-70.000	-65.000
3	455.9	94.7	-65.000	-65.000
4	456.4	114.8	-60.000	-65.000
5	457.0	134.9	-55.000	-65.000

The result is displayed.



Total feature points: 595

Average Error: 0.174 pixels

Maximum Error: 0.644 pixels

Index	Row	Column	World X	World Y
0	454.2	34.7	-80.109	-65.103
1	454.8	54.6	-75.061	-65.059
2	455.3	74.6	-70.023	-65.012
3	455.9	94.7	-65.004	-64.973
4	456.4	114.8	-59.993	-64.944

Point

The 'error' value indicates that how far the position of the predicted feature point from the actual feature point. It varies depending on the lens performance and accuracy of calibration grid.

After the completion of a calibration, a calibration structure is created and "Calib" appear in the cell where the CalibrateGrid function is placed.

Dot grid and checkerboard

The differences between dot grid and checkerboard are as follows.

■Dot grid

- Relatively high accuracy, up to 0.05 (1/20) pixels.
- Tolerates up to 30° perspective distortion.
- Excellent tolerance to noise and inconsistent lighting.
- Each dot must be between 10 and 50 pixels in diameter (dots of 15 pixels or greater will yield more accurate results).

■Checkerboard

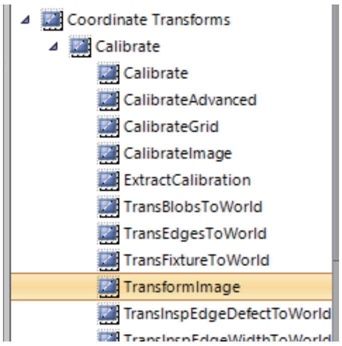
- The highest degree of accuracy, up to 0.025 (1/40) pixels.
- Tolerates up to 45° perspective distortion.
- Good tolerance to noise and inconsistent lighting.
- Squares should be at least 15 pixels in width.

Generating a calibrated image

The following show the procedure for generating a calibrated image using calibration result (☞ Page 79 Performing a calibration).

Operating procedure

1. Select [Functions] tab ⇨ "Coordinate Transforms" ⇨ "Calibrate" ⇨ "TransformImage" in the Palette window, and drag and drop it to a spreadsheet.



2. Specify the cell where a calibration structure is placed (☞ Page 79 Performing a calibration) for "Calibration" in the "Property Sheet" screen.

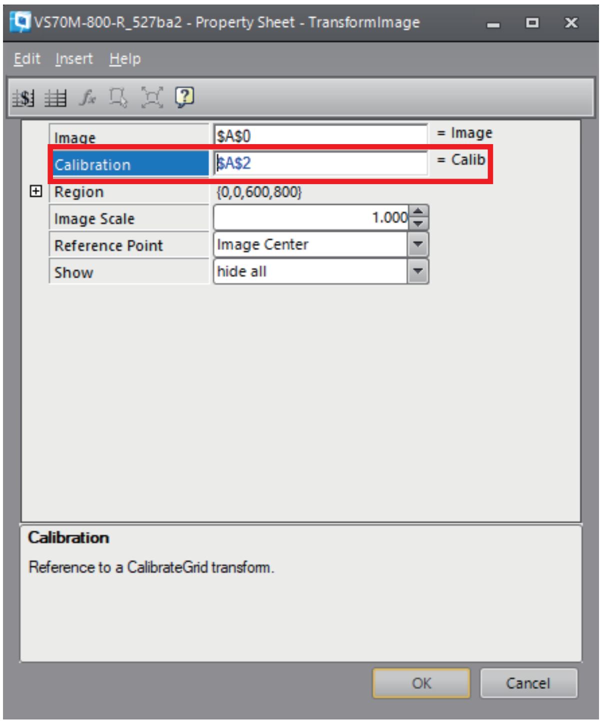


Image	A0	= Image
Calibration	$A$2	= Calib
Region	{0,0,600,800}	
Image Scale	1.000	
Reference Point	Image Center	
Show	hide all	

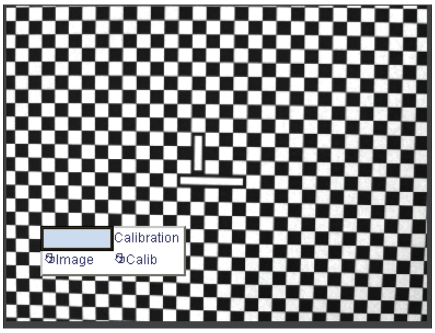
Calibration

Reference to a CalibrateGrid transform.

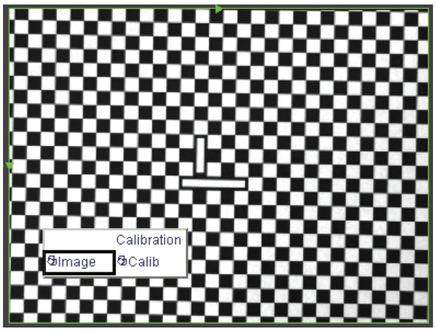
An image structure and a calibration structure is generated in the spreadsheet.

For the image structure, an image which is calibrated by the CaribrateGrid function will be stored.

(1)



(2)



(1) Image taken by a camera

(2) Image with no distortion by calibration

Converting a unit

The following shows the procedure for converting a unit.

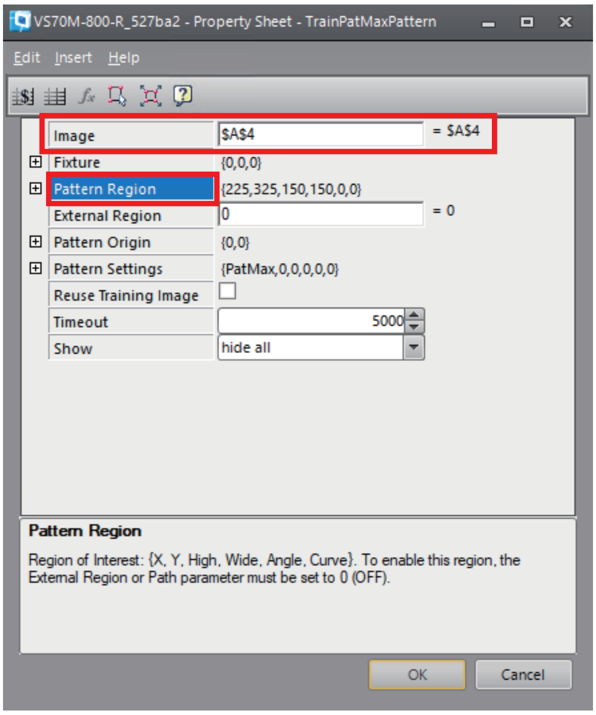
Operating procedure

1. Select [Functions] tab ⇨ "Vision Tools" ⇨ "Pattern Match" ⇨ "TrainPatMaxPattern" in the Palette window, and drag and drop it to a spreadsheet.

2. Set the items in the "Property Sheet" screen as follows.

Image: Specify the cell where an image structure of the TransformImage function is placed (☞ Page 85 Generating a calibrated image).

Pattern Region: Double-click "Pattern Region", enclose a pattern to be trained, and press the [Enter] key.



VS70M-800-R_527ba2 - Property Sheet - TrainPatMaxPattern

Image	$A$4	= $A$4
⊞ Fixture	{0,0,0}	
⊞ Pattern Region	{225,325,150,150,0,0}	
External Region	0	= 0
⊞ Pattern Origin	{0,0}	
⊞ Pattern Settings	{PatMax,0,0,0,0,0}	
Reuse Training Image	□	
Timeout	5000	
Show	hide all	

Pattern Region

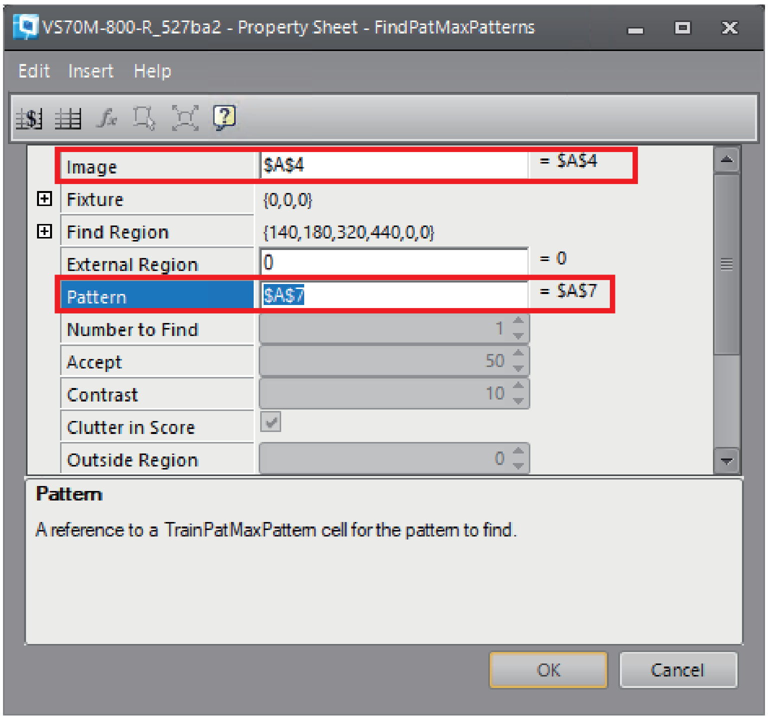
Region of Interest: {X, Y, High, Wide, Angle, Curve}. To enable this region, the External Region or Path parameter must be set to 0 (OFF).

3. Select [Functions] tab ⇨ "Vision Tools" ⇨ "Pattern Match" ⇨ "FindPatMaxPatterns" in the Palette window, and drag and drop it to a spreadsheet.

4. Set the items in the "Property Sheet" screen as follows.

Image: Specify the cell where an image structure of the TransformImage function is placed (☞ Page 85 Generating a calibrated image).

Pattern: Specify the cell where the TrainPatMaxPattern function is placed in the step 1.



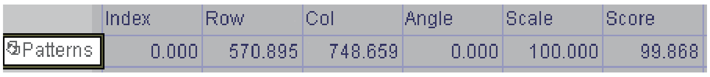
VS70M-800-R_527ba2 - Property Sheet - FindPatMaxPatterns

Image	$A$4	= $A$4
⊞ Fixture	{0,0,0}	
⊞ Find Region	{140,180,320,440,0,0}	
External Region	0	= 0
Pattern	$A$7	= $A$7
Number to Find	1	
Accept	50	
Contrast	10	
Clutter in Score	☑	
Outside Region	0	

Pattern

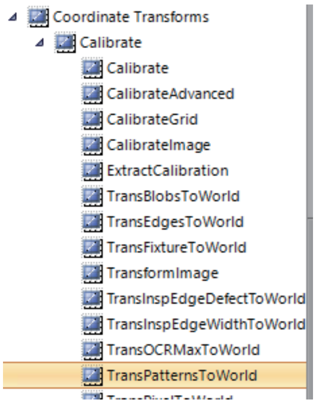
A reference to a TrainPatMaxPattern cell for the pattern to find.

The contents of the vision data access function, such as a row, column, angle, scale, and score are placed in the spreadsheet.



	Index	Row	Col	Angle	Scale	Score
Patterns	0.000	570.895	748.659	0.000	100.000	99.868

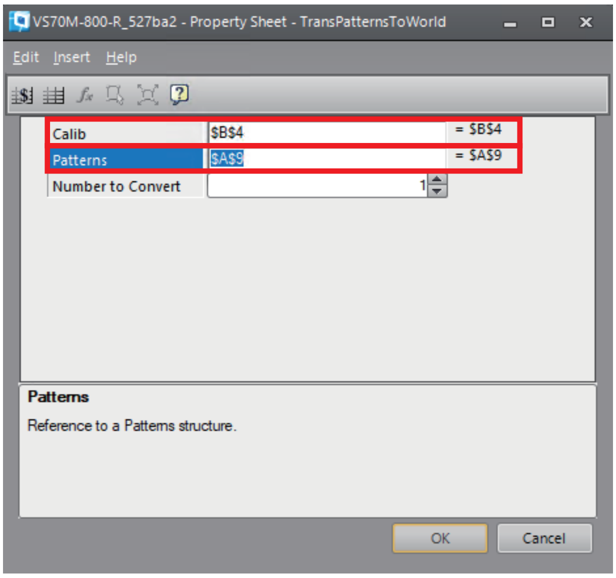
5. Select [Functions] tab ⇨ "Coordinate Transforms" ⇨ "Calibrate" ⇨ "TransPatternsToWorld" in the Palette window, and drag and drop it to the spreadsheet.



6. Set the items in the "Property Sheet" screen as follows.

Calib: Specify a cell on the right side of the TransformImage function (a cell where "Calib" is displayed) (☞ Page 85 Generating a calibrated image).

Pattern: Select the cell where the FindPatMaxPatterns function is placed in the step 3.

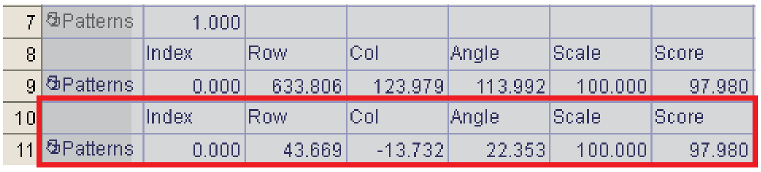


Calib	$B$4	= $B$4
Patterns	$A$9	= $A$9
Number to Convert	1	

Patterns

Reference to a Patterns structure.

A pattern structure after the conversion and a vision data access function are placed in the spreadsheet.



7	Patterns	1.000					
8		Index	Row	Col	Angle	Scale	Score
9	Patterns	0.000	633.806	123.979	113.992	100.000	97.980
10		Index	Row	Col	Angle	Scale	Score
11	Patterns	0.000	43.669	-13.732	22.353	100.000	97.980

3.4 Procedure for Setting Commonly Used Functions

This section shows the procedure for setting the following functions.

☞ Page 90 Blob detection (ExtractBlobs function)

☞ Page 92 Edge inspection (BeadFind function, BeadInspect function)

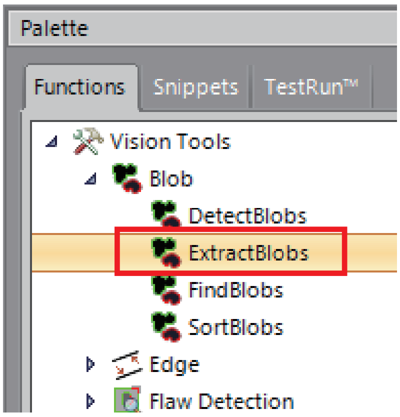
☞ Page 96 OCV/OCR (OCRMax function)

Blob detection (ExtractBlobs function)

This function detects a work which has an irregular form and measures the dimension of a feature by detecting a blob.

Operating procedure

1. Select [Functions] tab ⇨ "Vision Tools" ⇨ "Blobs" ⇨ "ExtractBlobs" in the Palette window, and drag and drop it to a spreadsheet.



2. Select "Region" in the "Property Sheet" screen, and click the icon ().

The entire image is targeted as a blob detection area.

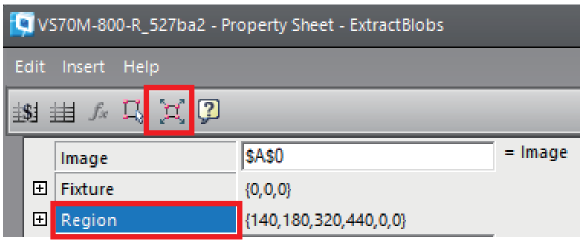
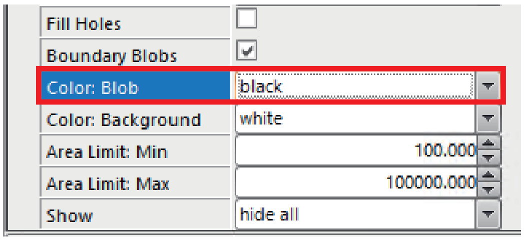


Image	A0	= Image
⊞ Fixture	{0,0,0}	
⊞ Region	{140,180,320,440,0,0}	

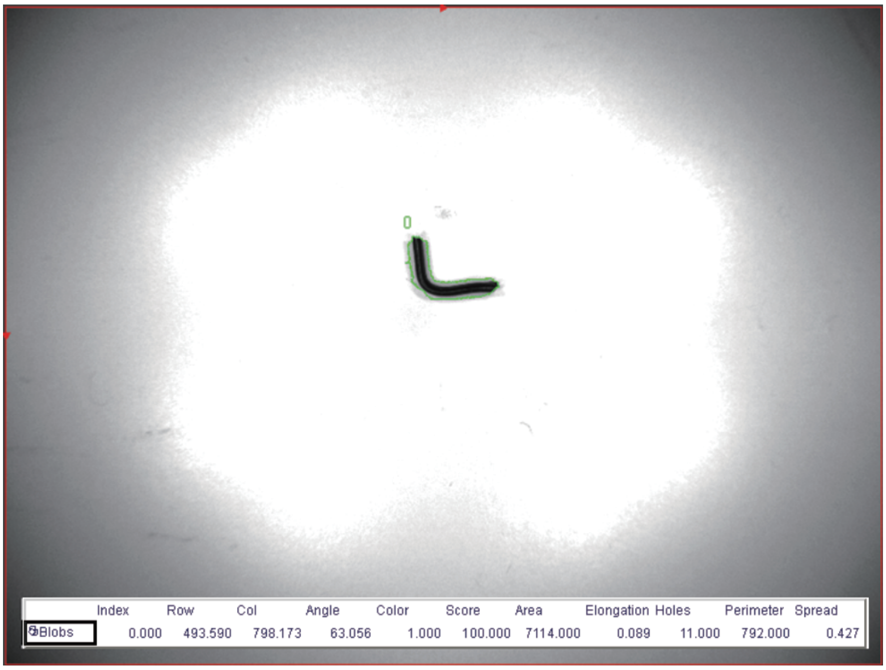
3. Set "black" for "Color: Blob".



Fill Holes	□
Boundary Blobs	☑
Color: Blob	black
Color: Background	white
Area Limit: Min	100.000
Area Limit: Max	100000.000
Show	hide all

4. Change the values in "Area Limit: Min" and "Area Limit: Max" according to the size of the feature.

A blob is detected.



	Index	Row	Col	Angle	Color	Score	Area	Elongation	Holes	Perimeter	Spread
Blobs	0.000	493.590	798.173	63.056	1.000	100.000	7114.000	0.089	11.000	792.000	0.427

Edge inspection (BeadFind function, BeadInspect function)

These functions detect edge width, chipping, and position gap by inspecting edge feature.

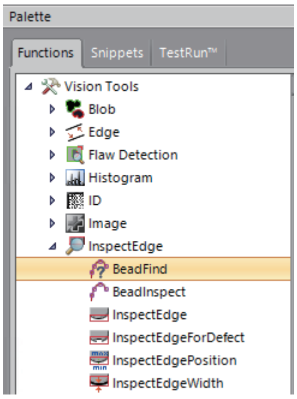
The following shows the procedure for training a bead feature[*1] using the BeadFind function and inspecting it using the BeadInspect function.

[*1] A line of glue connecting parts.

