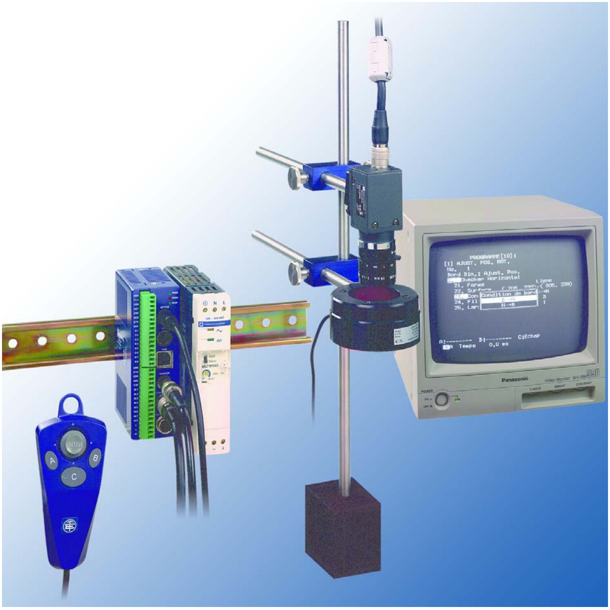
Exploitation Guide
July

2003

Vision Controller

Osiview

Firmware OCR



a brand of Schneider Electric

Telemecanique

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Introduction

Be sure to read this guide carefully before using this product to ensure proper use.
There are two manuals available for the VISION CONTROLLER:

- Hardware exploitation guide
- Firmware exploitation guide.

Please read the guide appropriate for your needs.
Please ensure that the correct manual is read in accordance with objectives for use.

Warnings and Cautions

To be observed at all times.
Read the guide carefully before installing, running, maintaining or inspecting the equipment.
This guide uses two safety flags to indicate different levels of danger.

WARNING:
A handling error could cause serious physical injury to an operator, and in the worst case could even be fatal.

NOTE:
A handling error could cause serious physical injury to an operator, or damage to the equipment.

DANGER

This symbol means a handling error could cause serious physical injury to an operator, and in the worst case could even be fatal

- When using the equipment for a purpose which could conceivably result in the physical injury of an operator and/or damage to the equipment itself, adequate secondary or backup safety and/or protection mechanisms of one sort or another should also be incorporated into the system.
- Do not use the VISION CONTROLLER in an environment which contains combustible gases as this may result in an explosion.
- Never open the VISION CONTROLLER. The main unit contains high-voltage components which are dangerous to touch. Do not loosen the retaining screws as this may result in electric shocks.
- Configure so that the emergency stop and interlock circuits are external circuits.

- Be certain to use the equipment within its specified ratings and environmental conditions at all times. Failure to do so can cause overheating.
- Do not disassemble or restructure the VISION CONTROLLER in any way as this may result in electric shocks or in the emission of smoke.

- Do not bend the VISION CONTROLLER's power cable, or place anything heavy on top of the cable. Do not place the cable close to any other items of equipment that emit significant amounts of heat. When disconnecting the power cable, always grip the plug, and never pull the cable, as this could result in an electric shock or the emission of smoke.
- Always ground the earth wire. Failure to do so may result in an electric shock.
- The power cable must be carefully secured in position using the terminal screw. A faulty connection may result in the generation of excessive heat or the emission of smoke.
- Do not touch the terminals while the power is ON, as this may result in an electric shock.

Precautions to be taken before using the VISION CONTROLLER

Installation Environment

Avoid using the VISION CONTROLLER XUVM230 in the following types of locations:

- Locations with direct sunlight or environmental temperatures that exceed a range of 0°C to 50°C.
- Locations with a relative humidity exceeding a range of 35%RH to 75%RH or that are subject to condensation due to dramatic temperature fluctuations.
- Locations with an atmosphere containing corrosive gases or flammable gases.
- Locations that subject the main unit to direct vibration or impact.
- Locations with a lot of fine particles, iron filings or salt.
- Locations likely to have contact with water, oil or chemicals.
- Locations with an atmosphere likely to contain organic solvents such as benzine, paint thinner, and alcohol as well as strongly alkaline materials such as ammonia and caustic soda.

Static Electricity

In a dry environment, there is a risk of accumulation of static electricity, so when there is a need to touch the equipment, users should always discharge the accumulated static by touching an earthed part of the equipment first.

Cleaning

Do not use thinners or similar solvents, as they may dissolve parts of the unit and cause colors to run.

Power

Use an insulated power source with built in protection circuits. The VISION CONTROLLER power unit uses non-insulted circuits, so if an irregular voltage is applied, there is a danger that the internal circuitry will be damaged. If you use a power source that does not use protection circuits, supply the power via a fuse or other protective device.

Power Sequence

- Arrange the power sequence so that the VISION CONTROLLER power source is turned off before the input/ output power source.
- If you turn off the input/output power source before the VISION CONTROLLER power source, the VISION CONTROLLER will detect an input signal level change and may not run properly.

Before Switching On the Power

The following points should be checked before switching the power on to the VISION CONTROLLER for the first time.

- Check that no extra wiring left installation, especially conductive materials, have become attached to the board.
- Confirm that the power supply wiring and I/O wiring and power supply voltage are correct.
- Firmly tighten all installation screws and terminal block screws.

Before Creating Type Data

Before creating type data, be sure to initialize the environment settings and all type settings.

General Cautions

- Use monitor, monitor cable, keypad, camera and camera cable models and serial numbers specified by Telemecanique.
  Be aware that malfunctions, damage, destruction, etc. due to use of models or serial numbers other than those specified by Telemecanique will not be covered by the product warranty.
- Do not disassemble, modify, or change internal settings for the VISION CONTROLLER unit or other equipment. Be aware that malfunctions, damage, destruction, etc. due to disassembly, modification or use other than that described in the guide will not be covered by the product warranty.
- Setting or changing items other than those that can be set or changed, as described in the product guide and specifications, will result in damage. Be aware that in the event that damage or destruction occurs due to settings or changes, it will not be covered by the product warranty.
- After completing all of the settings for the VISION CONTROLLER, do not connect the personal computer used for connecting the keypad, restoring or backup, in order to prevent malfunctioning due to noise.
- Do not perform insulation resistance or pressure resistance tests between metal areas of the power supply, input/output signal and connectors and the camera case.

Important Symbols

The following symbols are used in this guide:

Whenever the warning triangle is used, especially important safety instructions are given. If they are not adhered to, the results could be:

- personal injury and/or
- significant damage to instruments or their contents

Ex:

Contains an illustrative example of the previous text section

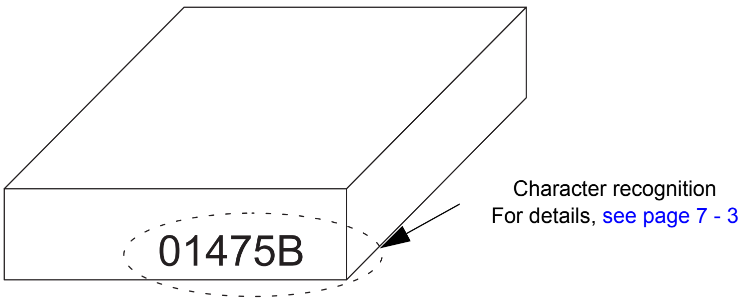
CHAPTER 1

Main Features

Features of the OCR Package

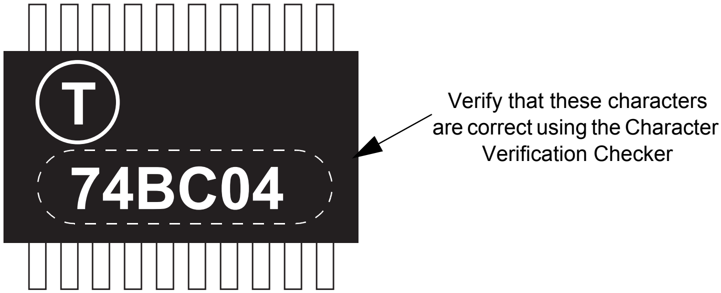
1. Character recognition is possible using the neural net (character recognition checker), see page 7 - 3.

   - A maximum of five dictionaries (fonts) can be registered (comes standard with two fonts: OCR-A and OCR-B).
   - Compatible with connected letters and dotted letters.
   - Cuts noise such as background patterns that can be mistakenly recognized as characters.
   - Recognized character strings are output serially.
   - Compares the recognized character string with a template or model string (can be changed by the external device.) to determine whether it matches or not.

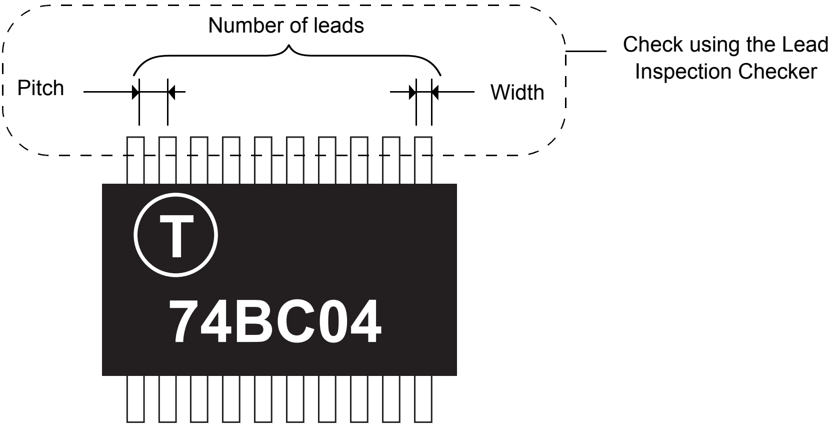


2. Allows easy character-by-character inspection (character verification checker), see page 8 - 3.

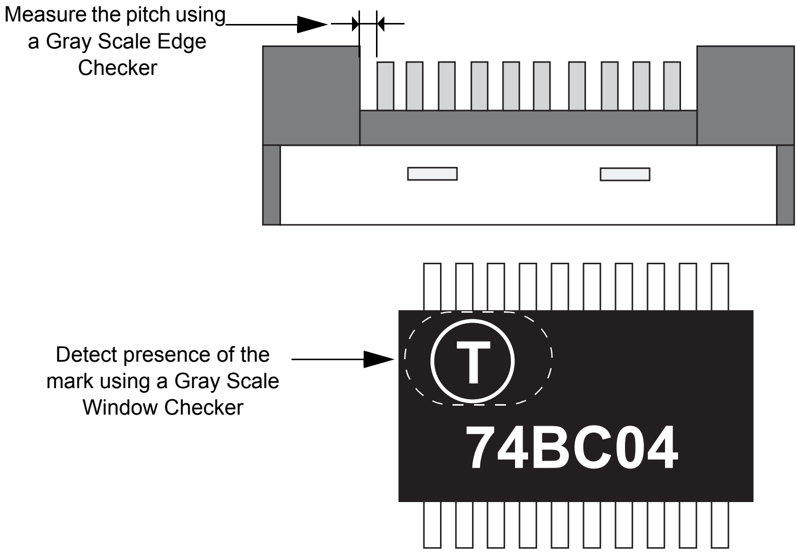
   - Checks for missing characters, dirt, blurring, and incorrect characters on a character-by-character basis.
   - Just enclose the text with a checker shape to extract and register each character as a reference image for inspection.
   - The background-processing function eliminates unwanted noise (background patterns etc.) that may otherwise be interpreted as characters.



3. Simultaneously measure the number of leads, lead width, and lead pitch (lead inspection checker), see page 10 - 3.
   - Inspects pitch, breakage and bending of IC and connector leads.

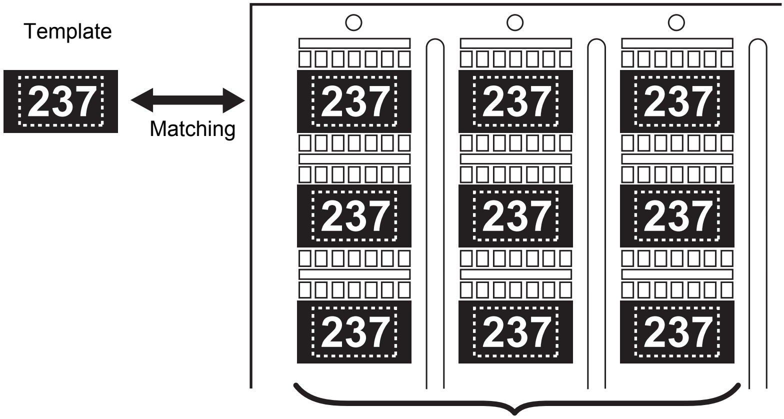


4. You can use a gray-scale edge detection checker and gray-scale window checker to measure the dimensions, determine the orientation and detect missing leads, see page 11 - 3 and see page 12 - 3.



5. Use the position/rotation adjustment function to correct possible misplacements of the inspection target before performing the inspection, see page 6 - 3.

6. You can use the smart matching checker to count the number of inspection targets and to check them against a registered image (template), see page 9 - 3.



7. You can combine a numerical calculation program and judgment conditions program to make a pass/fail decision based on the inspection results, see page 13 - 3.

8. You can use input from external equipment to re-register inspection reference characters (or patterns) and templates, or switch types in accordance with the changes in the items to be inspected, see page 16 - 34, page 16 - 40, and page 16 - 43.

9. Functions such as the Trap function, NG Display function, and Save Image function are provided to assist with fault analysis, see page 13 - 30 and page 13 - 31.

CHAPTER 2

Outline of Functions

Available Functions

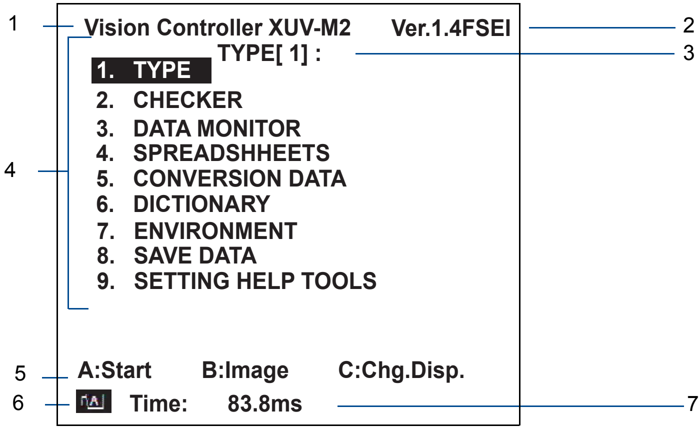
Item	Function	Description	Page
Inspection environment preparations	Setting Help function	This function is provided in order to enable you to set the camera and lighting correctly for inspection. It is possible check the lighting, adjust the focus, and check gray levels.	19 - 3
Inspection	Position/Rotation Adjustment function	This function automatically adjusts for positional or rotational shift in the target before performing an inspection.	6 - 3
	Character recognition checker	This function checks one by one letters or symbols extracted within a set area to compare with the character image registered in a dictionary beforehand and reads the label attached to the one in a dictionary in the highest match (recognition values).	7 - 15
	Dictionary	This data is the standard for recognizing the characters. Up to 5 dictionaries can be created and up to 40 labels (for letters and symbols) can be registered per dictionary.	7 - 5
	Character Verification checker	Checks detected characters (or patterns) against registered characters (or patterns) on a character–by–character basis (or all together).	8 - 3
		The character image being used as the reference for the inspection can be re–registered via input from external equipment.	16 - 40
	Smart Matching function	This function finds target objects that match the image registered in the template. It detects the number and position of the matches.	9 - 3
		Templates can be re–registered using external input.	16 - 43
	Lead Inspection checker	This function counts the leads of ICs and connectors and measures the width and pitch of the leads.	10 - 3
	Gray Scale Edge checker	This function detects edges and determines the position and shape.	11 - 3
	Gray Scale Window checker	This function detects the average gray value of a specified area.	12 - 3

Item	Function	Description	Page
Measurement	Numerical calculation function	– This function is used to output the data detected by the various checkers to external devices or for performing calculations using the detected data. – You can also set to detect whether the calculated results lie within a set range (i.e. you can set upper and lower limits).	13 - 7
	Judgment output	The judgment results from each checker can be output to external devices. It is also possible to combine multiple judgment results.	13 - 23
Communications with external equipment	Communication function	– The judgment results and numerical calculation results can be output to other external devices over either a serial or parallel interface. – External devices perform a range of operations including starting inspections, switching product types, and changing calculation parameters. – The XUVM230 can communicate with PLCs manufactured by Telemecanique without a program on the external device side (using the Computer Link communication mode).	16 - 5
Debugging	Save Image function	This function saves inspection images, which can then be called up and tested again with different settings.	15 - 3
	NG Screen Display function	If an NG (No Good) is generated, it is possible to have the NG image display left on the screen.	13 - 30
	Trap function	The Trap function can be used to abort processing and save an image if a specified judgment result is NG.	13 - 30

CHAPTER 3

Screens and Basic Operations

Main Screen



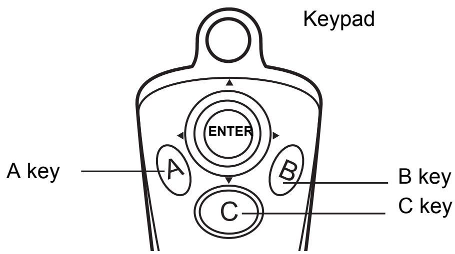
1 **Model information**
Shows the name and version number for the VISION CONTROLLER firmware you are using.

2 **Version**
Version of the firmware being used.

3 **Type and title**
Shows the currently displayed or selected type number.

4 **Menu items**
Displays the menu and setting items (see section below). The current selection is highlighted.

5 **Keypad key functions**
Displays the keys and functions that can be used with the current menu (for more information on the keypad keys, see page 3 - 5).



6 Image icon
Displays the type of the currently displayed image. Press <B> to switch images (see page 3 - 8).

7 Time
Displays the time required for inspection. The figure above always displays the total time needed for image processing including image capturing and result output. It is possible to switch this to **Outputs** (for information on how to change display items, see page 3 - 9).

Main Screen Options

1. **TYPE**
   Switches or copies the type.

2. **CHECKER**
   Sets up various check functions as well as Judgment Output and Numerical Calculation.

3. **DATA MONITOR**
   Sets the data displayed for data monitoring.

4. **SPREADSHEETS**
   Shows the inspection calculation results and statistical data in a table.

5. **CONVERSION DATA**
   Replaces the number of measured pixels with the actual dimensions.

6. **DICTIONARY**
   Replaces This function is used for Character Recognition checker.

7. **ENVIRONMENT**
   Selects the start method, input and output, and camera.

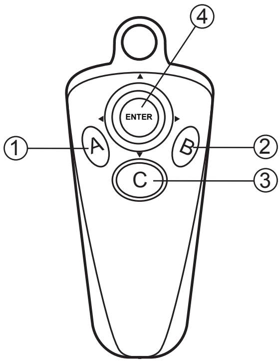
8. **SAVE DATA**
   Saves the setup data.

9. **SETTING HELP TOOLS**
   Adjusts camera and lighting settings.

Keypad

Buttons

All operations and settings for the XUVM230 VISION CONTROLLER Package are carried out with a special compact keypad.



1 <A> button
The start and test button. When this button is pressed, images are taken in from the camera, and an inspection is carried out.

2 <B> button
The display image mode-switching button. This button is used to switch the monitor display between Gray Scale Through and Gray Scale Memory.

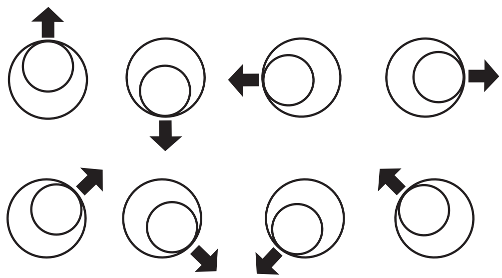
3 <C> button
ESC button. Use this button to exit a menu or to cancel an input. In the main menu, pressing this button opens the menu for changing the screen display.

4 Cursor lever/<Enter> button
This button is used to select menu items, and to draw or move the checker area. When the center is pressed, the key acts as the <Enter> button, which is used to confirm the item just selected from the menu, or the settings.

Operating the Keypad

Buttons <A>, <B> and <C>:
These buttons have the functions displayed at the bottom of the screen.

Operating the cursor:
The cursor can move in any of 8 directions. To move the cursor, move the lever to the desired direction.



Operating the <Enter> button:
To confirm (i.e. enter) input, press the center of the cursor lever.

Press straight downwards.

Note **If you happen to press the <Enter> button by accident while operating the cursor lever, you may carry out an input operation by mistake. To guard against this, make sure to press the cursor lever from the side when selecting menus and options.**

Main Screen Operations

Menu Selection

Use the cursor lever to select an item, then press <Enter> to confirm your selection. The selected screen will be displayed. To return to the previous menu, press <C>. These operations, which are basically the same for all menus, are illustrated below.

Use the cursor lever to select an item

```
TYPE[ 1] :
[2]. INSPECTION CHECKER
 21.  CHAR. RECOG.
 22.  CHAR. VERIF.
 23.  SMART MATCHING
 24.  LEAD INSPECTION
 25.  GRAY EDGE DETECTION
 26.  GRAY WINDOW
```

<C> <ENTER>

Use the cursor lever to select an item

```
TYPE[ 1] :
[5]. GRAY EDGE DETECTION
 No.   1              Jud.:NG Detected:  0
 1.  Select camera            A
 2.  Checker Setting
 3.  Detected Judgment        <256,   0>
 4.  Pos. Rot. Adj. Group     0
 5.  Result
 6.  Copy checker
 7.  Delete checker
```

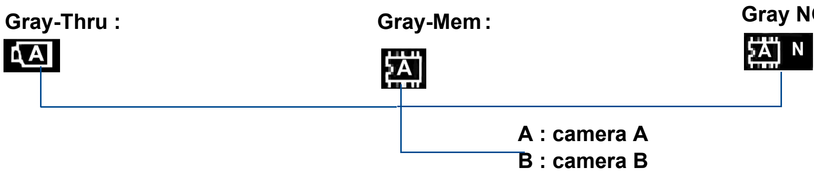
<C> <ENTER>

Use the cursor lever to select an item and press <Enter> to confirm the selection

```
TYPE[ 1] :
[5]. GRAY EDGE DETECTION
 No.   1              Jud.:NG Detected:  0
 1.  Select camera            A
 2.  Checker Setting
 3.  Detected             256,   0>
 4.  Pos. Rot.   Select camera
 5.  Result            A
 6.  Copy che          B
 7.  Delete checker
```

Changing the Camera Image Displayed on the Monitor

The camera image currently being displayed is indicated by the icon displayed on the bottom left of the screen.



Gray-Thru:
The live image as it is currently captured by the camera (if you cover the camera lens with your hand, the display will go dark).

Gray-Mem:
An image that has previously been captured. Inspections are performed using this memory image (covering the lens does not change the image).

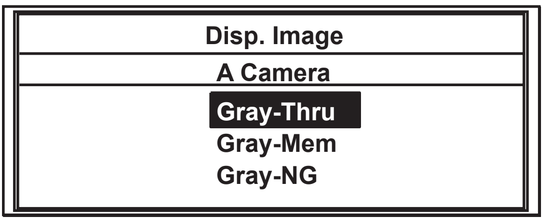
Gray-NG:
Similar to the memory image, this is a captured and inspected image. The image inspection produced results outside the range of a certain setting condition (i.e. NG (Not Good), for details on judgment output see page 13 - 23.

Note **When** Mem (NG) **is selected, if no image has been captured yet, there will be no image in the memory, and nothing will be displayed when the power is switched on.**

Press <B> in the main menu to change the displayed image. However, display settings performed here are temporary, and if the power is switched off, or a type switch is executed, the settings made in option **5. Camera/Image** in the **Type** menu take effect. The images that can be displayed depend on the settings you have made in **4. Capture Camera** in the **Type** menu.

Ex:

Camera setting A :



Changing the Screen Display Items Temporarily

Select the screen display items for the type that you have selected. The settings you make here are only valid for the current type. Use **6. Initial Display Settings** in the **Type** menu to make the initial settings for when the power is switched on and when you switch between types (see page 5 - 20).

Change Display Menu

Procedure :

1. Press <C> to open the **Change Display** menu (**Chg. Disp.**), and then use the cursor lever to select the items for display.

Chg. Disp.	
1. Screen Display	Main Menu
2. Checker Pattern	Response
3. Make Bright at NG	No
4. Detect Position	On
5. Status Display	Time

2. Press <Enter> to display the selection menus for each item. Use the cursor lever to select the display content

1.Screen Display
- Off
- Main Menu
- Data Monitor
- Checker List
- Spreadsheet

2.Checker Pattern
- Off
- Fixed
- Response

3.Make Bright at NG
- Yes
- No

** Fixed at No when the checker pattern display is set to off*

4.Detect position
- Off
- On

** Fixed at Off when the checker pattern display is set to Fixed*

5.Status Display
- Off
- Outputs
- Time

3. Press <Enter> to confirm your selection. Press <C> to update the monitor display.

Available Display Options

Option	Setting	Display function
1. Screen Display	Off	displays nothing
	Main Menu	displays the menus for performing settings and inspection, see page 21 - 3
	Data Monitor	displays the data monitor, see page 13 - 36
	Checker List	displays the checker list, see page 13 - 42
	Spreadsheet	displays the spreadsheet, see page 13 - 33
2. Checker Pattern (page 4 - 21)	Off	displays nothing
	Fixed	displays the checker pattern in a fixed position.
	Response	displays the checker pattern in accordance with the amount of position adjustment.
3. Make Bright at NG	Off/On	displays checker patterns for NG (No Good) with high brightness and checker patterns for OK checkers with low brightness.
4. Detect Position	Off/On	displays the coordinates of the position detected by execution of the checker.
5. Status Display	Off	displays nothing
	Outputs	displays the ON/OFF status of the parallel output (RDY, ERR, STR, OVF and D1 to D8) at the bottom of the screen (see figure below).
	Time	displays the time required for inspection at the bottom of the screen.

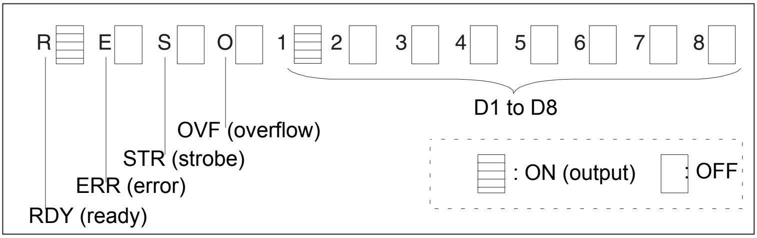
Note **When you select** Fixed **and** Detect Position **was set to On (display), then** Detect Position **is automatically set to Off.**

If the cameras selected for the checkers do not match those selected using Camera/Image**, the checker pattern is not displayed.**

When Checker Pattern **is set to Off (no display), the** Make Bright at NG **setting is fixed at** No.

When Fixed **is selected for the Checker Pattern setting, the** Detect Position **setting cannot be changed.**

When **5. Status Display** is set to Outputs



Setting Numerical Values

Procedure :

1. Move the cursor lever left and right to move the highlighting to the digit to be changed
2. Move the cursor lever up and down to increase or decrease the highlighted value

004000 ► ► ▲ 005000

Other digits are automatically incremented or decremented when appropriate.

000590 ▲ 000600

000320 ▼ 000319

Ex:

Changing "4000" to "7900"

004000 ► ► 004000 ▲ ▲ ▲ ▲ 008000 ► 008000 ▼ 007900

<Enter> 7900

Note **The upper limit cannot be set to a value less than the lower limit, and the lower cannot be set to a value higher than the upper limit. In this situation, using the cursor lever simply moves the highlighting to a different digit.**
If you need to set the upper limit to a value less than the current lower limit, first select the lower limit and reduce its value before reducing the upper limit.

CHAPTER 4

Inspection Procedure

Checker Setting before Starting an Inspection

Select a checker suitable for the inspection to be performed. See:
IC Inspection Example (see page 4 - 4)
Connector Inspection Example (see page 4 - 13)
IC Inspection Example (see page 4 - 16)

Create the checker

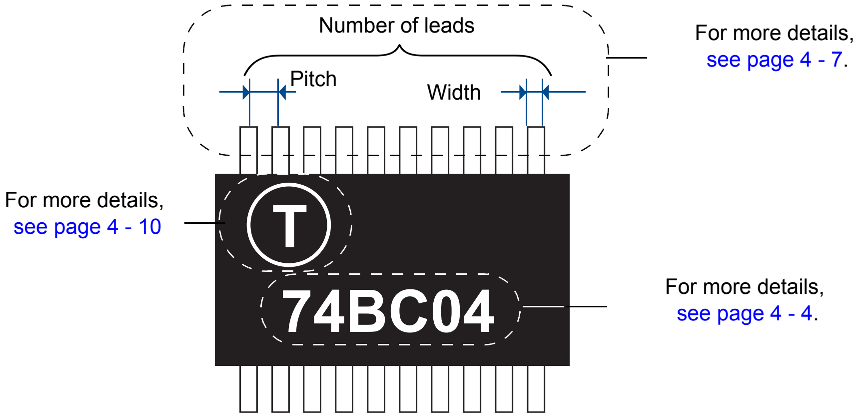
- Select a camera (see page 4 - 24)
- Set the inspection method and conditions (checker settings). See:
  Area Setup and Out–of–Area Range (see page 4 - 25)
  Checker Area Setting Method (see page 4 - 27)
- Setting judgment conditions and processing conditions. See:
  Setting Masking (see page 4 - 29)
  Filter Setup (see page 4 - 30)
- Settings for position/rotation adjustment. See:
  Specifying Position and Rotation Adjustment Group (see page 4 - 23)
- Perform a test

Set the inspection result output method

Start the inspection

IC Inspection Example

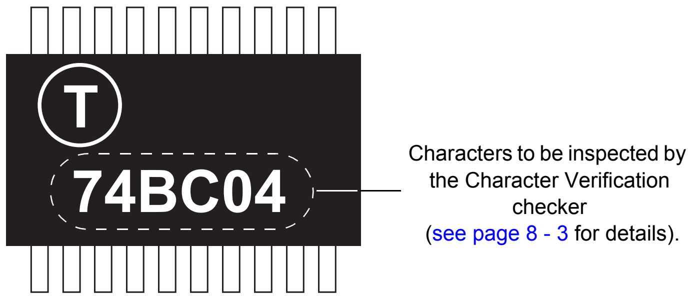
In this example, we will use an IC to illustrate what kinds of inspection are possible and how to perform them.



Character Verification (Character Verification Checker)

Use the character verification checker to inspect characters and numbers printed on the inspection target. The character verification checker compares the characters on the inspection target with registered images to see if they are the same and thereby identify quality problems.

There are two types of inspection: Character verification (character-by-character) and pattern inspection (comparison of multiple characters at one time). Refer to the corresponding chapter (see page 8 - 3) for a detailed explanation.



The text portion to be inspected is the white part as shown in the diagram.

Here we will run through the character inspection procedure using this as an example.

Step 1 Register a good example as the reference for inspection
PROCEDURE :

1. Select a target object example on which the printing is clear and free of omissions. Capture the text on the camera.

2. Here we will use character verification with character-by-character inspection. Select **Checker** - **CHAR. VERIF. - Character** from the menu. The character verification checker setting menu will appear.

```
[2] CHAR. VERIF.           Jud. :NG Det. Char.: 0
 No.01 Character
 1. Select Camera                 A
 2. Checker Setting
 3. Condition
 4. Sub. Det. Area                1
 5. Sub. Det. Judgment            128
 6. Pos. Rot. Adu. Group          0
 7. Result
 8. Copy Checker
 9. Delete Checker

A:Test          B:Image          C:Esc.
```

3. Select **Checker Setting** from the menu, and set the character segmentation conditions.

Item	*Description of Setting*
Area	Encloses the region on the image for performing segmentation.
Segmentation Color	Select the text color to be detected (either black or white).
Segmentation Area Min.	Set this when you want to eliminate unwanted noise.
Background Process	Set this when you want to eliminate unwanted noise.
Registered Image	Allows you to check the registered character image.

In this example we will use the following settings.

```
21. Area                        ( 407, 303) - ( 511, 340)
22. Segmentation Color          White
23. Segmentation Area Min.        16
24. Background Process          No

25. Smart Setting               No
26. Registered Image
```

4. Press <A> to register.
   The unit performs segmentation and displays the result.

5. If the character that you want to register was correctly segmented, press the <Enter> button. The image inside the segmented range is registered as the character image reference for the inspection. You can check this image by selecting **26. Registered Image**.

6. Press <A> in the **CHAR. VERIF.** menu to perform a test, and confirm that the result is OK.
   If the result is not OK, change the process conditions (Condition menu item) and judgment conditions and continue to test until the result is OK. If you select **Result**, Correlation, **Sub. Det. Qty**., and **Sub. Det. Area** will be displayed, so refer to these for your settings.

Step 2 Perform an inspection

Once you have registered a character image for use as a reference, you can perform the character inspection.

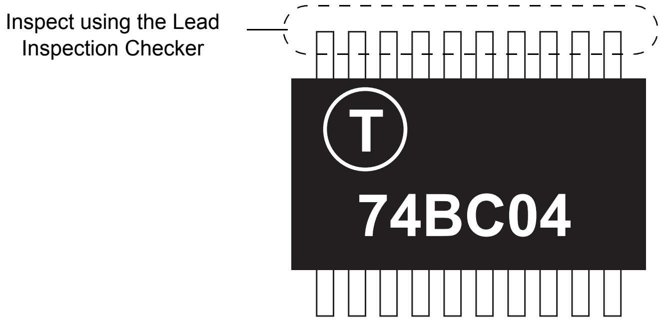
1. Return to the main menu and press button <A> (Start) to perform an inspection on a new target object.

Inspecting No. of Leads, Pitch and Width

Use a Lead Inspection checker to inspect the number of leads on an IC or connector. Counting the number of leads and measuring the width and pitch of the leads allows you to check for bent leads etc. For a detailed explanation about each item, see page 10 - 3.

Ex:

In this example we will inspect the leads on the topside of the package. - The leads to be inspected are the white portions shown in the diagram.



Step 1 Set the conditions for an acceptable product
With the lead inspection checker, inspection is performed based on the settings in Judgment Conditions. First, perform an inspection on a good article, and then set the judgment conditions based on the results of this.

PROCEDURE :
1. Select an article that has no missing or bent leads and capture it on the camera.

2. From the menu select **Checker** - **LEAD INSPECTION**. The lead inspection checker setting menu will appear.

[4] LEAD INSPECTION Detected:NG Cnt.: 0
No. 1 Width.:OK Pitch:OK
2. Checker Setting

21. Shape	**Plane**
22. Direction	**Hor.**
23. Area	**(206, 200) - (305, 279)**
24. Object	**White**
25. Edge Thres. Value	**50**
26. Condition	

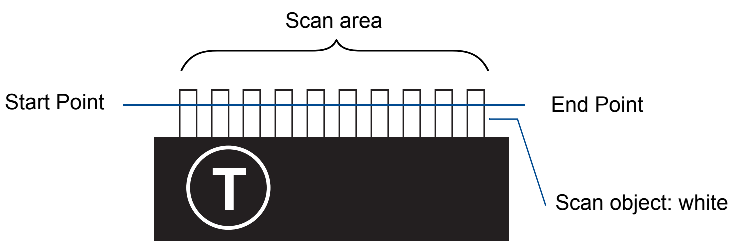
A:Test B:Image C:Esc.

3. Select **Checker Setting** from the menu, and set the scanning method for the inspection.

Item	*Description of Setting*
Shape	Select either “Line” or “Plane” as the scanning area.
Direction	Select either “Horizontal” or “Vertical” for the direction (in the case of “Plane” as the scanning area only).
Area	Specify the range to scan on the image.
Object	Select whether the leads to be inspected are black or white in the camera image.

In this example we will use the following settings.

21. Shape	**Line**
22. Area	**(206, 200) - (305, 279)**
23. Object	**White**



4. Press <A> to perform a test.

5. Select **Result**, and confirm the result.
   The Width, Pitch and Sub. Det. values are displayed.
   If the leads are not being detected well, refer to the Sub. Det. value, and select **Edge Thres. Value** from the Checker Setting menu. Modify the setting for this value until the leads are detected.

6. Select **Detect Judgment**, and set the correct number of leads.

7. Select **Width Judgment** and set the correct lead width after referring to the value in Result.

8. Select **Pitch Judgment** and set the correct lead pitch after referring to the value in Result.

Item	*Pass value*
No. of leads	20
Width	2.0 to 3.5
Pitch	7.0 to 9.5

3. Detect Judgment	**20**
4. Width Judgment	**< 3.5, 2.0>**
5. Pitch Judgment	**< 9.5, 7.0>**

9. Press <A> to perform a test, and confirm that the result is OK.
   If it is not OK, change the judgment conditions and continue to test until the result is OK.

Step 2 Perform an inspection
Once you have registered a character image for use as a reference and set the scan method, you can execute the lead inspection checker.

1. Return to the main menu and press <A> to perform an inspection on a new target object.

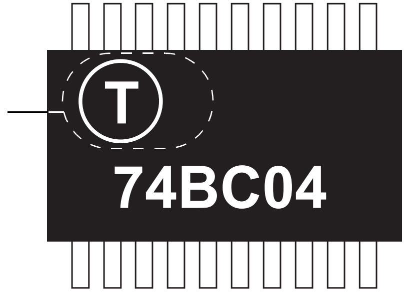
Mark Detection (Gray-Scale Window Checker)

Use a gray-scale window checker to inspect a mark printed on an article and determine whether or not it is acceptable. With the checker you can check the average brightness value to determine whether or not the mark is present, and its quality (blurring etc.). For a detailed explanation of each item, see page 12 - 3.

Ex:

The mark to be inspected is the white part as shown in the diagram.

For inspection by the Gray Scale Window checker,



Step 1 Set the conditions for an acceptable product
With the gray scale window checker, inspection is performed based on the settings in Average Judgment. First, perform an inspection on a good article, and then set the judgment conditions based on the results of this.

PROCEDURE :

1. Select an article on which the mark is printed correctly, and capture it on the camera.
2. From the menu select **Checker - Gray Window**. The gray scale window checker setting menu will appear.

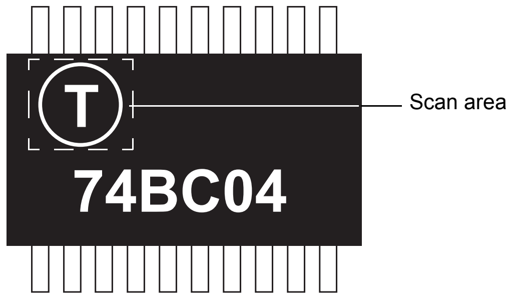
```
[6] GRAY WINDOW          Jud.:NG
 No.  1                   Average: 0
 2.  Checker Setting
     21. Shape                     Rect.
     22. Area            ( 206, 200 ) - ( 305, 279 )
     23. Mask Shape                None
     24. Mask Area       (      ,      ) - (      ,      )
```

3. Select Checker Setting from the menu, and set the scanning method for the inspection.

Item	*Description of Setting*
Shape	Select the shape of the area to scan.
Area	Specify the range to scan on the image.
Mask Shape	Use this to select a shape not to scan on the area that you specified to scan.
Mask Area	Use this to select an area not to scan on the area that you specified to scan.

In this example we will use the following settings.

21. Shape	**Rect.**
22. Area	**(206, 200) - (305, 279)**
23. Mask Shape	**None**
24. Mask Area	**(,) - (,)**



4. Press <A> to perform a test.

5. Note the average displayed on the top right of the screen. Select the Average Judgment, and set the maximum and minimum values for an acceptable article.

Item	*Value*
Average	42

3. Average Judgment   < 50, 30>

Maximum value   Minimum value

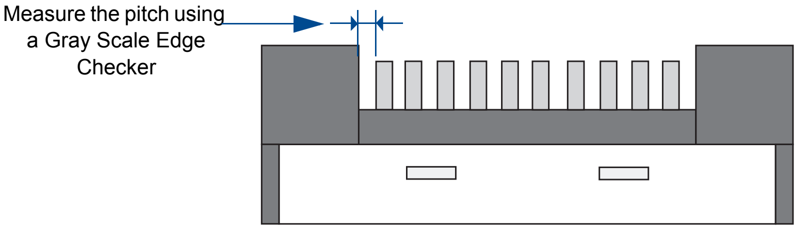
6. Press <A> to perform a test and confirm that it is OK.
   If it is not OK, revise the judgment conditions and continue testing until you get an OK result.

Step 2 Perform an inspection
Once you have set the judgment reference you can execute the Gray Window Checker.

1. Return to the main menu and press <A> to perform an inspection on a new target object.

Connector Inspection Example

In this example we will use a connector to illustrate what kinds of inspection are possible and how to perform them.



Connector Dimension Measurement

Use a gray-scale edge detection checker to check whether or not the dimensions of the connector part are correct or not. For a detailed explanation of each item, see page 11 - 3.

Step 1 Measure the edge position of the part to be measured
With a Gray Scale Edge checker you can measure the coordinates of the edges (contours) on an inspection target. Inspection of the positional relationships is possible by setting a good article as a reference.

PROCEDURE :

1. Select a target object on which all of the connectors are present and straight and capture it on the camera.

2. Select **Checker - Gray Edge** from the menu.
   The Gray Scale Edge Checker setting menu will appear.

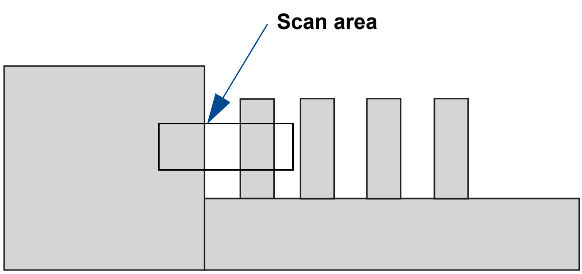
```
[5] GRAY EDGE DETECTION
 No.  1                       Jud.:OK Detected:0
 2.  Checker Setting
     21. Shape                    Plane
     22. Direction                Hor.
     23. Scan Method              Single
     24. Area             ( 206, 200 ) - ( 305, 279 )
     25. Edge Condition           Both
     26. Edge Thres. Value         50
     27. Condition
     28. Detect Position          Plural
```

3. Select **Checker Setting** from the menu, and set the scan method for inspection.

Item	*Description of Setting*
Shape	Select either Plane scan or Line scan.
Direction	Select either vertical or horizontal for the scan direction (in the case of Plane scan only).
Scan Method	Select Single scan or Projection scan according to the characteristics of the target object.
Area	Specify the range to scan on the image.
Edge Condition	Select from one of the three edge types to detect (light to dark, dark to light, or both).
Edge Thres. Value	Set the reference boundary for edge detection.
Condition	Set this when you cannot detect an edge correctly.
Detect Position	Select what part of the boundary that you want to detect as the edge (front edge, front edge and back edge, maximum differential (part with the greatest contrast), or multiple (all detected edges).

In this example we will use the following settings.

21. Shape	**Plane**
22. Direction	**Hor.**
23. Scan Method	**Single**
24. Area	**(206, 200) - (305, 279)**
25. Edge Condition	**Both**
26. Edge Thres. Value	**50**
27. Condition	
28. Detect Position	**Plural**



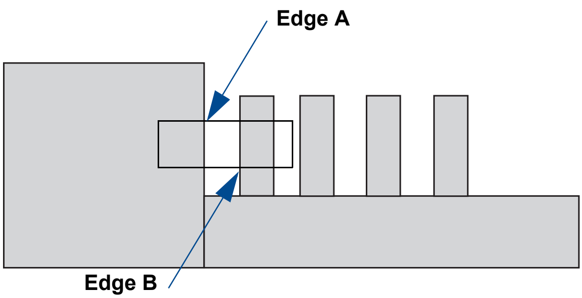
4. Press <A> to perform a test.
   Confirm that the edge that you want to measure was detected. If it was not detected, change the edge threshold value and process condition until the edge is detected.

5. Select Result from the Gray Scale Edge Checker menu, and confirm the X and Y coordinates for the edge that you want to measure.

Step 2 Set the judgment conditions for the dimensions
A Gray Scale Edge checker can perform judgments based on the number of edges detected, it cannot measure dimensions. To do this, use the detected results in a numerical calculation as illustrated below.

Ex:

Affichage d'un checker de bord NDG



Calculation example: Dimension from A to B
X coordinate of edge B - X coordinate of edge A = GE01021 - GE01011

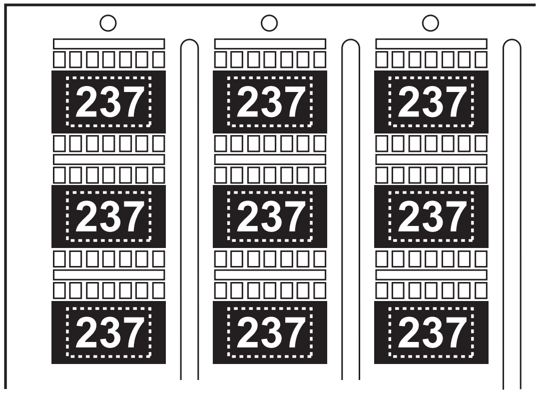
You can set maximum and minimum values for the dimension obtained here, and perform judgment. For details regarding numerical calculations, see page 13 - 7.

Step 3 Perform an inspection

1. Return to the main menu and press <A> to perform an inspection on a new target object.
   The dimension is calculated based on the detection results of the Gray Scale Edge checker. If you establish judgment conditions for the Numerical Calculation function and index the judgment output, you can output the judgment result to an external device.
   It is also possible to output calculation data to external devices. See the settings under **Communication** in the **Environment** menu.

IC Inspection Example

In this example we will use ICs to illustrate what kinds of inspection are possible and how to perform them.



Counting ICs

Use the smart matching checker to count a number of the same article. For a detailed explanation of the various setting items, see page 9 - 3.

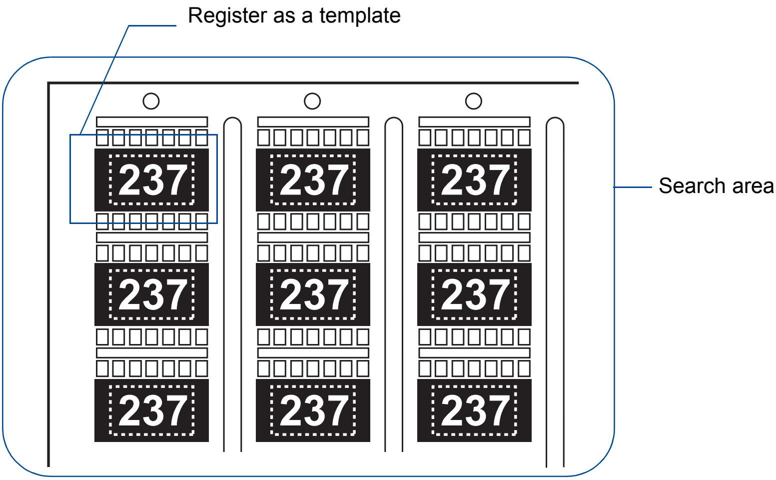
Step 1 Register a template image of the target object to be counted

1. Capture one of the articles to be counted on the camera.

2. Select **Checker - Smart Matching - Checker Setting** from the menu. The Smart Matching menu screen will appear.

```
[3] SMART MATCHING                    Jud.:NG
 No.  1                               Detected:0
2.  Checker Setting
    21. Template
                        (    ,     ) - (     ,     )
                        Output Unit (     ,     )
    22. Seatch Area
                        (    0,    0) - ( 511, 479 )
    23. Sequence
    24. Output Unit                No
```

3. Select **Template**.
   Enclose one of the articles to be counted in a rectangular marquee to register it as a template. Proceed to specify an Output Point.
   The Output Point specifies the positional coordinates of the inspection target.



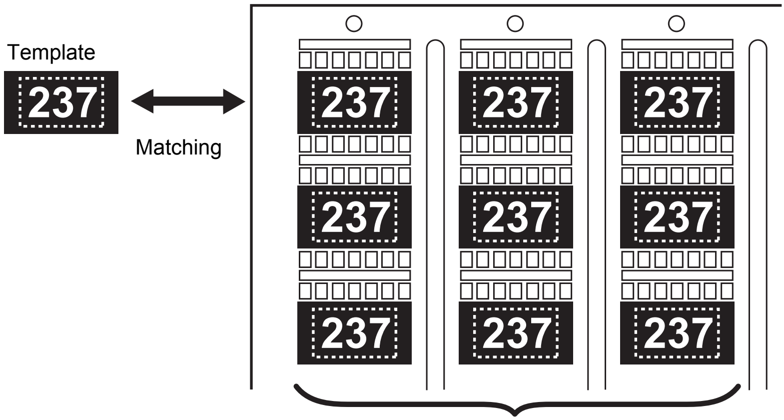
4. Select a search area and enclose is with a marquee. The Smart Matching checker will search the area inside the marquee.

5. Select Sequence, and set the search conditions. Searching is a five-stage process. You can set judgment conditions such as accuracy, quantity, and correlation for each stage. If you want to count the number of articles, set the number of articles that should be detected (i.e. the quantity) in the judgment conditions.

6. Press <A> to perform a test, and confirm that the articles are detected.
   It is also possible to check the detected articles against the template image (substraction, see page 9 - 14).

Step 2 Perform an inspection

1. Return to the main menu and press <A> to perform an inspection. The number of articles detected inside the search area is displayed on the top right of the screen.



9 objects that match the template are detected.

Displayed Image and Test Functions

The execution sequence when performing a test is position and rotation adjusters, then other checkers.

The inspection time displayed represents only the time required to execute the checkers selected from the menu.

Numerical calculation, judgment output, and spreadsheets are not included in a test, and there is no parallel or serial output.

Note **Test inspections are only performed to check how inspections run with particular settings and parameters. For ordinary inspections we recommend that you input the start signal from an external device from the main menu.**

Hiding Images and Menus

The VISION CONTROLLER gives you several possibilities to hide images and menus so that the monitor display is reduced to the essentials.

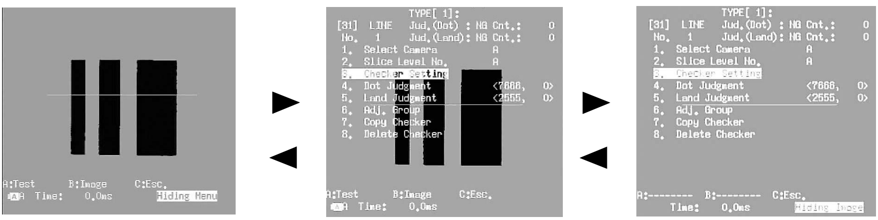
Checker Display

If you select a number for a checker that has already been set, the settings are displayed and the checker pattern is displayed brightly. If you select a number for a checker that has not been set, the settings are not displayed.

Hiding Images and Menus

When you select and confirm a checker number, the setup menu for each checker is displayed. The **Hide Image** and **Hide Menu** functions are available only when you are working in this menu.
Use the cursor lever to toggle between displaying and hiding the image or the menu.

Hide menu **Curser lever** **Curser lever** **Hide image**



While the image is suppressed, the highlighted message ”Hiding Image” is displayed. In this state, some functions including <A:Test>, <B:Image> and display of results cannot be selected.

If filter or area settings are selected while the image is suppressed, the image is displayed temporarily, then suppressed again after the appropriate settings have been made.

Checker Pattern Display

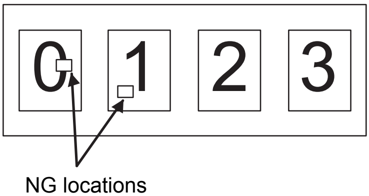
The pattern for the selected checker is displayed more brightly than the patterns for other checkers.

Note **On the main menu, none of the checkers are displayed brightly unless** Make Bright at NG **is set to** YES**. If Make Bright at NG is set to** NO**, no checker is displayed brightly.**

Character Verification

Displays the checker pattern, detected character area and the part for which the comparison result was NG (failed). The rectangles on the characters indicate the NG locations.

Ex:



Smart Matching Checker

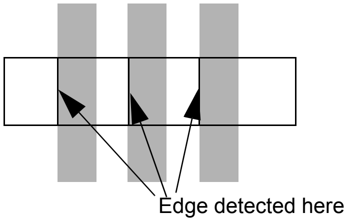
"+" marks indicate the positions specified as the output points for the checker pattern and pattern. If no object corresponding to the pattern was detected, the "+" marks are not displayed.

Gray-Scale Edge Checker Display

The detected edge is displayed as a straight line with two triangles. The straight lines and triangles are not displayed if no edge is found.

