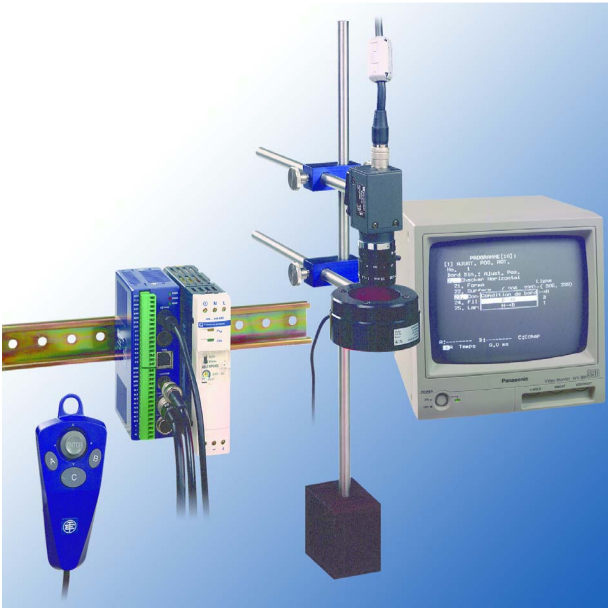
Exploitation Guide
March

2003

Telemecanique
Osiview
VISION CONTROLLER
Firmware



Telemecanique

Schneider Electric

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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 XUVM110/210:

- 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 XUVM110/210 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.

How to use this guide

Two similar functions on the XUVM110 and XUVM210 have different names, and in this guide, the XUVM210 naming convention is employed.
These functions are given in the table below.

XUVM110	*XUVM210*
POS. ADJ. (Position Adjustment)	POS.ROT. ADJ. (Position and Rotation Adjustment)
Matching	Smart Matching

Also, the XUVM210 menu displays are used in this guide.

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

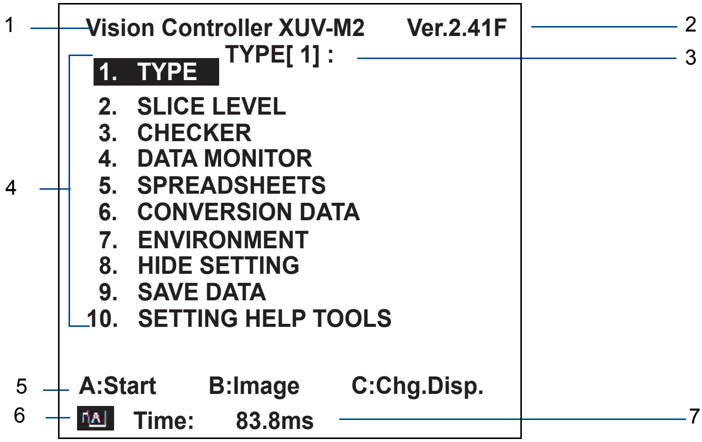
Ex:

Contains an illustrative example of the previous text section

CHAPTER 1

Screens and Basic Operations

Main Screen



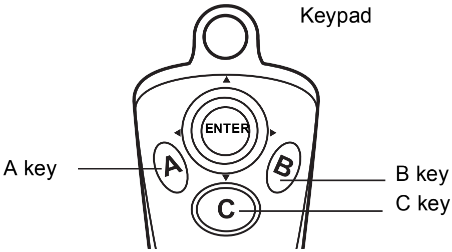
1 Model information
Shows the name and version number for the VISION CONTROLLER firmware you are using.

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 1 - 6).



6 Image icon
Displays the type of the currently displayed image. Press <B> to switch images (see page 1 - 9).

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 1 - 10).

Main Screen Options

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

2. **SLICE LEVEL**
   Sets the binary level.

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

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

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

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

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

8. **HIDE SETTING**
   Customizes the menu display with password protection.

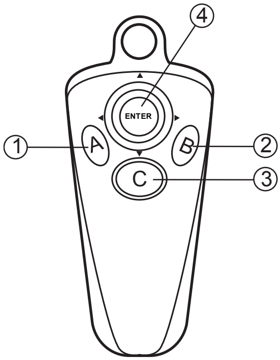
9. **SAVE DATA**
   Saves the setup data.

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

Keypad

Buttons

All operations and settings for the XUVM110/210 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, Gray Scale Memory, Binary Through, and Binary Memory modes.

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.

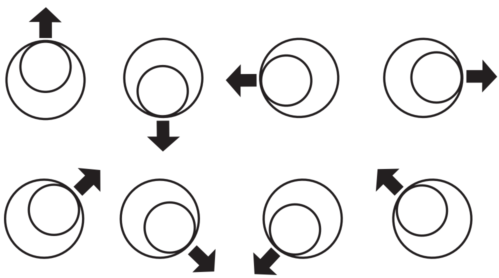
Note **It is possible emulate keyboard operations by inputting serial commands from an external device to the COM port (see page 16 - 44).**

In some submenus, the keypad buttons have a different function, which you find explained in the corresponding guide sections.

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.

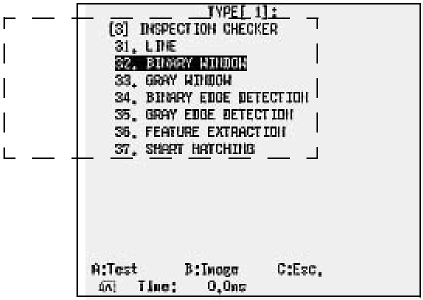
Note **If you happen to press the <Enter> button by accident while operating the cursor lever, you may carry out an input operation by mistake. To guard against this, make sure to press the cursor lever from the side when selecting menus and options.**

Main Screen Operations

Menu Selection

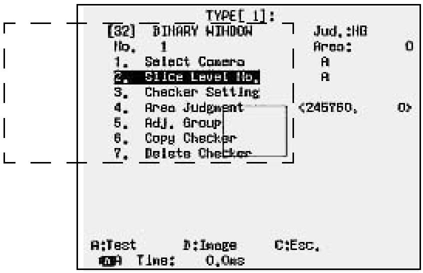
Use the cursor lever to select an item, then press <Enter> to confirm your selection. The selected screen will be displayed. To return to the previous menu, press <C>. These operations, which are basically the same for all menus, are illustrated below.

Use the cursor lever to select an item



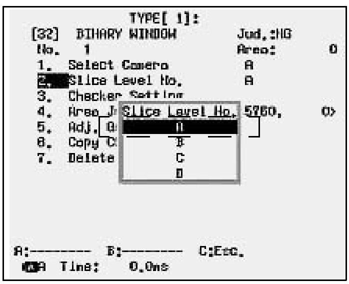
<C> <ENTER>

Use the cursor lever to select an item



<C> <ENTER>

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



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 :

A : caméra A
B : caméra B (XUVM210 only)

Binary-Thru :

A to F : Slice levels A to F
A : caméra A
B : caméra B (XUVM210 only)

Gray-Mem :

A : caméra A
B : caméra B (XUVM210 only)

Binary-Mem :

A to F : Slice levels A to F
A : caméra A
B : caméra B (XUVM210 only)

Gray NG :

A : caméra A
B : caméra B (XUVM210 only)

Binary-NG :

A to F : Slice levels A to F
A : caméra A
B : caméra B (XUVM210 only)

Gray-Thru/Binary-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/Binary-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/Binary-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 - 29).

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. For information on gray-value and binary pictures as well as slice levels, see page 2 - 19.

Ex:

Camera setting A :

Disp. Image						
A Camera						
Gray-Thru						
Gray-Mem						
Gray-NG						
Binary-Thru	A	B	C	D	E	F
Binary-Mem	A	B	C	D	E	F
Binary-NG	A	B	C	D	E	F

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 3 - 25).

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
6. Marker	On

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
- 6.Marker.
  - Off
  - On

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 - 43
	Checker List	displays the checker list, see page 13 - 49
	Spreadsheet	displays the spreadsheet, see page 13 - 40
2. Checker Pattern (page 2 - 17)	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.
6. Marker	Off/On	displays the set marker, see page 15 - 9

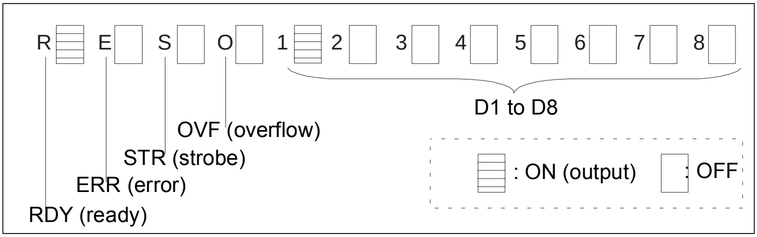
Note **When you select** Fixed **and** Detect Position **was set to On (display), then** Detect Position **is automatically set to Off.**

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 2

Inspection Procedure

Sequence for Checker Setup

The **Checker Setting** menu includes some items such as the group number(s) for position and rotation adjustment and/or exposure adjustment. The group numbers must be set in advance in order for data entry to be accepted. The same applies when referring to checker data in program input for numerical calculation and judgment output.
Use the following sequence when setting up type data for the VISION CONTROLLER.

Environment settings
↓
Select type
↓
Set binarization levels
↓
Capture image with <A> button
↓
Set position and rotation adjusters
↓
Set exposure adjusters
↓
Set inspection checkers
↓
Set conversion data
↓
Set numerical calculations
↓
Set judgment output
↓
Set data monitor
↓
Set spreadsheets

Inspection Execution Procedures

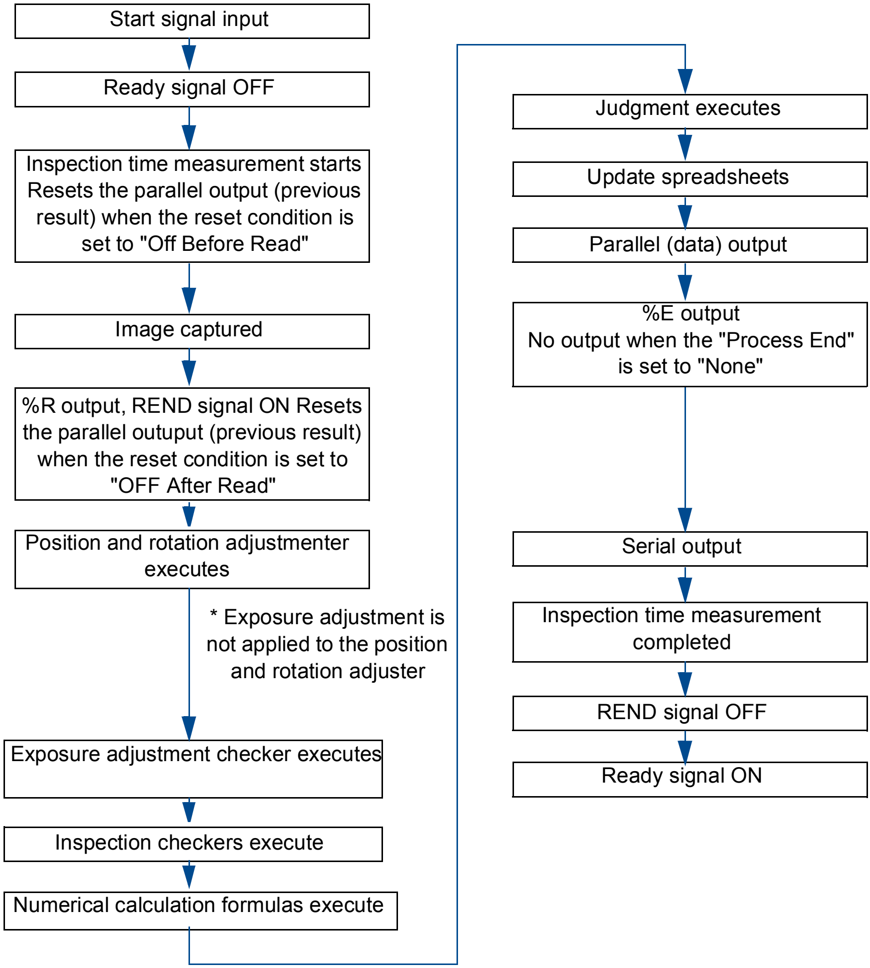
Broadly broken down, when you initiate an inspection by pressing <A:Start>, the procedure order is:

1. Image capture,
2. adjustment by the adjustment checkers (position, rotation and exposure),
3. inspection and judgment by the inspection checkers and
4. numerical calculation and result output.

Inspection checkers execute in numerical order, but it is also possible to use **Autom. Switch** (Automatic Switch) mode and **User-Defined** mode to change the checker to be executed according to certain conditions (see page 2 - 5).

Sequence for Executing Checkers

With the VISION CONTROLLER XUVM110/210 the sequence shown below is used for performing inspection with checkers.



Execution Modes

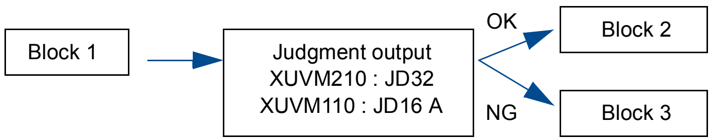
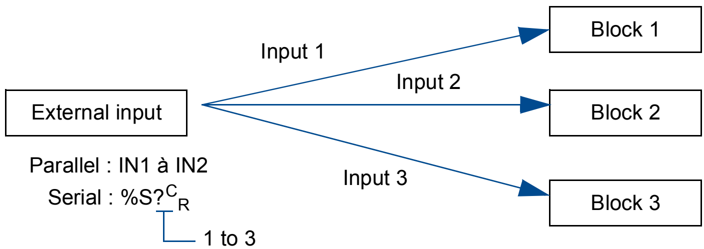
You can select from among three execution modes per type to specify the execution order for an inspection checker. With the **Autom. Switch** (Automatic Switch) and **User-Defined** modes, all checkers in a type are broken into three blocks, and the block to be executed is determined based on certain conditions.

Inspection Checker Block Structure

	Checker Number	
	XUVM210	XUVM110
Block 1	01 to 32	01 to 16
Block 2	33 to 64	17 to 32
Block 3	65 to 96	33 to 48

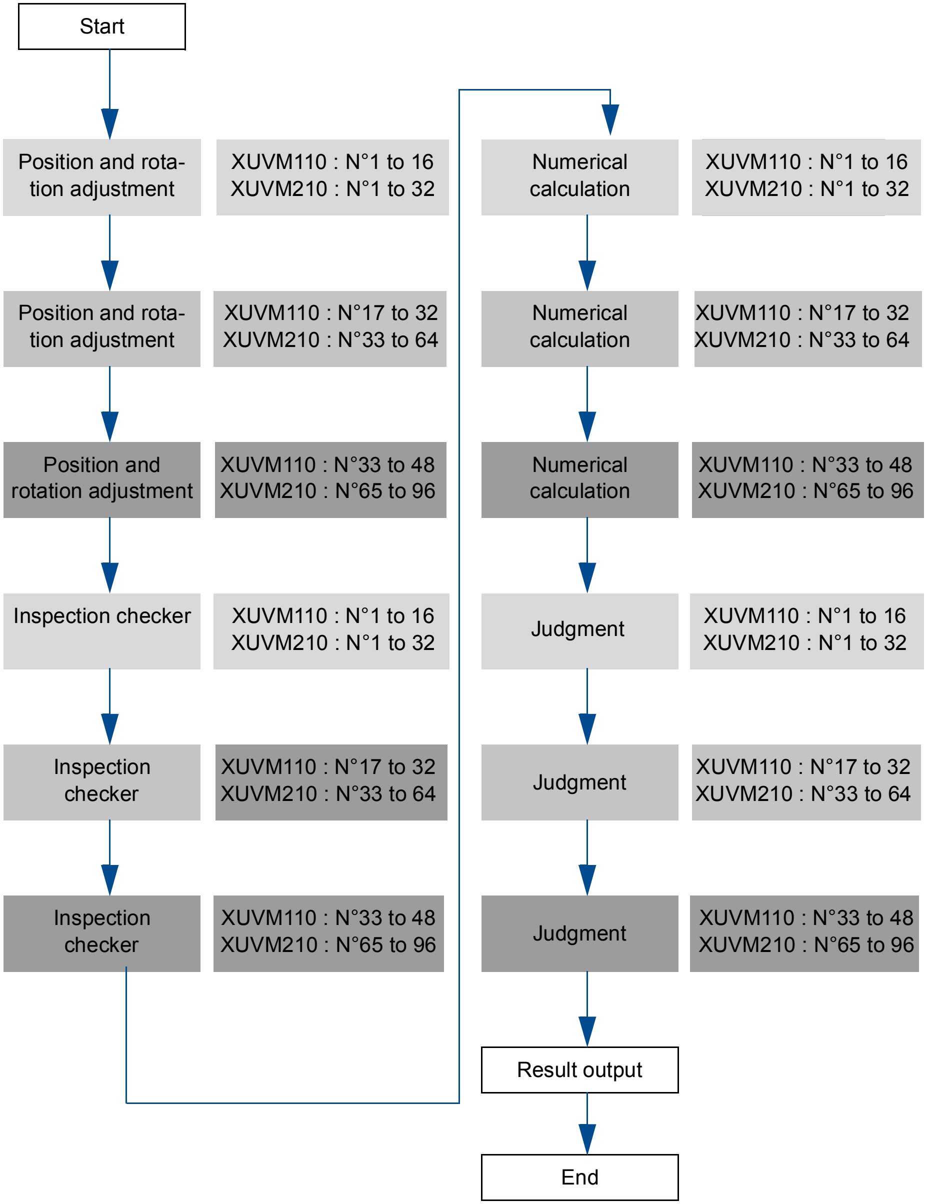
Take the blocks into consideration when setting checkers that will use either the **Autom. Switch** (Automatic Switch) or the **User-Defined** mode.

The Three Execution Modes

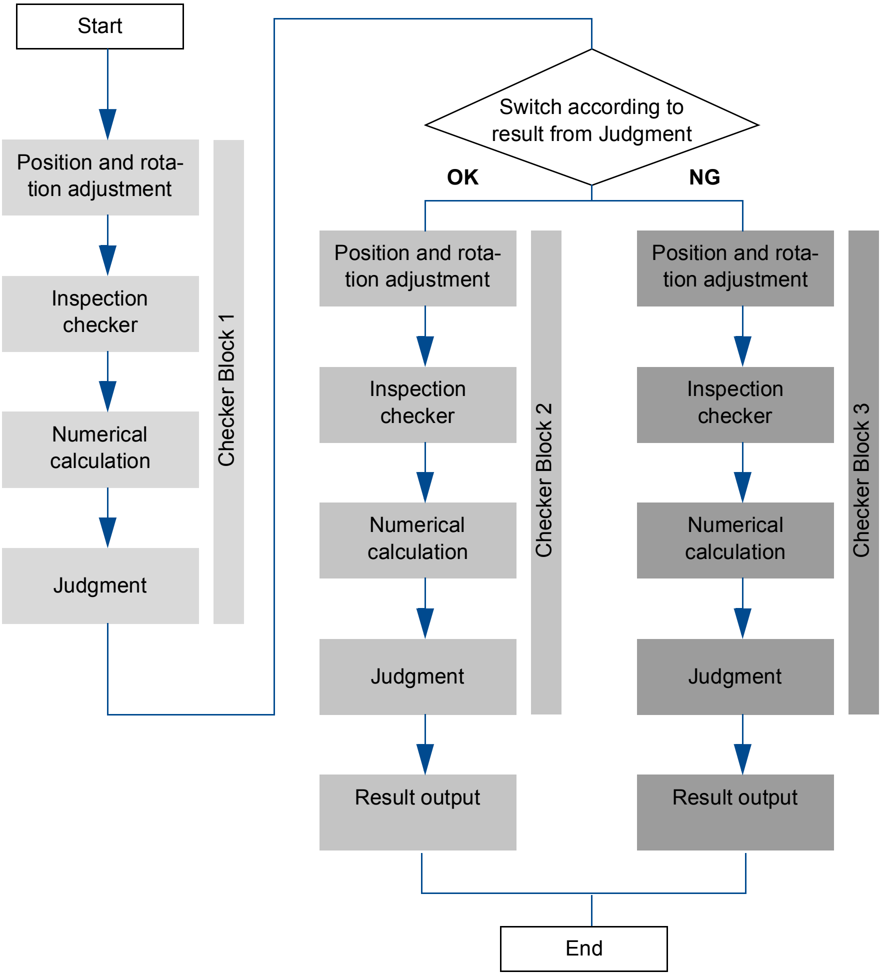
Execution Mode	*Function*
Execute All	The checkers for all blocks are executed in order. 
Autom. Switch	After Block 1 is executed, either Block 2 or Block 3 is executed in accordance with specified judgment output results (register JD32 for the XUVM210 and JD16 for the XUVM110). 
User-Defined	Use the serial or parallel inputs to specify which block is to be executed. 

- Execute All mode

The set checkers are executed in this order.



- Autom. Switch (Automatic Switch) Mode
  The checkers in Block 1 are executed in order, and if the judgment output (JD32 for the XUVM210 and JD16 for the XUVM110) is OK, Block 2 is executed, and if it is NG, Block 3 is executed. Only the executed checker patterns are displayed.

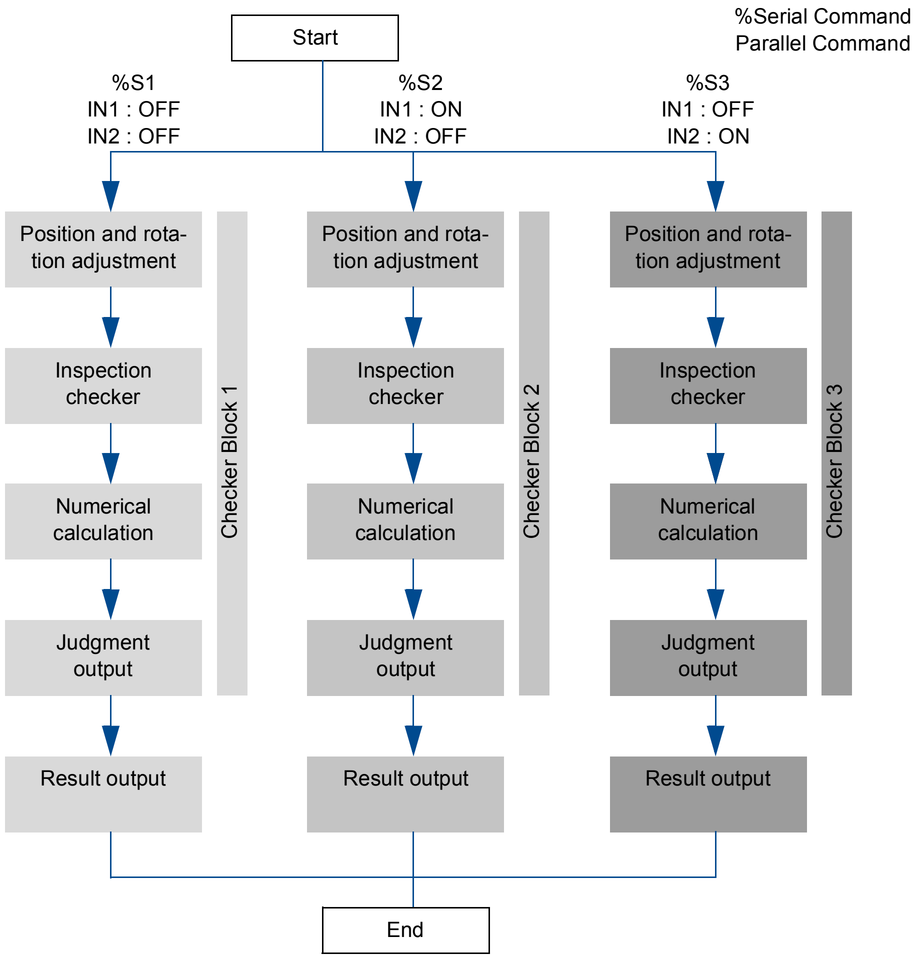


Note **The results form checker block 1 are not output. If you would like to output a formula or judgment result from checker block 1, define the result for output in both checker block 2 and checker block 3**

Autom. Switch **mode will be executed whenever the option <A:Start> is available. In all other cases, checker blocks 1 to 3 will be executed like in** Execute All **mode. However, the checker results are not output to the interfaces.**

During test execution, Execute All **mode is used, and all checker patterns are displayed. User-Defined Mode Use external input (serial or parallel communication) to specify which block is to be executed. User-Defined Mode**

- User-Defined Mode
  Use external input (serial or parallel communication) to specify which block is to be executed.

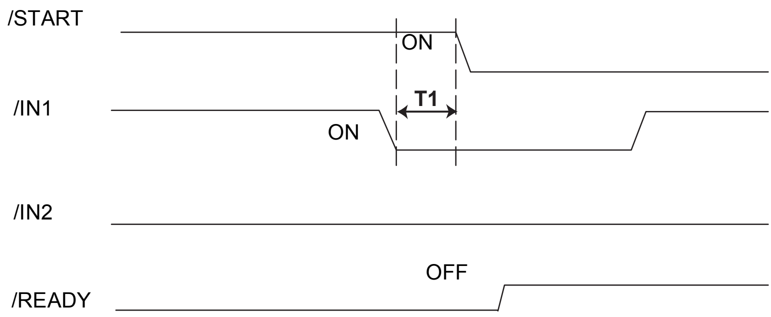


With the serial interface, send the start signal followed by the number of the checker block you wish to execute. With the parallel interface the signal code applied to the inputs IN1 and IN2 determines which checker block will be executed.