Operating procedure

1. Load the image of a non-defective work, or acquire an image from a vision sensor.

2. Select [Functions] tab ⇨ "Vision Tools" ⇨ "InspectEdge" ⇨ "BeadFind" in the Palette window, and drag and drop it to the spreadsheet.



3. Double-click "Bead Sample Location" in the "Property Sheet" screen.

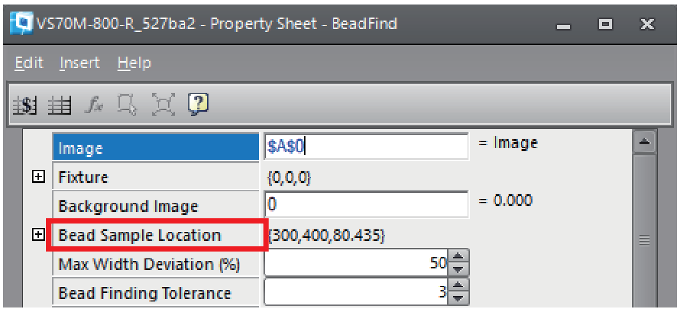
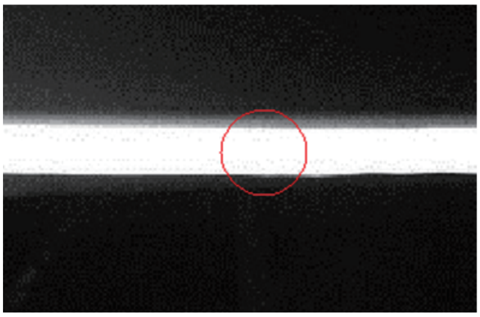
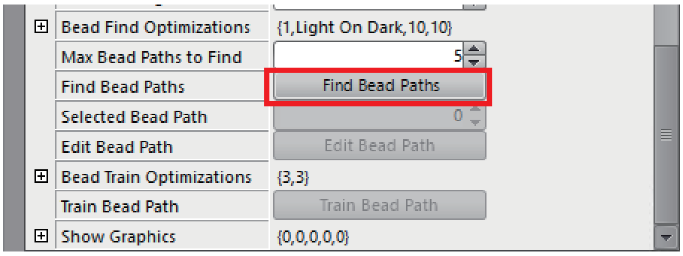


Image	A0	= Image
Fixture	{0,0,0}	
Background Image	0	= 0.000
Bead Sample Location	{300,400,80.435}	
Max Width Deviation (%)	50	
Bead Finding Tolerance	3	

4. Specify a position of the bead sample: the edges of both sides should be included as follows.

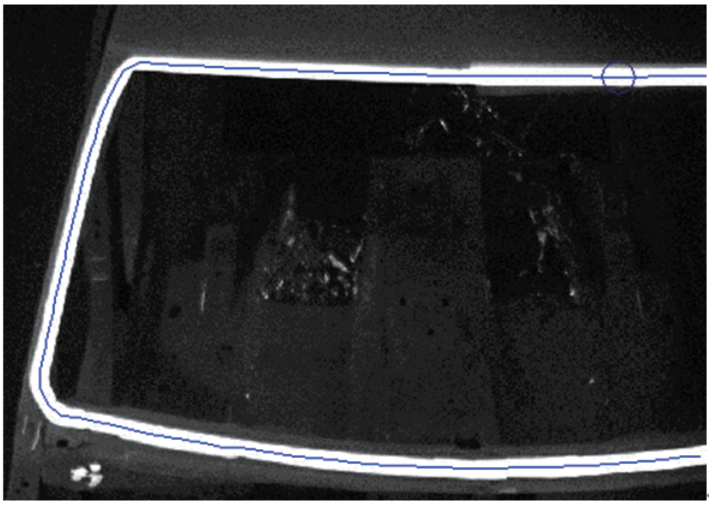


5. Click the [Find Bead Paths] button to detect a bead feature.

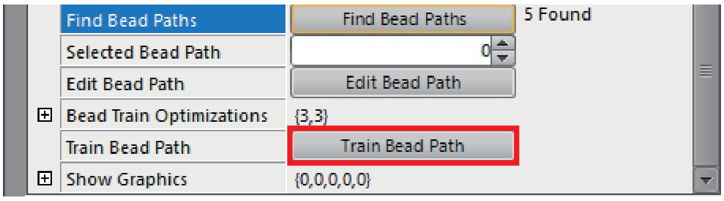


⊞ Bead Find Optimizations	{1,Light On Dark,10,10}
Max Bead Paths to Find	5
Find Bead Paths	Find Bead Paths
Selected Bead Path	0
Edit Bead Path	Edit Bead Path
⊞ Bead Train Optimizations	{3,3}
Train Bead Path	Train Bead Path
⊞ Show Graphics	{0,0,0,0,0}

When a bead path is detected, a blue line appears on the path.

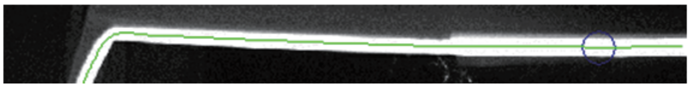


6. Check that the bead path is recognized as intended, and click the [Train Bead Path] button.

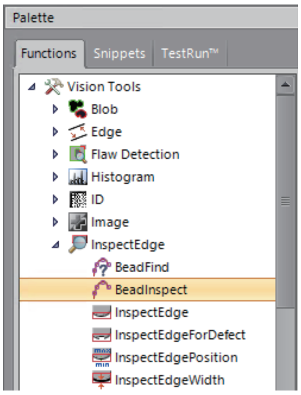


Find Bead Paths	Find Bead Paths	5 Found
Selected Bead Path	0	
Edit Bead Path	Edit Bead Path	
⊞ Bead Train Optimizations	{3,3}	
Train Bead Path	Train Bead Path	
⊞ Show Graphics	{0,0,0,0,0}	

After the training, the path is displayed in green.



7. Select [Functions] tab ⇨ "Vision Tools" ⇨ "InspectEdge" ⇨ "BeadInspect" in the Palette window, and drag and drop it to the spreadsheet.



8. Double-click "BeadFind" in the "Property Sheet" screen.

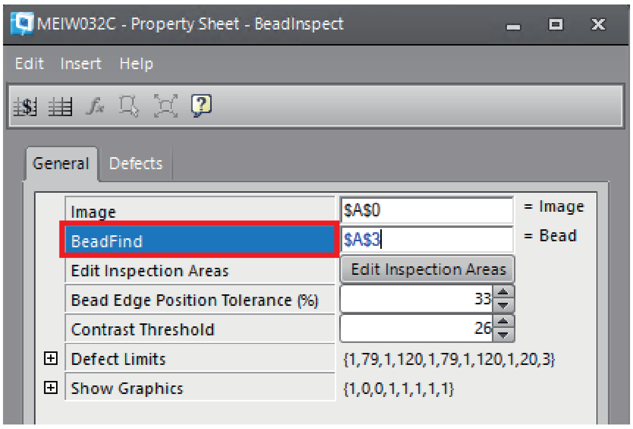
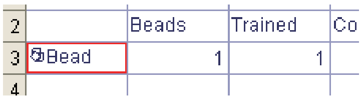


Image	A0	= Image
BeadFind	$A$3	= Bead
Edit Inspection Areas	Edit Inspection Areas	
Bead Edge Position Tolerance (%)	33	
Contrast Threshold	26	
⊞ Defect Limits	{1,79,1,120,1,79,1,120,1,20,3}	
⊞ Show Graphics	{1,0,0,1,1,1,1,1}	

9. Select a cell where a bead structure of the BeadFind function is placed, and press the Enter key.

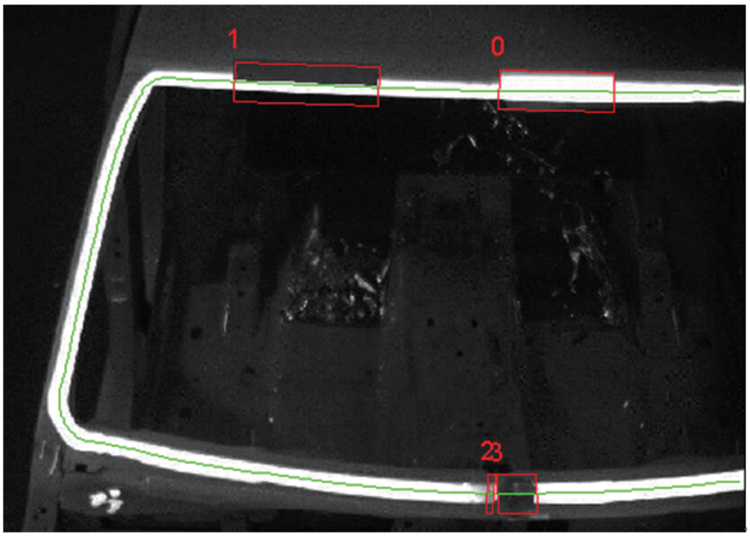


2		Beads	Trained	Co
3	Bead	1	1	
4				

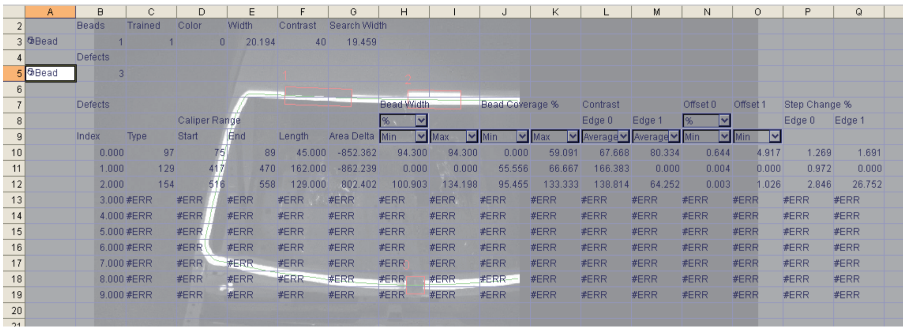
A vision data access function is placed in the spreadsheet.

10. To check if a defective part can be detected, load the image of a defective work or acquire an image.

When a defective is detected, the defective part is enclosed with a line and a number appear in the image.



The information regarding the detective part is displayed in the spreadsheet.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2		Beads	Trained	Color	Width	Contrast	Search Width										
3	Bead	1	1	0	20.194	40	19.459										
4		Defects															
5	Bead	3															
6																	
7		Defects						Bead Width		Bead Coverage %		Contrast		Offset 0	Offset 1	Step Change %	
8				Caliper Range				%				Edge 0	Edge 1	%		Edge 0	Edge 1
9		Index	Type	Start	End	Length	Area Delta	Min	Max	Min	Max	Average	Average	Min	Min		
10		0.000	97	75	89	45.000	-852.362	94.300	94.300	0.000	59.091	67.668	80.334	0.644	4.917	1.269	1.691
11		1.000	129	417	470	162.000	-862.239	0.000	0.000	55.556	66.667	166.383	0.000	0.004	0.000	0.972	0.000
12		2.000	154	516	558	129.000	802.402	100.903	134.198	95.455	133.333	138.814	64.252	0.003	1.026	2.846	26.752
13		3.000	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR
14		4.000	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR
15		5.000	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR
16		6.000	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR
17		7.000	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR
18		8.000	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR
19		9.000	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR	#ERR
20																	

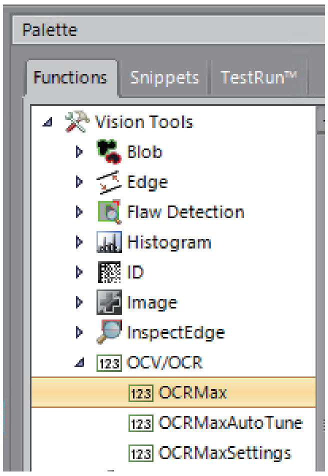
OCV/OCR (OCRMax function)

This function reads characters in an inspection region.

Characters which are illegible (corrupted or inclined by a print) can also be read using the OCRMax function.

Operating procedure

1. Select [Functions] tab ⇨ "Vision Tools" ⇨ "OCV/OCR" ⇨ "OCRMax" in the Palette window, and drag and drop it to a spreadsheet.



2. Double-click "Region" in the "Property Sheet" screen.

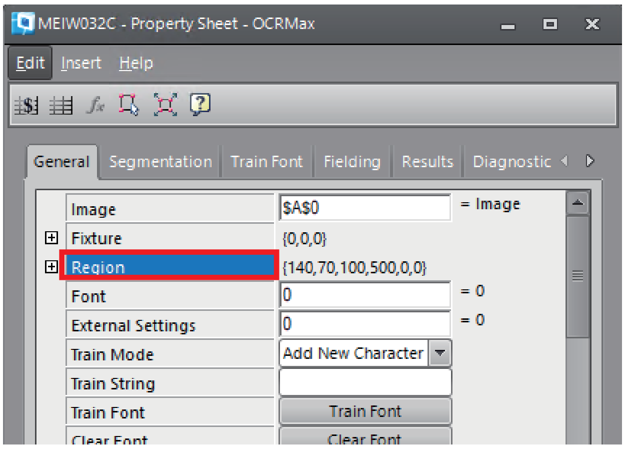
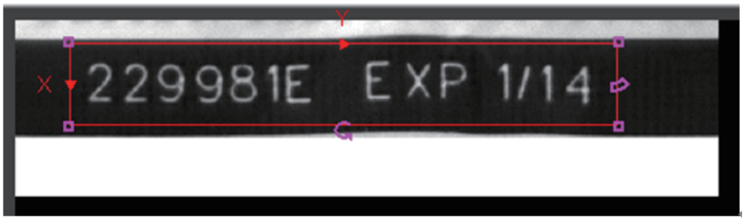


Image	A0	= Image
Fixture	{0,0,0}	
Region	{140,70,100,500,0,0}	
Font	0	= 0
External Settings	0	= 0
Train Mode	Add New Character	
Train String		
Train Font	Train Font	
Clear Font	Clear Font	

3. Enclose characters to be read.



4. Click the [Auto-Tune] button in the "Property Sheet" screen.

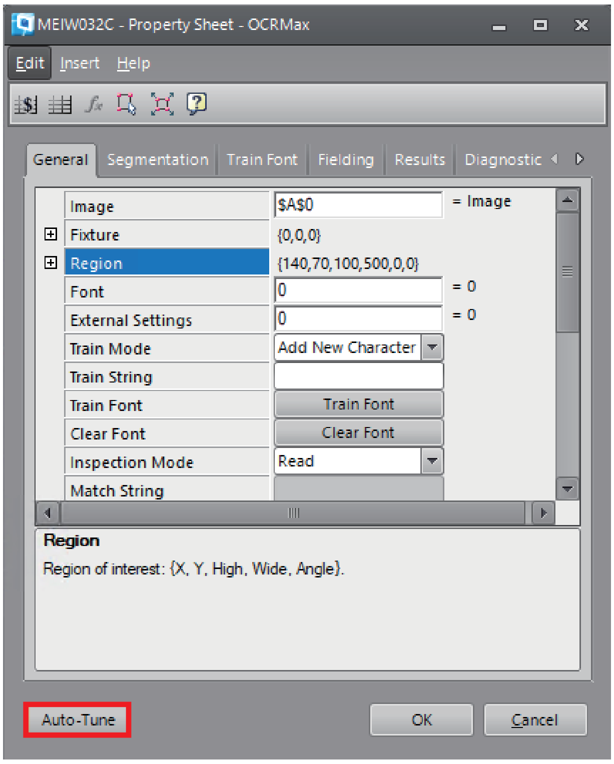
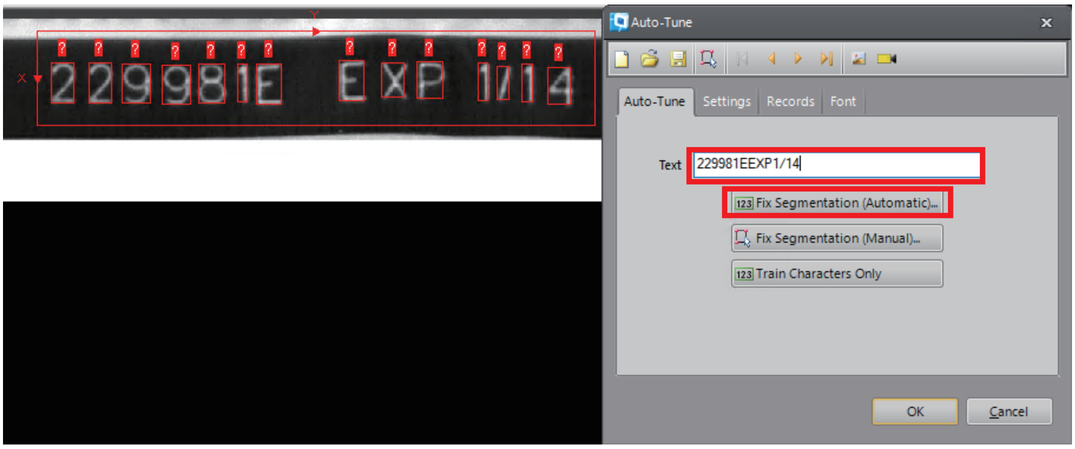

MEIW032C - Property Sheet - OCRMax
Edit Insert Help
General Segmentation Train Font Fielding Results Diagnostic
Auto-Tune
OK
Cancel

Image	A0	= Image
Fixture	{0,0,0}	
Region	{140,70,100,500,0,0}	
Font	0	= 0
External Settings	0	= 0
Train Mode	Add New Character	
Train String		
Train Font	Train Font	
Clear Font	Clear Font	
Inspection Mode	Read	
Match String		

Region

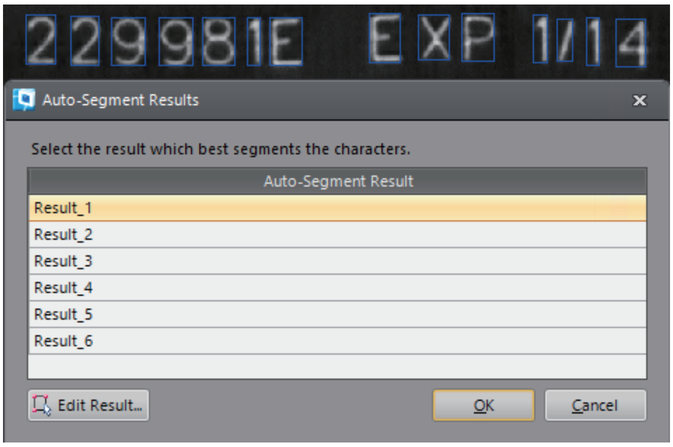
Region of interest: {X, Y, High, Wide, Angle}.

5. In the "Auto-Tune" screen, enter the characters to be read in "Text", and click the [Fix Segmentation (Automatic)] button.


Auto-Tune
Auto-Tune Settings Records Font
Fix Segmentation (Automatic)...
Fix Segmentation (Manual)...
Train Characters Only
OK
Cancel

Text 229981EEXP1/14

6. After the process is completed, the "Auto-Segment Results" screen appears.
Depending on the characters to be read, two or more results will be displayed.
Select an appropriate result and click the [OK] button.