Ex:

Gray-scale edge checker pattern display

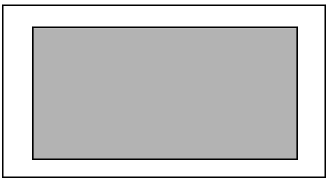


Gray-Scale Window Checkers

Checker patterns are displayed according to the selected type and shape, i.e. line checkers appear as lines, window checkers as rectangles.

Ex:

Gray scale window checker pattern display



Note **When position adjustment is used, the checker is displayed at a position that has been moved by the amount of correction. If the position after correction is off screen, the checker is displayed at the position where it was set.**

Specifying Position and Rotation Adjustment Group

Sets the active position and rotation adjustment number within the product type. Only pre–set position and rotation adjuster can be set here. The corresponding position and rotation adjuster pattern is displayed brightly during number selection.

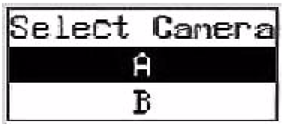
When changing the group number of a checker to which rotation adjustment has been applied, or when changing the adjuster group which has an angle of rotation, an “Area will be changed. OK?” message is displayed. Select Yes to change the group number. The execution position (angle) of the checker adjusted for position or rotation will change at that point. If you select No, the group number will not change.

If the position and rotation adjustment group is specified before setting an area, then when setting the area, the image is displayed according to the rotation angle, enabling the area to be set at the required position.

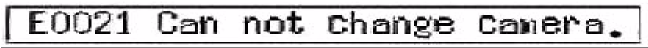
If the position and rotation adjustment group is specified after setting an area, the execution position of the checker may change according to the amount of adjustment requiring the area to be set again.

Selecting a Camera

Use the **Select Camera** setting for each checker to select scanning for the image captured by either camera A or Camera B.



For the XUVM210
If only one camera is connected, or if the setting for **Capture Camera** in the **Type** menu is something other than **AB**, it is not possible to select anything but **A** (otherwise, an error message will be displayed).



Area Setup and Out-of-Area Range Setting

Area coordinates can be set in the ranges X: 0 to 511, Y: 0 to 479. When the area has been set correctly, it is executed at the specified position from the next test. If a checker area is moved, the mask moves with it at the same time.

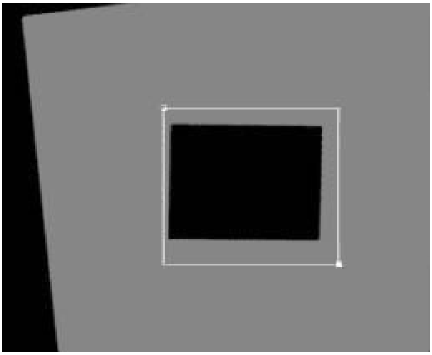
Note **If filtering with a 5x5 erosion or dilation filter is set for a binary filter, the coordinates can be set in the range X: 2 to 509, Y: 2 to 477.**

If you attempt to set coordinates outside the range available, the error message "Position is out of image range." is displayed. The coordinates are reset to those before the attempted change.

With the character verification checker, the allowed setting range depends on the value set for 24. Background Process**. For details,** see page 8 - 10**.**

Checkers can only be moved horizontally or vertically. If the XUVM230 detects a rotation, the image has to be rotated by the detected angle so that you are able to proceed with setting the checkers horizontally or vertically (see figure).

When the XUVM230 rotates an image it is possible that the XUVM230 needs to display areas that are outside the camera's view range (out-of-area, see left-hand side in the figure). The color of the parts of the screen where there is no image is determined by the option **62. Outside Region Value** in the **Environment** menu. (In the case of binary image processing checkers, this also depends on the maximum and minimum values for the slice levels.) It is not possible to set a checker in the out-of-area part of the image.



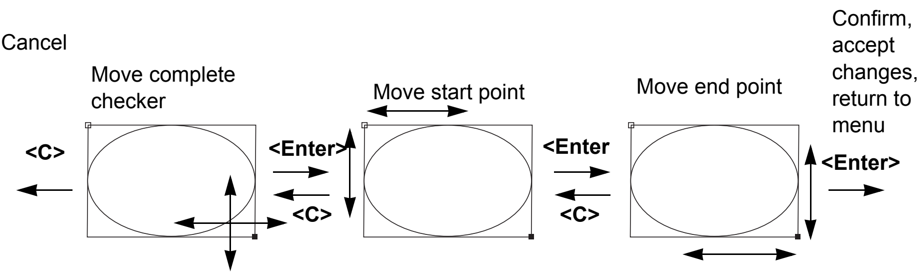
If an error occurs during checker setting because the position and rotation adjustment failed, the error message “Position is out of image range.” is displayed. Inspection checkers depending on the position and rotation adjustment will not adjusted. Instead, the checker patterns are displayed at the setting position. In this case, check and, if necessary, correct, the position and rotation adjustment checker before you continue setting inspection checkers.

Note **Only Smart Matching checkers resp. the search area where smart matching takes place may be moved outside the image area. If a Smart Matching checker is adjusted by a position and rotation adjustment checker, make sure when you change the smart matching settings, that the checker area and the search area still are within the image area.**

Checker Area Setting Method

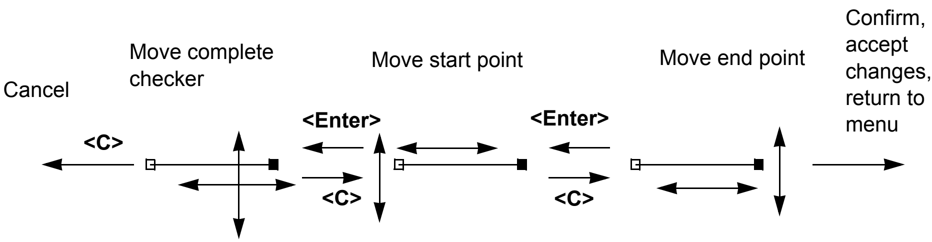
Rectangle / Circle / Elliptic Circle

Press <Enter> to switch between the elements that can be moved (complete checker, start point, end point). Press <C> to go in the opposite direction. Use the cursor lever to move the selected element.



Line

Press <Enter> to switch between the elements that can be moved (complete checker, start point, end point). Press <C> to go in the opposite direction. Use the cursor lever to move the selected element.



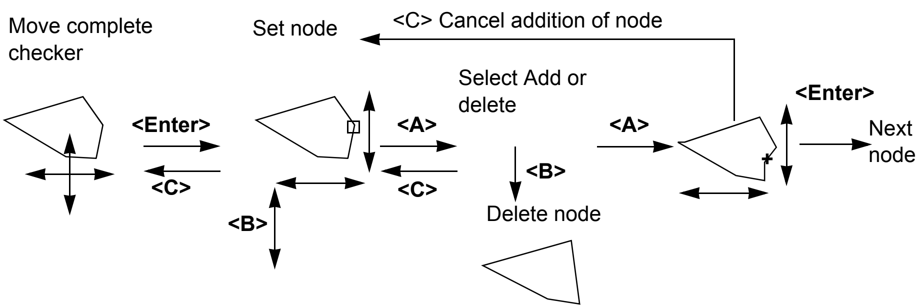
Note **When setting a line shape for position and rotation adjustment, only a horizontal line can be set when the scanning direction is horizontal, and only a vertical line can be set when the scanning direction is vertical. It is not possible to create diagonal lines.**

Polygon

Press <Enter> to switch between moving the complete checker and setting a node. Press <C> to go in the opposite direction. Use the cursor lever to move the complete checker.

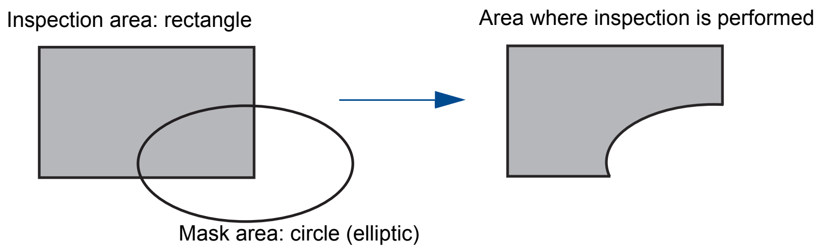
Adding a node
Press <A> twice to add another node. Use the cursor lever to move the added node, then press <Enter> to fix it. Press <C> if you wish to cancel the addition and revert to Set node mode. More nodes can be added up to a maximum of 16.

Deleting a node
Press <A> and then <B> to delete a node. Nodes can be deleted until only the minimum three nodes remain.



Setting Masking

Mask areas can be set for gray scale window checkers.
A mask area is an area within an inspection area where inspection is not performed. Setting a mask area is one way of adapting a checker's inspection area to a complex shape. Only one mask area can be set per checker.



Mask area coordinates can be set in the range X: –511 to 1022, Y: –479 to 958. It is therefore possible to set the mask outside the screen area, and as long as it remains within this range, no error is produced if it is moved outside the screen area by a position and rotation adjustment checker. However, if you are setting the mask area and it does not fall within the above range, it will go back to the setup position.

A checker that generates an error when moved outside the screen area by an adjuster when an inspection is performed has its checker pattern displayed at the position where it was set. The area setting is then made by changing the area from this position. The checker will be executed from the same position where the area is set from the next time it is executed.

When you set the masking area it is possible that the inspection checker is moved to an out-of-area part of the image due to the position and rotation adjustment. In this case it is not possible to set the masking area and the error message “Position is out of image range.” is displayed. Move the inspection checker to the center of the screen before you set the masking area. If the error occurs while setting the area, the coordinates revert to the coordinates before the change was attempted.

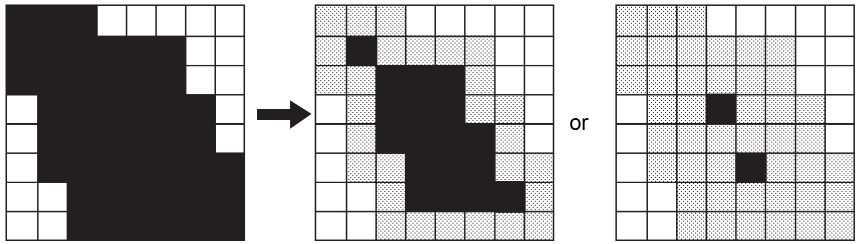
Filter Setup

You can use filter processing with Smart Matching checkers to eliminate unwanted parts (erosion) or to close gaps (dilation).
Both dilation and erosion filters are available. These filters work on a captured image, performing dilation or erosion before inspection.

Note **You can check the effect of the filters with the option** Area **in the** Checker Settings **in the** Checker **menu. The image displayed is a filtered image. In all other screens the image is unfiltered because displaying the filters would take too much time.**

Two levels of filtering, 3x3 and 5x5, are available for both dilation and erosion filters. The filters have the following effect on the original image:

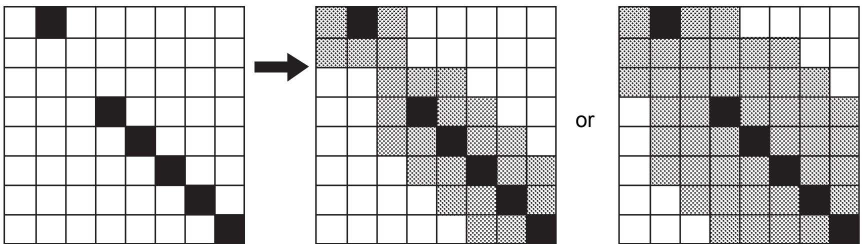
Filter size	*Filter type*	*Effect on the image*
3x3	Erosion	Removes a rim of 1 pixel width from the object
5x5	Erosion	Removes a rim of 2 pixels width from the object
3x3	Dilation	Adds a rim of 1 pixel width to the object
5x5	Dilation	Adds a rim of 2 pixels width to the object



Original image
objet = black

3x3 erosion filter
original object = gray
object after filtering = black

5x5 erosion filter
original object = gray
object after filtering = black



Original image
object = black

3x3 dilation filter
original object = black
object after filtering = gray

5x5 dilation filter
original object = black
object after filtering = gray

Changing Shapes

When you change a checker shape (e.g. form a line to a window or vice versa), please note:

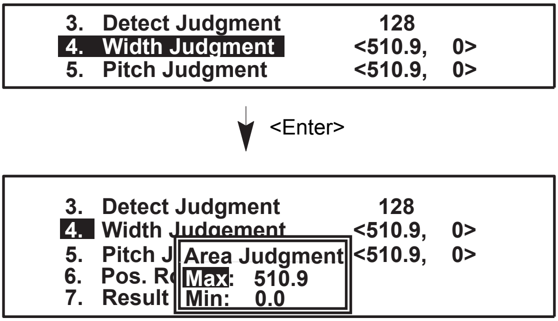
- Changing the shape is performed at the position where you have set the checker. The checker then appears in the standard size of the new shape you have selected.
- The shape cannot be changed when the checker is inside a masked area. In this case, the error message ”No searching area exists. Changes can’t be stored.” is displayed. Move the checker to a different position before attempting the shape change again.
- The shape cannot be changed if the checker is too close to the edge of the screen. In this case, the error message ”Position is out of image range.” is displayed. Move the checker to the center of the screen before attempting the shape change again.

Entering Upper and Lower Limit Values

This section describes how to enter upper and lower limit values in the setup menu for each checker.

Ex:

Judgment conditions :
The parameters for entering upper and lower limit values are normally displayed as in Max, Min. You can select which parameter you want to enter, Max or Min, and enter values..



Copying a Checker

Procedure:
f

1. Select a new checker number that has not been used

2. Select **Copy Checker**

3. Set the checker number for the source checker within the same type
   The message “Data exists in destination, OK to overwrite?” is displayed.

4. Select and confirm **Yes** if you want to copy or **No** to cancel the copying

---

Note **You must initiate copying from the new checker number; i.e. the new checker number can copy** from **a set checker number, but a set checker number cannot copy** to **a new checker number.**

Only checker numbers that have already been set are displayed when you are selecting the copy source for the checker number. If there are no source checkers, an error message saying “No checker for copying exists.” is displayed. An error message is also displayed if there is not enough space for copying.

Deleting a Checker

Procedure:

1. Select the number of the checker to be deleted

2. Select **Delete Checker** and confirm
   A message saying, “Delete?” is displayed.

3. Select and confirm **Yes** if you want to delete or **NO** to cancel the deleting

---

Note **All of the data that has been set for the specified checker number will be deleted when you execute** Delete Checker**. The checker number selection menu is displayed after deletion is complete.**

CHAPTER 5

Environment and Type

List of Setting Items

Environment settings set the operating environment and are common for all types. Type settings are set for each inspection target.

Setting item		Setting menu	Explanation
Camera settings	Camera mode and type	Environment	see page 5 - 5
	Shutter speed	Environment	see page 5 - 5
	Camera selection (when two are connected)	Type	see page 5 - 16
Scan method	Scan start method	Environment	see page 5 - 7
	Image data save method	Environment	see page 5 - 11 and page 15 - 3
Status after power up	Type selection at power up and type switching	Environment	see page 5 - 8
	Camera image selection at power up and type switching	Type	see page 5 - 17
	Display item selection at power up and type switching	Type	see page 5 - 20
Display settings	Screen brightness setting	Environment	see page 5 - 10
	Display item selection at power up	Type	see page 5 - 20
Communication settings	Serial/parallel settings	Environment	see page 5 - 9 and page 16 - 15
	Computer Link	Environment	see page 5 - 9 and page 16 - 58
Type creation	Input type title	Type	see page 5 - 15
	Delete type settings	Type	see page 5 - 20
	Copy the settings for another type	Type	see page 5 - 20
	Initialize all types (delete all at once)	Type	see page 5 - 22

Environment Settings Common to All Types

Main Menu Options

Set environment settings such as the camera mode and shutter speed for use in inspections, and also the I/O settings.

```
                TYPE [ 1]:
  [7] ENVIRONMENT
   1.  Camera
   2.  Start                        Once
   3.  Start Type                   No. 1

   4.  Communication
   5.  Display Setting
   6.  Save Image Mode              Manual
   7.  Initialize


 A:---------    B:----------    C:Esc.
```

1. **Camera**
   Sets the camera mode and shutter speed (see page 5 - 5).
2. **Start**
   Sets the inspection start method (Once, Manual Repeat or Auto Repeat, see page 5 - 7).
3. **Start Type**
   Sets the number of the type that starts up when the power is turned on (see page 5 - 8).
4. **Communication**
   Sets serial, parallel or other communication parameters (see page 5 - 9).
5. **Display Setting**
   Sets the screen display (see page 5 - 10).
6. **Save Image Mode**
   Sets up how images are saved (see page 5 - 11).
7. **Initialize**
   Returns the **Environment** settings to the original factory settings (see page 5 - 12).

Camera

Set the camera mode, shutter speed, and whether or not to use flash illumination.

```
[7] ENVIRONMENT
 1.  Camera
     11. Camera Mode
           Normal Frame
     12. Shutter speed
           1/60 Fix
     13. Flash
           Unused
```

11. Camera Mode

- **Normal Frame**
  This is the standard mode for static objects. Use a standard camera. The shutter speed is fixed at 1/60. Use this mode when utilizing a strobe.

- **Normal Field**
  This is the mode for an electronic shutter camera. Use a standard camera. The shutter speed can be set between 1/60 and 1/10000. The resolution is reduced to 512x240 pixels.

- **D.S. Random Frame**
  This is the setting for random shutter camera mode. Use the XUVC002 camera. Shutter speeds between 1/120 to 1/20,000 are available. The resolution is 512x480 pixels.

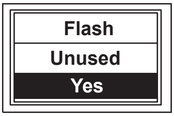
- **D.S. Random Field**
  This is the setting for random shutter camera mode. Use the XUVC002 camera. Shutter speeds between 1/120 to 1/20,000 are available. The resolution is 512x240 pixels.

- **Internal Synchronization mode Frame**
  In this mode, the camera uses internal synchronization in frame mode. It is compatible with composite video input (NTSC). Only one camera can be used (camera A).

- **Internal Synchronization mode Field**
  In this mode, the camera uses internal synchronization in field mode. It is compatible with composite video input (NTSC). Only one camera can be used (camera A). The shutter speed setting range is 1/60 to 1/10,000s.

12. Shutter Speed
Set the shutter speed after selecting one the following camera modes: Normal field, FULLFRAME frame/field, internal sync-mode field.

13. Flash
Set to **Yes** if you wish to use flash illumination. The initial setting is **Unused**.



Note **To connect a flashlight you need external hardware. Please contact your local Telemecanique branch.**

If you try to connect the flashlight directly to the FLA output of the XUVM230, the output will be damaged.

Start

Set the inspection start method. Repeated inspection is only possible with the main menu, **Numerical Calculation** menu, **Judgment** menu and **Spreadsheets** menu. Furthermore, repeated inspection is possible when you display the checker list or the spreadsheet instead of the main menu (press <C: Chg. Disp.> from the main menu and set the option **1. Screen Display** to **Checker List** or **Spreadsheet** (see page 3 - 9).

- **Once**
  When <A> is pressed, or if a start input is received from the parallel interface or a start command is received from the serial interface, a single inspection is performed.

- **Manual Repeat**
  When <A> is pressed, or if a start input is received from the parallel interface or a start command is received from the serial interface, continuous repeated inspection occurs until <A> is pressed again. (Inspection stops even if another start input is received from the parallel or serial interface.)

- **Auto Repeat**
  Continuous repeated inspection commences as soon as the power is turned on. Inspection stops when <A> is pressed. To restart inspection, press <A> again.

	Button <A>	*Parallel start*	*Serial (%S)*	*Serial (%P)*	*Serial (%R)*
Once	Single inspection	Single inspection	Single inspection	Single inspection	Single inspection
Manual Repeat/ Auto Repeat	Continuous inspection	Continuous inspection	Continuous inspection	Continuous inspection	Single inspection

Start Type

Set the number of the type that starts up when the power is turned on.

- If you set **No. 1**, No. 1 will always start up when the power is turned on.
- If you set **Last Store Type No**., the type currently being inspected or the type being set up will start up the next time the VISION CONTROLLER starts up. When you want to start up another type on the next startup, select the type number you want to start up and select this item.

Note **Note that if you set** Last Store Type No**., the type number at the last point at which the data was saved is the active type number. If you set** No. 1**, type number 1 will still start up even if there is no data defined for this type.**

31.Display Message

This can only be displayed when **Last Store Type No.** is set as the **Start Type** setting.

- If you set **Yes**, when the type switch is executed, a message saying, “Data changed, but not saved.” is displayed on the screen when the switch to the different type is complete.
- If you set **No**, the message above is not displayed. In addition, if No. 1 is selected under **Start Type**, the message is not displayed.

Communication

Use this option to set serial, parallel or other communications.

```
[7] ENVIRONMENT
 4. Communication
      41.  Com. Mode           Normal Mode
      42.  RS232C
      43.  Serial Output
      44.  Parallel Output
      45.  Type Switch Min.            0ms
```

41.Communication Mode

Select either Normal Mode or Computer Link as the communication mode (see page 16 - 8).

42.RS232C

For detailed information, see page 16 - 10.

43.Serial Output

For detailed information, see page 16 - 12.

44.Parallel Output

For detailed information, see page 16 - 15.

45. Type Switch Min. (0 to 100ms in 10ms steps)

Set the minimum type switch time for switching using parallel or serial input. Because the type switch time is extremely short, this function can prove effective in cases when it is not possible to perform switch completion notification using the external device. The initial setting is 0ms (see page 16 - 34).

Ex:

1) Setting value = 0ms: READY signal OFF time = switch time
2) Setting value ≤ switch time: READY signal OFF time = switch time
3) Setting value > switch time: READY signal OFF time = setting value

Ex.	*Setting value*	*Switch time*	*READY à OFF time*
1	0 ms	20 ms	20 ms
2	10 ms ≤ 20 ms		20 ms
3	50 ms > 20 ms		50 ms

Display Setting

Sets the screen display.

```
[7] ENVIRONMENT
 5. Display Setting
    51.  Display Brightness        Image:Dark
    52.  Outside Region Value          0
    53.  Language                   English
```

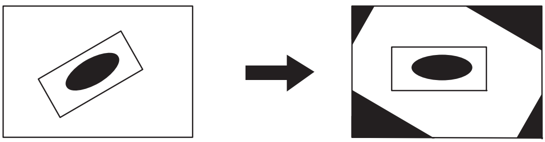
51.Display Brightness

This function changes the display brightness. Select either **Normal** or **Image:Dark**.

The initial setting is **Normal**, and when **Image:Dark** is selected, the camera image is made darker, so that the menu names are easier to read (this setting has no effect on actual inspection). However, this setting only applies to gray images, and the brightness is not changed in the case of binary images. Select **Image:Dark** when a bright (whitish) image is being displayed, and the white menu text is difficult to read.

52.Outside Region Value (only for the XUVM210)

When you use a rotation adjustment and wish to set a checker, the XUVM230 will rotate the complete image so that the checker shape appears square to the screen. In this case, the XUVM230 may need to display image parts of which the gray value is unknown. Use this option to set a standard gray value for these image parts (0 to 255).



If you are using a gray checker, the specified gray-scale value is displayed but if you are using a binary checker, the area will be black or white, according to the slice level that has been set.

53.Language

Switches the menu display language (English or French).

Save Image Mode

Allows you to set up how images are saved. The maximum number of images that can be saved is 8. If you select **Continuity, Trap**, or **Lim. Cond.** as the save mode, you can select **Overwrite**: **Yes** or **No** for the saved image memory for all of the save modes.

- **Manual**
  Current memory image is saved using the keypad.

- **Continuity**
  Saves the image for every inspection.

- **Trap**
  Saves the image when the result in the register set for **Trap** in the **Judgment** menu is NG (i.e. when the trap condition is established).
  When the **Save Image Mode** is set to **Trap**, processing is not interrupted even if the trap condition is established. However, if **Overwrite** is set to **No**, processing is interrupted at the point when the limit for the number of images that can be saved is exceeded and the trap conditions are established, and an error message is displayed on the screen (for details regarding the Trap function, see page 13 - 30).

- **Limit Condition (Lim. Cond.)**
  Sets the upper and lower limit values for the last three formulas of the numerical calculation results (CA30, CA31, CA32), and whenever one of them exceeds that range, the image is saved.

61.Overwrite

Yes :
When the total 8 images have been saved in the image save memory, the oldest image is overwritten if there is a trigger to capture more images.

No :
When the total 8 images have been saved in the image save memory, new images are not saved even if there is a trigger to capture more images.

Note **Saved images are lost under the following conditions (for details on loading and saving image data,** see page 15 - 3**):**
When you switch the power off.
When you switch to Camera mode (Camera Settings**) or change the shutter speed.When you change the settings for this option.**
When you delete, initialize, or copy a type.
When you initialize the Environment **settings.**
When you switch the capture camera setting to a different type.

Initialize

This returns the **Environment** settings to the original factory settings. The language setting is not initialized even if you initialize, so the currently displayed language remains the selected language.

Note **If you change settings in the** Environment **menu, select** Save Data **from the main menu and save. Note that if the power is turned off and you have not saved your data, the setting changes will be lost.**

Types

You can register a maximum of 32 sets of inspection condition data for the XUVM230. This inspection data is called a **type**, and each type is managed by giving it a title. The **Type** menu allows you to switch between types, copy or delete them, and set how to display them.

Main Menu Options

```
                TYPE [ 1]:
[1] TYPE                    Rest: 432520
 No.01
 1.  Copy Type
 2.  Delete Type
 3.  Input Type Title
 4.  Capture Camera            A
 5.  Camera/Image              A: Gray-Thru
 6.  Menu Setting
 7.  Initialize All Types
```

TYPE:
Use this option to input the type number. Input any number in the range 1 to 32. If data has already been set for the number entered, the appropriate settings are displayed. If no data has been entered, then only the type number is displayed.

1. **Copy Type**
   Copies the data from an existing type into the currently active type (see page 5 - 19).

2. **Delete Type**
   Deletes the currently active type (see page 5 - 20).

3. **Input Type Title**
   Defines a title for the type. If you select **Input Type Title**, the keyboard menu is displayed, allowing you to enter a title. You can enter up to 16 characters for a title (see page 5 - 15).

4. **Capture Camera**
   Sets the image capture camera for each type (see page 5 - 16).

5. **Camera/Image**
   Selects the camera image to be displayed on the monitor when the selected type is read due to application of power or by the type switch operation (see page 5 - 17).

6. **Menu Setting**
   Selects the initial settings for particular menus and display items for the current type. The settings made here are used for the display when the VISION CONTROLLER power is turned on (see page 5 - 20 and page 3 - 10).

7. **Initialize all Types**
   Returns all type settings to the original factory settings. Note that if you select this, all the type data you have entered will be deleted (see page 5 - 22).

Rest:
Displays the amount of available memory for setting the type data.

Note **The following restrictions apply to the settings for type data.**

1) The amount of data for all checkers for all types must not exceed 1024 kbytes (approximately).

2) The total number of checkers set for all types must not exceed 4096. The method for counting differs according to the checker:

Types, numerical calculations, judgment outputs, marker, simple spreadsheets and data monitor: Each is counted as one checker

Position/rotation adjustment reference: Number of reference checkers + 2 (and + 1 in the case that priority is specified). For example, the checker count is 15 in the case of position/rotation adjustment of gray–edge reference with priority specified.

Position/rotation adjustment – matching reference:
(2 x number of reference checkers) + 2

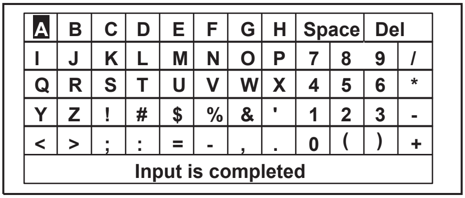
Character verification inspection:
(2 x number of registered characters) + 2
Smart matching: every two are counted as one checker.

Entering a Type Title

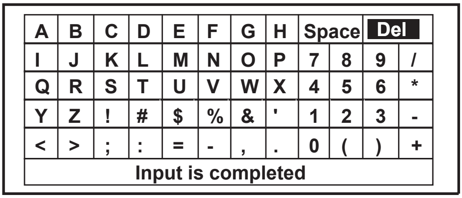
Procedure:

1. Select **Input Type Title**.

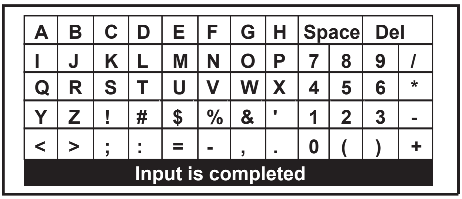
2. The character selection window shown below will be displayed. Use the cursor lever to select and set characters. You can input up to 16 characters for the title



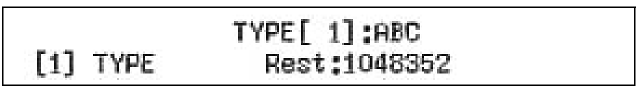
To delete a character that you have input, move the cursor to **Del** at the top right of the window and press <Enter> (this deletes one character).



3. When you have completed input, move the cursor to **Input is Completed** and press <Enter>.



The title is displayed to the right of the type number at the top of the screen (“ABC” in this case).



Setting the Capture Camera

Sets the image capture camera for each type. Two cameras can be connected (camera A and camera B), so select from among the following five possibilities.

Setting	*Image Capturing*
A	Capture images with camera A only (don’t capture with camera B). Checkers set for camera B do not scan.
B	Capture images with camera B only (don’t capture with camera A). Checkers set for camera A do not scan.
AB	Capture images with both cameras A and B simultaneously.
AB Vertical	Camera A captures the left half of the image, camera B captures the right half, and the image is composed as a memory (camera) A image. Only the checkers set for camera A are executed.
AB Horizontal	Camera A captures the top half of the image, camera B captures the bottom half, and the image is composed as a memory (camera) A image. Only the checkers set for camera A are executed.

Note **If you are only connecting one camera, connect it to the Camera A port. Capture errors may occur if you connect it to the Camera B port.**

Only one internal synchronizing camera can be connected, so only A **can be selected.**

When the settings for the capture camera are changed, all saved image data (including locked data) is erased.

When an external device switches the type set for the capture camera to a different type, image capture is not performed when the type is switched. Therefore, when the display image of the changed type is a memory image, after the type is switched, no image is displayed until the next image is captured.

Selecting the Camera/Image

Use this option to select the camera image to be displayed on the monitor. The display selected here takes priority when the power is switched on, or the type is switched (the display camera, and image change settings done with the <B> button in the main menu are temporary settings that remain valid until the power is switched off or the type is changed). The menus differ depending on the settings made in **Capture Camera**.

Settings in Capture Camera	*Available display options*
A AB Vertical AB Horizontal	**Disp. Image** **A Camera** **Gray-Thru** **Gray-Mem** **Gray-NG**
B	**Disp. Image** **B Camera** **Gray-Thru** **Gray-Mem** **Gray-NG**
AB	**Disp. Image** **A Camera** **B Camera** **Gray-Thru** **Gray-Mem**

Note **Select either** Mem Image **or** NG Image **(gray) for inspection execution (for** Thru Image **display, regardless of whether the standard camera or the FULLFRAME camera is used, the image capture execution time will be longer than normal).**

Switching Between Types

Procedure:

1. Enter the type number for the type you want to switch to.

2. Press <C> , and the type is switched and you return to the main menu.

Note **If you selected** Yes **in the** Environment **menu for the data change message (Display Message), a message saying, "Data changed, but not saved." is displayed on the screen when you have finished switching to a different type. If you selected** No**, the above message is not displayed. The message is also not displayed if you set** No.1 **as the start type number.**

When you switch types, the execution results are cleared for all of the checkers. In addition, if you select a type number that has not been set up, the type cannot be switched. Select a type number that has been set up and switch the type.

Copying a Type

Procedure:

1. Set a copy destination for the type number.
   When changing the capture camera, the saved image data, including those that are locked, are all deleted.

2. Select and confirm **Copy Type**.

3. Set the type number copy source.

4. Enter **YES** to copy when “Execute?” is displayed. Enter **NO** to go back without copying.

Note **Even if you are copying a type that has already been set, the source type data overwrites the current data, so make sure that the data for the currently selected type is no longer required.**

If memory capacity is insufficient or too many checkers are set, an error message is displayed and the type is not copied.

When the type was copied, the image data saved with the copy destination type, including those that are locked, are all deleted.

When the type was copied, spreadsheet data for the number of scans with the copy destination type, data for the number of errors, and OK and NG data are all set to zero.

Deleting a Type

Procedure:

1. Set the type number to be deleted.
2. Select **Delete Type** and press **<Enter>**.
3. Enter **YES** to delete when “Delete?” is displayed. Enter **NO** to go back without deleting.

Note **When you delete a type, the saved data (including locked items) is deleted.**

Selecting Initial Display Settings

For the current type, select the initial settings for particular menus and display items. The settings made here are used for the display when the VISION CONTROLLER power is turned on (for temporary display changes, see page 3 - 9).

Procedure:

1. Set and confirm the type number for setting the initial display.
2. Select and confirm **6. Menu Setting**.

```
                  TYPE [  1]:
[1]  TYPE                   Rest:
 No.   1
6.  Menu Setting
  61.  Screen Display          Main Menu
  62.  Checker Pattern         Response
  63.  Make Bright at NG       No
  64.  Detect Position         On
  65.  Status Display          Time
```

3. Select the item that you want to set, and confirm your selection to display the selection menus (for details, see page 3 - 9). Use the cursor lever to select the display items.

- **1.Screen Display**
  - **Off**
  - **Main Menu**
  - **Data Monitor**
  - **Checker List**
  - **Spreadsheet**
- **2.Checker Pattern**
  - **Off**
  - **Fixed**
  - **Response**
- **3.Make Bright at NG**
  - **Yes**
  - **No**

  **Fixed at No when the checker pattern display is set to off.*
- **4.Detect Position**
  - **Off**
  - **On**

  **Fixed at Off when the checker pattern display is set to Fixed.*
- **5.Status Display**
  - **Off**
  - **Outputs**
  - **Time**

4. Press <Enter> to confirm.

Initializing All Type Data

Returns all type settings to the original factory settings. Note that if you select this, all the type data you have entered will be deleted.

Procedure:

1. Select **7. Initialize all Types** and confirm with <Enter>
   A message saying, “CAREFUL! Type data will be lost. OK?” is displayed.

2. Enter **YES** to delete all types. Enter **NO** to go back without deleting.

Note **Be careful when using this option because ALL type data are irretrievably deleted.**

After executing Initialize All Types, if no type is set, you will not return to the main menu. Enter a type number and press <Enter> to set a type.

CHAPTER 6

Position and Rotation Adjustment

Position and Rotation Adjustment

Position and rotation adjusters find the difference of adjustment required between the coordinates recorded as setup (reference point) and the coordinates found when executed. Individual checkers come under a position and rotation adjuster group, and by applying the amount of adjustment, checker coordinates can be adjusted by an appropriate amount for inspection. The detection methods available for position and rotation adjusters are binary edge checkers, gray edge checkers, feature extractors, and matching. (Settings for base checker.) Base checkers with different methods of inspection cannot be combined into one position and rotation adjuster. For instance, for position adjustment, it is not possible to use a binary edge checker for horizontal adjustment and a feature extractor for vertical adjustment.
14 different position and rotation adjuster modes are available with different types of base checker and different methods of inspection.

```
        TYPE[ 1] :
[1] POS.ROT. ADJ.
No. 1
1.  GRAY  EDGE  DETECTION
2.  MATCHING
```

Gray Edge Detection
- Pos. Adj
- Hor. Det. Rot. Adj
- Ver. Det. Rot. Adj

Matching
- One Chkr. Pos. Adj
- Theta Rot. Adj
- One Chkr. Rot. Adj
- Two Chkr. Rot. Adj

Note **In order to make the appropriate adjustments, the VISION CONTROLLER uses checker functions to provide position and rotation adjustment. Consequently, you need to be aware of the functions of inspection checkers in order to set adjusters. First users of the VISION CONTROLLER should read chapters** Gray-Scale Edge detection Checkers **and** Smart Matching **in order to gain an understanding of the basics of the various inspection checkers.**

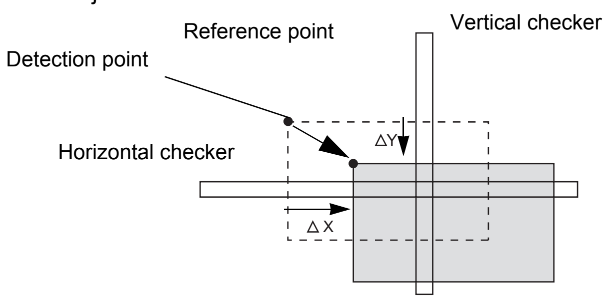
Position/Rotation Adjustment Modes

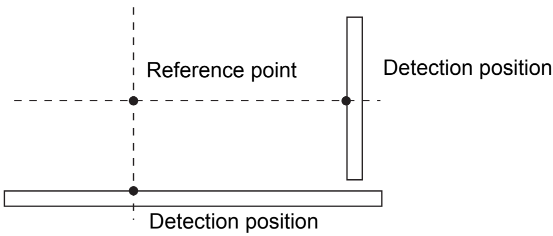
Gray-Scale Edge Detection Checkers

The following sections contain information on position or position and rotation adjustment with gray edge checkers.

Position Adjustment

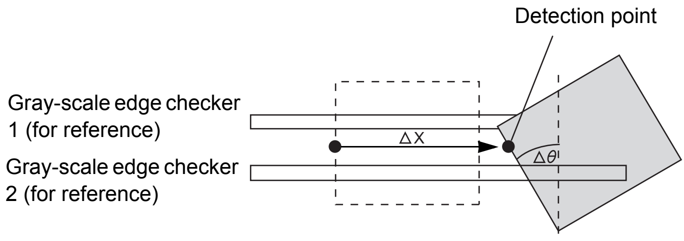
Gray edge checkers are used as the base checkers, calculating adjustments ∆X and ∆Y from the results of vertical and horizontal scanning checkers. Shapes available are lines and planes, with a mixture of the two being possible.
If position adjustment needs to be performed in only one direction, it is sufficient to set either only the horizontal or the vertical checker. If you set both position adjustment checkers, you can specify the priority to determine which checker will be executed first. Edge detection is performed in Front detection position mode.
The reference point is the intersection between vertical and horizontal lines passing through the coordinate obtained by the horizontal checker and the coordinate obtained by the vertical checker.
The distance between the reference point and the detection point is the amount of adjustment.

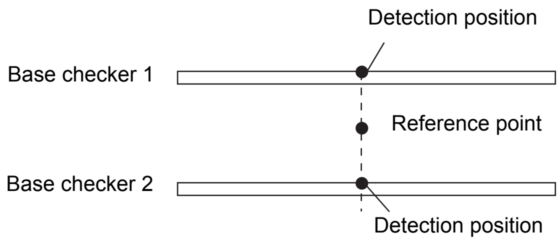




Horizontal Detection Rotation Adjustment

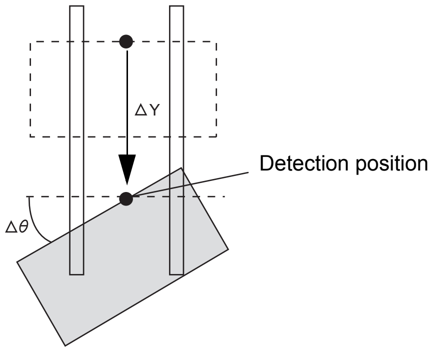
Gray-scale edge checkers are used as the base checkers, and the amount of adjustment ΔX $\Delta\theta$ (angle of rotation) is calculated from the results of two horizontal checkers. Shapes available are lines and planes, with a mixture of the two being possible.
Since the amount of adjustment is calculated from the results of two base checkers, the reference position cannot be set unless two checkers are set.
Edge detection is performed in Front detection position mode.
The reference point is the center point of the coordinate obtained by checker 1 and the coordinate obtained by checker 2.

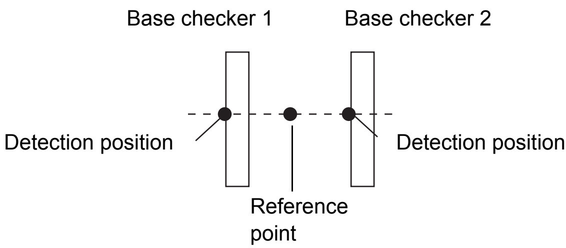




Vertical Detection Rotation Adjustment

Gray-scale edge checkers are used as the base checkers, and the amount of adjustment ΔY $\Delta\theta$ (angle of rotation) is calculated from the results of two vertical checkers. Shapes available are lines and planes, with a mixture of the two being possible.
Since the amount of adjustment is calculated from the results of two base checkers, the reference position cannot be set unless two checkers are set.
Edge detection is performed in Front detection position mode.
The reference point is the center point of the coordinate obtained by checker 1 and the coordinate obtained by checker 2.



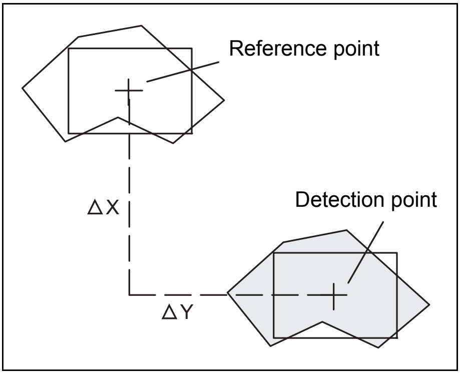


Matching Checker

The following sections contain information on position or position and rotation adjustment with matching checkers.

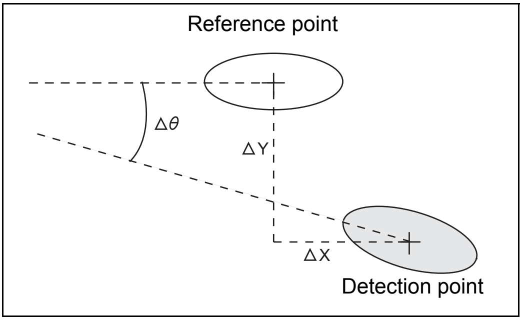
One-Checker Position Adjustment

The amount of adjustment ∆X, ∆Y, can be calculated from the results of using a single matching checker as the base checker.
The reference point is the detection position sought using matching, and any one point can be selected from a maximum of 5 detection results.



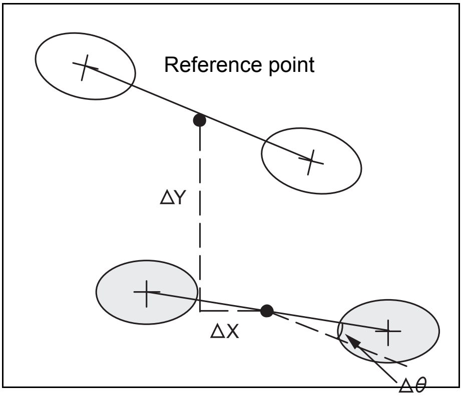
Theta Rotation Adjustment

The amount of adjustment ΔX, ΔY, Δθ can be calculated from the results of using a single matching checker as the base checker.
The reference point is the detection position sought using matching, and any one point can be selected from a maximum of 5 detection results.
The rotation angle is the difference between the detection angle when the reference was set up and the detection angle sought with this execution.



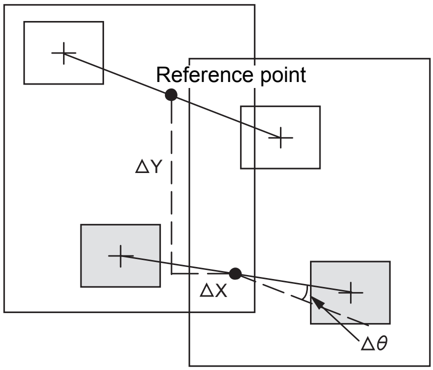
One Checker Rotation Adjustment

If the object has two distinctive features, use these for position and rotation adjustment. With the help of the two features, the amount of adjustment ΔX, ΔY, Δθ can be calculated. You only need one singe matching checker to detect the two features.
The reference point is the detection position sought using matching, and any two points can be selected from a maximum of 5 detection results. The reference point becomes the midpoint between those two points.
The rotation angle Δθ is calculated from two angles as follows: During setup, the XUVM230 calculates the angle between a virtual horizontal line and the line generated by the two points selected. When you execute the rotation adjustment checker, the XUVM230 detects the two points in the object and calculates the angle again. After adjusting the checker by the amount of adjustment ΔX and ΔY, the rotation angle is applied as the result of angle 1 minus angle 2.



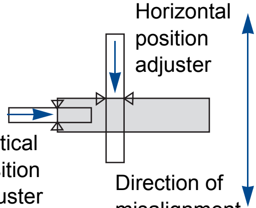
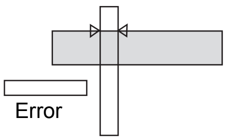
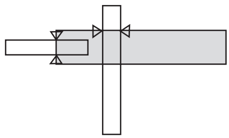
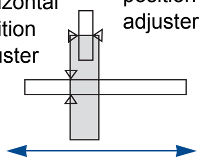
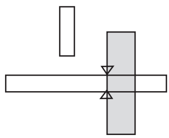
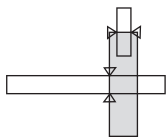
Two Checker Rotation Adjustment

If the object has two distinctive features, use these for position and rotation adjustment. With the help of the two features, the amount of adjustment ΔX, ΔY, $\Delta\theta$ can be calculated. Only rectangle can be set as the shape. Unlike the method described in previous §, you set one matching checker for each feature.
The rotation angle is the angle at the intersection of the line created by the two points selected during reference setup when the ΔX and ΔY adjustment values were generated for the amount the reference point must be moved and the line created by the two points detected when the command was executed.



Priority

For position adjustment using binary edge checkers, or position adjustment using gray-scale edge checkers, the checkers can be prioritized. The checker with the higher priority is executed first. The result is used to adjust the second checker before executing it.

	Checker setting	*Priority not specified*	*Priority specified*
Priority to vertical adjustment	Horizontal position adjuster  Vertical position adjuster Direction of misalignment	 Error	 Priority given to vertical adjustment
Priority to horizontal adjustment	Vertical position adjuster Horizontal position adjuster  Direction of misalignment	Error 	 Priority given to horizontal adjustment

Priority can be assigned to the horizontal checker and thus prevents the vertical checker from causing a detection error.

Setting the Base Position

A position and rotation adjuster is a checker that obtains the amount of adjustment between the coordinates (base or reference point) set at the time the checker is set up, with the coordinates at the time the checker is executed. A test must be conducted to set the base point. Press <A> to perform a test run.
The following confirmation message is displayed if you attempt to terminate the setting procedure without conducting a test and setting a reference (base) position.

```
No base position has been set. Cancel?
           [YES]   [NO]
```

If you select **YES**, the settings and changed data will be lost. Unless you want to abandon the setup procedure and lose the settings, select **NO** and set the reference position as described below:

Procedure:

1. Define the reference checker number and type
   For an example of defining a position adjustment with a binary edge checker see page 6 - 14.

2. Select **Base Position**

3. Press <A> to test the reference checker
   The base position is displayed. With an edge checker, the system highlights the detected edge.

4. Press <Enter> to confirm the detected base position
   Pressing <C> cancels the process of setting the base position. Please note that you cannot leave the reference checker setup without either setting a base position or deleting the reference checker.

The base position is cleared whenever changes are made to shape, area, or priority setting. When any of these items have been changed, set the base position and the position and rotation adjuster again.
If only a horizontal base checker has been set, the display shows only the value for the X coordinate, and if only a vertical base checker has been set, the display shows only the value for the Y coordinate. (for position and rotation adjustment, the angle is fixed and displayed as 0, and for rotation adjustment, the reference angle is displayed.) The amount of adjustment for a direction which has not been set is fixed and displayed as 0.
When the reference position has been reset, checkers dependent on the adjustment are displayed at the newly adjusted positions.

Note **Conditions for changing execution position:**

When position and rotation adjuster is set:
Each checker is reset with angle 0 close to the previous execution position.

When position and rotation adjuster has been deleted:All dependent checkers return to their original setting positions. The next execution is from the setting position.

Setting a Position/Rotation Adjustment Checker

The only time that it is possible for you to select the type for a position/rotation adjustment checker is when you are creating a new one. If a checker has already been set for the number that you select, either select a new number or delete the checker set for the selected number and perform the settings again.

Gray-Edge Detection Checkers

This explains how to use a gray-scale edge checker as an adjustment checker.
If you are unfamiliar with the operation of gray-scale edge detection checkers, see page 10 - 3.

Position Adjustment

You can set horizontal and vertical checkers, and it is possible to use them for adjustment on their own or together. When using vertical and horizontal checkers together, you can specify which checker has priority.

Procedure:

1. Select the position adjustment checker number

```
          TYPE[ 1] :
[1] POS.ROT. ADJ.
No. 1
1.  GRAY  EDGE  DETECTION
2.  MATCHING
```

2. Select **1. GRAY EDGE DETECTION**

```
[1] POS. ROT. ADJ
No. 1
1. GRAY EDGE DETECTION
     11.  Pos. Adj.
     12.  Hor. Det. Rot. Adj.
     13.  Ver. Det. Rot. Adj.
```

3. Select **11. Pos. Adj.**
   The setting menu for position adjustment using gray edge detection is displayed.

```
[1] POS. ROT. ADJ.          Jud:NG              ΔX:-----
 No. 1                                          ΔY:-----
 Gray Edge :Pos. Adj.                           Δθ:-----
 1.  Select Camera              A
 2.  Horizontal Checker       Empty
 3.  Vertical Checker         Empty
 4.  Priority
 5.  Base Pos.              (-----, -----, -----)
 6.  Pos. Rot. Adj. Group         0
 7.  Delete Checker
```

Available Option	*Usage*	*Details*
1. Select Camera	Select either the camera A or camera B image for operating the position adjustment checker.	see page 9 - 3
2. Horizontal Checker	Use these to create the checker and set items such as the scan conditions.	see page 6 - 4
3. Vertical Checker		see page 6 - 5
4. Priority	Use this to specify which checker result is to have priority as necessary (either vertical or horizontal).	see page 6 - 11
5. Base Pos.	Execute a test to register the reference position for adjustment.	see page 6 - 12
6. Pos. Rot. Adj. Group	Set which checker is to be used for adjustment if you are using multiple settings for position and rotation adjustment. Select a group number.	see page 6 - 32
7. Delete Checker	Use this to delete a checker. If you have created both a vertical and a horizontal checker, select which one you want to delete (**Both, Hor. Only, Ver. Only**).	see page 4 - 34

Note **If you delete a Position Adjustment checker, the inspection results for all checkers that follow the deleted checker are cleared.**

4. Select **2. Horizontal Checker** to display the checker setting menu
   The setting procedure is the same for both vertical and horizontal checkers. Here we will set a horizontal checker.

```
[1] POS. ROT. ADJ.
 No. 1
 Gray Edge :Pos. Adj.
 2. Horizontal Checker
    21.  Shape                       Plane
    22.  Scan mode
    23.  Area   ( 206, 200)-( 305, 279)
    24.  Edge Condition            Both
    25.  Edge Thres.Value            50
    26.  Scan Pitch                  1
    27.  Filter                      3
    28.  Width                       5
    29.  Average Area                5
```

   For details on the checker settings, see page 11 - 3.
   This same menu is displayed when you select **3. Vertical Checker.**

5. Set the vertical checker, if required

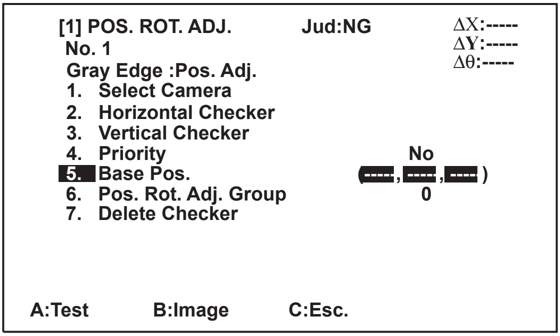
6. Press <C> to return to the **POS. ROT. ADJ.** menu

7. Select **4. Priority** to specify whether the vertical or horizontal checker results are to have priority
   When you select **4. Priority,** the following menu is displayed.