Checker block	Command for the serial interface	Command for the parallel interface	
		IN1	IN2
1	$\%S1^{C}_{R}$	OFF	OFF
2	$\%S2^{C}_{R}$	OFF	ON
3	$\%S3^{C}_{R}$	ON	OFF

Ex:

Execute checker block 3 via the parallel interface



Note **Apply the code determining the checker block to the inputs IN1 and IN2 at least 1ms before giving the start signal (T1).**

How to Specify the Starting Block in User-Defined Mode with the Keypad
Even with no external devices connected, it is possible to use the keypad as follows to specify and execute a block (including external output).

Procedure :

1. Select **User-Defined** in the option **7. Execution Mode** in the menu **1. Type**

2. Press <A> in the main menu

Screen Display **(Ready signal On)**   **A:Start B:Image C:Chg.Disp.**

3. Select a block for execution using the keypad keys

A:bloc1 **A:bloc2** **A:bloc3**

Selecting the execution block No. **(Ready signal Off)**   **A:U-Def.1 B:U-Def.2 C:U-Def.3**

Inspection will be performed using the specified block number. After execution of inspection by the specified block, you are returned to the screen in step 2.

4. If you wish to execute another block, repeat steps 2 and 3

Note **During test execution,** Execute All **mode is used, and all checker patterns are displayed.**

User-defined **mode will be executed whenever the option <A:Start> is available. In all other cases, checker blocks 1 to 3 will be executed like in** Execute All **mode. However, the checker results are not output to the interfaces.**

The option 3. Start Trigger **from the** Environment **menu is not available for execution mode** User-defined**.**

If the option 2. Start **in the menu** 7. Environment **is set to** Manual Repeat, **the same block will be executed repeatedly.**

Displayed Image and Test Functions

The image displayed corresponds to the settings under **Menu Setting** in the **Type** menu (see page 3 - 25).

In the **Checker Setting** menu, the XUVM110/210 displays a binary or gray-scale image, depending on the selected checker. The camera that displays the image is determined by the **Select Camera** setting for each of the binary checkers (XUVM210 only). When you send a start signal by pressing <A>, only the selected checker will be executed (with position and rotation adjustment, if defined).

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 Package 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.

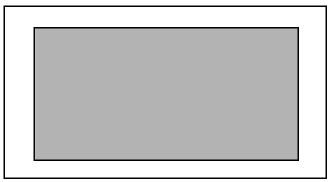
Note **On the main menu, none of the checkers are displayed brightly unless Make Bright at NG is set to YES. If Make Bright at NG is set to NO, no checker is displayed brightly.**

Exposure Adjusters, Line, Binary and 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:

Binary window checker pattern display

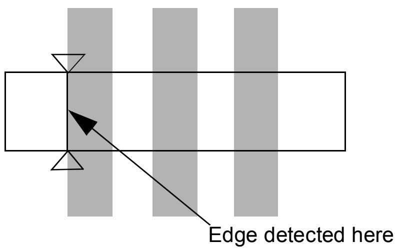


Binary Edge Detection Checker Display

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

Ex:

Binary edge checker pattern display

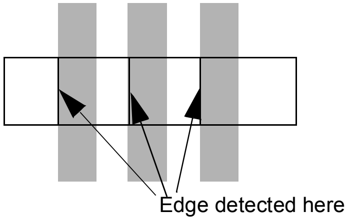


Gray-Scale Edge Checker Display

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

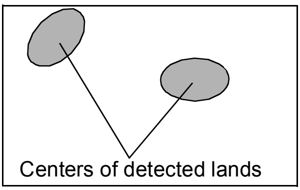


Feature Extraction Checker Display

"+" marks indicate the center of gravity of each detected land. The "+" marks are not displayed if no land is found.
When operating from the Feature Extraction menu, the "+" marks rotate according to the angle of the principal axis

Ex:

Feature extractor pattern display



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.

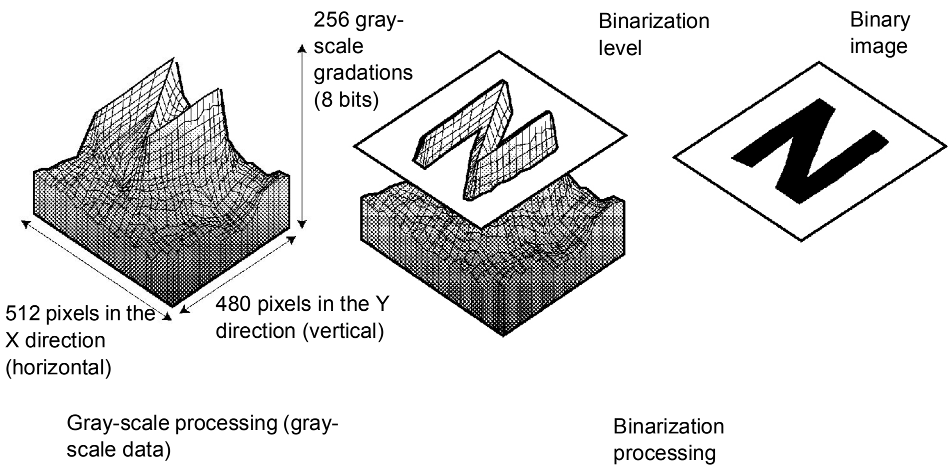
Note **When position adjustment is used, the checker is displayed at a position that has been moved by the amount of correction. If the position after correction is off screen, the checker is displayed at the position where it was set.**

Display in Autom. Switch and User-Defined Execution Mode

Only the checker pattern(s) for the executed block is/are displayed. When **3. Checker** in the main menu is selected, all checkers are executed and all checker patterns are displayed.

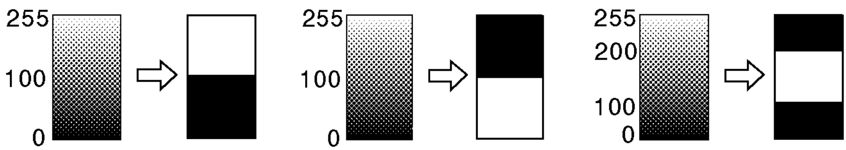
Slice Levels / Binarization Levels

In the XUVM110/210, the image signal from the camera is stored in the memory in the form of a gray-scale image (i.e. a set of image data including brightness data) with 256 gradations. The XUVM110/210 has a memory comprising 480 x 512 pixels, each using 8 data bits to represent 256 gray-scale gradations.
The gray-scale image is converted directly into brightness data (data concerning conditions and differentials in changes in brightness values) which is then processed.
Feature extraction and edge detection checkers need binary images for processing. While gray-scale images contain all gray-scale gradations, binary images only contain black and white. This makes processing easier because objects can be easily separated into foreground and background.
Pixels brighter than a specified brightness level (slice level) are regarded as white, while pixels darker than the specified level are regarded as black.
Determine the slice level in the **Slice Level** menu. The VISION CONTROLLER offers six slice levels that can be set individually (A, B, C, D, E, F). This makes it possible to use different slice levels for feature extractors and edge detectors. All gray values within the maximum and minimum level are displayed as white, all gray value outside the maximum and minimum level are displayed as black.



About the Binarization Process

Threshold values are applied to a 256-gradation gray-scale image to convert it into a 2-gradation (black and white) image called a “binarized” or “binary” image. Making binarization level settings means setting upper and lower limit values defining “white” and “black”, as shown in the diagrams below.



Upper limit value : 255
Lower limit value : 100

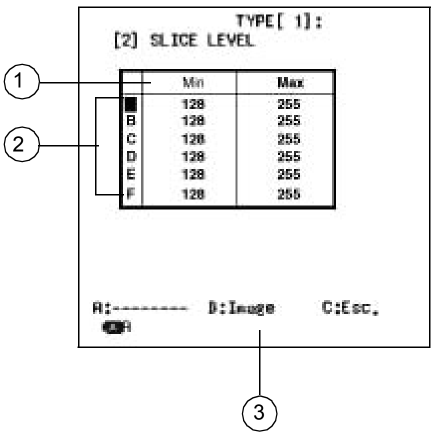
Upper limit value : 100
Lower limit value : 0

Upper limit value : 200
Lower limit value : 100

With the XUVM110/210 you can create six groups from A to F with upper and lower binarization limit values for each type. Each level can be set to a value between 0 and 255.

By changing a binarization level for one of the groups in this screen, the binary level for each of the binary checkers belonging to the same group is changed.

Slice Level Menu



1:Maximum, Minimum: sets the up per and lower limit value for the slice level

2: A to F (Binary Group): Shows the six binary level groups, ABCDEF. You can set binarization levels for each of them individually.

3:B: Image: The <B> button switches the image display on the monitor from Binary-Through to Binary-Memory and vice versa.

Slice Level Setup

Procedure :

1. Switch the image displayed on the monitor as required
2. Use the cursor lever to move the cursor to the position for slice level group A to F
3. Move the cursor with the cursor lever and press <Enter> at the upper or lower limit value you wish to set
4. Change the binary level values using the cursor lever
5. Press <Enter> to set the binarization levels

If you press <C> before you confirm with <Enter>, the settings will be lost and will return to their original values.

Note **You cannot make the upper limit value lower than the lower limit value. Conversely, you cannot make the lower limit value larger than the upper limit value. If you want to make the upper limit value a level lower than the current lower limit value, first lower the lower limit value and then set the upper limit value. If you want to change the lower limit value to a level higher than the current upper limit value, first raise the upper limit value and then set the lower limit value.**

---

6. If you are changing binarization levels in the same binary level group, repeat steps 3 to 5
7. If you are changing binarization levels for a different binary level group, repeat steps 2 to 5
8. After making the settings, return to the main screen by pressing <C>

Reference and Modify Slice Levels from an External Device

Using serial commands it is possible to reference and modify the slice levels (see page 16 - 38).

Specifying Position and Rotation Adjustment Group

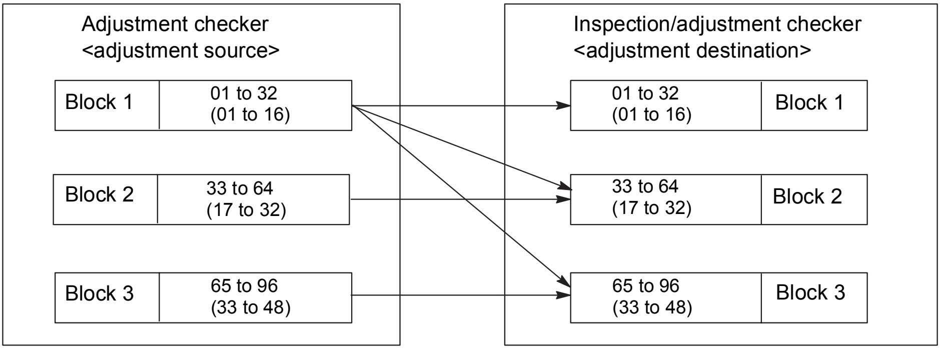
You assign a position and rotation adjustment (XUVM110: position adjustment only) to an inspection checker by entering the number of the position and rotation adjustment checker in the inspection checker's parameters. You can only assign the numbers of position and rotation adjusters that have previously been defined. The corresponding position and rotation adjuster pattern is displayed brightly during number selection.
You can assign a position and rotation adjustment checker either BEFORE or AFTER setting the inspection checker.

When you assign a position and rotation adjustment number BEFORE you set the area of the inspection checker, the image will be displayed in the adjusted position when you define the checker parameters. This makes it possible to position the inspection checker correctly under the current circumstances.

When you assign a position and rotation adjustment number AFTER you set the area of the inspection checker or when you assign a different position and rotation adjustment checker to the inspection checker, the message “Area will be changed. OK?” is displayed. Select **Yes** to assign or change the position and rotation adjustment checker number. The inspection checker will be adjusted and displayed at the new execution position. Check whether the inspection checker still works at the new position. Otherwise you need to set the checker area differently.

Limitations on Setting Adjustment Groups

Position and rotation adjustment is only possible in the direction of the arrows. Where there is no connecting arrow, no position and rotation adjustment number can be set. The checker numbers available for the XUVM110 are in brackets.



The following position and rotation adjustment group numbers can be set for the checker numbers. The checker numbers available for the XUVM110 are in brackets.

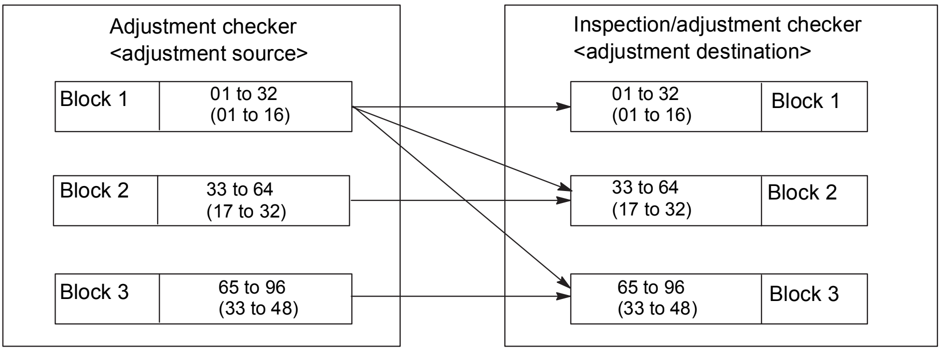
Checker No.	*Adjustment group numbers that can be set*
01 to 32 (01 to 16) <Block No. 1>	01 to 32 (01 to 16) <Block No. 1>
33 to 64 (17 to 32) <Block No. 2>	01 to 32, 33 to 64 (01 to 16, 17 to 32) <Block No. 1 and 2>
65 to 96 (33 to 48) <Block No. 3>	01 to 32, 65 to 96 (01 to 16, 33 to 48) <Block No. 1 and 3>

Specifying the Exposure Adjustment Group

Within a type, it is possible to specify the number of the exposure adjuster to be applied. The group number is only displayed for exposure adjusters which have the group number already specified. When selecting a number, the pattern for the corresponding adjuster is displayed brightly.
If the exposure adjuster group is set to upper limit, the upper limit for binarization is adjusted, and if it is set to lower limit, the lower limit for binarization is adjusted. (It is possible to set both.)

Limitations on Setting Exposure Adjustment Groups

Exposure adjustment is only possible in the direction of the arrows. Where there is no connecting arrow, no exposure adjustment group can be set. The checker numbers available for the XUVM110 are in brackets.

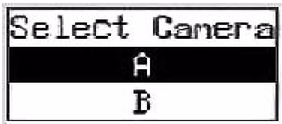


The following exposure adjustment group numbers can be set for the checker numbers. The checker numbers available for the XUVM110 are in brackets.

Checker No.	*Adjustment group numbers that can be set*
01 to 32 (01 to 16) <Block No. 1>	01 to 32 (01 to 16) <Block No. 1>
33 to 64 (17 to 32) <Block No. 2>	01 to 32, 33 to 64 (01 to 16, 17 to 32) <Block No. 1 and 2>
65 to 96 (33 to 48) <Block No. 3>	01 to 32, 65 to 96 (01 to 16, 33 to 48) <Block No. 1 and 3>

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.



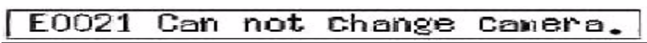
For the XUVM210

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).

Note **If you cannot select camera B, check whether the option** Capture Camera **in the** Type **menu has been set to** AB**.**

For the XUVM110

The XUVM110 works with only one camera. Therefore, this setting is fixed at A and cannot be changed. If you try to select a different camera, the following message is displayed



Area Setup and Out-of-Area Range Setting

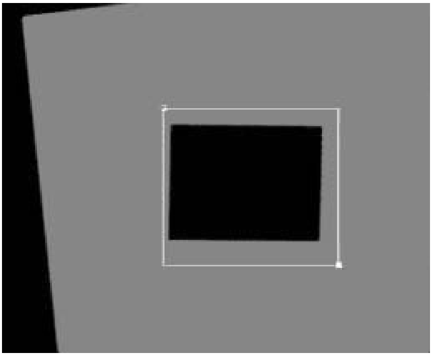
Area coordinates can be set in the ranges X: 0 to 511, Y: 0 to 479. When the area has been set correctly, it is executed at the specified position from the next test. If a checker area is moved, the mask moves with it at the same time.

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.

Area Setting Image Display (XUVM210)

Checkers can only be moved horizontally or vertically. If the XUVM210 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 XUVM210 rotates an image it is possible that the XUVM210 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.**

Display Conditions

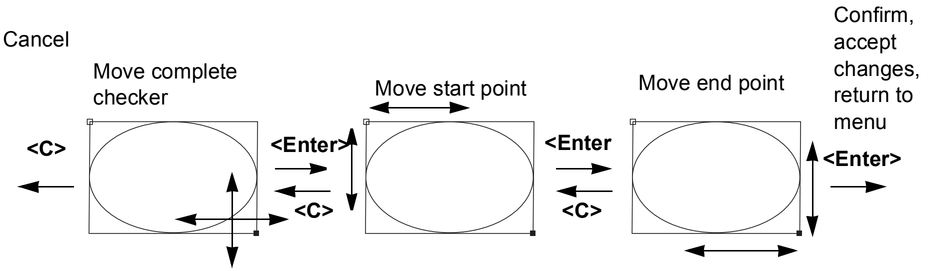
1. Adjusting with a rotation angle
   An adjusted image is displayed so that the angle of rotation comes to 0 degrees.
2. Binary checker with filtering specified
   The filtered image is displayed.
3. Binary checker adjusted with an exposure adjuster
   An image with the adjusted binarization level is displayed.

If the conditions in (1), (2) and (3) are satisfied, the image is displayed with all those conditions present.

Checker Area and Marker Area Setting Method

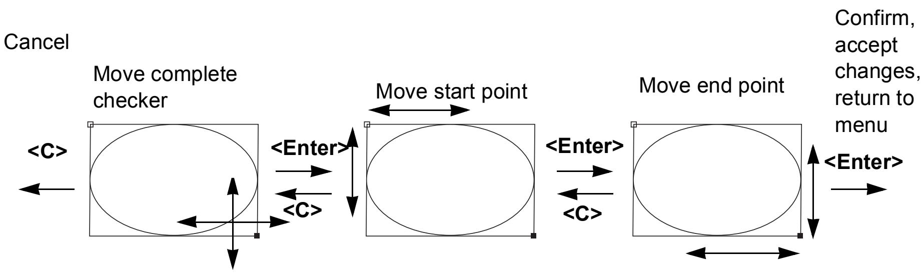
Rectangle / Circle / Elliptic Circle

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.

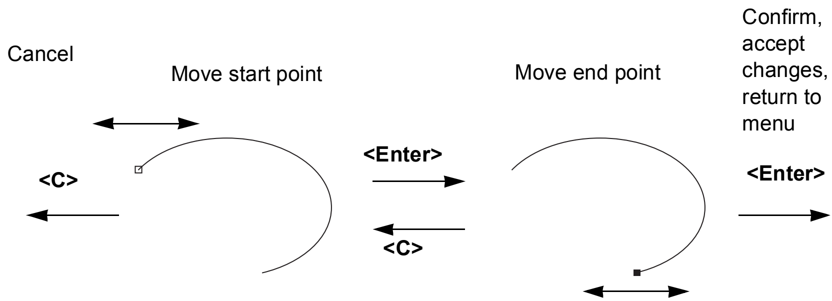


Arc

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



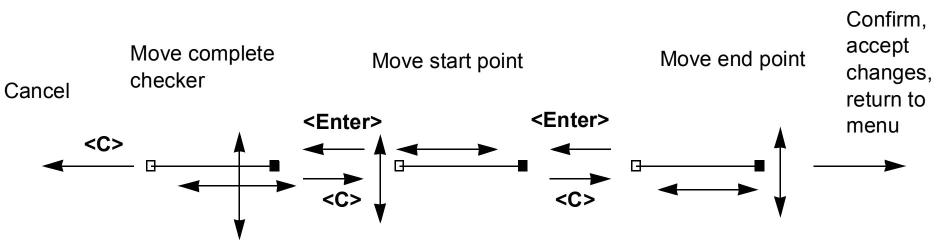
Note **When the start point or end point is moved, the shape is automatically converted to from an arc to a circle. Button <A> switches between right and left rotation**



The arc shape cannot be fixed if any part of the arc is outside the screen area. Make sure to set the arc so that it is all within the screen area.

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.



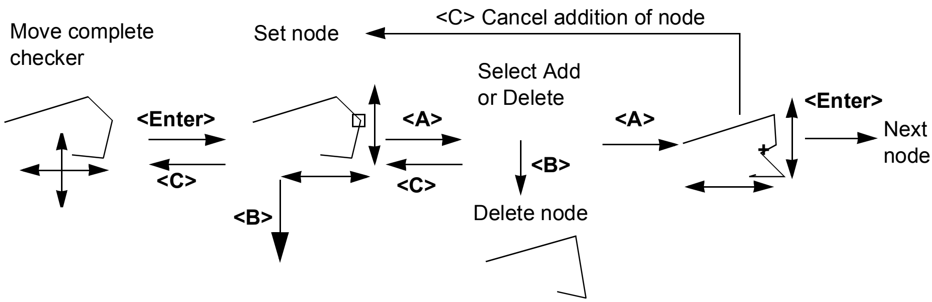
Note **When setting a line shape for position and rotation adjustment, only a horizontal line can be set when the scanning direction is horizontal, and only a vertical line can be set when the scanning direction is vertical. It is not possible to create diagonal lines.**

Polygonal Line

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.

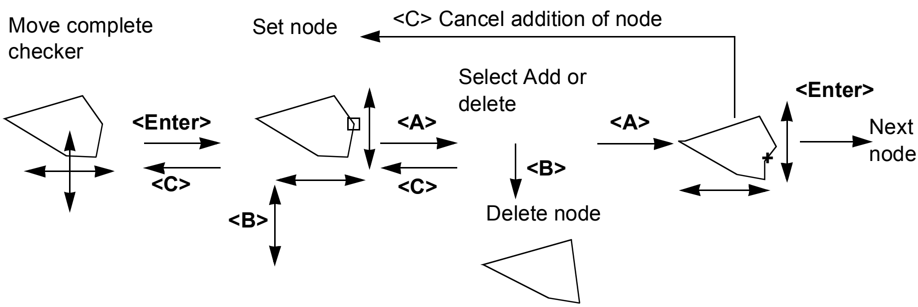


Polygon

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.

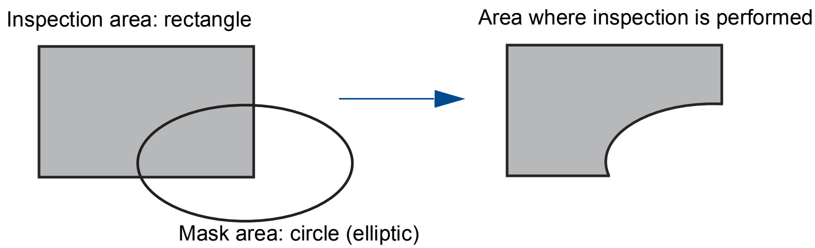
Adding a node
Press <A> twice to add another node. Use the cursor lever to move the added node, then press <Enter> to fix it. Press <C> if you wish to cancel the addition and revert to Set node mode. More nodes can be added up to a maximum of 16.

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 binary window checkers, gray-scale window checkers and feature extractors.
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.

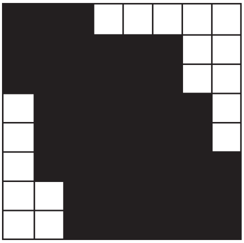
Filter Setup

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.