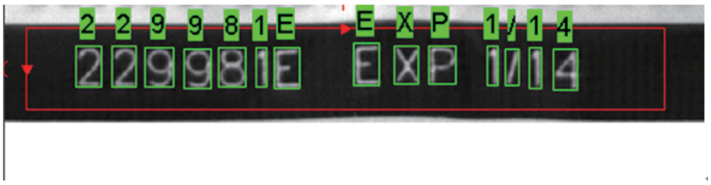


Auto-Segment Results

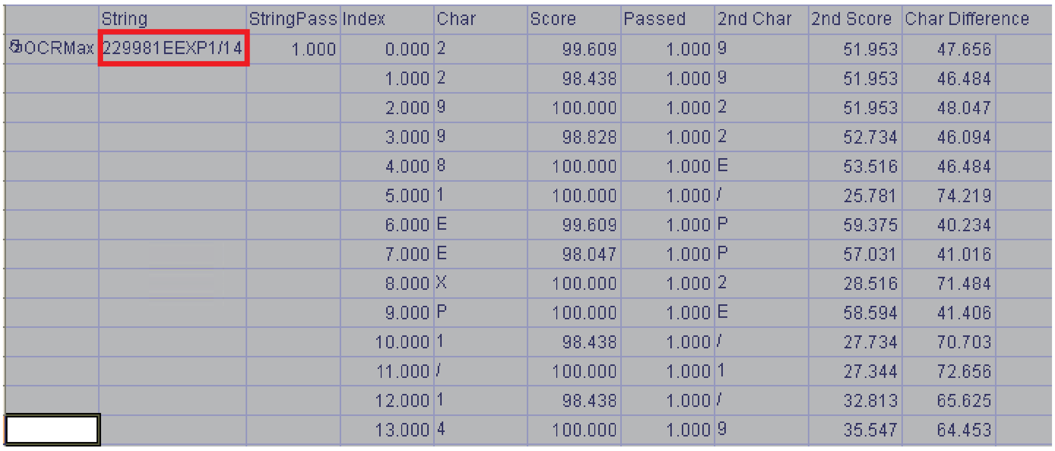
Select the result which best segments the characters.

Auto-Segment Result
Result_1
Result_2
Result_3
Result_4
Result_5
Result_6

The characters read by the OCRMax function are displayed as follows.



A vision data access function is placed in the spreadsheet.



	String	StringPass	Index	Char	Score	Passed	2nd Char	2nd Score	Char Difference
OCRMax	229981EEXP1/14	1.000	0.000	2	99.609	1.000	9	51.953	47.656
			1.000	2	98.438	1.000	9	51.953	46.484
			2.000	9	100.000	1.000	2	51.953	48.047
			3.000	9	98.828	1.000	2	52.734	46.094
			4.000	8	100.000	1.000	E	53.516	46.484
			5.000	1	100.000	1.000	/	25.781	74.219
			6.000	E	99.609	1.000	P	59.375	40.234
			7.000	E	98.047	1.000	P	57.031	41.016
			8.000	X	100.000	1.000	2	28.516	71.484
			9.000	P	100.000	1.000	E	58.594	41.406
			10.000	1	98.438	1.000	/	27.734	70.703
			11.000	/	100.000	1.000	1	27.344	72.656
			12.000	1	98.438	1.000	/	32.813	65.625
			13.000	4	100.000	1.000	9	35.547	64.453

Point

To refer to the read character from another function, refer to the right side of the cell where the OCRMax function is placed, or use the GetString function.

3.5 Using Snippets

Snippet is a term for a re-usable function which includes a predefined cell range.

Some snippets are prepared for a vision sensor.

A part of a created job can be exported as a snippet.

In the [Snipptes] tab in the Pallet window, the list of snippets is displayed.

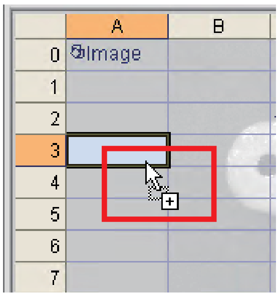
The following shows the procedure for using the prepared snippet, "FindPatMaxFeatures.cxd".

"FindPatMaxFeatures.cxd" contains the TrainPatMaxPattern function and the FindPatMaxPatterns function, and can train a model and detect a model trained.

Operating procedure

1. Select [Snippets] tab ⇨ "PatMax" ⇨ "FindPatMaxFeatures.cxd" in the Palette window.

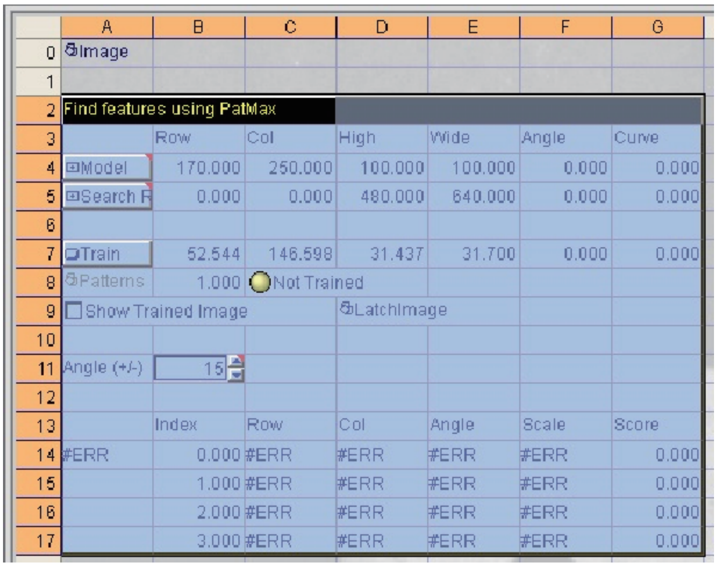
2. Drag and drop a snippet to the spreadsheet.
Alternatively, select a cell and double-click a snippet to be pasted.



	A	B
0	Image	
1		
2		
3		
4		
5		
6		
7		

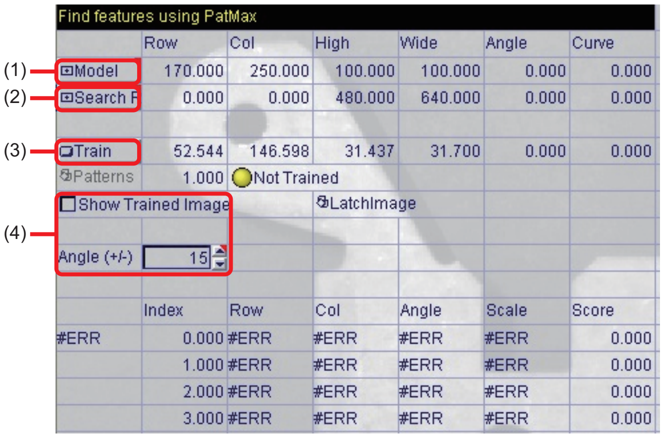
Point

The snippet is deployed to the cells around the pasted cell. The cells are overwritten and therefore avoid placing the snippet close to another data.



	A	B	C	D	E	F	G
0	Image						
1							
2	Find features using PatMax						
3		Row	Col	High	Wide	Angle	Curve
4	Model	170.000	250.000	100.000	100.000	0.000	0.000
5	Search R	0.000	0.000	480.000	640.000	0.000	0.000
6							
7	Train	52.544	146.598	31.437	31.700	0.000	0.000
8	Patterns	1.000	● Not Trained				
9	□ Show Trained Image			LatchImage			
10							
11	Angle (+/-)	15					
12							
13		Index	Row	Col	Angle	Scale	Score
14	#ERR	0.000	#ERR	#ERR	#ERR	#ERR	0.000
15		1.000	#ERR	#ERR	#ERR	#ERR	0.000
16		2.000	#ERR	#ERR	#ERR	#ERR	0.000
17		3.000	#ERR	#ERR	#ERR	#ERR	0.000

3. Using the control function in the snippet, train a model, search a region, and set parameters.



Find features using PatMax

	Row	Col	High	Wide	Angle	Curve
⊡Model	170.000	250.000	100.000	100.000	0.000	0.000
⊡Search F	0.000	0.000	480.000	640.000	0.000	0.000
❐Train	52.544	146.598	31.437	31.700	0.000	0.000
Patterns	1.000	○Not Trained				
□Show Trained Image			LatchImage			
Angle (+/-)	15					
	Index	Row	Col	Angle	Scale	Score
#ERR	0.000	#ERR	#ERR	#ERR	#ERR	0.000
	1.000	#ERR	#ERR	#ERR	#ERR	0.000
	2.000	#ERR	#ERR	#ERR	#ERR	0.000
	3.000	#ERR	#ERR	#ERR	#ERR	0.000

(1) EditRegion function for defining model region

(2) EditRegion function for defining search region

(3) Button for training models

(4) Parameters

Set a model region and search region, and click the [Train] button.

The model is trained and the coordinate can be acquired.

Depending on the work, a rotation angle and scale change amount can be set.

Point

- Some snippets can be set without opening the "Property Sheet" screen.
- Some controls in a snippet are controlled by a mathematical formula to set each item easily.

APPENDIX

Appendix 1 Sample Program

This section introduces sample programs of a spreadsheet. Features, utilization and sample programs of each function are explained.

PatMax

Spreadsheet-specific PatMax parameters

PatMax® in a spreadsheet consists of two dedicated functions: model training and searching. Additionally, more parameters can be set in the spreadsheet than EasyBuilder. The following shows a difference in applicable settings between EasyBuilder and spreadsheet. Some parameters are explained in detail.

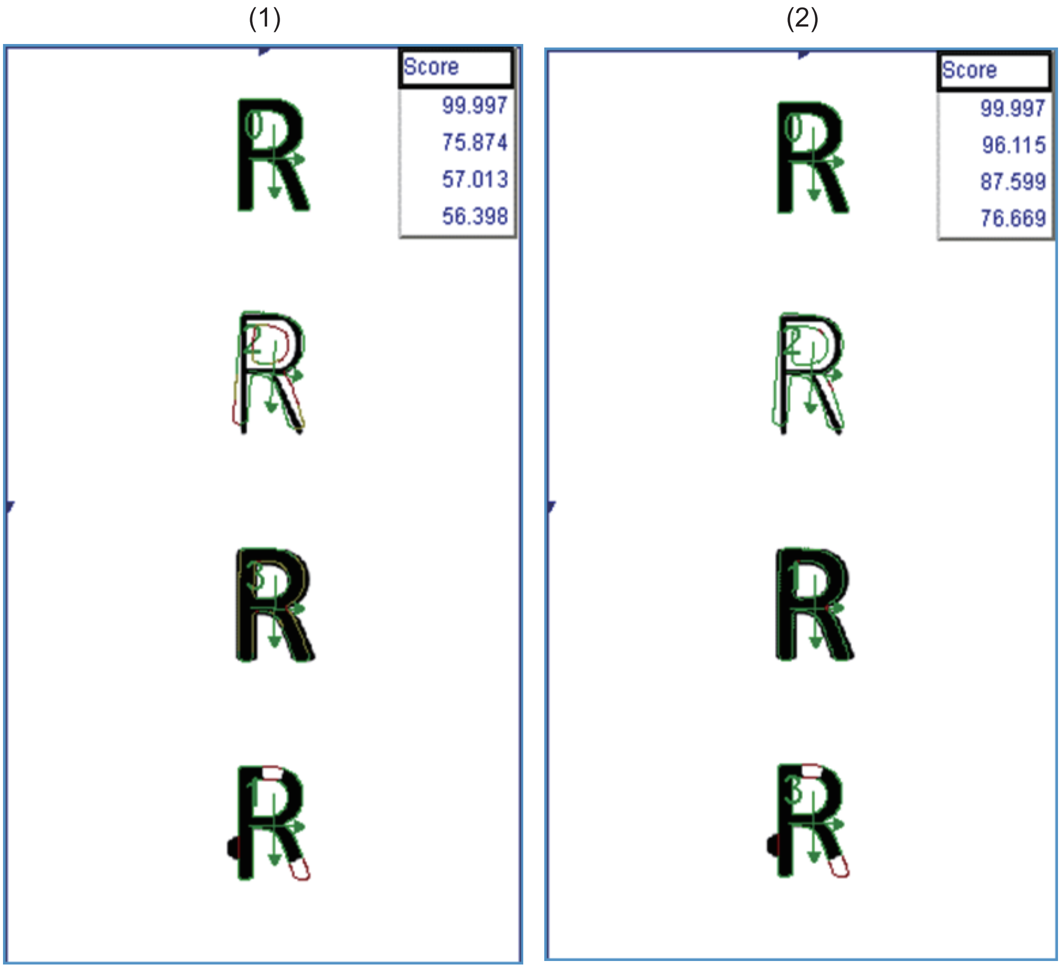
■Model training (TrainPatMaxPattern)

Parameter	EasyBuilder	Spreadsheet
Pattern origin	Not applicable (The center of a specified region is an origin)	Applicable to set a pattern origin
Elasticity	Not applicable (No tolerance)	Applicable within 0.000 to 10.000
Coarse granularity	Not applicable (Calculated automatically according to the condition of a feature)	Applicable within 0.000 to 10.000
Fine granularity	Not applicable (Calculated automatically according to the condition of a feature)	Applicable within 0.000 to 10.000

● Elasticity

The degree to which PatMax tolerates deformation can be set.

Figure 1 shows the difference in execution results when the elasticity value is changed. With high elasticity, high execution result score is maintained even with some parts of the character missing. This parameter does not affect the execution speed of PatMax.



(1)

Score
99.997
75.874
57.013
56.398

(2)

Score
99.997
96.115
87.599
76.669

Figure 1 Difference in scores for pattern matching according to the setting values of elasticity

(1) Without elasticity (setting value: 0.00)

(2) With elasticity (setting value: 0.01 to 10.00)

● Coarse and fine granularity

PatMax performs two-step searching processing.

Firstly, PatMax extracts search candidates by searching coarsely, and then detects shapes that match with a trained model by searching across the candidates finely. 'Coarse granularity' can be used for a coarse search, and 'fine granularity' can be used for a fine search (Figure 2).

Set a low granularity value to obtain the accuracy of a pattern position. On the other hand, set a high granularity value to prioritize a processing time. The accuracy and processing time are in a trade-off relation; therefore, set an appropriate value depending on the intended purpose.

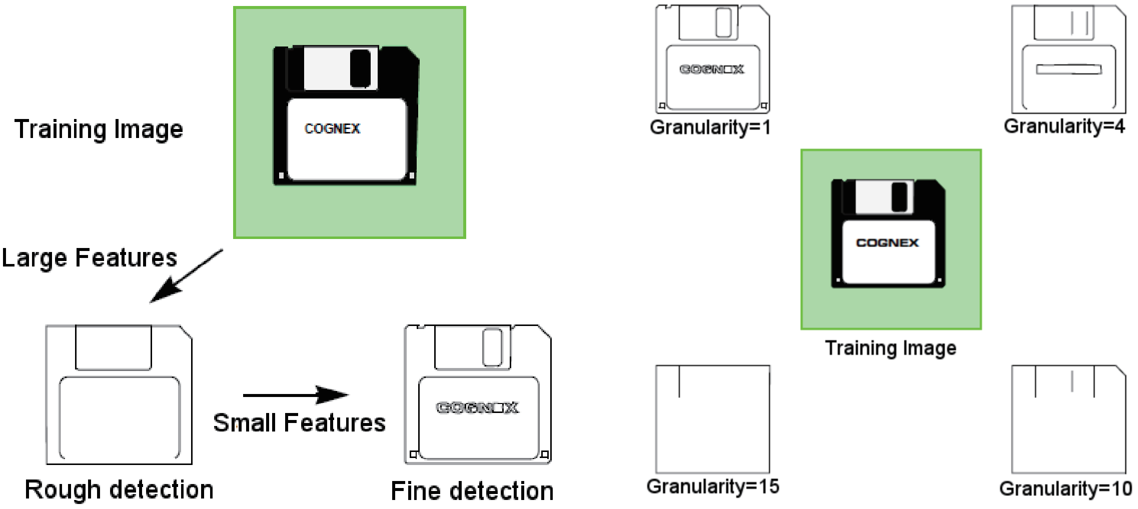


Figure 2 Coarse and fine granularity parameters

■Searching (FindPatMaxPatterns)

Parameter	EasyBuilder	Spreadsheet
Number to Find	Maximum 10 (The upper limit value varies depending on the tool)	Maximum 1024
Angle	The same value in the ± is set for staring and ending angles Example) -30 to 30° are set when the setting value is 30	Starting and ending angles can be set individually within -180 to 180 °
Scale Tolerance	The same value in the ± is set on the basis of 100% Example) 90 to 110% are set when the setting value is 10	Starting and ending scales can be set individually within 1 to 10000
Aspect Ratio	Not applicable (Not allowed for changing an aspect ratio)	Starting and ending aspect can be set within 1 to 10000
Overlapping	Not applicable (Only a part of overlap is tolerated)	Overlap tolerance value related to position, rotation, scale, and aspect can be set

Detecting all overlapping works

■Expected scene

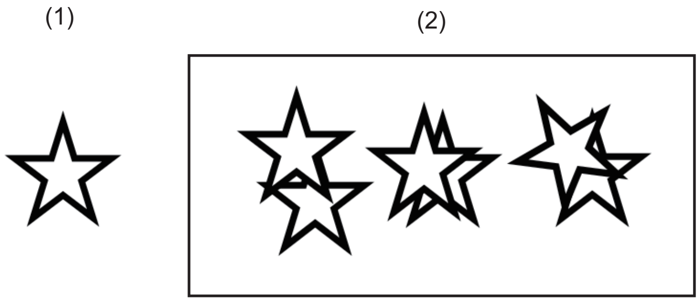


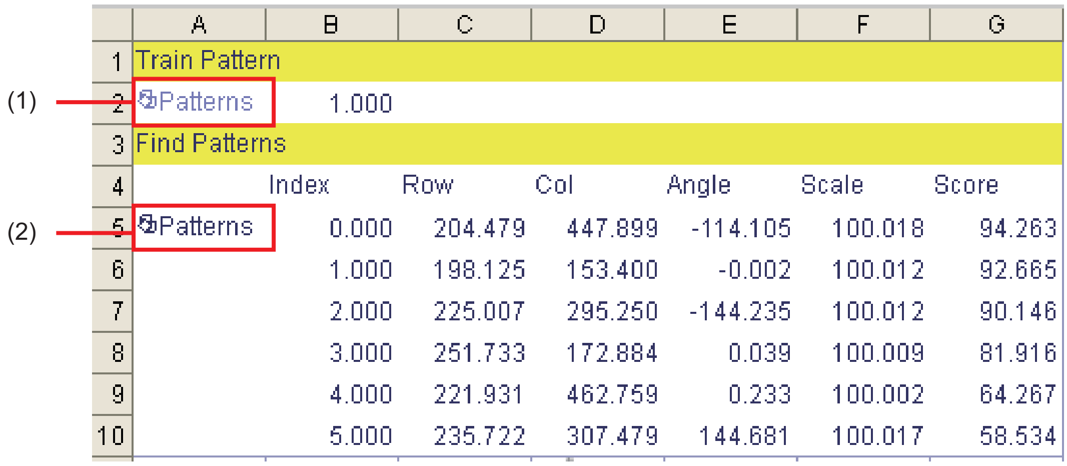
Figure 3 PatMax pattern search target

(1) Detection target

(2) Captured image

■Sample program

- Display content of spreadsheet



	A	B	C	D	E	F	G
1	Train Pattern						
2	Patterns	1.000					
3	Find Patterns						
4		Index	Row	Col	Angle	Scale	Score
5	Patterns	0.000	204.479	447.899	-114.105	100.018	94.263
6		1.000	198.125	153.400	-0.002	100.012	92.665
7		2.000	225.007	295.250	-144.235	100.012	90.146
8		3.000	251.733	172.884	0.039	100.009	81.916
9		4.000	221.931	462.759	0.233	100.002	64.267
10		5.000	235.722	307.479	144.681	100.017	58.534

- Program contents

(1) A2: TrainPatMaxPattern (...)