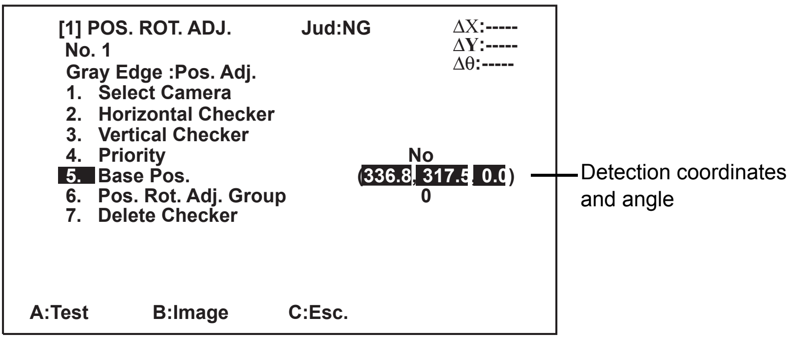
```
Priority
   No
  Hor.
  Ver.
```

8. Make the appropriate selection
   For details, see page 6 - 11.

9. Select **5. Base Position**
   For details on setting the reference position, see page 6 - 12.



10. Press <A:Test> to display the current detection coordinates and angle



Note **Press <B:Image> to check the reference position using the image.**

11.Press <Enter> to register the displayed coordinates and angle as the base position
The adjustment amounts (ΔX, ΔY and Δθ) are displayed at the top right of the screen.

```
[1] POS. ROT. ADJ.        Jud:NG          ΔX:----0
 No. 1                                    ΔY:----0
 Gray Edge :Pos. Adj.                     Δθ:--0.0
 1.  Select Camera                 A
 2.  Horizontal Checker
 3.  Vertical Checker
 4.  Priority                        No
 5.  Base Pos.               (336.8, 317.5, 0.0)
 6.  Pos. Rot. Adj. Group             0
 7.  Delete Checker

A:Test       B:Image       C:Esc.
```

Adjustment amounts

Horizontal or Vertical Detection Rotation Adjustment

The setting method for the two checker types is identical, and you must set two checkers. In this example we will perform the settings for a horizontal detection rotation adjustment checker.

Procedure:

1. Select the position/rotation adjustment checker number

```
                 TYPE[ 1] :
[1] POS.ROT. ADJ.
 No. 1
 1.   GRAY   EDGE   DETECTION
 2.   MATCHING
```

2. Select **1. GRAY EDGE DETECTION**

```
[1] POS. ROT. ADJ
 No. 1
 1.  GRAY EDGE DETECTION
      11.  Pos. Adj.
      12.  Hor. Det. Rot. Adj.
      13.  Ver. Det. Rot. Adj.
```

3. Select **12. Hor. Det. Rot. Adj.**
   The setting menu for position adjustment using gray edge detection is displayed.

```
[1] POS. ROT. ADJ.          Jud:NG          ΔX:-----
 No. 1                                      ΔY:-----
 Binary Edge :Hor. Det. Rot.                Δθ:-----
 1.   Select Camera              A
 2.   Checker1                 Empty
 3.   Checker2                 Empty
 4.   Base Pos.          (-----,------,-----)
 5.   Pos. Rot. Adj. Group       0
 6.   Delete Checker
```

Available Option	Usage	Details
1. Select Camera	Select either the camera A or camera B image for operating the position adjustment checker.	see page 4 - 24
2. Checker 1	Use these to create the checkers and set items such as the scan conditions.	see page 6 - 5
3. Checker 2		see page 6 - 6
4. Base Pos.	Execute a test to register the base position for adjustment.	see page 6 - 12
5. Pos. Rot. Adj. Group	Set which checker is to be used for adjustment if you are using multiple settings for position and rotation adjustment. Select a group number.	see page 6 - 32
6. Delete Checker	Use this to delete a checker. If you have created both a vertical and a horizontal checker, select which one you want to delete (**Both, Hor. Only, Ver. Only**).	see page 4 - 34

Note **If you delete a position adjustment checker, the inspection results for all checkers that follow the deleted checker are cleared.**

4. Select either **Checker 1** or **Checker 2**
   The setting procedure is the same for both checkers. Here we will use Checker 1 as an example.

5. Select **Checker 1** to display the **Checker 1** setting menu

```
[1] POS. ROT. ADJ.
 No. 1
 Gray Edge :Hor. Det. Rot.
 2.  Checker 1
     21.  Shape                        Plane
     22.  Scan mode
     22.  Area                  ( 206, 200)-( 305, 279)
     23.  Edge Condition               Both
     24.  Edge Thres.Value             50
     25.  Scan Pitch                   1
     26.  Filter                       3
     27.  Width                        5
     28.  Average Area                 5
```

For details on the checker settings, see page 11 - 3.

6. Set the other checker, if required

7. Press <C> to return to the **POS. ROT. ADJ.** menu

8. Select **4. Base Position**
   For details on setting the reference position, see page 6 - 12.

```
[1] POS. ROT. ADJ.          Jud:NG          ΔX:-----
 No. 1                                      ΔY:-----
 Gray Edge :Hor. Det. Rot.                  Δθ:-----
 1.   Select Camera                   A
 2.   Checker 1
 3.   Checker 2                     Empty
 4.   Base Pos.               (-----, -----, -----)
 5.   Pos. Rot. Adj. Group            0
 6.   Delete Checker


A:--------       B:Image        C:Esc.
```

9. Press <A:Test> to display the current detection coordinates and angle

```
[1] POS. ROT. ADJ.          Jud:NG          ΔX:-----
 No. 1                                      ΔY:-----
 Gray Edge :Hor. Det. Rot.                  Δθ:-----
 1.   Select Camera                   A
 2.   Checker 1
 3.   Checker 2
 4.   Base Pos.               (360.4, 209.0, 14.9)
 5.   Pos. Rot. Adj. Group            0
 6.   Delete Checker


A:--------       B:Image        C:Esc.
```

Detection coordinates and angle

Note **Press <B:Image> to check the reference position using the image.**

10. Press <Enter> to register the displayed coordinates and angle as the base position
The adjustment amounts (ΔX, ΔY and Δθ) are displayed at the top right of the screen.

```
[1] POS. ROT. ADJ.          Jud:NG          ΔX:----0
 No. 1                                      ΔY:----0
 Gray Edge :Hor. Det. Rot.                  Δθ:--0.0
 1.   Select Camera                 A
 2.   Checker 1
 3.   Checker 2
 4.   Base Pos.               (360.4, 290.0, 14.9)
 5.   Pos. Rot. Adj. Group          0
 6.   Delete Checker

A:--------      B:Image      C:Esc.
```

Adjustment amounts

Matching Checker

This explains how to use a matching checker as an adjustment checker. If you are unfamiliar with the operation of matching checkers, see page 9 - 3.

One Checker Position Adjustment

Procedure:

1. Select the position/rotation adjustment checker number

```
                TYPE[ 1] :
[1] POS.ROT. ADJ.
No. 1
1.  GRAY  EDGE  DETECTION
2.  MATCHING
```

2. Select **2. MATCHING**

```
[1] POS. ROT. ADJ.
No. 1
2.  MATCHING
    21.  One Chkr. Pos. Adj.
    22.  Theta Rot. Adj.
    23.  One Chkr. Rot. Adj.
    24.  Two Chkr. Rot. Adj.
```

3. Select **21. One.Chk.Pos.Adj.**
   The setting menu for position adjustment using matching is displayed.

```
[1] POS. ROT. ADJ.          Jud:NG                ΔX:-----
No. 1                                             ΔY:-----
Matching :One Chkr. Pos.                          Δθ:-----
1.  Select Camera                       A
2.  Checker Setting                   Empty
3.  Base Pos.                  (-----, -----, -----)
4.  Pos. Rot. Adj. Group                0
5.  Delete Checker
```

Available Option	Usage	Details
1. Select Camera	Select either the camera A or camera B image for operating the position adjustment checker.	see page 4 - 24
2. Checker Setting	Use this to create the checker and set items such as the scan conditions.	see page 9 - 5
3. Base Pos.	Execute a test to register the base position for adjustment.	see page 6 - 12
4. Pos. Rot. Adj. Group	Set which checker is to be used for adjustment if you are using multiple settings for position and rotation adjustment. Select a group number.	see page 6 - 32
5. Delete Checker	Use this to delete a checker.	see page 4 - 34

Note **If you delete a position adjustment checker, the inspection results for all checkers that follow the deleted checker are cleared.**

4. Select 2. Checker Setting

```
[1] POS. ROT. ADJ.
 No. 1
 Matching:One Chkr. Pos.
 2.   Checker Setting
      21.  Template
        (      ,      )-(      ,      )/(      ,      )
      22.  Search Area
        (     0,     0)-(  511,  479)
      23.  Sequence
      24.  Output Unit            No
      25.  Check Template
```

For details on the checker settings, see page 9 - 5. Note, however, there is no rotation setting in **23. Sequence**, and no theta setting in **241. Sorting** under **24. Output Unit**. This same menu is displayed when you select **Vertical Checker.**

5. Set the vertical checker, if required

6. Press <C> to return to the **POS. ROT. ADJ.** menu

7. Select **3. Base Position**

8. Press <A:Test> to display the current detection coordinates, detection angle, and correlation for a maximum of five points

[1] POS. ROT. ADJ.
No. 1
Matching :One Chkr. Pos.
3. Base Position

No	Grav.		Area	Theta
	X	Y		
1	316.5	275.5	0.0	1.00
2				
3				
4				
5				

A:Test B:Pos. Dsp. C:Esc.

9. Press <Enter> to register the selected coordinates and angle

10. Press <C> to return to the setting menu
When you return to the setting menu, the adjustment amounts (ΔX, ΔY and $\Delta\theta$) are displayed at the top right of the screen.

11. Press <B> to confirm the base position for the image
With <C> you cancel setting the base position.

Theta Rotation Adjustment

Procedure:

1. Select the position/rotation adjustment checker number

```
TYPE[ 1] :
[1] POS.ROT. ADJ.
No. 1
1.  GRAY  EDGE  DETECTION
2.  MATCHING
```

2. Select **2. MATCHING**

```
[1] POS. ROT. ADJ.
No. 1
2.  MATCHING
    21.  One Chkr. Pos. Adj.
    22.  Theta Rot. Adj.
    23.  One Chkr. Rot. Adj.
    24.  Two Chkr. Rot. Adj.
```

3. Select **22. Theta Rot. Adj.**
   The setting menu for position adjustment using matching is displayed.

```
[1] POS. ROT. ADJ.          Jud:NG          ΔX:-----
No. 1                                       ΔY:-----
Matching :Theta Rot.                        Δθ:-----
1.  Select Camera                 A
2.  Checker Setting               Empty
3.  Base Pos.                (-----, -----, -----)
4.  Pos. Rot. Adj. Group          0
5.  Delete Checker
```

Available Option	*Usage*	*Details*
1. Select Camera	Select either the camera A or camera B image for operating the position adjustment checker.	see page 4 - 24
2. Checker Setting	Use this to create the checker and set items such as the scan conditions.	see page 6 - 5
3. Base Pos.	Execute a test to register the base position for adjustment.	see page 6 - 12
4. Pos. Rot. Adj. Group	Set which checker is to be used for adjustment if you are using multiple settings for position and rotation adjustment. Select a group number.	see page 6 - 32
5. Delete Checker	Use this to delete a checker.	see page 4 - 34

Note **If you delete a position adjustment checker, the inspection results for all checkers that follow the deleted checker are cleared.**

4. Select **2. Checker Setting**

```
[1] POS. ROT. ADJ.
 No. 1
 Matching:Theta Rot.
 2.  Checker Setting
     21.  Template
       (260,233)-(359,312)/(309,272)
     22.  Search Area
       (     0,      0)-(  511,  479)
     23.  Sequence
     24.  Output Unit             No
     25.  Check Template
```

For details on the checker settings, see page 9 - 5. Note, however, there is no rotation setting in **23. Sequence**, and no theta setting in **241. Sorting** under **24. Output Unit**.

5. Press <C> to return to the **POS. ROT. ADJ.** menu

6. Select **3. Base Pos.**

7. Press <A:Test> to display the current detection coordinates, detection angle, and correlation for a maximum of five points

[1] POS. ROT. ADJ.
No. 1
Feat. Extr. :Theta Rot.
3. Base Position

No	Grav.		Area	Theta
	X	Y		
1	325.1	276.4	1454	40.6
2	416.3	371.8	1200	34.2
3				
4				
5				

A:Test B:Pos. Dsp. C:Esc.

8. Press <Enter> to register the selected coordinates and angle

9. Press <C> to return to the setting menu
When you return to the setting menu, the adjustment amounts (ΔX, ΔY and $\Delta\theta$) are displayed at the top right of the screen.

10. Press <B> to confirm the base position for the image
With <C> you cancel setting the base position.

One Checker and Two Checker Rotation Adjustment

One checker rotation adjustment uses one checker, and two checker rotation adjustment uses two checkers. With two checker rotation adjustment there are two types of checker settings, but the setting method for each is the same as that for one checker rotation adjustment.

Procedure:

1. Select the position/rotation adjustment checker number

```
                TYPE[ 1] :
[1] POS.ROT. ADJ.
No. 1
1.  GRAY  EDGE  DETECTION
2.  MATCHING
```

2. Select **2. MATCHING**

```
[1] POS. ROT. ADJ.
 No. 1
 2.  MATCHING
     21.  One Chkr. Pos. Adj.
     22.  Theta Rot. Adj.
     23.  One Chkr. Rot. Adj.
     24.  Two Chkr. Rot. Adj.
```

3. Select **23. One Chkr. Rot. Adj.**
   The setting menu for position adjustment using matching is displayed.

```
[1] POS. ROT. ADJ.        Jud:NG              ΔX:-----
 No. 1                                        ΔY:-----
 Matching :One Chkr. Rot.                     Δθ:-----
 1.  Select Camera                  A
 2.  Checker Setting              Empty
 3.  Base Pos.             (-----, -----, -----)
 4.  Pos. Rot. Adj. Group           0
 5.  Delete Checker
```

Available Option	*Usage*	*Details*
1. Select Camera	Select either the camera A or camera B image for operating the position adjustment checker.	see page 4 - 24
2. Checker Setting or 2. Checker 1 and 3. Checker 2 for two-checker rotation adjustment	Use this to create the checker and set items such as the scan conditions.	see page 6 - 5
3. Base Pos.	Execute a test to register the base position for adjustment.	see page 6 - 12
4. Pos. Rot. Adj. Group	Set which checker is to be used for adjustment if you are using multiple settings for position and rotation adjustment. Select a group number.	see page 6 - 32
5. Delete Checker	Use this to delete a checker.	see page 4 - 34

Note **If you delete a position adjustment checker, the inspection results for all checkers that follow the deleted checker are cleared.**

4. Select **2. Checker Setting**

```
[1] POS. ROT. ADJ.
 No. 1
 Matching:Theta Rot.
 2.   Checker Setting
      21.  Template
           (238,225)-(337,304)/(287,264)
      22.  Search Area
           (     0,     0)-(  511,  479)
      23.  Sequence
      24.  Output Unit              No
      25.  Check Template
```

For details on the checker settings, see page 9 - 5. Note, however, there is no rotation setting in **23. Sequence**, and no theta setting in **241. Sorting** under **24. Output Unit**.

5. Press <C> to return to the **POS. ROT. ADJ.** menu

6. Select **3. Base Pos.**

7. Press <A:Test> to display the current detection coordinates, detection angle, and correlation for a maximum of five points

[1] POS. ROT. ADJ.
No. 1
Matching :One Chkr. Rot.
3. ref. point 1 : Ref. point

No	Co.X	Co.Y	Theta	Corre.
1	287.8	265.0	0.0	0.80
2	286.5	427.0	0.0	0.75
3				
4				
5				

In the example the XUVM230 detects two points.

8. Select one of the points as **Ref. Point 1**

9. Move the cursor lever to the left or right to display **Ref. Point 2**

[1] POS. ROT. ADJ.
No. 1
Matching :One Chkr. Rot.
3. ref. point 2 : Ref. point

No	Co.X	Co.Y	Theta	Corre.
1	287.8	265.0	0.0	0.80
2	286.5	427.0	0.0	0.75
3				
4				
5				

10. Select a different point as Ref. Point 2

Note **It is very important to select different points for** Ref. Point 1 **and** Ref. Point 2. **Otherwise the XUVM230 will not be able to calculate the correct amount of adjustment during inspection.**

---

11. Press <Enter> to register the selected coordinates and angle for the two reference points
    Pressing <Enter> returns you to the setting menu. The adjustment amounts (ΔX, ΔY and $\Delta\theta$) are displayed at the top right of the screen.

12. Press <B> to confirm the base position for the image
    With <C> you cancel setting the base position.

Position Adjustment Groups

A particular position adjustment is associated with checkers by specifying the position adjustment group number for the checker to use. Inspection checkers initially have the position adjustment group number set to “0”, which means OFF. If you want a checker to use a position adjuster, you must first define the position adjustment, then specify its position adjustment group number.

Note **After defining a position adjuster, be sure to give it a group number so that other checkers can use it for position adjustment.**

Specifying the Group Number

When defining an inspection checker, set the number of the position adjustment group to be used by highlighting the group number. The initial value for the group number is “0”.

Note **If you are going to carry out position adjustment followed by a further position adjustment, be sure to set the group number (i.e. the position adjustment number corresponding to the adjustment). The position will not be adjusted if the group number is “0”.**

If you are using nested position adjustments (using a further position adjuster to act on the result of an earlier position adjuster), make sure the earlier position adjustment number is lower than the later position adjustment number.

Position adjusters are executed in ascending number order (i.e. the lowest number goes first). This is why you need to ensure that earlier position adjusters have lower numbers.

Ex:

For checker areas R1 and R2 set the parameter **Pos. Rot. Adj. Group = 1** (abbreviated to ”G” in the figures below), as shown in Figure 1.
Because both checkers use the same position adjustment group the whole workpiece can be inspected reliably with only a single position adjuster, even if the workpiece is misaligned as shown in Figure 2. The dotted line rectangles indicate the areas inspected by the checkers..

Figure 1

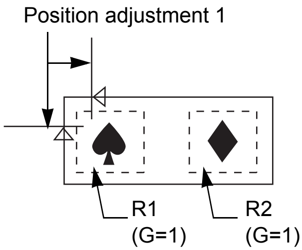
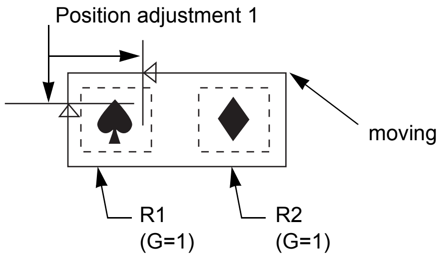
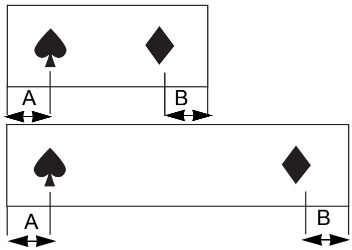


Figure 2

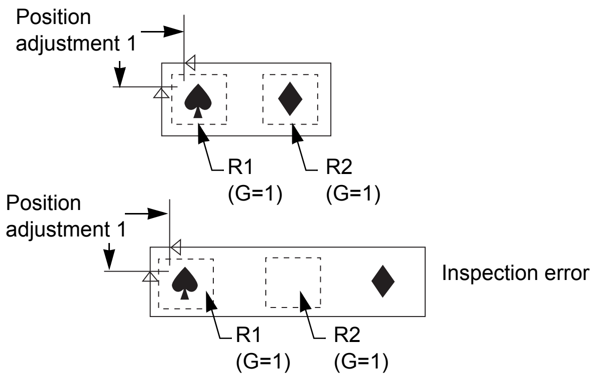


Ex:

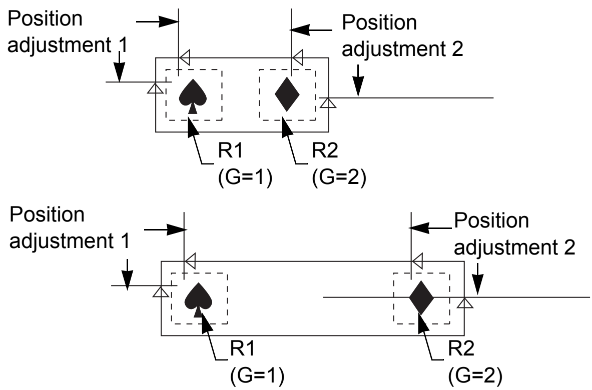
Keeping the same checker settings as example 1, two workpieces of different dimensions are inspected. See how the position adjustment group number affects the result when the length of the workpiece varies..



(1)Inspection using only one group, group No.1 (G=1): Because only a single position adjustment is performed, the position is only properly adjusted for one of the checkers. The other checker does not inspect the correct position..

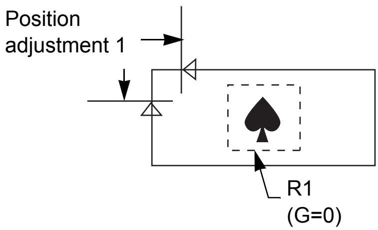


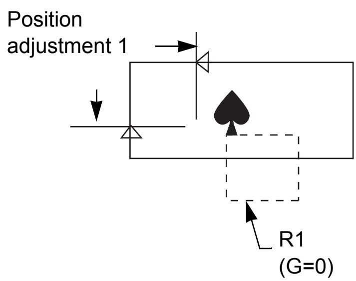
(2)Inspection using two separate groups, group No.1 (G=1) and No.2 (G=2): Position adjustment is carried out independently for each checker, so the checkers can move on both sides. .



Ex:

If the position adjustment group No. is “0”, no adjustment is performed, and the checker always inspects the same position.

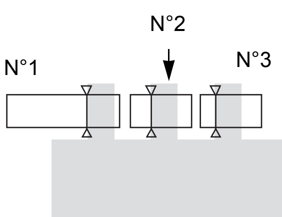




Note **If you find that the position is not adjusted despite having defined position adjustment checkers, the cause may be that the inspection checker still has its group number set to “0”. Consider examples 1 and 2 and set the group number appropriately.**

Ex:

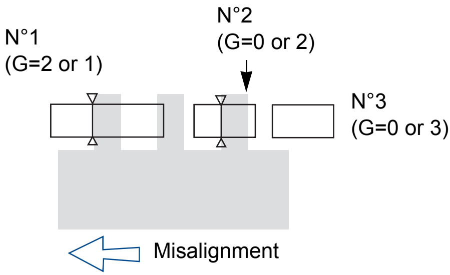
By specifying the position adjustment group number, a position adjuster can be set to adjust the result of an earlier position adjuster (multiple position adjustment). This can be repeated to give several layers of nesting. The example below shows three position adjusters. The numbers represent the position adjuster number set from the position adjustment menu.



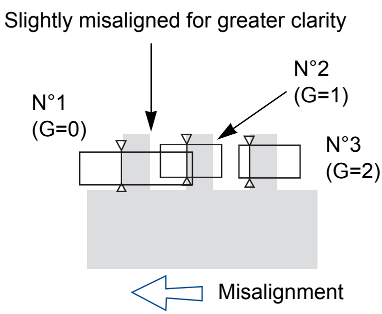
Ex:

If a displaced workpiece is then inspected, the result differs according to the group number settings.

(1)When the position adjusters have all been set independently: If the group numbers are all different or all set to “0” as shown below, inspection will only be performed by those checkers which have not gone outside the search area**.**



(2) When the position adjusters have been nested, each adjusting the result of the previous adjuster: Each adjuster works on the result of the position adjustment checker specified by the group number, so that all the edges required are successfully detected.



Position adjustment N°1

Follow-up — *Adjustment for Group No.1*

Position adjustment N°2

Follow-up — *Adjustment for Group No.2*

Position adjustment N°3

Ex:

No.2 is adjusted in accordance with the amount of movement of No.1, and No.3 is adjusted in accordance with the amount of movement of No.2. By setting the position adjustments in this way, it is possible to have a position adjustment checker based on the results of an earlier position adjustment checker. This is known as ”nesting” position adjusters or multiple position adjustment..

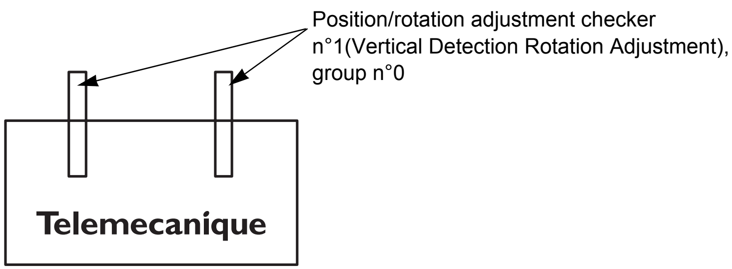
Note **If you want to adjust position adjustments (i.e. to nest position adjustments), ensure that the later adjuster specifies a group number lower than its own number.**

Multiple Position/Rotation Adjustment Checkers

It is possible to set multiple position/rotation adjustment checkers for one image. The position/rotation adjustment checkers are executed in order from the smallest checker number.
Set a checker in rotation adjustment mode and set a position adjustment mode checker to follow this. With this type of setting, it is possible to adjust subsequent checkers by the movement adjustment (ΔX and ΔY) and the rotation adjustment ($\Delta\theta$).

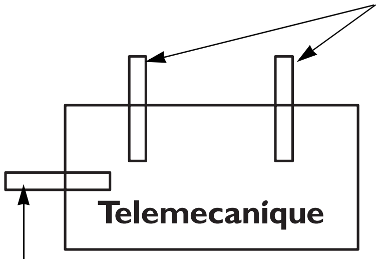
Procedure:

1. Create position/rotation adjustment checker No. 1
2. Select **1. Gray Edge Detection**
3. Select **13. Ver. Det. Rot. Adj.**
4. Set the reference checker area and conditions
   For details, see page 6 - 19.
5. Set the base position
   For details, see page 6 - 22.



6. Set Position/Rotation Adjustment Group No. 0
7. Create position/rotation adjustment checker No. 2
8. Select **1. Gray Edge Detection**
9. Select **11. Pos. Adj.**
10. Set the reference checker area and conditions

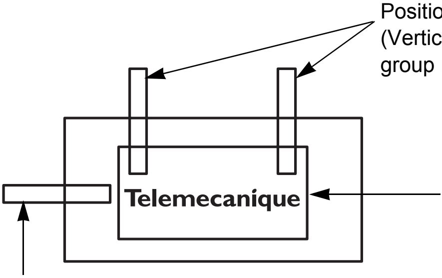
11.Set the base position



12.Set Position/Rotation Adjustment Group No. 1

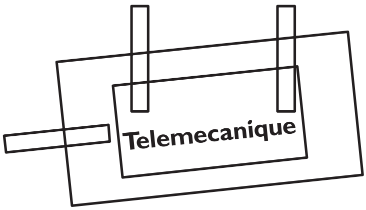
13.Create Smart Matching checker No. 1

14.Set the area and conditions for the checker.



15.Set Position/Rotation Adjustment Group No. 2

When you execute the inspection, the position/rotation adjustment checker No. 1 will execute and adjust position/rotation adjustment checker No. 2. The adjustment amount of position/rotation adjustment checker No. 2 will be used to adjust the smart matching checker so that inspection is performed in the best possible position.



CHAPTER 7

Dictionary and Character Recognition

Introduction

About Character Recognition

The XUVM230 character recognition recognizes characters using the neural net. To be concrete, this function checks one by one letters or symbols extracted within a set area to compare with the character image registered in a dictionary beforehand and reads the label attached to the one in a dictionary in the highest match (recognition values). 1 checker can recognize up to 16 characters.
The character recognition checker can output the recognized character string using the serial port to the external device. In addition, if you register a judgment character string beforehand, this judges whether the recognized string matches the registered (called overall judgement) and judges the letters one by one (Individual judgement), of which results can be output to the external device.

About the Dictionary

The typeface (called font hereafter) of the characters to be read are “registered” and “learned” in the dictionaries. The character recognition checker reads the characters based on these dictionaries. Character recognition type XUVM230 has five dictionaries that can only be used for the character recognition function and up to 40 characters can be registered in each. OCR-B font is registered in the Dictionary No. 1 and OCR-A font in the Dictionary No. 2 at shipping from the factory. (User-setting is available for all dictionaries.)
Learning is done after the registration of the extracted letters or symbols (the labeling). Learning is required each time the content of a dictionary is changed. (The XUVM230 has an “additional learning” function by which only the changed parts of a dictionary is re-learned.)

How to Work with Character Recognition

Proceed as follows to use character recognition.

1. Create a dictionary
   Register a font to be recognized into a dictionary and start the learning process.
   1. Set the segmentation conditions.
   2. Register extracted characters in a dictionary.
   3. Dictionary learns the registered characters.

2. Define the character recognition conditions
   Set the character recognition checker.
   1. Set the segmentation conditions.
   2. Set the recognition conditions (dictionary selection and recognition lower limits, etc.)
   3. Set the character string for judging the detected characters.

Dictionary

6. Dictionary
   - 1. Select Camera
   - 2. Area
   - 3. Segmentation Color
   - 4. Segment. Condition
     - 41. Segmentation Area Min.
     - 42. Filter
     - 43. Segment. Method
       - Auto Slice
       - Gray
       - Fixed Slice
     - 44. Slice Level (if Segment. Method = Auto Slice or Fixed Slice)
     - 44. Thickness (if Segment. Method = Gray)
     - 45. Noise Reduction
     - 46. Connection Level

     45 and 46: only available when Segment. Method = Gray
   - 5. Dictionary Registration
   - 6. Dictionary Check
   - 7. Learn
   - 8. Copy Dictionary
   - 9. Delete Dictionary

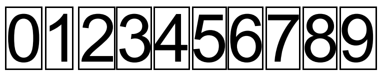
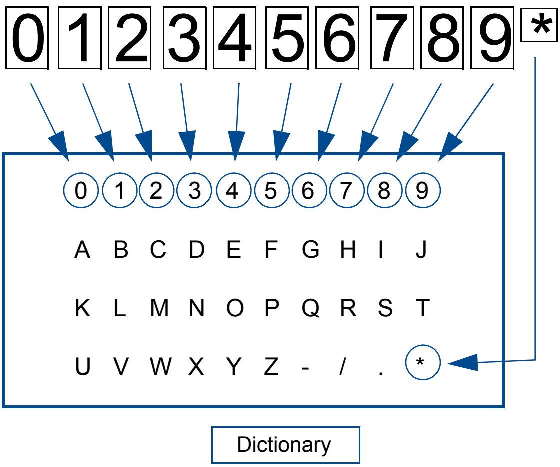
Dictionary Configuration

The character recognition package XUVM230 has five dictionaries, which can only be used for the character recognition function. You can register up to 40 characters (including symbols) in each dictionary.
OCR-B font is registered in Dictionary No.1 and OCR-A font in Dictionary No.2 at shipping from the factory. If these fonts are to be used, no dictionary creation is required.

Dictionary number	*Setting detail*	*Additional informations*
1	factory setting: OCR-B font	Delete the factory setting if you wish to create user-defined dictionaries
2	factory setting: OCR-A font	
3	factory setting : empty	user-defined dictionaries
4		
5		

Overview over the Setting Procedure

Set dictionaries according to the following procedure. The three steps from the "Flow" column are described in detail in the following sections.

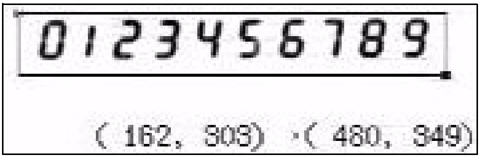
Flow	*Registerd characters :* 0123456789	*Related parameters*
1 Segmentation		– Seg.Color – Seg. Condition
2 Registrationt		– Dictionary Registration – Dictionary Check
3 Learning		– Learning (Learning and additional Learning)
Finish		

Preparing and Setting Segmentation Conditions

PROCEDURE :

1. Select the dictionary number and camera
2. Set the area where you wish to extract characters for learning with “2. Area”

   Set the area by surrounding the characters.



3. Select “**3. Segmentation Color**” to set the color of the characters to be extracted
   If the characters to be extracted are darker against a background, select “**Black**”. If the characters to be extracted are lighter against a background, select “**White**”.

Segmentation Color
White
Black

4. Select “**4. Segment. Condition**”
   This options determines how the VISION CONTROLLER segments characters. Use <A: Extract> to display on the screen what the VISION CONTROLLER has extracted. Press <C: Esc.> to return to the options in “**4. Segment. Condition**” and to adjust the conditions. Verify the result on the screen with <A: Extract>.

4. Condition Segment.	
41. Segment. Area Min.	**36**
42. Filter	**No**
43. Segment. Method	**Auto Slice**
44. Slice Level	**---**

Available option	Usage
41. Segment. Area Min.	Set the segment area minimum values of what to be extracted. This is useful for removing parts you wish NOT to be extracted, such as noise etc.
42. Filter	Contracts or expands the area in the segmentation color. If you wish to extract dotted characters, you can make extraction easier with dilatation: It expancs the dotted characters to connect the dot interval. Use erosion to contract the characters if they are light in color or with lines on the back.
43. Segment. Method	Use a slice level or gray values. For details refer to the specific section, see page 7 - 9
44. Slice Level 44. Thickness	Depending on the setting selected for “43. Segment. Method”, this option is different, seesee page 7 - 9
45. Noise Reduction 46. Connection Level	These options are only available when “43. Segment. Method” is set to “Gray”, see page 7 - 9

Note **The maximum size of 1 character (the size of the rectangular character enclosure) is 6,000 pixels, e.g. a character can be 100 (length) x 60 (width) in pixels.**

Details on “43. Segmentation Method”

Depending on the options you choose there are different parameters available. The available options are **Auto Slice**, **Gray** or **Fixed Slice**.

Segment . Method	*Parameters in “4. Segment. Condition”*	*Usage*
Auto Slice	**4. Condition Segment.** **41. Segment. Area Min. 36** **42. Filter No** **43. Segment. Method Auto Slice** **44. Slice Level ---**	Extracts the characters in the binary image (in black and white) in the area. The slice levels, threshold values for binarization, are automatically set according to the gray scale values of the pixels within the set area. The set slice levels are displayed under ”44. Slice Level” when you have selected “Auto Slice” and have pressed <A: Extract>.
Fixed Slice	**4. Condition Segment.** **41. Segment. Area Min. 36** **42. Filter No** **43. Segment. Method Fixed Slice** **44. Slice Level 128**	Extracts the characters in the binary image (black and white) in the area. The slice levels (threshold values for binarization) can be set in “44. Slice Level” from the menu “4. Segmentation Condition”. The value range is 0 to 255.
Gray	**4. Condition Segment.** **41. Segment. Area Min. 36** **42. Filter No** **43. Segment. Method Gray** **44. Thickness Thin** **45. Noise reduction 1.20** **46. Connection Level 5**	When you select this setting, different parameters become available, for details see page 7 - 9.

Additional Parameters When “43. Segmentation Method” = “Gray”

44.Thickness (Thin/Thick)

Select the width of the characters to be extracted.

45.Noise Reduction (1.00 to 2.00)

Set the level to delete the noise. The default setting is 1.20. The higher level tends to remove the noise easily. The lower level tends to extract the small characters easily, but the user’s attention is needed as the noise is also often extracted.

46.Connection Level (02 to 10)

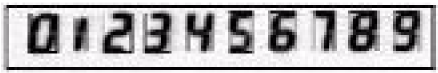
The default setting is 05. Select a lower level if the noise and characters turn out to be inseparable when you view the extraction result or when noisy areas combine to big areas and you are unable to eliminate them.

Registering the Dictionary

The next step is to label each segmented character. The image of the character and its name (label) are registered (stored) in the dictionary.

PROCEDURE :

1. **Select “5. Dic. Registration”**
   The screen for selecting the segmented characters is displayed.

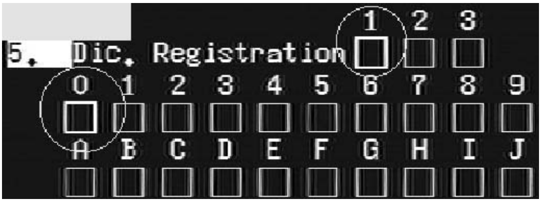


2. Use the keypad to select a character
   When you move the cursor lever, you move a rectangle around the extracted character. The rectangle indicates which character is selected.

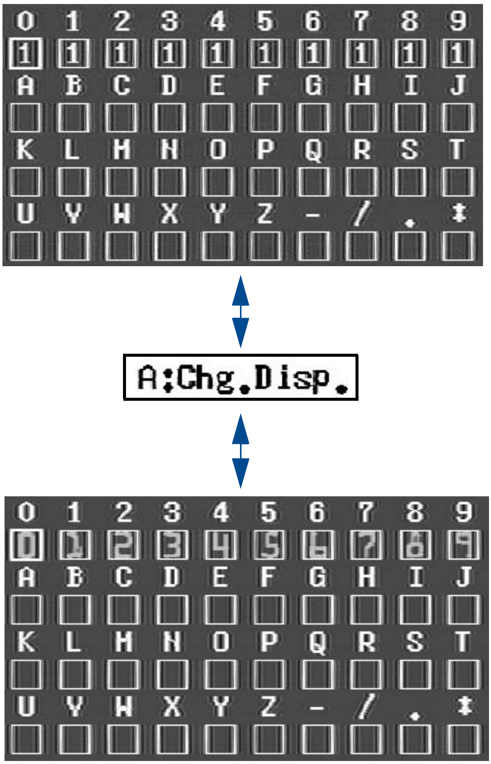
3. Press <Enter>
   The label selection screen appears.

40 labels are available. If a number or image is displayed in the box beneath the label, it indicates that a letter or symbol has already been registered in that label.

4. Select a label and press <Enter>
   You can register 3 different images per label. It does not matter which of the three locations you first use for registering.



5. Repeat steps 1 to 3 for all the characters you want to register
   When you have registered 0 up to 9, the registration screen looks like shown below. The box below the label contains either the number of images registered for that label (up to 3) or it displays the registered image (Press <A:Chg.Disp> to change the display).



Learning

PROCEDURE :

1. Select “**7. Learn**”

```
Learn
Learn
Relearn
```

The option “Re-learning” is used when you wish to learn only the parts added since the last learning process. Accordingly, it can learn in a short time compared to the regular learning function. A message is displayed during learning.

```
New Learning.
16 %
```

Note **If you do not execute the learning after having registered or changed the dictionary, the message below will appear. Press <C> to erase the message and then execute the learning function.**

```
Dictionary Registration is executed
Please execute Learning.
```

Be sure to conduct learning or additional learning every time you have registered new characters or edited a dictionary.

If you wish to interrupt the learning process, select <C:Stop>.

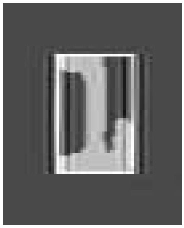
Editing a Dictionary

This section explains how to verify or delete the registered images.

Verifying Registered Images

PROCEDURE :

1. Select “**6. Dic. Check”**
2. Select the label with the registered pattern you want to verify
   The image registered in the selected label and pattern appears in the size registered.



Deleting Registered Images

PROCEDURE :

1. Select **“6. Dic. Check”**
2. Select the label you want to delete
3. Highlight the pattern you want to delete and select <B:Delete>

Deleting a Dictionary

PROCEDURE :

1. Select “**9. Delete Dictionary**

    7. Learn
    8. Copy Dictionary
    9. Delete Dictionary

    A message is displayed asking which dictionaries you wish to delete.

    Delete Dictionary
    Selected Dictionary
    All Dictionaries

    Select whether to select a dictionary for deletion or to delete all dictionaries (1 through 5). For **“Selected Dictionary**” see step 2, for **“All Dictionaries”** see step 3.

2. With **“Selected Dictionary”** you select the number of the dictionary you wish to delete the currently selected dictionary (the number is displayed at the top of the main screen),

3. With **“All Dictionaries”** you delete all dictionaries.
    The following message is displayed.

    All dictionary data will be lost.
    Return to the initial dictionary?
    [YES] [NO]

    Select **“YES”** to delete the dictionary and return to the initial settings (default settings at shipping). Select **NO** to delete and empty the content of the dictionaries without returning to the default settings.

Note **Returning to the initial settings means Dictionary No. 1 is set back to OCR-B font and Dictionary No. 2 to OCR-A font.**

Character Recognition Checkers

- 21. OCR (Recon)
  - 1. Select Camera
  - 2. Checker Setting
    - 21. Area
    - 22. Segmentation Color
    - 23. Segmentation Direction
    - 24. Dictionary No.
    - 25. Condition
      - 251. Separate
      - 252. Char. Height Max. (251. = Yes)
      - 253. Char. Height Min. (251. = Yes)
      - 254. Char. Width Max. (251. = Yes)
      - 255. Char. Width Min. (251. = Yes)
      - 256. Separate Level (251. = Yes)
    - 26. Segmentation Condition
      - 262. Filter
      - 263. Segmentation Method
      - 264. Slice Level
      - 261. Segment Area Min.
  - 3. String Judgment
  - 4. Rec. Lower Limit
  - 5. Output Control
  - 6. Pos. Rot. Adj. Group
  - 7. Results
  - 8. Copy Checker
  - 9. Delete Checker

Overview over the Setting Procedure

Flow	*Output of recognition character string:* 20011215	*Related parameters*
1 Character segmentation	2 0 0 1 1 2 1 5	For checker settings – Segmentation Color – Segment. Direction – Condition – Segment.Condition
2 Character Recognition	2 0 0 1 1 2 1 5 0 1 2 3 4 5 6 7 8 9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - / . *	– Dictionary No. (1 to 5) – Rec. Lower Limit (00 to 99)
3 Judgment – Overall judgment – Individual judgment of each character	Recognition character string 20011215 Judgment character string 20011215 The overall judgment for the checker is OK if the recognized string matches the judgment string. Individual judgment: determines for each character whether the recognized character matches the judgment character string. The results and judgment can be output.	– String Judgment
Output of Recognition character string	Recognition character string 20011215 outputs to the external device using the serial port.	– Output Control (Settings for output using the serial port. Please also see the settings in the ”Environment” menu.)

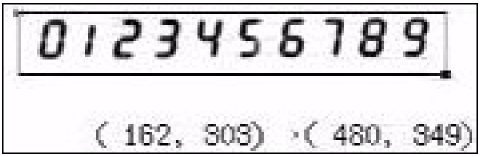
Setting the Character Recognition Checker

This section describes in four steps how to set up a character recognition checker, verify and output the result.

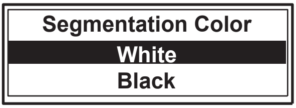
Setting Character Segmentation

PROCEDURE :

1. Select a checker number and select “**2. Checker** Setting”
2. Select **“21. Area”** to enclose the characters to be recognized with the checker area



3. Select **“22. Segmentation Color**”
   Select **“Black”** for segmenting characters darker against a background and “White” for segmenting characters lighter against a background.



4. Select **“23. Segment. Direction”** to set the string direction
   Use the table to determine the direction of the string you wish to inspect.

String	*Segmentation Direction*
Left to right	1215A
Right to left	1215A
Up to down	1215A
Down to up	1215A

Note **When the option** "251. Separation**" under "**25. Condition**" has been set to "**YES**", only "**Left → Right**" can be selected for the segmentation direction.**

5. Select "**25. Segmentation Condition**" to set the conditions for character segmentation
   For details about segmentation conditions, see page 7 - 6.

6. Select "**251. Separation**"
   This option is useful when you need to extract and verify characters which are joined or connected as shown below.

Setting of "252. Separation"	*Object with joined characters*	*Recognition result*
No	LEI	L E I ? I
Yes		L E I L E I

```
2. Checker Setting
 25. Condition
   251. Separate               Yes
   252. Char. Height Max       Dic. Quot.
   253. Char. Height Min.      Dic. Quot.
   254. Char. Width Max.       Dic. Quot.
   255. Char. Width Min.       Dic. Quot.
   256. Separate Level         Middle
```

7. Set "**251. Separate**" to "Yes"
   Five additional parameters appear on the screen.

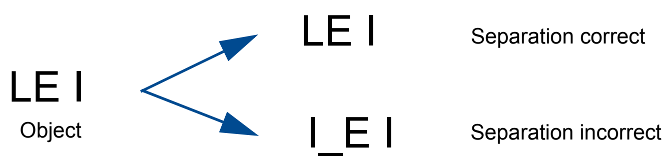
8. Set the parameters “**252. Char. Height Max**.” to “**255. Char. Width Min.**”
   These are the parameter for the separate processing of characters. Normally, the size of characters (images) registered in a dictionary is used. If the registered characters have a different size than the characters to be read, you can change the size by enclosing the characters in their own recognition area. Select the parameter you want to set and select “Frame Setting” to create the area. Depending on whether the characters you wish to recognize vary in height and width you have to set all parameters or only one.

   Char. Width Max.
   Dic. Quot.
   Frame Setting

9. Set the parameter “**256. Separate Level**”
   Select “**Middle**” (default setting) or “**Low**”.

   Separate Level
   Middle
   Low

   It may happen that when you try to separate “L” from “E” as shown in the figure, the system separates the character at the wrong position. In such a case, select “Low”.



Setting the Recognition Conditions

The procedure continues from where the last procedure finished.

PROCEDURE :

1. Select “**24. Dictionary No.**”
   Select among 1 to 5 the dictionary to be used. The message below will be displayed.

```
Segment. Condition in selected dic.
will be copied. OK to overwrite?
[YES]    [NO]
```

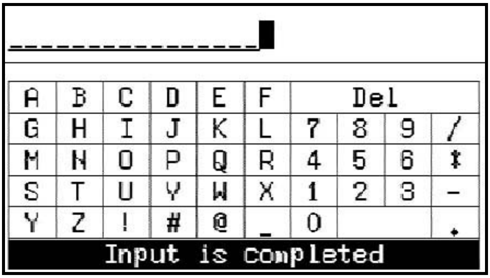
2. Select “YES” to copy the segmentation condition from the selected dictionary Later on, you can adjust the settings of the segmentation conditions. see page 7 - 6 for details about segmentation conditions.

3. Press <C: Esc.> to return to the checker’s main menu

```
[1]  CHAR RECOG.              Jud.:NG
   No. 1                   Rec. Char.:
   1. Select Camera              A
   2. Checker Setting
   3. String Judgment            ----------------
   4. Rec. Lower Limit           0
   5. Output Control             No
   6. Pos. Rot. Adj. Group       0
   7. Result
   8. Copy Checker
   9. Delete Checker
```

4. Select “**4. Rec. Lower Limit**“
   Use this option to set the lower limit for the recognition value in the range from 00 to 99. If the detected characters have a recognition value below the set value when compared with the characters in the selected dictionary, the character is NOT recognized.

5. Select “**3. String Judgment**”
   If you wish to recognize a certain string and judge the recognition result, enter the string text here (continue with step 6). When the judgement is NOT required, leave the initial setting (“__” for each of the 16 characters). The judgment character string can be changed by inputting the serial command from the external device.

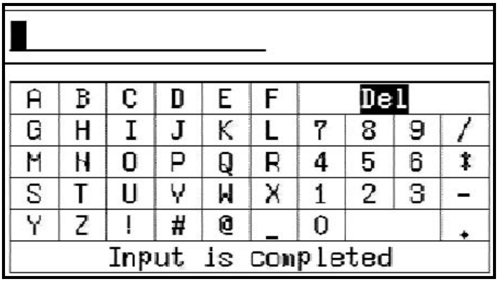


As shown above, with “--” set for the maximum of 16 characters, the overall judgment result or individual judgment result for each character will be OK regardless of whether characters were recognized or not and regardless of what those characters were, if recognized. If you intend to only output the recognized characters from the XUVM230 and not to specify a judgment character string, then set the judgment character string this way. Otherwise, select the string text to be recognized and confirm your input with “Input is completed” and <Enter>.

Note **Characters cannot be recognized when you delete the default setting “----------------” for the judgment character string.**
When you leave the default setting “--” set for all 16 characters, the overall judgment result or individual judgment result for each character will be OK regardless of whether characters were recognized or not and regardless of what those characters were, if recognized. If you intend to only output the recognized characters from the XUVM230 and not to specify a judgment character string, then leave the judgment character string this way. Otherwise, select the string text to be recognized.

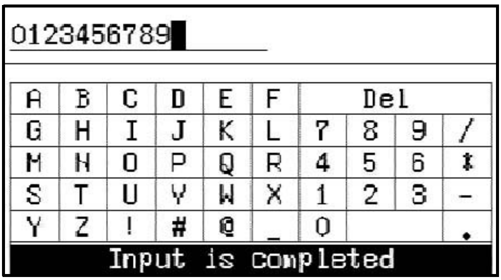
---

6. Highlight "**Del**" and press <Enter> until all "--" are deleted



You cannot move the cursor that is on the judgment character string.

7. Enter the string you wish to recognize by selecting it with the keypad and pressing <Enter> after each character
   Here the user entered "0123456789".



8. When the string is complete, highlight "Input is completed" and press <Enter>

Special Codes for the Character String used for Judgment
Special codes are available for setting the judgment character string in addition to the character labels that are registered in the dictionary.

!: Out of the first or second character recognition ranking, this takes the letter of the alphabet (A to Z) as the recognition result, regardless of the recognition ranking. When the characters in the both ranks are letters of the alphabet, the letter with the first recognition ranking is taken. When both characters are numerals or symbols, it is judged to be NG and recognition has been deemed not possible.

#: Out of the first or second character recognition ranking this takes the numeral (0 to 9) as the recognition result, regardless of the recognition ranking. When both characters are numerals, the numeral with the first recognition ranking is used. When both characters are letters of the alphabet, it is judged to be NG and recognition has been deemed not possible.

“!” and ”#” are effective when the recognition ranking for the character to be read is not always the first ranking, because the particular letters or numerals are similar due to the font being used. In other words, use these codes when the difference between the recognition values for both is small and the OCR checker is reading a letter when you are trying to read a numeral, and vice versa.

Ex:

You wish to recognize the letter “O” from the alphabet. However, the recognition result is such that the 1st ranking is given to 0 (numeral) and only the 2nd ranking is given to O (alphabet).
Recognized character when “!” is set: O (alphabet, although it ranked 2nd, the code gives it priority)
Recognized character when “!” is not set: 0 (numeral, because it ranked 1st)

You wish to recognize the letter “O” from the alphabet. However, the recognition result is such that the 1st ranking is given to 0 (numeral) and only the 2nd ranking is given to O (alphabet).
Recognized character when “!” is set: O (alphabet, although it ranked 2nd, the code gives it priority)
Recognized character when “!” is not set: 0 (numeral, because it ranked 1st)

@: With no restriction as to whether the character is a letter of the alphabet, a numeral or a symbol, if the system recognizes a character with a recognition value exceeding the set lower limit, it is judged to be OK.

__: Default setting. Use this setting when you do not want to judge a character string. The checker judgment result will be OK whether a character is recognized or not. Set this code when you only want to output the detected character string without judging it.

Outputting the OCR String via the Serial Port

The recognized character string can be output to an external device via the serial port (COM port). There are two places where you need to make the appropriate settings in order to activate the output: The **Environment** menu and each individual character recognition checker.

Environment Settings
The following settings are required to output all or a part of the recognition character strings of the character recognition checkers:

PROCEDURE :

1. From the main menu, select “**7. ENVIRONMENT**”
2. Select “**4. Communication**”
3. Select “**43. Serial Output**”

4. Communication	
41. Com. Mode	**ASCII**
42. RS232C	
43. Serial Output	
44. Parallel Output	
45. Type Switch Min.	

4. Set the option “**438. Char. Recog.**” to “Out”

438.Char. Recog.	**Out**

Leave the setting “None” when you do not want to output all of the character strings of the character recognition checkers via the serial interface.

438.Char. Recog.	**None**

5. In “**432. Output Char.**”, set the maximum number of characters that can be recognized in a character string

432.Output Char.	**16Char. (1-16)**

The option number will differ depending on which communication mode you have selected (see page 7 - 6).

Ex:

Example of serial output with the following settings:
Option “Output Char.” = 10
Option “Inval. Digit” = “Replace”

Checker No.	*Recognition character string*	*Output*
1	012345	012345_ _ _ _0123456789$^{C}_{R}$
2	0123456789	
Remark	Where left in the string space, because of not fulfilling the number of output characters, is replaced with the blank.	
Checker No.	*Recognition character string*	*Output*
1	012???	012???_ _ _ _0123456789$^{C}_{R}$
2	01234567890123	
Remark	When the number of characters exceeding the number of output characters is recognized, the characters over the set number can not be output. “?” is output for the characters can not be recognized.	