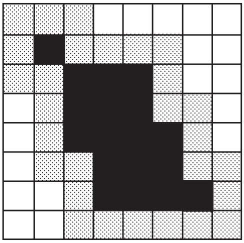
Note **You can check the effect of the filters with the option** Area **in the** Checker Settings **in the** Checker **menu. The image displayed is a filtered image. In all other screens the image is unfiltered because displaying the filters would take too much time.**

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

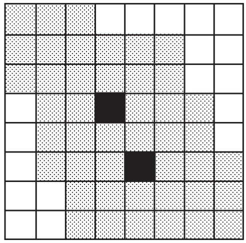


Original image
objet = black

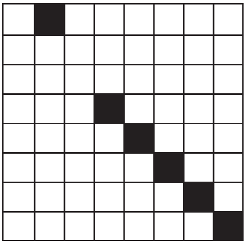


3x3 erosion filter
original object = gray
object after filtering = black

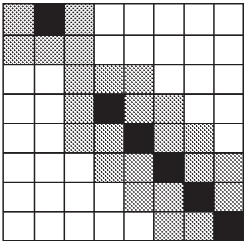
or



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

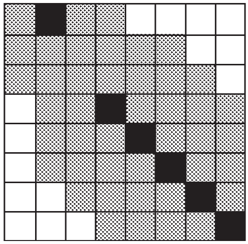


Original image
object = black



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

or



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..

```
2.  Slice Level No.    A
3.  Checker Setting
4.  Area Judgment     <245760,   0>
5.  Adj. Group
```

<Enter>

```
3.  Checker Setting
4.  Area Judgment   <245760,   0>
5.  Adj. Gr  Area Judgment
6.  Copy C   Max:   245760
7.  Delete   Min:   0.0
```

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 3

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 3 - 5
	Shutter speed	Environment	see page 3 - 5
	Camera selection (when two are con-nected)	Type	see page 3 - 21
Scan method	Scan start method	Environment	see page 3 - 7
	Setting the Execution Mode	Type	see page 3 - 27
	Image data save method	Environment	see page 3 - 16 and page 15 - 3
Status after power up	Type selection at power up and type switching	Environment	see page 3 - 13
	Camera image selection at power up and type switching	Type	see page 3 - 22
	Display item selection at power up and type switching	Type	see page 3 - 25
Display settings	Screen brightness setting	Environment	see page 3 - 15
	Display item selection at power up	Type	see page 3 - 25
Communication settings	Serial/parallel settings	Environment	see page 3 - 14 and page 16 - 16
	Computer Link	Environment	see page 3 - 14 and page 16 - 67
Type creation	Input type title	Type	see page 3 - 20
	Delete type settings	Type	see page 3 - 25
	Copy the settings for another type	Type	see page 3 - 25
	Initialize all types (delete all at once)	Type	see page 3 - 28

Environment Settings Common to All Types

Main Menu Options

```
                TYPE [ 1]:
  [7] ENVIRONMENT
   1.  Camera
   2.  Start                          Once
   3.  Start Trigger                  No
   4.  Start Type                     No. 1
   5.  Communication
   6.  Display Setting
   7.  Save Image Mode                Manual
   8.  Initialize

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

1. **Camera**
   Sets the camera mode and shutter speed (see page 3 - 5).
2. **Start**
   Sets the inspection start method (Once, Manual Repeat or Auto Repeat, see page 3 - 7).
3. **Start Trigger**
   Causes the XUVM110/XUVM210 itself to detect whether a target object is inside the inspection region (see page 3 - 8).
4. **Start Type**
   Sets the number of the type that starts up when the power is turned on (see page 3 - 13).
5. **Communication**
   Sets serial, parallel or other communication parameters (see page 3 - 14).
6. **Display Setting**
   Sets the screen display (see page 3 - 15).
7. **Save Image Mode**
   Sets up how images are saved (see page 3 - 16).
8. **Initialize**
   Returns the **Environment** settings to the original factory settings (see page 3 - 17).

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.

- **FULLFRAME 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.

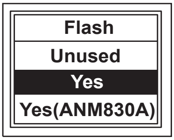
- **FULLFRAME Field**
  This is the setting for random shutter camera mode. Use the XUVC002 camera. Shutter speeds between 1/120 to 1/20,000 are available. The resolution is 512x240 pixels.

- **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 **If the standard camera being used is the XUVC001, set this to** Yes (XUVC001)**.**

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 XUVM110/210, 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 1 - 10).

- **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.)

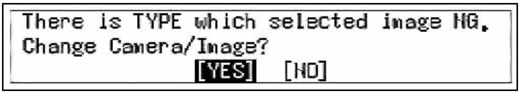
- **Auto Repeat**
  Continuous repeated inspection commences as soon as the power is turned on. Inspection stops when <A> is pressed. To restart inspection, press <A> again.

	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 Trigger

This function causes the XUVM110/M210 itself to start an inspection when an object reaches inspection region. To recognize the correct inspection position, the position and rotation adjustment checker number 1 is used.
Set the option **Start** to **Manual Repeat** or **Auto Repeat**. Images are continuously captured until a target object enters the inspection region, and at this point, the inspection checker executes.

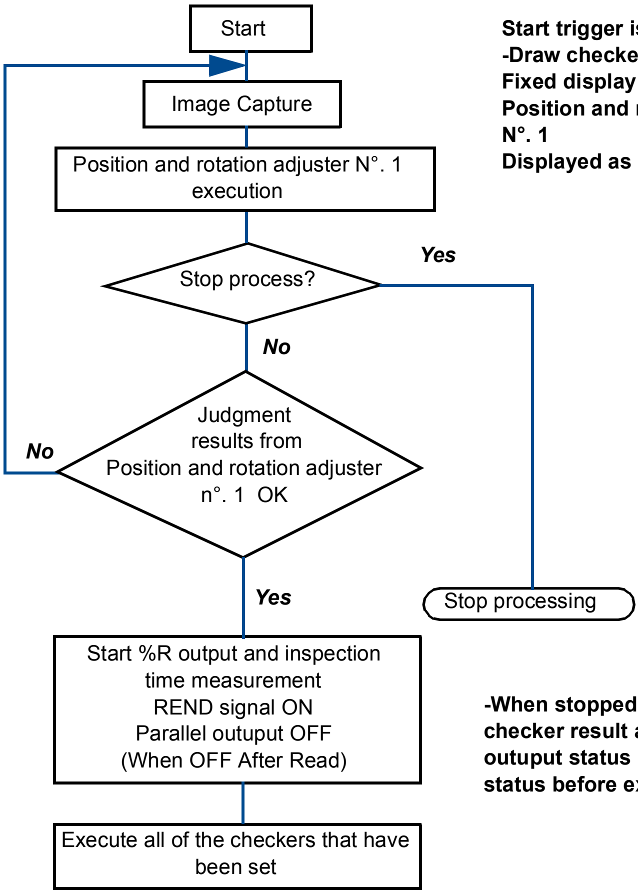
Display restrictions when Start Trigger is executed
When the **Start Trigger** function is executed, it is not possible to display **Gray NG** or **Binary NG** images. When **Start Trigger** is set to **YES**, **Gray NG** and **Binary NG** are not displayed in the **Chg.Disp.** (Change Display) menu.
If there are types for which the display image is set to a NG image, and you change the **Start Trigger** setting to **YES**, the following message is displayed. If you select **YES**, the image display for the type with the NG image selected will be changed to either a **Gray Mem** or **Binary Mem** image.



The Image Start Trigger Process Stops When

- the button <A> on the keypad is pressed.
- the serial communication command (%S) is input.
- the parallel start signal is input.

However, some time may elapse between giving the signal to stop the Start Trigger process and the actual stopping. This is because the XUVM110/M210 needs time to check whether there has been an input from the keypad or the parallel inputs.
When the process is stopped, only the serial command %E is output. The %R command is not output. Also, the ON/OFF status of the parallel signal is kept as it was after the previous execution. Execution time is expressed as ”----.- ms”.



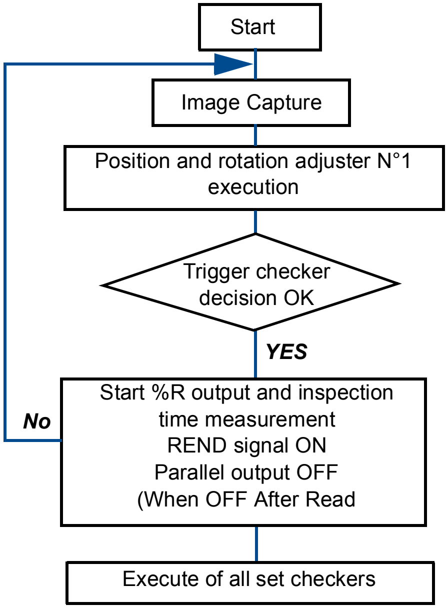
Start trigger is processing
-Draw checker
Fixed display of imaging
Position and rotation adjuster N°. 1
Displayed as "____._ms "

-When stopped, the trigger checker result and parallel outuput status return to the status before execution.

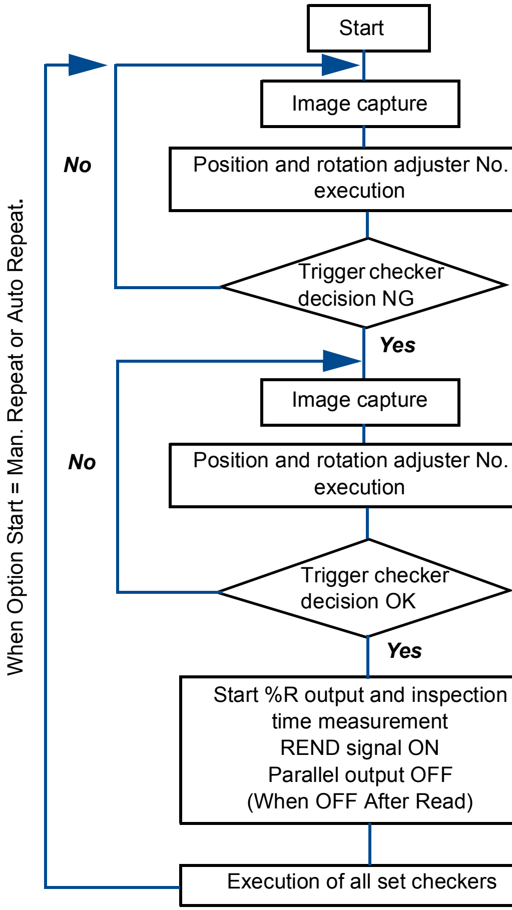
Start Trigger Action during Repeated Starting

If set so that the start trigger executes when the start method is manual/automatic repeat, the start trigger action works as follows so that inspection will not take place more than once for the same object.

- **First Execution**



- Second and Following Executions



During repeated image loading, the image start triggering process stops if the <A> button on the keypad, serial command %S, or parallel start signal is input.

- **Serial communication during image start trigger process**
  Only the %S command for stopping the process is accepted. Other commands are ignored

- **Parallel communication during image start trigger process**
  Only the start signal for stopping the process is accepted. Other signals are ignored.

- **Execution time**
  Execution time is measured after the trigger checker decision. It is not the time between OFF and ON of the ready signal.

- **Output of the %R image capture completion serial command**
  For the start trigger, the %R command will not be output even if it is set to output in the Communication settings under the Environment menu.

- **Output of the REND signal**
  The REND signal is always OFF.

- **Re-execution serial command %R**
  When the XUVM110/210 receives the command %R, the reaction depends on the current state of the XUVM110/210. If the XUVM110/210 is still busy with image processing, the command %R will be ignored. If the XUVM110/210 is in a stop state, e.g. because it has received the command %S, the trigger checker will be executed without capturing a new image. When the trigger checker finds an object, all inspection checkers will be executed. If not, the XUVM110/210 waits for the next start signal.

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 **It is also possible to save a project with the command %MCR via the serial interface,** see page 16 - 42**. 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.**

41.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 **4. Start Type**, the message is not displayed.

Communication

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

```
[7] ENVIRONMENT
 5.  Communication
      51.  Com. Mode       Normal Mode
      52.  RS232C
      53.  Serial Output
      54.  Parallel Output
      55.  Min. Ready OFF Time     0ms
```

51.Communication Mode

Select either Normal Mode or Computer Link as the communication mode (see page 16 - 9).

52.RS232C

For detailed information, see page 16 - 11.

53.Serial Output

For detailed information, see page 16 - 13.

54.Parallel Output

For detailed information, see page 16 - 16.

55. Min. Ready OFF Time (0 to 1000ms in 10ms steps)

It is possible to use serial or parallel communication to set the minimum time that the Ready signal is off for (range 0 to 1000ms in 10ms steps). For detailed information, see page 16 - 38.

Display Setting

Sets the screen display.

[7] ENVIRONMENT	
6. Display Setting	
61. Display Brightness	Image:Dark
62. Outside Region Value	0
63. Language	English

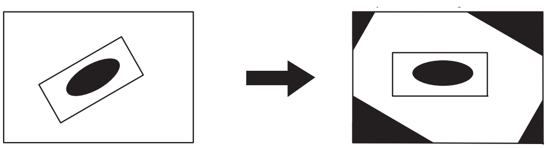
61.Display Brightness

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.

62.Outside Region Value (only for the XUVM210)

When you use a rotation adjustment and wish to set a checker, the XUVM110/210 will rotate the complete image so that the checker shape appears square to the screen. In this case, the XUVM110/210 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.

63.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 30 for the XUVM210 and 8 for the XUVM110. 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 - 37).

- **Limit Condition (Lim. Cond.)**
  The image is saved if any of the upper or lower setting limits of the results of the three optional formulas set as limit conditions are exceeded (see page 13 - 28).

71.Overwrite

Yes :
When the total 30 (XUVM110 = 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 30 (XUVM110 = 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 64 sets of inspection condition data for the XUVM210 in the VISION CONTROLLER (32 for the XUVM110). 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.  Execution Mode
 8.  Initialize All Type
```

TYPE:

Use this option to input the type number. Input any number in the range 1 to 64 for the XUVM210, or 1 to 32 for the XUVM110. 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 3 - 24).

2. **Delete Type**
   Deletes the currently active type (see page 3 - 25).

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 3 - 20).

4. **Capture Camera**
   Sets the image capture camera for each type (see page 3 - 21).

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 3 - 22).
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 3 - 25 and page 1 - 12).

7. **Execution Mode**
   Selects one of the execution modes **Execute All**, **Autom. Switch** or **User-Defined** mode (see page 2 - 5 and page 3 - 27).

8. **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 3 - 28).

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

Note **The following restrictions apply to the settings for type data.**
The amount of data for all checkers for all types must not exceed 1280 kbytes (approximately).
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
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
.

A	B	C	D	E	F	G	H	Space		Del	
I	J	K	L	M	N	O	P	7	8	9	/
Q	R	S	T	U	V	W	X	4	5	6	*
Y	Z	!	#	$	%	&	'	1	2	3	-
<	>	;	:	=	-	,	.	0	(	)	+
Input is completed											

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).

A	B	C	D	E	F	G	H	Space		Del	
I	J	K	L	M	N	O	P	7	8	9	/
Q	R	S	T	U	V	W	X	4	5	6	*
Y	Z	!	#	$	%	&	'	1	2	3	-
<	>	;	:	=	-	,	.	0	(	)	+
Input is completed											

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

A	B	C	D	E	F	G	H	Space		Del	
I	J	K	L	M	N	O	P	7	8	9	/
Q	R	S	T	U	V	W	X	4	5	6	*
Y	Z	!	#	$	%	&	'	1	2	3	-
<	>	;	:	=	-	,	.	0	(	)	+
Input is completed											

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

```
                 TYPE[ 1]:ABC
[1] TYPE           Rest:1048352
```

Setting the Capture Camera

Sets the image capture camera for each type (fixed at A for the XUVM110). Two cameras can be connected to the XUVM210 (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 (XUVM110/XUVM210) AB Vertical (XUVM210 only) AB Horizontal (XUVM210 only)	**Disp. Image** **A Camera** **Gray-Thru** **Gray-Mem** **Gray-NG** **Binary-Thru A B C D E F** **Binary-Mem A B C D E F** **Binary-NG A B C D E F**
B (XUVM210 only)	**Disp. Image** **B Camera** **Gray-Thru** **Gray-Mem** **Gray-NG** **Binary-Thru A B C D E F** **Binary-Mem A B C D E F** **Binary-NG A B C D E F**
AB (XUVM210 only)	**Disp. Image** **A Camera B Camera** **Gray-Thru** **Gray-Mem** **Binary-Thru A B C D E F** **Binary-Mem A B C D E F**

Note **Select either** Mem Image **or** NG Image **(gray/binary) 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).**

When Start Trigger **is set to** YES**,** Gray-NG **and** Binary-NG **cannot be selected (the selection branches are not displayed). If you select a** NG **image and then set** Start Trigger **to** YES**, the following message will be displayed. If you select** YES**, the image will be switched to a** Gray Mem **or** Binary Mem **image.**

Not valid for NG display or Execution Mode=User-Defined. Change these types?

[YES] **[NO]**

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 1 - 10).

Procedure:

1. Set and confirm the type number for setting the initial display.

2. Select and confirm **6. Initial Display Settings**.

```
                    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
  66.   Marker                  On
```

3. Select the item that you want to set, and confirm your selection to display the selection menus (for details, see page 1 - 10). 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**

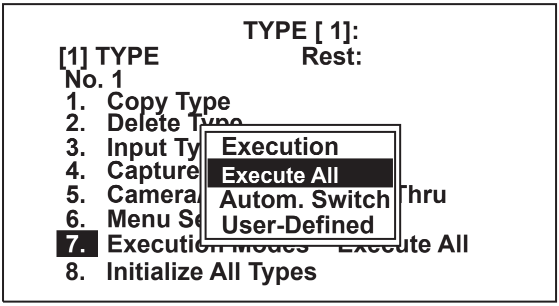
  **Fixed at No when the checker pattern display is set to off.*
- **4.Detect Position**
  - **Off**
  - **On**

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

4. Press <Enter> to confirm.

Setting the Execution Mode

Use **7. Execution Mode** to select either **Execute All**, **Autom. Switch** (Automatic Switch) or **User-Defined** for the execution order for each checker.



Procedure:

1. Set and confirm the type number for setting the execution mode

2. Select and confirm 7. **Execution Mode**

3. Use the cursor lever in the Execution Mode window to select the **execution mode** that you want to use and confirm the selection with <Enter>
   For details on the three execution modes, see page 2 - 7.

4. If you have selected **Execute All or Autom**. Switch, you can give the start signal to execute the type

5. If you have selected **User-Defined**, you also need to specify the checker block to be executed

	Checker Number	
	XUVM210	XUVM110
Block 1	01 to 32	01 to 16
Block 2	33 to 64	17 to 32
Block 3	65 to 96	33 to 48

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.**

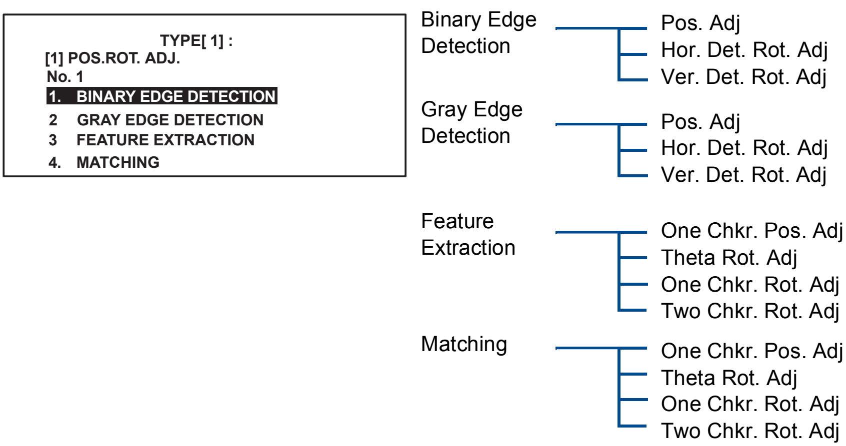
After executing Initialize All Types, if no type is set, you will not return to the main menu. Enter a type number and press <Enter> to set a type.

CHAPTER 4

Position and Rotation Adjustment

Position and Rotation Adjustment

The XUVM210 is equipped with a position and rotation adjustment function (position adjustment only in the case of the XUVM110) for performing position adjustment. You can set up to a maximum of 96 adjustment checkers for the XUVM210, and 48 for the XUVM110. Although the XUVM110 is not equipped with a **rotation adjustment function**, in this document the function is described as **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.



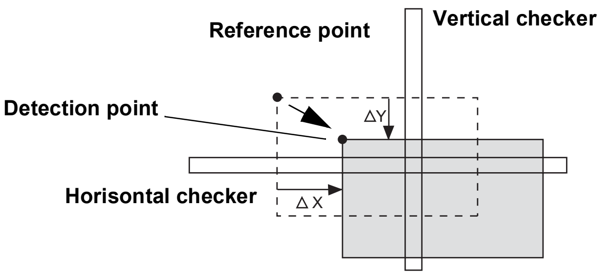
Note **In order to make the appropriate adjustments, the VISION CONTROLLER uses checker functions to provide position and rotation adjustment. Consequently, you need to be aware of the functions of inspection checkers in order to set adjusters. First users of the VISION CONTROLLER should read chapters 9 Binary Edge Checkers, 10 Gray-Scale Edge Checkers, 11 Feature Extraction Checkers, and 12 Smart Matching in order to gain an understanding of the basics of the various inspection checkers.**

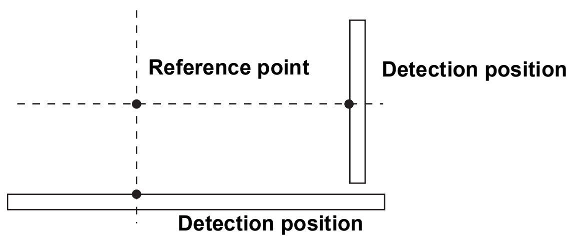
Position/Rotation Adjustment Modes

Binary Edge Detection Checkers

Position Adjustment (XUVM110/XUVM210)

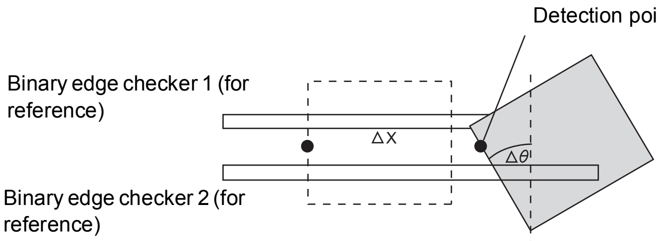
Binary edge checkers are used as the base checkers, calculating adjustments ΔX and ΔY from the results of vertical and horizontal scanning checkers. Shapes available are lines and planes, with a mixture of the two being possible.
If position adjustment needs to be performed in only one direction, it 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.
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.

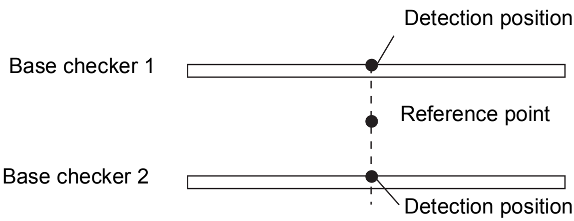




Horizontal Detection Rotation Adjustment (XUVM210 Only)

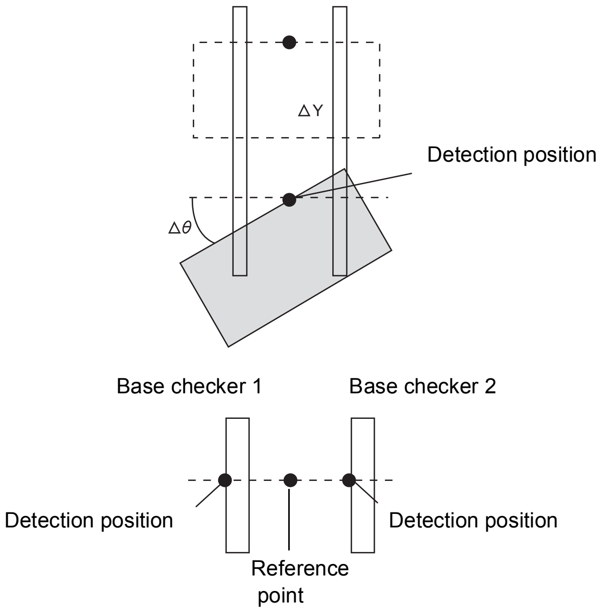
Binary edge checkers are used as the base checkers, and the amount of adjustment ΔX $\Delta\theta$ (angle of rotation) is calculated from the results of two horizontal checkers. Shapes available are lines and planes, with a mixture of the two being possible.
Since the amount of adjustment is calculated from the results of two base checkers, the reference position cannot be set unless two checkers are set.
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 (XUVM210 Only)

Binary edge checkers are used as the base checkers, and the amount of adjustment ΔY Δθ (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.
The reference point is the center point of the coordinate obtained by checker 1 and the coordinate obtained by checker 2.

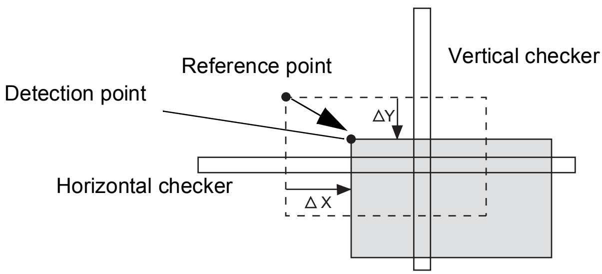


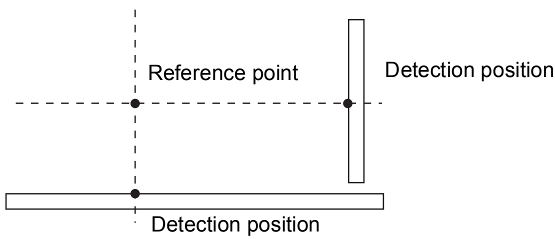
Gray-Scale Edge Detection Checkers

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

Position Adjustment (XUVM110/XUVM210)

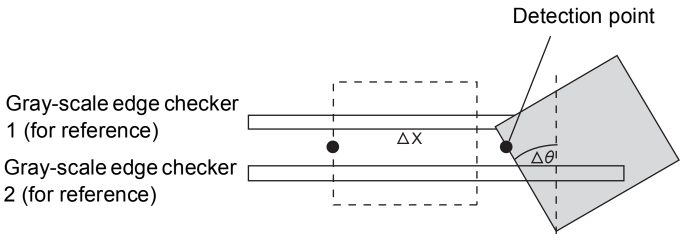
Gray edge checkers are used as the base checkers, calculating adjustments ∆X and ∆Y from the results of vertical and horizontal scanning checkers. Shapes available are lines and planes, with a mixture of the two being possible.
If position adjustment needs to be performed in only one direction, it is 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.