(2) A5: FindPatMaxPatterns (...)

■Program description

(1) Use the TrainPatMaxPattern function to train a pattern model.

Surround a pattern to be trained in "Pattern Region" (Figure 4). Pattern origin is positioned at the center of the pattern region when the origin is not specified. Set "Pattern Origin" as necessary.

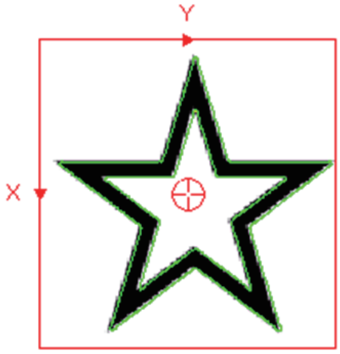


Figure 4 Trained model

(2) Use the FindPatMaxPatterns function to search the shape of a model trained.

Specify a cell of the TrainPatMaxPattern function for "Pattern." Specify the number of works to be detected simultaneously in "Number to Find." Additionally, select the checkbox of "Clutter in Score" to adjust "XY Overlap" to detect overlapping works. In this example, set 6 for "Number to Find," and 95 for "XY Overlap." When the angle of the works is not determined, set the "Angle Start" and "Angle End" of find tolerances to -180 and 180 respectively to detect the works positioned at any angles (Figure 5).

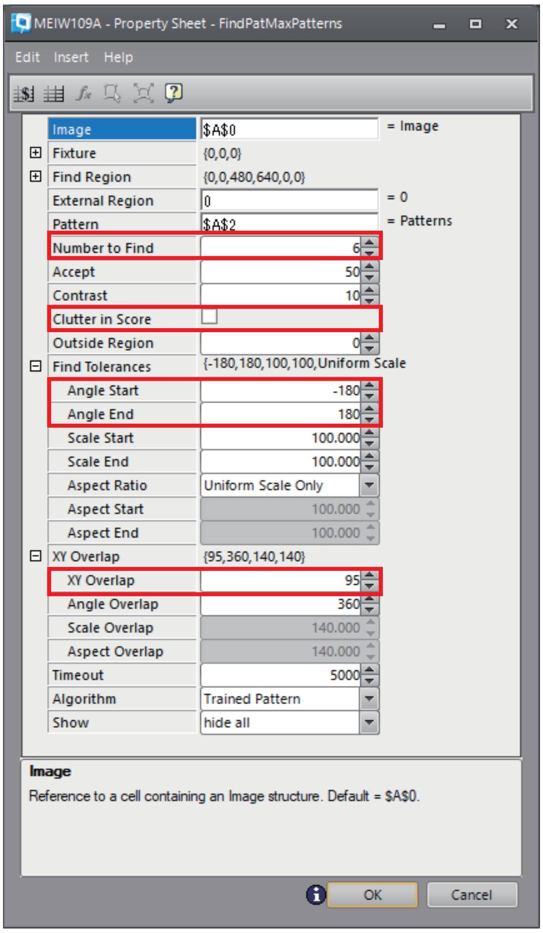


Image	A0	= Image
⊞ Fixture	{0,0,0}	
⊞ Find Region	{0,0,480,640,0,0}	
External Region	0	= 0
Pattern	$A$2	= Patterns
Number to Find	6	
Accept	50	
Contrast	10	
Clutter in Score	□	
Outside Region	0	
⊟ Find Tolerances	{-180,180,100,100,Uniform Scale	
Angle Start	-180	
Angle End	180	
Scale Start	100.000	
Scale End	100.000	
Aspect Ratio	Uniform Scale Only	
Aspect Start	100.000	
Aspect End	100.000	
⊟ XY Overlap	{95,360,140,140}	
XY Overlap	95	
Angle Overlap	360	
Scale Overlap	140.000	
Aspect Overlap	140.000	
Timeout	5000	
Algorithm	Trained Pattern	
Show	hide all	

Image

Reference to a cell containing an Image structure. Default = A0.

Figure 5 FindPatMaxPatterns function property sheet

■Execution result example

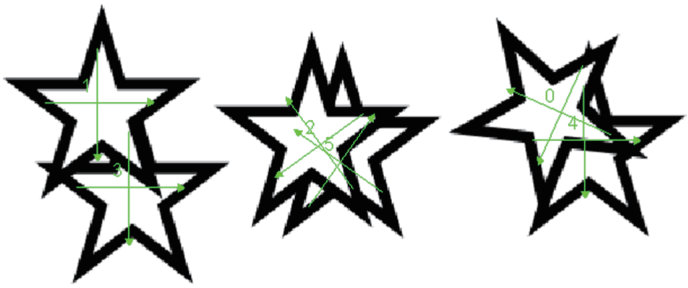
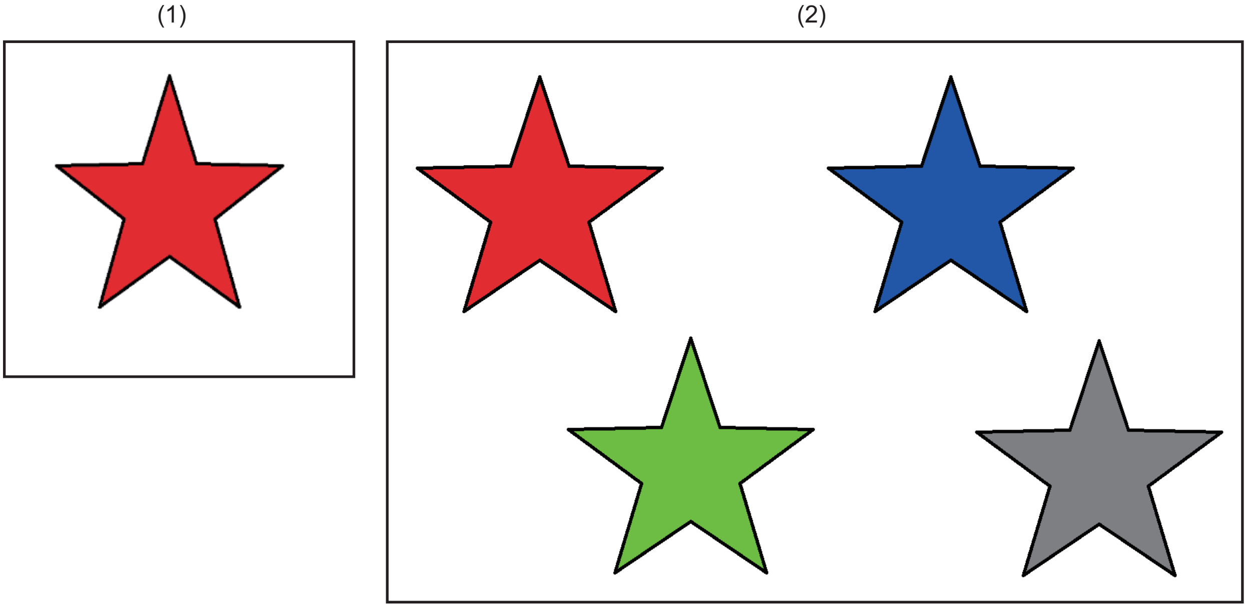


Figure 6 Search result of overlapping works according to PatMax pattern

Detecting the pattern of a specific color within a color image

The PatMaxRedLineColor function can detect a pattern, including not only a shape but also a color of a work.

■Expected scene

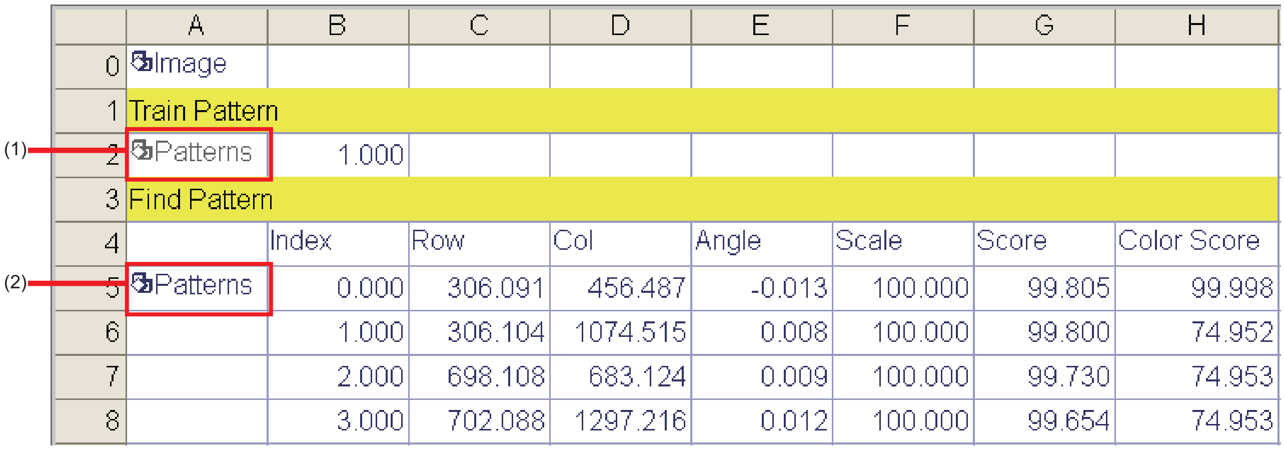


(1) Detection target

(2) Captured image

■Sample program

- Display content of spreadsheet



	A	B	C	D	E	F	G	H
0	Image							
1	Train Pattern							
2	Patterns	1.000						
3	Find Pattern							
4		Index	Row	Col	Angle	Scale	Score	Color Score
5	Patterns	0.000	306.091	456.487	-0.013	100.000	99.805	99.998
6		1.000	306.104	1074.515	0.008	100.000	99.800	74.952
7		2.000	698.108	683.124	0.009	100.000	99.730	74.953
8		3.000	702.088	1297.216	0.012	100.000	99.654	74.953

- Program contents

(1) A2: TrainPatMaxRedLineColor(...)

(2) A5: FindPatMaxRedLineColor(...)

■Program description

(1) Use the TrainPatMaxRedLineColor function to train a pattern model.

Surround a pattern to be trained in "Pattern Region" to register the shape. Set "Selected Colors" for "Match Colors" and specify a color for detecting in "Select Colors" (Figure 8).

By selecting a color of a detection target, the function scores based on the color; therefore, a pattern including the color information is detected. A color can be specified by clicking on the screen with the mouse.

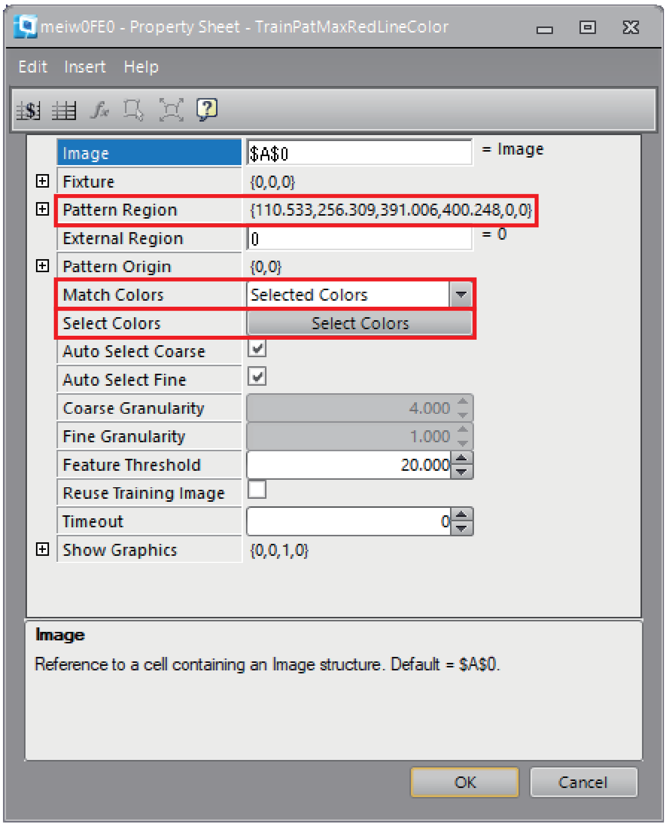
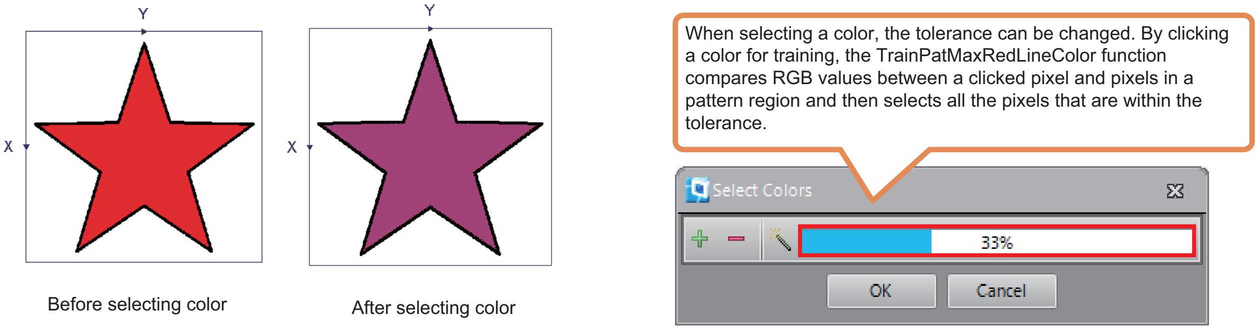


Image	A0	= Image
⊞ Fixture	{0,0,0}	
⊞ Pattern Region	{110.533,256.309,391.006,400.248,0,0}	
External Region	0	= 0
⊞ Pattern Origin	{0,0}	
Match Colors	Selected Colors	
Select Colors	Select Colors	
Auto Select Coarse	☑	
Auto Select Fine	☑	
Coarse Granularity	4.000	
Fine Granularity	1.000	
Feature Threshold	20.000	
Reuse Training Image	□	
Timeout	0	
⊞ Show Graphics	{0,0,1,0}	

Image

Reference to a cell containing an Image structure. Default = A0.

Figure 7 TrainPatMaxRedLineColor function property sheet



Before selecting color

After selecting color

When selecting a color, the tolerance can be changed. By clicking a color for training, the TrainPatMaxRedLineColor function compares RGB values between a clicked pixel and pixels in a pattern region and then selects all the pixels that are within the tolerance.

Figure 8 Selecting colors for pattern

(2) Use the FindPatMaxRedLineColor function to search the shape of a model trained.
Specify a cell of the TrainPatMaxRedLineColor function for "Pattern." Specify the number of works to be detected simultaneously in "Number to Find." In this example, set 4 for "Number to Find" (Figure 9).
Additionally, set a value in "Accept Threshold, Color" as necessary. If the color score is lower than the acceptance threshold value, the result will not be output.

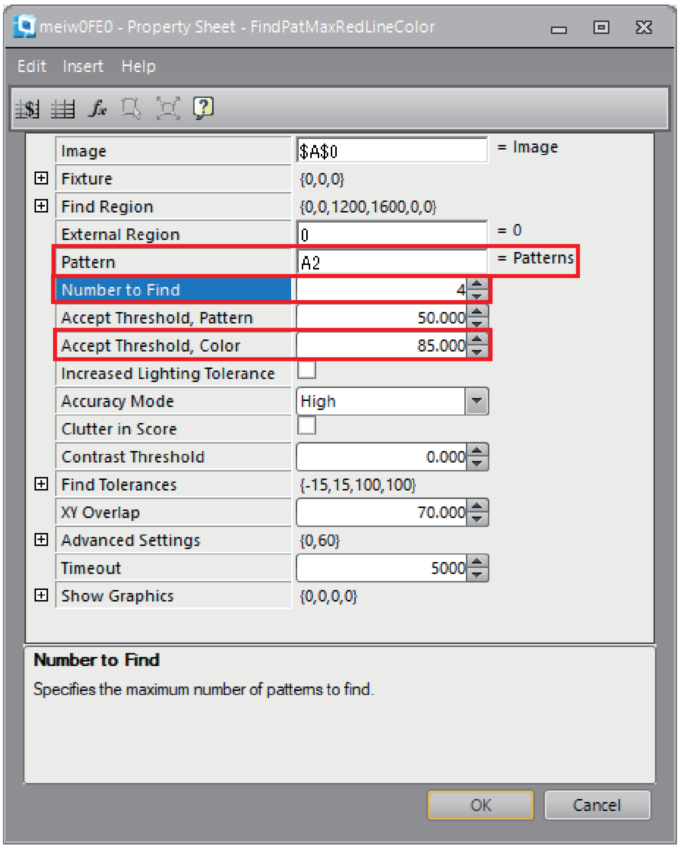
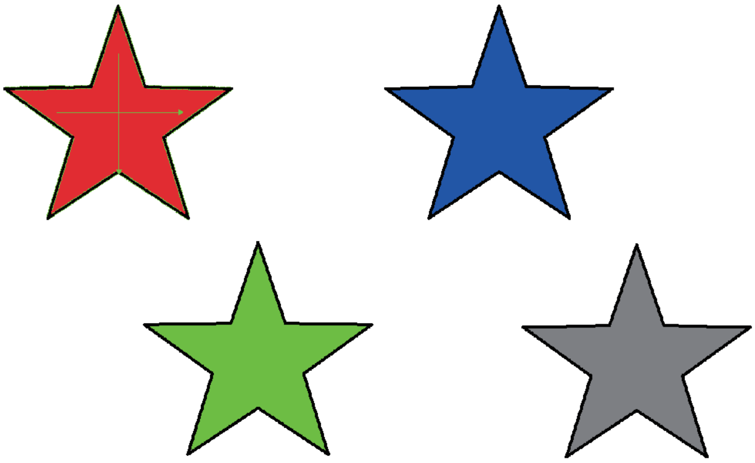


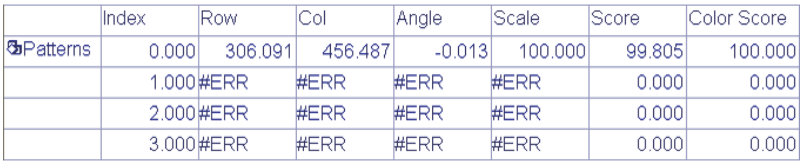
Image	A0	= Image
⊞ Fixture	{0,0,0}	
⊞ Find Region	{0,0,1200,1600,0,0}	
External Region	0	= 0
Pattern	A2	= Patterns
Number to Find	4	
Accept Threshold, Pattern	50.000	
Accept Threshold, Color	85.000	
Increased Lighting Tolerance	□	
Accuracy Mode	High	
Clutter in Score	□	
Contrast Threshold	0.000	
⊞ Find Tolerances	{-15,15,100,100}	
XY Overlap	70.000	
⊞ Advanced Settings	{0,60}	
Timeout	5000	
⊞ Show Graphics	{0,0,0,0}	

Number to Find
Specifies the maximum number of patterns to find.