Settings for Each Character Recognition Checker

PROCEDURE :

1. From the checker’s main menu, select “**5. Output Control**”

```
[1]  CHAR RECOG.              Jud.:NG
  No. 1                   Rec. Char.:
  1. Select Camera            A
  2. Checker Setting
  3. String Judgment          ----------------
  4. Rec. Lower Limit         0
  5. Output Control           No
  6. Pos. Rot. Adj. Group     0
  7. Result
  8. Copy Checker
  9. Delete Checker
```

This option is used for setting whether or not the checker will output the recognized character string.

```
5. Output Control          No
```

Note **Please note that the global output setting in the Environment menu will override the setting you make here. You need to set the option** "438. Char. Recog." **to** "Output" **in order to output any result from an OCR checker. Then you can configure every OCR checker individually whether its result should be output via the serial interface or not.**

2. To activate the output, set the control to "**No**"

Output Control
No
Yes

Verifying the Result

Verify the recognition character string and the overall judgment result. The recognized character string and the judgment result made using the judgment character string are displayed in the upper part of the screen in all the menus of the character recognition checker.

[1] CHAR RECOG.	Jud.:OK
No. 1	Rec. Char.:12345
1. Select Camera	A
2. Checker Setting	
3. String Judgment	12345

overall judgment result is OK

[1] CHAR RECOG.	Jud.:NG
No. 1	Rec. Char.:??3
1. Select Camera	A
2. Checker Setting	
3. String Judgment	12345

overall judgment result is NG

"?" marks displayed in the recognition result indicate that the judgment for those individual characters is NG.

Example of Recognition Character and Judgment Result

When the number of the judgement character string is more than the number of recognition character string.

Judgement character string	Character string to be read	Recognized character	Judgment
1215A	1215	1215	NG
1215_	1215	1215	OK

When the number of the judgement character string is less than the number of recognition character string.

Judgement character string	Character string to be read	Recognized character	Judgment
1215A	1215AB	1215A?	NG
1215_	1215AB	1215A?	NG
_ _ _ _ _	1215ABC	1215AB?	NG

When the number of the judgement character string is equal to than the number of recognition character string.

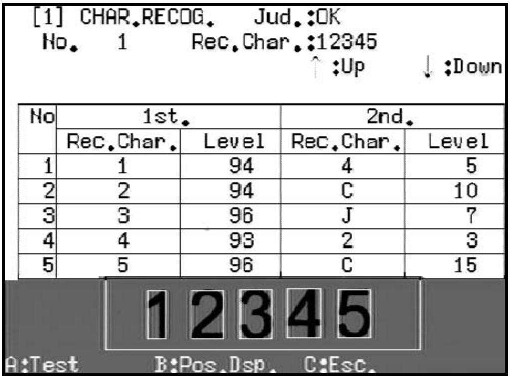
Judgement character string	Character string to be read	Recognized character	Judgment
1215AB	1215BA	1215??	NG
1215_ _	1215BA	1215BA	OK

Verifying the Result Details for Each Character

You can verify the details of each recognized character in “Result”.

PROCEDURE :

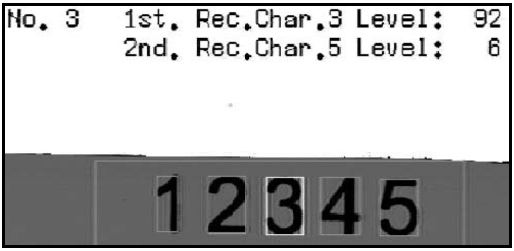
1. From the checker’s main menu, select “7. Result”
   The first column contains the recognition number, the column labeled “1st” the first-ranking character which has been recognized and its respective recognition values, and the column labeled “2nd” contains the second-ranking character.


[1] CHAR.RECOG. Jud.:OK
No. 1 Rec.Char.:12345
↑ :Up ↓ :Down

No	1st.		2nd.	
	Rec.Char.	Level	Rec.Char.	Level
1	1	94	4	5
2	2	94	C	10
3	3	96	J	7
4	4	93	2	3
5	5	96	C	15

You can also display the result and recognition values for each recognition number.

2. Select <B: Pos. Dsp.>
   The recognition result and values are displayed for each recognized character number. The figure shows character No. 3, which has been recognized as “3” with the first ranking (level 97) and as “5” with second ranking (level 5).



   Move the cursor lever up and down to move between the recognized character numbers.

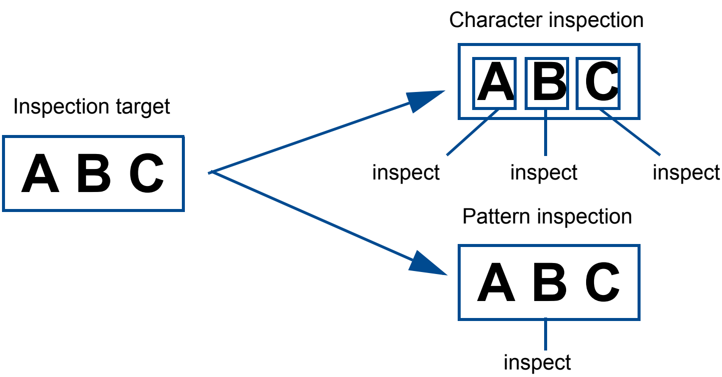
CHAPTER 8

Character Verification Checker

Introduction

- 2. Checker
  - 22. Char. Verif
    - 1. Character
      - 1. Select Camera
      - 2. Checker Setting
        - 21. Area
        - 22. Segmentation Color
        - 23. Segment Area Min.
        - 24. Background Process
        - 25. Noise Reduction
        - 26. Smart Setting
        - 27. Registered Image
      - 3. Condition
        - 31. Search Area
        - 32. Positioning
        - 33. Cor. Min.
        - 34. Template Contrast
        - 35. Rotation Angle
        - 36. Delta Angle
        - 37. Threshold
        - 38. Filter
      - 4. Sub. Det. Area
      - 5. Sub. Det. Judgment
      - 6. Pos. Rot. Adj. Group
      - 7. Result
      - 8. Copy Checker
      - 9. Delete Checkerz
    - 2. Pattern (Same as for 1. Character)

Using the character verification function, it is possible to extract information such as part numbers and lot numbers and verify their correctness. It is also possible to check quantities and quality of marking (defects and tone). There are two types of character inspection; you can inspect the characters one at a time, or perform pattern inspection and inspect multiple characters at one time. Choose the method most appropriate for your application. Up to 16 character verification checkers can be used with each type.



When you have specified the inspection range and have executed the segmentation, the XUVM230 extracts the character portion and registers it as the reference character image for inspection. Inspection means that the A230 compares the characters on other articles and objects with the registered reference image.

An OK judgment depends on the results of the following two items:

1. Whether or not the number of detected characters matches the number of registered characters.
2. Whether or not the differential detection is smaller than the setting in “**5. Sub. Det. Judgment**”.

The procedure for using the character verification checker is as follows.

PROCEDURE :

1. Select **2. CHECKER** from the main menu and press <Enter>
2. Select “**2. Inspection Checker**“ and press <Enter>
3. Select “**22. CHAR. VERIF.**” and press <Enter>

```
[2] INSPECTION CHECKER
    21. CHAR. RECOG.
    22. CHAR. VERIF.
    23. SMART MATCHING
    24. LEAD INSPECTION
    25. GRAY EDGE DETECTION
    26. GRAY WINDOW
```

4. Select a number for the character verification checker
5. If this is the first time to make settings for this number, select either “**Character**” or “**Pattern**”
6. If there are two cameras connected, select the camera to be used for inspection (A or B)
7. Specify the inspection range and perform segmentation to create the character image that will be the inspection reference
8. Set the processing conditions and judgment conditions as required
9. If you want to perform position or rotation adjustment, select a position/rotation adjustment checker
10. Press <A: Test> to perform a character inspection and then confirm the result

	Operation	*Related settings*	
Register	Register character image	Checker settings	Segmentation color Segmentation area minimum Background processing Noise reduction Smart processing
	Inspect registered image		Display the registered image
Inspect	Character extraction	Processing conditions	Search area Positioning Correlation value minimum Template contrast Rotation angle Delta angle
	Comparison inspection (differential)		Differential threshold value
	Differential result processing		Filter
	Differential result refusal selection	---	Differential detection area value
	Judgment		Differential inspection number judgment conditions (+number of registered characters)

Main Menu

```
[2] CHAR. VERIF.     Jud. :NG Det. Char.: 0
    No.  01 Character
    1. Select Camera              A
    2. Checker Setting
    3. Condition
    4. Sub. Det. Area             1
    5. Sub. Det. Judgment         128
    6. Pos. Rot. Adu. Group       0
    7. Result
    8. Copy Checker
    9. Delete Checker

A:Test     B:Image     C:Esc.
```

Number (Checker No.):

Sets the number of the character verification checker to be created.

1. Select Camera

Select which camera (A or B) will supply the image on which the character verification checker is to be activated.

2. **Checker Setting**
   Performs segmentation and registration of the character to be used as the inspection reference (see page 8 - 8).

3. **Condition**
   Sets the character extraction conditions and inspection conditions and the process settings for the inspection result screen (see page 8 - 12).

4. **Sub. Det. Area**
   Sets the minimum area for groups of white pixels extracted by comparison (subtraction) to be treated as a target of judgment (see page 8 - 16).

5. **Sub. Det. Judgment**
   Sets the OK quantity for groups of white pixels extracted by comparison (subtraction, see page 8 - 16).

6. **Pos. Rot. Adj. Group**
   Sets which position and rotation adjuster will adjust the character verification checker being created (see page 8 - 17).

7. **Result**
   Displays the position and inspection results for the inspected character (see page 8 - 18).

8. **Copy Checker**
   When creating a new checker it is possible to copy settings from existing checkers to save time (see page 8 - 19).

9. **Delete Checker**
   Use this option to delete checkers.

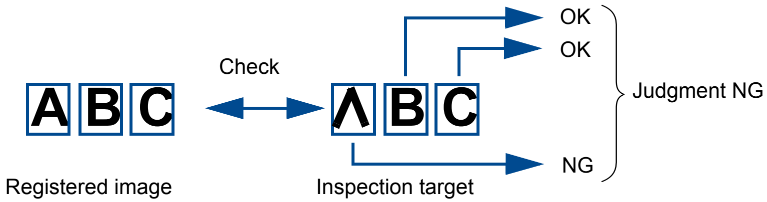
Pattern or Character Selection

If no settings have been made for the character verification checker number that you selected, the first thing to do is select either “**Character**” or “**Pattern**”.

```
[2] CHAR. VERIF.
    No. 1
    1. Character
    2. Pattern
```

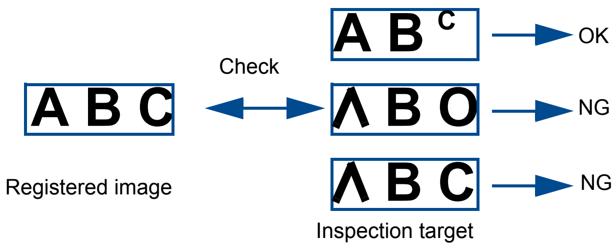
Character

This extracts the characters one at a time. A maximum of 30 characters can be inspected at one time.



Pattern

Inspects multiple characters in a specified range at one time.



Note **Once you select either** “Character” **or** “Pattern” **for the type of inspection, you cannot change this setting. If you want to change the setting from either** “Character” **to** “Pattern” **or vice versa, delete the checker and perform the settings again (**see page 8 - 19 **for details).**

Register the Reference Character Image

In order to perform character inspection you must first segment, extract and register the character to be used as the reference for the inspection. Set the inspection range and segmentation conditions and execute the segmentation.

```
[2] CHAR. VERIF.      Regist. Num.: 2
   No.  1 Character
  2. Checker Setting
   21. Area                  ( 47, 338)–( 146, 417)
   22. Segmentaton Color       Black
   23. Segment. Area Min.      16
   24. Background Process      Low
   25. Noise Reduction         8
   26. Smart Setting           No
   27. Registered Image


 A:Regist      B:----------      C:Esc.
```

PROCEDURE :

1. Select “**21. Area**”
2. Specify the segmentation area by enclosing the character in the rectangular shape see page 4 - 27 for details regarding area specification. Note, however, depending of the setting value that you use in step 4 when you set “**24. Background Process**”, the range that can be specified for the area will change (see page 8 - 10 for details).
3. Set the color of the character to be inspected under “**22. Segmentation Color**” Select either “**White**” (light) or “**Black**” (dark) for the character to be segmented.
4. Set a value under “**23. Segment. Area Min**” to prevent small marks from being segmented
   Marks smaller than this setting will be ignored. Next, you can perform background processing to eliminate unnecessary noise.
5. Select “**24. Background Process**” and set the level for background processing
   Use this option if it is not possible to segment a character due to the presence of background noise (such as a base pattern, see page 8 - 10 for details).
6. Select “**25. Noise Reduction**” and set the a value from 1 to 10
   Use this option to fine-tune the background processing (see page 8 - 10 for details).

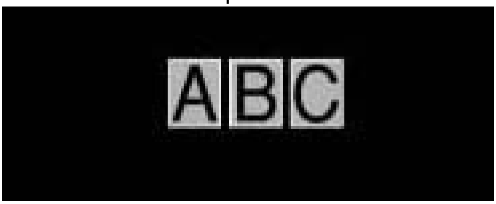
7. Set a mask with the option “**26. Smart Setting**” if you wish to exempt the contour part of the segmented character from the differential inspection
   If variations in the thickness of lines in a character are affecting the checking results, adjust the level of ”**26. Smart Setting**”. As the setting is changed from Low to Middle to High, the mask region increases.

Note **If you wish to use the option “**26. Smart Setting**”, make the settings before you register the character image (if you do this afterwards, the option will have no effect unless you perform the registration again).**

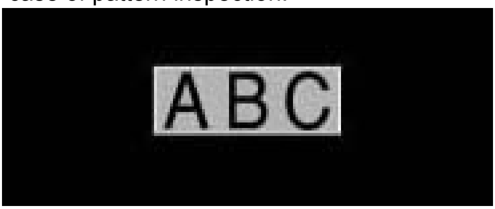
---

8. Select <A: Register> key to perform segmentation
9. If the segmentation is performed correctly, press <Enter> to register the character as the reference image for inspection
10. To check the character image that will be used for inspection reference select “**27. Registered Image**”

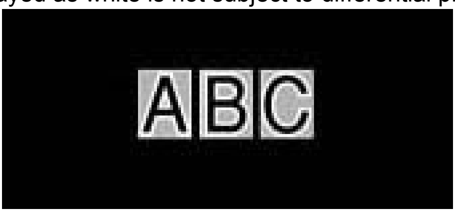
In the case of character inspection:



In the case of pattern inspection:



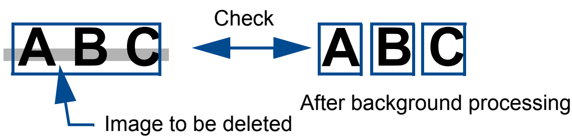
If you are using Smart Setting and wish to check the mask, select <B: Mask>. The area displayed as white is not subject to differential processing.



Note **Make sure to select** "27. Registered Image**" and use <B: Mask> to check the effect of the mask set with** "26. Smart Setting**". This is important because smart setting is performed with respect to the image displayed when segmentation is performed. It is also performed on character images that are somewhat deformed by background processing.**

Background Processing and Noise Reduction

Background processing can be used to patterns and noise captured in the background. Set the option "**24. Background Process**" using the following procedure and while checking the image.



PROCEDURE :

1. Set "**24. Background Process**" to "**Low**"
2. Perform segmentation
3. Check the image to see if the noise has been eliminated
4. If the noise is still present, increase the value under "**25. Noise Reduction**"
5. Perform segmentation
6. Check the image to see if the noise has been eliminated
7. If the noise is not eliminated even when you increase the value under "**25. Noise Reduction**" to 10, set "**24. Background Process**" to "**Middle**"
8. Perform segmentation
9. Check the image to see if the noise has been eliminated
10. If the noise is still present, repeat from step 4
11. If the noise is not eliminated even when "**24. Background Process**" is set to "**Middle**", set it to "**High**", and repeat from step 4

Note **When the option** “24. Background Process**” is set to “**Middle**” or “**High**”, the character(s) will be displayed in a somewhat deformed state after segmentation. However, this display is not the character image that will be registered. To view the character image that will be registered, select “**27. Registered Image**”.**

Setting Range for Background Processing

Depending on the setting you select for “**24. Background Process**”, the area available fro setting the checker changes in size.

Setting in “24. Background Process”	*Start point (X, Y)*	*End point (X, Y)*
No	(0 , 0)	(511, 479) (default)
Low	(12 , 12)	(499, 467)
Middle	(18 , 18)	(493, 461)
High	(24 , 24)	(487, 455)

If you set an area that exceeds these ranges, a warning message will be displayed. In that case, correct the area setting so that it is compatible with the setting for “**24. Background Process**” that you selected.

Setting the Process Conditions

You can use the following settings to set the process conditions for character inspection. If you find that extraction is not going well when the inspection is performed, change these settings and try again.

```
[2] CHAR. VERIF.     Jud.:NG Det. Char.:0
  No.  1 Character
  3. Condition
    31. Search Area              10
    32. Positioning              Fine
    33. Cor. Min.                0.60
    34. Template Contrast        Good
    35. Rotation Angle           0
    36. Delta Angle              0
    37. Threshold                50
    38. Filter                   No

 A:Regist      B:----------     C:Esc.
```

Note **Refer to the contents in** "7. Result" **as an aid in setting the correlation and threshold values.**

Available Options

Options 31 to 36

These settings defiine the conditions for detecting (hereafter referred to as searching) the position of a character (pattern) based on the image (hereafter referred to as the template image) registered using the checker settings. The basic search sequence is that same as that for the smart matching checker. The search is divided into a number of steps using different compression ratios within the template image and the search area. Initially, a fast search is performed using a rough image (i.e. high compression ratio), then the compression ratio for the periphery of the detected locations is gradually reduced until finally, at the last stage, the search is performed using the original image with no compression.

Options 37 to 38

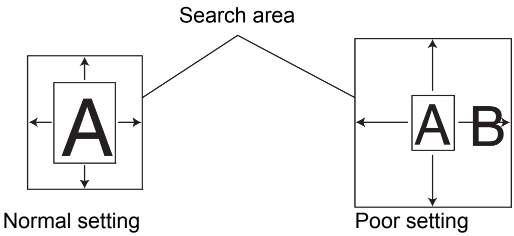
Set the conditions for when the detected image and template image are overlaid and inspected (hereafter referred to as differential processing).

31. Search Area

This allows you to specify the range to search for each character. By setting a wider search area, you can avoid missed inspections due to shifted character position.

Note **When you increase the search, do not enclose the neighboring characters.**

The greater the size of the search area, the longer is takes to process.



32. Positioning

Select from among Fine, Extra Fine, Medium, and Coarse for the search method.

<table>
<tr><th>Setting</th><th>Fonction</th></tr>
<tr><td>Fine</td><td>The search method is automatically decided based on the registered template image and the search area size.</td></tr>
<tr><td>Extra fine</td><td>This is effective when the image cannot be detected using the “Fine” search. Searching is performed using an image with a low compression ratio from the first stage of the search, and this makes it possible to perform more reliable detection. However, on occasion searching can take longer than when “Fine” is used.</td></tr>
<tr><td>Medium</td><td rowspan="2">The final-stage search (searching without using a compressed image) is eliminated so the “Medium” and “Coarse” searches are faster than the “Fine” and “Extra Fine” searches. However, as a compressed image is also used for the final-stage search, the accuracy can suffer, and this can affect the inspection result.</td></tr>
<tr><td>Coarse</td></tr>
</table>

33. Correlation Minimum (Cor. Min.)
The correlation value is a numerical indicator of the degree to which the target matches the reference image. If you cannot extract characters that should be acceptable, make the correlation minimum smaller. If you are extracting unwanted noise, make the correlation minimum larger.

34. Template Contrast
Used to make the settings for the template image to be used for the search.
Good:
Use the registered template image (gray-scale image). This is the same method used for the smart matching checker.
Weak:
Uses the registered template image with enhanced contrast up until halfway through the search. Compared to the setting “Good”, it is easier to detect objects in cases when the gray-scale differentiation between the characters and the background is small.

35. Rotation Angle
The range over which the search is performed in the direction of rotation. The setting range is 0 to 30° , and when the setting is 30, searching is performed over the range ±30°.

36. Delta Angle
Sets the angular step for searching over the range set in 35. Rotation Angle. The setting range is 0 to 30, and when the setting is 5, searching is performed every 5°.

Ex:

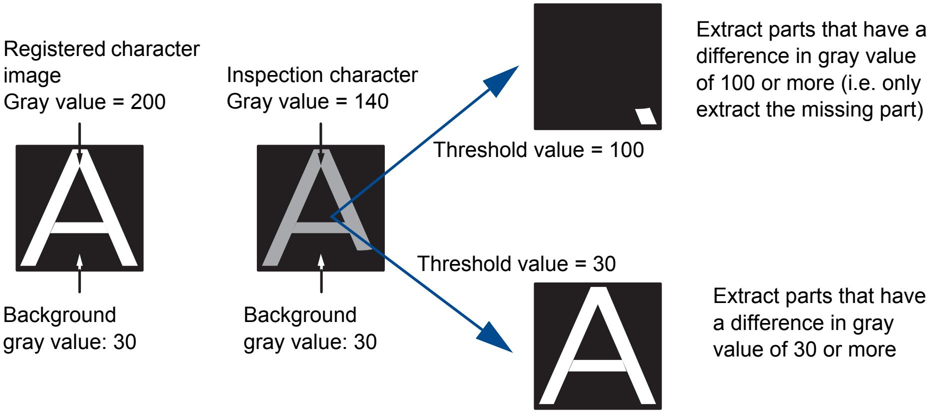
If the Rotation Angle setting is 6° and the Delta Angle setting is 2° , searching is performed every 2° over the range +/-6° .
(-6° , -4° , -2° , 0° , +2° , +4° , +6°)

Note **When the template is registered, it is a 0° image. The smaller you set the delta angle, the better the detection accuracy, but processing also takes longer.**

37. Threshold Value

This setting is used to set the difference in gray level for the extraction when comparing a target object with the registered reference image. Parts for which the difference in gray value is larger than the threshold are extracted as white pixels.

Note **The gray value comparison is performed on all pixels in the registered image. By changing the threshold value it s possible to extract missing parts only as white pixels, and to extract parts with different brightness as white pixels.**



Différence NDG entre le caractère enregistré et le caractère inspecté :
200 – 140 = 60
Différence NDG entre la partie manquante du caractère enregistré et le caractère inspecté :
200 – 30 = 170

38. Filter

By applying a filter you can compress the differential result and eliminate unwanted parts. Also, by expanding after compression, and then compressing again, you can gradually remove unwanted parts without greatly affecting other parts (see page 4 - 30 for more details).

Setting the Judgment Conditions

Use the judgment conditions to set OK/NG (pass/fail) criteria for the area difference (”**4. Sub. Det. Area**”) and quantity difference (”**5. Sub. Det. Judgment**”) when the target object is compared to the reference character image.

4. Sub. Det. Area	1
5. Sub. Det. Judgment	128

4. Sub. Det. Area
Use this option to set the minimum area for groups of extracted pixels that result from comparison (differential) of the registered image and the target image. Areas bigger than the minimum setting will be subject to the judgment defined in “**5. Sub. Det. Judgment**”. Pixel groups with areas smaller than the setting are not counted.

5. Sub. Det. Judgment.
Use this option to set the quantity of the number of extracted pixel groups (differential detection number) that result from comparison (differential) of the registered image and the target image for an article to be considered good. If the number of detected white pixel groups exceeds the setting value, the result is judged to be NG.

Note **When the judgment conditions are set as follows:**
4. Sub. Det. Area = 30
5. Sub. Det. Judgment = 0
If there is even one group of white pixels with an area of 30 or more pixels, the result is NG!

Selecting a Position/Rotation Adjustment Checker

By setting position or rotation adjustment checkers for the character verification checker, you can automatically correct for shifting of the target and correctly perform inspection.

PROCEDURE :

1. From the checker’s main menu, select “**6. Pos.Rot. Adj. Group**”
2. Select the number of a previously set position/rotation adjustment checker

Note **In order to perform position and/or rotation adjustment, you must set the position/rotation adjustment checkers before setting the character verification checker (**see page 6 - 14**).**

Viewing Inspection Results

Select “**7. Result**” from the checker’s main menu to display the values for Det. Pos. (detected position), Corre. (correlation with the reference image), Sub. Det. Area (number of detected subtraction areas) and Max. Area (maximum size of detected area) in a table.

TYPE[1] :

[2] CHAR. VERIF. Jud. :OK Det. Char.: 10

No. 1 Character :Up :Down

No	Det.Pos.		Corre.	Sub.	
	X	Y		Sub.Det.	Max.Area
1	68.0	379.4	1.00	1	1
2	108.4	379.8	0.99	5	2
3	146.5	378.8	1.00	0	0
4	184.5	378.9	1.00	0	0
5	223.0	378.9	1.00	0	0

A:Test B:Pos.Dsp. C:Esc.

Press <B: Pos. Dsp.> to observe the detected image while checking the inspection results. The items displayed in the result screen (number of detected characters, detection position coordinates, correlation value, Sub. Det., and Max. Area) can be used in numerical calculations and output to external devices see page 13 - 10.

Copying and Deleting OCV Checkers

It is possible to copy and delete the settings for character verification checkers.

How to Copy a Character Verification Checker

When you want to create a new character verification checker, it is possible to copy the settings from an existing character verification checker to save time.

PROCEDURE :

1. Select "**2 CHECKER**" from the main menu
2. Select "**2 Inspection Checker**"
3. Select "**22. CHAR. VERIF.**" from the Checker menu
4. Select an empty character verification checker number
5. Select "**1. Character**" or "**2. Pattern**"
6. Select "**8. Copy Checker**" from the menu

Note **If no checkers have been set, the message "No checker available to copy." is displayed.**

---

7. Select the number of the checker with the settings you wish to copy
   The message "Overwrite existing data?" will appear.

Data exists in destination,
OK to overwrite?
[YES] [NO]

8. Select "**YES**" to copy the checker settings
   With "**NO**" you abort the copy operation.

How to Delete a Character Verification Checker

Use the following procedure to delete all settings for a character verification checker at one time.

PROCEDURE :

1. Select “**2 CHECKER**” from the main menu
2. Select “**2 Inspection Checker**”
3. Select “**22. CHAR. VERIF.**” from the Checker menu
4. Select the number of the character verification checker number you wish to delete
5. Select **9. Delete Checker** from the menu.
   The message “Delete?” will appear.

   Delete?
   [YES] **[NO]**

6. Select “**YES**” to delete the checker
   With “**NO**” you abort the delete operation.

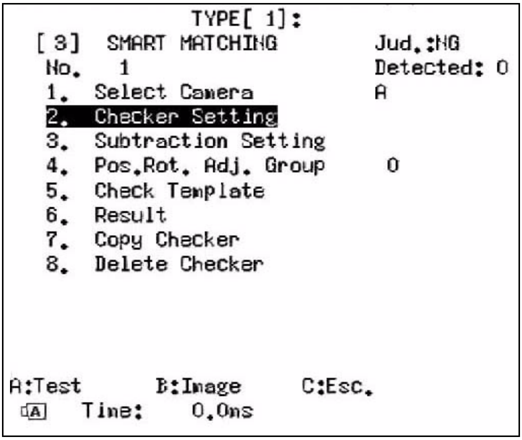
CHAPTER 9

Smart Matching

Smart Matching

The smart matching checker registers a base image (called a “template”), and detects images similar to that registered image from the checker area. The correlation value represents the degree of similarity to the template.
You can set up to 4 checkers per type
It is possible to re-register template images using input from external equipment (see page 16 - 43).

Main Menu



No. (Checker No.)
Sets the number of the smart matching checker to be created.

1. **Select Camera**
   Select which camera (A or B) will supply the image on which the smart matching checker is to be activated.

2. **Checker Setting**
   Sets the parameters for the smart matching checker (see page 9 - 5).

3. **Subtraction Settings**
   Sets the parameters for the subtraction settings (see page 9 - 11).

4. **Position and Rotation Adjustment Group**
   Sets which position and rotation adjuster will correct the smart matching checker to be created.

5. **Check Template**
   Verifies the set template image and the compressed image being processed (see page 9 - 16).

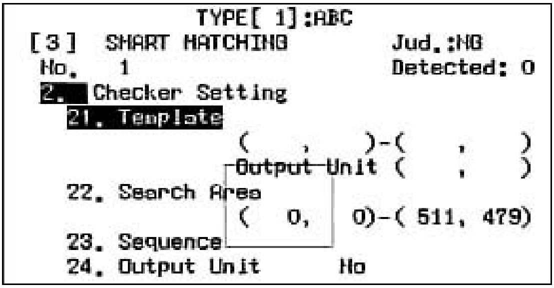
6. **Result**
   Displays the inspection results (see page 9 - 17).

7. **Copy Checker**
   Copies the data from an existing checker into the currently selected checker.

8. **Delete Checker**
   Deletes a checker.

Checker Setting

Sets the parameters and checker conditions for the smart matching checker.



21.Template

Registers the template image that will serve as the checker base. The template is displayed as a square area. Then set the output point for outputting the coordinate position of the checker results. After the template area is confirmed, the output point can be set anywhere inside the area using the cursor lever. Press <A: Tmp. Cnt.> to set the point in the center of the area.

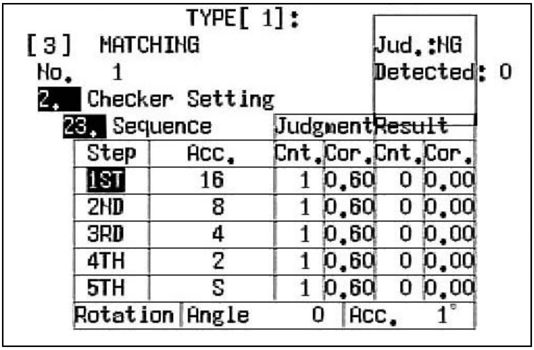
22. Search Area

Sets the search area in the photographed image. The checker will detect objects that resemble the template within the search area.

Note **The search area can be set as a square area using the cursor lever, but since setting the entire range of the image as the search area will slow down the image processing, please set the search area as the smallest necessary range. Position adjustments make it possible to set a very limited search area.**

23. Sequence

The XUVM230 compresses the image to increase speed when searching for an object matching the template. The matching takes place step by step, starting with an image compressed by e.g. factor 16. If the XUVM230 finds a matching object, it remembers the position and increases the search accuracy, e.g. factor 4. This way the search process is performed step by step until the highest level of accuracy is reached. Use this options to set the individual search steps.



Step
Selects the step of the sequence that sets the search conditions. You can set up to five steps (1st to 5th). Set the search conditions for each step.

Accuracy (Acc.)
Adjusts the level of each step (1st to 5th) to match the checker level of the search object and to perform a stable search. Each accuracy value shows a number of pixels.
You can select a search accuracy of ±16 pixels, ±8 pixels, ±4 pixels, ±2 pixels, ±1 pixel, or S (subpixels) in each step. The accuracy must be set to increase with each level, in order from 1st to 5th. Once you set the 1st search accuracy, the 2nd, 3rd, and 4th will automatically be set, so if you set the 1st at 16 pixels, the rest will be set at 8 pixels, 4 pixels, and subpixels. Once you set a step at an accuracy of 1 pixel or subpixels, additional steps cannot be set. For example, if you set the 3rd step at 1 pixel or subpixels, you cannot set the 4th and 5th steps.

Judgment conditions (Judgment)
- Number **(Cnt.)**
  Sets the upper limit of the number of detected objects (maximum: 64 objects). The checker will detect a number of objects similar to the template within the number set here. At the beginning, we recommend to start with more objects than expected because it is possible that the XUVM230 also detects unwanted objects, when the search accuracy is low. However, the number of detected objects cannot be set to exceed the previous step.
- Correlation value **(Cor.)**
  The correlation value reflects the degree of similarity between the template and the search object. If it is large, only objects with a high degree of similarity will be detected. The checker will search for objects with a degree of similarity above the correlation value set here.
  The setting range for the correlation value is 0.01 to 1.00. The default value is 0.60.

Detection Results (Result)

- Number **(Cnt.)**
  Shows the number of objects detected in each step.
- Correlation (Cor.)
  Shows the correlation values of objects detected in each step.

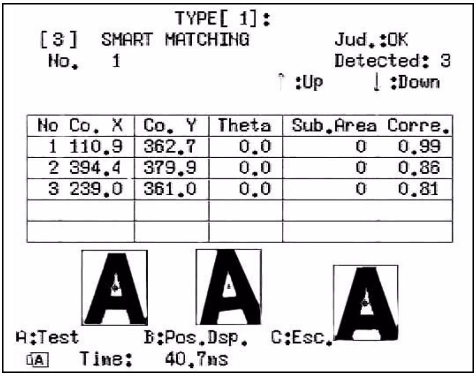
Rotation Settings

- Angle range **(Angle)**
  After an object has been detected based on the correlation value, the VISION CONTROLLER rotates the template within the angle range set in the rotation settings (up to ±30), and detects the object's rotation angle.

- Accuracy **(Acc.)**
  Set the minimum unit for rotating the template when performing angle detection. Use the cursor lever to select the angle (to one decimal place). The VISION CONTROLLER rotates the template at each angle set here, compares it to the object, and finally detects the rotation angle.

Ex:

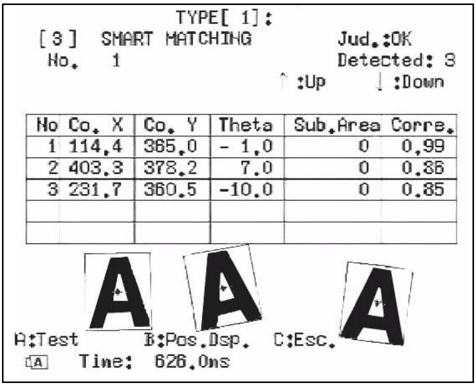
When no rotation angle is et (angle range : 0):


TYPE[1]:
[3] SMART MATCHING Jud.:OK
No. 1 Detected: 3
↑ :Up ↓ :Down

No	Co. X	Co. Y	Theta	Sub.Area	Corre.
1	110.9	362.7	0.0	0	0.99
2	394.4	379.9	0.0	0	0.86
3	239.0	361.0	0.0	0	0.81

A:Test B:Pos.Dsp. C:Esc.
Time: 40.7ms

When a rotation angle is set (angle range : 10 ; accuracy : 1)


TYPE[1]:
[3] SMART MATCHING Jud.:OK
No. 1 Detected: 3
↑ :Up ↓ :Down

No	Co. X	Co. Y	Theta	Sub.Area	Corre.
1	114.4	365.0	- 1.0	0	0.99
2	403.3	378.2	7.0	0	0.86
3	231.7	360.5	-10.0	0	0.85

A:Test B:Pos.Dsp. C:Esc.
Time: 626.0ms

Note **Search accuracy**

The smart matching checker compresses the template and the camera image, and the degree of compression used in conducting the search is set by setting the search accuracy (by setting±a certain number of pixels or subpixels). The accuracy setting is the unit that compresses the template image.

For example, an accuracy setting of±16 pixels will compress the template image in the ratio of 16 pixels to one. At this setting, the search will be conducted very quickly, but the accuracy will be lower than at other settings.

Conversely, if the image compression is performed in subpixel units, a highly accurate search will be performed, but the image processing will take some time. Thus, to process the image quickly but without compromising accuracy, try using different settings to adjust the image compression rate so that the VISION CONTROLLER can search the template image most effectively.

The search is performed in up to five steps. In the 1st step (±16 pixels), the VISION CONTROLLER will search for images that are roughly similar to the sample image. In the 2nd step, it will process only the areas detected in the 1st step with a higher degree of accuracy than in the 1st step.

It can then quickly search the template image with a high degree of accuracy if the accuracy settings are increased in the 3rd and 4th steps. Thus you can fine-tune the settings to adjust the processing time and accuracy.

When the VISION CONTROLLER is performing a search in steps to search a compressed image, it may go outside the search area. If this occurs, the correlation value results will be displayed as "– – –", an undetected error will be generated without a completed search, and the judgment will be NG.

If the accuracy of the final output is set at the subpixel level, the output can be obtained at the subpixel level regardless of whether the 1st or 5th step is set at subpixels. If you set the 1st step at subpixels, the search will take an extremely long time.

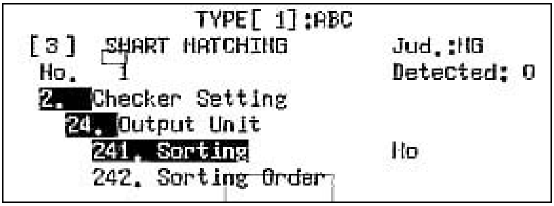
However, since it is possible to shorten the search time without compromising final output accuracy by setting subpixels in the 5th step, we recommend reducing the search time by setting and adjusting the sequencing, and confirming the final search accuracy.

Since it is possible to set the correlation values (judgment lower limits) independently in each search step, we recommend setting them up

separately to suit the step (start with a low value).
The image compression can be set from±16 pixels, but if the size of the set template does not fulfill that condition, there may be conditions under which the search accuracy cannot be set.

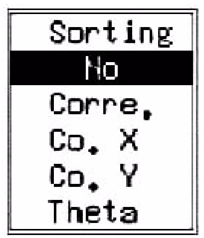
24. Output Unit

Sets the data output order for the search results in the case that more than one object was found.



241.Sorting

Selects the method for sorting the data output conditions. Data can be sorted by correlation value, X-coordinate, Y-coordinate, or Theta.



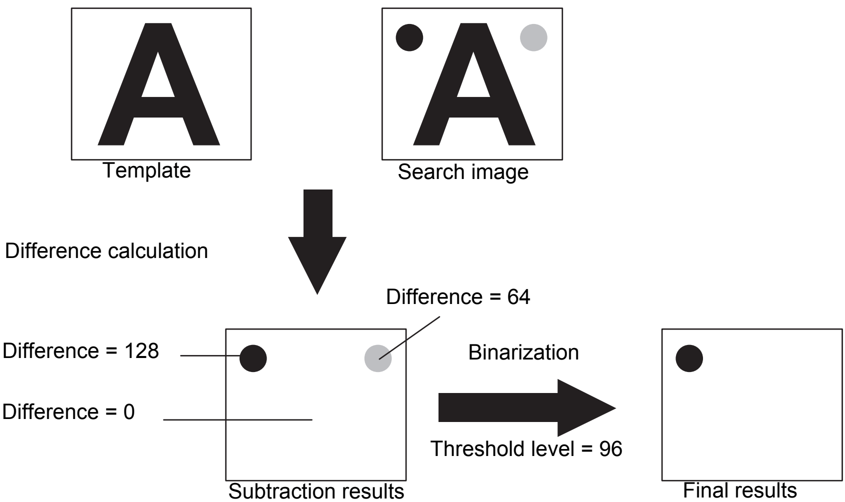
242. Sorting Order

Selects whether to sort in ascending or descending order.

Subtraction and Deviation

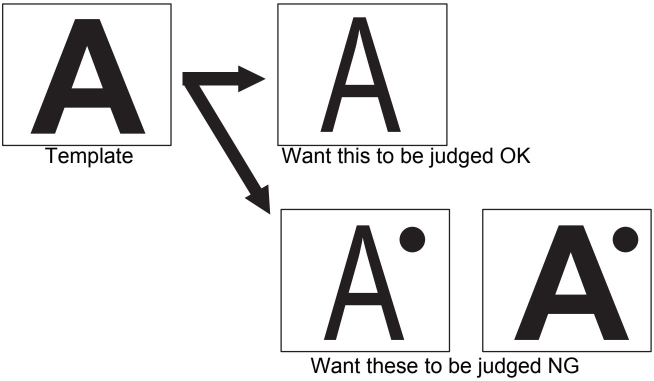
Subtraction

The **Subtraction** option performs subtraction processing on the points detected by the smart matching checker. The results are output as the area of the portion where the search image and template images do not match. It overlaps the search image and the template image at the detected points, and processes them as follows:
The VISION CONTROLLER calculates the difference in brightness between the search image f(x,y) and the template g(x,y). If the absolute value of the difference is larger than the threshold level (th), the result will be 1; if it is smaller, the result will be 0. It will search for the number of pixels where the result is 1 to find the area size (S) of the differential, and will output that number as the result. It can perform the same filter processing as other binary checkers on pixels where the result is 1.



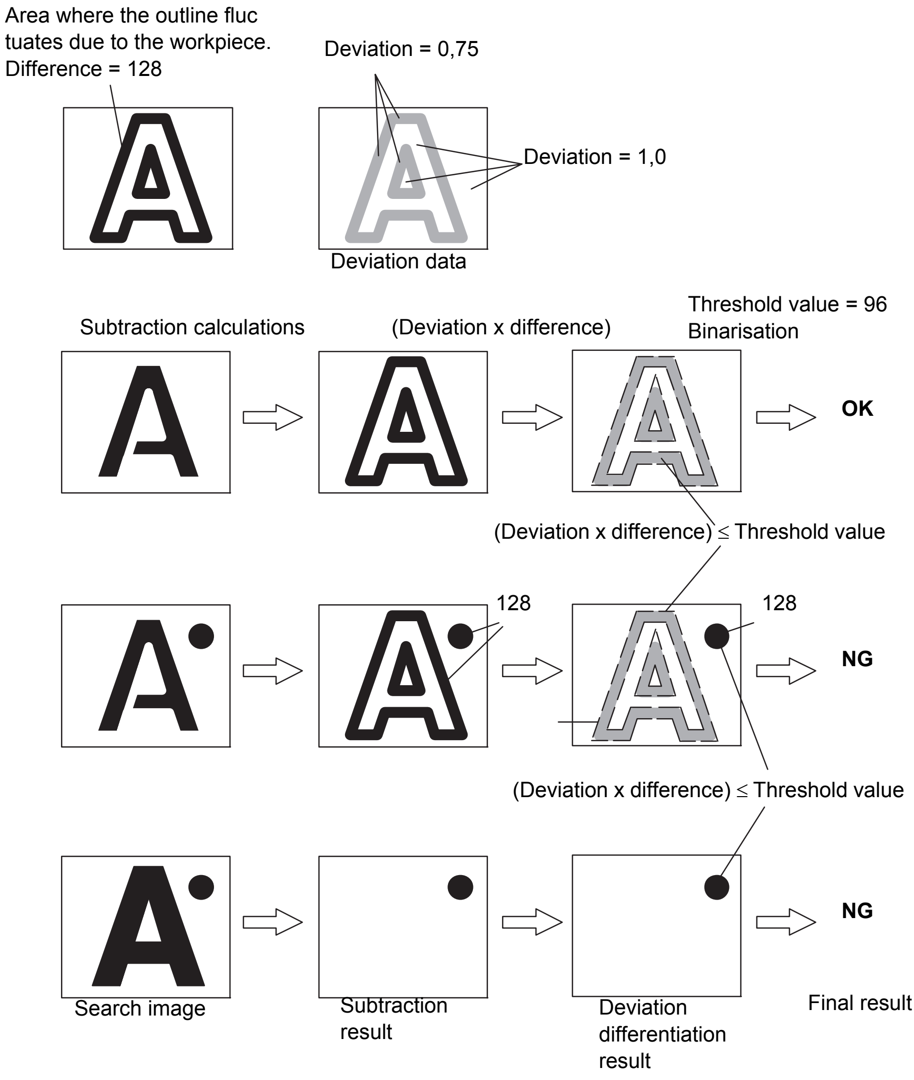
Deviation

As shown in the diagram below, **deviation processing** is used when you only want abnormalities outside the object workpiece to be recognized as differences, but not differences in the outline area of the object workpiece.



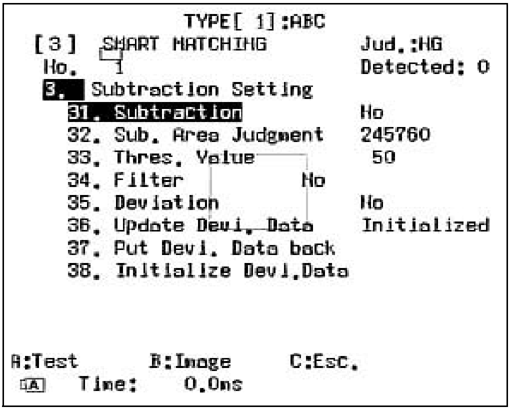
The VISION CONTROLLER will use the deviation data for each pixel in the results obtained during the subtraction processing, and will revise the portions you do not want it to recognize as differences (the outline area in the example above) to the results below the threshold value. By doing this, the corresponding portion will appear as the final results of the binarization. Deviation data is set for each pixel in the template.

As shown in the diagram below, with subtraction processing alone, differences in the outline areas (difference: 128 > threshold value: 96) are recognized as black parts in the second row, but if deviation data is also used, the results of the outline portions become equal to the threshold value (difference: 128 x deviation: 0.75 = 96 $\leq$ threshold value), and are not recognized as abnormalities. On the other hand, abnormalities that exceed the threshold value (difference: 128 x deviation: 1.0 = 128 > threshold value) are recognized as such.


Area where the outline fluc
tuates due to the workpiece.
Difference = 128
Deviation = 0,75
Deviation = 1,0
Deviation data
Subtraction calculations
(Deviation x difference)
Threshold value = 96
Binarisation
OK
(Deviation x difference) ≤ Threshold value
128
128
NG
(Deviation x difference) ≤ Threshold value
NG
Search image
Subtraction result
Deviation differentiation result
Final result

Available Settings

Use this option to make the subtraction and deviation settings.



31.Subtraction

Sets whether or not to perform subtraction processing. As long as this option is set to **No**, the following parameters cannot be changed.

32. Subtracted Area Judgment

Sets the upper limit of the subtracted area value searched for in the subtraction processing, and perform an OK/NG judgment.

33. Threshold Value

The threshold value indicates the gray-scale difference that needs to be exceeded so that the pixel will be set for subtraction.

34. Filter

Once the gray-scale image has been binarized, it is possible to use various filters to effectively eliminate noise outside of the target image and to connect and separate objects. For details, see page 4 - 30.

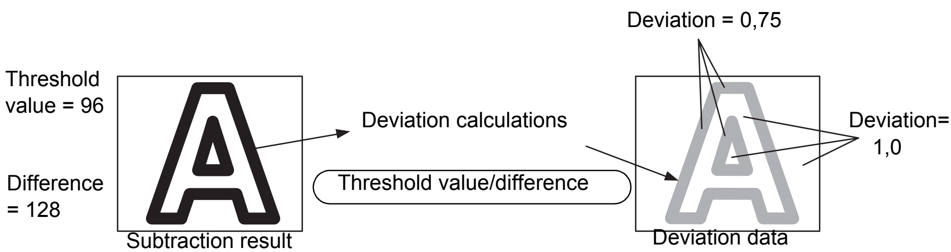
35. Deviation

Sets whether or not to perform deviation processing. To perform deviation processing, the subtraction processing must be set to execute, select **YES**. If the VISION CONTROLLER is not set to perform deviation processing, deviation data cannot be updated, restored, or reset.

36.Update Deviation Data

Use this option to update deviation data used in deviation differentiation. If the deviation data is not changed a single degree, then it is set at 1.0 for all pixels. As shown below, deviation data is changed only for pixels that are converted to 1 in the threshold value processing performed under the direction of the execution results of the subtraction processing performed immediately prior. The formula for calculating deviation data is shown below.

New deviation = (threshold value) / (difference in brightness)



Use the cursor keys to select the results to be used in updating the deviation data, then press <Enter>. A message will appear. Select **YES** to update data or **NO** to leave data unchanged.

37. Put Deviation Data back

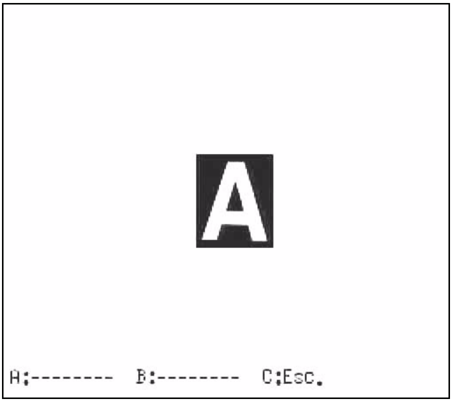
Restores deviation data to what it was before the last change was made.

38. Initialize Deviation Data

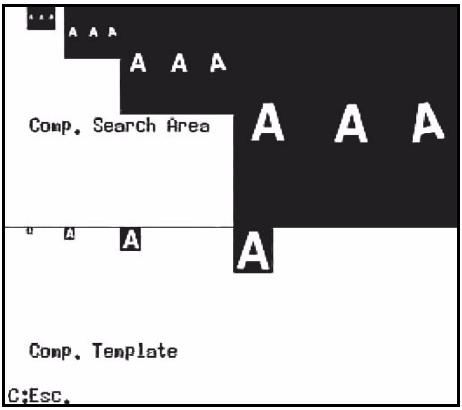
Resets all deviation data to 1.0. Once the data is reset, the values cannot be restored to what they were prior to the reset.

Check Template

You can verify the set template image and the compressed image being processed. Display the set template image by selecting **Check Template** and then **Template**.

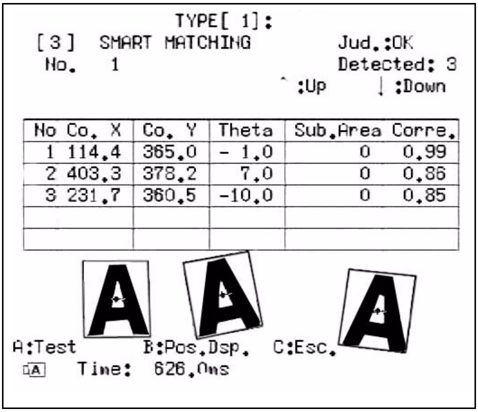


Verify the search area compressed image and the template compressed image by selecting **Check Template** and then **Middle Step**.



Result

Displays the inspection results (the coordinates and rotation angle of the detected object, and the correlated value).



Display the detect point of the detected object by pressing <B> while the results are displayed. When there is more than one detected object, switch between them moving the cursor lever up and down.

Button option	*Functionality*
<A: Test>	Executes a test.
<B: Pos. Dsp.>	Displays a representation of the image you have taken.
<C: Esc.>	Returns to the previous menu.

Smart Matching Checker Setup

Procedure:

1. Set the number of the smart matching checker to be created
2. Use **Select Camera** to select which camera (A or B) will supply the image on which the checker will be activated
3. Select **Checker Setting**, then **Template**
4. Set the coordinates of the template area
5. Set the output point for the detected point coordinates
   Set the output point somewhere within the template area. Press <A:Tmp. Cnt.> to set the point in the center of the area.
6. Set the parameter **Search Area**
   Set only the area necessary, keeping in mind the effects of the search area size on processing speed.
7. Set the parameter **Sequence**
   Set the search conditions for each step, keeping in mind the effects of these conditions on the detected objects and search time.
8. Set data output conditions under **Output Unit** if necessary
   When searching for multiple objects in a single search area, it is easier to determine which detection results correspond to which search object data output conditions are set. Set the subtraction parameters if necessary.
9. Select **Subtraction Setting** and set **Subtraction** to **YES**
10. Set **Subtracted Area Judgment**
    Set the maximum subtracted area for which the judgment value will be OK.
11. Set the subtraction **Threshold Value**
    Set the threshold value that will be applied when performing binary processing on the gray-scale difference between the template and the search object. The threshold value can be set in the range 0 to 255.

12.Set a **Filter** if necessary
You can select whether to apply only an erosion filter (3x3 or 5x5 erosion), or a filter that first erodes the image and dilates it, or conversely, a filter that dilates the image and then erodes it. If you want to conceal small noise or garbage, use the erosion -> dilation filter to erode the image and eliminate small bits of garbage, and then dilate the image. Eroding the image allows you to restore the details of the search object and to eliminate only the garbage. Likewise, you can use the dilation -> erosion filter to eliminate small pinholes, etc.

13.Under **Deviation**, set deviation processing if necessary

14.Set the number of the position and rotation adjustment group

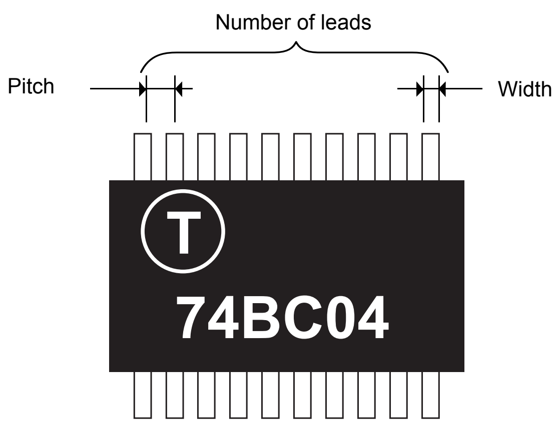
CHAPTER 10

Lead Inspection Checker

Introduction

- 2. Checker
  - 24.LEAD INSPECTION
    - 1.Select Camera
    - 2.Checker Setting
      - 21. Shape
      - 22. Direction
      - 23. Area
      - 24. Object
      - 25. Edge Thres. Value
      - 26. Condition
        - 261. Scan Pitch
        - 262. Filter
        - 263. Width
        - 264. Average Area
    - 3. Detect Judgment
    - 4. Width Judgment
    - 5. Pitch Judgment
    - 6. Pos. Rot. Adj. Group
    - 7. Result
    - 8. Copy Checker
    - 9. Delete Checker

You can use the lead inspection function to count IC and connector pins and measure their pitch and width. You can also set judgment conditions for these parameters. You can set up to a maximum of 32 lead inspection checkers for each type.