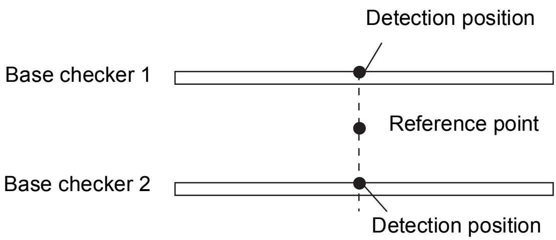




Horizontal Detection Rotation Adjustment (XUVM210 Only)

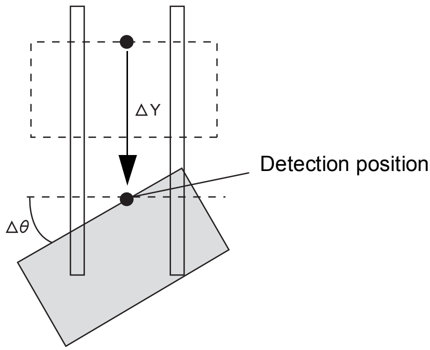
Gray-scale edge checkers are used as the base checkers, and the amount of adjustment ΔX $\Delta\theta$ (angle of rotation) is calculated from the results of two horizontal checkers. Shapes available are lines and planes, with a mixture of the two being possible.
Since the amount of adjustment is calculated 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.

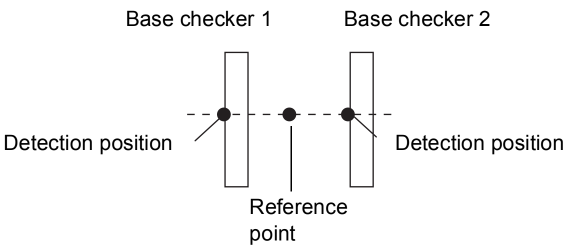




Vertical Detection Rotation Adjustment (XUVM210 Only)

Gray-scale edge checkers are used as the base checkers, and the amount of adjustment ΔY Δθ (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.



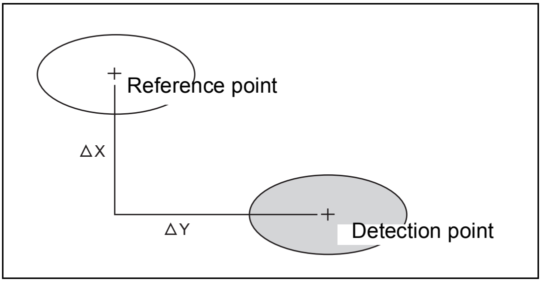


Feature Extraction Checker

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

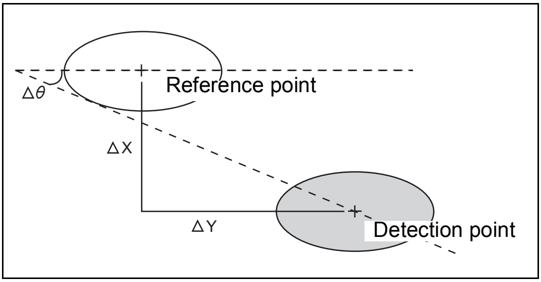
One Checker Position Adjustment (XUVM110/XUVM210)

The amount of adjustment ∆X, ∆Y can be calculated from the results of using a single feature extractor as the base checker. Only rectangle can be set as the shape. The reference point is the position of the center of gravity obtained by the feature extractor. Any point can be selected from a maximum of 5 detection results.



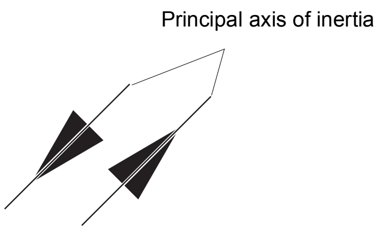
Theta Rotation Adjustment (XUVM210 Only)

The amount of adjustment ΔX, ΔY, $\Delta\theta$ can be calculated from the results of using a single feature extractor as the base checker. Only rectangle can be set as the shape. The reference point is the position of the center of gravity obtained by the feature extractor. Any point can be selected from a maximum of 5 detection results. The angle of rotation is the difference between the angle of the principal axis when the reference point is measured and the angle of the principal axis at the time of detection.



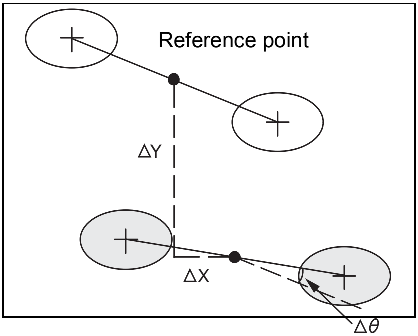
Angle of principal axis

The angle of the principal axis is obtained by feature extraction as a value in the range –90 to +90 degrees. This means that a workpiece will not be correctly adjusted for rotation if it has rotated by more than 90 degrees. Note that the principal axis is the same for the two following items.



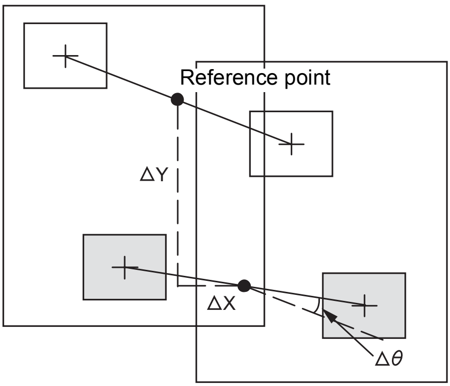
One Checker Rotation Adjustment (XUVM210 Only)

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 ∆X, ∆Y, ∆θ can be calculated. Only rectangle can be set as the shape. You only need one singe feature extraction checker to detect the two features.
The reference point is the position of the center of gravity obtained by the feature extractor. Any two points can be selected from a maximum of 5 detection results, and the center between the two points used as the reference point.



Two Checker Rotation Adjustment (XUVM210 Only)

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. Unlike the method described in previous §, you set two feature extraction checkers (one for each feature) and thus points can be selected from a maximum of 10 detection results.
The amount of adjustment ΔX, ΔY, Δθ can be calculated from the results of using two feature extractors as the base checkers. Only rectangle can be set as the shape.
From the detection results, set each point one at a time to the location you desire. The midpoint becomes the reference point.

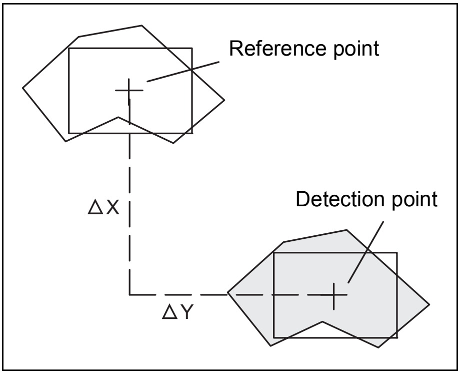


Matching Checker

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

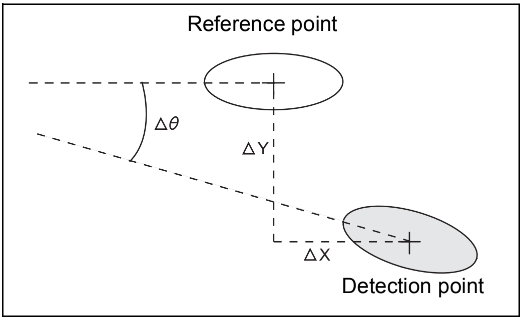
One-Checker Position Adjustment

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.



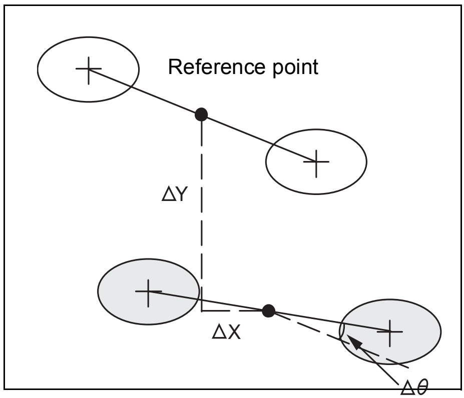
Theta Rotation Adjustment (XUVM210 Only)

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 (XUVM210 Only)

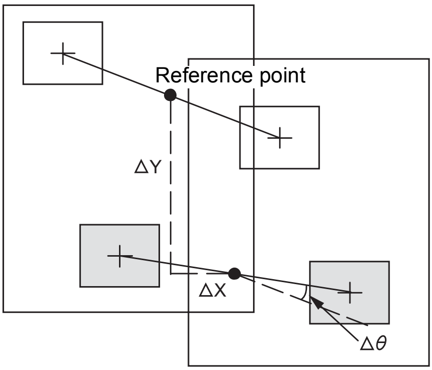
If the object has two distinctive features, use these for position and rotation adjustment. With the help of the two features, the amount of adjustment ΔX, ΔY, $\Delta\theta$ can be calculated. You only need one singe matching checker to detect the two features.
The reference point is the detection position 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 $\Delta\theta$ is calculated from two angles as follows: During setup, the XUVM210 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 XUVM210 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 (XUVM210 Only)

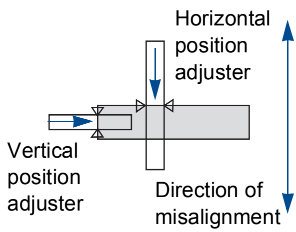
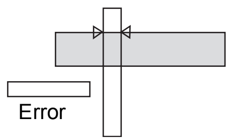
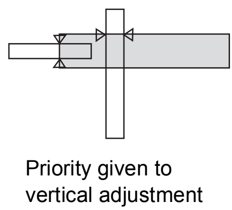
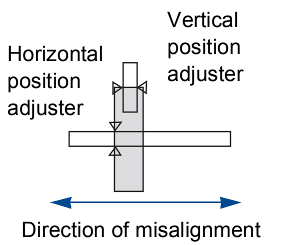
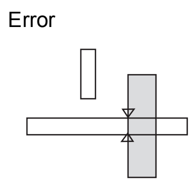
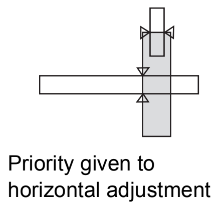
If the object has two distinctive features, use these for position and rotation adjustment. With the help of the two features, the amount of adjustment ΔX, ΔY, Δθ can be calculated. Only rectangle can be set as the shape. Unlike the method described in previous §, you set one matching checker for each 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			
Priority 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.

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 4 - 22.

2. Select 6. 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. (With the XUVM210, 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.

Binary Edge Detection Checkers

Position Adjustment

This explains how to use a binary edge checker as an adjustment checker. If you are unfamiliar with the operation of binary edge checkers, see page 9 - 3. Here we will set checkers for the horizontal and vertical directions, although is also possible to perform position adjustment using just one of them. When using both checkers, specify which one has priority.

Procedure:

1. Select the position/rotation adjustment checker number

```
            TYPE[ 1] :
[1] POS.ROT. ADJ.
No. 1
1.  BINARY EDGE DETECTION
2   GRAY EDGE DETECTION
3   FEATURE EXTRACTION
4.  MATCHING
```

2. Select 1. BINARY EDGE DETECTION

```
[1] POS. ROT. ADJ
No. 1
1. BINARY 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 binary edge detection is displayed.

```
                         TYPE[ 1] :
 [1] POS. ROT. ADJ.          Jud:NG      ΔX:-----
  No. 1                                  ΔY:-----
  Binary Edge :Pos. Adj.                 Δθ:-----
  1.  Select Camera            A
  2.  Checker 1                Empty
  3.  Checker  2               Empty
  4.  Slice Level No.          A
  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 4 - 5
3. Vertical Checker		see page 4 - 7
4. Priority	Use this to specify which checker result is to have priority as necessary (either vertical or horizontal).	see page 4 - 19
5. Slice Level No.	Select the slice level number for the reference checker.	see page 9 - 3
6. Base Pos.	Execute a test to register the reference position for adjustment.	see page 4 - 20
7. 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 4 - 61
8. Delete Checker	Use this to delete a checker.	see page 2 - 38

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

4. **Set and confirm the** 5. Slice Level No. **for the reference checker**

Slice Level No.
A
B
C
D
E
F

5. **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
 Binary Edge :Pos. Adj.
 2. Horizontal Checker
    21.  Shape               Plane
    22.  Area              ( 206, 200)-( 305, 279)
    23.  Edge Condition      Both
    24.  Filter              3
    25.  Width               5
```

For details on the checker settings, see page 9 - 4. This same menu is displayed when you select **3. Vertical Checker.**

6. Set the vertical checker, if required

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

8. 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.

9. Make the appropriate selection
For details, see page 4 - 19.

10. Select 6. Base Position
For details on setting the reference position, see page 4 - 20.

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

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

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

```
[1] POS. ROT. ADJ.          Jud:NG     ΔX:----0
 No. 1                                 ΔY:----0
 Binary Edge :Pos. Adj.                Δθ:---0.0
 1.  Select Camera                A
 2.  Horizontal Checker
 3.  Vertical Checker             Empty
 4.  Priority
 5.  Slice Level No               A
 6.  Base Pos.        (61.3, 38.0, 89.3)
 7.  Pos. Rot. Adj. Group     0
 8.  Delete Checker

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

Detection coordinates and angle

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

---

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

```
[1] POS. ROT. ADJ.          Jud:NG    ΔX:----0
 No. 1                                ΔY:----0
 Binary Edge :Pos. Adj.               Δθ:---0.0
 1.  Select Camera                A
 2.  Horizontal Checker
 3.  Vertical Checker             Empty
 4.  Priority
 5.  Slice Level No               A
 6.  Base Pos.               (61.3, 38.0, 89.3)
 7.  Pos. Rot. Adj. Group         0
 8.  Delete Checker

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

Adjustment amounts

Horizontal or Vertical Detection Rotation Adjustment (XUVM210 Only)

This explains how to use a binary edge checker as a position and rotation adjustment checker.

If you are unfamiliar with the operation of binary edge checkers, see page 9 - 3. The setting method for the two checker types is identical, and you need to 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.  BINARY EDGE DETECTION
2.  GRAY EDGE DETECTION
3.  FEATURE EXTRACTION
4.  MATCHING
```

2. Select 1. BINARY EDGE DETECTION

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

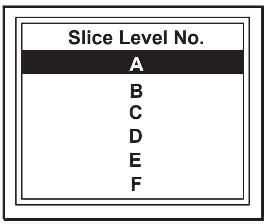
3. Select 12. Hor. Det. Rot. Adj. (or 13. Ver. Det. Rot. Adj)
   The setting menu for position adjustment using binary edge detection is displayed.

```
              TYPE[ 1] :
[1] POS. ROT. ADJ.          Jud:NG     ΔX:-----
No. 1                                  ΔY:-----
Binary Edge :Pos. Adj.                 Δθ:-----
1.  Select Camera             A
2.  Checker 1                 Empty
3.  Checker  2                Empty
4.  Slice Level No.           A
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. Checker 1	Use these to create the checkers and set items such as the scan conditions.	see page 4 - 5
3. Checker 2		see page 4 - 7
4. Slice Level No.	Select the Slice Level No. for the reference checker.	see page 9 - 3
5. Base Pos.	Execute a test to register the base position for adjustment.	see page 4 - 20
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 4 - 61
7. Delete Checker	Use this to delete a checker.	see page 2 - 38

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

4. Set and confirm 4. Slice Level No. for the reference checker



5. Select 2. Checker 1 to display the setting menu for checker 1
   The setting procedure is the same for both checkers.
   Here we will use Checker 1 as an example.

```
[1] POS. ROT. ADJ.
 No. 1
 Binary Edge :Hor. Det. Rot.
 2.  Checker1
      21.  Shape                    Plane
      22.  Area   ( 206, 200)-( 305, 279)
      23.  Edge Condition            Both
      24.  Filter                       3
      25.  Width                        5
```

For details on the checker settings, see page 9 - 4.

6. Set the other checker, if required

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

8. Select 5. Base Position
For details on setting the base position, see page 4 - 20.

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


A:Test          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:-----
 Binary Edge :Hor. Det. Rot.              Δθ:-----
 1.  Select Camera              A
 2.  Checker1
 3.  Checker2
 4.  Slice Level No             A
 5.  Base Pos.   (338.5,199.5,-45.0)
 6.  Pos. Rot. Adj. Group          0
 7.  Delete Checker

A:Test        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:-----
 No. 1                                    ΔY:-----
 Binary Edge :Hor. Det. Rot.              Δθ:-----
 1.  Select Camera              A
 2.  Checker1
 3.  Checker2
 4.  Slice Level No             A
 5.  Base Pos.  (338.5,199.5,-45.0)
 6.  Pos. Rot. Adj. Group          0
 7.  Delete Checker

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

Adjustment amounts

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.   BINARY EDGE DETECTION
 2.   GRAY EDGE DETECTION
 3.   FEATURE EXTRACTION
 4.   MATCHING
```

2. Select 2. GRAY EDGE DETECTION

```
[1] POS. ROT. ADJ
No. 1
 2.  GRAY EDGE DETECTION
      21.  Pos. Adj.
      22.  Hor. Det. Rot. Adj.
      23.  Ver. Det. Rot. Adj.
```

3. Select 21. 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 4 - 5
3. Vertical Checker		see page 4 - 7
4. Priority	Use this to specify which checker result is to have priority as necessary (either vertical or horizontal).	see page 4 - 19
5. Base Pos.	Execute a test to register the reference position for adjustment.	see page 4 - 20
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 4 - 61
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 2 - 38

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 10 - 4.
   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 4 - 19.

9. Select 5. Base Position
   For details on setting the reference position, see page 4 - 20.

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

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

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

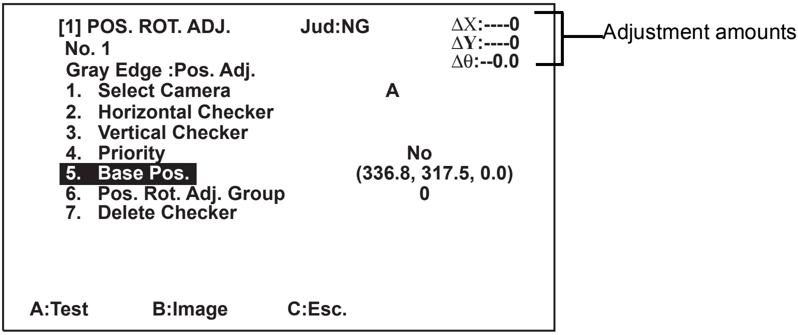
```
[1] POS. ROT. ADJ.          Jud:NG          ΔX:-----
 No. 1                                      ΔY:-----
 Gray Edge :Pos. Adj.                       Δθ:-----
 1.  Select Camera
 2.  Horizontal Checker
 3.  Vertical Checker
 4.  Priority                          No
 5.  Base Pos.                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

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

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.



Horizontal or Vertical Detection Rotation Adjustment (XUVM210 Only)

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.   BINARY EDGE DETECTION
2.   GRAY EDGE DETECTION
3.   FEATURE EXTRACTION
4.   MATCHING
```

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

```
[1] POS. ROT. ADJ
No. 1
2.  GRAY EDGE DETECTION
    21.  Pos. Adj.
    22.  Hor. Det. Rot. Adj.
    23.  Ver. Det. Rot. Adj.
```

3. **Select** 22. 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 9 - 3
2. Checker 1	Use these to create the checkers and set items such as the scan conditions.	see page 4 - 5
3. Checker 2		see page 4 - 7
4. Base Pos.	Execute a test to register the base position for adjustment.	see page 4 - 20
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 4 - 61
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 2 - 38

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 10 - 4.

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 4 - 20.

```
[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 $\Delta\theta$) 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

Feature Extraction Checkers

The following sections explain how to use feature extraction checkers for position or position and rotation adjustment.
If you are unfamiliar with the operation of feature extraction checkers, see page 11 - 3.

One Checker Position Adjustment

Procedure:

1. Select the position/rotation adjustment checker number

```
                TYPE[ 1] :
[1] POS. ROT. ADJ.
No. 1
 1.  BINARY EDGE DETECTION
 2.  GRAY EDGE DETECTION
 3.  FEATURE EXTRACTION
 4.  MATCHING
```

2. Select 3. FEATURE EXTRACTION

```
[1] POS. ROT. ADJ
No. 1
 3. FEATURE EXTRACTION
     31.  One Chkr. Pos. Adj.
     32.  Theta Rot. Adj.
     33.  One Chkr. Rot. Adj.
     34.  Two Chkr. Rot. Adj.
```

3. Select 31. One Chkr. Pos. Adj.
   The setting menu for position adjustment using feature extraction is displayed.

```
[1] POS. ROT. ADJ.         Jud:NG              ΔX:-----
No. 1                                          ΔY:-----
Feat. Extr. :One Chkr. Pos.                    Δθ:-----
1.  Select Camera                    A
2.  Checker Setting                Empty
3.  Slice Level No.                  A
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 9 - 3
2. Checker Setting	Use this to create the checker and set items such as the scan conditions.	see page 4 - 5
3. Slice Level No.	Select the Slice Level No. for the reference checker.	see page 9 - 3
4. Base Pos.	Execute a test to register the base position for adjustment.	see page 4 - 20
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 4 - 61
6. Delete Checker	Use this to delete a checker.	see page 2 - 38

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

4. Set and confirm 3. Slice Level No. for the reference checker

```
Slice Level No.
A
B
C
D
E
F
```

5. Select 2. Checker Setting

```
[1] POS. ROT. ADJ.
 No. 1
 Feat. Extr. :One Chkr. Pos.
2. Checker Setting
   21.  Shape                 Rect.
   22.  Area                  ( 206, 200)-( 305, 279)
   23.  Object                B
   24.  Object Area           <245760, 1>
   25.  Filter                No
   26.  Sorting               No
   27.  Sorting Order         Des.
   28.  Labeling/Boundary     ON / OFF
```

Available Option	*Usage*	*Details*
21. Shape	The shape is fixed at Rect. (rectangle) and cannot be changed.	see page 11 - 4
22. Area	Use this to move and set the checker area.	
23. Object	Select whether black or white pixels within the object area are to be processed.	
24. Object Area	Set upper and lower limits. The region within this range is treated as the object for inspection. The setting range for both the upper and lower limits is 1 to 245760.	see page 11 - 3
25. Filter	Select whether or not to perform image erosion or dilation.	see page 11 - 5
26. Sorting	Select whether or not to sort the detected regions in order of area, center X coordinate or center Y coordinate.	see page 11 - 5
27. Sorting Order	Select whether the result outputs are to be sorted in ascending or descending order.	
28. Labeling/ Boundary Available Settings: OFF/ON ON/OFF ON/ON	Labeling: This function recognizes individual target objects if that multiple target objects exist. On: Recognizes individual target objects Off: Recognizes one target object even if there are multiple target objects. Boundary: This is used to set whether target objects that contact the lines of the checker shape are to be inspected or not. On: Inspect Off: Ignore	see page 11 - 5

6. Set each of the items from the table

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 4 - 20.

9. 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. :One Chkr. Pos.
4. Base Position

No	Grav.		Area	Theta
	X	Y		
1	321.8		1452	0.0
2	328.7	445.6	1567	0.0
3	412.9	376.2	1193	0.0
4				
5				

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

10. Select the appropriate base position from the table

11. Press <Enter> to register the selected coordinates and angle as the base position
    When you return to the setting menu, the adjustment amounts (ΔX, ΔY and $\Delta\theta$) are displayed at the top right of the screen.

12. Press <B:Pos.Dsp.> to confirm the base position of the image
    With <C> you cancel setting the base position (for more details on setting the base position, see page 4 - 20).