Figure 9 FindPatMaxRedLineColor function property sheet

■Execution result example





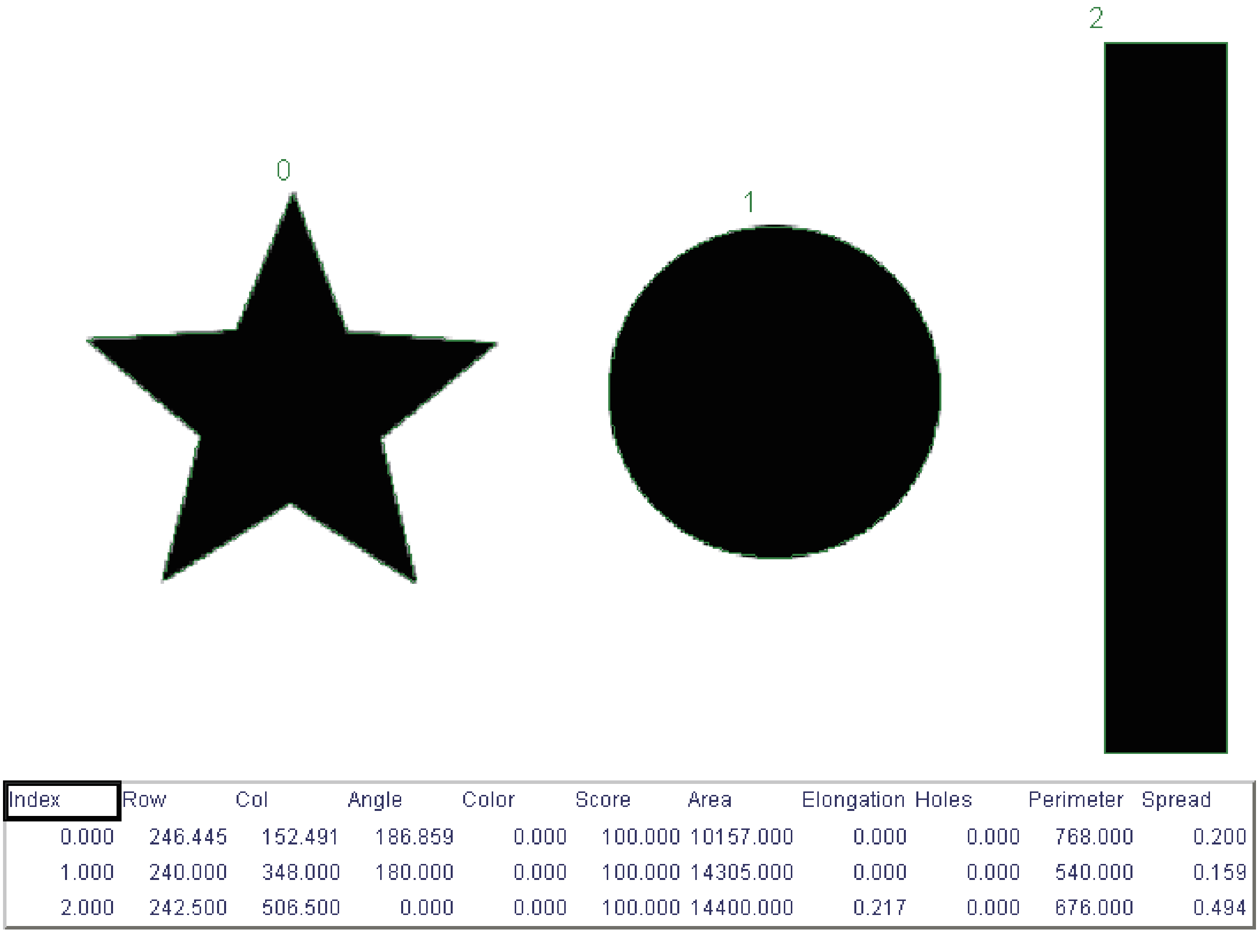
	Index	Row	Col	Angle	Scale	Score	Color Score
Patterns	0.000	306.091	456.487	-0.013	100.000	99.805	100.000
	1.000	#ERR	#ERR	#ERR	#ERR	0.000	0.000
	2.000	#ERR	#ERR	#ERR	#ERR	0.000	0.000
	3.000	#ERR	#ERR	#ERR	#ERR	0.000	0.000

FindBlobs

Classifying blobs according to geometric properties

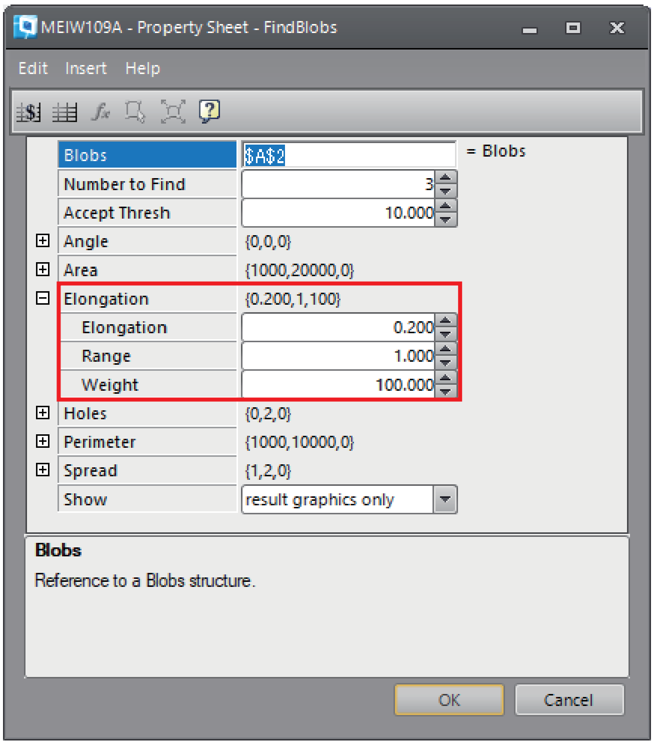
FindBlobs function is used for sorting blobs which satisfy specified requirements from blobs detected in advance. The function has parameters of angle, area, elongation, holes, perimeter, and spread, and defines requirements according to the parameters. Blobs with shapes which satisfy the specified requirements score higher and sorted by score.

The following example shows an example of detecting only rectangle blobs by using ExtractBlobs and FindBlobs functions. Figure 10 indicates the execution result of ExtractBlobs function for blobs with different shapes. The elongation parameters of the star blob (Number 0) and the circular blob (Number 1) are 0.000, while the rectangular blob (Number 2) is 0.217. Setting the elongation parameters to 0.2 for "Elongation," 1.0 for "Range," 100 for "Weight," and zero for the "Weight" of all other parameters in FindBlobs function property sheet (Figure 11) will result in only the rectangular blob being found. (Figure 12)



Index	Row	Col	Angle	Color	Score	Area	Elongation	Holes	Perimeter	Spread
0.000	246.445	152.491	186.859	0.000	100.000	10157.000	0.000	0.000	768.000	0.200
1.000	240.000	348.000	180.000	0.000	100.000	14305.000	0.000	0.000	540.000	0.159
2.000	242.500	506.500	0.000	0.000	100.000	14400.000	0.217	0.000	676.000	0.494

Figure 10 Difference in execution results of ExtractBlobs for blobs with different shapes

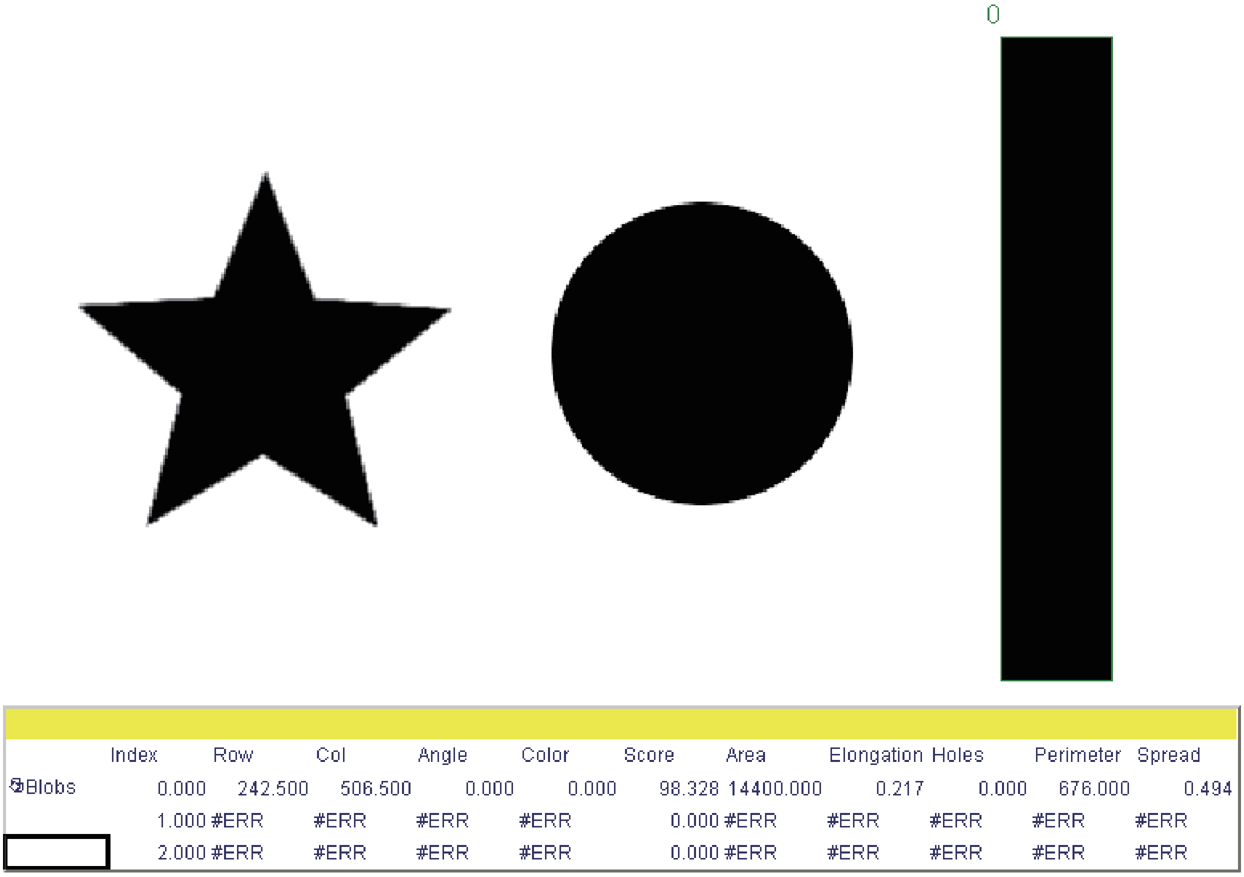


Blobs	$A$2	= Blobs
Number to Find	3	
Accept Thresh	10.000	
⊞ Angle	{0,0,0}	
⊞ Area	{1000,20000,0}	
⊟ Elongation	{0.200,1,100}	
Elongation	0.200	
Range	1.000	
Weight	100.000	
⊞ Holes	{0,2,0}	
⊞ Perimeter	{1000,10000,0}	
⊞ Spread	{1,2,0}	
Show	result graphics only	

Blobs

Reference to a Blobs structure.

Figure 11 Elongation parameter settings in the FindBlobs function property sheet



	Index	Row	Col	Angle	Color	Score	Area	Elongation	Holes	Perimeter	Spread
Blobs	0.000	242.500	506.500	0.000	0.000	98.328	14400.000	0.217	0.000	676.000	0.494
	1.000	#ERR	#ERR	#ERR	#ERR	0.000	#ERR	#ERR	#ERR	#ERR	#ERR
	2.000	#ERR	#ERR	#ERR	#ERR	0.000	#ERR	#ERR	#ERR	#ERR	#ERR

Figure 12 Extracting only specified blobs by using FindBlobs function parameters

Detecting a long screw among screws with different length

■Expected scene

Find a long screw among screws with different length.

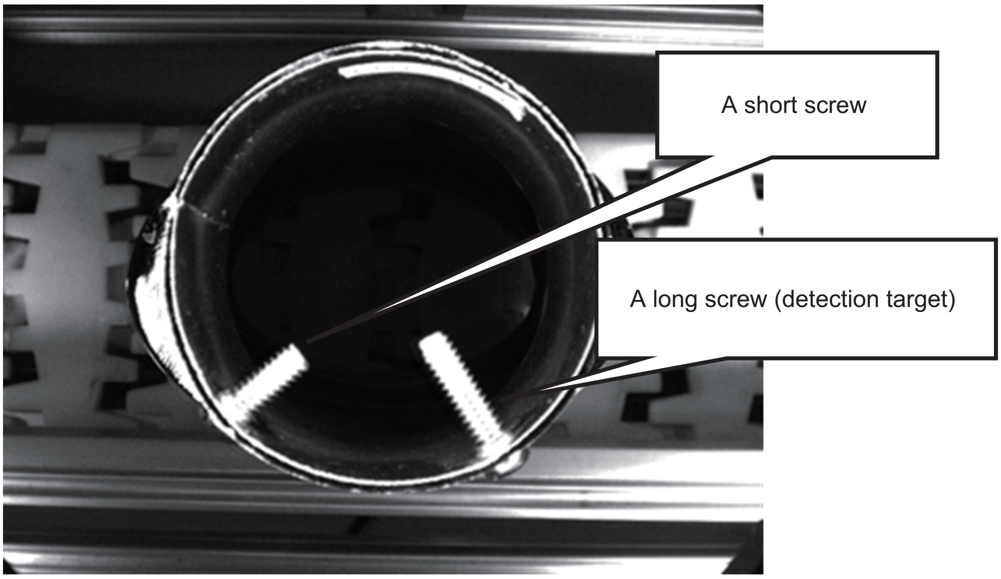
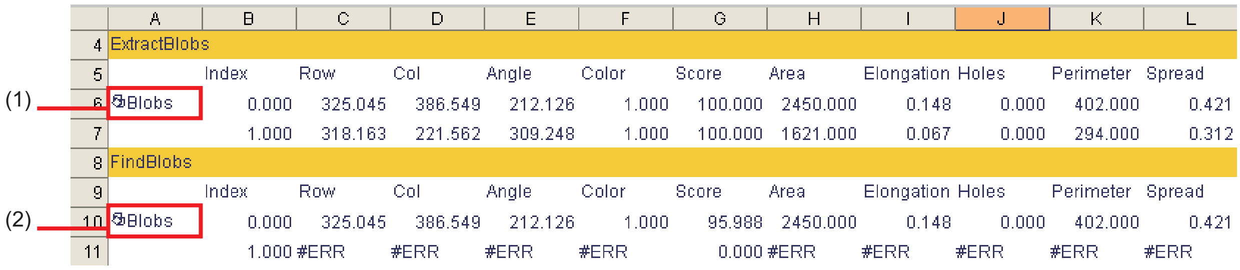


Figure 13 Expected scene image diagram

■Sample program

- Display content of spreadsheet



	A	B	C	D	E	F	G	H	I	J	K	L
4	ExtractBlobs											
5		Index	Row	Col	Angle	Color	Score	Area	Elongation	Holes	Perimeter	Spread
6	Blobs	0.000	325.045	386.549	212.126	1.000	100.000	2450.000	0.148	0.000	402.000	0.421
7		1.000	318.163	221.562	309.248	1.000	100.000	1621.000	0.067	0.000	294.000	0.312
8	FindBlobs											
9		Index	Row	Col	Angle	Color	Score	Area	Elongation	Holes	Perimeter	Spread
10	Blobs	0.000	325.045	386.549	212.126	1.000	95.988	2450.000	0.148	0.000	402.000	0.421
11		1.000	#ERR	#ERR	#ERR	#ERR	0.000	#ERR	#ERR	#ERR	#ERR	#ERR

- Program contents

(1) A6: ExtractBlobs (...)

(2) A10: FindBlobs ($A$6, ...)

■Program description

(1) Use the ExtractBlobs function to detect screws.

Specify "Region" and set 3 for "Number to Sort." Set parameters such as "Area Limit: Min" and "Area Limit: Max" as necessary.

When the settings are confirmed, blobs (screws in this example) are detected within the specified region (Figure 14).

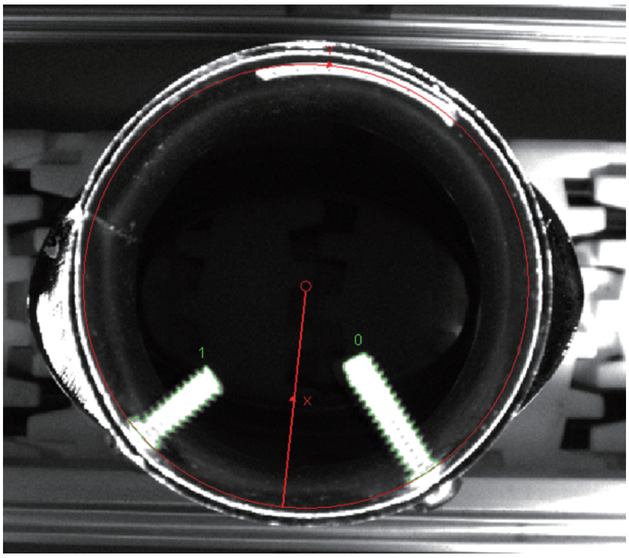
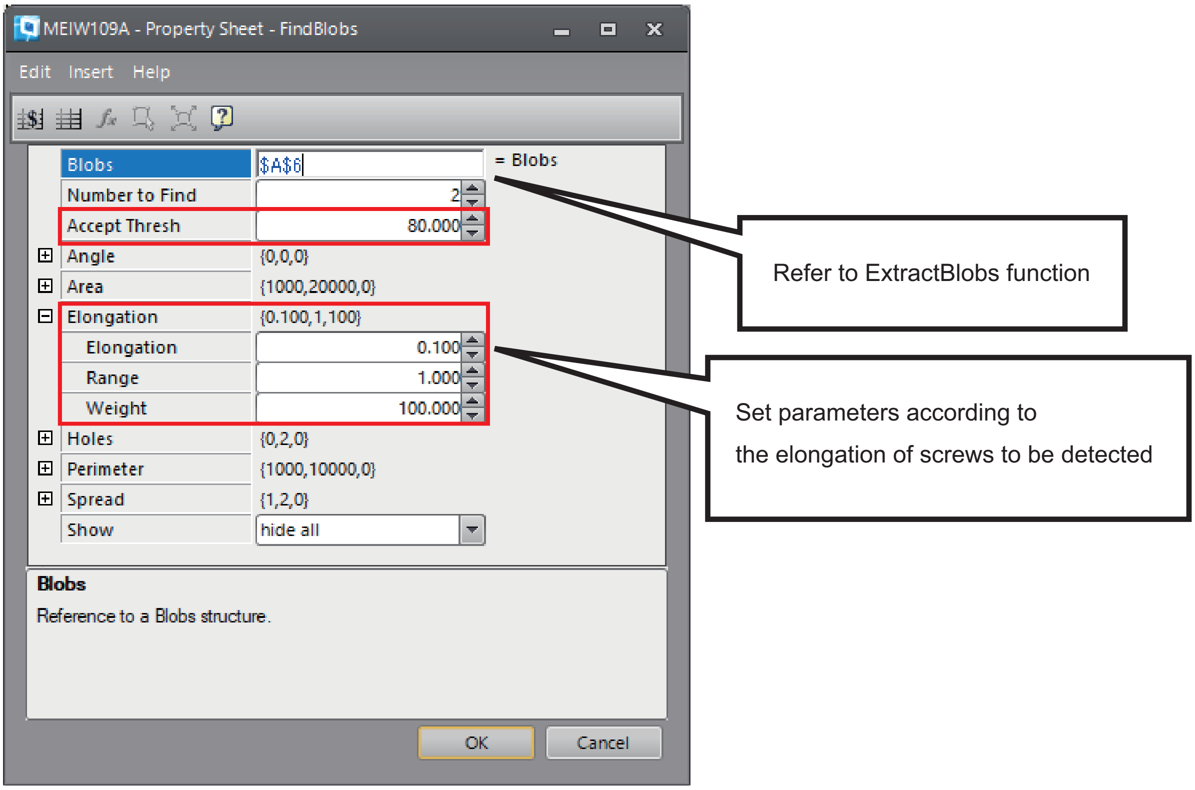


Figure 14 Detecting the screw part

(2) Use the FindBlobs function to detect only the long screw.