The procedure for using lead inspection checkers is as follows.

PROCEDURE

1. Select **2. CHECKER** from the main menu and press <Enter>
2. Select **"2. Inspection Checker"** and press <Enter>
3. Select **"24. LEAD INSPECTION"** and press <Enter>
4. Select a number for the lead inspection checker
5. If there are two cameras connected, select the camera to be used for inspection (A or B)
6. Specify inspection process conditions such as inspection range and scan direction
7. Set judgment conditions as required
8. Select a position/rotation adjustment checker if you intend to perform position or rotation adjustment
9. Press the A (Test) key to initiate lead inspection, and verify the results.
10. Press <A: Test> to initiate lead inspection and then confirm the result

Main Menu

```
[4] LEAD INSPECTION  Detected:NG Cnt.: 0
   No. 1                  Width: OK Pitch:OK
   1. Select Camera             A
   2. Checker Setting
   3. Detect Judgment           128
   4. Width Judgment        <510.9,   0.0>
   5. Pitch Judgment        <510.9,   0.0>
   6. Pos. Rot. Adj. Group      0
   7. Result
   8. Copy Checker
   9. Delete Checker

  A:Start      B:Image      C:Chg.Disp.
```

Number (Checker No.):

The number of the checker being created.

1. Select Camera

Select which camera screen (A or B) to operate the lead Inspection checker from.

2. Checker Setting

Settings relating to the lead inspection method (see page 10 - 6).

3. **Detect Judgment**
   Specify the number of leads for an OK result in the case that you will perform judgment based on the number of leads (see page 10 - 10).

4. **Width Judgment**
   Specify the lead width for an OK result in the case that you will perform judgment based on the lead width (see page 10 - 10).

5. **Pitch Judgment**
   Specify the Pitch for an OK result in the case that you will perform judgment based on the pitch (see page 10 - 10).

6. **Pos.Rot. Adj. Group**
   Select a position or rotation adjustment checker number in the case that you will perform position or rotation adjustment (see page 10 - 10).

7. **Result**
   Displays data about the detected leads (see page 10 - 11).

8. **Copy Checker**
   When creating a new checker it is possible to copy settings from existing checkers to save time (see page 10 - 12).

9. **Delete Checker**
   Use to delete checkers (see page 10 - 12).

Checker Setting

```
[4] LEAD INSPECTION  Detected:NG Cnt.: 0
   No. 1                 Width: OK Pitch:OK
   2. Checker Setting
     21. Shape                     Plane
     22. Direction                 Hor.
     23. Area              ( 206, 200)–( 305, 279)
     24. Object                    White
     25. Edge Thres. Value          50
     26. Condition


 A:Test     B:Image     C:Esc.
```

PROCEDURE

1. Select **2. CHECKER** from the main menu and press <Enter>
2. Select **"2. Inspection Checker"** and press <Enter>
3. Select **"24. LEAD INSPECTION"** and press <Enter>
4. Select a number for the lead inspection checker
5. Select **"2. Checker Setting"**
6. Select **"Plane"** or **"Line"** for the option **"21. Shape"**
7. Set **"22. Direction"** to **"Hor."** (horizontal) or **"Ver."** (vertical)
   The option **"22. Direction"** is not available when you have selected **"Line" under "21. Shape".**
8. Set the checker area with **"23. Area"**
   The specification method differs depending on whether you selected Line or Plane for the **Shape** setting. For details regarding specifying the area in the case of a **plane** scan, see page 4 - 27.
9. Set the color of the inspection target in **"24. Object"**
   Select **"White"** if the color of the leads to be detected is lighter than the background, and **"Black"** if the color of the leads to be detected is darker than the background.
10. Change **"25. Edge Thres. Value"** only, if necessary
    Normally, leave the setting at its default setting. If you find that it is not possible to detect the edges (contours) of the leads as well as you require, change the differential value for the transition between the light and dark areas. Check the option **"7. Result"** to see the differential value before and after the edge, and use this to set the edge threshold value.
11. Change **"26. Condition"** only, if necessary
    Normally, the default setting should be sufficient. Change the setting if detection is not working well, or if you want to reduce the detection time.

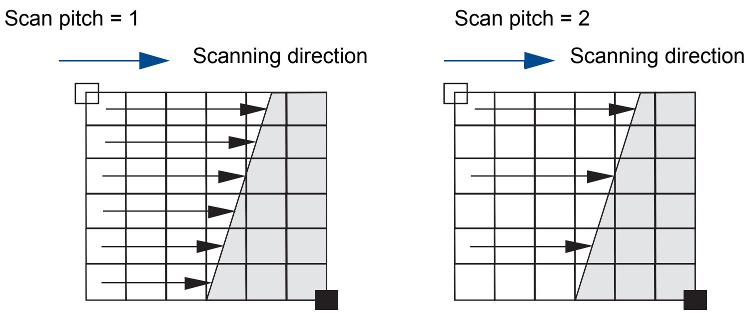
```
[4] LEAD INSPECTION  Detected:NG Cnt.: 0
   No. 1               Width: OK Pitch:OK
   2. Checker Setting
     26. Condition
       261. Scan Pitch           1
       262. Filter               3
       263. Width                5
       264. Average Area         5



  A:Test     B:Image     C:Esc.
```

Available Options under “26. Condition”

This section describes the options available under **“26. Condition”** and how to use them in order to optimize the lead inspection.

Scan Pitch

The option **“261. Scan Pitch”** sets the number of pixels for the scanning interval with respect to the scan direction in the inspection area. The initial (default) value is 1. Setting a wide pitch makes inspection faster, but there is a greater interval between the sections examined. If the pitch is set wider than the scanning area, only a single line is scanned.

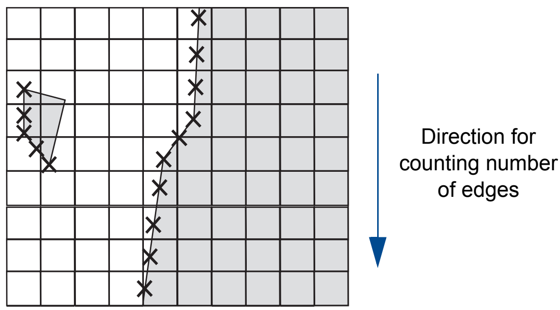


Filter/Width

This item allows you to change the conditions for the lead edges (contours). Refer to the example for details.

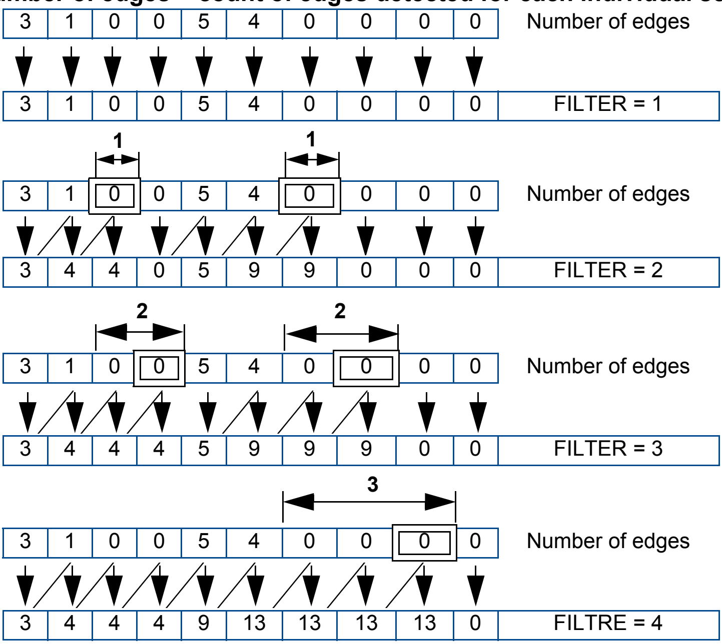
Ex:

In the example below, with Filter = 2 and Width = 7, the XUVM230 detects the 6th column as an edge..



	3	1	0	0	5	4	0	0	0	0	**Nb of edges***
WIDTH	3	1	0	0	5	4	0	0	0	0	FILTER=1
WIDTH	3	4	4	0	5	9	9	0	0	0	FILTER=2
WIDTH	3	4	4	4	5	9	9	9	0	0	FILTER=3
WIDTH	3	4	4	4	9	13	13	13	13	0	FILTER=4

***Number of edges = count of edges detected for each individual scan line.**

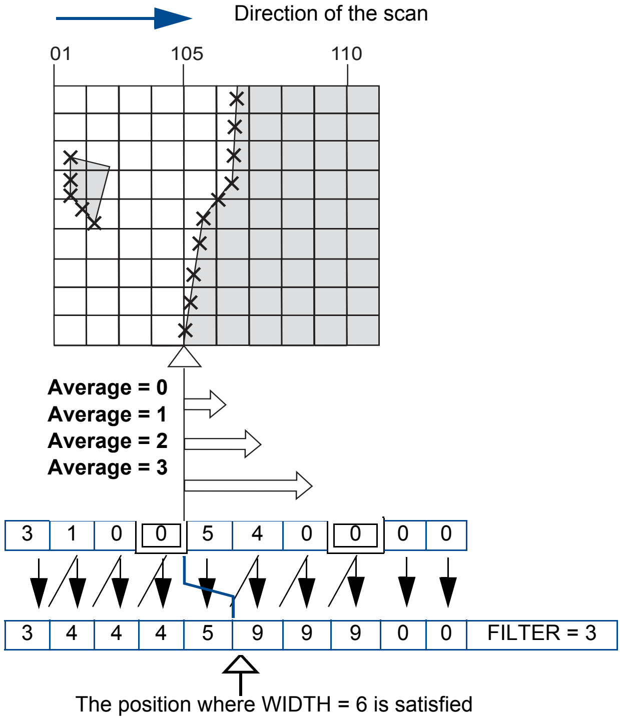


Average Area

This sets a range for averaging (starting from the edge position that satisfies the conditions set in **"262. Filter"/"263**. Width**"** to the setting in "**264. Average Area"),** and allows intervals between protrusions to be detected as edges.

Ex:

See how different settings of "**264. Average Area**" work when "**262. Filter** "is set to "3" and "**263 Width**" is set to "6".



Set the Judgment Conditions

You can set judgment conditions for the number of leads, lead width, and lead pitch.

```
3. Detect Judgment          128
4. Width Judgment        <510.9,   0.0>
5. Pitch Judgment        <510.9,   0.0>
```

3. **Detect Judgment**
   Produces an OK result if the number of leads detected matches the setting.

4. **Width Judgment**
   Set maximum and minimum limits for the width of the leads. An OK result is produced if the detected width is between these limits. Perform an inspection on a good article to obtain the width value (use the option **“7. Result”** to verify the value, see page 10 - 11) and use this value as an aid in setting the limits.

5. **Pitch Judgment**
   Set maximum and minimum limits for the lead pitch. An OK result is produced if the pitch is between these limits. Perform an inspection on a good article to obtain the pitch value (use the Result item to verify the value) and use this value as an aid in setting the limits.

Select a Position/Rotation Adjustment Checker

By setting position or rotation adjustment checkers for the lead inspection checker, you can automatically correct for shifting of the target and correctly perform inspection.

PROCEDURE

1. From the checker’s main menu, select **“6. Pos.Rot. Adj. Group”**
2. Select the number of a previously set position/rotation adjustment checker

Note **In order to perform position and/or rotation adjustment, you must set the position/rotation adjustment checkers before setting the lead inspection checker (see page 6 - 14).**

Viewing Inspection and Judgment Results

Select “**7. Result**” from the checker’s main menu to display the values for width, pitch, and difference. values for the detected object. Refer to these values when setting the judgment and process conditions.

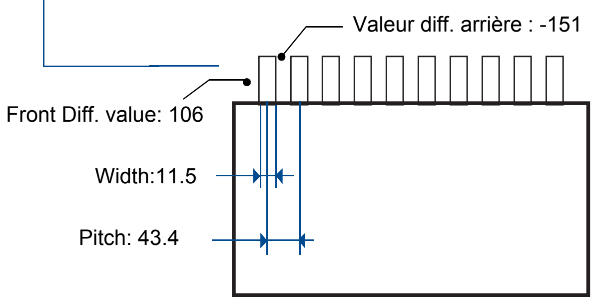
[4] LEAD INSPECTION Detected:NG Cnt. : 4
No. 1 Width: OK Pitch:OK
↑:Up ↓:Down

No.	Width	Pitch	Diff.	
			Front	Rear
1	11.5	43.4	106	–151
2	13.9	21.7	148	–199
3	11.3	15.1	196	–168
4	13.9	0.0	117	–177

A:Test B:Pos.Dsp. C:Esc.

Press <B: Pos. Dsp.> to observe the detected image while checking the inspection results.

Count: 4 Lead No.: 1
Width: 11.5 Pitch: 43.4 Diff. Front: 106
Rear: –151



Copying and Deleting Lead Inspection Checkers

It is possible to copy and delete the settings for lead inspection checkers.

How to Copy a Lead Inspection Checker

When you want to create a new lead inspection checker, it is possible to copy the settings from an existing lead inspection checker to save time.

PROCEDURE

1. Select **“2 CHECKER”** from the main menu
2. Select **“2 Inspection Checker”**
3. Select **“24. LEAD INSPECTION”** from the Checker menu
4. Select an empty lead inspection checker number
5. Select **“8. Copy Checker”** from the menu

Note **If no checkers have been set, the message “No checker available to copy.” is displayed.**

---

6. Select the number of the checker with the settings you wish to copy.
   The message “Overwrite existing data?” will appear.
7. Select **“YES”** to copy the checker settings With **“NO”** you abort the copy operation.

How to Delete a Lead Inspection Checker

Use the following procedure to delete all settings for a lead inspection checker at one time.

PROCEDURE

1. Select **“2 CHECKER”** from the main menu
2. Select **“2 Inspection Checker”**
3. Select **“24. LEAD INSPECTION”** from the Checker menu
4. Select the number of the lead inspection checker number you wish to delete
5. Select **9. Delete Checker** from the menu.
   The message **“Delete?”** will appear.
6. Select **“YES”** to delete the checker
   With **“NO”** you abort the delete operation.

CHAPTER 11

Gray–Scale Edge Detection Checkers

Gray-Scale Edge Detection Checkers

Gray-scale edge checkers use gray-scale differences to detect edges. They are capable of detecting edge coordinates with subpixel precision. They can also judge whether or not a product is OK on the basis of the number of objects detected.

Up to 256 edges can be detected. (However, only up to 99 gray-scale edge checkers can be used for numerical calculation.) You can set up to 32 checkers.

Main Menu

```
[5] GRAY EDGE DETECTION
    No. 1                        Jud.:NG Detected:  0
    1. Select Camera                     A
    2. Checker Setting
    3. Detected Judgment                 <256,    0>
    4. Pos. Rot. Adj. Group              0
    5. Result
    6. Copy Checker
    7. Delete Checker


  A:Test        B:Image       C:Esc.
```

No. (Checker No.)

Sets the number of the gray-scale edge checker to be created.

1. **Select Camera**
   Select which camera (A or B) will supply the image on which the gray-scale edge checker is to be activated.
2. **Checker Setting**
   Sets the gray-scale edge checker parameters (see page 11 - 4).
3. **Detected Judgment**
   Sets the upper and lower limits for the number of edges detected by the gray-scale edge checker and perform judgment based on those limits.
4. **Position and Rotation Adjustment Group**
   Sets which position and rotation adjuster will adjust the gray-scale edge checker being created.
5. **Result**
   Displays result information for up to 99 detected edges (see page 11 - 11).
6. **Copy Checker**
   Copies the data from an existing checker into the currently selected checker.
7. **Delete Checker**
   Deletes the checker.

Checker Setting

Creates the gray-scale edge checker and sets parameters, etc.

```
[5] GRAY EDGE DETECTION
   No. 1                  Jud.:NG Detected:  0
   2. Checker Setting
     21. Shape                       Plane
     22. Direction                   Hor.
     23. Scan Method                 Single
     24. Area              ( 206, 200)–( 305, 279)
     25. Edge Condition              Both
     26. Edge Thres. Value            50
     27. Condition
     28. Detect Position             Plural

  A:Test       B:Image       C:Esc.
```

21. Shape

Selects the shape for the checker area. Possible shapes are rectangle and line.

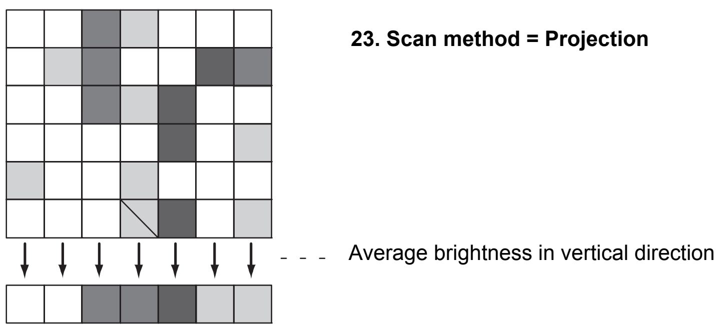
22. Direction

Sets the scanning direction when plane scanning is selected for the shape. For vertical edges you need a horizontal scanning direction, for horizontal edges a vertical scanning direction. When you have selected line as the shape, you cannot change the scanning direction.

23. Scan Method

Selects the scan method for the checker being created. Two different scanning methods are supported for gray-scale edge checkers: **Single** and **Projection**. The default is **Single**. This parameter is not displayed when line scanning is selected.

Setting	*Use for*	*Explanation*
Single	Edge detection method using the first edge. Recommended when e.g. determining the diameter of an object or when detecting edges on a degraded or uneven object.	A method of edge detection where the inspection area is scanned horizontally for each individual pixel in the scanning direction. Scanning is performed according to four parameters, scan pitch, filter, width, and average area. It is relatively unaffected by noise, enabling reliable edge detection.
Projection	reliable detection of edges, even if the surface of an object is rough, the gray-scale image is grainy, and individual edges stand out.	Reliable edge detection can be achieved by averaging the brightness in the vertical direction and using the integrated image data produced as the basis for edge detection in the scanning direction (see figure below). Images that have undergone projection scanning can be confirmed from **Result**.



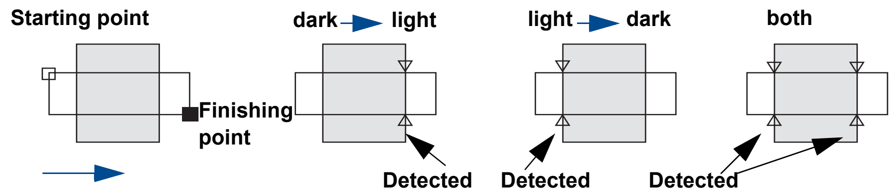
24. Area

Use this option to change the size or move the checker area or to change the scanning direction. The area cannot be set to a size of less than 7 pixels in the scanning direction. The error message “Illegal checker area size.” will appear.

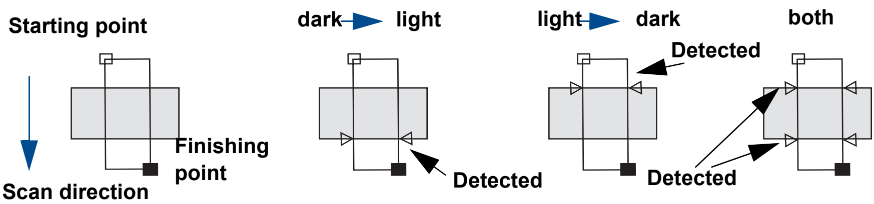
25. Edge Condition

Sets the edge conditions for the checker being created.
A gray-scale edge checker scans from start point to end point, detecting edges in the image under inspection where light changes to dark, or where dark changes to light, or both.
The default setting is **Both**. When set to **Both**, the filter, width and average area functions work on both light to dark edges and dark to light edges, enabling edges with positive and negative differentials to be detected independently.

Detection direction = horizontal



Detection direction = vertical



26. Edge Threshold Value

A gray-scale edge checker detects edges with the help of gray-value differences. Use this option to determine the thresholds. If a pixel shows a gray-value difference exceeding the threshold, it is considered an edge.

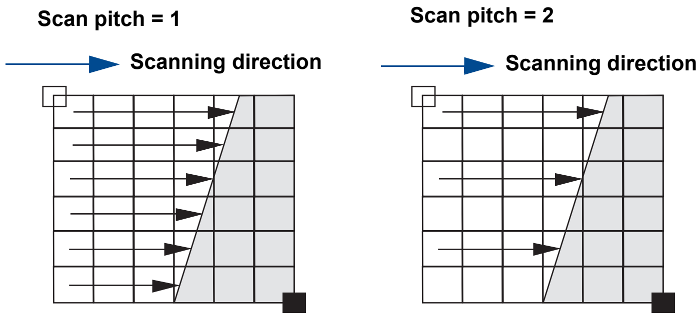
27. Condition

Sets the processing conditions for the checker being created.

```
[5] GRAY EDGE DETECTION
   No. 1                Jud.: NG Detected:  0
   2. Checker Setting
     27. Condition
       271. Scan Pitch          3
       272. Filter              3
       273. Width               5
       274. Average Area        5
```

271.Scan Pitch (can only be set for individual scans)

Sets the interval in terms of pixels in the scanning direction at which scanning is performed in the inspection area. The initial value is 3. Setting a wide pitch makes inspection faster, but there is a greater interval between the sections examined. If the pitch is set wider than the scanning area, only a single line is scanned.



272.Filter

Combines and makes one edge if the interval between pixels where an edge was detected relative to the scanning direction is less than the filter value.

273.Width (can only be set for individual scans)

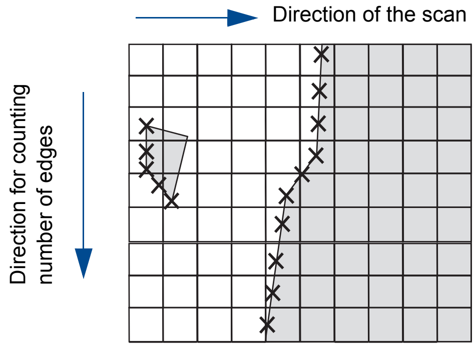
Counts the detected number of edges in the vertical direction relative to the scanning direction, calculates the sum of the continuous edge counts, and if it is as large as or larger than the width value, records it as an edge.

Ex:

Filter/Width

In the example below, with Filter = 2 and Width = 7, the XUVM230 detects the 6th column as an edge

X : edge position



	3	1	0	0	5	4	0	0	0	0	**Nb of edges***
WIDTH	3	1	0	0	5	4	0	0	0	0	FILTER =1
WIDTH	3	4	4	0	5	9	9	0	0	0	FILTER =2
WIDTH	3	4	4	4	5	9	9	9	0	0	FILTER =3
WIDTH	3	4	4	4	9	13	13	13	13	0	FILTER =4

***Number of edges= count of edges detected for each individual scan line.**

3	1	0	0	5	4	0	0	0	0	**Number of edges**
3	1	0	0	5	4	0	0	0	0	**FILTER = 1**

1 **1**

3	1	0	0	5	4	0	0	0	0	**Number of edges**
3	4	4	0	5	9	9	0	0	0	**FILTER = 2**

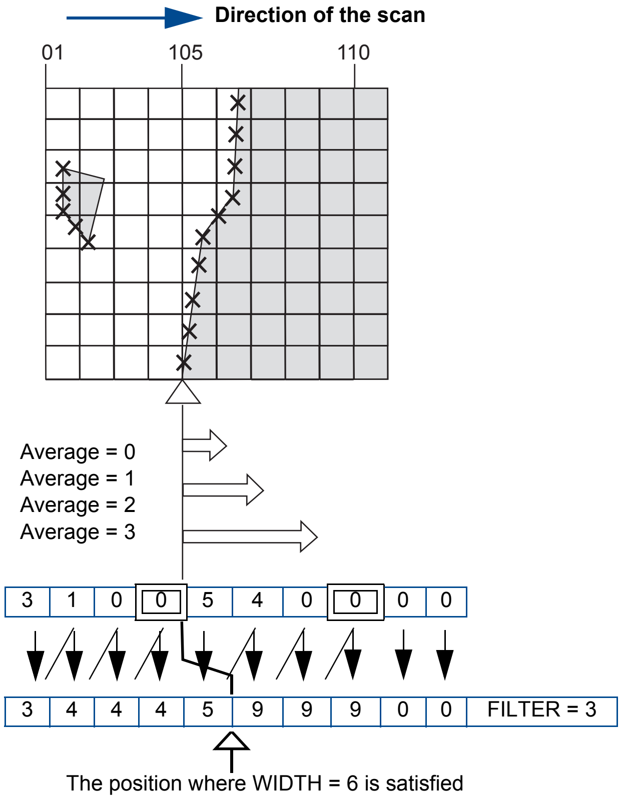
2 **2**

3	1	0	0	5	4	0	0	0	0	**Number of edges**
3	4	4	4	5	9	9	9	0	0	**FILTER = 3**

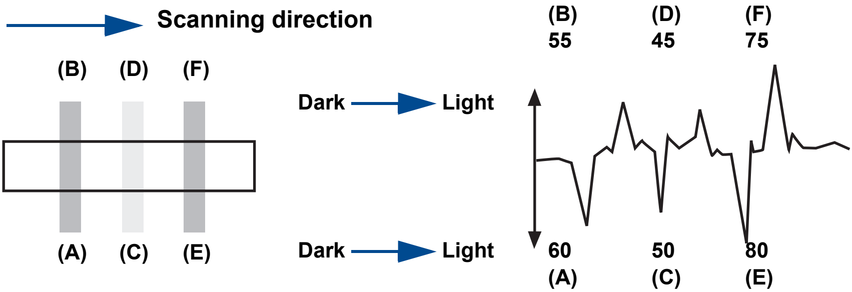
3

3	1	0	0	5	4	0	0	0	0	**Number of edges**
3	4	4	4	9	13	13	13	13	0	**FILTER = 4**

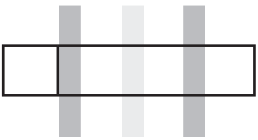
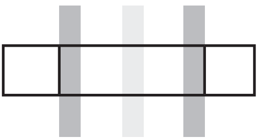
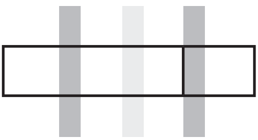
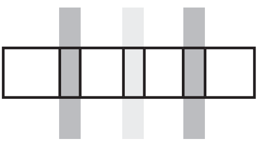
274.Average Area (can only be set for individual scans)
Sets the range for averaging, starting from the edge position that fulfills the filter/width conditions.



28. Detect Position
Sets the edge detection point of the checker to be created.

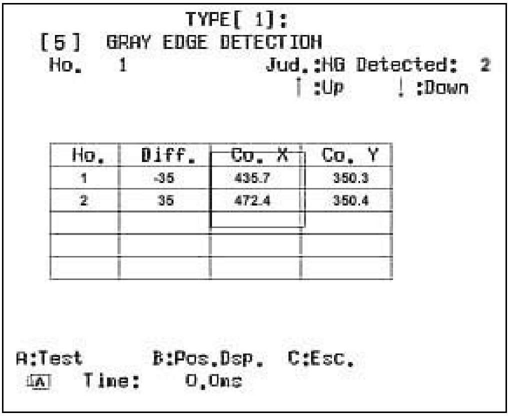


Figures show differential values

Method	*Display / output coordinates*	*Differential value*	*Edge count*	*Output*
Front		60 Differential value at point (A)	1	Point (A) output
Front / Rear		60 Differential value at point (A) 75 Differential value at point (F)	6	Points (A) and (F) output
Peak		80 Differential value at point (E)	1	Point (E) output
Plural		Differential values for individual edge positions	6	Points (A), (B), (C), (D), (E) and (F) output

Result

Use this option to display result information for up to 99 detected edges.



<A: Test>

In camera mode: Captures an image from the camera and inspects it.
In memory mode: Inspects a current memory image without capturing a new image from the camera. Displays the results after inspection.

<B: Pos.Dsp.>

After deleting the display of results, <B: Pos.Dsp.> displays the detected edge position and the edge data (coordinates and differential value). Pressing <C> returns to the display of results. With projection scanning, the image resulting from projection processing is displayed.

<B: Disp. All>

Displays the positions of all the edges detected as a pattern. Pressing <C> returns to the display of results. Two more key functions become available:
<↑ : Prev.>
Displays the edge immediately prior to the one currently being displayed.
<↓ : Next>
Displays the edge immediately following the one currently being displayed.

<C: Esc.>

Pressing <C> returns to the previous checker setting menu.

Gray-Scale Edge Detection Checker Setup

Procedure:

1. Set the number of the gray-scale edge checker to be created.
2. Select which camera (A or B) screen you will move the gray-scale edge checker in.
3. Select **Checker Setting**
4. Select **Shape** from the menu and select either line scanning or plane scanning.

Note **With line scanning, the direction and scanning method cannot be selected.**

---

5. Select either horizontal or vertical as the scanning direction.
6. If you use a plane shape, select **Scan Method** to set projection scanning or single scanning.
7. From **Area** set the coordinates for the inspection area. For details on how to set the area, see page 4 - 27.

Note **If the length of the X-coordinate (if a horizontal scan) or the Y-coordinate (if a vertical scan) is less than 12 pixels, the area of the gray-value edge checker cannot be set.**

---

8. Select **Edge Condition** from the menu and select whether to detect edges as the differential value changes from light to dark, or dark to light, or both.
9. At **Edge Thres. Value**, set the differential value threshold for edge detection.
10. Select **Condition** from the menu and enter the conditions for processing

---

Note **Only the filter parameter value can be set with line scanning or projection scanning.**

---

11. Select **Detect Position** from the menu and select the method by which they are detected.
12. Press <C>
13. When you wish to judge the number of detected edges, enter limits under **Detected Judgment**. However, we recommend to perform all judgments in the **Calculation** menu so that judgments can be viewed at one glance.
14. Select the position and rotation adjustment group number.

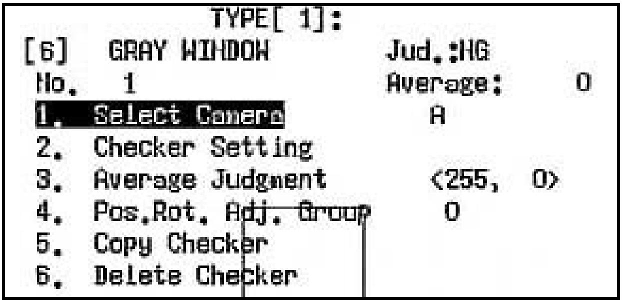
CHAPTER 12

Gray–Scale Window Checkers

Gray-Scale Window Checkers

Gray-scale window checkers are used for calculating the average value for gray-scale brightness data within an area.
You can set up to 32 checkers per type. Area shapes and mask shapes can be either square, circular, or polygonal.

Main Menu



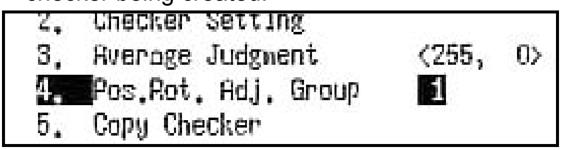
No. (Checker No.)
Sets the number of the gray-scale window checker to be created.

1. **Select Camera**
   Selects which camera (A or B) will supply the image on which the gray-scale window checker is to be activated.

2. **Checker Setting**
   Creates the gray-scale window checker and sets parameters, etc. (see page 12 - 4).

3. **Average Judgment**
   If the average gray-scale value in the inspection area is within the upper and lower limits, it is judged to be OK (= 1). The limits for average gray-scale value judgment can be set in the range 0 to 255.
   The judgment results and average gray-scale value are displayed in the upper right portion of the screen.

4. **Position and Rotation Adjustment Group**
   Sets which position and rotation adjuster will adjust the gray-scale window checker being created.



5. **Copy Checker**
   When creating a checker, copies the data from an existing checker.

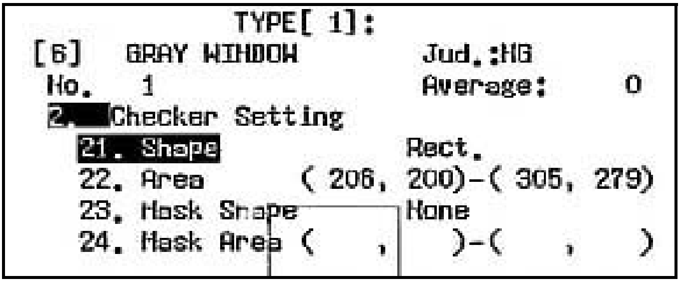
6. **Delete Checker**
   Deletes the checker.

Judgment:
Shows whether or not the value is within the average gray-scale value limits.

Average:
Displays the average gray-scale value detected.

Checker Setting

Creates the gray-scale window checker and sets parameters, etc.



21. Shape
   Selects the shape for the checker area.

22. Area
   Creates or moves the checker area.

23. Mask Shape
   Selects the shape for the mask area.

24. Mask Area
   Creates or moves the mask area.

Gray-Scale Window Checker Setup

Procedure:

1. Set the number of the gray-scale window checker to be created.
2. Select **Checker Setting**, then **Shape**.
3. Set the inspection area to rectangle, circle or polygon from **Shape**.
4. From **Area** set the coordinates for the inspection area. For details on how to set the area, see page 4 - 27.

Note **Circular / elliptical areas must be set so that the difference between the X-coordinate start point and end point is an odd number of pixels.**

---

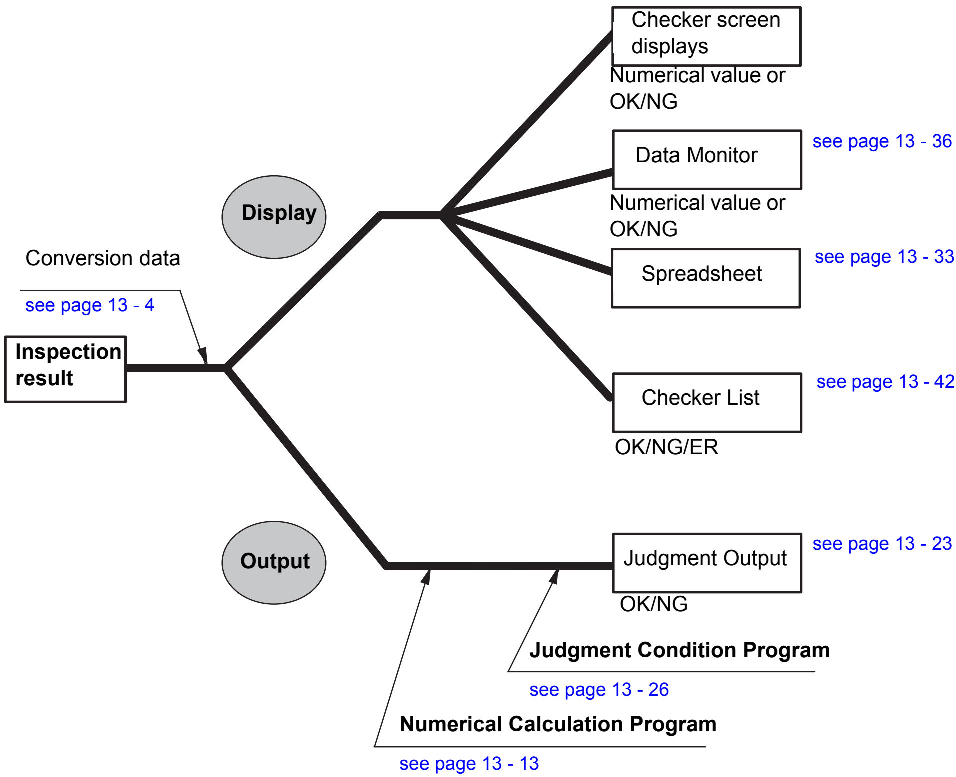
5. Set the **mask area** to rectangle, circle or polygon from Mask Shape.
6. From **Mask Area** set the coordinates for the mask area. For details on how to set the mask area, see page 4 - 29.
7. From **Average Judgment**, set the upper and lower limits for average gray-scale value in the inspection area.
During inspection, the average value obtained is judged to see whether or not it is within these limits.
8. When required, set position and rotation adjustment and exposure adjustment group numbers.

CHAPTER 13

Inspection Results and Output

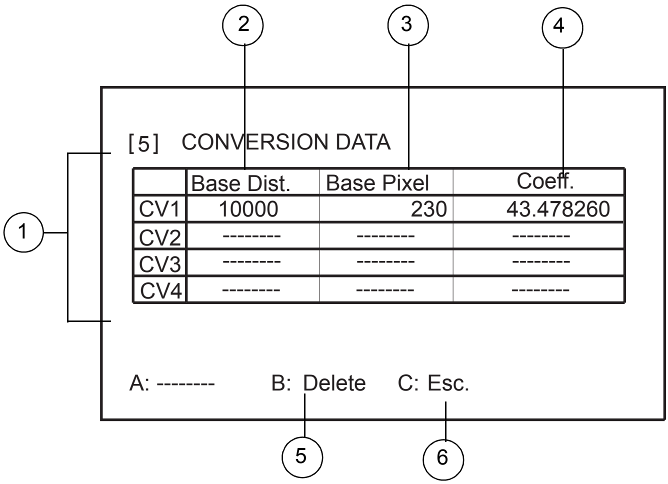
Inspection Results and Output

In addition to displaying inspection results on the screen, it is also possible to output them to external equipment and to perform numerical calculations on the results and create judgment programs to judge the results.



Conversion Data

This function is useful when you wish to replace the number of measured pixels with the real object dimensions. You can set up to four sets of conversion data for one VISION CONTROLLER, so it is possible to set them separately for the vertical and horizontal directions and to use for conversion of units.



1 **CVx = Conversion Data No.**
Conversion data can be used in numerical calculations. Specify this number when you wish to use the conversion data in a formula.

2 **Base (Reference) Distance**
Input the actual dimension (measure the object using a scale or calipers) that is to be used for the reference measurement. Input a number of up to seven digits (1 to 9999999).

3 **Base Pixel (Pixels)**
Input the real measurement as the number of pixels from the image. Input a number of up to seven digits (1 to 9999999).

4 **Coefficient (Scale)**
When you have input the reference distance and number of pixels, the scale factor is calculated automatically and displayed using up to a maximum of nine digits (including the decimal point). The scale factor is calculated using the following formula.
Scale = Base Distance/Pixels

5 **<B: Delete>**
To delete an input, select it and press the <B: Delete> button.

6 **<C: Exit>**
Returns you to the previous menu.

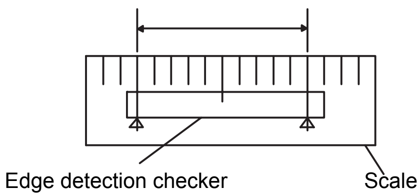
Note **Internally, the system works with integer accuracy. This means that digits after the decimal point are cut off after a calculation. In order to avoid miscalculations, use a coefficient that is large enough. For example, instead of 4.347 use the coefficient 43.47.**

Conversion Data Setup

Procedure:

1. First, measure the reference target object (a scale or calipers will be useful). For this measurement use an edge detector to obtain the number of pixels between the gradations.

Example : 10000µm = How many pixels?



2. Select **5. Conversion Data** from the Menu screen, select the number for the conversion data (CV01 to CV04), and press <Enter>.
   First, input the distance between the scale measurement gradations as the **Base Distance**.

	Base Dist.	Base Pixel	Coeff.
CV1	0010000	-------	---------
CV2	-------	-------	---------
CV3	-------	-------	---------
CV4	-------	-------	---------

3. Next, input the number of pixels between the scale measurement gradations obtained in step 1.

	Base Dist.	Base Pixel	Coeff.
CV1	10000	0000230	---------
CV2	-------	-------	---------
CV3	-------	-------	---------
CV4	-------	-------	---------

4. When you finish inputting the number of reference pixels, the scale factor is calculated automatically and displayed under ”Coeff.”.

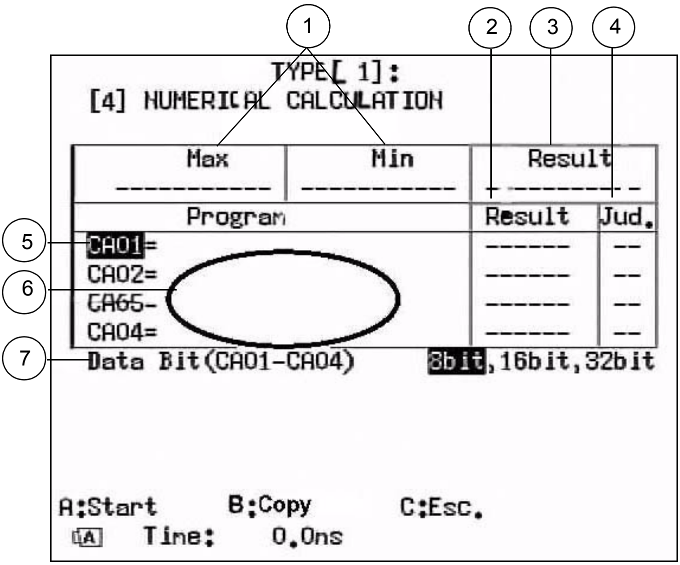
	Base Dist.	Base Pixel	Coeff.
CV1	10000	230	43.478260
CV2	-------	-------	---------
CV3	-------	-------	---------
CV4	-------	-------	---------

Note **The four sets of conversion data set in CV01 to CV04 (base distance, base pixels, and coefficient) are not initialized even if the data for all types is initialized. To initialize the conversion data, either initialize the environment data, or individually delete each item by moving the cursor to it and pressing <B: Delete>.**

Numerical Calculation

Programs can be created to carry out numerical calculations on the results of measurements by checkers. You can set up to a maximum of 32 formulas (for each type). The image cannot be changed once you enter the **Numerical Calculation** menu, so if you wish to be able to see a particular image during numerical calculation setup, change to the required image before entering the **Numerical Calculation** menu.

Main Menu



1 **Maximum/Minimum**
Displays the upper and lower limits for the numerical calculation result. The maximum and minimum values can be referenced and changed via the serial interface (see page 16 - 56). If a formula result is outside the range defined by the maximum and minimum value, the formula is judged as NG, if it is inside, the formula is OK.

2 **Calculation result**
Displays the result of the numerical calculation. However, if the result exceeds six digits, "******" is displayed.

3 **Calculation result column**
Displays the result and judgment of the numerical calculation.

4 **Judgment**
Displays the result of judgment. Judges the result of numerical calculation to be OK if it is within the specified upper and lower limits, and NG if it exceeds the limits. If a checker existed at the point of setup but has since been deleted, or if there is an item which could previously be selected but can no longer be used for calculations, then the judgment result in error and ”ER” is displayed.

5 **Register No.**
The register setting No. (CA01 to CA32) for numerical calculation programs. These are displayed four at a time. Move the cursor lever left or right to display the previous or following four registers. For details on creating a program, see page 13 - 13. For available data and operators, see page 13 - 10.

6 **Program**
Displays the set calculation program. A numerical calculation program can be up to 55 characters in length, and up to 12 items can be set. Example: BW01 + 50 = 7 characters = 2 items

7 **Data Bit**
Sets the size of data in bits for output of numerical calculation data by the parallel interface (see page 13 - 9).

<A: Start>
Press <A> to capture a new image and perform an inspection, outputting parallel and serial signals in accordance with I/O settings.

<B:Copy>
When you are creating a program, it is possible to copy a program set in another register and use it.

Note **In screens that display <A: Start> (unless the display has been hidden), external start signals can also be accepted.**

Data Bit

This parameter is only necessary for communication via the parallel interface (see page 16 - 27). It does not influence the calculation accuracy.
However, it is only possible to set one data length for the four registers that are displayed at the same time (e.g. if CA01 to CA04 are displayed, it is not possible to set CA01 to 8 bits and CA02 to 16 bits).

The ranges that can be handled by the different data-bit sizes are as follows:
8-bit: 0 to 255
16-bit: 0 to 65535
32-bit: –2147483648 to 2147483647.
External output registers that are not set are skipped during output.

Output data length	*Output port (output pin No.)*
8 bits-data d8 d1	(output pin No.) D8 D7 D6 D5 D4 D3 D2 D1 d8 d7 d6 d5 d4 d3 d2 d1
16 bits-data d16 d1	(output pin No.) D8 D7 D6 D5 D4 D3 D2 D1 d8 d7 d6 d5 d4 d3 d2 d1 d16 d15 d14 d13 d12 d11 d10 d9
32 bits-data d32 d1	(output pin No.) D8 D7 D6 D5 D4 D3 D2 D1 d8 d7 d6 d5 d4 d3 d2 d1 d16 d15 d14 d13 d12 d11 d10 d9 d24 d23 d22 d21 d20 d19 d18 d17 d32 d31 d30 d29 d28 d27 d26 d25

Symbols and Operators for Numerical Calculation Programs

The following checker results can be used in calculations. Depending on the settings for each checker, items that cannot be selected are skipped.

Checker	*Program Symbol*	*Checker No.*	*Object No.*	*Item*	*Reference Data*
Position/ Rotation Adjustment	PA	01 to 8	*	1	ΔX (amount of position adjustment in the horizontal direction)
				2	ΔY (amount of position adjustment in the vertical direction)
				3	Δθ (amount of angular rotation adjustment) (x10)
Character Verification	CH	01 to 16	01	0	No. of detections
			01 to 30	1	nth correlation value (×100)
				2	nth X–coordinate (×10)
				3	nth Y–coordinate (×10)
				4	nth subtraction qty.
				5	nth subtraction maximum area
Smart Matching	SM	01 to 4	01	0	Number of detections
			01 to 64	1	Nth correlation value
				2	Nth X coordinate
				3	Nth Y coordinate
				4	Nth theta angle (x 10)
				5	Nth subtraction area
Lead Inspection	LD	01 to 32	01	0	No. of detections
			01 to 99	1	nth lead width (×10)
				2	nth pitch (×10)
Gray-Scale Edge	GE	01 to 32	01	0	Number of detections
			01 to 99	1	Nth X coordinate
				2	Nth Y coordinate
Gray-Scale Window	GW	01 to 32	*	*	Average gray value
Numerical Calculation	CA	01 to 32	*	*	Numerical calculation data register
Previous Numerical Calculation	OCA	01 to 32	*	*	Numerical calculation data register (previous value)
Spreadsheet	QS	0	*	0	Number of scans
		01 to 40	*	1	OK count
				2	NG count
Conversion Data	CV	1 to 4	*	1	Factor
				2	Standard distance
				3	Standard number of pixels

Note **"n" indicates the object number.**
Items that cannot be selected due to checker setting conditions are skipped.

Operators and symbols that can be used for calculations are as follows:

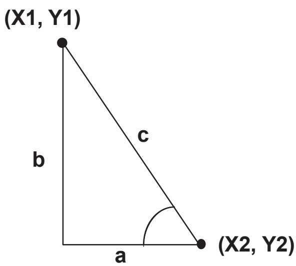
Operators	*Symbol*	*Please note*
Addition	+	
Subtraction	-	
Multiplication	*	
Division	/	
Left bracket	(	
Right bracket	)	
Atan	@	The result is multiplied by 100, example below and page 13 - 18
Root	$	The result is multiplied by 10,000, example below and page 13 - 18
Distance	T	The result is multiplied by 10,000, example below and page 13 - 18

Atan, Root, Distance

Atan is denoted by ”@” and root is denoted by ”$”. Atan and root can be utilized in calculations using ordinary calculation methods. Parts of a program enclosed in brackets are evaluated with priority over the rest of the calculation. For example, in the program $ (CA01+CA02), the part in the brackets is evaluated first.

Ex:

The two coordinates of the locations in the diagram detected by a gray-scale edge detection checker can be used with the Root ($), Distance (T) and Atan (@) functions to calculate the angle (θ) and the length of each side.:



Pythagoras’ theorem

$c^2 = a^2 + b^2$

$c = \sqrt{(a^2 + b^2)}$

Trigonometry

Angle θ =Atan (b/a)

cos(Angle θ)= a/c

sin(Angle θ)= b/c

Item	*Register setting*	*Explanation*
Side a	CA01 = X2 – X1	
Side b	CA02 = Y2 – Y1	
Side c	CA03 = $(CA01*CA01 + CA02*CA02) CA03 = CA01TCA02)	Using the Root ($) function (Pythagoras’ theorem) Using the Distance (T) function In both cases, the result is output multiplied by 10000.
Angle θ	CA04 = @(CA02*10000/CA01)	In the case of the Atan function, the input is multiplied by 10000, and the result is output multiplied by 100.

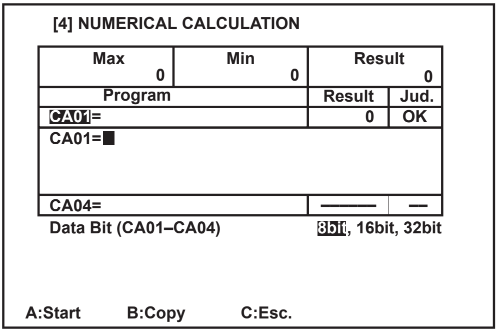
Numerical Calculation Programs

Creating a Program

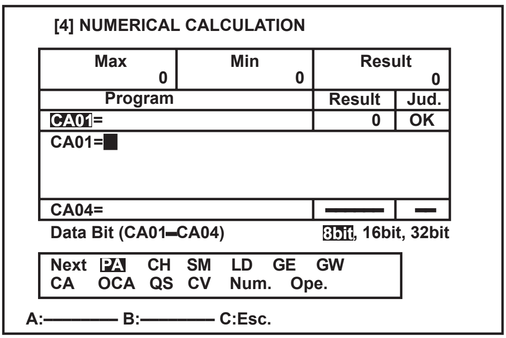
As an example, here we will explain a calculation program that calculates dimensions using the edges detected by gray edge checkers No. 1 and No. 2. CA01 = x–coordinate of the first edge detected by gray edge checker 2 – x–coordinate of the first edge detected by gray edge checker 1

Procedure:

1. Align the cursor to select the register number for the calculation program you are going to create.



2. From the state shown in step 1 above, press **<Enter>** again. A subwindow is displayed to select parameters to be input.



Note **With the exception of** QS, **if no checker data exists, selection is not possible.** Next **cannot be selected if the formula has not been registered yet or if a program error occurs.**

3. Next, select the checker results to be referenced using the cursor lever.

Next	PA	CH	SM	LD	GE	GW
CA	OCA	QS	CV	Num.	Ope.	

CHECKER: 2

↓

Next	PA	CH	SM	LD	GE	GW
CA	OCA	QS	CV	Num.	Ope.	

Det. No. : 2 1 Item: 1 Co. X

↓

Max	Min	Result	
0	0	0	
Program		Result	Jud.
CA01=		0	OK
CA01=GE02011 ■			
CA04=		———	—

Data Bit (CA01–CA04) 8bit, 16bit, 32bit

↓

Next	PA	CH	SM	LD	GE	GW
CA	OCA	QS	CV	Num.	Ope.	

↓

Max	Min	Result	
0	0	0	
Program		Result	Jud.
CA01=		0	OK
CA01=GE02011-■			
CA04=		———	—

Data Bit (CA01–CA04) 8bit, 16bit, 32bit

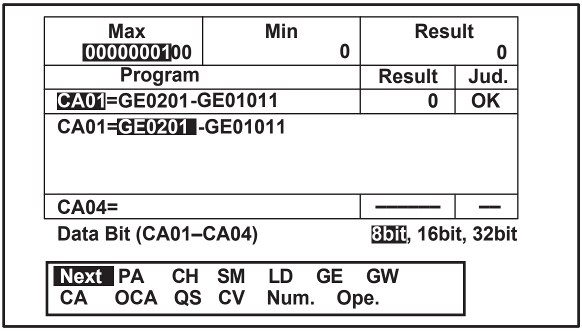
↓

Max	Min	Result	
0	0	0	
Program		Result	Jud.
CA01=		0	OK
CA01=GE02011-GE01011■			
CA04=		———	—

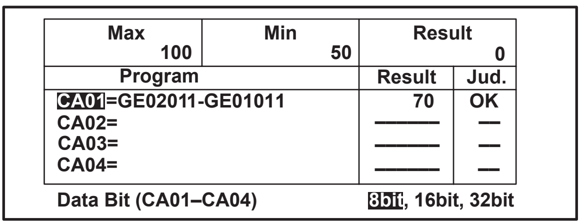
Data Bit (CA01–CA04) 8bit, 16bit, 32bit

4. After entry is complete, press <C>.
   A confirmation message asks if you wish to register the changes you have made. To register the changes select **YES**. To discard the information input select **NO**. To continue editing the formula, press <C>.