Theta Rotation Adjustment

Procedure:

1. Select the position/rotation adjustment checker number

```
TYPE[ 1] :
[1] POS. ROT. ADJ.
No. 1
1.  BINARY EDGE DETECTION
2.  GRAY EDGE DETECTION
3.  FEATURE EXTRACTION
4.  MATCHING
```

2. Select 3. FEATURE EXTRACTION

```
[1] POS. ROT. ADJ
No. 1
3.  FEATURE EXTRACTION
    31.  One Chkr. Pos. Adj.
    32.  Theta Rot. Adj.
    33.  One Chkr. Rot. Adj.
    34.  Two Chkr. Rot. Adj.
```

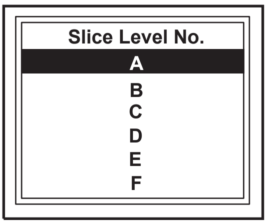
3. Select 32. Theta Rot. Adj.
   The setting menu for position adjustment using feature extraction is displayed.

```
[1] POS. ROT. ADJ.        Jud:NG              ΔX:-----
No. 1                                         ΔY:-----
Feat. Extr. :One Chkr. Pos.                   Δθ:-----
1.  Select Camera                A
2.  Checker Setting              Empty
3.  Slice Level No.              A
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 9 - 3
2. Checker Setting	Use this to create the checker and set items such as the scan conditions.	see page 4 - 5
3. Slice Level No.	Select the Slice Level No. for the reference checker.	see page 9 - 3
4. Base Pos.	Execute a test to register the base position for adjustment.	see page 4 - 20
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 4 - 61
6. Delete Checker	Use this to delete a checker.	see page 2 - 38

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

4. Set and confirm 3. Slice Level No. for the reference checker



5. Select 2. Checker Setting

```
[1] POS. ROT. ADJ.
 No. 1
 Feat. Extr. :One Chkr. Pos.
2. Checker Setting
   21.  Shape                    Rect.
   22.  Area                     ( 206, 200)-( 305, 279)
   23.  Object                   B
   24.  Object Area              <245760, 1>
   25.  Filter                   No
   26.  Sorting                  No
   27.  Sorting Order            Des.
   28.  Labeling/Boundary        ON / OFF
```

Available Option	*Usage*	*Details*
21. Shape	The shape is fixed at Rect. (rectangle) and cannot be changed.	
22. Area	Use this to move and set the checker area.	see page 11 - 4
23. Object	Select whether black or white pixels within the object area are to be processed.	
24. Object Area	Set upper and lower limits. The region within this range is treated as the object for inspection. The setting range for both the upper and lower limits is 1 to 245760.	see page 11 - 3
25. Filter	Select whether or not to perform image erosion or dilation.	see page 11 - 5
26. Sorting	Select whether or not to sort the detected regions in order of area, center X coordinate or center Y coordinate.	see page 11 - 5
27. Sorting Order	Select whether the result outputs are to be sorted in ascending or descending order.	
28. Labeling/Boundary Available Settings: OFF/ON ON/OFF ON/ON	Labeling: This function recognizes individual target objects if multiple target objects exist. On: Recognizes individual target objects Off: Recognizes one target object even if there are multiple target objects. Boundary: This is used to set whether target objects that contact the lines of the checker shape are to be inspected or not. On: Inspect Off: Ignore	see page 11 - 5

6. Set each of the items from the table

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 4 - 20.

9. 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. :One Chkr. Pos.
4. 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.

10. Select the appropriate base position from the table

11. Press <Enter> to register the selected coordinates and angle as the base position
    When you return to the setting menu, the adjustment amounts (ΔX, ΔY and $\Delta\theta$) are displayed at the top right of the screen.

12. Press <B:Pos.Dsp.> to confirm the base position of the image
    With <C> you cancel setting the base position (for more details on setting the base position, see page 4 - 20).

One-Checker and Two-Checker Rotation Adjustment

One-checker rotation adjustment uses one checker, and **two-checker rotation adjustment** uses two checkers. There are two **checker settings** in the case of **two-checker rotation adjustment**, but the setting method is the same as for **one-checker rotation adjustment**. The following example illustrates **one-checker rotation adjustment**.

Procedure:

1. Select the position/rotation adjustment checker number

```
TYPE[ 1] :
[1] POS. ROT. ADJ.
No. 1
1.  BINARY EDGE DETECTION
2.  GRAY EDGE DETECTION
3.  FEATURE EXTRACTION
4.  MATCHING
```

2. Select 3. FEATURE EXTRACTION

```
[1] POS. ROT. ADJ
No. 1
3. FEATURE EXTRACTION
    31.  One Chkr. Pos. Adj.
    32.  Theta Rot. Adj.
    33.  One Chkr. Rot. Adj.
    34.  Two Chkr. Rot. Adj.
```

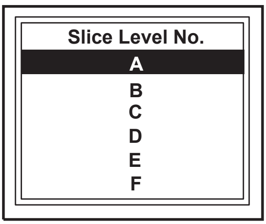
3. Select 33. One Chkr. Rot. Adj.
The setting menu for position adjustment using feature extraction is displayed.

```
[1] POS. ROT. ADJ.         Jud:NG               ΔX:-----
No. 1                                           ΔY:-----
Feat. Extr. :One Chkr. Rot.                     Δθ:-----
1.  Select Camera                   A
2.  Checker Setting                 Empty
3.  Slice Level No.                 A
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 9 - 3
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 4 - 5
3. Slice Level No.	Select the Slice Level No. for the reference checker.	see page 9 - 3
4. Base Pos.	Execute a test to register the base position for adjustment.	see page 4 - 20
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 4 - 61
6. Delete Checker	Use this to delete a checker.	see page 2 - 38

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

4. Set and confirm the 3. Slice Level No. for the reference checker



5. Select 2. Checker Setting

```
[1] POS. ROT. ADJ.
 No. 1
 Feat. Extr. :One Chkr. Rot.
 2. Checker Setting
     21.  Shape                    Rect.
     22.  Area                ( 278, 241)-( 462, 404)
     23.  Object                     B
     24.  Object Area          <245760, 1>
     25.  Filter                     No
     26.  Sorting                    No
     27.  Sorting Order              Des.
     28.  Labeling/Boundary        ON / OFF
```

Available Option	*Usage*	*Details*
21.Shape	The shape is fixed at Rect. (rectangle) and cannot be changed.	
22. Area	Use this to move and set the checker area.	see page 11 - 4
23. Object	Select whether black or white pixels within the object area are to be processed.	
24. Object Area	Set upper and lower limits. The region within this range is treated as the object for inspection. The setting range for both the upper and lower limits is 1 to 245760.	see page 11 - 3
25. Filter	Select whether or not to perform image erosion or dilation.	see page 11 - 5
26. Sorting	Select whether or not to sort the detected regions in order of area, center X coordinate or center Y coordinate.	see page 11 - 5
27. Sorting Order	Select whether the result outputs are to be sorted in ascending or descending order.	
28. Labeling/Boundary Available Settings: OFF/ON ON/OFF ON/ON	Labeling: This function recognizes individual target objects if multiple target objects exist. On: Recognizes individual target objects Off: Recognizes one target object even if there are multiple target objects. Boundary: This is used to set whether target objects that contact the lines of the checker shape are to be inspected or not. On: Inspect Off: Ignore	see page 11 - 5

6. Set each of the items from the table

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

8. Set 3. Checker 2, if required

9. Select 4. Base Position

10. 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. :One Chkr. Rot.
5. Base Position

No	Grav.		Area	Theta
	X	Y		
1	312.0	280.0	1074	0.0
2	401.1	377.4	890	0.0
3				
4				
5				

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

In the example the XUVM110/XUVM210 detects two points.

11. Select one of the points as Ref. Point 1

12. Press <Enter> to register the selected coordinates and angle of Ref. Point 1

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

[1] POS. ROT. ADJ.
No. 1
Feat. Extr. :One Chkr. Rot.
5. Base Position 2

No	Grav.		Area	Theta
	X	Y		
1	312.0	280.0	1074	0.0
2	401.1	377.4	890	0.0
3				
4				
5				

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

14. 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 XUVM110/XUVM210 will not be able to calculate the correct amount of adjustment during inspection.**

15. Press <Enter> to register the selected coordinates and angle of the second point

16. Press <C> to return to the setting menu
    When you return to the setting menu, the adjustment amounts (DX, DY and Dq) are displayed at the top right of the screen.

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

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 12 - 3.

One Checker Position Adjustment

Procedure:

1.Select the position/rotation adjustment checker number

```
              TYPE[ 1] :
[1] POS.ROT. ADJ.
No. 1
1.  BINARY EDGE DETECTION
2.  GRAY EDGE DETECTION
3.  FEATURE EXTRACTION
4.  MATCHING
```

2.Select 4. MATCHING

```
[1] POS. ROT. ADJ.
 No. 1
 4.   MATCHING
      41.  One Chkr. Pos. Adj.
      42.  Theta Rot. Adj.
      43.  One Chkr. Rot. Adj.
      44.  Two Chkr. Rot. Adj.
```

3.Select 41. 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 9 - 3
2. Checker Setting	Use this to create the checker and set items such as the scan conditions.	see page 12 - 5
3. Base Pos.	Execute a test to register the base position for adjustment.	see page 4 - 20
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 4 - 61
5. Delete Checker	Use this to delete a checker.	see page 2 - 38

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 12 - 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. X	Grav. Y	Area	Theta
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 (DX, DY and Dq) 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 (XUVM210 Only)

Procedure:

1. Select the position/rotation adjustment checker number

```
TYPE[ 1] :
[1] POS.ROT. ADJ.
No. 1
1.  BINARY EDGE DETECTION
2.  GRAY EDGE DETECTION
3.  FEATURE EXTRACTION
4.  MATCHING
```

2. Select 4. MATCHING

```
[1] POS. ROT. ADJ.
No. 1
4.  MATCHING
    41.  One Chkr. Pos. Adj.
    42.  Theta Rot. Adj.
    43.  One Chkr. Rot. Adj.
    44.  Two Chkr. Rot. Adj.
```

3. Select 42. 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
5a.  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. Checker Setting	Use this to create the checker and set items such as the scan conditions.	see page 12 - 5
3. Base Pos.	Execute a test to register the base position for adjustment.	see page 4 - 20
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 4 - 61
5. Delete Checker	Use this to delete a checker.	see page 2 - 38

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 12 - 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.
4. 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 (XUVM210 Only)

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.  BINARY EDGE DETECTION
2.  GRAY EDGE DETECTION
3.  FEATURE EXTRACTION
4.  MATCHING
```

2. Select 4. MATCHING

```
[1] POS. ROT. ADJ.
No. 1
4.  MATCHING
    41.  One Chkr. Pos. Adj.
    42.  Theta Rot. Adj.
    43.  One Chkr. Rot. Adj.
    44.  Two Chkr. Rot. Adj.
```

3. Select 43. 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 9 - 3
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 12 - 5
3. Base Pos.	Execute a test to register the base position for adjustment.	see page 4 - 20
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 4 - 61
5. Delete Checker	Use this to delete a checker.	see page 2 - 38

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 12 - 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.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.
4. 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 XUVM110/XUVM210 detects two points.

7. Select one of the points as Ref. Point 1

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

[1] POS. ROT. ADJ.
No. 1
Matching :One Chkr. Rot.
4. 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				

9. 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 XUVM110/XUVM210 will not be able to calculate the correct amount of adjustment during inspection.**

10.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.

11.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”.

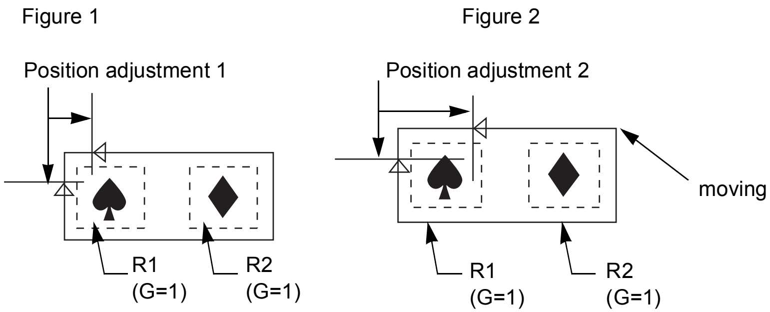
Note **If you are going to carry out position adjustment followed by a further position adjustment, be sure to set the group number (i.e. the position adjustment number corresponding to the adjustment). The position will not be adjusted if the group number is “0”.**

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.

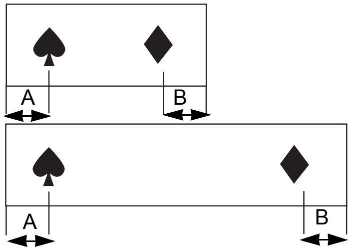
Ex:

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..

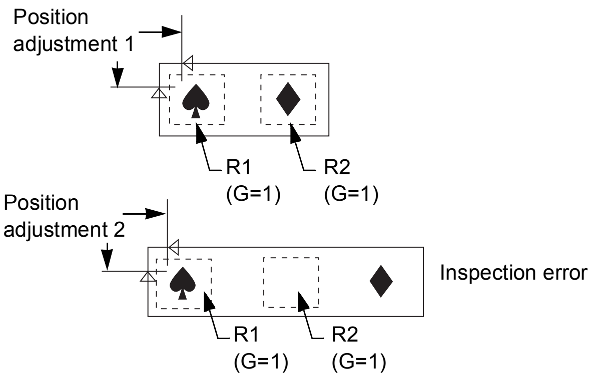


Ex:

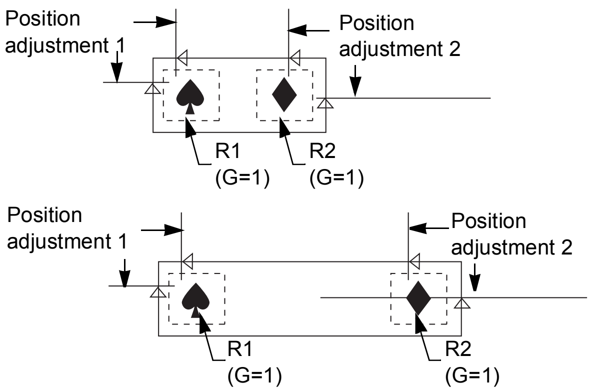
Keeping the same checker settings as example 1, two workpieces of different dimensions are inspected. See how the position adjustment group number affects the result when the length of the workpiece varies..



(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..

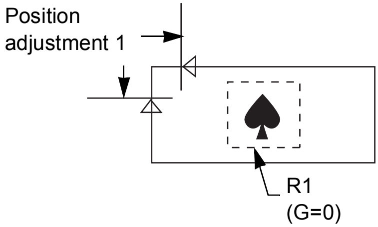


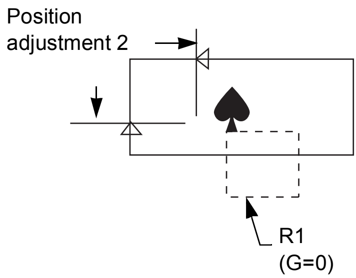
(2)Inspection using two separate groups, group No.1 (G=1) and No.2 (G=2): Position adjustment is carried out independently for each checker, so the checkers can move on both sides. .



Ex:

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

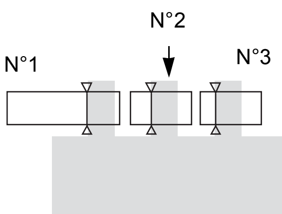




Note **If you find that the position is not adjusted despite having defined position adjustment checkers, the cause may be that the inspection checker still has its group number set to “0”. Consider examples 1 and 2 and set the group number appropriately.**

Ex:

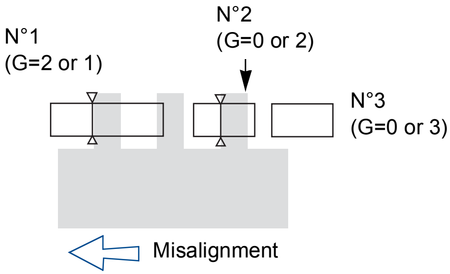
By specifying the position adjustment group number, a position adjuster can be set to adjust the result of an earlier position adjuster (multiple position adjustment). This can be repeated to give several layers of nesting. The example below shows three position adjusters. The numbers represent the position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



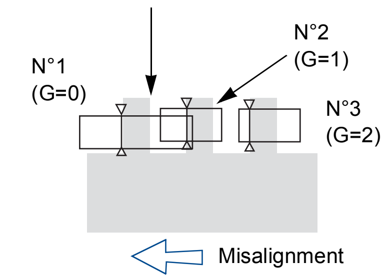
Ex:

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..

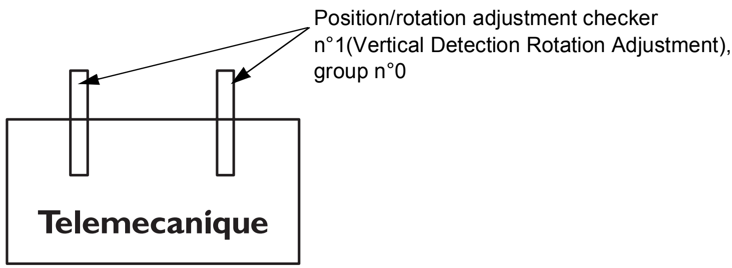
Note **If you want to adjust position adjustments (i.e. to nest position adjustments), ensure that the later adjuster specifies a group number lower than its own number.**

Multiple Position/Rotation Adjustment Checkers (XUVM210 Only)

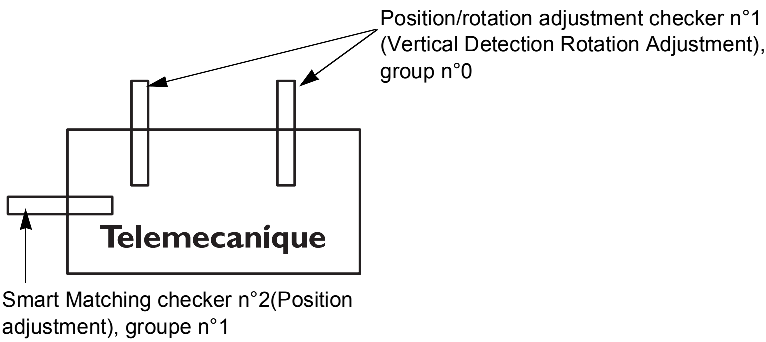
With the XUVM210, it is possible to set multiple position/rotation adjustment checkers for one image. The position/rotation adjustment checkers are executed in order from the smallest checker number.
Set a checker in rotation adjustment mode and set a position adjustment mode checker to follow this. 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 2. Gray Edge Detection
3. Select 23. Ver. Det. Rot. Adj.
4. Set the reference checker area and conditions
   For details, see page 4 - 35.
5. Set the base position
   For details, see page 4 - 39.

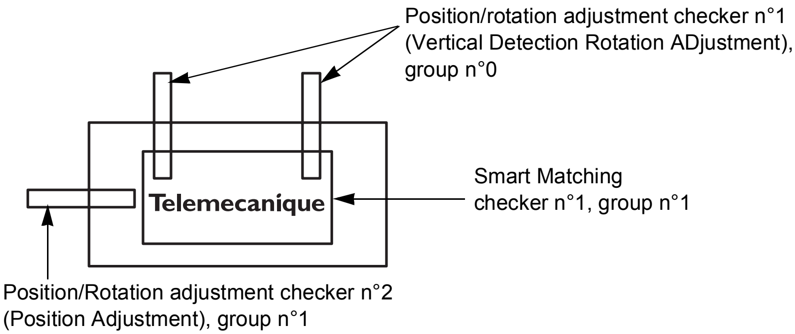


6. Set Position/Rotation Adjustment Group No. 0
7. Create position/rotation adjustment checker No. 2
8. Select 2. Gray Edge Detection
9. Select 21. Pos. Adj.
10. Set the reference checker area and conditions
11. Set the base position

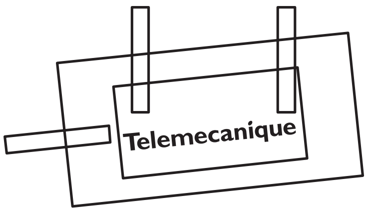


12. Set Position/Rotation Adjustment Group No. 1
13. Create Smart Matching checker No. 1

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.



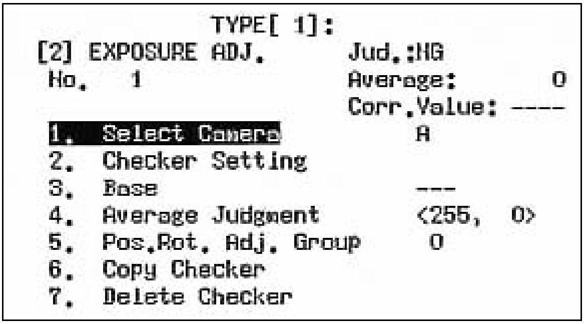
CHAPTER 5

Exposure Adjustment

Exposure Adjustment

Exposure adjustment makes sure that the image taken into gray-scale memory is the optimum image for inspection. Exposure adjustment is performed by calculating the average value of the brightness data inside the area of an exposure adjustment checker and obtaining the optimum exposure adjustment from the difference between the measured value and a reference value.
If an exposure adjustment group is set for a binary checker, the binarization level is adjusted by the amount of exposure adjustment, ensuring optimum inspection. You can set up to 96 exposure adjustment checkers per type for the XUVM210, and up to 48 per type for the XUVM110.

Main Menu Options



No. (checker number)
Set the number of the exposure adjuster to be created.

1. **Select Camera**
   For the XUVM210, select which camera (A or B) will supply the image on which the exposure adjustment checker is to be activated. This is fixed at A with the XUVM110 (see page 2 - 25).

2. **Checker Setting**
   Use this option to create the exposure adjuster and to set the adjustment coefficient, etc. (see page 5 - 5).

3. **Base**
   Use this option to set the gray scale inside the area of the exposure adjuster. The gray-scale value set as the “base shade” is used as the reference value in order to obtain the amount of exposure adjustment.

4. **Average Judgment**
   Here you set upper and lower limits to the average gray-scale value obtained, and evaluate the value with regard to the limits. OK if the average is within the range of the upper and lower limits, but NG if it exceeds the range.

5. **Position and Rotation Adjustment Group**
   Use this option to specify which position and rotation adjuster the exposure adjuster to be created will be adjusted by (see page 4 - 61).

6. **Copy Checker**
   Use this option to create a new exposure adjustment checker by copying the data from an existing checker.

7. **Delete Checker**
   Use this option to delete the checker.

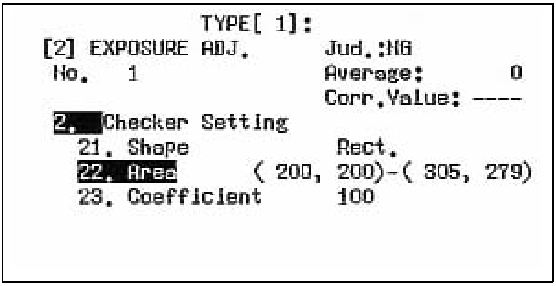
Note **If the exposure adjuster is deleted, the exposure adjustment group of the adjusted side of the checker will automatically revert to 0 (exposure adjustment will not be executed).**

Average:
Shows the average value of the brightness data within the set area.

Correlation Value (Corr. Value):
This is the difference between the average gray-scale value taken into the gray memory when the exposure adjustment checker executes, and the value set as the reference gray-scale value.

Checker Setting

Create the check area and set the coefficient for reflecting the amount of exposure adjustment in the binarization level.



21. Shape

The exposure adjuster can only be set as a square.

22. Area

Use this option to create or move the checker area.

23. Coefficient

Use this option to set the coefficient for reflecting the amount of exposure adjustment in the binarization level. The exposure-adjusted binarization level is calculated as shown below.

Adjusted binarization level =
(Binarization level setting) + (Ave. gray-scale value – ref. value) (Adjustment coefficient)

For 1:1 adjustment of binarization level relative to variations in brightness, set the coefficient to 100%. For 1:2 adjustment, set it to 200%, and for 1:0.5 adjustment, set it to 50%. The default value of the exposure adjustment coefficient is 100%, and it can be set in the range 0 to 200%.

Exposure Adjustment Setup

Procedure:

1. Set the number of the exposure adjuster to be created
2. Select 2. Checker Setting
3. Set the inspection area coordinates in 22. Area
   For details, see page 2 - 28.
4. Select 23. Coefficient to set the coefficient
   For details, see page 5 - 5.
5. Select Base <A: Test>
6. Press <Enter> to set the average gray-scale value
   Press <C> to cancel setting the gray-scale base value.

Note **When the test is conducted, the reference gray-scale value is set by executing at the position after adjustment by position and rotation adjusters. If the adjustment takes part of the exposure adjuster area outside the screen area, the error message "Area protrudes outside screen." is displayed.**

A reference gray-scale value must be set. If you do not set a reference gray-scale value, the exposure adjuster setup cannot be completed. If you press <C: Esc.> without setting a reference gray-scale value, a warning message is displayed. If you select YES**, the settings will be lost and the exposure adjuster deleted. If you select** NO**, set a reference gray-scale value by selecting** Base**.**

---

7. **Select** 4. Average Judgment

8. Set the upper and lower limits for the average gray-scale values taken into the setting area
   Set the upper and lower limits with reference to the average gray-scale values shown at the top of the screen. If the average gray value captured is outside this range, the judgment will be NG.

Note **The exposure adjustment is not affected if the average gray-scale value is outside the range you have set for average gray-scale judgment. The average gray-scale judgment conditions are used in judging the brightness of images taken into gray-scale memory.**

---

9. Set a position and rotation adjustment group

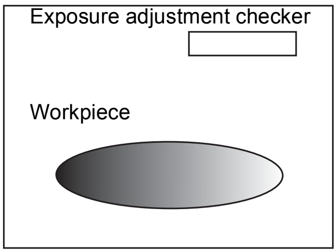
Example for Exposure Adjustment Setup

This section shows how to perform a reliable exposure adjustment with the image shown below.

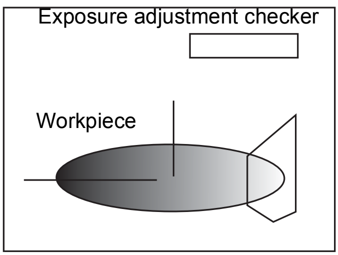
Procedure:

1. Set the binarization levels to give the optimum binary image for the object being inspected

2. Set an exposure adjuster on the area serving as a background to the workpiece or similar area
   If the average gray-scale value judgment conditions are set at this point they can be used for judgment output when adjusting for variations of brightness in illumination, etc.



3. Set the inspection checkers



Note **In general, the amount of adjustment is around ±50. If large changes in exposure due to excessive variations in illumination, etc. occur, the following message will appear: "As a result of the Exposure Adjustment, the slice level exceeds the range (0 to 255) or lower-limit ³ upper-limit."**

CHAPTER 6

Line Checkers

Line Checkers

Line checkers are used to draw lines at locations for measurement, and for counting the number of black or white dots or lands (continuous areas of the same color dot) on the line.
Line checkers can have three different shapes: straight lines, polygonal lines, and arcs.
Line checkers are useful for measuring dimensions, and for inspecting moldings for burrs or missing sections.
You can set up to 96 checkers per type for the XUVM210, and up to 48 per type for the XUVM110.

Main Menu

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

1. Select Camera
   For the XUVM210, select which camera (A or B) will supply the image on which the line checker is to be activated. This is fixed at A with the XUVM110.

2. Slice Level No.
   Sets the binary level group for the line checker being created.

3. Checker Setting
   Creates the line checker and sets parameters, etc. (see page 6 - 5).

4. Dot Judgment
   If the dot count is within the range bounded by the upper and lower limits, the judgment is considered to be OK (= 1). If the dot count exceeds the range, it is considered to be NG (= 0).
   The dot judgment parameters can be set in the range 0 to 7666.
   Dot judgment / Number of dots
   The judgment results judged from the dot judgment conditions, and the number of dots counted are shown.

5. Land Judgment
   If the land count is within the range bounded by the upper and lower limits, the land judgment is considered to be OK = 1. If the land count exceeds the range, it is considered to be NG = 0.
   The land judgment parameters can be set in the range 0 to 2555.
   Land judgments / Number of lands
   The results judged from the land judgment conditions and the number of lands counted are shown.

6. Adjustment Group
   Sets whether or not the checker being created will be adjusted by a position and rotation adjuster, or exposure adjuster.

7. Copy Checker
   When creating a checker, copies the data from an existing checker.

8. Delete Checker
   Use this option to delete a checker.

Checker Setting

Create the line checker and set parameters, etc.