Set a value, which is appropriate for screws to be detected, for "Elongation" in the FindBlobs function property sheet.

Additionally, screws can be detected with focusing on only elongation by setting 100 for "Weight" of the elongation, and 0 for "Weight" of the other parameters.



MEIW109A - Property Sheet - FindBlobs

Blobs	$A$6	= Blobs
Number to Find	2	
Accept Thresh	80.000	
⊞ Angle	{0,0,0}	
⊞ Area	{1000,20000,0}	
⊟ Elongation	{0.100,1,100}	
Elongation	0.100	
Range	1.000	
Weight	100.000	
⊞ Holes	{0,2,0}	
⊞ Perimeter	{1000,10000,0}	
⊞ Spread	{1,2,0}	
Show	hide all	

Blobs

Reference to a Blobs structure.

Refer to ExtractBlobs function

Set parameters according to the elongation of screws to be detected

Figure 15 FindBlobs function property sheet

■Execution result example

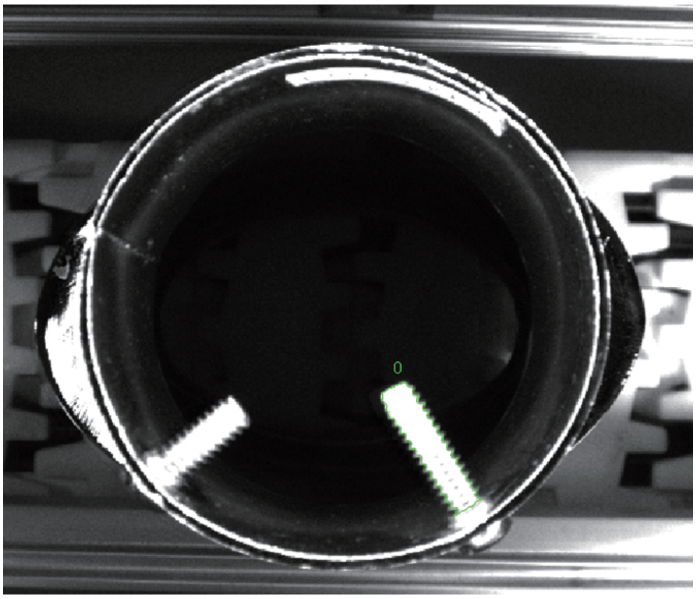


Figure 16 Detecting only the long screw

SurfaceFX

Specific image tool

SurfaceFX is one of the image filter tools. The function processes the four images captured with different lighting directions, and outputs an image with enhanced surface scratches and recessed or raised surfaces. By doing so, emboss-like markings and scratches on a metal surface can be detected easily. To use the SurfaceFX function, lights from four different directions are required. Therefore, a VS70 with integrated lights, an externally controlled 4ch power supply or a 4ch power supply that supports parallel input is required for illumination.

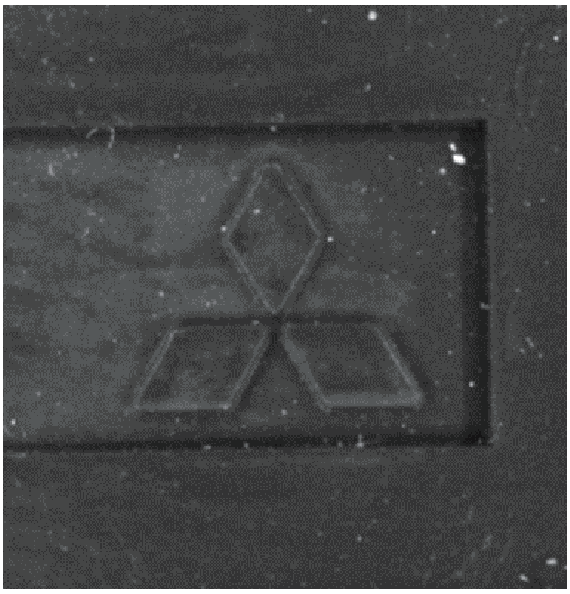
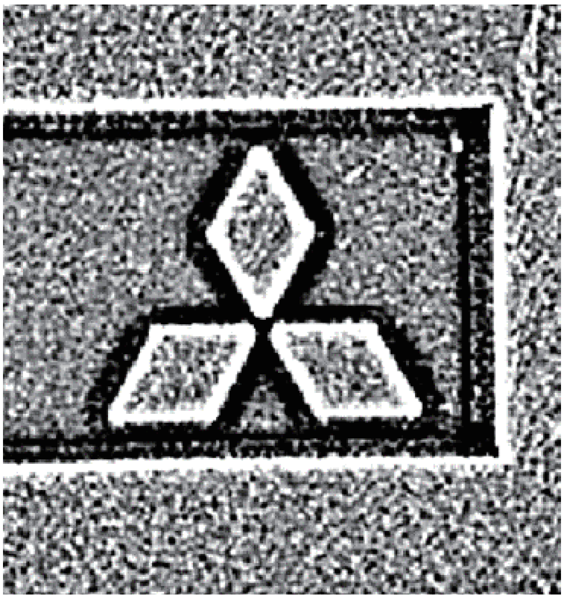
	

Figure 17 Normal image	Figure 18 Image using SurfaceFX function

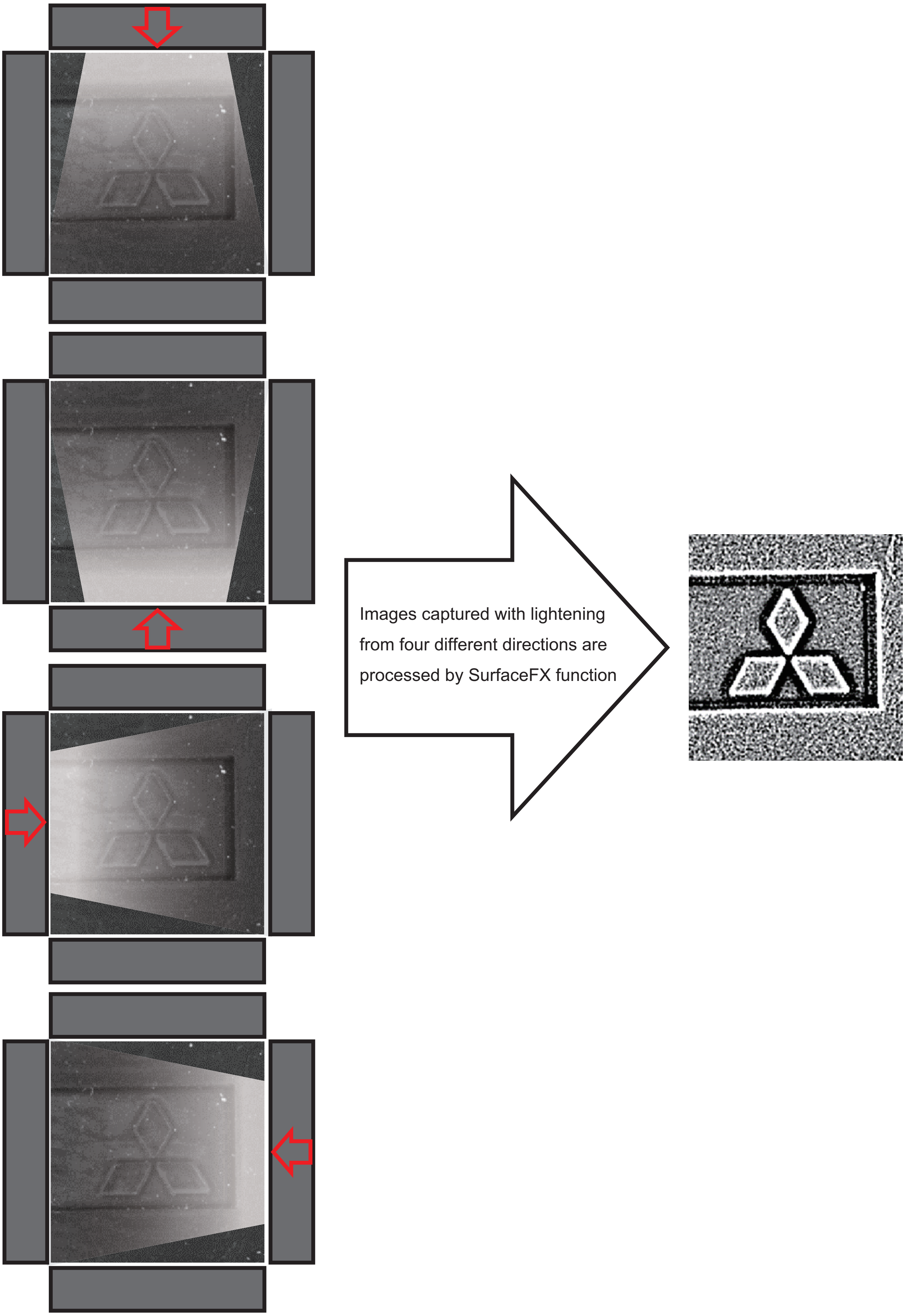
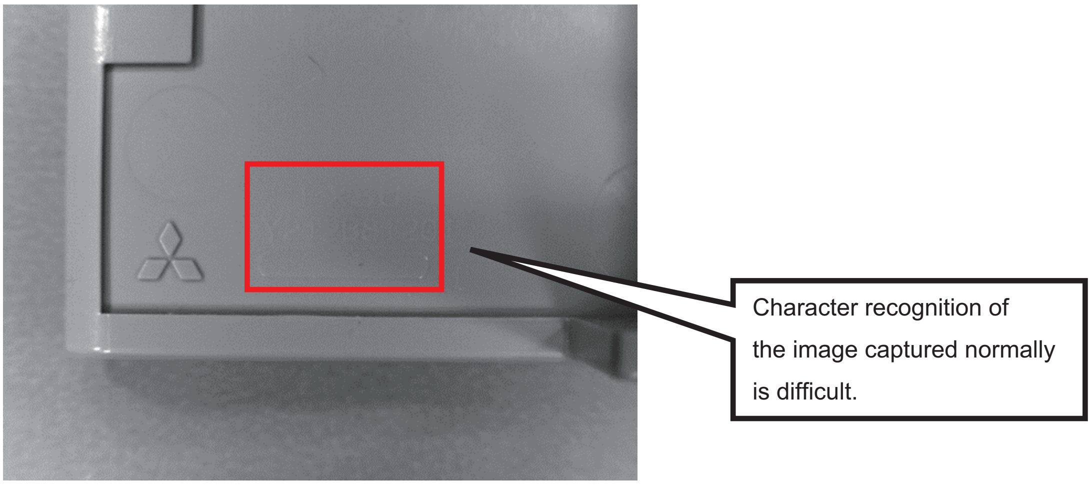

Images captured with lightening from four different directions are processed by SurfaceFX function

Figure 19 Procedure for generating an image using SurfaceFX function

Inspecting characters embossed on a plastic

■Expected scene

Inspect the accuracy of characters embossed on a plastic by using VS70 with integrated lights.

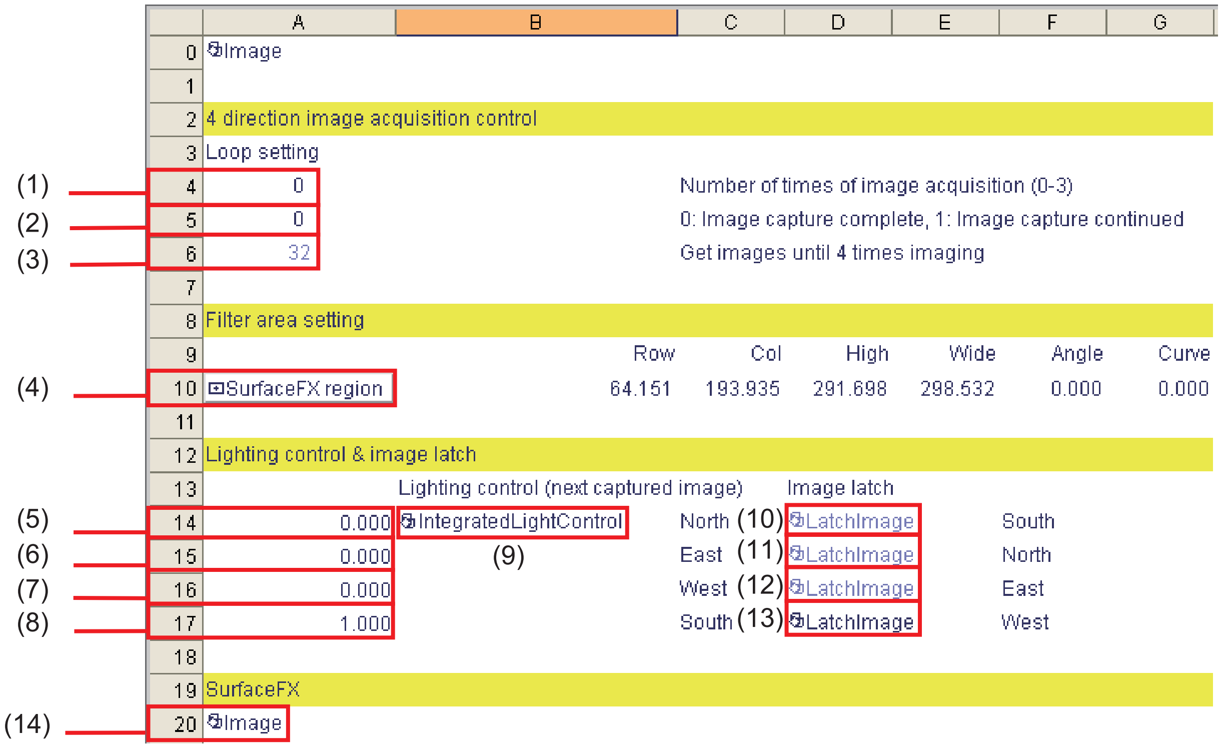


Character recognition of the image captured normally is difficult.

Figure 20 Captured image of characters scribed on a plastic

■Sample program

- Display content of spreadsheet



	A	B	C	D	E	F	G
0	Image						
1							
2	4 direction image acquisition control						
3	Loop setting						
4	0		Number of times of image acquisition (0-3)				
5	0		0: Image capture complete, 1: Image capture continued				
6	32		Get images until 4 times imaging				
7							
8	Filter area setting						
9		Row	Col	High	Wide	Angle	Curve
10	SurfaceFX region	64.151	193.935	291.698	298.532	0.000	0.000
11							
12	Lighting control & image latch						
13		Lighting control (next captured image)		Image latch			
14	0.000	IntegratedLightControl	North	LatchImage		South	
15	0.000		East	LatchImage		North	
16	0.000		West	LatchImage		East	
17	1.000		South	LatchImage		West	
18							
19	SurfaceFX						
20	Image						

- Program contents

(1) A4: Count (A0, 3, 0, 0)

(2) A5: If (A4=0, 0, 1)

(3) A6: SetEvent (32)

(4) A10: EditRegion (...)

(5) A14: If ($A$4=1, 1, 0)

(6) A15: If ($A$4=2, 1, 0)

(7) A16: If ($A$4=3, 1, 0)

(8) A17: If ($A$4=0, 1, 0)

(9) B14: IntegratedLightControl (...)

(10) D14: LatchImage (...)

(11) D15: LatchImage (...)

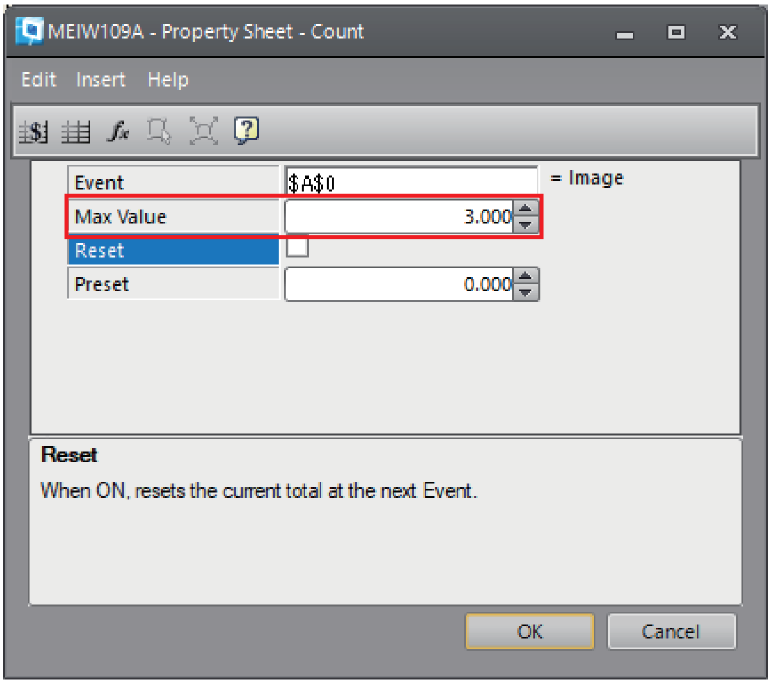
(12) D16: LatchImage (...)

(13) D17: LatchImage (...)

(14) A20: SurfaceFX (...)

■Program description

(1) Use the Count function to count the number of triggers (Figure 21). Set 3 for "Max Value" to capture an image four times. By doing so, the count value is incremented as 1 → 2 → 3 → 0 (4), so it is reset to zero on the fourth image capture.



Event	A0	= Image
Max Value	3.000	
Reset	□	
Preset	0.000	

Reset

When ON, resets the current total at the next Event.

Figure 21 Count function property sheet

(2) The control code to judge whether or not an image is captured four times.

0: Completed

1: Not completed

(3) Use the SetEvent function to generate triggers for capturing the second to fourth images. Triggers for capturing the first image is controlled by the programmable controller. The triggers are generated repeatedly until (2) is referred in "Cell State" on the right-click menu and the image is captured four times.