5. Set the upper and lower limit values. Select **Next** on the subwindow to move the cursor to the **Max** field.



Set the maximum and minimum values.



Revising a Program during Input

Procedure:

1. Set the numerical calculation program register No., move the cursor to the incorrect item and press <B> to delete the item.

```
CA01=GE02011-GE01011
```

2. When you add something to a program, the characters are inserted in front of the cursor.

```
CA01=GE02011+GE01011
```

Deleting a Program

Procedure:

1. Select the register number of the program you want to delete.

2. Move the cursor to the "=" location, then press <B> to delete the program.

```
CA01=GE02011-GE01011
```

Restrictions

Order of Priority of Operators

Operators are executed in the following order of priority from highest to lowest priority

High (,)
@, $,
*, /, T,
Low +, –

Division

If a division is used in a calculation program, the digits after the decimal point are discarded. This not only affects the end result, but also each division in the formula. In order to avoid errors due to wrong rounding-off, make sure to put the division at the end of the formula, if possible (see the following examples)

Ex:

CA05=CA01/2*100 (when CA01 = 3)
CA01/2 = 3/2 = 1.5
Since the digits after the decimal point are discarded, 1.5 becomes 1.
CA01/2 x 100 = 1 x 100 = 100
Therefore the result of this calculation is CA05 = 100..

Ex:

CA05=100*CA01/2 (when CA01 = 3)
100 x CA01 = 100 x 3 = 300
100 x CA01 / 2 = 300 / 2 = 150.
Therefore the result of this calculation is CA05 = 150..

Numerical Range of Calculations

The numerical range is between –2147483648 and 2147483647. If an overflow occurs during calculation, i.e. if an intermediate or final result exceeds the permissible range, the XUVM230 displays “0” as the result and sets the ERR signal of the parallel port to ON. The serial interface outputs in this case ”e” as the formula result.
Constants can be specified in the range –65535 to 65535.

Division by Zero

If during a calculation a division by zero occurs, the formula result is displayed as “0” and the ERR signal of the parallel interface goes ON. The serial interface outputs in this case ”e” as the formula result.

Order of Calculation of CA Registers

All calculations in CA registers (numerical calculation registers) are carried out in ascending order of register number. If the result of a calculation in a CA register is to be used by another CA register, the register being used needs to be set earlier than the register using it.

Ex:

Correct:	CA01 = BW01 + BW02
	CA02 = CA01 / 2
Incorrect:	CA01 = CA02 / 2
	CA02 = BW01 + BW02

Calculation of Negative Values

If a negative constant is used in a program, it must be enclosed in brackets ( ).

Ex:

Correct:	(–1) * 235
Incorrect:	–1 * 235

Number of Terms in a Program

A single program can have up to 55 characters and up to a maximum of 12 terms.

Units Used for Input and Output

The units used for input and output of values and operators is shown in the table below.

Operator	*Input value*	*Output value*
@ (atan)	x 10000	x 100
$ (root)	x 1	x 10000
T (distance)	x 1	x 10000

Output Control Function

Use this function when you do not wish to output calculation results (numerical value and judgment result) to the serial or parallel interface. For information on setting and deleting output control, see page 13 - 20.

Ex:

CA01 = X direction distance
CA02 = Y direction distance
CA03 = angle calculated using CA01 and CA02
When using several formulas to calculate the final result (an angle in the case above), you can use this function to output the final result only.

CA01 = X direction distance
CA02 = Y direction distance
CA03 = angle calculated using CA01 and CA02

Use output control to suppress output of CA01 and CA02

XCA01 = X direction distance
XCA02 = Y direction distance
CA03 = angle calculated using CA01 and CA02

When output control is set for CA01 and CA02, only the CA03 result is output to the interfaces.

Setting Output Control

Restrict output of numerical calculation registers that you do not want to output over the serial or parallel interface.

Procedure:

1. Select the register number of the program you do not want to output.
2. Use the cursor lever to move the cursor to any location other than ”=”, then press <A:OutpContr>. An ”X” is displayed to the left of the register number.

```
XCA01=GE02011+GE01011
```

Deleting Output Control

1. If a register has been specified for output control, but you want to change the setting so that it can be output, move the cursor to any location other than ”=”.
2. Press <A:OupContr> and the ”X” mark disappears, enabling numerical calculation output for that program.

```
CA01=GE02011+GE01011
```

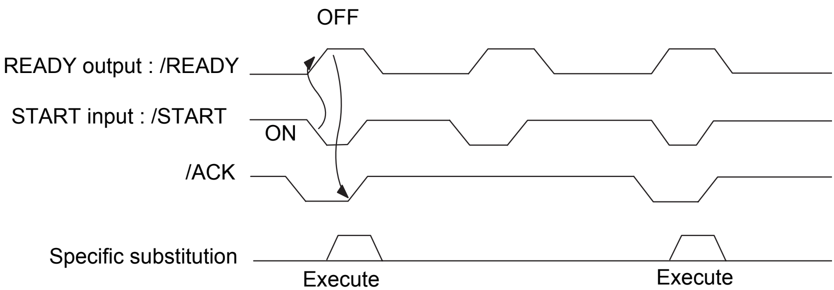
Even if a formula is set and the serial output settings in the **Environment** menu are set to output a numerical calculation, the results of numerical calculation registers that have an ”X” in front of the register number are not output.

Specific Substitution Function

If you activate specific substitution for a formula, the formula will only be calculated again, when the ACK input of the parallel interface is set to ON when the calculation is executed (see timing diagram). Otherwise the old formula result remains. This function is useful if you wish to store reference values from a test object in order to compare them with measurements later during inspection.

Ex:

CA01 ! GF01011
CA02 = CA01 - GE02011 (Min = -10, Max = +10)
The CA01 calculation stores the average gray-value of the gray window checker GF01 for reference. When the value of CA01 does not deviate by more than 10 from this reference value, the CA02 calculation will be judged OK, otherwise NG..



When you wish to calculate formulas specified for specific substitution, make sure that the ACK signal is ON even BEFORE the START signal is set to ON and remains ON until the XUVM230 resets the READY signal.
You can set the specific substitution function in a numerical calculation regardless of whether the ACK signal is ON or OFF.
Specific substitution can also be executed from the serial interface with the %P command.

Note **Even when the specific substitution is executed, it is not written to the F-ROM. When you switch on the XUVM230, formulas set for specific substitution have the value 0.**

Setting Specific Substitution

Procedure:

1. Align the cursor with the ”=” position.

```
CA01=GE02011–GE01011
```

2. Press <A> to change the “=” to “!”, and specific substitution is set.

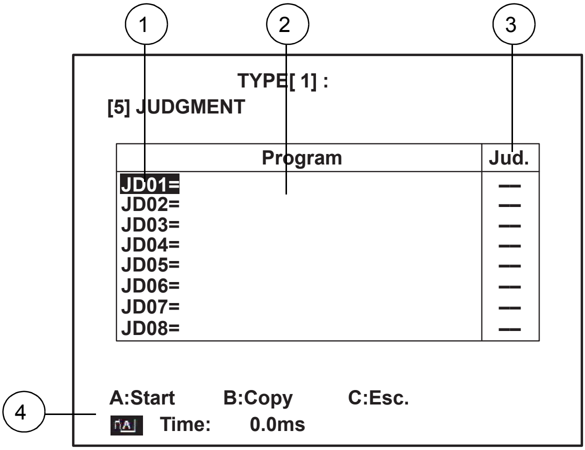
```
CA01!GE02011–GE01011
```

3. To cancel specific substitution, press <A> again and “!” changes back to “=”.

Judgment Output

The results of judgments performed on checkers and numerical calculation programs can be communicated to other devices. The conditions for output are described here. The image cannot be changed once you enter the **Judgment** menu, so if you wish to be able to see a particular image during judgment setup, change to the required image before entering the **Judgment** menu.

Main Menu



1 **Output register number**
Specify which output register the results of judgment are output from. There are two different types of judgment output registers; internal judgment registers (R) and registers for external output (D). You can set up to 32 registers for the XUVM230. Only 8 registers can be shown on screen at a time, but the screen can be scrolled with the cursor lever.

Note **The judgment results set in JR01 to JR32 are not externally output.**

2 **Judgment conditions program**
Displays the judgment conditions program that has been set. The judgment conditions program can be up to 55 characters in length.

3 **Judgment**
Displays the judgment result for the set judgment conditions (OK, NG, or ER).

4 **<A: Start>**
Press <A> to capture an image. The image is then inspected, and, depending on the I/O settings, the judgment result signal is output on the parallel or serial interface.

Note **In screens that offer the function <A: Start>, external start signals can also be accepted.**

Symbols and Operators for Judgment Output

The judgment output menu includes the following items:

Checker	Program Symbol	Checker No.	Object No.	Item	Reference Data
Position/ Rotation Adjustment	PA	01 to 8	*	*	
Character Recognition	CR	01 to 8	00	*	Overall judgment result
			01 to 16	*	Judgment result per character
Character Verification	CH	01 to 16	00	*	Overall judgment result (detected characters + number of differences)
			01 to 30	*	Judgment result per character (only the object No. in the case of pattern verification)
Smart Matching	SM	01 to 4	*	*	
Lead Inspection	LD	01 to 32	*	1	Overall judgment result (No. of detections + lead width + pitch)
				2	Detected leads
				3	Lead width
				4	Pitch
Gray-Scale Edge	GE	01 to 32	*	*	Detection qty. judgment result
Gray-Scale Window	GW	01 to 32	*	*	Average gray value judgment result
Numerical Calculation	CA	01 to 32)	*	*	
Previous Numerical Calculation	OCA	01 to 32	*	*	Judgment result from the previous calculation
Judgment Output R register	JR	01 to 32	*	*	
Judgment Output D register	JD	01 to 32	*	*	

The following operators are used:

Operator Symbol	*Reading*	*Name*	*Content*
+	OR	Inclusive OR	When either of the results is ”1”, the result output is ”1”.
*	AND	AND	When both of the results are ”1”, the result output is ”1”.
#	XOR	Exclusive OR	When the two results are different, the result output is ”1”.
/	NOT	NOT	”1” and ”0” results are inverted.

In this table, ”1” represents OK, and ”0” represents NG.
In the following situations, the result of judgment is ”ER”.

- When the checker referred to produced an error.
- When a checker specified in the judgment program could not be referenced. This occurs when, for instance, the checker is deleted after the judgment program is set up and working properly.

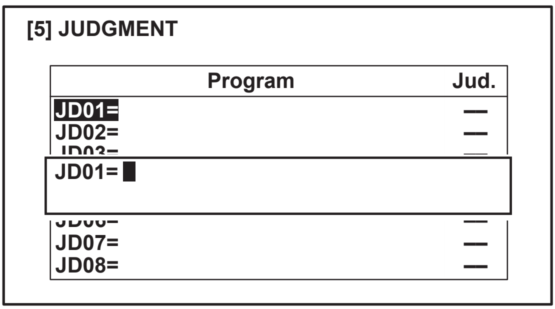
Judgment Programs

Creating a Judgment Program

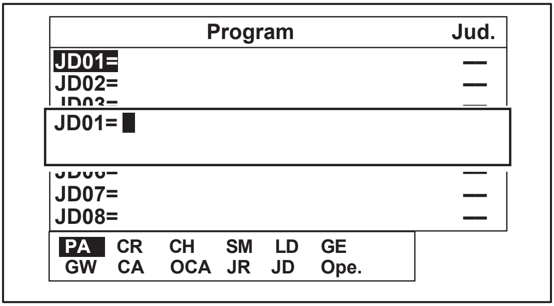
In the judgment condition program example described here, JD01 goes on if the character verification checker No. 1 is OK.

Procedure:

1. Align the cursor to select the register number for the judgment program you are going to create and press **<Enter>**.

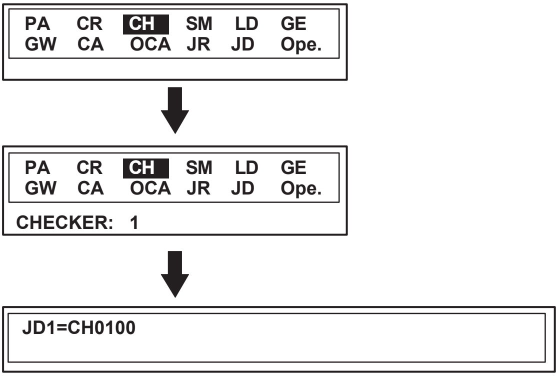


2. From the state shown in step 1 above, press **<Enter>** again. A subwindow is displayed where you select items for input.



Note **Items can only be selected if the corresponding checker results exist.**

3. Next, select the checker results to be referenced.



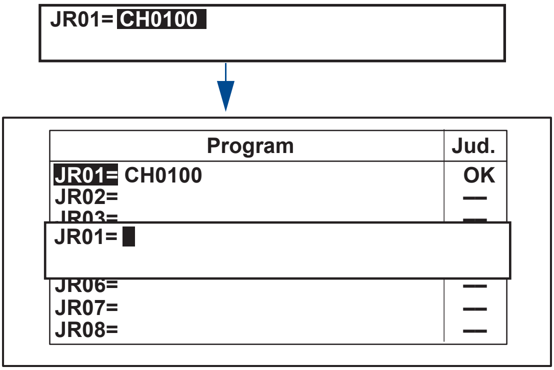
Note **Checker numbers can only be selected if the corresponding checker has been set.**

4. After entry is complete, press <C>.
   A confirmation message asks if you wish to register the changes you have made. To register the changes select **YES**. To discard the information input select **NO**. To cancel, press <C>.

Revising a Judgment Program

Procedure:

1. If you make an input error, then after setting the judgment program register No., use the cursor lever to move the highlight cursor to the incorrect item and press <B> to delete the item..



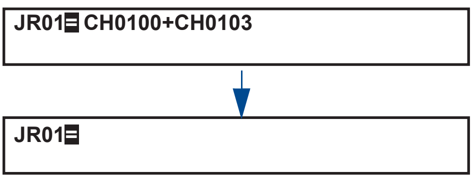
2. To add to a program, characters are inserted in front of the highlight cursor.

Deleting a Judgment Program

Procedure:

1. Select the register No. of the judgment program you want to delete.

2. Use the cursor lever to move the highlight cursor to the ”=” location, then press <B> to delete the program.



Note **If a trap has been specified for the program, the trap is deleted along with the program.**

Restrictions

When setting up judgment programs, please consider the following restrictions.

Order of Priority for the Operators

Order of priority for the operators is as follows:

High	(,)
	/
	*
	#
low	+

Order of Calculation of JR and JD Registers

All registers are carried out in ascending order of register number. If the result of judgment in a JR or JD register is to be used by another register, the register being used needs to be set earlier than the register using it.

Ex:

Correct:	JR01 = PA01 + PA02
	JR02 = JR01 * PA02
Incorrect:	JR01 = JR02 * PA02
	JR02 = PA01 + PA02

Number of Terms in a Program

A single program can have up to 55 characters, and up to a maximum of 16 terms.

Conditions for using NOT (/)

NOT (/) cannot be used together with brackets.

Ex:

Correct:	/ PA01
Incorrect:	/ (PA01)
	/ (PA01 + PA02).

Function Tables for the Operators

You can use the operators to link judgment results with each other.

Result A	*Result B*	*A + B*	*A * B*	*A#B*	*/A*
OK	OK	OK	OK	NG	NG
OK	NG	OK	NG	OK	NG
NG	OK	OK	NG	OK	OK
NG	NG	NG	NG	NG	OK

Note **Judgment result is ER if the judgment register could not be referenced.**

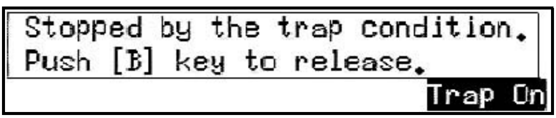
NG Operation

When a "NG" result is generated in a judgment register (i.e. the conditions were not satisfied) you can execute either the Trap function or NG Display. Each type can only be set in one register, and if you execute a data save, the settings will be saved even if the power is switched off.

Trap Function (T)

If you execute an inspection from the main menu and a judgment register that has a trap set for it becomes NG, the execution depends on the following two settings.

1. When the Trap function is set by the judgment, the READY signal is held at the OFF level even after inspection is finished, and the message shown below is displayed. Because the READY signal is off, the START signal is not accepted, and the next inspection is not performed.



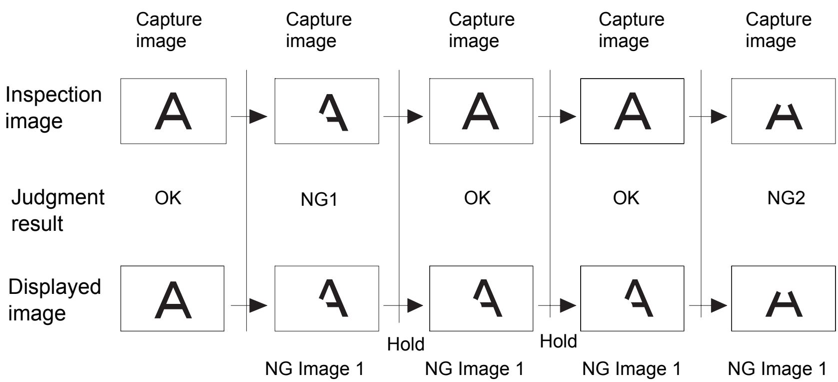
At this time, the only way to return (to the state where the next inspection can be performed) is to press <B>.

2. If **Save Image Data** is also set for the Trap function in addition to the settings for (1), the memory image at the time the NG occurs is saved (see page 15 - 4). Unlike 1., the READY signal stays on, so it is possible to continue performing inspections after a NG is generated.

NG Display Function (N)

If you execute an inspection from the main menu and an NG occurs, (i.e. the conditions were not satisfied), this function just displays the image. This is done if you have set an **N** (NG indicator) in the judgment register, and either **Gray NG** for the display image. This cannot be used when the capture camera is set to **AB**.
When the conditions for a judgment register that has an **N** (NG Display) set for it become NG, the image is displayed on the monitor, and, subsequently, the monitor display image is only updated when another NG occurs (i.e. the current NG image is displayed until the next NG occurs under the same register conditions). The monitor only displays the NG image, and inspections are executed on a new image.

Ex: **How to use the** NG Display **function:**



It is also possible to set and change checkers when an NG image is being displayed. However, in the following cases, the NG display image is reset:

- The button <B> is pressed to switch display images.
- The type is switched.
- The power is switched off.

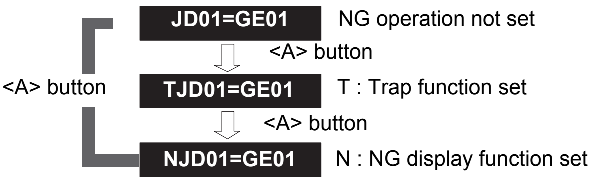
Setting and Canceling the NG Display Function

Procedure:

1. Set the register No. for the judgment condition that you want to set or cancel (<A: NG-Exec> is displayed at the bottom left of the screen).

2. When nothing is displayed to the left of the Register No., NG operation is not set.

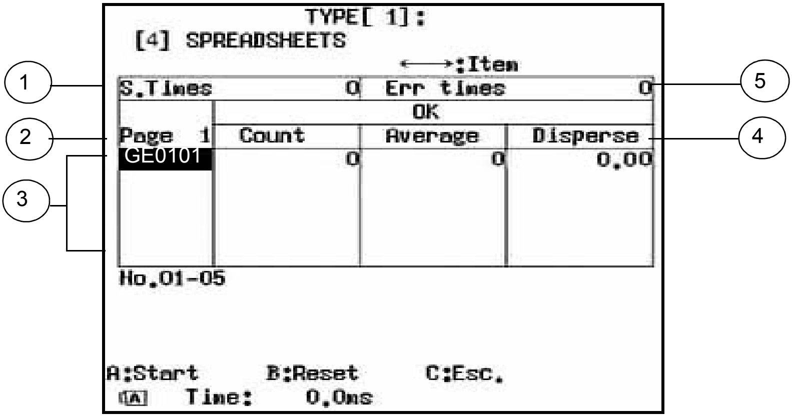
3. Press <A> to display a **T** to the left of the Register No.
   Press it again to display an **N** to the left of the Register No.



4. Press <A> again, and the **N** will disappear. This cancels the setting.

Spreadsheets

When executing, the total number of scans and errors, as well as the count, average, dispersal value, maximum value, minimum value, and range of each of the OK and NG outputs of the designated checker are counted and displayed. However, scans are not counted unless at least one checker has been set.
The image cannot be changed once you enter the **Spreadsheets** menu, so if you wish to see a particular image, change to the required image before entering the menu.



1 **Scan Times**
Counts the total number of scans for all executions. However, the number of scans will not be counted if no checkers are registered. The maximum count is 4,294,967,295. Scans that exceed this maximum will not be counted.

2 **Page**
Move the cursor to this location, and then use the cursor lever to open the spreadsheets page. The spreadsheets can reference up to 40 checkers, but only five can be displayed at one time on the screen. Therefore, there are 8 pages with 5 checkers each.

3 **Reference checker**
Sets and displays a checker for referencing. Move the cursor to this location and press <Enter> to display a list of the checker numbers. Select the checker that you want to reference. Up to a maximum of 40 checkers can be referenced.

4 **Data items**
Three items can be displayed on the monitor at one time (either Count, Average and Disperse, or Maximum, Minimum, and Range). To switch the display, move the cursor to the reference checker location, and use the cursor lever to change.

Item name	*Display information*
Count	Counts the OK and NG judgments of the checker data.
Average	Records the average of the OK and NG judgments of the checker data.
Disperse	Records the dispersal value of the OK and NG judgments of the checker data. The dispersal value is calculated from the following formula: Dispersal value = $(\Sigma((X_n - X_{ave})$ ´ $(X_n - X_{ave})))/n$
Maximum	Shows the maximum number of OK and NG judgments for the checker.
Minimum	Shows the minimum number of OK and NG judgments for the designated checker.
Range	Shows the range of the OK and NG judgments of the designated checker. The range is an absolute value between the maximum and minimum values.

5 **Error Times**
Counts the number of errors generated (number of times that the parallel error signal was output).

<A: Start>
Press <A> to capture an image, perform an inspection and output parallel and serial signals in accordance with I/O settings.

<B: Reset>
All values are reset to 0. Select **YES** to reset all values; select **NO** or press <C> to abort reset.

<C: Esc.>
Press <C> to return to the main menu.

Note **The number of scans is the total number of starts. The number of OK and NG outputs will count the data after the checker item is designated. Consequently, the "OK count" and the "NG count" will not necessarily equal the "Total scan times". In addition, if the result is ERR, only the number of errors is counted, and the NG data is not updated.**
Spreadsheets can be operated for each type.
Spreadsheet data is cleared when you switch types or switch off the power. The results for each type are stored in the QS register.

You can perform numerical calculations on the spreadsheet results. The markings for numerical operations in spreadsheets are as follows:

Symbol	*No.*	*Mode*	*Content*
QS	1	0	No. of scans
	1 to 40	1	No. of OK outputs
		2	No. of NG outputs

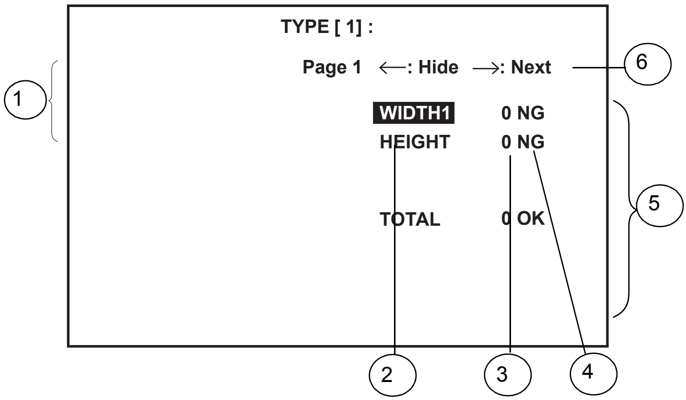
Data Monitor

The **Data Monitor** function displays the results of numerical calculations and judgment outputs in a list. It is also possible to change the maximum and minimum values for the numerical calculations displayed.
You can register up to 20 items (10 items/page x 2 pages) with titles (of up to 8 characters/symbols). In order to use this function, set the main screen display to **Data Monitor**: In the **Type** menu, use the option **6. Menu Setting** to set the **61. Screen Display** to **Data Monitor**. Then use **4. Data Monitor** from the main menu to set the items to be displayed.

Note **For information on changing the display temporarily,** see page 3 - 9**. For information on changing the display permanently,** see page 5 - 20**.**

The Data Monitor Display

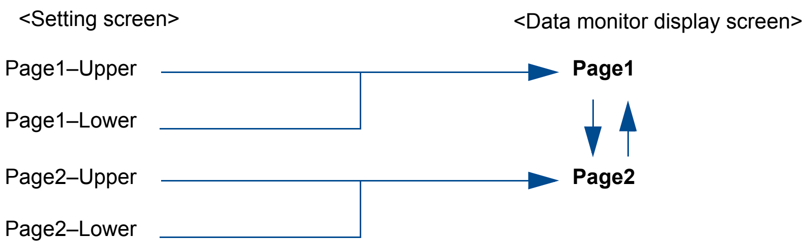
The inspection result values are displayed with their titles. Up to 10 items can be displayed on each page.



1 Title (up to 8 characters)
2 Numerical calculation result (up to 6 digits)
3 Numerical calculation judgment result
4 Data display (up to 10 items per page)
5 Move the cursor lever to the right to turn the page and display the next 10 items.

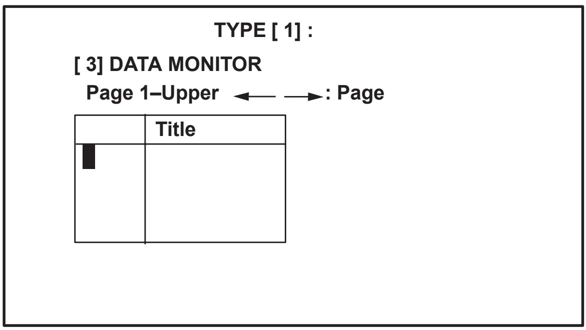
Setting the Data Monitor Display

The following example shows how to select data for display and set a title. Up to five items of data can be set for each screen. The relationship between the setting screen and the **Data Monitor** display screen is as follows.

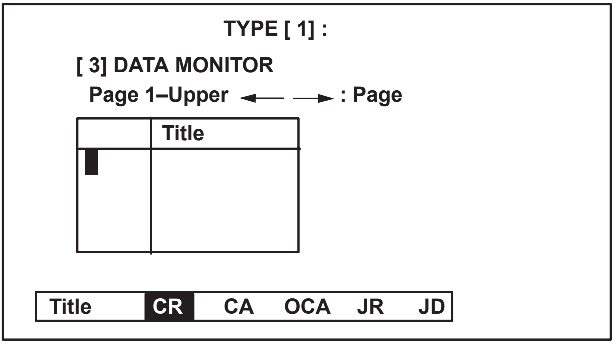


Procedure:

1. Select 3. Data Monitor from the menu and confirm the selection

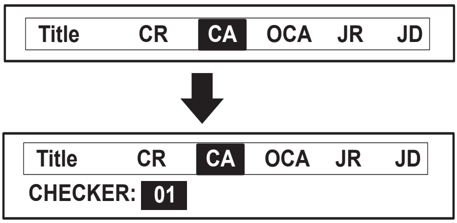


2. Press <Enter> to display the register selection window



3. Use the cursor lever to select the register to display in the Data Monitor and confirm the selection

Example: Select CA01.



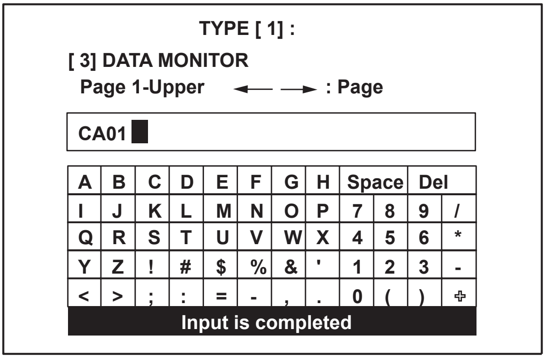
After you select a register, the title input window will appear.

Note **The title input window does not appear when you have selected an OCR/OCV checker (CR).**

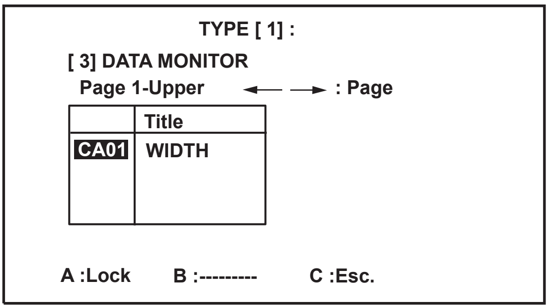
---

4. Input a title of up to eight characters in length

   The default (initial) setting is the register name. For details on using the keyboard, see page 5 - 15.



5. When you have finished entering the title, select Input Complete and confirm to display the title that you input



Editing Titles of Display Item

Note **This option is not available for OCV/OCR checkers**

Procedure:

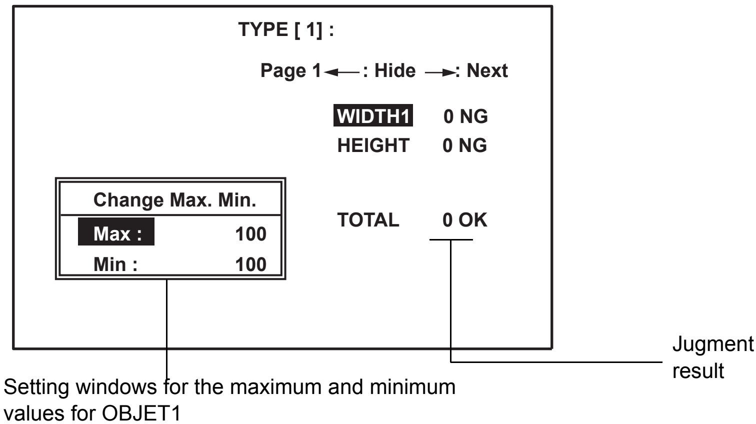
1. Select the item you wish to change
2. Press <Enter> to display the register selection window
3. Select "Title" <Enter>

   The title input window will appear.
4. Edit the title in the same way as you would input a new title
   For details on using the keyboard.

Changing the Maximum and Minimum Values

1. Highlight the register for which you wish to change the maximum and minimum values

2. Press <Enter> to display the setting window for the maximum and minimum values



3. Select Max : and press <Enter>

4. Set the maximum value
For details on how to change numerical values, see page 3 - 12.

5. Select Min : and set the minimum value accordingly
   It is possible to lock the maximum and minimum values so that they cannot be changed from the Data Monitor, see below.

Locking and Unlocking Maximum and Minimum Values

Procedure:

1. Highlight the register for which you wish to lock the maximum and minimum values

2. Press <A:Lock> with the register highlighted to lock the setting values

   An “L” will be displayed to the left of the item. To unlock it, press <A> again.

L	CA01	WIDTH

Deleting a Display Item from the Data Monitor

Procedure:

1. Highlight the register which you wish to delete

2. Press <B :Delete>

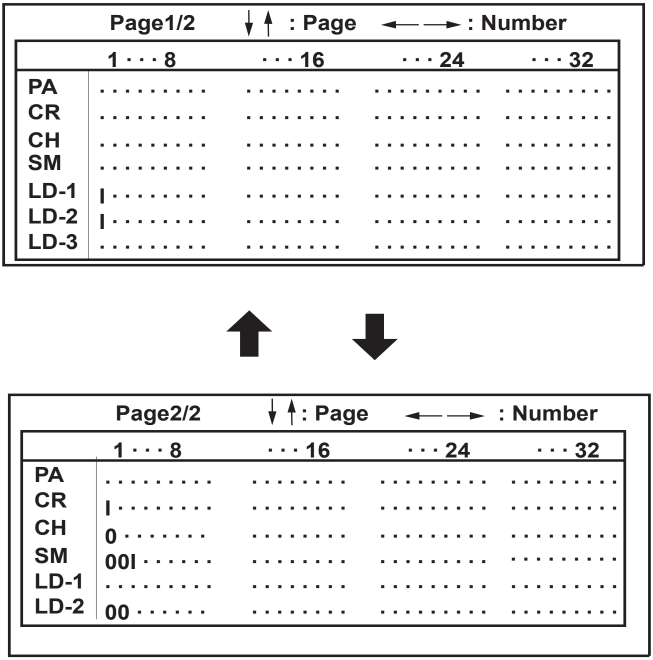
Checker List

This function displays the operational status of checkers in a list, and allows you to verify the set checkers, their numbers, and their results at a glance.
In order to use this function, set the main screen display to **Checker List**: In the **Type** menu, use the option **6. Menu Setting** to set the **61. Screen Display** to **Checker List**.

Note **For information on changing the display temporarily,** see page 3 - 9**. For information on changing the display permanently,** see page 5 - 20**.**

32 status items are displayed for each checker as shown in the diagram below.

Display	*Meaning*
I	Setting complete, the current result is OK
0	Setting complete, the current result is NG
E	Setting complete, the current result is error
-	Not set



Use the cursor lever to change pages. The page structure is as follows.

Page	*Display*	*Meaning*
1/2	PA	Position/Rotation Adjustment
	CR	Character Recognition
	CH	Character Verification
	SM	Smart Matching
	LD–1	Lead Inspection: Detected judgment
	LD–2	Lead Inspection: Width judgment
	LD–3	Lead Inspection: Pitch judgment
2/2	GE	Gray-Scale Edge Checker
	GW	Gray-Scale Window Checker
	CA	Numerical Calculation Register
	JR	Judgment Output (R register internal)
	JD	Judgment Output (D register external)

CHAPTER 14

Save Data

How to Save Your Data and Settings

Use this option to save the data and settings. If setting data is not saved, any changes made will be lost when the power is turned off.
As soon as you have changed checkers and other settings, a warning message is displayed at the bottom of the main menu until the data is saved.

```
Data changed, but not saved.
After POWER OFF changes will be lost.
```

The warning message will not appear in the following cases:

- When you have changed settings in the **Setting Help Tools** menu.
- When you have switched types and the parameter **Start Type** is set to **No.1**.
- When you have switched types and the parameter **Start Type** is set to **Last Store Type No.**, but the parameter **Display Message** is set off.

Via the Main Menu

Procedure:

1. Select **Save Data** and press **<Enter>**.
   All the changes made up to that point are saved. There is no need to save the data every time a change is made, but make sure to save the data before turning the power off if any settings or changes have been made. The message shown above is no longer displayed when you save data

```
Save the Changed Data?
      [YES]   [NO]
```

2. If you select **YES** when the above message is being displayed, the data will be saved. If you select **NO** or press <C>, the process will be abandoned
   The following message is displayed when the data save is in progress.

Danger of data loss or damage to the system!
Do not use the keypad, serial or parallel communications, or switch off the power while this message is on the screen. Doing so may cause not only the loss of the data, but may damage the system or prevent it from starting up.

The amount of time required to save data depends on the amount of data. A small amount of data can be saved quickly, but if there is a lot of data, saving may take up to a minute.

Note **The following data is not saved in the F-ROM when data is saved:**

Images saved using the 6. Save Data **menu**

Results of executing checkers (judgments/detection values)

Results of calculations specified for specific substitution of numerical calculation

Accumulated data count values

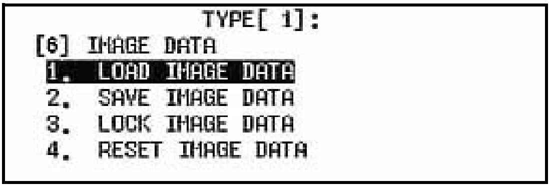
Spreadsheet values

CHAPTER 15

Useful Functions

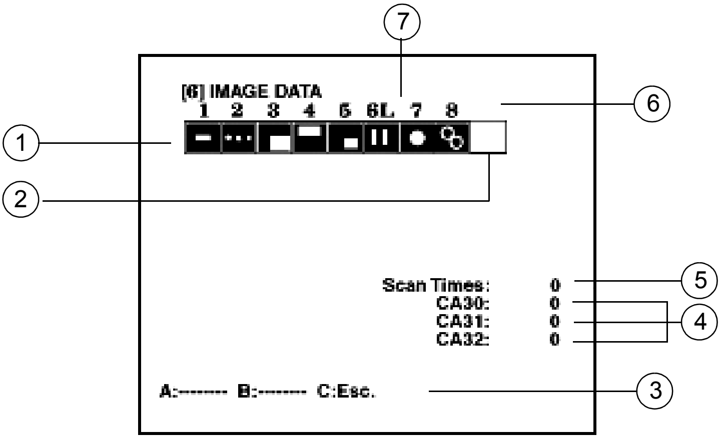
Loading and Saving Image Data

Image data from an image captured by a camera can be saved in memory. Up to 8 screens can be saved..



Load Image Data

Call up saved images. When image data is loaded, 8 reduced-size screens are displayed. Move the cursor over to load the desired image.



1 Display area for reduced images.

2 Displays the current image.

3 Press <C> to return to the previous image.

4 When the screen indicated by the cursor is saved, the result data in the numerical calculation register set for the **Limit Condition** is displayed (however, it is not displayed when the cursor is indicating the current image).

5 Shows the number of scans when the highlighted image was saved. (Will not be displayed when the cursor is highlighting the current image.)

6 Shows the index number of the image. The smaller the number, the older the image.

7 This ”L” marking will appear if the lock is set on the image.

Procedure:

1. Select the image you want to load with the cursor

2. Press <Enter>
   The selected image will be loaded, and you will return to the previous screen.

Save Image Data

Use this option to save the currently displayed image. If you select **2. Save Image Data**, the following message appears:

```
Save this image?
 [YES]   [NO]
```

If you select **YES**, the image being displayed is saved. If you select **NO**, the image is not saved.

Note **After the current image is saved (without capturing the image), it is not possible to save the same image again. The following message will be displayed if you try to do this.**

```
E0172 It is already saved.
```

You can select from among four methods for saving images. Set the method in the **Environment** menu (see page 5 - 11).

Lock Image Data

Use this option to lock and unlock saved images. When using the option **3. Lock Image Data**, as when using the option **2. Load Image Data**, 8 reduced-size screens are displayed.

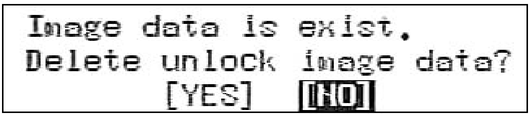
Procedure:

1. Select the image you wish to lock or unlock with the cursor
2. Press <A> to set or remove a lock

Note **The <Enter> button does not work in the** Lock Image Data **screen.**

Reset Image Data

Use this option to delete all saved images with the exception of locked images. When you select **4. Reset Image** Data, the following message appears:



Select **YES** to delete all unlocked images. Select **NO** to abort deletion.

Conditions for Deleting Image Data

When the processes listed below are performed, all images are cleared, including locked images.

- Switch power off
- Change camera mode
- Change the Save Image Data settings
- Delete, initialize, copy or switch types
- Initialize the settings in the **Environment** menu

Hints for Restoring Images

When restoring images using Vision Backup Tool (VBT), there is no distinction between one or two cameras or between cameras A and B. It is possible to restore the type of camera 2 to the type of camera 1. Consequently, discrepancies may arise between the index display and the camera link under the following conditions:

- When the type of the second camera is restored to the type of current camera 1.
- When the type of the first camera is restored to the type of current camera 2.
- When the type of camera 1 (B) is restored to the type of current camera 1 (A).
- When the type of camera 1 (A) is restored to the type of current camera 1 (B).

If discrepancies arise, either:

- Do not upload a type that has different camera connection information, or
- Delete all images saved before invoking VBT.

Group Move

Group move is a function for moving a group of already specified checkers that have the same position and rotation adjuster number.

Procedure:

1. Select **2. Checker** from the main menu.

2. Select **3. Group Move** from the **Checker** menu.

```
[3] GROUPE MOVE
    No. 0
    1. CHAR. RECOG.            Yes
    2. CHAR. VERIF.            Yes
    3. SMART MATCHING          Yes
    4. LEAD INSPECTION         Yes
    5. GRAY EDGE DETECTION     Yes
    6. GRAY WINDOW             Yes
```

3. Group No.
   Set the position and rotation adjustment group number for the checkers to be moved as a group.

Setting	*Functionality*
0	Move all checkers with position and rotation adjustment group set to ”0”.
1 to 8	Move all checkers adjusted by the specified position and rotation adjustment group number.

4. Select the types of checkers for group move.
   Group move only applies to checkers of a type specified as **Yes**.
   Group move does not apply to checkers of a type specified as **No**.

5. If necessary, press <A> to capture an image.

6. Select the position and rotation adjustment group number for the checkers to be moved.
   The number entered represents the appropriate position and rotation adjustment group. The checkers corresponding to the number entered are displayed brightly.

Note **Position and rotation adjusters cannot be moved by** Group Move**.**

7. Select the types of checkers to be moved.
   Set independently for each type of checker whether or not it should be included in a group move. The types of checkers included in a group move are displayed brightly.

8. Press <A> to start the group move.
   Images with rotation angle 0 are displayed during a group move. Use the cursor lever to move the checkers to the required position.

9. Press **<Enter>** to complete the group move.

Note **All results are cleared for checkers which have been group moved. Since the position to which the checkers are moved becomes the execution position for the next inspection, the amount of adjustment may prevent a checker from being set within the screen. (A situation where the setting position cannot be set within the screen.) In this situation, the error message "Position is out of image range." is displayed.**
If this error occurs after a group move when several checkers have been moved at once, the move is canceled for all checkers and they return to their positions before the move.

When <A> is pressed to execute a group move, in some cases an error message is displayed and the move does not occur, e.g.:

When the checkers being moved are adjusted by a position and rotation adjuster so that the X-coordinate is outside the range 0 to 511, or the Y-coordinate is outside the range 0 to 479.

When the mask areas for the checkers being moved are adjusted by a position and rotation adjuster so that the X-coordinate is outside the range –511 to 1022, or the Y-coordinate is outside the range –479 to 958.

When the checkers to be moved are adjusted by a position and rotation adjuster, and that position and rotation adjuster has generated an error.

When no checkers exist for the specified position and rotation adjuster group.

CHAPTER 16

Serial/Parallel Communication Settings

Available Functions for Parallel and Serial Interface

The VISION CONTROLLER is equipped with both serial (2 channels) and parallel interfaces. With these ports you can control the VISION CONTROLLER using a programmable logic controllers (hereafter PLC) or computer. The things that can be controlled differ depending on whether you are using serial or parallel communication.

Item	*Input or output*	*Details*	*Parallel*		*Serial*	
			I/O terminal	See page	Command	See page
Inspection preparation complete	Output	Inspection preparations complete (waiting for the next start signal)	RDY (READY) signal ON	16 - 25		
Start inspection	Input	Specific substitution formula not executed	STA (START)	16 - 25	%S$^{C}_{R}$	16 - 22
	Input	Specific substitution formula executed	ACK + STA (START) signal (hold ACK until RDY goes OFF)	16 - 25	%P$^{C}_{R}$	16 - 22
	Input	Re-inspect (image capture: not executed)			%R$^{C}_{R}$	16 - 22
Image capture complete	Output	Image capture only complete	REN (REND)	16 - 31	%R$^{C}_{R}$	16 - 22
Output inspection data	Output	Inspection complete (before data output)			%E$^{C}_{R}$	16 - 22
	Output	Judgment output	D1 to D8 (For D9 and after, handshaking is ACK and STROBE signal is required.)	16 - 27	Example: 002148030912$^{C}_{R}$ or 21,4803,912$^{C}_{R}$ etc.	16 - 23
	Output	Numerical data	D1 to D8 (Handshaking is ACK and STROBE signal is required.)	16 - 29		16 - 23

Item	*Input or output*	*Details*	*Parallel*		*Serial*	
			I/O terminal	See page	Command	See page
Re–register judgment string for character recognition	Input	Change judgment string			%W?, Judgment String (? = 1 to 8)	16 - 38
	Output	Change complete			%W?, Judgment String (? = 1 to 8)	16 - 38
Re–register character pattern	Input	Specification of Character Verification checker + re–registration timing	IN1 to 4 (Image Verification checker No. + IN6) (re–registration timing)	16 - 40	%O?? (??=01 to 16) You need to confirm the re–registration by sending %O again.	16 - 40
	Output	Registration complete	Confirm by RDY (READY) signal off to on transition.	16 - 40	%O (waiting for confirmation input) %O?? (??=01 to 16)	16 - 40
Smart Matching Checker re-registration	Input	Specification of Smart Matching checker No. + Re-registration signal	IN1 to 2 (Smart Matching checker No.) + IN8 (Re-registration signal)	16 - 45		
	Output	Switching complete	Confirm by RDY (READY) signal OFF to ON transition.	16 - 45		
Numerical Calculation	Input	Refer to max. and min. limits			%F??$^{C}_{R}$ (??=01 to 32)	16 - 56
	Output	Response to reference			%F??,n,n$^{C}_{R}$ (??=01 to 32)	16 - 56
	Input	Change max. and min. limits			%N??,n,n$^{C}_{R}$ (??=01 to 32)	16 - 57
	Output	Change complete			%N??,n,n$^{C}_{R}$ (??=01 to 32)	16 - 57
Switch Type	Input	Specification of type No. to switch to + switching signal	IN1 to 5 + TYPE	16 - 36	%X??$^{C}_{R}$ (??=01 to 32)	16 - 36
	Output	Switching complete	Confirm by RDY (READY) signal OFF to ON transition.	16 - 36	%Y??$^{C}_{R}$ (??=01 to 32)	16 - 36

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	See page	Command	See page
Camera switching	Input	Easy mode (switching between A and B)	IN7	16 - 54		
		Details mode (A or B, Thru or Memory))	IN1 to 2 (Image specification) + IN7 (Switching signal	16 - 54	$\%I?^{C}{}_{R}$ (??=0 to 3)	16 - 53
	Output	Switching complete	Confirm by RDY (READY) signal OFF to ON transition	16 - 54	$\%I^{C}{}_{R}$ (for switching with Details mode only)	16 - 53
Spreadsheets	Input	Spreadsheet reset			$\%Q^{C}{}_{R}$	16 - 18
	Output	Reset complete			$\%Q^{C}{}_{R}$	16 - 18

Communication Settings in the Communication Menu

In order to control the unit using serial or parallel communication, you must first set the communication settings. The various menu settings are explained below.

```
[7] ENVIRONMENT
4.  Communication
    41.  Com. Mode          Normal Mode
    42.  RS232C
    43.  Serial Output
    44.  Parallel Output
    45.  Type Switch Min.    0 ms
```

41. Com. Mode
see section below.

42. RS232C
see page 16 - 10

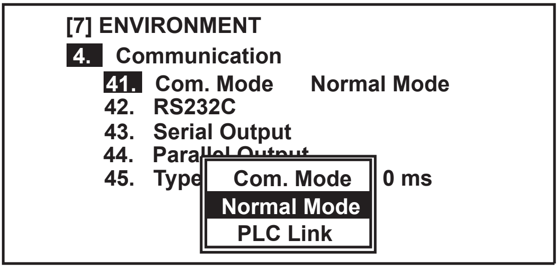
43. Serial Output
Settings required for communication via the serial interface (see page 16 - 12).

44. Parallel Output
Settings required for communication via the parallel interface (see page 16 - 15).

45. Type Switch Min.
It is possible to use serial or parallel communication to set the minimum time that the Ready signal is OFF for (range 0 to 100ms in 10ms steps). For detailed information, see page 16 - 34.

Com. Mode

Select **PLC Link** if you will be using the PLC Link function to communicate with a PLC (for example, Telemecanique PLC). Otherwise, select **Normal Mode** or **PLC Link**.



Setting	Details
Normal Mode	Perform communication using the proprietary VISION CONTROLLER protocol. All commands are available for use (see page 16 - 18).
PLC Link	With this mode you match the communications protocol to that of a specific PLC (Telemecanique, Omron PLC-C Series, Mitsubishi PLC-A Series and FX, Matsushita PLC-FP Series) for inspection data output and reading the Type No. when switching types. However, the communication via PLC Link requires parallel signals (see page 16 - 58).

RS232C

Sets the RS232C parameters in order to use serial communication. Set all options to the same settings as the equipment that you will be communicating with. If the settings differ from those of the other equipment, communication will not be possible.

```
[7] ENVIRONMENT
42. RS232C
    421. Baud rate (bps)   19200
    422. Length            8
    423. Stop Bit          1
    424. Parity            None
    425. Flow Control      None
```

421.Baud rate (bps)

Selects the transmission speed for communications (bps).
There are 8 transmission speeds available: 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200. For **PLC Link** mode, set the baud rate to the PLC's communication speed setting.

Note **Some computers or PLC do not support transmission speeds of 19200bps or greater (in some cases, communication will not work despite the fact that the settings are available).**

422.Length

Sets the number of data bits in each byte. You can select a 7-bit or 8-bit length. For **PLC Link** mode, set the length to the PLC's data length setting.

423.Stop Bit

Selects the number of stop bits in each byte (either 1 or 2). For **PLC Link** mode, set to the same as the PLC's stop bit setting.

424.Parity

Selects the type of parity checking to use to check the data. The selection options are None, Odd, or Even. For **PLC Link** mode, set the parity to the PLC's parity check setting.

425.Flow Control

Sets the method of handshake flow control. The selection options are **None** or **Xon/Xoff**.

What Is Flow Control?

During high-speed serial communication, an overflow may occur if the receiving device’s processing speed cannot keep up with the sending device’s transmission speed. Flow control is used to prevent this.

There are two types of flow control: soft flow and hard flow. Soft flow controls the flow using an XON/XOFF code embedded within the transmitted data, while hard control uses an RTS/CTS signal. Generally, soft flow is used when the transmitted data contains only text, and hard flow is used when binary data is transmitted.

However, neither type of flow control can completely prevent all errors. Overflows may also be generated by processing on the computer side. If this happens, adapt the computer transmission speed and the baud rate (communication speed).

Serial Output Settings for Normal Mode

The screen below will appear when you have set **41. Com. Mode** to **Normal Mode** and select **43. Serial Output** to set the output conditions for the serial interface. Here you select the data, signals and format for performing serial communication using **Normal Mode**.

[7] ENVIRONMENT	
43. Serial Output	
431.Output	11Colum (1-11)
432.Output Char.	16Char. (1-16)
433.Inval. Digit	Del
434.Read End	None
435.Process End	None
436.Numerical Calc.	None
437.Judgment	None
438.Char. Recogn.	None

431.Output

Sets the number of digits in the output data (setting range: 1 to 11).

432.Output Char.

Sets the maximum number of characters that can be recognized par checker.

433.Inval. Digit

Sets the method of handling invalid digits in the output data.
If you select **Del**, the data is handled as variable-length data, and if you select **Repl.0**, the data is handled as fixed-length data with the number of digits specified in the option **431. Output**.

434.Read End

Selects whether or not to perform serial output of the image capture complete signal (%R).

435.Process End

Selects whether or not to perform serial output of the inspection complete signal (%E).

436.Numerical Calc.

Selects whether or not to perform serial output of results of numerical calculations.

437.Judgment

Selects whether or not to perform serial output of the judgment results.

438.Char. Recog.

Set whether or not to output the recognized string.

Serial Output Settings for PLC Link

The screen below will appear when you have set **41. Com. Mode** to **PLC Link** and select **43. Serial Output** to set the output conditions for the serial interface. Here you select the data, signals and format for performing serial communication using PLC Link.

[7] ENVIRONMENT

43. Serial Output

431.	Type No Register	%MW0000
432.	Top Data Register	%MW0000
433.	Timeout	5000ms
434.	Output	16bit
435.	Output Char.	16Char. (1-16)
436.	Numerical Calc.	None
437.	Judgment	None
438.	Char. Recog.	None
439.	PLC Type	MODBUS-IEC
440.	PLC Adress	1

431.Type No. Register

Specifies the PLC register number in the range 0 to 9999.