```
                     TYPE[ 1]:
[31]  LINE     Jud.(Dot)  : NG Cnt.:      0
 No.   1       Jud.(Land): NG Cnt.:      0
   3. Checker Setting
     31. Shape                 Line
     32. Area         ( 206, 240)-( 305, 240)
     33. Dot Count              W
     34. Land Count             W
     35. Land Filter              5
     36. Gap Filter               3
     37. Filter                 No
```

31. Shape
Selects the shape of the checker area to be created.

32. Area
Creates or moves the checker area.

33. Dot Count
Selects whether to count white pixels or black pixels on the line.

34. Land Count
Selects whether to count white lands or black lands (continuous areas of the same color dot) on the line.

35. Land Filter
Sets the minimum number of adjacent dots on the line required for recognition as a land.
The minimum size of a land can be set in the range 2 to 254.

36. Gap Filter
Sets the minimum number of dots that have to be between lands for the space to be recognized as a gap. The gap filter value can be set in the range 1 to 254. The default value is 3.

37. Filter
Selects whether to apply erosion or dilation processing.

Dots and Lands

Line checkers can use two different methods for measurements and judgments: measurement and judgment using dot counts, and measurement and judgments using land counts.

Using dot counts

Counting the number of white or black dots (pixels) on the line. This method compares the count of dots of the specified color with the upper and lower limits that have been set to judge whether or not the count is within the limits.

Black dot count = 13

Using line counts

Counting the number of white or black lands on the line. The land filter setting determines how many pixels of the specified color have to occur consecutively to be regarded as a land, and the gap filter setting determines how many pixels of the other color have to occur consecutively to be regarded as a gap between lands. The number of lands is counted by applying these filters. This method compares the count of lands of the specified color with the land judgment conditions to judge whether or not the count is within the limits.

Black land count = 1
Land filter = 6
Gap filter= 4

Land filter and gap filter

The land and gap filters specify how large a consecutive block of pixels has to be along the line to be counted as a land, and how large a gap there has to be to mark the end of a land. Taking the line below as an example, see how changing the line filter and gap filter settings changes the number of lands reported.

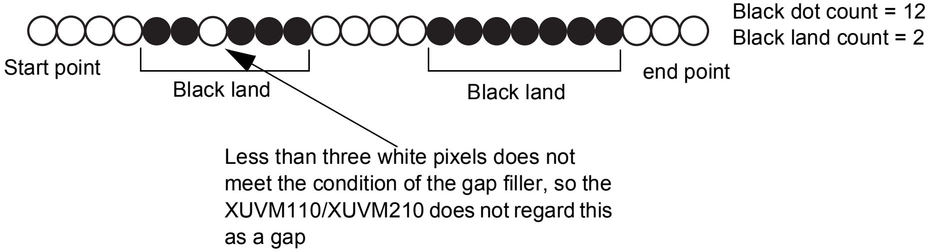
Black dot count = 12

Start point

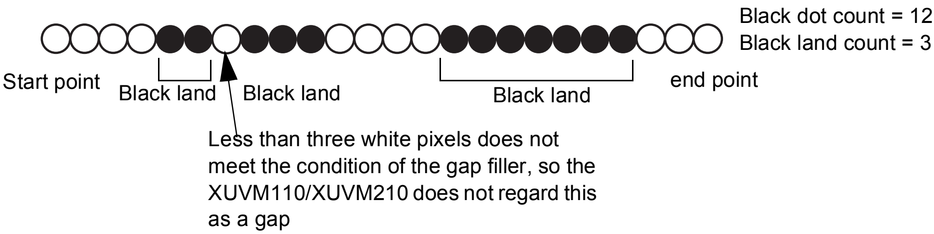
Option 34. Counting the number of black lands.

end point

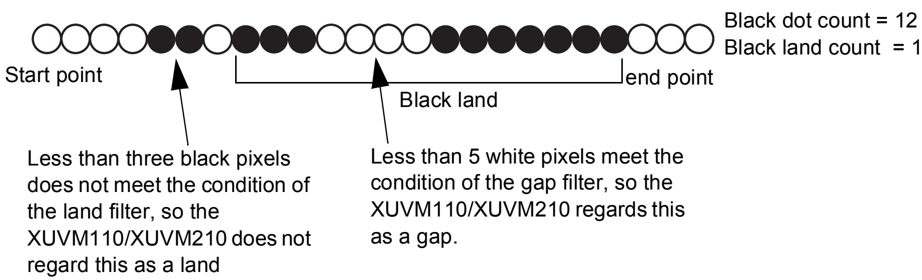
1) Land filter = 2, gap filter = 3



2) Land filter = 2, gap filter = 1

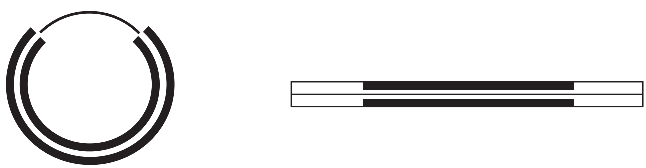


3) Land filter = 3, gap filter = 5



Lands on an arc

If a circular line checker is set up as shown below, the number of white lands may be reported as two. This is because it is inspected as if it were a single line with a white block at each end.



Line Checker Setup

Procedure:

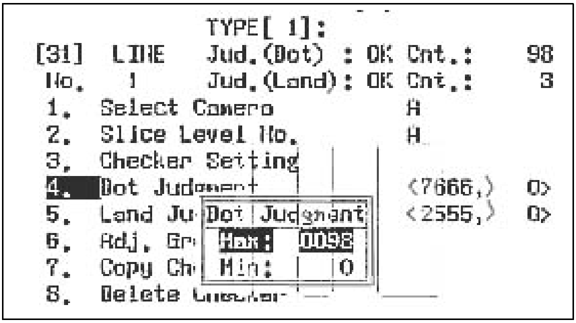
1. Set the number of the line checker to be created
2. Use **Slice Level No.** to select the slice level group (A to F)
3. Select **Checker Setting**
4. Select **Shape**
   Here you select the checker shape.
5. Select **Area** to set the coordinates for the **inspection area**
   For details on setting the checker area, see page 2 - 28.
6. Use **Dot Count** or **Land Count** to set the color of pixels to be counted
7. Use **Land Filter** to set the minimum width for a land
8. Use **Gap Filter** to set the minimum gap between lands

Note **Set the land filter and gap filter values to give the optimum land counts for the purposes of inspection.**

---

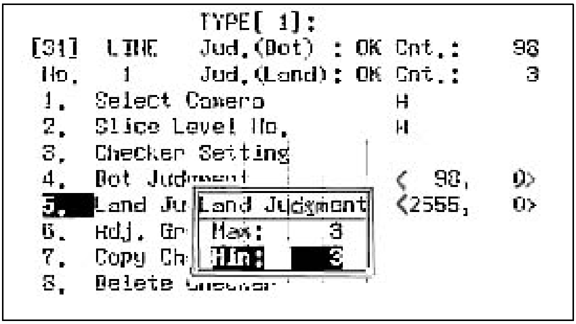
9. Use Filter to set the type of filter required
10. Press <C> to complete checker setup
11. Use Dot Judgment to set the conditions for number of dots

12. Press <A> to run a test
    Refer to the dot count shown at the top of the screen when setting the upper and lower limits.



13. Use Land Judgment to set the conditions for number of lands

14. Press <A> to run a test
    Refer to the land count shown at the top of the screen when setting the upper and lower limits.



15.When required, set position and rotation adjuster and exposure adjuster group number

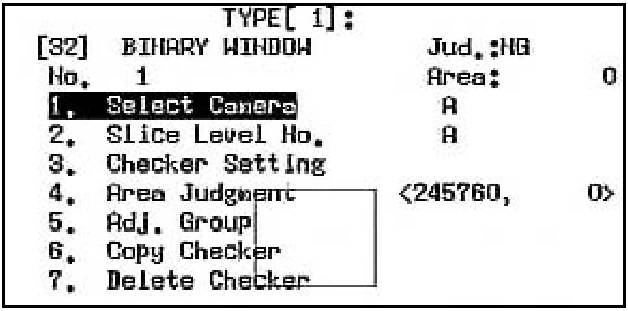
CHAPTER 7

Binary Window Checkers

Binary Window Checkers

Binary window checkers are used for creating a checker area as required for the area to be inspected, and measuring the area of specified color within the area. You can set up to 96 checkers for each type with the XUVM210 (48 for the XUVM110).
Binary window checkers can be shaped as rectangles, circles, or polygons, and rectangles, circles and polygons can be used as mask shapes.

Main Menu



No. (Checker No.)
Sets the number of the binary window checker to be created.

1. **Select Camera**
   For the XUVM210, selects which camera (A or B) will supply the image on which the binary window checker is to be activated. This is fixed at A with the XUVM110.

2. **Slice Level No.**
   Selects the binary level group for the binary window checker being created.

3. **Checker Setting**
   Creates the binary window checker and sets parameters, etc. (see page 6 - 3).

4. **Area Judgment**
   Based on the area of the specified color of pixels detected in the inspection area, sets the upper and lower limits to be used for OK / NG judgment.

5. **Adjustment Group**
   Sets which adjustment checker will adjust the binary window checker to be created (see page 7 - 5).

6. **Copy Checker**
   When creating a checker, copies the data from an existing checker.

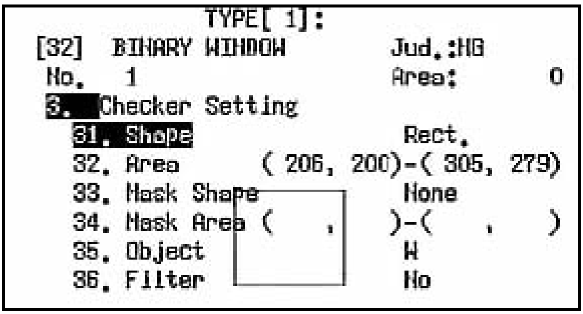
7. **Delete Checker**
   Deletes the checker.

Judgment:
If the area size value detected is within the upper and lower limits of the area size value judgment conditions, the judgment is OK, but if it exceeds the limits, the judgment is NG. An NG judgment also results if the binary window checker moves outside the screen area in compliance with the position and rotation adjustment, or if the position and rotation adjuster generates an error.

Area
The area size detected is displayed. Units are single pixels.

Checker Setting

Creates the binary window checker and sets parameters, etc.



31. Shape
Selects the shape for the checker area.

32. Area
Creates or moves the checker area.

33. Mask Shape
Selects the shape for the mask area.

34. Mask Area
Creates or moves the mask area.

35. Object
Selects whether to process white pixels or black pixels within the inspection area.

36. Filter
Selects whether to apply erosion or dilation filtering.

Select the Adjustment Group

Sets which adjustment checker will adjust the binary window checker to be created .

51. Position and Rotation Adjustment Group
Sets which position and rotation adjuster will adjust the binary window checker to be created.

52. Exposure Adjustment Group
Sets which exposure adjustment checker will adjust the binary window checker to be created.

Binary Window Checker Setup

Procedure:

1. Set the number of the binary window checker to be created.
2. For the XUVM210, select which camera (A or B) screen you will move the gray-edge detection checker in. This is fixed at A with the XUVM110.
3. From **Slice Level No.**, select or confirm the slice level group (A, B, C, D, E or F) to be used by the binary window checker.
4. Select or confirm **Checker Setting**, then **Shape**.
5. Set or confirm the shape as a rectangle, circle, or polygon.
6. From **Area** set the coordinates for the checker area. For details on how to create an area, see page 2 - 28.

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.**

---

7. From **Mask Shape**, set or confirm the mask shape as a rectangle, circle or polygon.
8. From Mask **Area** set the coordinates for the mask area. For details on how to set the mask area, see page 2 - 32.
9. From **Object**, set or confirm the color to be extracted as white or black.
10. From **Filter** set or confirm whether to apply dilation or erosion processing.
11. From **Area Judgment**, set the upper and lower limits, referring to the area size values displayed at the top of the screen.
12. Set the numbers of the position and rotation adjustment group and the exposure adjustment group.

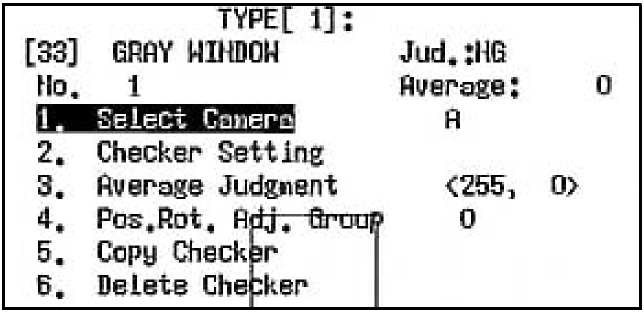
CHAPTER 8

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 96 checkers per type for the XUVM210, and up to 48 per type for the XUVM110.
Area shapes and mask shapes can be either square, circular, or polygonal.

Main Menu



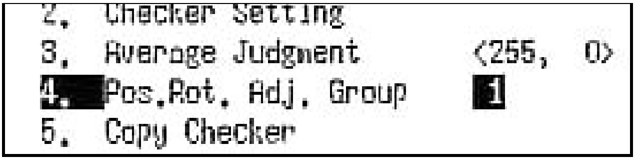
No. (Checker No.)
Sets the number of the gray-scale window checker to be created.

1. **Select Camera**
   For the XUVM210, selects which camera (A or B) will supply the image on which the gray-scale window checker is to be activated. This is fixed at A with the XUVM110.

2. **Checker Setting**
   Creates the gray-scale window checker and sets parameters, etc. (see page 8 - 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

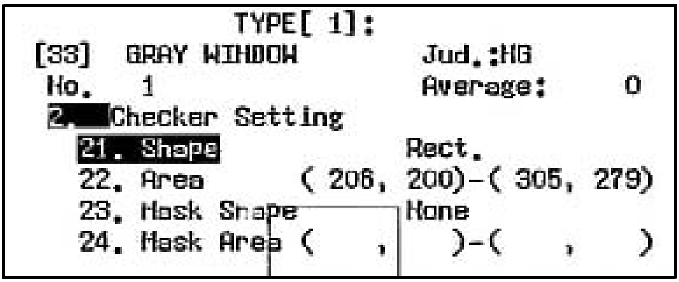
Deletes the checker.

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 2 - 28.

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 2 - 32.

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.

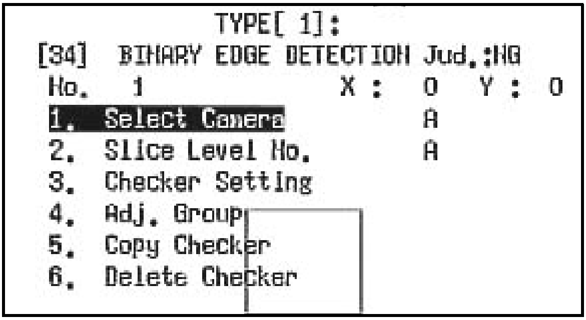
CHAPTER 9

Binary Edge Detection Checkers

Binary Edge Detection Checkers

Binary edge checkers use binary processing to detect the edge of an object. The checker results are the coordinates of the edge detected.
You can set up to 96 checkers per type for the XUVM210, and up to 48 per type for the XUVM110.

Main Menu



No. (Checker No.)
Sets the number of the binary edge checker to be created.

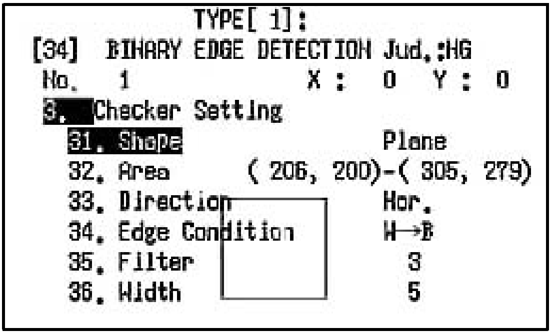
1. **Select Camera**
   For the XUVM210, selects which camera (A or B) will supply the image on which the binary edge checker is to be activated. This is fixed at A with the XUVM110.
2. **Slice Level No.**
   Selects the binary level group for the binary edge checker being created.
3. **Checker Setting**
   Sets the parameters for the binary edge checker (see page 9 - 4).
4. **Adjustment Group**
   Sets the position and rotation adjustment checker that will adjust the binary edge checker to be created (see page 9 - 7).
5. **Copy Checker**
   Copies the data from an existing checker into the currently selected checker.
6. **Delete Checker**
   Deletes the checker.

Judgment:
Shows OK if an edge is detected, and NG if no edge is detected.

X:, Y: (detection coordinates)
Displays the coordinates of the edge detected.

Checker Setting

Creates the binary edge checker and sets parameters, etc.



31. Shape

Selects the shape for the checker area. Possible shapes are rectangle and line.

32. Area

Use this option to change the size or move the checker area or to change the scanning direction (see page 9 - 7).

33. 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.

34. Edge Condition

Selects whether an edge is detected when white changes to black or when black changes to white in the image under inspection.

The judgment results and detected edge coordinates are displayed in the upper right portion of the screen.

35. Filter

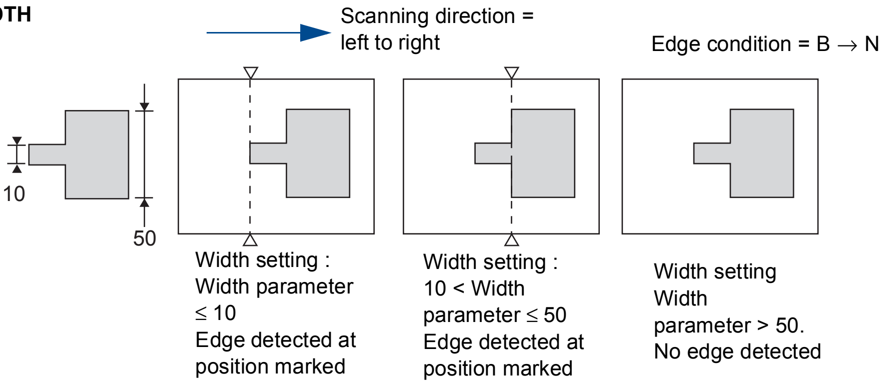
Sets the filter condition for detection size in the scanning direction. If the range is specified in the horizontal direction, the filter condition can be set in the range from 2 to the length of the checker in the X-direction. If the range is specified in the vertical direction, the filter condition can be set in the range from 2 to the length of the checker in the Y-direction.

36. Width

Sets the filter condition for detection size across the scanning direction. If the range is specified in the horizontal direction, the filter condition can be set in the range from 1 to (the length of the checker in the Y-direction) –1. If the range is specified in the vertical direction, the filter condition can be set in the range from 1 to (the length of the checker in the X-direction) –1.

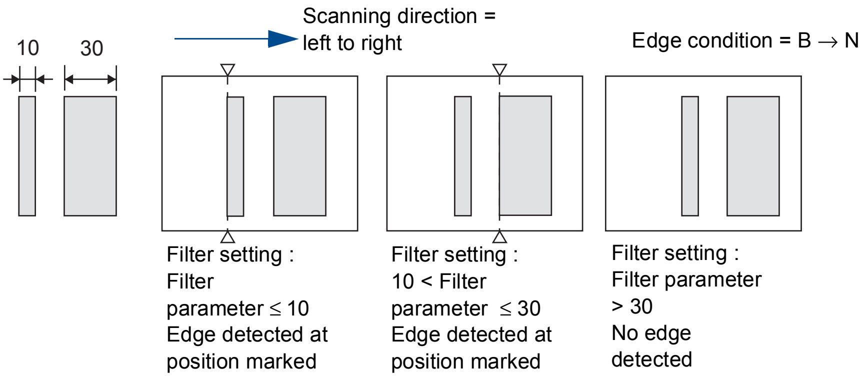
Nota Binary edge width and filter

WIDTH



The width parameter places conditions on the width across the scanning direction, so that areas less than the minimum width specified are not detected.

FILTER

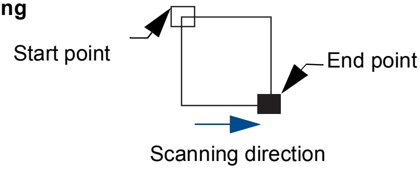


The filter parameter places conditions on the depth in the scanning direction, so that areas less than the minimum depth specified are not detected.

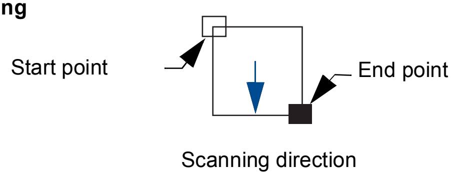
Note **Checker area "start point"/"end point" and edge detection conditions**

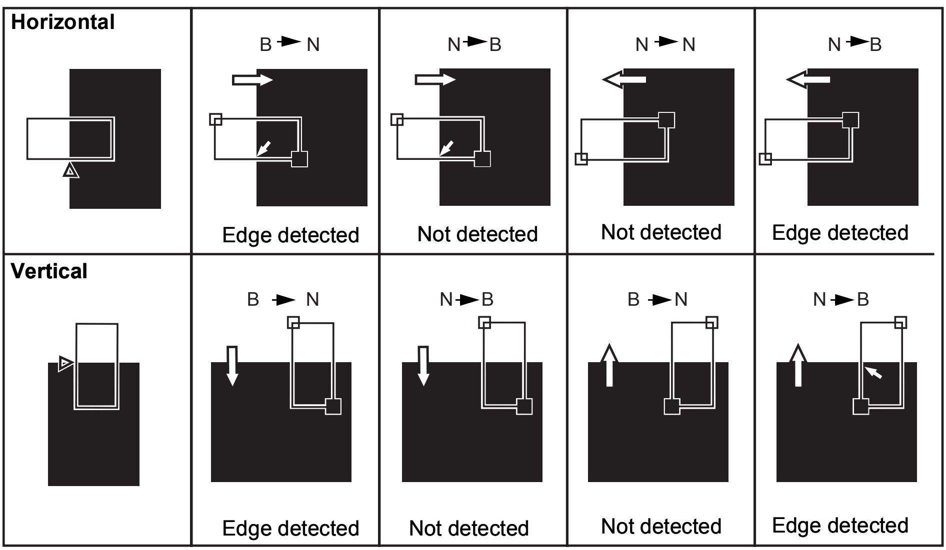
Checker area start/point"/end point" and edge detection conditions. Checkers are drawn by specifying the start and end point" of a rectangle. These are on the screen as a transparent square (= point) and a solkid square (=end point). When spectring the area defined, it is scanned from start point to the end. After drawing the checker, specify whether edge to be detected is a transition from white black or a transition from black to. The scanning direction and edge detection are vital parameters for edge detection sure to set them.

Horizontal scanning



Vertical scanning





Adjustment Group

Sets the position and rotation adjustment checker that will adjust the binary edge checker to be created.