Point

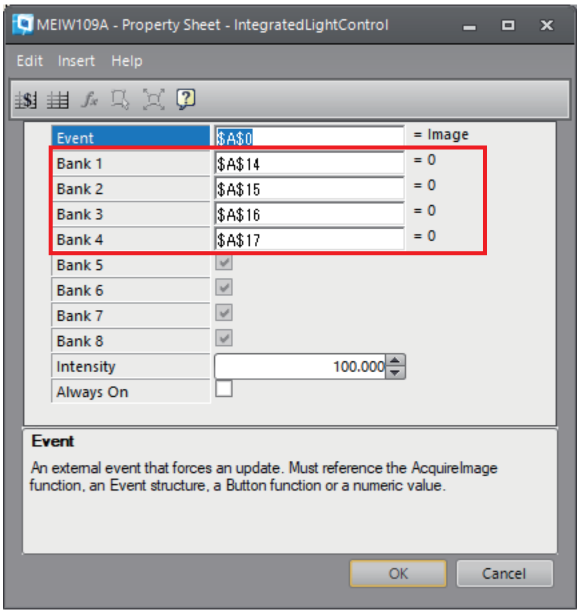
The SetEvent function is executed after sequential processing is executed.

(4) Use the EditRegion function to set an inspection region.

(5) to (8) The control codes for light and latch image control. The codes refer to (1) and switch between 0 and 1 according to the number of capturing image.

(9) Use the IntegratedLightControl function to control integrated lights of VS70. Refer to (5) to (8) in "Bank 1," "Bank 2," "Bank 3," and "Bank 4" to turn ON or OFF the light.

(10) to (13) Use the LatchImage functions to latch images. Four LatchImage functions are required to capture an image four times. The LatchImage function to be executed is determined according to the number of capturing images by referring each from (5) to (8) in the "Cell State" on the right-click menu (Figure 23).

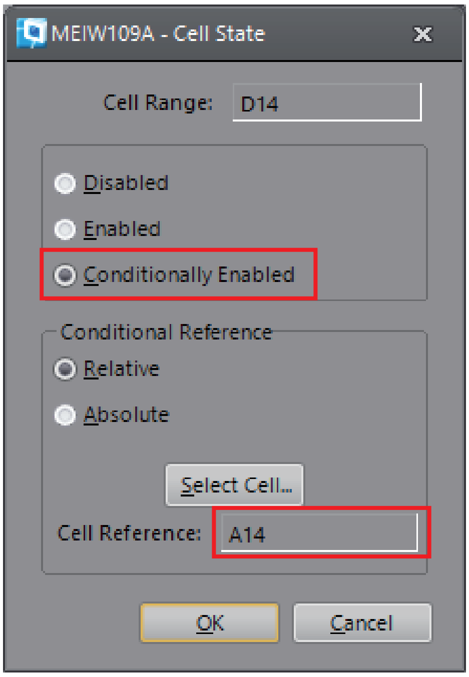


Event	A0	= Image
Bank 1	$A$14	= 0
Bank 2	$A$15	= 0
Bank 3	$A$16	= 0
Bank 4	$A$17	= 0
Bank 5	☑	
Bank 6	☑	
Bank 7	☑	
Bank 8	☑	
Intensity	100.000	
Always On	□	

Event

An external event that forces an update. Must reference the AcquireImage function, an Event structure, a Button function or a numeric value.

Figure 22 IntegratedLightControl function property sheet



Cell Range: D14

○ Disabled

○ Enabled

● Conditionally Enabled

Conditional Reference

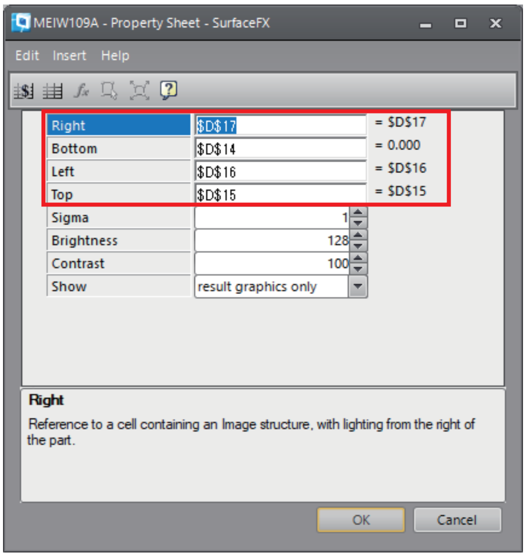
● Relative

○ Absolute

Cell Reference: A14

Figure 23 "Cell State" of LatchImage function in D14 cell

(14) Use the SurfaceFX function to execute SurfaceFX processing based on the four captured images. Refer to images which are latched using (10) to (13) on the property sheet. Set other parameters as necessary. Additionally, refer to (8) in the "Cell State" on the right-click menu to make SurfaceFX function executed at the timing when capturing the fourth image is completed.



MEIW109A - Property Sheet - SurfaceFX

Right	$D$17	= $D$17
Bottom	$D$14	= 0.000
Left	$D$16	= $D$16
Top	$D$15	= $D$15
Sigma	1	
Brightness	128	
Contrast	100	
Show	result graphics only	

Right

Reference to a cell containing an Image structure, with lighting from the right of the part.

Figure 24 SurfaceFX function property sheet

■Execution result example

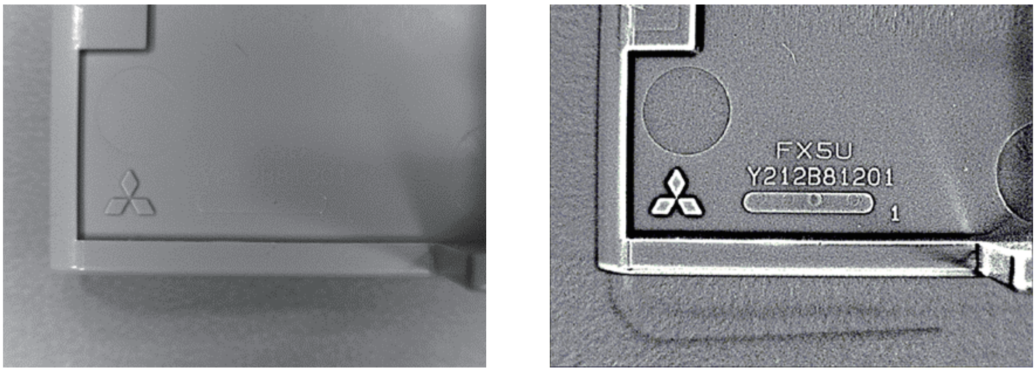


Figure 25 Images before and after applying SurfaceFX

Region structure function

Dynamic region setting

Region structure function is prepared in a spreadsheet. By using this function, a region setting based on the other tool results can be set dynamically. Therefore, an appropriate region can be specified for works with different shapes and sizes (Figure 26).

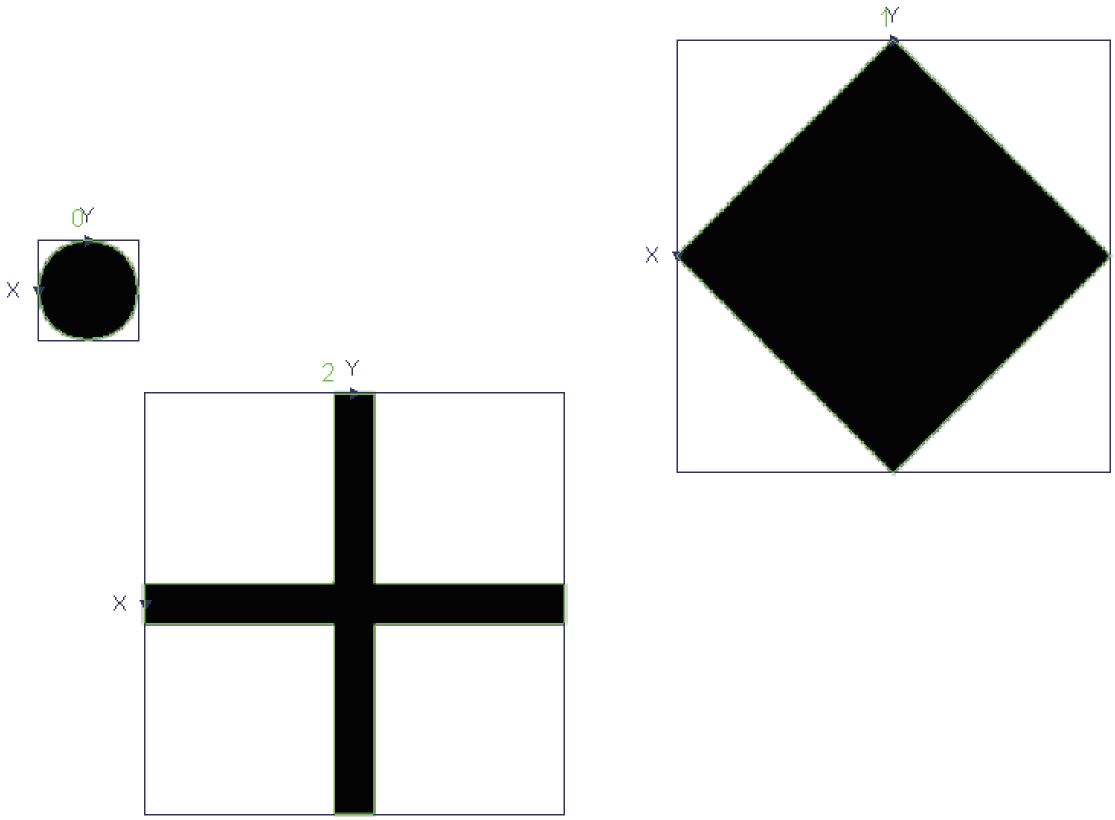


Figure 26 When a region is generated based on information of a detected blob

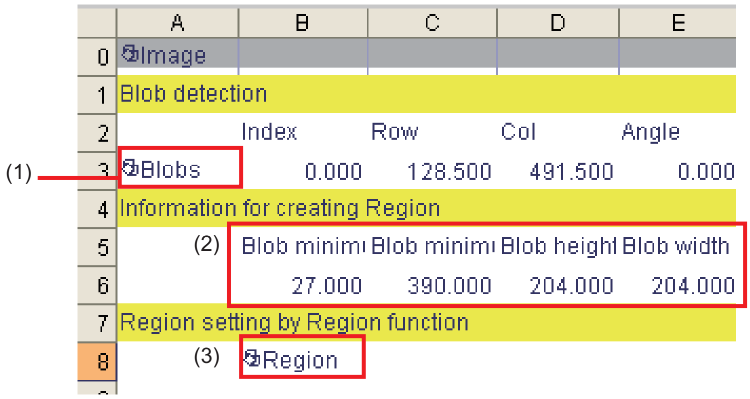
Specifying an appropriate region according to the shape and size

■Expected scene

Detect an unstructured work piece using a blob tool and inspect it by generating a region based on the information.

■Sample program

- Display content of spreadsheet



	A	B	C	D	E
0	Image				
1	Blob detection				
2		Index	Row	Col	Angle
3	Blobs	0.000	128.500	491.500	0.000
4	Information for creating Region				
5		Blob minimi	Blob minimi	Blob heighl	Blob width
6		27.000	390.000	204.000	204.000
7	Region setting by Region function				
8		Region			

- Program contents

(1) A3: ExtractBlobs (...)

(2) B6: GetMinRow ($A$3, ...)

C6: GetMinCol ($A$3, ...)

D6: GetHigh ($A$3, ...)

E6: GetWide ($A$3, ...)

(3) B8: Region (...)

■Program description

(1) Use the ExtractBlobs function to extract inspection target works. In this example, a setting for detecting three works at once is set (Figure 27).

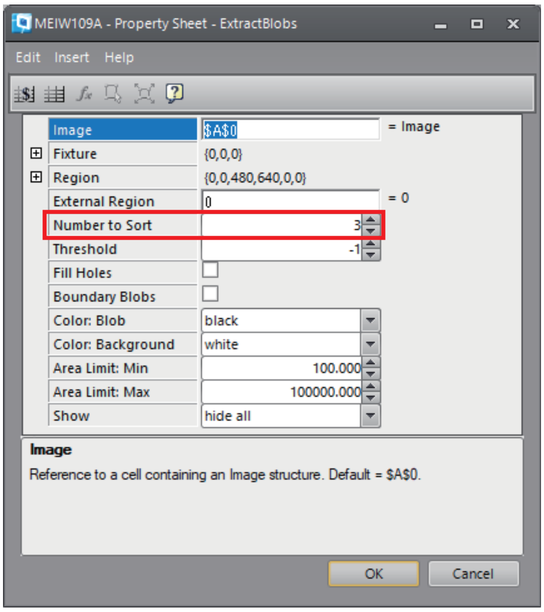


Image	A0	= Image
Fixture	{0,0,0}	
Region	{0,0,480,640,0,0}	
External Region	0	= 0
Number to Sort	3	
Threshold	-1	
Fill Holes	□	
Boundary Blobs	□	
Color: Blob	black	
Color: Background	white	
Area Limit: Min	100.000	
Area Limit: Max	100000.000	
Show	hide all	

Image

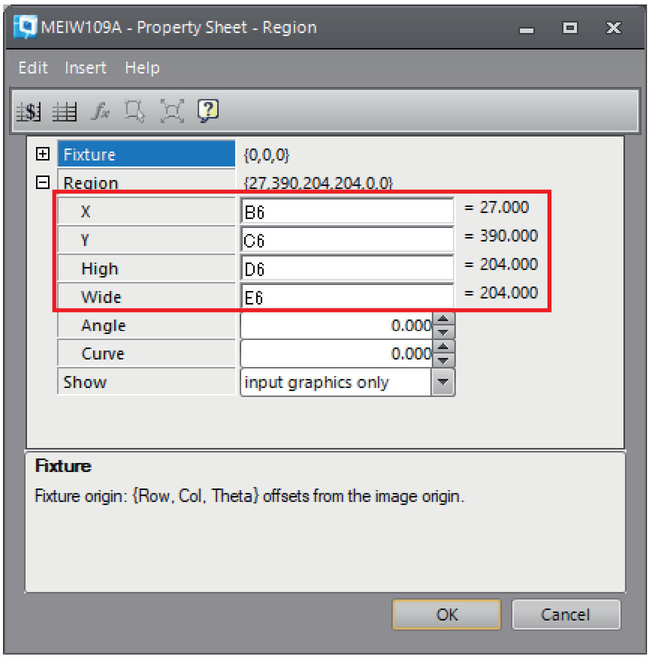
Reference to a cell containing an Image structure. Default = A0.

Figure 27 ExtractBlobs function property sheet

(2) Use the data access functions to acquire required information for setting a region.

The region setting information required in this example, and functions to be used to acquire the information are as follows.

GetMinRow (Blobs structure, Index): MinRow of Blobs → Region function X
GetMinCol (Blobs structure, Index): MinCol of Blobs → Region function Y
GetHigh (Blobs structure, Index): High of Blobs → Region function High
GetWide (Blobs structure, Index): Wide of Blobs → Region function Wide
(3) Use the Region function to specify a region.
Refer to the information of (2) which corresponds to "X," "Y," "High," and "Wide" respectively in the property sheet of Region function (Figure 28).



⊞ Fixture	{0,0,0}	
⊟ Region	{27,390,204,204,0,0}	
X	B6	= 27.000
Y	C6	= 390.000
High	D6	= 204.000
Wide	E6	= 204.000
Angle	0.000	
Curve	0.000	
Show	input graphics only	

Fixture
Fixture origin: {Row, Col, Theta} offsets from the image origin.

Figure 28 Region function property sheet

■Execution result

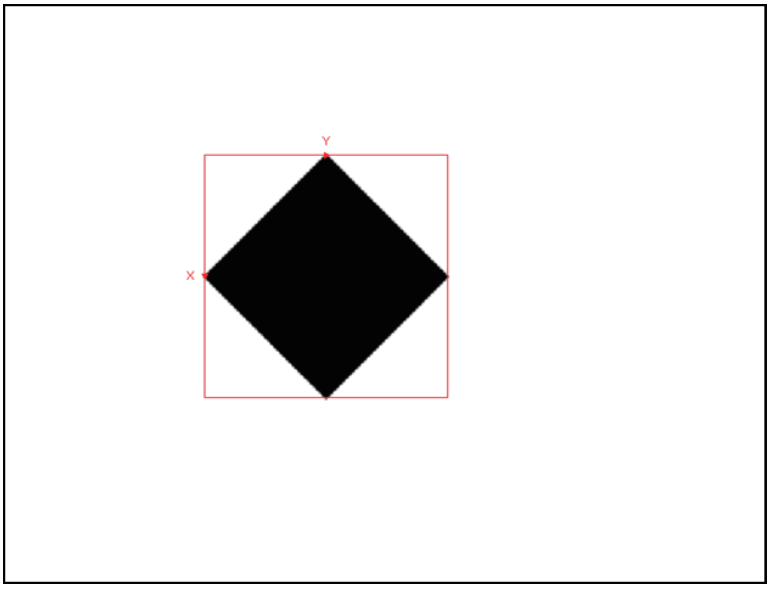


Figure 29 Execution result 1

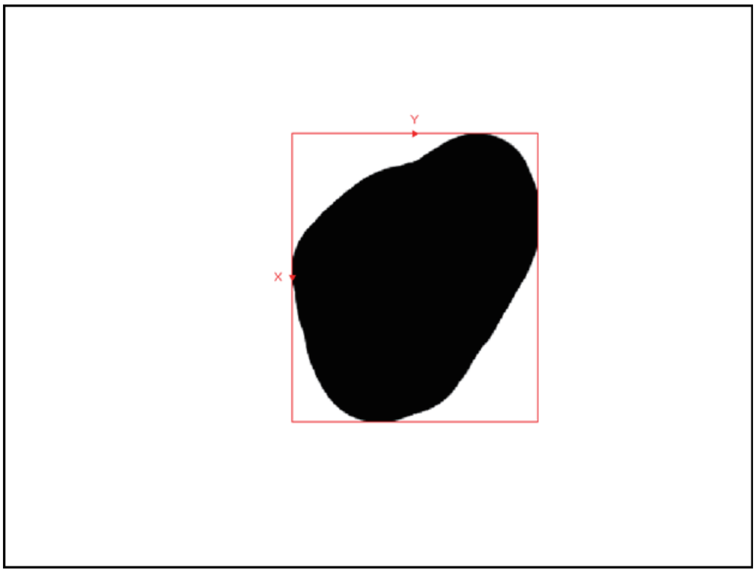


Figure 30 Execution result 2

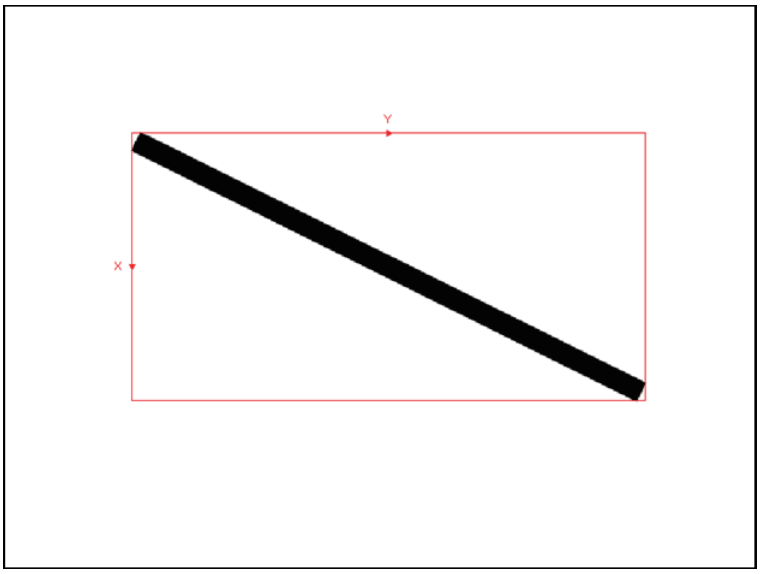


Figure 31 Execution result 3

Master and slave communication

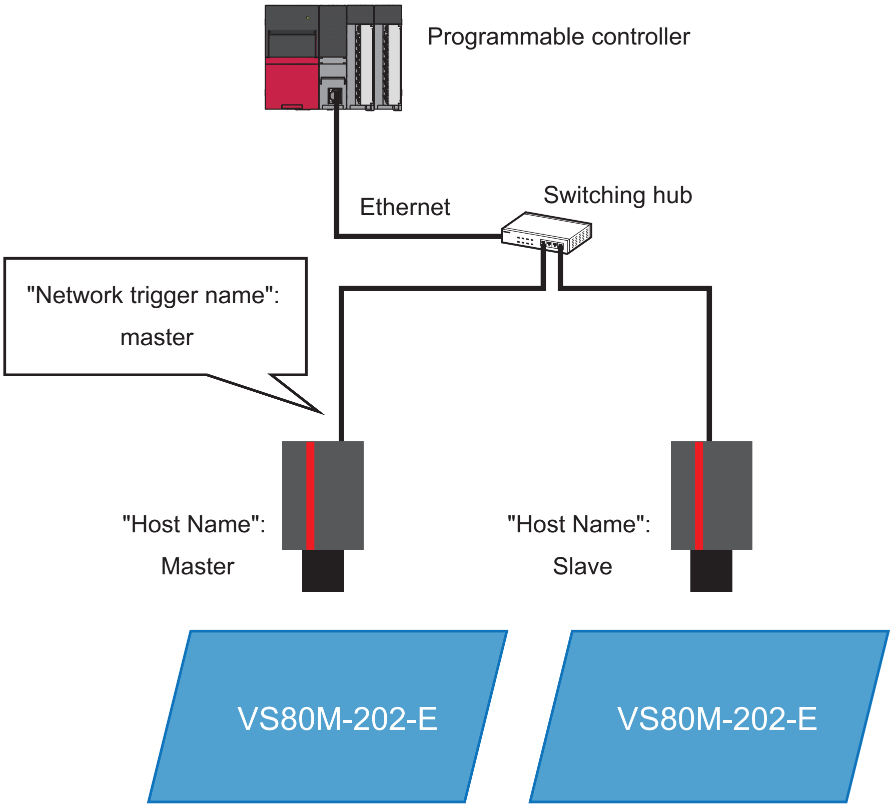
Data aggregation using master and slave communication