When the TYPE signal is input, the type is switched to the number that corresponds to the value saved in the register number specified here.

Ex:

If the type register setting is 1, and the value stored in register %MW1 is 5, then, when the TYPE signal is input, the type is switched to No. 5.

432.Top Data Register

Sets the top register number for use when outputting data to PLC. The setting range is 0 to 9999.

433.Timeout

Sets the maximum time to wait for a response after outputting data to the PLC, or after requesting a type switching number.

434.Output

Sets the bit length for the output data to either 16 or 32 bits.

Number of bits	*Value range*
16 bits	values in the range -2^{15} to $2^{15}-1$ (–32768 to 32767) can be output.
32 bits	values in the range -2^{31} to $2^{31}-1$ (–2147483648 to 2147483647) can be output.

435.Output Char.

Sets the maximum number of characters that can be recognized per checker.

436.Numerical Calculation

Sets whether or not to output the numerical calculation results.

437.Judgment

Sets whether or not to output the judgment results.

438.Char. Recog.

Sets whether or not to output the recognized string.

439.PLC Type

Sets the PLC type (Telemecanique PLC and models from some other manufacturers are available).

440.PLC Adress (Only for MODBUS / MODBUS-IEC PLC type)

Sets the PLC Adress (1 to 255).

Note **If the number of digits in the output data exceeds the setting for the number of output digits, the VISION CONTROLLER will output the OVF (overflow) signal, and will output the required portion of data as zeros. Be sure to monitor the OVF signal.**

Parallel Output Settings

Perform the following settings in order use parallel communication.

1. Select the data to be output

2. Select the data output and reset methods

3. Select the methods for re-registering the Smart Matching template and for switching the camera

[7] ENVIRONMENT	
44. Parallel Output	
441. Handshake	**Yes**
4411. Timeout	**5000ms**
4412. Delay Time	**300μs**
4413. Numerical Calc.	**None**
4414. Judgment	**Out**
442. Reset Cond.	**Latch**
443. Setting Template	**No**
444. Disp. Img. Change	**Easy Mode**

441.Handshake

In the case of output from JD01 to JD08 only, select "**No**" (there is no need for handshaking). In the case of output from JD09 and subsequent registers, and numerical calculation results in addition to JD01 to JD08, select "**Yes**" (handshaking is required). See options **4411 Timeout** to **4414 Judgment** as well.

4411.Timeout (To)

If handshaking is performed, this sets the maximum time to wait for the confirmation (ACK signal) from the external device in response to a signal output by the VISION CONTROLLER. The timeout can be set in the range from 20ms to 20000ms in 1ms steps.

4412.Delay Time (Td)

This sets a delay between the ACK signal and the STROB signal in order to prevent chattering during handshaking. The delay time can be set in the range from 300μs to 20000μs in 100μs increment

4413. Numerical Calculation

Selects whether or not to output the results of numerical calculation if handshaking is performed. If you want to output numerical calculation data, select 8-bit, 16-bit, or 32-bit as the output data length from the **Numerical Calculation** menu (see page 13 - 7).

4414.Judgment

Selects whether or not to output judgment results if handshaking is performed.

Note **If you use handshaking,** 4413. Numerical Calc. **and** 4414. Judgment **cannot both be set to** None**. One of the two must be set for output.**

442.Reset Conditions

Use this option to select from among one of the following three methods for resetting the parallel output data. For a detailed timing chart, see page 16 - 31.

Latch (initial setting):	Hold until the next inspection result.
Off after image capture:	Reset (switch OFF) after completion of the next inspection image capture.
Off before image capture:	Resets (OFF) before starting the next inspection image capture (after detecting the start signal).

443.Setting Template

Sets whether or not to re-register the smart matching template using parallel input, and select from among the four execution methods available (see page 16 - 43).

No:	Do not re-register, even is the re-register signal is input.
Setting position:	Execute re-registration at the position that the template region was set.
Execution position:	Execute the matching checker, and execute at the detected position (or the position with the highest correlation in case multiple objects are to be detected).
Adjustment position:	Position adjustment is executed, and re-registration is performed after the smart matching is adjusted. Smart matching is not executed and the image at this position is re-registered as the template.

444. Display Image Change

This switches the camera image displayed on the monitor using parallel input. There are three switching methods. For details regarding the timing chart and the method for specifying IN1 and IN2, see page 16 - 52.

No:	Select **No** if you want to perform template re-registration with a smart matching checker and the checker number is ≥ 64 (see page 16 - 43).
Easy mode	Changes between camera A and Camera B when parallel input IN7 goes ON.
Details mode :	Changes to the specified camera (A or B) for the parallel inputs IN1 and IN2, and the specified image (Thru or Memory) when IN7 goes ON.

Serial/Parallel Communication Command Tables

Serial Command Table

Data	Transmission	Function	Notes
%S $^{C}_{R}$ (*1)	External device to XUVM230	Inspection start command	Numerical calculation for specific substitution not executed.
%P $^{C}_{R}$ (*1)	External device to XUVM230	Inspection start command	Numerical calculation for specific substitution executed.
%R $^{C}_{R}$ (*1)	External device to XUVM230	Re-inspect command	Checkers executed without capturing a new image. Numerical calculation for specific substitution not executed. Note The image remains even if you switch to another type. This means you can execute different types on one and the same image.
%R $^{C}_{R}$	XUVM230 to external device	Capture end command	Capture end command not output if **434. Read End** (Normal mode) in the **Environment** menu is set to **None**.
%E $^{C}_{R}$	XUVM230 to External device	Inspection end command	Inspection end command not output if **435. Process End** in the **Environment** menu is set to **None**.
Example: 1012341234$^{C}_{R}$	XUVM230 to External device	Inspection data	Changes according to menu items 431 to 438 in Normal mode. Output sequence is judgment, then numerical calculation data.
%X?? $^{C}_{R}$	External device to XUVM230	Type switching command	Type switch numbers are from 01 to 32.
%Y?? $^{C}_{R}$	XUVM230 to External device	Type switching end command	Output when type switching ends normally.
%W?[judg-ment string] $^{C}_{R}$	External device to XUVM230	OCR checker – Change judgment string change command	Changes the Judgment string. Character Recognition numbers are 1 to 8.
%W?[judg-ment string] $^{C}_{R}$	XUVM230 to External device	OCR checker – Change judgment string change complete command	Outputs when change of the Judgment string was completed.

Data	Transmission	Function	Notes
%O?? $^{C}{}_{R}$	External device to XUVM230	OCV checker – Re–register reference image	Registers the reference image for character verification again. To perform re–registration, you must input this command twice. The character verification checker number range is 01 to 16.
%O?? $^{C}{}_{R}$	XUVM230 to External device	OCV checker – Re–registration of reference image complete command	This command is output when re–registration of the reference image is complete.
%N??, [minimum], [maximum] $^{C}{}_{R}$	External device to XUVM230	Change command for numerical calculation maximum and minimum values	Changes the maximum and minimum values for a numerical calculation. Register numbers are 01 to 32.
%N??, [minimum], [maximum] $^{C}{}_{R}$	XUVM230 to External device	Change complete command for numerical calculation maximum and minimum values	Output when change of the maximum and minimum values for a numerical calculation was completed normally.
%F??$^{C}{}_{R}$	External device to XUVM230	Reference command for numerical calculation maximum and minimum values	References the maximum and minimum values for a numerical calculation. Register numbers are 01 to 32.
%F??, [minimum], [maximum] $^{C}{}_{R}$	XUVM230 to External device	Notification command for numerical calculation maximum and minimum values	Output as a reply to the Reference command for numerical calculation maximum and minimum values.
%I?$^{C}{}_{R}$ (?=0 to 3)	External device to XUVM230	Camera change command	Changes the display camera.
%I $^{C}{}_{R}$	XUVM230 to External device	Camera change complete command	Output when the camera change was completed normally.
%Q $^{C}{}_{R}$ (*1)	External device to XUVM230	Spreadsheets data reset command	Clears spreadsheet scanning and error counts, averages, dispersions, maximum and minimum values, and ranges.
%Q $^{C}{}_{R}$	XUVM230 to External device	Spreadsheets data reset answer command	Output after spreadsheet reset has been completed.
%Z $^{C}{}_{R}$	XUVM230 to External device	Data not registered error command	Output if the type number for type switching, the register No. for reference or modification of the maximum and minimum limits for a numerical calculation, or the checker No. for Character Verification checker reference image re-registration are not registered yet. Also output if camera switching could not be executed.

Data	Transmission	Function	Notes
%U $^{C}{}_{R}$	XUVM230 to External device	Data code error command	Output when an undefined command is transmitted, or an illegal setting is specified for the type, a numerical operator, or checker No. (e.g. %D, %F50, %O17 etc.).

***1:This command can be invoked even when menus other than the main menu are displayed, for example the** *Numerical Calculation*, *Judgment*, **and** *Spreadsheets menu*.

Note **Perform serial communications using the main menu when READY = ON.**

Transmission of data at speeds of 19.200bps or greater is not supported by some hardware and/or software, and may not work correctly. Test transmission under current working conditions before using fast transmission speeds.

Note that serial input is not complete until the $^{C}{}_{R}$ (0dh) terminator byte arrives. If a command is ignored even though it is correct, send the terminator byte ($^{C}{}_{R}$ (0dh)), and then input the command again.

Switching types may take some time.

Parallel Signal Allocation Table

<table>
<tr><th colspan="2">Signal</th><th colspan="4">Allocation</th></tr>
<tr><td rowspan="6">Output</td><td>RDY (READY)</td><td colspan="4">Inspection preparation complete</td></tr>
<tr><td>ERR (ERROR)</td><td colspan="4">Error signal</td></tr>
<tr><td>REN (REND)</td><td colspan="4">Image capture complete</td></tr>
<tr><td>STR (STROB)</td><td colspan="4">Data output complete signal when handshaking is executed</td></tr>
<tr><td>OVF (OVERFLOW)</td><td colspan="4">Output signal when numerical calculation overflow occurs</td></tr>
<tr><td>D1 to D8</td><td colspan="4">Inspection result output signal (judgment output or numerical calculation)</td></tr>
<tr><td rowspan="11">Input</td><td>STA (START)</td><td colspan="4">Start signal (signal initiating inspection execution)</td></tr>
<tr><td>ACK</td><td colspan="4">Data reception complete signal when handshaking is executed
“ACK + STA” specifies execution of the specific substitution formula when inspection starts</td></tr>
<tr><td>TYP (TYPE)</td><td colspan="4">Type switch execution signal</td></tr>
<tr><td>IN1</td><td rowspan="5">IN1 to 5
Type No. specification register for type switching (the timing for the type switch depends on the TYP signal input)</td><td rowspan="4">IN1 to 4
Character verification checker No. specification register for character verification</td><td rowspan="2">IN1 to 2
Smart matching checker No. specification register for template re–registration</td><td rowspan="2">IN1 to 2
Camera/Image specification when the option 444. Disp. Img Change is set to Details.</td></tr>
<tr><td>IN2</td></tr>
<tr><td>IN3</td><td rowspan="5"></td><td rowspan="4"></td></tr>
<tr><td>IN4</td></tr>
<tr><td>IN5</td><td></td></tr>
<tr><td>IN6</td><td rowspan="3"></td><td>IN6
Character re-registration timing</td></tr>
<tr><td>IN7</td><td rowspan="2"></td><td>IN7
Display camera switching timing</td></tr>
<tr><td>IN8</td><td>IN8
Template re–registration timing</td><td></td></tr>
</table>

Inspection Execution via Serial and Parallel Input

This section explains how to initiate an inspection and output results using serial and parallel input (for a table of available functions, see page 16 - 5).

Inspection Using the Serial Interface

Procedure:

1. From the main menu, select **7. Environment**
2. Select **4. Communication**

```
[7] ENVIRONMENT
 4.  Communication
     41.  Com. Mode              Normal Mode
     42.  RS232C
     43.  Serial Output
     44.  Parallel Output
     45.  Type Switch Min.         0 ms
```

Make the following settings.

3. Set the option **41. Com. Mode** to **Normal Mode**
   In this example, we will use **Normal Mode** (for details, see page 16 - 8). If you use **PLC Link**, see page 16 - 13.
4. Select the option **42. RS232C**
   For details on the settings, see page 16 - 10.
5. Set all items to the same settings as the equipment that you will be communicating with.
   If the settings differ from those of the other equipment, communication will not be possible (see page 16 - 10).
6. Define the output in **43. Serial Output**
   For details on the settings, see page 16 - 12.
7. Check that READY = ON
8. Start the inspection with one of the commands from the table below

Command	$[\%S^{C}_{R}]$	$[\%P^{C}_{R}]$	$[\%R^{C}_{R}]]$
Function	Image capture + checker execution	Image capture + checker execution + specific substitution	Checker execution (reinspect the same image)

Output Examples

The output format of the results changes depending on the settings in **43. Serial Output**.

Ex:

JD01=ON
JD02=OFF
CN01=2513
CN02=325
CN03=-15
CN04=98

Inspection results

[7] ENVIRONMENT
43. Serial Output

431.Output	4Colum (1-11)
432.Output Char.	16Char. (1-16)
433.Inval. Digit	Del
434.Read End	None
435.Process End	None
436.Numerical Calc.	Out
437.Judgment	Out
438.Char. Recogn.	None

Output settings

1,0,2513,325,-15,98 $^{C}{}_{R}$

Serial output

Ex:

Serial output, when **432. Inval. Digit = Del** and an error occurs in numerical calculation

JD01=ON
JD02=OFF
CN01=2513
CN02=e (An error occured during calculation)
CN03=-15
CN04=98

Inspection results

[7] ENVIRONMENT
43. Serial Output

431.Output	4Colum (1-11)
432.Output Char.	16Char. (1-16)
433.Inval. Digit	Del
434.Read End	None
435.Process End	None
436.Numerical Calc.	Out
437.Judgment	Out
438.Char. Recogn.	None

Output settings

1,0,2513,e,-15,98 $^{C}{}_{R}$

Serial output

Ex:

When **432. Inval. Digit = Replace** : XUVM230 fills in zeros until number of digits specified in **431. Output** is reached.

Inspection results

JD01=ON
JD02=OFF
CN01=2513
CN02=325
CN03=-15
CN04=98

Output settings

[7] ENVIRONMENT
43. Serial Output

431.Output	**4Colum (1-11)**
432.Output Char.	**16Char. (1-16)**
433.Inval. Digit	**Replace**
434.Read End	**None**
435.Process End	**None**
436.Numerical Calc.	**Out**
437.Judgment	**Out**
438.Char. Recogn.	**None**

Serial output

1 0 2513 0325 -015 0098$^{C}{}_{R}$
CN01 CN02 CN03 CN04
JD02
JD01

Ex:

With errors, the zeros are replaced by spaces.

Inspection results

JD01=ON
JD02=OFF
CN01=2513
CN02=e (An error occured during calculation)
CN03=-15
CN04=98

Output settings

[7] ENVIRONMENT
43. Serial Output

431.Output	**4Colum (1-11)**
432.Output Char.	**16Char. (1-16)**
433.Inval. Digit	**Replace**
434.Read End	**None**
435.Process End	**None**
436.Numerical Calc.	**Out**
437.Judgment	**Out**
438.Char. Recogn.	**None**

Serial output

1025130325_ _ _e0098$^{C}{}_{R}$

The zeros are replaced with spaces.

Inspection Using the Parallel Interface

Procedure:

1. From the main menu, select **7. Environment**
2. Select **4. Communication**

```
[7] ENVIRONMENT
 44. Parallel Output
  441.  Handshake               No


  442.  Reset Cond.             Latch
  443.  Setting Template        No

  444.  Disp. Img. Change       Details Mode
```

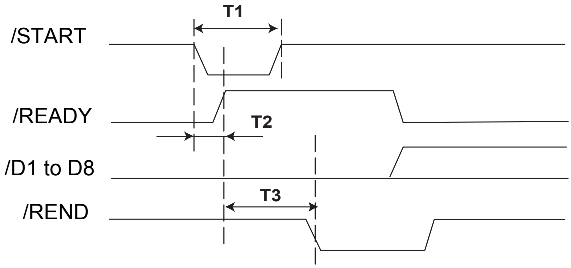
Make the following settings.

3. Set the option **441. Handshake**
4. If you have set the option **441. Handshake = No**, go to step 6
5. If you have set the option **441. Handshake = Yes**, set the options **4411. Timeout**, **4412. Delay Time**, **4413. Numerical Calc.**, and **4414. Judgment Output** as required
   For details on the available settings for these options, see page 16 - 15.
6. Confirm that the parallel interface outputs the READY signal
7. Start inspection by inputting the START signal as indicated in the table below

Details	*Input signal*
Specific substitution formula: Not executed	STA (START)
Specific substitution formula: Executed	ACK + STA signal (hold ACK until READY OFF)

Parallel Communication without Handshake

Judgment results are output using JD01 to JD08.



T1: Min. START signal 1ms width
T2: Max. 1ms START signal response time
T3: The image capture time differs de pending on the camera connected)

Note **The registers JD09 to JD32 for numerical calculations and judgment results are not output.**

Parallel Communication with Handshake

When you have set to output both numerical calculation results and judgment results, the judgment is output first, followed by the numerical calculations. The judgment output ends after the output of the last number set for judgment output. Numbers not specified in the Numerical Calculation settings and numbers subject to output control are skipped.

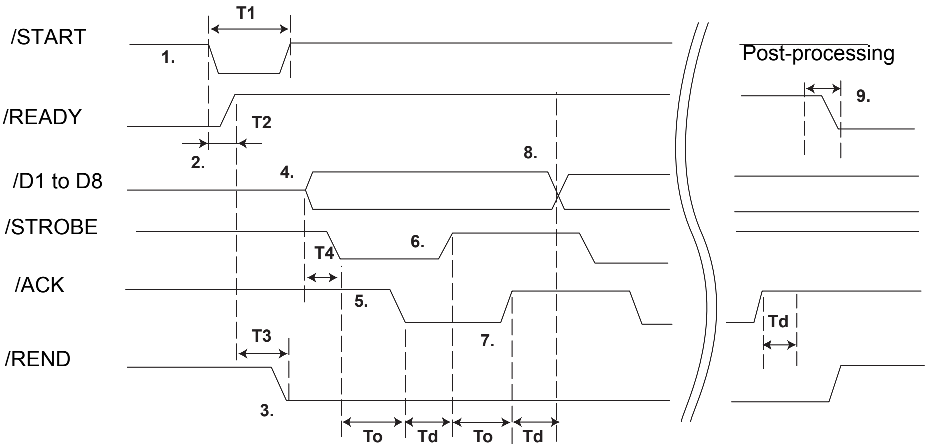
Numerical data is output in sequence from the least-significant byte. Negative values are output as two's complement only if the output data length is 32 bits; in the case of 16-bit or 8-bit data, overflow occurs.

Data output port	D1 to D8: Data output
	STROB output
	OVF output
	ERROR output

Note **If an overflow occurs, the number represented by the specified 8-bit range and the OVF signal (overflow flag) are output simultaneously. For example, if the register number result is "257" (100000001 in binary data), "1" and the overflow signal are output.**

For judgment and numerical calculation registers where an error (ER) was generated, the value output is 0.

Timing Chart with Handshaking



T1 : Width of START signal (min. 1ms)
T2 : Response time to START signal (max 1ms.)
T3 : Image capture time (varies according to camera type and shutter speed)
T4 : Time from the output of results to the STROBE signal turning ON (max. 1ms)
To : Timeout time
Td : Delay time (Includes signal confirmation time).

Set "To: timeout time" and "Td: delay time" in the options **4411. Timeout** and **4412. Delay Time** in the parallel communication settings in the **Environment** menu.
To=20ms to 20000ms
Td=300μs to 20000μs

1. Confirm that READY is ON, and input the START signal (min. 1ms).

2. When the START signal is input, READY will change to OFF, and the image will be captured.

3. When the image capture is completed, REND will change to ON.

4. Output data (D1 to D8) is output, then (max. 1ms later) STROBE is output.

5. When you have confirmed that STROBE is ON, switch ACK ON.
   At this point, if ACK does not go from OFF to ON within the timeout period (To), handle this as a timeout and abort communication.

6. After confirming that ACK is ON, wait for Td, then turn OFF STROBE.

7. After confirming that STROBE is OFF using external unit, switch ACK OFF.

8. After confirming that ACK is OFF, wait for Td, then the next data (D1 to D8) is output. Repeat for the number of times required for the data.

9. After outputting data the required number of times, check that ACK is OFF, wait for Td, handle checker drawing and other post-processing, then switch READY to ON. At the same time, REND will change to OFF.

Data Bit Assignment

Judgment Data Bit Assignment
With 8-bit output data:

D8	D7	D6	D5	D4	D3	D2	D1
JD08	JD07	JD06	JD05	JD04	JD03	JD02	JD01

Judgment Output to the Parallel Interface (8-Bit Data)
If one or more of JD09 to JD32 has been specified:

With 16-bit output data:

	D8	D7	D6	D5	D4	D3	D2	D1
Cycle 2n+0	JD08	JD07	JD06	JD05	JD04	JD03	JD02	JD01
Cycle 2n+1	JD16	JD15	JD14	JD13	JD12	JD11	JD10	JD09

With 32-bit output data:

	D8	D7	D6	D5	D4	D3	D2	D1
Cycle 4n+0	JD08	JD07	JD06	JD05	JD04	JD03	JD02	JD01
Cycle 4n+1	JD16	JD15	JD14	JD13	JD12	JD11	JD10	JD09
Cycle 4n+2	JD23	JD22	JD21	JD20	JD19	JD18	JD17	JD16
Cycle 4n+3	JD31	JD30	JD29	JD28	JD27	JD26	JD25	JD24

Note **When you wish to output judgment results, set** 436. Judgment (**serial output) or** 4414. Judgment **(parallel output) to** Out **from the** Environment **menu. If this (JD) is not set to enable output, then "0" will be output if you attempt to output data, even if you have made the data bits setting.**

When you wish to output numerical calculation results, set 435. Numerical Calc. **(serial output) or** 4413. Numerical Calc. **(parallel output) to** Out **from the** Environment **menu. Regardless of the output setting, if there are no numerical calculations set, the data will be output once as zero, regardless of the data width.**

With judgment output, handshaking continues until data has been output from the last specified external output register (JD).

With numerical calculation output, CA registers that have not been set and CA registers subject to output control are skipped, i.e. they are not output.

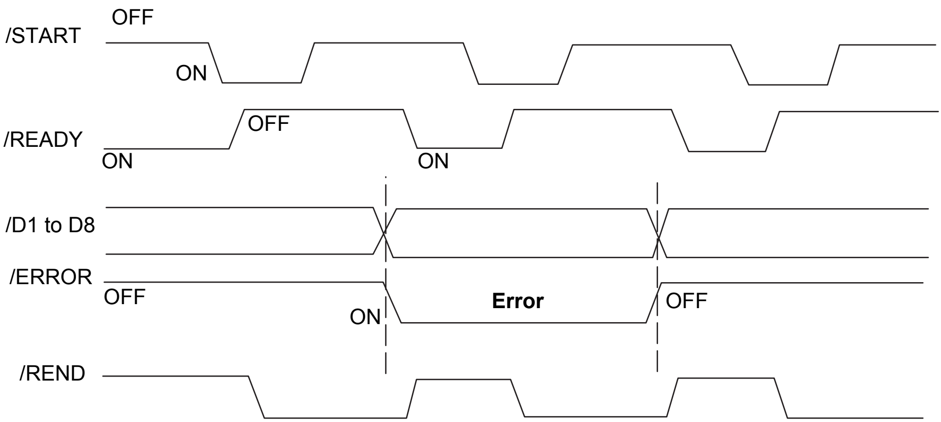
You can set the output data length for numerical calculations for each of 8 groups (CA01 to CA04, CA05 to CA08, CA09 to CA12 ... CA29 to CA32). The numerical ranges that can be handled by each data length setting are as follows (if a number outside of the range is output, the overflow flag goes ON).
8 bits: 0 to 255
16 bits: 0 to 65535
32 bits: -2147483648 to 2147483647

Timing of Output Data Switching

For the switching timing of the output data, select from among one of the following three selections from option **442. Reset Conditions**:

- Hold until the next inspection result (Latch),
- Switch OFF after image capture, or
- Switch OFF before image capture.

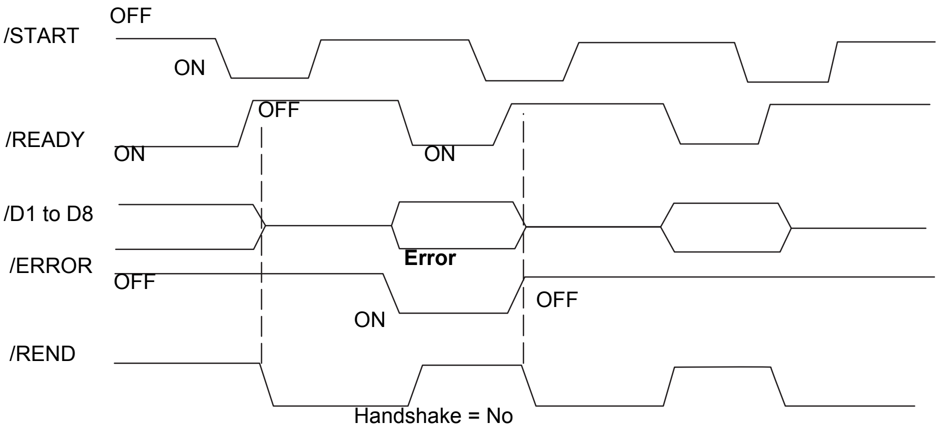
Latch
With this setting, the data is continuously output. After each inspection, the output values remain ON until the next inspection sends new results to the parallel interface.



Note **The timing of the Error output going OFF when an error has occurred is synchronized with the output data (D1 to D8).**

Off after Image Capture

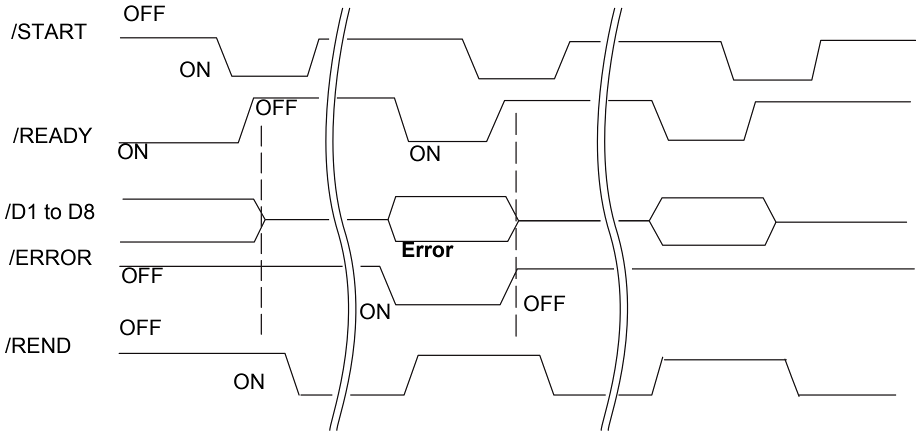
With this setting, the data output is switched OFF after image capture. After an image is captured, the outputs are all set to OFF, and the data is output when inspection ends.



Note **The timing of the error output going OFF when an error has occurred is synchronized with the READY output going ON.**

Off before Image Capture

With this method, the data output is switched OFF before the image is captured. Before the image is captured (after the START signal has been detected and when the READY signal is OFF), the previous outputs are all set to OFF, and the data is output when inspection ends. This is useful when the inspection processing time is extremely short.



Note **The timing for switching the error output OFF when an error has occurred is synchronous with the output data (D1 to D8).**

Type Switching

The following explanation tells you how to switch types using external equipment.

Availability for Parallel and Serial Interface

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	See page	Command	See page
Switch type	Input	Specify type number and give switch signal	IN1 to 5 + TYPE	16 - 36	%X??$^{C}{}_{R}$ (??=01 to 32)	16 - 36
	Output	Switching complete	Confirmation by OFF-to-ON transition of the RDY (READY) signal.	16 - 36	%Y??$^{C}{}_{R}$ (??=01 to 32)	16 - 36

Common Settings for Serial and Parallel Communication

```
[7] ENVIRONMENT
 4.  Communication
     41.  Com. Mode                 Normal Mode
     42.  RS232C
     43.  Serial Output
     44.  Parallel Output
     45.  Type Switch Min.          0 ms
```

Set the option **45. Type Switch Min.** (0 to 100ms in 10 ms steps) to define the minimum time the Ready signal will be OFF. Use this setting when the inspection execution time is fast (the Ready OFF time is short) and the external device cannot detect the end of execution. The initial setting is 0ms.

Ex:

Setting value = 0 : READY signal OFF time = switching time
Setting value ≤ switching time : READY signal OFF time = switching time
Setting value > switching time : READY signal OFF time = Setting value

<table>
<tr><th>Ex.</th><th>Setting value</th><th>Switch time</th><th>READY signal OFF time</th></tr>
<tr><td>1</td><td>0ms</td><td>20ms</td><td>20ms</td></tr>
<tr><td>2</td><td colspan="2">10ms <= 20ms</td><td>20ms</td></tr>
<tr><td>3</td><td colspan="2">50ms> 20ms</td><td>50ms</td></tr>
</table>

Type Switching Using Serial Communication

The commands %X01$^{C}{}_{R}$ to %X32$^{C}{}_{R}$ are used for type switching. When type switching is performed normally, %Y??$^{C}{}_{R}$ is returned as the response (?? = type number to switch to). When the specified type number is not set, type switching cannot be performed normally, so %Z$^{C}{}_{R}$ is returned as the response.
Type switching is also executed when the specified type number is the same as the current type number (%Y??$^{C}{}_{R}$ is returned).

Type Switching Using Parallel Communication

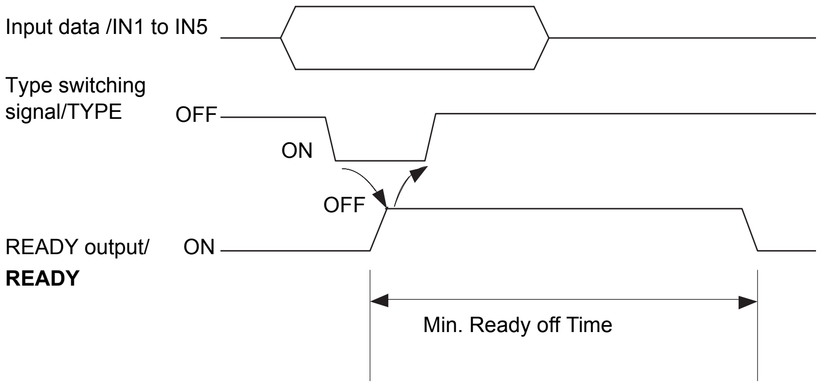
How to Specify the Type Number

Specify the value of the type number as being the actual type number minus 1, and apply it as BIN data at IN1 to IN5.

Type Number BIN Data Lookup Table

Nº	*IN5*	*IN4*	*IN3*	*IN2*	*IN1*
1	OFF	OFF	OFF	OFF	OFF
2	OFF	OFF	OFF	OFF	ON
3	OFF	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	ON	ON
5	OFF	OFF	ON	OFF	OFF
6	OFF	OFF	ON	OFF	ON
7	OFF	OFF	ON	ON	OFF
30	ON	ON	ON	OFF	ON
31	ON	ON	ON	ON	OFF
32	ON	ON	ON	ON	ON

Timing Chart



1. After setting the type number in the input data (IN1 to IN5), set TYPE to ON.
2. After TYPE goes ON, READY goes OFF, and the type is switched.
3. Confirm that READY output has gone OFF, then switch TYPE to OFF.
4. Ready goes ON when the type switch timing is complete.

Points of Caution Regarding Type Switching

Note **Type switching is performed even if the type number is the same as the current number.**

An error signal will be output if you specify an undefined type number.

Changing the Judgment String for the OCR Checker

Availability for Parallel and Serial Interface

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	See page	Command	See page
Change judgment string for OCR checker	Input	Change Judgment String			%W?, Judgment String (? = 1 to 8)	16 - 38
	Output	Change complete			%W?, Judgment String (? = 1 to 8)	16 - 38

Input the input command after confirming that the READY signal has been output from the parallel interface.

Changing the Judgment String of Character Recognition

Use the following command to change the judgment string.

Input %W?, Judgment string $^{C}{}_{R}$

Designate the label (for character) that is registered in dictionary. : Max.16 characters
Available characters: 0 to 9, A to Z, –, /, ., *, !, #, @, _

Number of OCR checker (1 to 8)

If the string changed normally, the following command is output.

Output %W?,Judgment string $^{C}{}_{R}$

Ex:

Input : %W1, 20011215 $^{C}{}_{R}$

Output : %W1, 20011215 $^{C}{}_{R}$

Note **The output is %U$^{C}{}_{R}$ if an invalid command is input.**
The output is %Z$^{C}{}_{R}$ if the input checker number is not registered yet or if the input string includes invalid characters, e.g. %W5, aaa.

Character/Pattern Re-registration for the OCV Checker

The following explanation describes how to re-register a character or pattern using input from external equipment.

Availability for Parallel and Serial Interface

Function	*Input or output*	*Details*	*Parallel*		*Serial*	
			I/O terminal	See page	Command	See page
Character (pattern) re-registration	Input	OCV checker number + Re-registration signal	IN1 to IN4 (OCV checker No.) + IN6 (Re-registration signal)	16 - 40	%O?? (??=01 to 16) You need to confirm the re-registration by sending %O again.	16 - 41
Character (pattern) re-registration	Output	Re-registration complete	Confirmation by OFF-to-ON transition of the RDY (READY) signal.	16 - 40	%O (waiting for confirmation input) %O?? (??=01 to 16)	16 - 41

Settings in the Communication Menu

There are no settings for character (pattern) re-registration. The condition for use is that a character verification checker for the specified number is set.

Registration Method

Serial Interface

Use the following command to re-register a character or pattern.

Input

%O??$^{C}_{R}$

Number of OCV checker (1 to 16)

The commands %O01$^{C}_{R}$ to %O16$^{C}_{R}$ are used to re-register the reference image for the OCV checker. You must input the command twice to perform the re-registration.

When type switching is performed normally, the same command is returned as the response (%O??$^{C}_{R}$). If the specified type number is not set, %Z$^{C}_{R}$ is returned as the response.

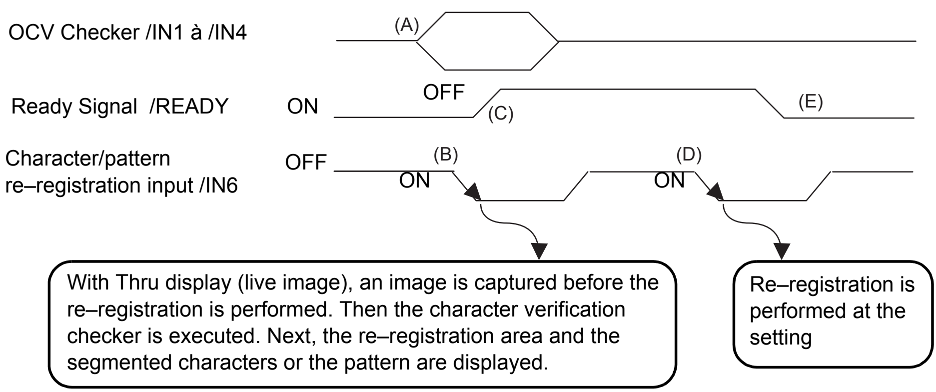
Parallel Interface

Specify the value of the type number as being the actual type number minus 1, and apply it as BIN data at IN1 to IN4.

Character Verification Checker Number BIN Data Lookup Table

Nº	IN4	IN3	IN2	IN1
1	OFF	OFF	OFF	OFF
2	OFF	OFF	OFF	ON
3	OFF	OFF	ON	OFF
4	OFF	OFF	ON	ON
5	OFF	ON	OFF	OFF
14	ON	ON	OFF	ON
15	ON	ON	ON	OFF
16	ON	ON	ON	ON

Re-Registration Timing Charts



Parallel Interface

(A): When READY is ON, input the character verification number on IN1 to IN4

(B): When READY is ON, input IN6.

(C): READY goes OFF, and the re–registration area is displayed. If an error occurs at this point (see below), processing is canceled and an ERROR signal is output.

(D): While READY is OFF, input IN6 again.

(E): After the character (pattern) image re–registration area disappears, the registered image is updated, and READY goes back ON.

Serial Interface

(A): When READY is ON, send the command with the correct checker number (%O01$^{C}_{R}$ to %O16$^{C}_{R}$).

(C): READY goes OFF, and the re-registration area is displayed. If an error occurs at this point (see below), processing is canceled and an ERROR signal is output.

(D): While READY is OFF, send the command (%O01$^{C}_{R}$ to %O16$^{C}_{R}$) again.

(E): After the character (pattern) image re-registration area disappears, the registered image is updated, and READY goes back ON.

Typical causes of an error occurring at this point:

- You specified a non-existent checker.
- The specified checker number is set for an image from a camera other than that set for the capture camera.
- The character verification checker could not perform segmentation to identify the characters or pattern for re-registration.

In addition, is a position/rotation adjustment group has been set, the error may be due to one of the following causes:

- When the XUVM230 executed the position/rotation adjustment checker, the result was NG (the checker could not detect an edge or object).
- As a result of the adjustment, the character verification checker area was moved outside the screen area or outside the valid setting range (that depends on the value set for background processing).

Note **Only character verification checkers of the current type can be re-registered.**
Perform re-registration when the main screen READY signal is in the ON state.
Registration executes if you capture a new image when the monitor display image is a “Thru” image, but if it is a “Mem” image, re-registration is executed using the currently displayed image.
The re-registered characters or pattern will be lost if the power is switched off. If you wish to keep them, perform a data save before switching the power off.

Template Re-registration via Smart Matching Checker

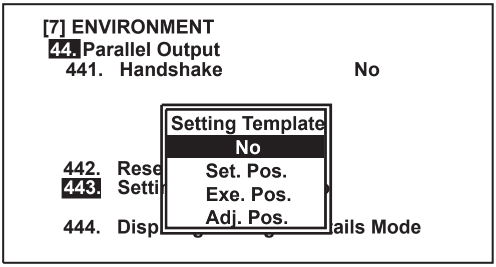
You can re-register template images for the smart matching checker with a command from the external device connected to the parallel interface. The teaching function allows you to change only the template image without changing the various pre-registered conditions. Only templates of the currently selected product type can be re-registered.

Availability for Parallel and Serial Interface

Function	*Input or output*	*Details*	*Parallel*		*Serial*	
			I/O terminal	See page	Command	See page
Smart Matching Template re-registration	Input	Smart matching number specification + Re-registration signal	IN1 to IN2 (Smart Matching No. specification) + IN8 (Re-registration signal)	16 - 45		
	Output	Re-registration complete	Confirm by RDY (READY) signal OFF to ON transition.	16 - 45		

Settings in the Communication Menu

Select from among three re-registration methods. Perform the settings in the **Environment** menu. Use the option **4. Communication**, then select **44. Parallel Output** and **443. Setting Template**.



The following settings are available:

Setting	*Function*
No	The template will not be re-registered, even is the re-register signal is input.
Setting Position	Re-registration is executed at the position set for the template area. Because position adjustment and smart matching are not executed, re-registration is not performed if the object or template image positions have moved.
Execution Position	Re-registration is executed at the detected position after smart matching is executed. Because position adjustment is not executed, re-registration is not performed if the object position has moved. If the template could not be detected when smart matching was executed (due to the template image and re-registration image being different etc.), an error is generated and re-registration is canceled.
Adjustment Position	Position adjustment is executed, and re-registration is performed after the smart matching is adjusted. Smart matching is not executed, so the positional correlation between the search area when the area was set and the template area is maintained, and the image at this position is re-registered as the template.

Re-registration Method

Specifying the Smart Matching Number

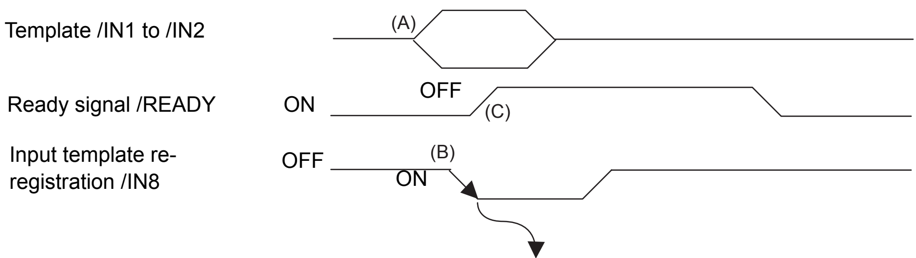
Subtract “1” from the actual template number (smart matching number), convert to BIN data, and specify on IN1 to IN2.

Smart Matching Number BIN Data Lookup Table

Smart Matching No	*IN2*	*IN1*
1	OFF	OFF
2	OFF	ON
3	ON	OFF
4	ON	ON

Timing Charts for Template Re-registration

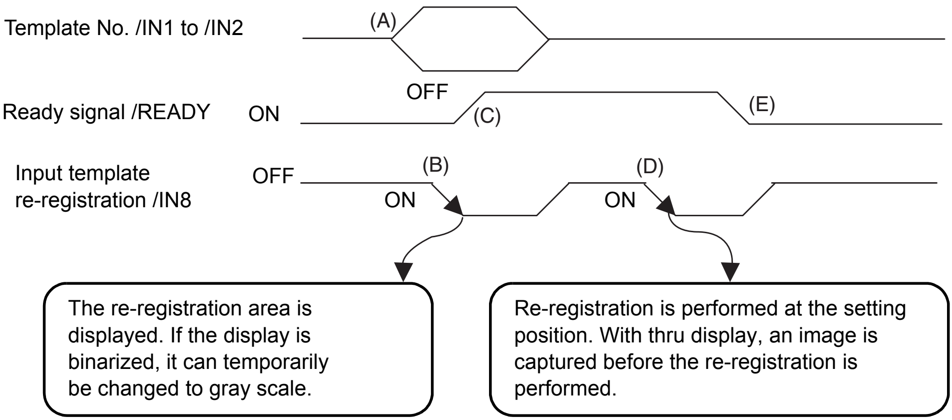
Setting, Execution, Position Adjustment, and Re-registration Area Display = NO



Setting : Re-registration executed.
Execution : Re-registration executed after execution of smart matching.
Ajustment : Re-registration executed after execution of position adjustment.
If a Thru image is displayed, operation is as above after the image capture is executed.

(A): When READY is ON, input the template number, IN1 to IN2.
(B): When READY is ON, input IN8.
(C): READY goes OFF. After the template image is updated, READY goes back ON.

Setting, and Re-registration Area Display = YES

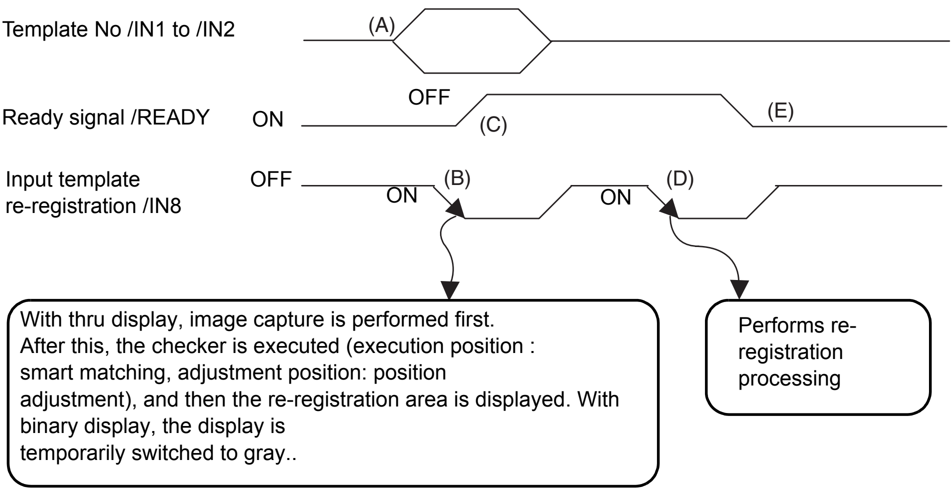


(A): When READY is ON, input the template number, IN1 to IN2.
(B): When READY is ON, input IN8.
(C): READY goes OFF, and the template image re-registration area is displayed. If an error occurs at this point (see below), processing is canceled and an ERROR signal is output
(D): While READY is OFF, input IN8 again
(E): After the template image re-registration area disappears, the template image is updated, and READY goes back ON.

Typical causes of an error occurring at this point:

- You specified a non-existent checker.
- The specified checker number is set for an image from a camera other than that set for the capture camera.

Re-registration using serial input



(A): When READY is ON, input the template number, IN1 to IN2.
(B): When READY is ON, input IN8.
(C): READY goes OFF, and the template image re-registration area is displayed. The re-registration area is decided at this point. If an error occurs (see below), processing is canceled and an ERROR signal is output.
(D): While READY is OFF, input IN8 again
(E): After the template image re-registration area disappears, the template image is updated, and READY signal goes ON.

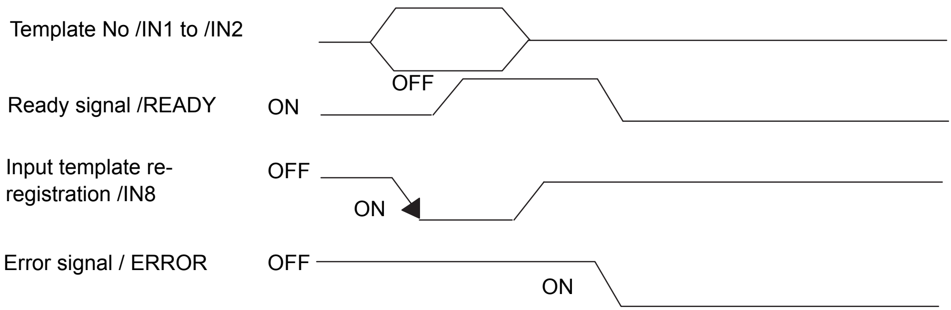
Typical causes of an error occurring at this point:

- You specified a non-existent checker.
- The specified checker number is set for an image from a camera other than that set for the capture camera.
- When re-registration is specified at the execution position, the result of number of detected objects from execution of the smart matching checker was 0.
- When re-registration is specified at the adjustment position, execution of position adjustment resulted in part of the template area protruding off the screen.

Timing Charts for Template Re-registration Error Generation

Setting Position: Re-registration Area Display: No or Yes
Execution Position, Adjustment Position:
Re-registration Area Display: No
Area display when set to “Yes” (first IN8 input)

Error example



The ERROR signal output conditions are as follows:
Setting position

- You specified a non-existent checker.
- The specified checker number is set for an image from a camera other than that set for the capture camera.
- The capacity was exceeded.
- You attempted to register an image without features.

Execution position

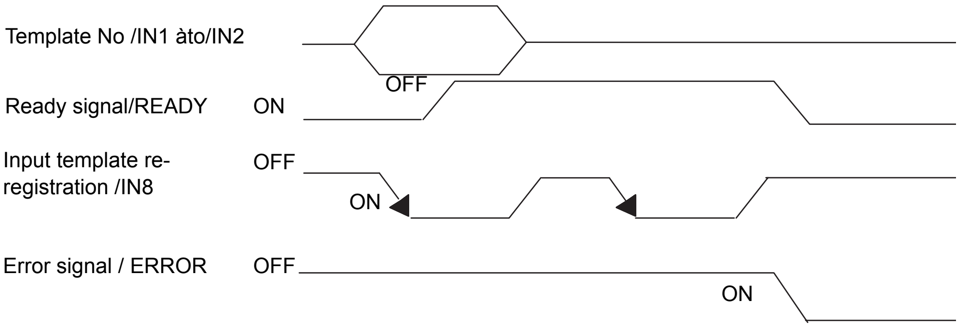
- You specified a non-existent checker.
- The specified checker number is set for an image from a camera other than that set for the capture camera.
- The result of number of detected objects from execution of the smart matching checker was 0.

Adjustment position

- You specified a non-existent checker.
- The specified checker number is set for an image from a camera other than that set for the capture camera.
- Execution of position adjustment resulted in part of the template area protruding off the screen.

Execution Position, Adjustment Position - Re-registration Area Display: Re-registration execution when set to “Yes” (second IN8 input)

Error example



The ERROR signal output conditions are as follows:

Execution Position/Adjustment Position:

- The capacity was exceeded.
- You attempted to register an image without features.

Notes Regarding Execution Order for Re-registration

Setting position (Re-registration Area Display: No)

Procedure:
1. Specify the template number for performing re-registration, and input template re-registration input signal IN8.
2. READY signal goes OFF, and re-registration is executed.
3. When re-registration is complete, the READY signal goes ON.

Setting position (Re-registration Area Display: Yes)

Procedure:
1. Specify the template number for performing re-registration, and input template re-registration input signal IN8.
2. READY signal goes OFF, and the re-registration area is displayed.
3. Input template re-registration input signal IN8 again.
4. When re-registration is complete, the READY signal goes ON.

Execution position (Re-registration Area Display: No)

Procedure:

1. Specify the template number for performing re-registration, and input template re-registration input signal IN8.
2. READY signal goes OFF, and the specified smart matching checker is executed.
3. Re-registration is executed at the position detected in step 2.
4. When re-registration is complete, the READY signal goes ON.

Execution position (Re-registration Area Display: Yes)

Procedure:

1. Specify the template number for performing re-registration, and input template re-registration input signal IN8.
2. READY signal goes OFF, and the specified smart matching checker is executed.
3. Re-registration is executed at the position detected in step 2.
4. Input template re-registration input signal IN8 again.
5. When re-registration is complete, the READY signal goes ON.

Adjustment position (Re-registration Area Display: No)

Procedure:

1. Specify the template number for performing re-registration, and input template re-registration input signal IN8.
2. READY signal goes OFF, and the position adjustment checker registered for the position adjustment group No. of the specified smart matching checker is executed, and the smart matching is adjusted.
3. Re-registration is executed at the position of the smart matching that was adjusted in step 2, and the positional relationship between the first registered search area and the template is maintained.
4. When re-registration is complete, the READY signal goes ON.

Adjustment position (Re-registration Area Display: Yes)

Procedure:

1. Specify the template number for performing re-registration, and input template re-registration input signal IN8.
2. READY signal goes OFF, and the position adjustment checker registered for the position adjustment group No. of the specified smart matching checker is executed, and the smart matching is adjusted.

3. Re-registration is executed at the position of the smart matching that was adjusted in step 2, and the template position (whose positional relationship with the first registered search area has been maintained) is displayed as the re-registration area.
4. Input template re-registration input signal IN8 again.
5. Re-registration is executed at the position of step 3, and when it is complete, the READY signal goes ON.

Note **Templates other than those of the current type cannot be re-registered.**

Perform re-registration when the main screen READY signal is in the ON state.

The template is registered as a gray image, regardless of the image displayed on the monitor.

Registration is possible if you capture a new image when the monitor display image is a "Thru" image, but if it is a "Mem" image, re-registration is executed using the currently displayed image.

The re-registered template will be lost if the power is switched off. If you wish to keep it, perform a data save before switching the power off.

Switching the Display Camera Externally

This function uses external input (serial or parallel) to switch the camera image displayed on the monitor.

The time needed for executing the camera switch is approximately 270ms max. The execution time is heavily influenced by the following settings, so confirm in actual operation.

- Capture camera (standard camera or FULLFRAME camera)
- Camera settings (frame or field)
- Display camera image before and after switching.

Switching is possible when the READY signal is ON and any of the following screens is displayed:

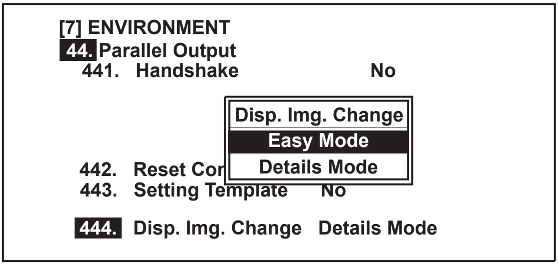
- Main menu
- Numerical calculation
- Judgment, and
- Spreadsheets

Availability for Parallel and Serial Interface

Item	*Input or output*	*Details*	*Parallel*		*Serial*	
			I/O terminal	See page	Command	See page
Camera switching	Input	**Easy** mode (switching between A and B)	IN7	16 - 54		
		Details mode (switching between A and B, and Thru and Mem)	IN1 to IN2 (Image specification) + IN7 (switching signal)	16 - 54	%I?$^{C}_{R}$ (??=0 to 3)	16 - 53
	Output	Switching complete	Confirm by RDY (READY) signal OFF to ON transition.	16 - 54	%I$^{C}_{R}$	16 - 53

Settings in the Communication Menu

Perform the settings in the **Environment** menu. Use the option **4. Communication**, then select **44. Parallel Output** and **444. Disp. Img. Change**.