```
                    TYPE[ 1]:
[34]  BINARY EDGE DETECTION Jud.:NG
 No.   1               X :   0   Y :  0
 4.  Adj. Group
   41. Pos.Rot. Adj. Group    0
   42. Expo. Adj. Group      <0,0>
```

41. Position and Rotation Adjustment Group
Sets which position and rotation adjuster will adjust the binary edge checker being created.

42. Exposure Adjustment Group
Sets which exposure adjuster will adjust the slice levels of the binary edge checker being created.

Binary Edge Detection Checker Setup

Procedure:

1. Set number of the binary edge checker to be created.

2. Select **Checker Setting**, then **Shape**.

3. From **Shape**, select either **line** scanning or **plane** scanning.

4. From **Area** set the coordinates for the inspection area. For details on how to set the area, see page 2 - 28.

5. From **Direction**, select either horizontal or vertical as the scanning direction.

Note **With line scanning, scanning proceeds along the line from the start point to the end point. This is why the scanning direction cannot be specified if line scanning has been selected.**

If it is a square, the X- and Y-coordinates of the start point and end point must be set higher than 4 4. If it is a line, either the X- or the Y-coordinate of the start point and end point must be set higher than 4.

---

6. Set Filter and Width if required.
   When the Filter and Width menu item is selected, the highlight cursor moves over to the value column. Move the cursor lever up and down to set the value required.

7. When required, set position and rotation adjustment and exposure adjustment group numbers.

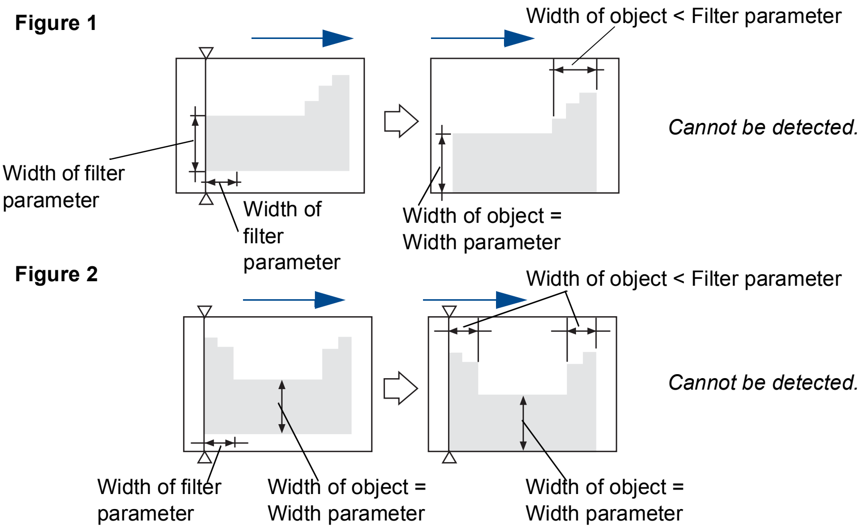
Restrictions on Binary Edge Checkers

In situations like those described below, calculation errors may occur and prevent detection.

(A) If an object in the inspection area has a section with a width equal to the width parameter, and the object is touching the bottom of the checker area when left-right edge detection is being used, or with the right of the checker area when up-down edge detection is being used, then the object may not be detected.

Figure 1

Figure 2



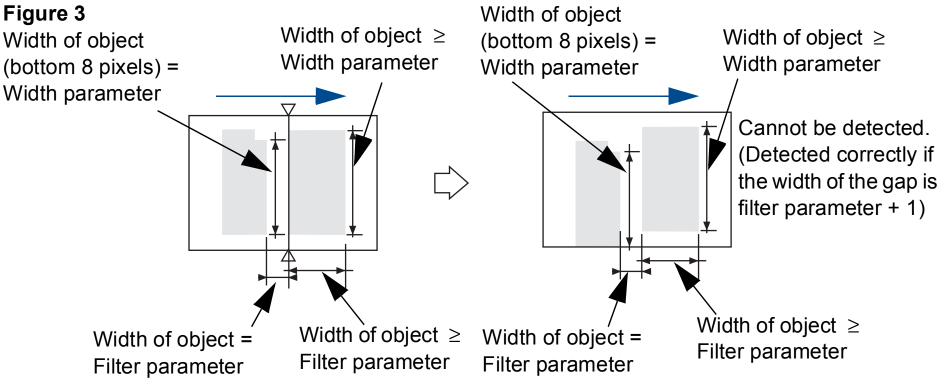
If it is necessary to scan objects at the boundaries of the inspection area, set up the checker so that the object comes at the top of the checker area when left-right edge detection is being used, or at the left of the checker area when up-down edge detection is being used.

(B) The following diagram shows a special inspection scenario:

- The section of the included color is positioned immediately before an area of the excluded color.
- The bottom 8 pixels of the width of the object in the width parameter direction are equal to the width parameter
- The object is touching the bottom of the checker area when left-right edge detection is being used, or with the right of the checker area when up-down edge detection is being used.

In a case like this, in order to detect the object, it must have a width of at least the filter parameter + 1.

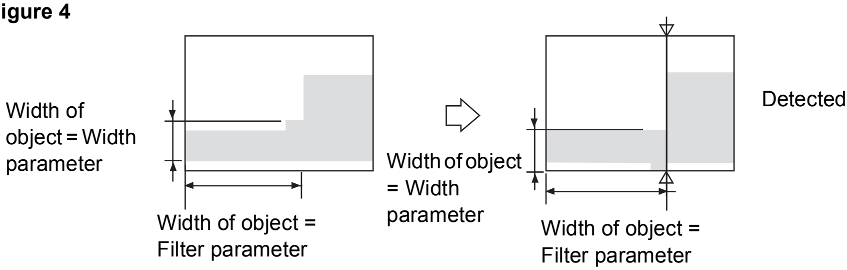
Figure 3



Set the filter parameter so that it is a little smaller than the actual gap.

(C) In detecting a region of the uncounted color, if the counted color area at the point where the filter conditions are met is touching the bottom of the checker area when left-right edge detection is being used, or with the right of the checker area when up-down edge detection is being used, then if the width is equal to the width parameter, it is treated as if an area of excluded color had been recognized.

Figure 4



Set the filter parameter a little smaller or take the same precautions as for situation (A).

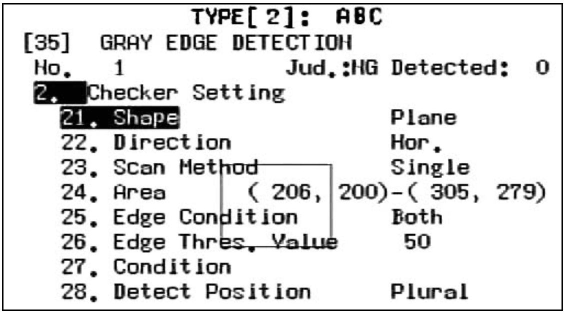
CHAPTER 10

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 96 checkers per type for the XUVM210XUVM210, and up to 48 per type for the XUVM110.

Main Menu

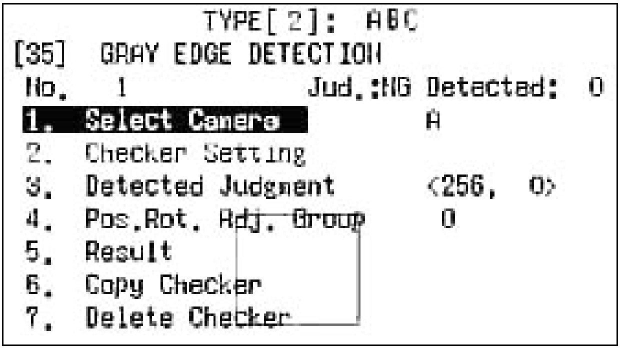


No. (Checker No.)
Sets the number of the gray-scale edge checker to be created.

1. **Select Camera**
   For the XUVM210, select which camera (A or B) will supply the image on which the gray-scale edge checker is to be activated. This is fixed at A with the XUVM110.
2. **Checker Setting**
   Sets the gray-scale edge checker parameters (see page 10 - 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 10 - 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.

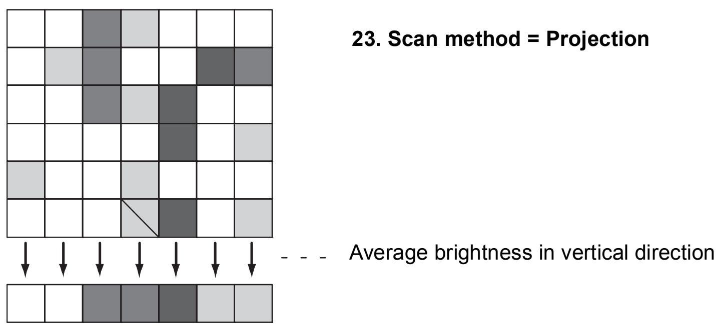


21. Shape
Selects the shape for the checker area. Possible shapes are rectangle and line.

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**.

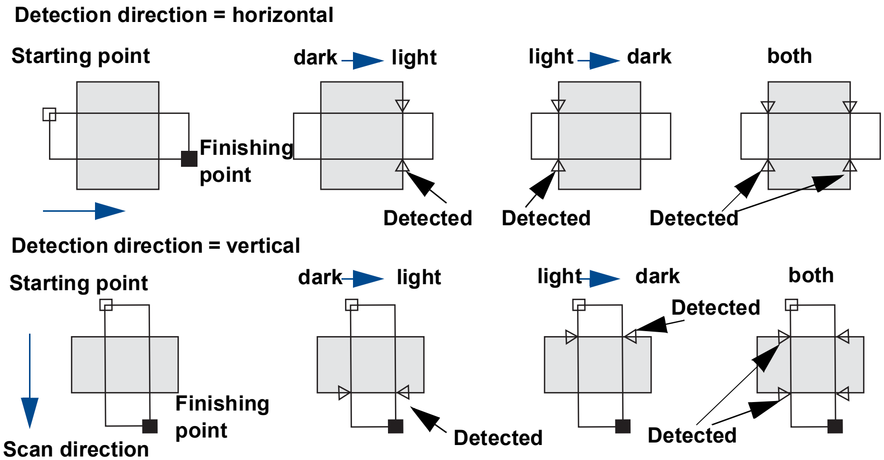


24. Area

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.

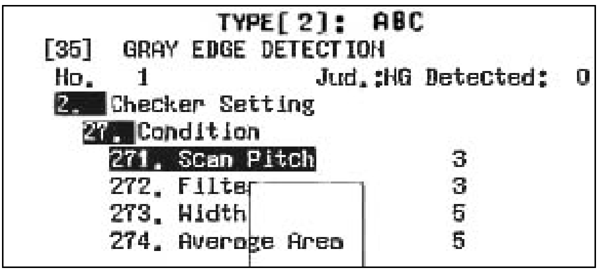


26. Edge Threshold Value

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

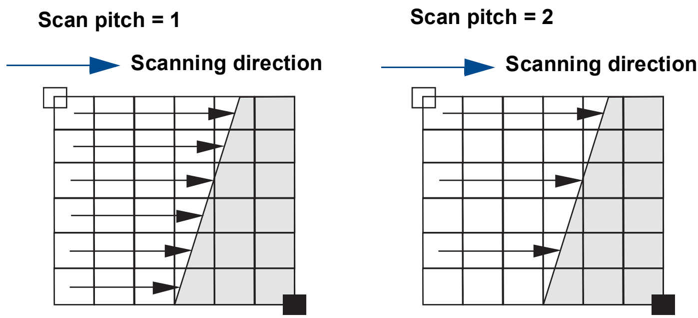
Sets the processing conditions for the checker being created.



```
TYPE[ 2]:  ABC
[35]  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.

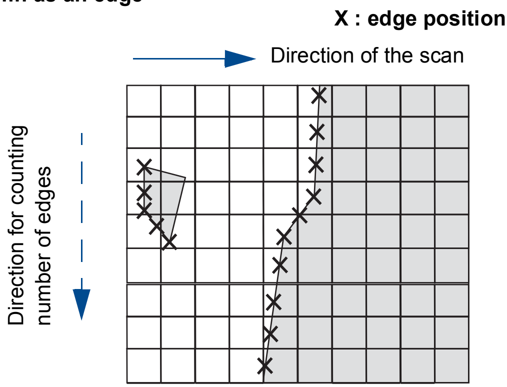
273.Width (can only be set for individual scans)

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.

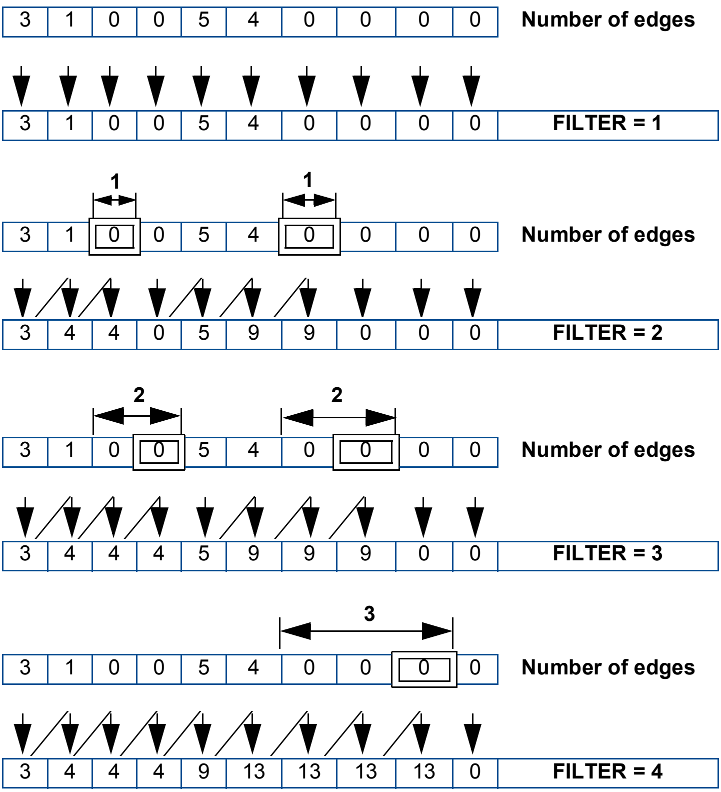
Ex:

Filter/Width

In the example below, with Filter = 2 and Width = 7, the XUVM110/XUVM210 detects the 6th column as an edge



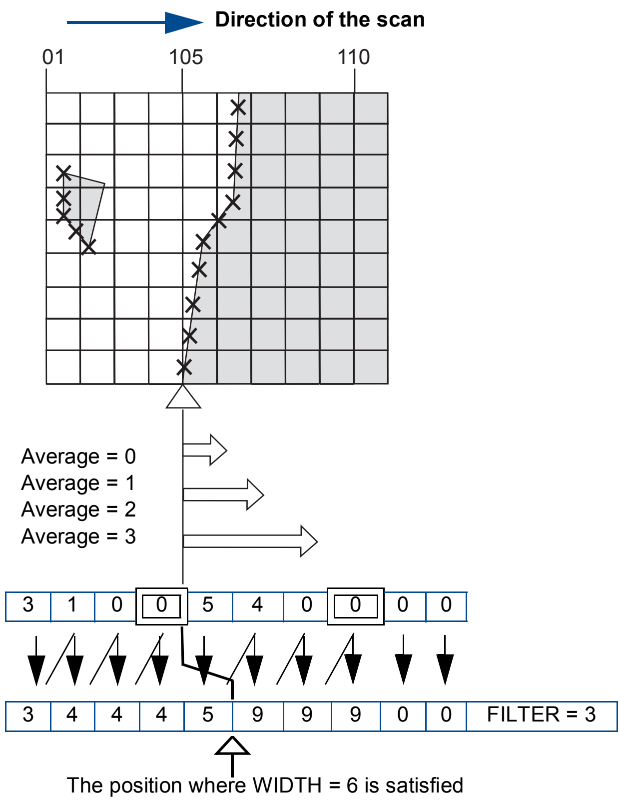
	3	1	0	0	5	4	0	0	0	0	**Nb of edges***
WIDTH	3	1	0	0	5	4	0	0	0	0	FILTER =1
WIDTH	3	4	4	0	5	9	9	0	0	0	FILTER =2
WIDTH	3	4	4	4	5	9	9	9	0	0	FILTER =3
WIDTH	3	4	4	4	9	13	13	13	13	0	FILTER =4



Note **The** Filter **and** Width **functions of the gray-scale edge checker are different from those of the binary edge checker.**

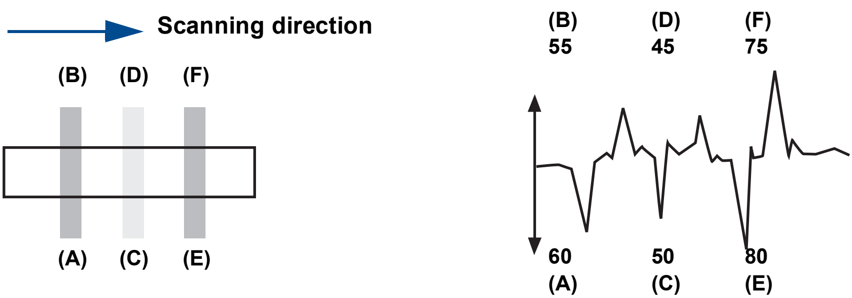
274.Average Area (can only be set for individual scans)

Sets the range for averaging, starting from the edge position that fulfills the filter/width conditions.

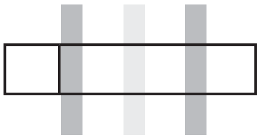
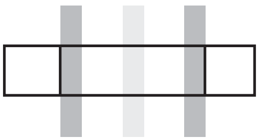
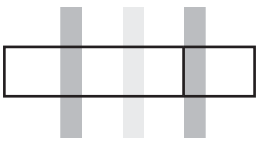
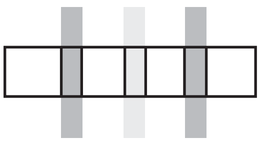


28. Detect Position

Sets the edge detection point of the checker to be created.

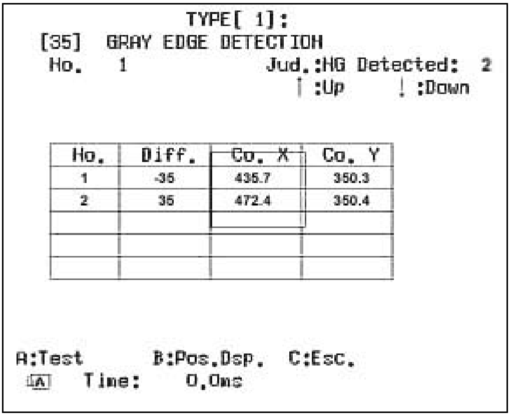


Figures show differential values

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. For the XUVM210, select which camera (A or B) screen you will move the gray-scale edge checker in. This is fixed at A with the XUVM110.

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 2 - 28.

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.

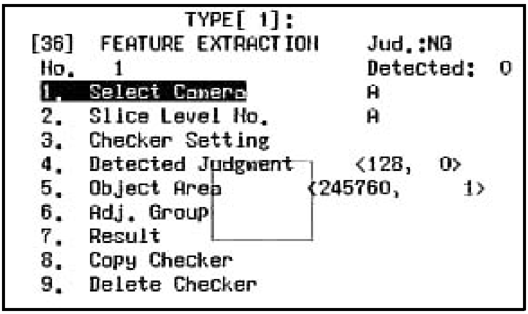
CHAPTER 11

Feature Extraction

Feature Extraction

A feature extractor is used by creating a checker and inspecting the checker area to count the number of specified objects and to detect their properties (areas, centers of gravity, perimeter lengths, projection widths, angle of principal axes, etc.). The feature extraction function is effective for detecting objects whose positions, attitudes, or numbers are not known in advance. The checker shapes available for both feature extractors and masks are rectangle, circle and polygon. Up to a maximum of 128 lands can be detected. Please note that numerical calculations can only use up to 99 results. You can set up to 96 checkers per type for the XUVM210, and up to 48 per type for the XUVM110.

Main Menu



No. (Checker No.)
Sets the number of the feature extractor to be created.

1. Select Camera
For the XUVM210, select which camera (A or B) will supply the image on which the feature extraction checker is to be activated. This is fixed at A with the XUVM110.

2. Slice Level No.
Selects the binarization level group for the feature extractor being created.

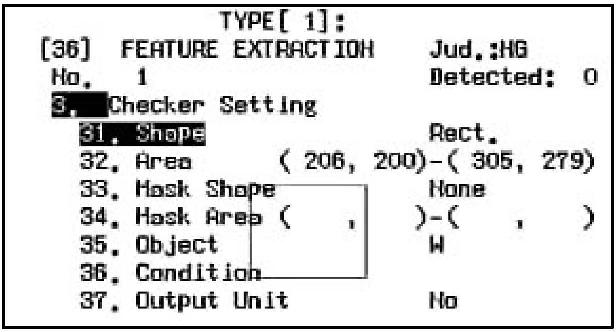
3. Checker Setting
Sets the feature extractor parameters (see page 11 - 4).

4. Detected Judgment
Sets judgment of good products and rejects on the basis of upper and lower **limits on the number of objects extracted.**

5. **Object Area**
   Sets the upper and lower limits, and makes the lands within that range as the target object(s). Both the upper and lower limits can be set in the range 1 to 245,760 (upper limit ≥ lower limit).
6. **Adjustment Group**
   Sets whether or not the checker being created will be adjusted by a position and rotation adjustment checker or an exposure adjustment checker (see page 11 - 10).
7. **Result**
   Displays a table of information about the detected lands, up to a maximum of 99 lands (see page 11 - 10).
8. **Copy Checker**
   Copies the data from an existing checker into the currently selected checker.
9. **Delete Checker**
   Deletes the checker.

Checker Setting

Creates the feature extractor and sets judgment conditions, etc.



31.Shape
Selects the shape for the feature extractor area. Possible shapes are rectangle, ellipse and polygon (line).

32.Area
Use this option to change the size or move the checker area or to change the scanning direction.

33.Mask Shape
The mask is an area within the checker shape which is excluded from the inspection. Use this option to select the shape for the mask area.

34.Mask Area
Changes the size of the mask area or moves the mask.

35.Object

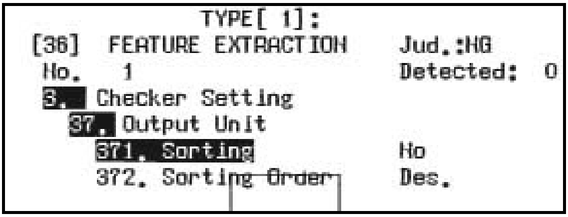
Selects whether processing in the inspection area is performed on white pixels or black pixels.

36.Condition

Sets the conditions for the feature extractor (see page 11 - 5).

37.Output Unit

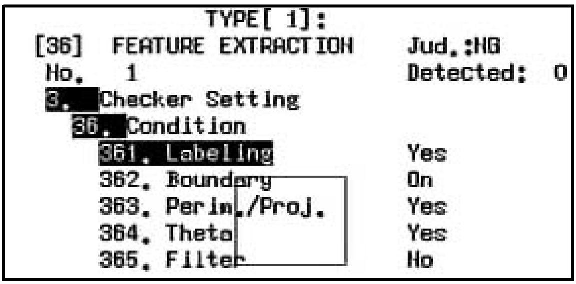
Sets the conditions for the feature extractor.



Here you define whether or not to sort the data according to individual feature amounts (area of individual lands, or X and Y coordinates of the center of gravity) for output of the calculated feature amounts.

Condition

Sets the conditions for the feature extractor.



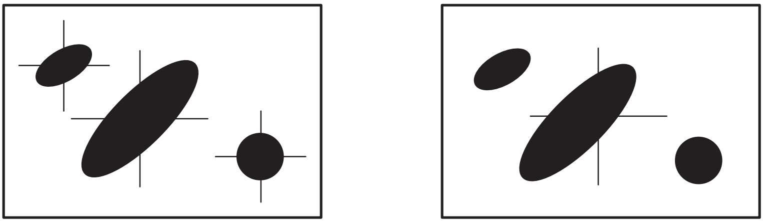
361.Labeling

Labeling: Yes

Handles each of the separate block of the color being inspected as individual lands within the feature extraction area. Count of lands and individual land information are available.

Labeling: No
Totals all the objects of the color being inspected within the feature extraction area, treating them as a single object. Count of lands and individual land information are not available. The total area of objects in the area is measured, and center of gravity coordinate data and principal axis data are measured at the same time.

Note **If** Labeling **is set to** No**,** Perim./Proj. **(obtain perimeter and projection width) is also set to** No**. The** Boundary **parameter is also invalid.**

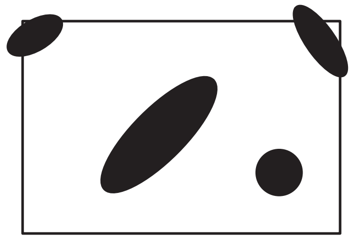


Labeling : Yes **Labeling : No**

Labeling: No
The three objects are handled as one, and the overall area is obtained.
Labeling: Yes
The three objects are handled individually, and the area and perimeter length of each is obtained.

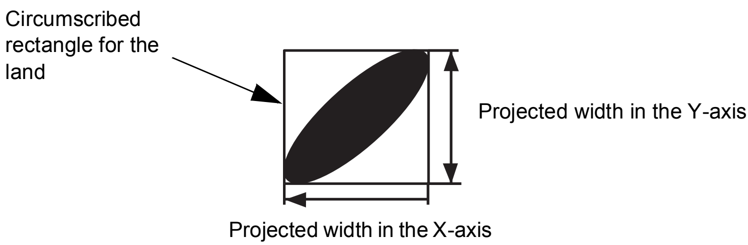
362.Boundary

If boundary processing is set to **Off**, then lands encroaching on the specified boundary area are not extracted as objects. If boundary processing is set to **On**, then the lands in the boundary area are also extracted. In this case, the area of the land within the inspection area has to meet the extraction conditions.
When set to **Off**, shape change and mask shape cannot be specified.

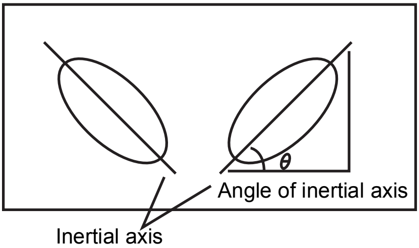


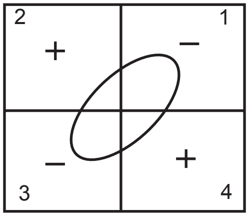
Boundary: Off
Objects detected: 2
Boundary: On
Object detected: 4
(Labeling must be set to **Yes**.)