Master and slave communication synchronizes triggers, and allows for the slave vision sensors to be triggered in tandem when the master vision sensor is triggered. In a spreadsheet, a master can acquire information obtained in a slave. Therefore, information can be aggregated into the master, when performing inspection using multiple vision sensors for capturing a large work and verifying data acquired from multiple works.

Verifying characters using two vision sensors

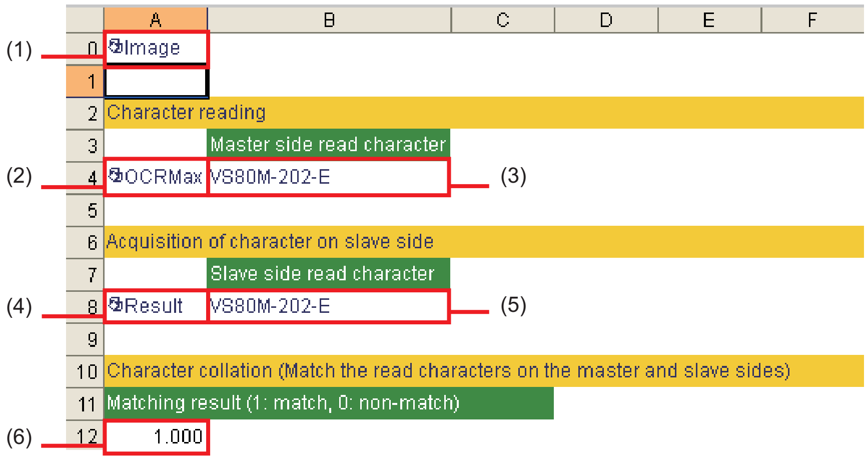
■Expected scene

Aggregate characters recognized in each vision and verifying characters by using two vision sensors.



■Sample program (master side)

- Display content of spreadsheet



	A	B	C	D	E	F
0	Image					
1						
2	Character reading					
3		Master side read character				
4	OCRMax	VS80M-202-E				
5						
6	Acquisition of character on slave side					
7		Slave side read character				
8	Result	VS80M-202-E				
9						
10	Character collation (Match the read characters on the master and slave sides)					
11	Matching result (1: match, 0: non-match)					
12	1.000					

- Program contents

(1) A0: AcquireImage (...)

(2) A4: OCRMax (...)

(3) B4: GetString ($A$4)

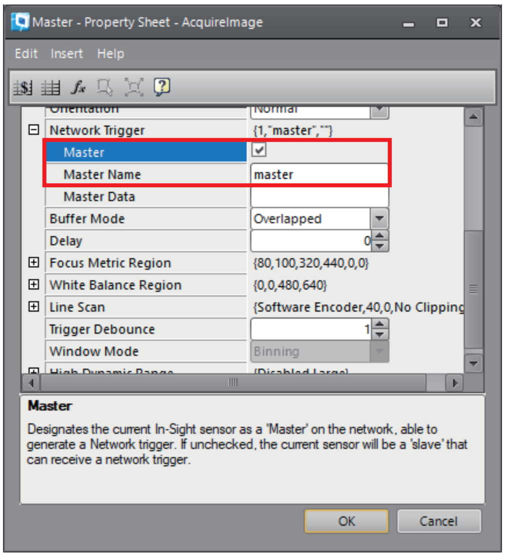
(4) A8: ReadResult (A0, "Slave," 1000)

(5) B8: GetResult ($A$8, 0)

(6) A12: Exact (B4, B8)

■Program description (master side)

(1) The sensor is set as the master in the AcquireImage function property sheet.



Orientation	Normal
⊟ Network Trigger	{1,"master",""}
Master	☑
Master Name	master
Master Data	
Buffer Mode	Overlapped
Delay	0
⊞ Focus Metric Region	{80,100,320,440,0,0}
⊞ White Balance Region	{0,0,480,640}
⊞ Line Scan	{Software Encoder,40,0,No Clipping
Trigger Debounce	1
Window Mode	Binning
⊞ High Dynamic Range	{Disabled,Large}

Master

Designates the current In-Sight sensor as a 'Master' on the network, able to generate a Network trigger. If unchecked, the current sensor will be a 'slave' that can receive a network trigger.

Set the following parameters.

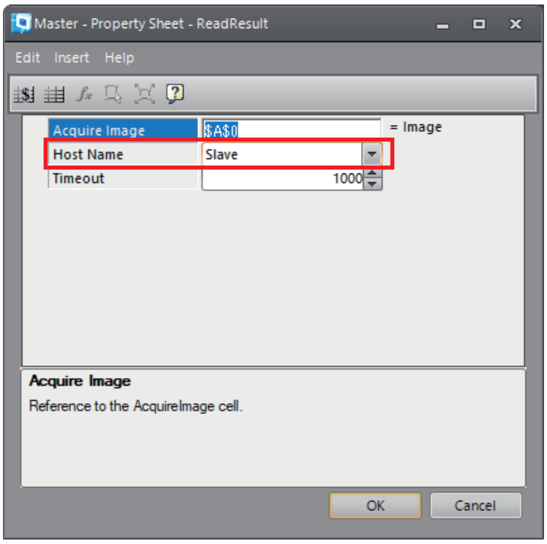
- "Master": ON (select the checkbox)
- "Master Name": An arbitrary network trigger name

* Use the network trigger name which is set in the property sheet, in a slave side. In this example, "master" is set.

(2) Use the OCRMax function to recognize characters within a specified region.

(3) Use the GetString function to acquire characters recognized in OCRMax function.

(4) Use the ReadResult function to read information on the slave side.



Acquire Image	A0	= Image
Host Name	Slave	
Timeout	1000	

Acquire Image

Reference to the AcquireImage cell.

Set the following parameters.

- "Host Name": A host name of a vision sensor which is set as a slave.

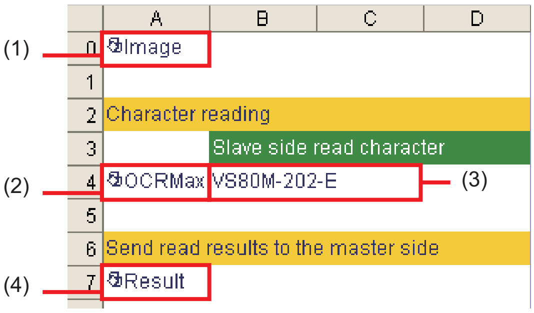
* In this example, "Slave" is set.

(5) Use the GetResult function to acquire read information on a slave side.

(6) Use the Exact function to compare the recognized characters between a master and slave, and judges whether the characters are matched completely or are mismatched.

■Sample program (slave side)

- Display content of spreadsheet



	A	B	C	D
0	Image			
1				
2	Character reading			
3		Slave side read character		
4	OCRMax	VS80M-202-E		
5				
6	Send read results to the master side			
7	Result			

- Program contents

(1) A0: AcquireImage (...)

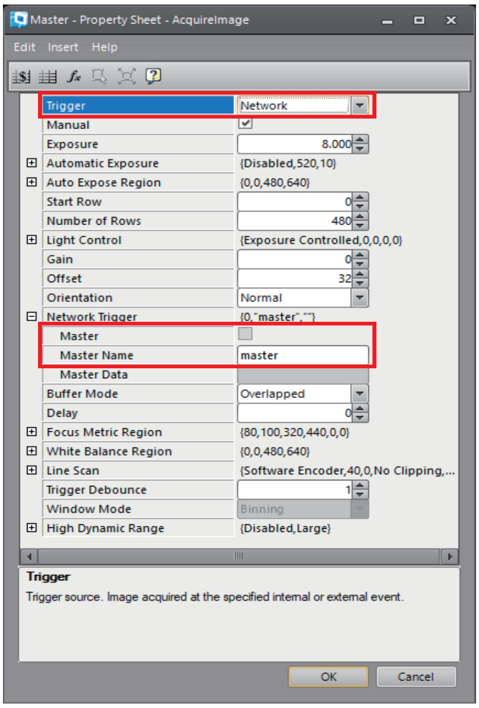
(2) A4: OCRMax (...)

(3) B4: GetString ($A$4)

(4) A7: WriteResult (A0, $B$4)

■Program description (slave side)

(1) The sensor is set as the slave in the AcquireImage function property sheet.



Master - Property Sheet - AcquireImage

Trigger	Network
Manual	☑
Exposure	8.000
⊞ Automatic Exposure	{Disabled,520,10}
⊞ Auto Expose Region	{0,0,480,640}
Start Row	0
Number of Rows	480
⊞ Light Control	{Exposure Controlled,0,0,0,0}
Gain	0
Offset	32
Orientation	Normal
⊟ Network Trigger	{0,"master",""}
Master	□
Master Name	master
Master Data	
Buffer Mode	Overlapped
Delay	0
⊞ Focus Metric Region	{80,100,320,440,0,0}
⊞ White Balance Region	{0,0,480,640}
⊞ Line Scan	{Software Encoder,40,0,No Clipping,...
Trigger Debounce	1
Window Mode	Binning
⊞ High Dynamic Range	{Disabled,Large}

Trigger

Trigger source. Image acquired at the specified internal or external event.

Set the following parameters.

- "Trigger": Network
- "Master": OFF (unselect the checkbox)
- "Master Name": A network trigger to be synchronized

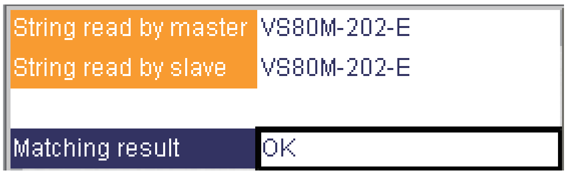
* In this example, "master" is set.

(2) Use the OCRMax function to recognize characters within a specified region.

(3) Use the GetString function to acquire characters recognized in OCRMax function.

(4) Use the WriteResult function to write information to a master side. Specify A0 as the first argument and specify the information to be written as the second argument.

■Execution result example



String read by master	VS80M-202-E
String read by slave	VS80M-202-E
Matching result	OK

Appendix 2 Commonly Used Functions

Blobs

Function	Description
ExtractBlobs	To categorize pixels into white and black based on a threshold value to be set, and detect blobs by grouping pixels that touch each other.
FindBlobs	To score blobs according to the parameters of angle, area, elongation, holes, perimeter, and spread among the blobs detected by using ExtractBlobs, and select blobs that have greater scores than the score set in the AcceptThresh value.
SortBlobs	To sort blobs detected by using ExtractBlobs based on X coordinate, Y coordinate, angle, the distance from the fixture origin · X-axis distance · Y-axis distance, width, and height.

Edges

Function	Description
Caliper	To perform the following edge-related inspections: measure the width of objects, determine the location of single edges and the location and spacing of edge pairs. A scoring method can be defined in detail by comparing with other edge tools such as FindLine function. Therefore, more detailed and accurate edge parameters can be set.
FindLine	To detect a straight-line edge. FindLine forms a one-dimensional projection of the image region by projecting pixel values to the Y-direction and summing the values in the local coordinate system (XY coordinate system) of a specified region. Edges are detected from the one-dimensional projection.
SortEdge	To sort edges based on contrast, polarity, and scan direction by referring to an Edge data structure which consists of multiple straight-line edges.

SurfaceFlaw

Function	Description
SurfaceFlaw	To detect a flaw such as a scratch, nick, or tear on the object or part being inspected.

Histogram

Function	Description
ExtractHistogram	To collect statistics of a pixel value in a specified region, and calculate optimal binary threshold, contrast, total number of bright count and dark count, and an average pixel value in the region.
HistMax	To output the most prevalent pixel value that occurs in the histogram by referring to the ExtractHistogram function result.
HistMean	To output the pixel value mean in the histogram by referring to the ExtractHistogram function result.
HistMin	To output the least prevalent pixel value that occurs in the histogram by referring to the ExtractHistogram function result.
HistSum	To output the total pixel values in the histogram by referring to the ExtractHistogram function result.
HistThresh	To output optimal binary threshold in the histogram by referring to the ExtractHistogram function result.

Edge analysis

Function	Description
BeadFind	To detect the center of a bead.
InspectEdge	To detect edges of cracks, nicks, dents, or crimps in a region.
InspectEdgeForDefect	To create an edge model and an edge scoring criteria from edge information returned by InspectEdge function, and detect points where are out of a straight line fit or a circle line fit as defects or gaps, based on the model and criteria.

Image

Function	Description
Filter	To use for adjusting image contrast and enhancing expose features in an image. This function makes inspection applications more reliable and repeatable by selecting appropriate region and filter type.
ImageMath	To produce output images by referencing two image data and processing image operation such as subtraction, addition, or averaging.
SurfaceFX	To output an image with enhanced surface scratches and recessed or raised, from four images captured with lightening from different directions.

Identification

Function	Description
ReadIDMax	To detect and decode 1D or 2D symbols within a region of interest.

Character recognition

Function	Description
OCRMax	To perform Optical Character Recognition (OCR). Firstly, this function identifies the regions which contain lines of text, and then classifying and train characters by corresponding them to fonts one by one. Characters are identified by comparing the images of characters and trained fonts.

Patterns

Function	Description
TrainPatMaxPattern	To create a model to be used with FindPatMaxPatterns function. This function extracts and trains shape features from images, and create a pattern structure which includes a trained pattern.
FindPatMaxPatterns	To detect matched patterns from an image based on a trained pattern.

Geometry and measure

Function	Description
LineFromNPoints	To create a line by entering two or more coordinates.
PointToPoint	To calculate the distance between two points.

Graphics and plot

Function	Description
Button	To insert a labeled push button control into the spreadsheet. A button press can be configured to signal an event trigger.
CheckBox	To insert a labeled checkbox control into the spreadsheet.
EditRegion	To insert an interactive graphical region control into the spreadsheet. When the control is clicked, the display switches to Interactive Graphics Mode where the size, position, rotation, and curvature of the region can be adjusted. The specified region which is set in this mode can be used as an external specified region.
EditString	To insert a text edit control into the spreadsheet. The EditString control works like other interactive text input boxes.
PlotCross	To plot a cross on the image.
PlotString	To plot a text string on the image.

Math and logic

Function	Description
And (Value 1, Value 2,...)	To return 1 if all values are non-zero.
Or (Value 1, Value 2,...)	To return 0 if all values are zero; otherwise, return 1.
Not (Value)	To return 0 if Value is non-zero, or return 1 if Value is zero.
If (Cond, Value 1, Value 2)	To return Value 1 if Cond is non-zero; otherwise, return Value 2.

Text

Function	Description
Stringf	To return a text string constructed using a "C" library standard format-string.

Calibration

Function	Description
CalibrateGrid	To calculate a transformation between pixel and real-world coordinate systems by using calibration grid pattern and plate. Additionally, this function automatically accounts for any optical or perspective distortion present in the lens being used to acquire the image.
TransformImage	To create an image whose image distortion is corrected, based on the CalibrateGrid function result.
TransPixelToWorld	To convert a point from pixel coordinates to real-world coordinates.

I/O and communication

Function	Description
ReadDiscrete	To read data of an arbitrary bit range from a discrete input channel.
WriteDiscrete	To write an arbitrary range of bits to a discrete output channel.
Event	To update the spreadsheet on the specified event trigger.
FormatInputBuffer	To set the format of data that is received from each industrial network.
FormatOutputBuffer	To set the format of data that is sent to each industrial network.
CombineOutputBuffers	To set the outputs of multiple FormatOutputBuffer functions into a single Buffer data structure that is transmitted in a single communication packet.
ReadDevice	To receive data from another host on the network using a TCP/IP or UDP connection.
ReadMC	To receive specified device data from a programmable controller or robot controllers by SLMP communication.
ReadUserDataBuffer	To read data contained in the [User Data] field of a communication frame.
TCPDevice	To define a spreadsheet cell as a TCP/IP device (client or server) which opens a connection between the vision system and another TCP/IPdevice for sharing data over the network.
WriteDevice	To send data to another host on the network using a TCP/IP or UDP connection.
WriteImageFTP	Vision systems have an integrated FTP client/server that allows them to share files with other vision systems on the network using the FTP protocol. WriteImageFTP function outputs the current image to an FTP server on the network.
WriteMC	To send data to a device specified by a programmable controller or robot controllers by SLMP communication.
WriteResultsBuffer	To write the [Result Code] field of a communication frame.
SetEvent	To queue up an Event function to execute after the job execution is completed.

Others

Function	Description
CountPassFail	To count passes, failures, and total events for a reference cell to be specified.
LatchImage	To store (latch) a specified image.

REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
March 2019	BCN-P5999-1072-A	First edition
August 2019	BCN-P5999-1072-B	■Added or modified parts APPENDIX
January 2020	BCN-P5999-1072-C	■Added or modified parts INTRODUCTION, RELEVANT MANUAL, Appendix 1

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