Select the camera switching method. If you do not wish to specify an image, and wish to switch between camera A and camera B, select **Easy**. If you wish to specify an image and a camera, select **Details**.

Using Serial Input to Switch the Display Camera

Use the following commands to switch the display:

Switch command	*Display camera*	*Image*
[%I0$^{C}_{R}$]	A	Thru
[%I1$^{C}_{R}$]	B	Thru
[%I2$^{C}_{R}$]	A	Memory
[%I3$^{C}_{R}$]	B	Memory

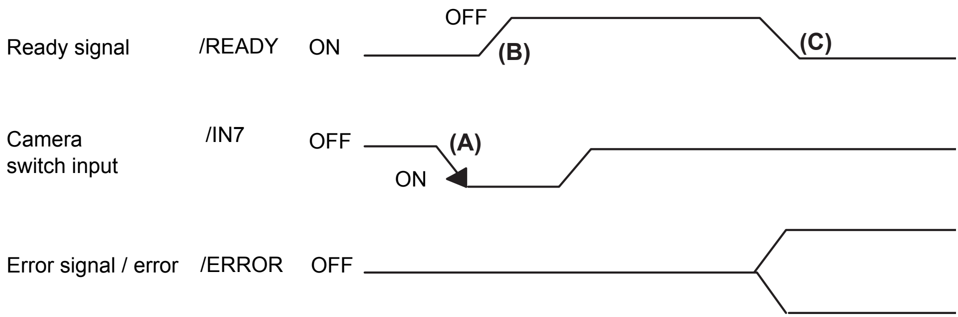
After executing switching, the following commands are returned.

Response command	*Result*
[%I$^{C}_{R}$]	Image switch complete
[%Z$^{C}_{R}$]	Could not change camera image. Check the camera switching settings and the capture camera settings.
[%U$^{C}_{R}$]	An invalid command was sent (e.g. [%I4$^{C}_{R}$])

Using Parallel Input to Switch the Display Camera in Easy Mode

Data input port	IN7 = signal for switching the display camera
Data output port	READY = Ready signal ERROR = Error signal

Timing Chart for Camera Switching in Easy Mode



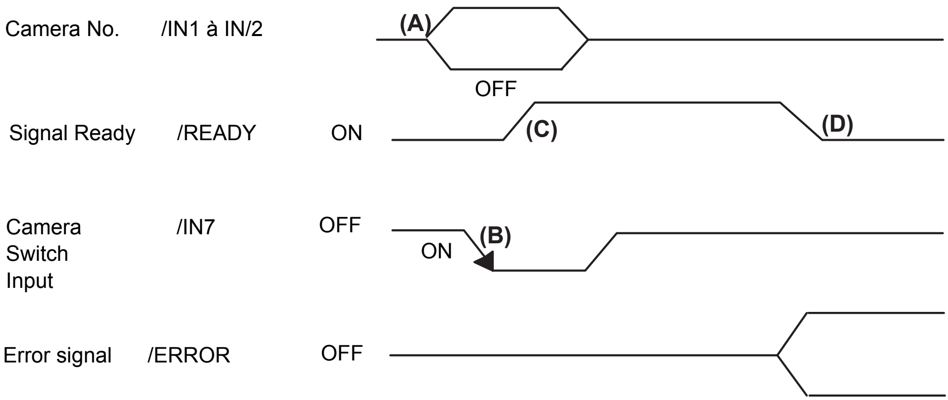
(A): With the READY signal ON, input IN7 from the external device.
(B): The OFF-to-ON transition of IN7 is detected, and the READY signal goes OFF.
(C): After the camera has switched, the READY signal goes ON (if a display switch error is generated, the ERROR flag goes ON at the same time as the READY signal).

Camera Switching in Details Mode

Display Camera/Image	*IN2*	*IN1*
A camera/Thru image	OFF	OFF
B camera/Thru image	OFF	ON
A camera/Mem image	ON	OFF
B camera/Mem image	ON	ON

Data input port	IN7 = signal for switching the display camera IN1 to IN2 = Camera image designation No.
Data output port	READY = Ready signal ERROR = Error flag

Timing Chart for Camera Switching in Details Mode



(A): Input the signal indicating the camera and image from the external device
(B): With the READY signal ON, input IN7 from the external device
(C): The OFF-to-ON transition of IN7 is detected, and the READY signal goes OFF
(D): After the camera has switched, the READY signal goes ON (if a display switch error is generated, the ERROR flag goes ON at the same time as the READY signal)

Reference and Change Numerical Calculation Limits

It is possible to reference and modify the maximum and minimum values used in numerical calculations from an external device.

Availability for Parallel and Serial Interface

Item	*Input or output*	*Details*	*Parallel*		*Serial*	
			I/O terminal	See page	Command	See page
Numerical calculation	Input	Refer to max. and min. limits			%F??$^{C}_{R}$ (??=01 to 32)	16 - 56
	Output	Response to reference			%F??,n,n$^{C}_{R}$ (??=01 to 32)	16 - 56
	Input	Change max. and min. limits			%N??,n,n$^{C}_{R}$ (??=01 to 32)	16 - 57
	Output	Change complete			%N??,n,n$^{C}_{R}$ (??=01 to 32)	16 - 57

Referencing the Maximum and Minimum Values

Input

%F?? $^{C}_{R}$

Register No. (two. Digits : 01 to 32)

The following is output if the maximum and minimum values for the numerical calculation are referenced normally.

Output

%F??,n, n $^{C}_{R}$

Maximum value

Minimum value

Register No.
(two digits: 01 to 32)

If you specify a register that has not been set, %Z$^{C}_{R}$ (Error) is output.

Changing the Maximum and Minimum Values

Input

%N??,n, n $^{C}{}_{R}$

Maximum value
Minimum value
Register No.
(two digits: 01 to 32)

The following is output if the maximum and minimum values for the numerical calculation are changed normally.

Output

%N??,n, n $^{C}{}_{R}$

Maximum value
Minimum value
Register No.
(two digits: 01 to 32)

PLC Link

This is a communications mode with protocols that allow the VISION CONTROLLER to communicate with PLCs.
Because the VISION CONTROLLER can write inspection results (numerical calculation and judgment results), there is no need for the PLC to perform polling or flag monitoring, and this reduces the load on the PLC communications program.
It is possible to switch types by referring to values set in the PLC registers. Because the VISION CONTROLLER can read the PLC registers, all the PLC has to do is to write values to its own registers, and set the TYPE signal in order to initiate a type switch.

The compatible PLCs are:

- Telemecanique Twido,
- Telemecanique Premium / Micro,
- Telemecanique Quantum / Momentum,
- Omron SYSMAC-C Series
- Allen-Bradley SLC500
- Matsushita PLC-FP Series,
- Mitsubishi Electric MELSEC-A Series (protocol 4),
- Mitsubishi Electric MELSEC-FX Series,

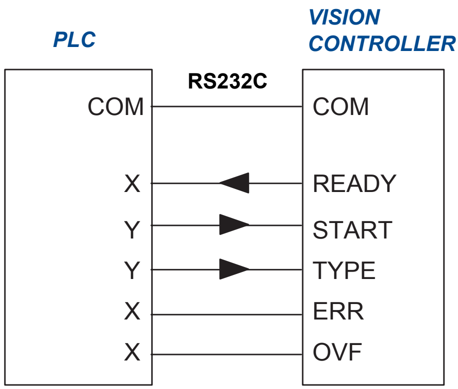
Limitations in PLC Link Mode

None of the serial commands for the COM port can be used. Therefore, the following items that are not compatible with parallel communication cannot be used.

- Referencing and changing the maximum and minimum values for numerical calculations
- Resetting the spreadsheet from an external device

Connection to a PLC

Connection to the CCU and CPU COM Port of the Telemecanique PLC.



Procedure:

1. Connect the three parallel signals **READY**, **START** and **TYPE**
2. Connect **ERROR** and **OVF** (Overflow Flag) as required
3. Refer to the section on the serial interface in the hardware exploitation guide regarding RS232C connection

Setting the PLC Type

In the **7. Environment** menu, select **43. Serial Output** and set **439. PLC Type** as required.

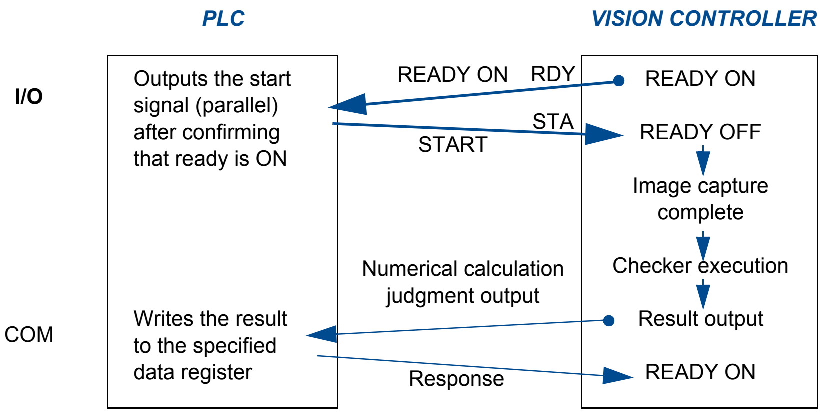
```
[7] ENVIRONMENT
 43. Serial Output
   431.  Type No Register                  %MW0000
   432.  Top Data R                         %MW0000
   433.  Timeout       PLC Type             3000ms
   434.  Output        MODBUS               16bit
   435.  Output Ch     MODBUS IEC          16Char.(1-16)
   436.  Numerical     MEW FP               None
   437.  Judgemen      MELSEC A             None
   438.  Char. Reco    MELSEC FX            None
   439.  PLC Type      AB SLC              MODBUS-IEC
   440.  PLC Adres     OMRON C              1
```

The examples in this guide refer to the Telemecanique PLCs. If you are using one of the other PLCs, refer to this guide and the following table.

Setting in 439. PLC Type	Manufacturer and series	Details
MODBUS	Telemecanique	See chapter 16.
MB-IEC	Telemecanique	
AB SLC	Allen-Bradley SLC500 PLC	Restrictions that apply when the Allen-Bradley SLC500 is used. Use the following PLC settings: Duplicate Detect: OFF ACK Timeout (x20 ms): 20 Control Line: NO HANDSHAKING Error Detect: BCC NAK Retries: 3 ENQ Retries: 0 Embedded Responses: AUTO DETECT The only register address that can be used is that for the integer register (N7).
OMRON C	Omron SYSMAC-C Series PLC	Refer to the XUVM230 VISION CONTROLLER Hardware exploitation guide for details regarding connection to the PLC RS232C connector. Refer to the PLC manufacturers manuals regarding the PLC side parallel connector allocation. Refer to the relevant PLC manufacturers manual regarding the commands and registers used for communication.
MI-A	Mitsubishi MELSEC-A Series PLC	
MI-FX	Mitsubishi MELSEC-FX Series PLC	
MEW-FP	Matsushita Electric Group. Series FP	

Communication between PLC and XUVM230

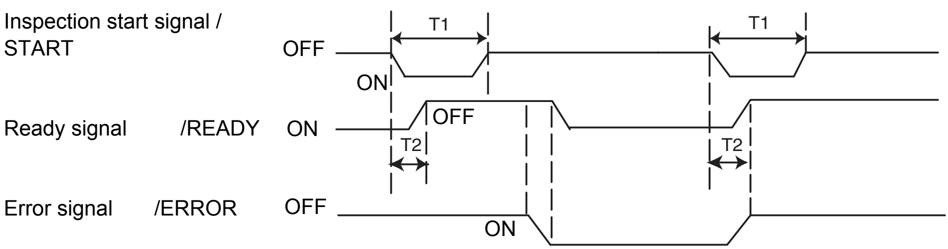
Inspection Result Output



If the specified data register number is out of range, the following command is returned by the PLC. In this case, communication stops, the Error signal is output, and Ready goes ON.

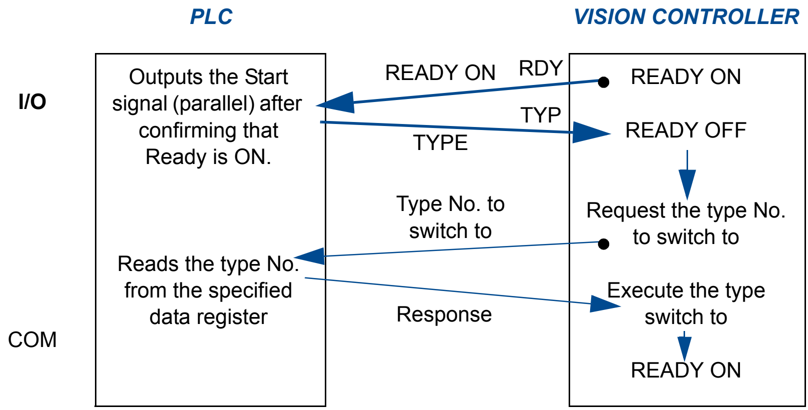
Response:
Function code = 90 (10+80)
Data field = 02

If the communication times out, the Error signal is output and Ready goes ON.



T1:START signal width (1ms min.)
T2:Response time with respect to the START signal (within 1ms).

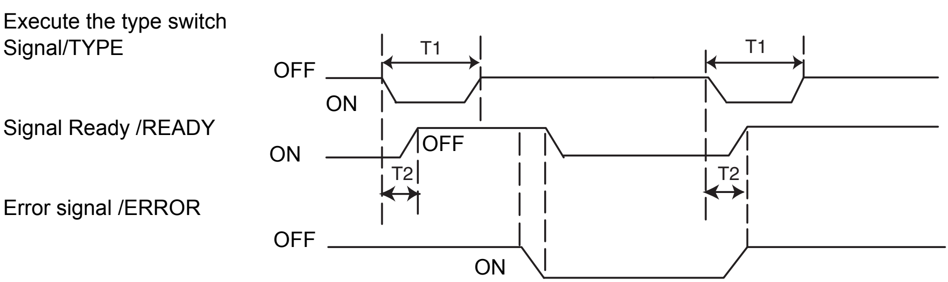
Type Switching



If the specified data register number is out of range, the following command is returned by the PLC. In this case, communication stops, the Error signal is output, and Ready goes ON.

Response:
Function code = 83 (03+80)
Data field = 02

If type switching is not possible, the Error signal is output and Ready goes ON.



T1:TYPE signal width (1ms min.)
T2:Response time with respect to the TYPE signal (within 1ms).

VISION CONTROLLER Communication Settings

All these settings are available when you select **4. Communication** from the **Environment** menu.

Option name	*Suboption name*	*Setting*
41. Com. Mode		PLC Link
42. RS232C	421. Baud rate (bps)	Use the same value as the PLC ”Communication speed setting”. There are eight possible settings (1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200).
	422. Length	Select either 7 bits or 8 bits, but use the same value as the PLC ”Data length” setting.
	423. Stop Bit	Select either 1 bit or 2 bits, but use the same value as the PLC ”Stop bits” setting.
	424. Parity	Select either None, Even, or Odd, but use the same value as the PLC ”Parity check” setting.
	425. Flow Control	Sets the handshake flow control method. Select either None or Xon/Xoff.
43. Serial Output	431. Type No Register	Specify a data register number (in the range 0 to 9999) for performing the PLC type switch request.
	432. Top Data Register	Specify a start data register number (in the range 0 to 9999) for when data is output to the PLC.
	433. Timeout	Sets the timeout for the response after output of data to the PLC and the response to a type switch number request.
	434. Output	Specify the number of bits for the output data. Select either 16 or 32 bits for the number of bits. 16 bits: values in the range -2^{15} to $2^{15}-1$ (–32768 to 32767) can be output. 32 bits: values in the range -2^{31} to $2^{31}-1$ (–2147483648 to 2147483647) can be output.
	435. Output Char.	Set the number of maximum characters per character recognition checker.
	436. Num. Calculation	Set whether or not to output the numerical calculation result.
	437. Judgment	Set whether or not to output the judgment result.
	438. Char. Recog.	Set whether or not to output the character recognition checker.
44. Parallel Output	442. Reset Cond.	Set so that the parallel output is either latched (the output is held until the next parallel output) or goes OFF (the parallel output goes OFF when image capture completes).

PLC Communication Settings

Parameter	*Setting*
Operation	PLC Link
Data length	Set to same as the ICH ”Length”
Parity check	Set to same as the ICH ”Parity”
Stop bits	Set to same as the ICH ”Stop bit”
Stop code	C_R
Start code	No STX
Communication speed setting	Set to same as the ICH ”Baud rate”
Slave adress	1

Communication Example: Telemecanique PLC TWIDO-COM Port

Result Output

This is the description of the result output from the VISION CONTROLLER:

Numerical calcul Result	*Judgment*
CN01 = 1234	JD01 = ON
CN02 = –12	JD02 = Not defined
CN03 = Non défini	JD03 = OFF
CN04 = 56	JD04 = OFF
CN05 ... = Not defined	JD05 ... = Not defined

Communication Conditions

Parameter	*Setting*
Transmission speed	19200
Bit length	8
Stop bits	1
Parity	None

Communication Settings

VISION CONTROLLER communication settings

[7] Environment

41.	Communication modePLC Link		
42.	RS232C		
	421.	Baud rate (bps)	19200
	422.	Length	8
	423.	Stop Bit	1
	424.	Parity	None
43.	Serial Output		
	432.	Top Data Register	1
	434.	Output	16 bit
	435.	Output Char.	1 to 16
	436.	Numerical calculation	Out
	437.	Judgment	Out
	439.	PLC Type	Modbus IEC 11 31
	440.	PLC Adress	1

PLC communication settings

PLC system register settings (COM port)

No. 412 COM port selection	PLC Link
No. 413 COM port sending data length	8
No. 413 COM port sending parity check	With-Odd
No. 413 COM port sending stop bit	1
No. 413 COM port sending terminator	CR
No. 413 COM port sending header	No-STX
No. 414 COM port baud rate	19200

PLC Data Monitor

1	%MW1	1	00E1	1 word (hex)
2	%MW2	2	1234	1 word integer (decimal)
3	%MW3	3	–12	1 word integer (decimal)
4	%MW4	4	0	1 word integer (decimal)
5	%MW5	5	56	1 word integer (decimal)
6	%MW6	6	0	1 word integer (decimal)
7	%MW7	7	0	1 word integer (decimal)
8	%MW8	8	0	1 word integer (decimal)
9	%MW9	9	0	1 word integer (decimal)
10	%MW10	10	0	1 word integer (decimal)
11	%MW11	11	0	1 word integer (decimal)

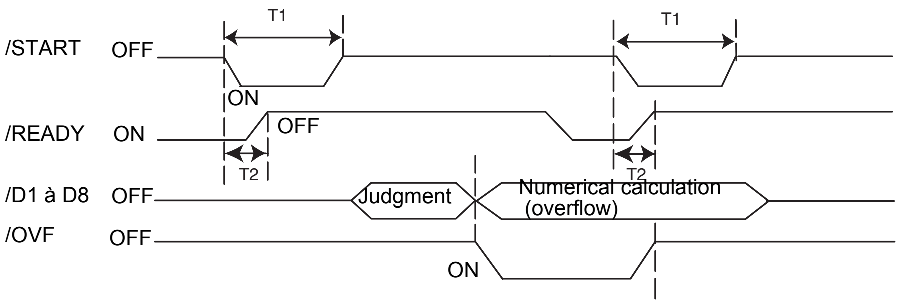
The output start data register was set to “1” in the serial output settings, so the judgment output (word data in four data units with one judgment as one character) and numerical calculations are output starting at %MW1.

%MW 1	**0 0 E 0**	←	Judgment (D1 to D4)
	D4 (not set) **D3 D2 D1**		
%MW 2	**1 2 3 4**	←	Numerical calculation (CA01)
%MW 3	**-12**	←	Numerical calculation (CA02)
%MW 4	**0**	←	Numerical calculation (CA03 not set)
%MW 5	**56**	←	Numerical calculation (CA04)

Nota **The OCR results are obtained after the Judgment and Numerical calculation results**

Timing Chart for When an Overflow Occurs

If a numerical calculation overflows (according to 16 or 32 bits mode), the OVF signal is output and the data block required for the numerical calculation is output as zeros.



T1:START signal width (1ms min.)
T2:Response time with respect to the START signal (within 1ms.)

Command 10 Hex: Write to the PLC

Description :
Writing values into a sequence of registers.

Query :
The query specifies the register references to be write.

Here is an example of a request to write 00 0A hex and 01 02 hex data in %MW1 and %MW2:

Field Name	Example (Hex)
Slave Address	01
Function	10
Starting Address Hi	00
Starting Address Lo	01
Nb. of Registers Hi	00
Nb. of Registers Lo	02
Byte Count	04
Data Hi	00
Data Lo	0A
Data Hi	01
Data Lo	02
Error Check (LRC or CRC)	----

Response:
The response returns the slave address, function code, starting address, and quantity of registers.
Here is an example of a response to the query shown above.

Field Name	Example (Hex)
Slave Address	01
Function	10
Starting Address Hi	00
Starting Address Lo	01
Nb. of Registers Hi	00
Nb. of Registers Lo	02
Error Check (LRC or CRC)	----

Command 03 hex: Read from the PLC

Description:
Reads the binary contents of registers in the slave.

Query:
The query specifies the starting register and quantity of registers to be read.

Here is an example of a request to read registers %MW107–%MW109:

Field Name	Example (Hex)
Slave Address	01
Function	03
Starting Address Hi	00
Starting Address Lo	6B
No. of Points Hi	00
No. of Points Lo	03
Error Check (LRC or CRC)	----

Response :

The data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

Here is an example of a response to the query on the previous page:

Field Name	Example (Hex)
Slave Address	01
Function	03
Byte Count	06
Data Hi (Register %MW107)	02
Data Lo (Register %MW107)	2B
Data Hi (Register %MW108)	00
Data Lo (Register %MW108)	00
Data Hi (Register %MW109)	00
Data Lo (Register %MW109)	64
Error Check (LRC or CRC)	----

CHAPTER 17

Vision Backup Tool

Vision Backup Tool

The Vision Backup Tool (VBT) connects to a computer with a serial cable, and makes it possible to download and upload, as well as copy or delete types, environments, and image data saved in the VISION CONTROLLER from a computer.

Communications Environment

Communications environment settings on the VISION CONTROLLER side are set under the communications settings on the **Environment** menu. Set the communications environment as follows:

Communications mode:Normal
RS232C:

Baud rate:	Set to match the computer baud rate.
Length:	8-bit
Stop bit:	2-bit
Parity:	None
Flow control:	Hard flow is automatically used regardless of setting.

Activation Conditions

In order to operate VBT, you need to be in RUN mode. This is usually the case when type switching from an external device is possible, that is, under the following conditions:

- when the main menu is displayed
- when the checker list is displayed (activated with <C: Chg. Disp.>)
- when spreadsheets are displayed (activated with <C: Chg. Disp.>)

However, if you enter a submenu, e.g. the **Spreadsheets** or **Numerical Calculations/Judgment** menu, you leave RUN mode and enter setup mode. Then it is not possible to operate VBT until you return to the main menu and activate RUN mode again.

Transmission Data

Data that can be transmitted with VBT are as follows:

- Type data (by type or all together)
- Environment data (settings in the **Environment** menu)
- Hide Settings information
- Save Image Data (single screen units)

Operations

The transfer to VBT mode is conducted entirely at the computer. If you shift to VBT mode, the menu disappears, and the READY signal goes OFF. For additional information, see the computer's VBT online help.

Warnings

You can restore desired types and images using VBT, but if the image data is saved and there is a camera-related discrepancy between the original type information and the restored type information, VBT will not operate properly after that restoration (see page 15 - 6).

How to Force a Return from VBT Mode

If due to some problem you cannot return from VBT mode, press the buttons <A> and <B> on the keypad at the same time to force a return.

Note **Before using Vision Backup Tool, please read the detailed information in the program description.**

CHAPTER 18

Error Output

Error Processing

If a problem occurs when using the XUVM230 VISION CONTROLLER for inspection, an error signal is output. If this happens, check the error result and perform appropriate processing on the external equipment.

Error Output Conditions

The XUVM230 outputs an error if any of the following conditions are met:

Type switching

- When you attempt to switch to a type that has not been set via the parallel interface.

Data output when handshaking is not performed during execution

- When an error occurs in the numerical calculation register or judgment register.
- When image capturing fails.

Data output when handshaking is performed during execution

Error signal

- When an error occurs in the numerical calculation register or judgment register.
- When image capture fails.
- When a handshaking timeout occurs.

Overflow signal

- When the numerical calculation register set for output overflows.
  (Output data length: 32 bits)
- When the numerical calculation register set for output overflows or result of calculation is negative.
  (Output data length: 8 bits, 16 bits)
- When an error occurs in the numerical calculation register set for output.

Note **With parallel output when communication mode is set to** Normal
If an error occurs, judgment and numerical calculation outputs are 0.
With serial output when communication mode is set to Normal**:**
If an error occurs in the judgment register or numerical calculation register, "e" is output.
If image capture fails, all outputs are "e".
"e" is not output when communication mode is set to PLC Link**. Parallel output conforms to the** PLC Link **mode protocol.**

Image capturing-

- When a problem occurs in the process of capturing an image, e.g. when the camera settings and the connected camera do not match.
- When the image is not captured successfully.

Save data error

- When data is not saved properly, and writing original saved data to flash memory fails.

Parallel monitor within setting help

- When the ERR signal goes ON with the parallel monitor setting.
- When after an error is output before entering setting help, and you are taken out of setting help and returned back to the main menu.

Errors will occur in spreadsheets when:

- A referenced checker does not exist.
- A formula is not registered in the referenced numerical calculation register or judgment output register.
- A numerical calculation register or judgment output register that has generated an error is referenced.

Errors will occur in the template re-registration process when:

- Smart Matching is not set (a non-existent checker was specified).
- The specified checker number is set for an image from a camera other than that set for the capture camera.
- The number of detected objects during re-registration at the execution position is 0.
- Execution of position adjustment for re-registration at the adjustment position resulted in part of the template area protruding off the screen.
- You attempted to register an image without features.
- The quantity exceeds the limits.

Errors will occur in the numerical calculation register or judgment output register when:
The numerical calculation register and judgment output register output up to the last register number for which a formula is set (excluding numerical calculation output control).

Numerical calculation register

- When a referenced checker does not exist.
- When a formula is not registered in the referenced numerical calculation register.
- When a 32-bit overflow occurs during calculation.
- When a zero divide occurs during calculation.

Judgment output register

- When a referenced checker does not exist.
- When a formula is not registered in the referenced numerical calculation register or judgment output register.
- When a numerical calculation register or judgment output register that has generated an error is referenced.

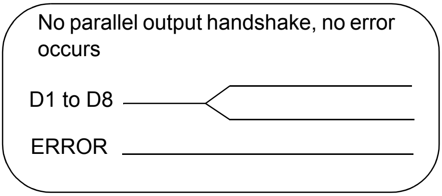
Camera switching error conditions

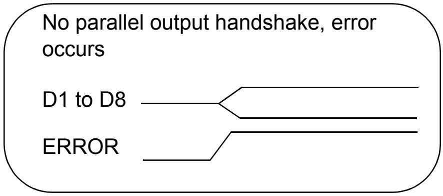
- If you attempt to switch cameras using one of the following methods when the setting for **4. Capture Camera** in the **Type** menu is something other than AB.

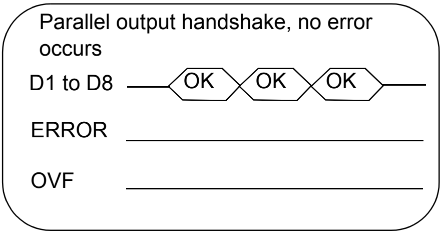
    - The “Easy” switch (camera A to/from camera B) signal was input.
    - With the capture camera set at either A, AB Vertical Division, or AB Horizontal Division, a switch signal specifying camera B (either Thru or Mem) was input.
    - With the capture camera set at B, a switch signal specifying camera A (either Thru or Mem) was input.

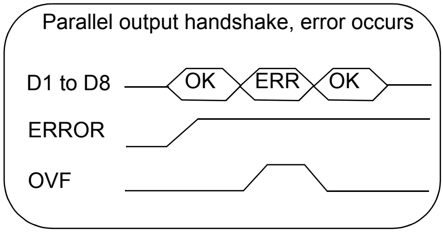
- Camera switching failed.

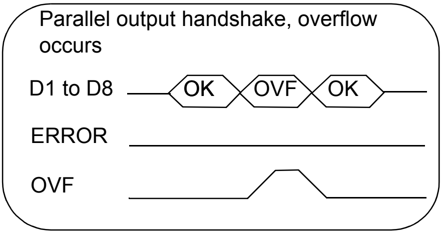
Timing Chart for Errors











When an error occurs during numerical calculations and judgement output, hand shaking starts and the error signal turns on at the same time.

When there is an error in the numerical calculations, OVF (overflow signal) turns on only when the register in which the error occurred is output.

CHAPTER 19

The Setting Help Tools

Purpose of the Setting Help Tools

It is important to adjust camera and lighting settings properly before performing inspections. The Setting Help Tools help with adjusting the settings, making it easier to set the focus, lighting, slice level and similar parameters.
Select **9. Setting Help Tools** from the main menu. The screen shown below will appear.

[9] SETTING HELP TOOLS
1. Lighting Adjustment
2. Focus
3. Aperture
4. Image Profile
5. In Out Monitor

A:———— B:———— C:Esc. Camera:A

Available Options

The **Setting Help Tools** menu provides the following functions.

1. **Lighting Adjustment**
   Checks whether the lighting is uniform.

2. **Focus**
   Helps you adjust the focus correctly, watching the screen while turning the focus ring on the lens.

3. **Aperture**
   Helps you adjust the aperture correctly, watching the screen while turning the aperture ring on the lens.

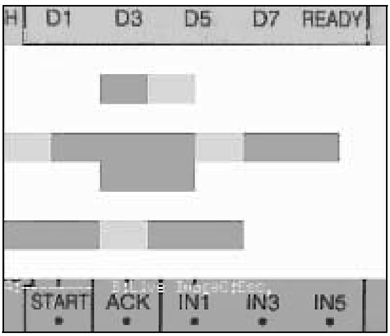
4. **Image Profile**
   Displays a gray-scale graph for a specified line on the image.

5. **In Out Monitor**
   Checks the parallel interface by displaying input states and forcing output states. Useful for checking the connections with external devices.

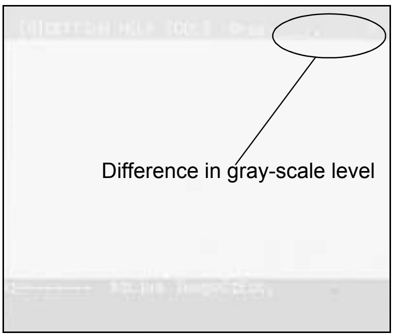
Lighting Adjustment

Checks whether the lighting is uniform. If the lighting is not uniform when there is no workpiece in position, as shown in the figure on the left, a large difference in gray scale is produced, making inspection less reliable. Adjust the lighting to ensure uniformity.
Pressing <B: Live Image> displays a live image direct from the camera.

Lighting not uniform



Uniform lighting



Focus

Helps you adjust the focus correctly by watching a bar graph on the screen while turning the focus ring on the camera lens.

Procedure:

1. **Select 2. Focus**, and a screen such as Figure a is displayed. Press <A: Chg. Area> to set the area of the image with the required feature.

2. Following the instructions, turn the focus ring all the way in either direction then press <Enter> (Figure b).

3. Next, turn the focus ring all the way in the other direction then press <Enter> again (Figure c).

4. Looking at the bar graph on screen, turn the focus ring to a position where ”Focus is adjusted” is displayed and adjust the ring to the position where the bar in the bar graph is closest to 100 (Figure d).

Figure a

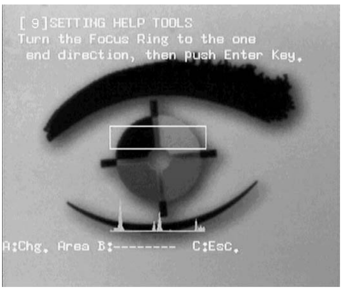


Figure b

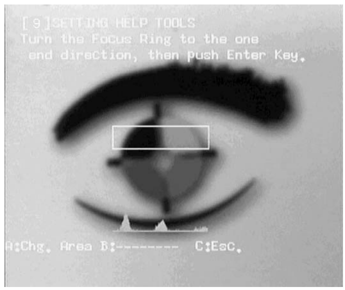


Figure c

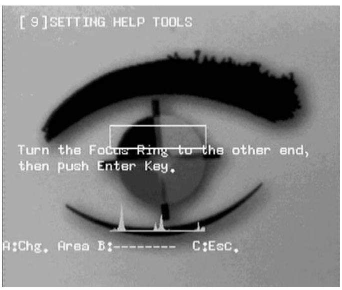
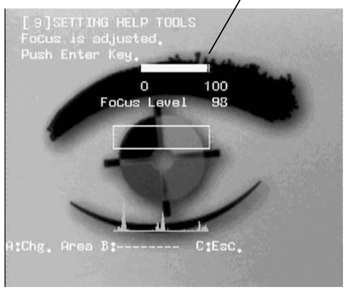


Figure d

Bar graph



Aperture

Helps you adjust the aperture correctly by watching a bar graph on the screen while turning the iris ring on the camera lens.

Procedure:

1. Select **3. Aperture**, and a screen such as Figure a. is displayed. Press <A: Chg. Area> to set the area of the image with the required feature.

2. Following the instructions, turn the iris ring all the way in either direction then press <Enter> (Figure b).

3. Next, turn the iris ring all the way in the other direction then press <Enter> again (Figure c).

4. Looking at the bar graph on screen, turn the iris ring to a position where ”Iris is adjusted” is displayed and adjust the ring to the position where the bar in the bar graph is closest to 100 (Figure d).

Figure a

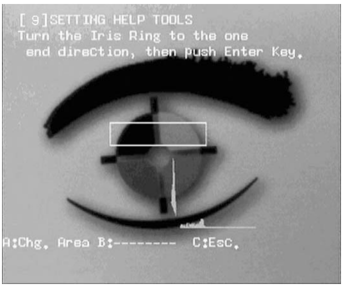


Figure b

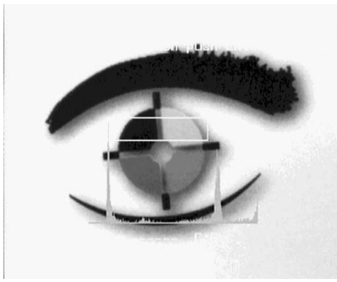


Figure c

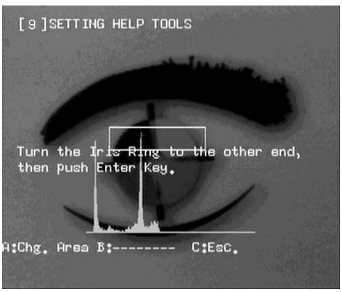


Figure d

Bar graph

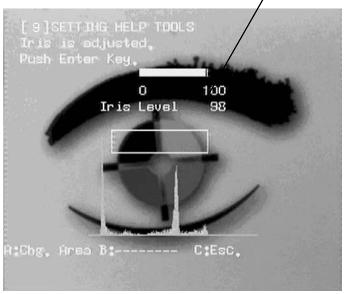
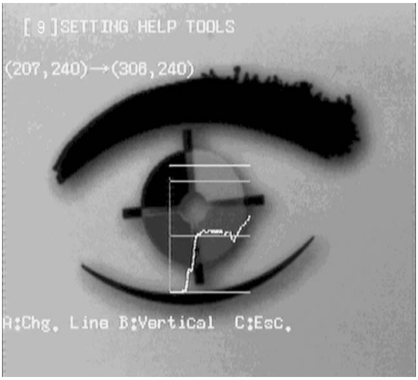
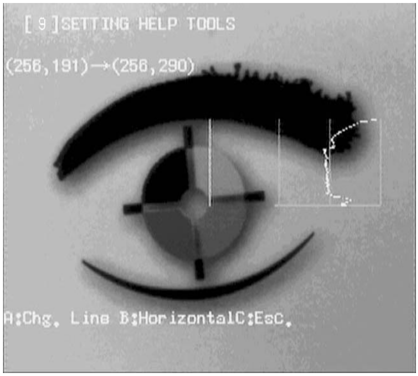


Image Profile

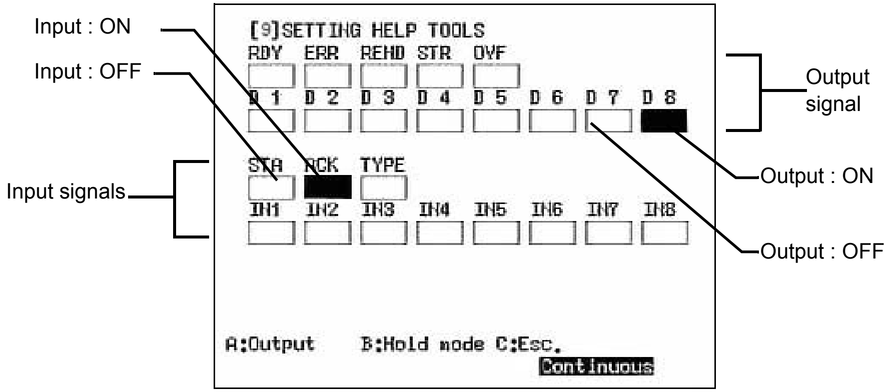
Displays a graph of gray-scale distribution along a line specified on the image. Select **4. Image Profile**, and a straight line and corresponding graph are displayed on the screen as shown below. Press <A> to draw a straight line at the point you wish to be graphed. Press <B> to switch the line to a vertical line.





In Out Monitor

Checks the parallel interface by monitoring input states and forcing output states. Useful for checking input and output data flow when the XUVM230 is connected to an external device.



Forced Output

Press <A: Output> and move the cursor to any of the output signals **RDY** (Ready), **ERR** (Error), **REND**, **STR** (Strobe), **OVF** (Overflow) or **D1 to D8**, then press <Enter> to turn the output for that signal ON/OFF.

Input Monitor

The ON/OFF status of input signals **STA** (Start), **ACK**, **TYPE**, and **IN1** to **IN8** can be monitored. Press <B> to switch input status between **Hold** and **Continuous**.

Hold: When the input signal goes ON, the display goes ON and remains ON when the input signal goes off again.

Continuous: The display only goes ON while the input signal is ON.

CHAPTER 20

Specifications

Specifications

Item		Specifications
Frame memory		512 x 480 (pixels) x 256 gradations
Operator interface		Menu selection by specialized keypad
Monitor display		Change between gray-scale memory/gray-scale through/Gray NG
Processing	Gray-scale	8-bit 256 gradations
Number of types		32
Inspection	Position and rotation adjustment	8/type
		Priority adjustment Multi-stage adjustment Sequence setting by matching/gray-scale edge/binary edge or feature extraction detection.
	OCR	Max. 8 per type Area: Rectangle Inspection method: Outputs character label with highest match with specified dictionary. Processing: Character reading using Neural Network Inspection object: Black/white specification possible Inspection direction: Right to left, left to right, up to down, and down to up Character segment: Gray scale, automatic binarization, fixed binarization, with dilation/ erosion function Adjustment: Position and rotation adjustment group Output value: Read character string (16 characters max.) Other: Read function for joined characters and ability to specify character strings for judgment
	Dictionary for character recognition	5 max. (equipped with OCR–A and OCR–B fonts) 40 characters max. (36 alphanumeric characters and 4 symbols) per dictionary 3 patterns max. per character

<table>
<tr><th colspan="2">Item</th><th>Specifications</th></tr>
<tr><td rowspan="8">Inspection</td><td rowspan="2">Character verification</td><td>16 per type</td></tr>
<tr><td>Character quality inspection using matching, subtraction and labeling. (Supports up to ±30 degrees rotation for each character.) Character/Pattern detection selection method:
Character: Possible to inspect up to a maximum of 30 characters.
Auto pattern registration function that uses an original character segmentation function.
It is possible to set so that only character edges are masked during pattern registration.
Pattern: Patterns can be registered without character segmentation.
Output: Number of detections, Detection position, Maximum subtraction, Number of subtraction, and Correlation value for each character.
Judgment: OK/NG for whole characters and individual characters.</td></tr>
<tr><td rowspan="2">Smart matching (subpixel processing)</td><td>4 per type</td></tr>
<tr><td>Includes a subtraction processing function that operates after detection matching
Sub–pixel accuracy multiple detection matching by gray scale correlation processing
Rotation by raster detection and raster detection position (±30 degrees)
Output: number of detected items, correlation values, detection, position and angle, teaching registration changes possible from external source
Judgment learning function via smart template</td></tr>
<tr><td rowspan="2">Lead inspection (sub–pixel processing)</td><td>32 per type</td></tr>
<tr><td>Detection at gray sub–pixel unit
Area specification: Line or rectangle
Scan method: Single, gray filter/width
Detection position: Dual edge detection
Output: Number of leads
Judgment: Number of leads, pitch, width, and overall judgment</td></tr>
<tr><td rowspan="2">Gray-scale edge detection (subpixel processing)</td><td>32 per type</td></tr>
<tr><td>Detection at gray sub–pixel units
Area specification: Line or rectangle
Scan method: Single/projection, gray filter/width
Detection position: Edge, front edge and rear edge, maximum differential value, or multiple edge (256 max.)
Output: Detected edge coordinates, number of detections
Judgment: Number of detections</td></tr>
</table>

Item		Specifications
Inspection	Gray-scale window	32 per type
		Area: Rectangle, polygon (3 to 16 points), circle or oval Mask area: None, rectangle, polygon (3 to 16 points), circle or oval Output value: Gray scale mean value
Conversion data		4 registers, Can quote to numerical calculation. Can convert numerical calculation result to actual distance.
		Standard distance, Number of pixels, Coefficient
Numerical calculations		32 per type
		Arithmetic, arctan, square root, distance between two points, specific substitution, referencing of previous data, and output control
Judgement output		External output (D) register = 32 per type Internal judgement (R) register = 32 per type
External interface	Serial	RS232C = 2ch (max.115200bps) Telemecanique PLC. Compatible with Allen-Bradley , Omron C Series PLC , Mitsubishi A/FX Series PLC and Matsushita PLC FP series CCU
	Parallel	Input = 11 points Output = 14 points Removable screw-down terminal block
Display functions		Display image brightness modification, Image suppress function when setting checkers, Image rotation function when setting checkers, Bright display of reject locations, Data monitor, Checker list
	Marker function	8 graphics (line, rectangle or ellipse)/type (max.) can be registered for display on the main screen.
Setup tools	Image save function	8 screens
		Save/load function for inspection image (all screens/problem screens) Store images for re–inspection/resetting Windows PC image save/load function using the Vision Backup Tool
	Debugging	Trap function Spreadsheet
	Setup help	Focus setup, Aperture setup, Lighting adjustment, Gray scale profile monitor, Input monitor function, Forced output function
Moving work compatibility		FULLFRAME camera /flash/electronic shutter used
Camera support		FULLFRAME camera = XUVC002 Standard camera = XUVC001 Composite video (NTSC) input used (however the connection requires one port)
Number of supported cameras		2
Operating voltage		24V DC less than 0.9A
Setup data backup		Setup data can be saved to a Windows PC using the Vision Backup-Tool
Dimensions (mm)		40 (W) x 120 (H) x 84 (D)

CHAPTER 21

Menu Layout

Menu Layout

- 1 TYPE see page 5 - 13
  - 1 Copy Type see page 5 - 19
  - 2 Delete Type see page 5 - 20
  - 3 Input Type Title see page 5 - 15
  - 4 Capture Camera see page 5 - 16
  - 5 Camera/Image see page 5 - 17
  - 6 Menu Setting see page 5 - 10
    - 61. Screen display see page 3 - 10
    - 62. Checker pattern see page 4 - 21
    - 63. Make bright at NG see page 3 - 10
    - 64. Detect position see page 3 - 10
    - 65. Status display see page 3 - 10
  - 7 Initialiser tous programmes see page 5 - 22

- 2 CHECKER
  - 1 POS. ROT. ADJ. see page 6 - 3
    - 1 GRAY EDGE DETECTION see page 6 - 4
      - 11. Pos. Adj. see page 6 - 4
      - 12. Hor. Det. Rot. Adj. see page 6 - 5
      - 13. Ver. Det. Rot. Adj. see page 6 - 6
    - 2 MATCHING see page 6 - 7
      - 21. One Chkr. Pos. Adj see page 6 - 7
      - 22. Theta Rot. Adj. see page 6 - 8
      - 23. One Chkr. Rot. Adj. see page 6 - 9
      - 24. Two Chkr. Rot. Adj. see page 6 - 10

Next Page

- 2 INSPECTION CHECKER
  - 21 OCR (Recogn.) see page 7 - 3
    - 1 Select camera
    - 2 Checker Setting see page 7 - 17
      - 21. Area
      - 22. Segmentation Color
      - 23. Segmentation Direction
      - 24. Dictionary No.
      - 25. Condition see page 7 - 20
        - 251. Separate
        - 252. Char. Height Max.
        - 253. Char. Height Min.
        - 254. Char. Width Max.
        - 255. Char. Width Min.
        - 256. Separate Level
        - (252–256: 251=Oui)
      - 26. Segmentation Condition see page 7 - 17
        - 261. Segment Area Min.
        - 262. Filter
        - 263. Segmentation Meth
        - 264. Slice Level
    - 3. String Judgment see page 7 - 20
    - 4. Rec. Lower Limit
    - 5. Output Control
    - 6. Pos. Rot. Adj. Group
    - 7. Results
    - 8. Copy Checker
    - 9. Delete Checker
  - 22.OCV(Verif.) see page 8 - 3
    - 1. Character
      - 1. Select Camera
      - 2. Checker Setting see page 8 - 8
        - 21. Area
        - 22. Segmentation Color
        - 23. Segment Aera. Min.
        - 24. Background Process
        - 25. Noise Reduction
        - 26. Smart Setting
        - 27. Registered Image
      - 3. Condition see page 8 - 12
        - 31. Search Area
        - 32. Positioning
        - 33. Cor. Min.
        - 34. Template Contrast
        - 35. Rotation Angle
        - 36. Delta Angle
        - 37. Threshold
        - 38. Filter
      - 4. Sub. Det. Area see page 8 - 16
      - 5. Sub. Det. Judgment see page 8 - 16
      - 6. Pos. Rot. Adj. Group
      - 7. Result see page 8 - 18
      - 8. Copy Checker
      - 9. Delete Checker
    - 2. Pattern (Same as 1. Character)

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- 23 SMART MATCHING see page 9 - 3
  - 1. Select camera
  - 2. Checker Setting see page 9 - 5
    - 21. Template
    - 22. Seach Area
    - 23. Sequence
    - 24. Output Unit
      - 241 Sorting
      - 242 Sorting Order
  - 3. Subtraction Setting see page 9 - 11
    - 31. Substraction
    - 32. Sub. Area Judgment
    - 33. Thres. Value
    - 34. Filter
    - 35. Deviation
    - 36. Update Devi. Data
    - 37. Put Devi. Data back
    - 38. Initialize Devi. Data
  - 4. Pos. Rot. Adj. Group
  - 5. Check Template see page 9 - 16
  - 6. Result see page 9 - 17
  - 7. Copy Checker
  - 8. Delete Checker
- 24. LEAD INSPECTION see page 10 - 3
  - 1. Select camera
  - 2. Checker Setting see page 10 - 6
    - 21. Shape
    - 22. Direction
    - 23. Area
    - 25. Edge Thres. Value
    - 26. Condition
    - 24. Object
      - 261.Scan Pitch
      - 262. Filter
      - 263. Width
      - 264. Average Area
  - 3. Detect Judgment see page 10 - 10
  - 4. Width Judgment see page 10 - 10
  - 5. Pitch Judgment see page 10 - 10
  - 6. Pos. Rot. Adj. Group
  - 7. Result see page 10 - 11
  - 8. Copy Checker
  - 9. Delete Checker

Next Page

- 25. GRAY EDGE DETECTION see page 11 - 3
  - 1. Select camera
  - 2. Checker Setting see page 11 - 4
    - 21. Shape
    - 22. Direction
    - 23. Scan Method
    - 24. Area
    - 25. Edge Condition
    - 26. Edge Thres. Value
    - 27. Condition
      - 271. Scan Pitch
      - 272. Filter
      - 273. Width
      - 274. Average
    - 28 Detect Position see page 11 - 10
  - 3 Detect Jugment
  - 4 Pos. Rot. Adj. Group
  - 5 Résult see page 11 - 11
  - 6 Copy checker
  - 7 Delete checker
- 26 GRAY WINDOW see page 12 - 3
  - 1. Select camera
  - 2. Checker Setting see page 12 - 4
    - 21 Shape
    - 22 Area
    - 23 Mask shape
    - 24 Mask area
  - 3. Average Judgement
  - 4. Pos. Rot. Adj. Group
  - 5. Copy Checker
  - 6. Delete Checker

- 3. GROUP MOVE see page 15 - 7
- 4. NUMERICAL CALCULATION see page 13 - 7
- 5. JUGMENT see page 13 - 23
- 6. IMAGE DATA see page 15 - 3
  - 1. LOAD IMAGE DATA
  - 2. SAVE IMAGE DATA
  - 3. LOCK IMAGE DATA
  - 4. RESET IMAGE DATA

3 DATA MONITOR see page 13 - 36

4 SPREADSHEET see page 13 - 33

5 CONVERSION DATA
see page 13 - 4

- CV01
- CV02
- CV03
- CV04

6 Dictionary

- 1. Select Camera
- 2. Area
- 3. Segmentation Color
- 4. Segment. Condition
  - 41. Segmentation Area Min.
  - 42. Filter
  - 43. Segment. Method
    - Auto Slice
    - Gray
    - Fixed Slice
  - 44. Slice level (if Segment. Method. = Auto Slice or Fixed Slice)
  - 44. Thickness (if Segment. Method. = Gray)
  - 45. Noise Reduction
  - 46. Connection Level

  } only available if 43.Sgment. Method = Gray
- 5. Dictionary Registration
- 6. Dictionary Check
- 7. Learn
- 8. Copy Dictionary
- 9. Delete Dictionary

- 7 ENVIRON-MENT see page 5 - 4
  - 1 CAMERA see page 5 - 5
    - 11 Camera Mode
    - 12 Shutter
    - 13 Flash
  - 2 START see page 5 - 7
  - 3 Start Type. see page 5 - 8
    - Nr.1
    - Last Store Type No.
      - 31 Display message
  - 4 Communication see page 5 - 9
    - 41 Com. Mode page 16 - 9
    - 42 RS232C page 16 - 10
      - 421. Baudrate (bps)
      - 422. Length
      - 423. Stop Bit
      - 424. Parity
      - 425. Flow Control
    - 43 Serial Output page 16 - 12
      - 41 Com. Mode = Normal
        - 431. Output
        - 432. Output Char.
        - 433. Inval. Digit
        - 434. Read End
        - 435. Process End
        - 436. Numerical Calc.
        - 437. Judgment
        - 438. Char. Recog.
      - 41 Com. Mode = PLC Link
        - 431. Type No Register
        - 432. Top Data Register
        - 433. Timeout
        - 434. Output
        - 435. Output Char.
        - 436. Numerical Calc.
        - 437. Judgment
        - 438. Char. Recog.
        - 439. PLC Type
        - 440. PLC Address
    - 44 Parallel Output page 16 - 15
      - 441. Handshake
      - 442. Reset Cond.
      - 443. Setting Template
      - 444. Disp. Img. change
    - 45 Type Switch Min.
  - 5 Display Setting see page 5 - 10
    - 51. Display Brigheness
    - 52. Outside Region Value
    - 53. Language
  - 6 Save image Mode see page 5 - 11
    - Manuel
    - Continu
    - Stop Def.
    - Cond. Limite
      - 61. Superposer
  - 7 Initialise see page 5 - 12
- 8 SAVE DATA see page 14 - 3
- 9 SETTING HELP TOOLS see page 19 - 3
  - 1 Lighting adjustment page 19 - 4
  - 2 Focus page 19 - 5
  - 3 Aperture page 19 - 6
  - 4 Image Profile page 19 - 7
  - 5 In Out Monitor page 19 - 8

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