363.Perimeter and Projection Width (Perim./Proj.)
Selects whether or not to measure the perimeter lengths of individual lands or to measure the size of the rectangle which circumscribes each land.
If labeling is set to **No**, **Perim./Proj.** cannot be set to **Yes**.



364.Theta
Selects whether or not to obtain the inertial axis.
Obtaining the trigonometric ratios of the inertial axis of an object enables the angle of the principal axis to be detected.





The angle of the inertial axis is negative when oriented into the first or third quadrant, and positive when oriented into the second or fourth quadrant.

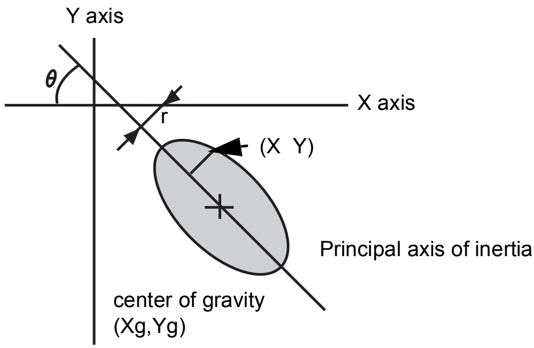
Note **Inertial axis**

If the rotational inertia moments (moment of inertia about the center of gravity) of straight lines passing through the center of Xg, Yg) of a figure are obtained, the line with the least inertial moment indicates and can be used to detect the angle of the figure.

The angle between the X-axis and the line is the inertial angle, and the line indicates the orientation of the principal axis of inertia.

The turning moment for a line can be calculated from the square of the distance from a point (X,Y) to the straight line times the weight (1 in this case due to black/white binarization.

Calculating the detected inertial moments of lines in this way, the principal axis of inertia is defined as the line passing through the center of gravity which has the smallest moment of inertia. The angle between the X axis and the principal axis of inertia is the inertial axis angle, theta.



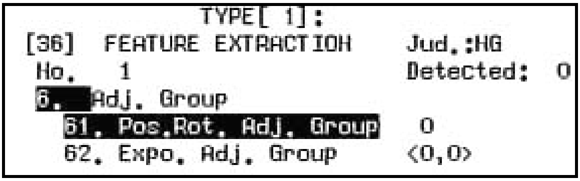
Note **The inertial axis angle cannot be obtained if the object has a regular shape like a square, circle, or isosceles triangle. Even if a value is displayed, the data will not be reliable. If an axis cannot be found, the XUVM110/XUVM210 displays the angle of the principal axis as 180 degrees. No error message is displayed. If theta is set to** Yes**, the pattern displayed at the detection position rotates in accordance with the angle of the principal axis. It does not rotate if theta is set to** No**, or if a value for theta could not be obtained.**

365.Filter

Selects whether or not to apply erosion or dilation filters to the image (see page 2 - 33).

Adjustment Group

Sets whether or not the checker being created will be adjusted by a position and rotation adjustment checker or an exposure adjustment checker.



61.Position and Rotation Adjustment Group

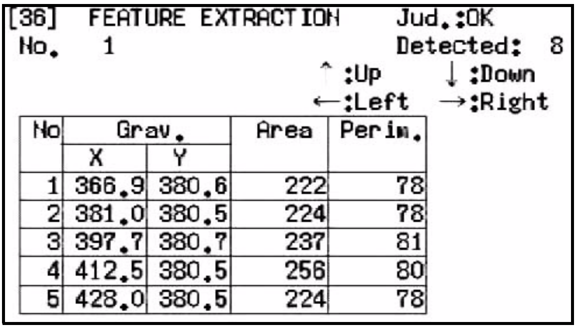
Sets which position or rotation adjuster the feature extractor will be adjusted by.

62. Exposure Adjustment Group

Sets which exposure adjuster the feature extractor will be adjusted by.

Result

Use this option to display a table of information about the detected lands, up to a maximum of 99 lands.



No	Grav.		Area	Perim.
	X	Y		
1	366.9	380.6	222	78
2	381.0	380.5	224	78
3	397.7	380.7	237	81
4	412.5	380.5	256	80
5	428.0	380.5	224	78

<A: Test>

Mode	*Function*
Camera mode	Capture a new image from the camera and perform an inspection. Display the results after inspection.
Memory mode	Perform an inspection on a image from memory without capturing a new image from the camera. Display the results after inspection.

<B: Disp. All>

Turns off the display of results and displays the overall center of gravity marked with ”+”.

<C: Esc>.

Returns to the display of results.

<↑ : Prev.>

Displays the center of gravity of the land immediately prior to the one currently being displayed. Pressing this from No. 1 displays the center of gravity for the last land (the land with the largest detection number.)

<↓ : Next>

Displays the center of gravity of the land immediately following the one currently being displayed. Pressing this from the last land detected displays No. 1.

Output Values for Detection Results

Parameter	Output value	Display on screen	Output precision
Grav.X	0 to 5110	0 to 511.0	x 10
Grav.Y	0 to 4790	0 to 479.0	x 10
Perim.	0 to 245760	0 to 245760	x 1
Area	0 to 245760	0 to 245760	x 1
Theta	–899 to 900, 1800*	–89.9 to 90.0, 180.0*	x 10
Proj.X	1 to 511	1 to 511	x 1
Proj.Y	1 to 479	1 to 479	x 1

* If theta could not be obtained, the output value for theta is 1800, and the on-screen display is 180.0.

Data detectable by feature extractor

a: Count of objects
When labeling has been used, this detects how many of the specified objects are within the area. Up to 128 objects can be detected.

b: Center coordinates of object
Detects the position of the center of gravity.
With labeling:
center of gravity coordinates can be measured for each individual land meeting the area limits for detection.
Without labeling:
Measures overall center of gravity coordinates when the total area of specified object meets the area limits for detection.

c: Area of objects
Measures the area detected.
With labeling:
Area can be measured for each individual land meeting the area limits for detection.
Without labeling:
Measures the area when the total area of the target color meets the area limits for detection.

d: Perimeter lengths of objects
Measures the perimeter lengths in pixels of individual labeled lands.
With labeling:
Perimeter length is measured for each individual land meeting the area limits for detection.
Without labeling:
Perimeter lengths are not measured.

e. Projected widths of objects
   Measures the projected widths of individual labeled lands.
   With labeling:
   Projected width is measured for each individual land meeting the area limits for detection.
   Without labeling:
   Projected widths are not measured.
f. Theta for objects
   Measures the inertial axis angle for detected objects.
   With labeling:
   Inertial axis angle is measured for each individual land meeting the area limits for detection.
   Without labeling:
   Measures theta when the total area of the target color meets the area limits for detection.

Note **If the number of lands extracted exceeds 128, the error message ”Number of lands exceeds 128.” is displayed. If this happens, adjust the upper and lower area detection limits to make them more restrictive, so that the number of lands extracted does not exceed 128.**

If the number of lands extracted is below 128, but the number of lands detected when executing the checker exceeds 512, the error message ”Labeling buffer overflow. Make the area smaller.” is displayed. If this occurs, make the feature extractor area smaller.

Feature Extraction Setup

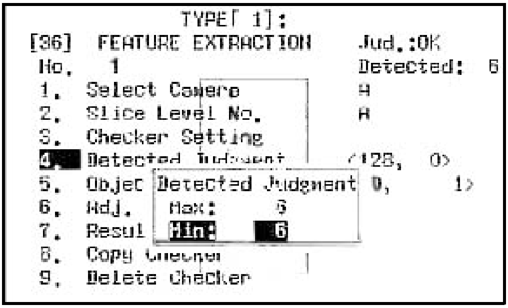
Procedure:

1. Set number of the feature extractor to be created.
2. Select **Slice Level No**. from the menu and select or confirm the slice level group (A, B, C, D, E or F) to be used by the feature extractor.
3. Select **Checker Setting**
4. Select **Shape** from the menu and select either rectangle, circle or polygon.
5. Select **Area** from the menu and set the coordinates for the inspection area. For details on how to set the area, see page 2 - 28.

Note **Please note that the system sets circular and elliptical areas in such a way that the X-coordinate difference between start point and end point is an odd number of pixels.**

---

6. If you wish to exclude areas within the checker shape from inspection, select **Mask Shape** from the menu and set the mask area to rectangle, circle or polygon.
7. From Mask **Area** set the coordinates for the mask area. For details on how to set the mask area, see page 2 - 32.
8. Select **Object** from the menu and set the color for the objects to be found to white or black.
9. Select **Object Area** from the menu and set the upper and lower limits of areas to be extracted. Results are only displayed for objects with areas between these limits.
10. If necessary, select **Condition** to display the menu for processing conditions.
11. Set **Labeling**, **Boundary**, **Perim./Proj.**, **Theta**, **Filter**. When settings are complete press <C> to return to the previous screen.
12. When you wish to judge the number of detected objects, 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.



13. When required, set position and rotation adjustment, and exposure adjustment group numbers.

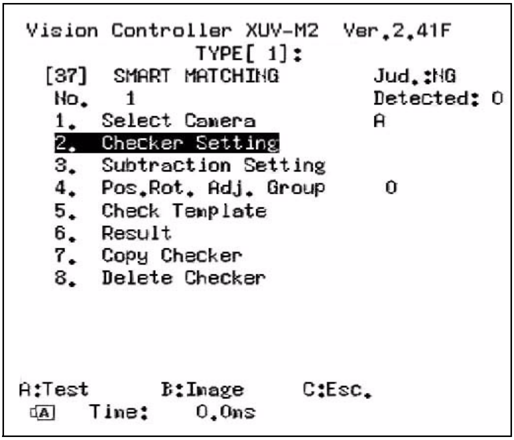
CHAPTER 12

Smart Matching

Smart Matching

This function is called **Smart Matching** on the XUVM210 and **Matching** on the XUVM110. In this guide, only the term **Smart Matching** is used.
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.
It is possible to re-register template images using input from external equipment (see page 16 - 43).
You can set up to 96 checkers per type for the XUVM210, and up to 48 per type for the XUVM110.

Main Menu



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

1. **Select Camera**
For the XUVM210, select which camera (A or B) will supply the image on which the smart matching checker is to be activated. This is fixed at A with the XUVM110.

2. **Checker Setting**
Sets the parameters for the smart matching checker (see page 12 - 5).

3. **Subtraction Settings (XUVM210 only)**
Sets the parameters for the subtraction settings (see page 12 - 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 12 - 16).

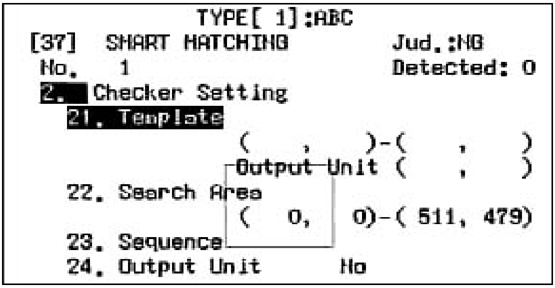
6. **Result**
   Displays the inspection results (see page 12 - 17).

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

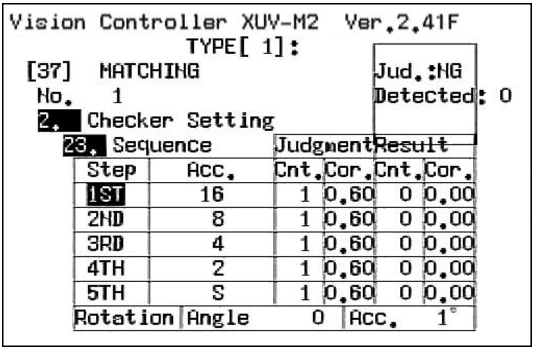
Sets the search area in the photographed image. The checker will detect objects that resemble the template within the search area.

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 XUVM110/XUVM210 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 XUVM110/ XUVM210 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 XUVM110/XUVM210 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.

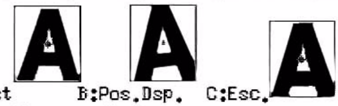
- Accuracy **(Acc.)**
  Set the minimum unit for rotating the template when performing angle detection. Use the cursor lever to select the angle (to one decimal place). The VISION CONTROLLER rotates the template at each angle set here, compares it to the object, and finally detects the rotation angle.

Ex:

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

Vision Controller XUV-M2 Ver.2.41F
TYPE[1]:
[37] 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

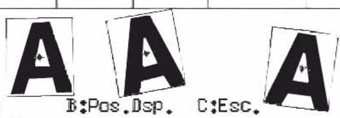


A:Test B:Pos.Dsp. C:Esc.
[A] Time: 40.7ms

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

Vision Controller XUV-M2 Ver.2.41F
TYPE[1]:
[37] 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.
[A] 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.

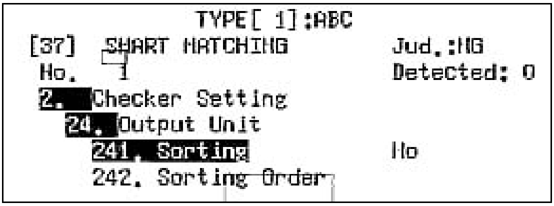
However, since it is possible to shorten the search time without compromising final output accuracy by setting subpixels in the 5th step, we recommend reducing the search time by setting and adjusting the sequencing, and confirming the final search accuracy.

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.

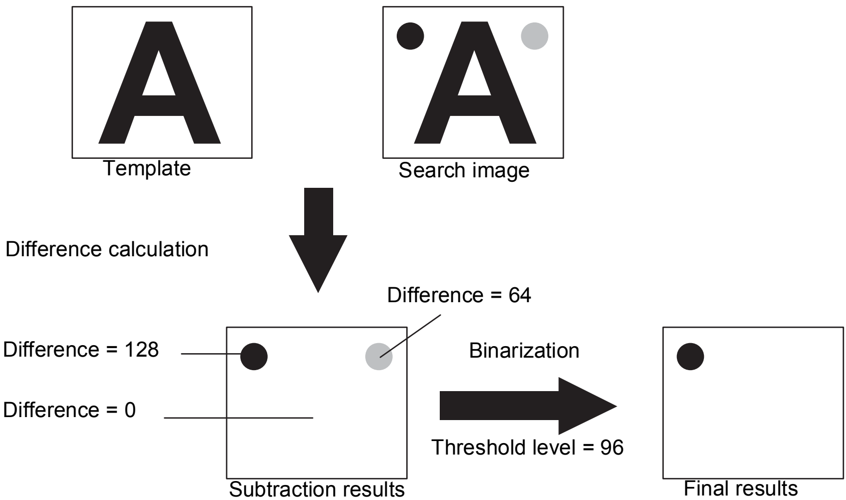
242. Sorting Order

Selects whether to sort in ascending or descending order.

Subtraction and Deviation (XUVM210 Only)

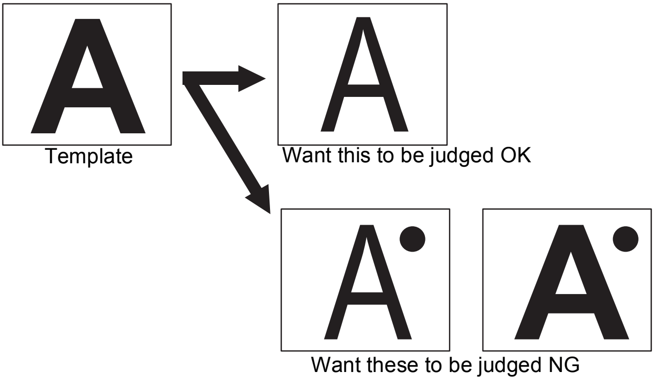
Subtraction

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.



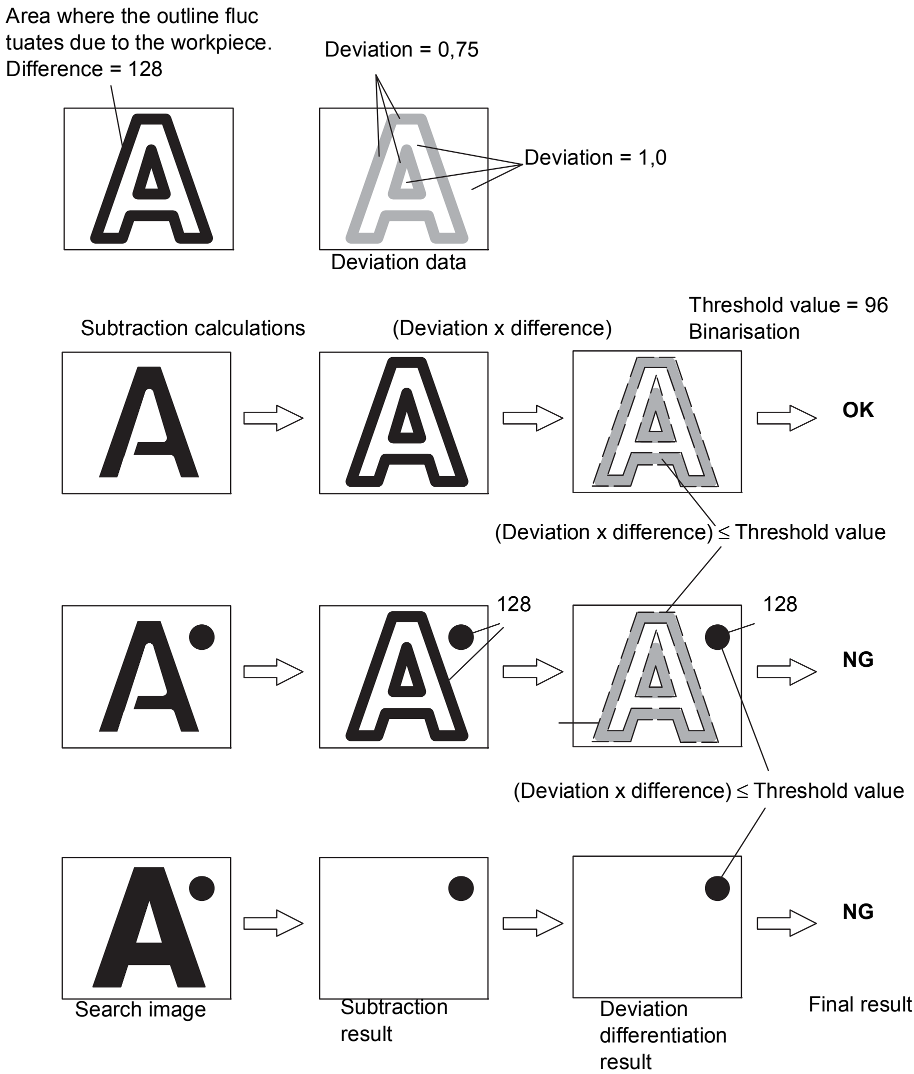
Deviation

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.



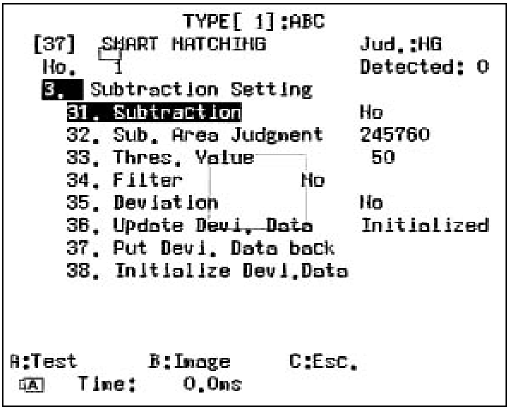
The VISION CONTROLLER will use the deviation data for each pixel in the results obtained during the subtraction processing, and will revise the portions you do not want it to recognize as differences (the outline area in the example above) to the results below the threshold value. By doing this, the 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 2 - 33.

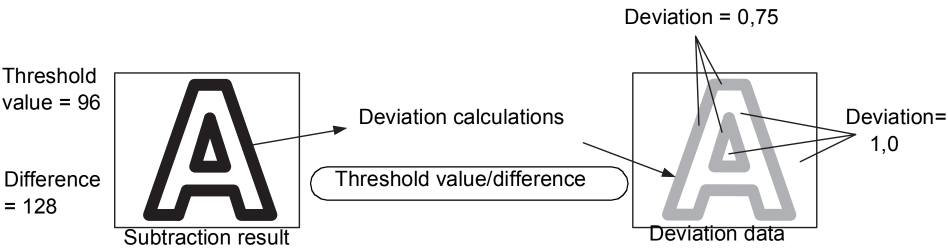
35. Deviation

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

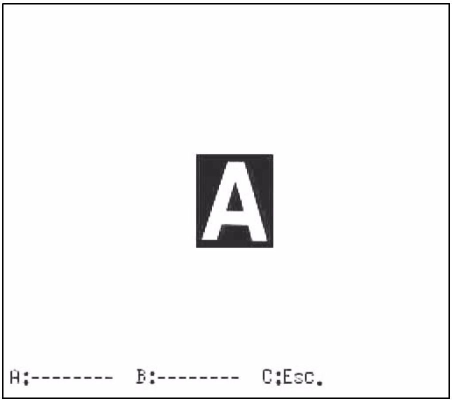
Restores deviation data to what it was before the last change was made.

38. Initialize Deviation Data

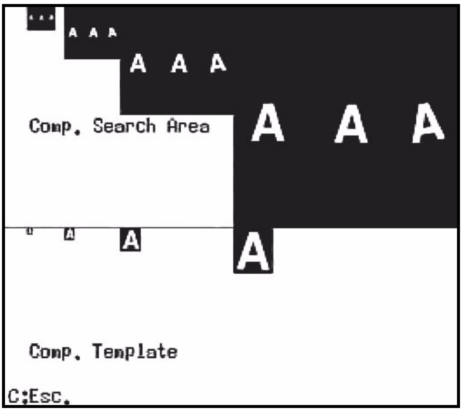
Resets all deviation data to 1.0. Once the data is reset, the values cannot be restored to what they were prior to the reset.

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.

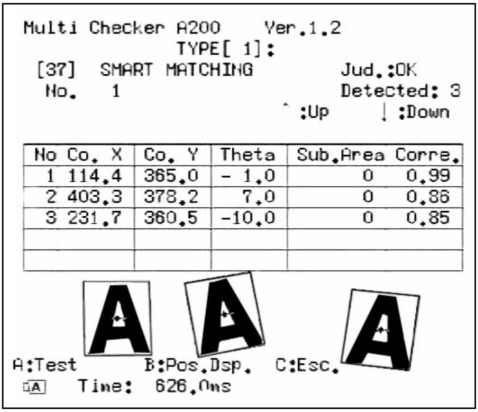


Verify the search area compressed image and the template compressed image by selecting Check Template and then Middle Step.



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 for the XUVM210

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

Matching Checker Setup for the XUVM110

Procedure:

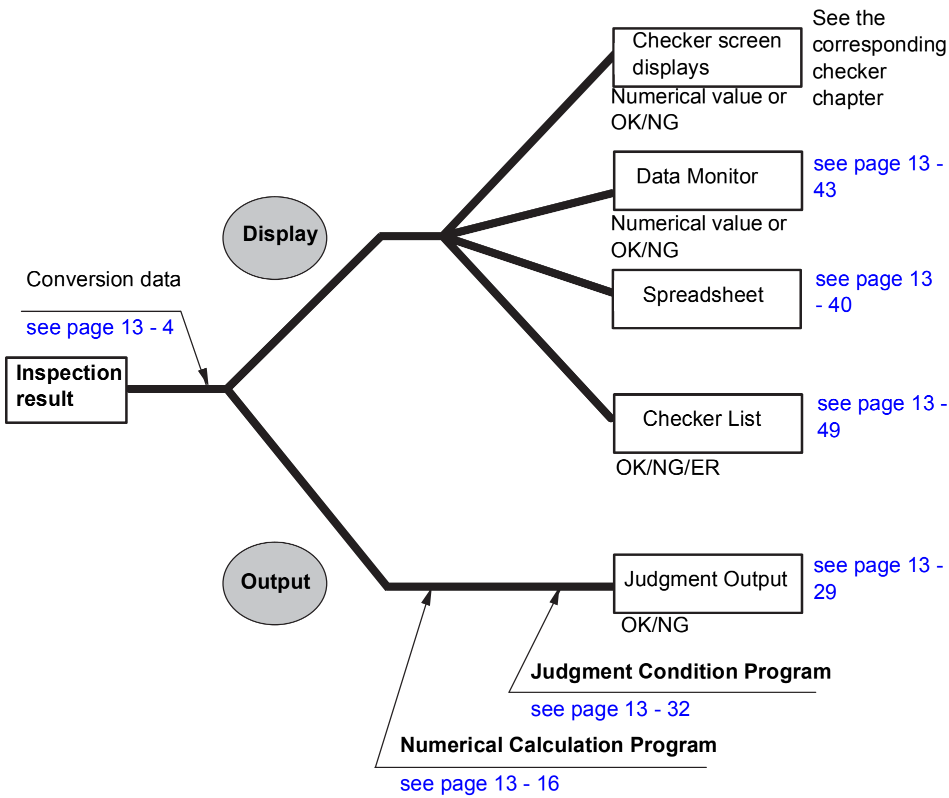
1. Select or confirm the number of the matching checker to be created
2. Select Checker Setting, then Template
3. Set the coordinates of the template area
4. Set the output point for the detected point coordinates
   Set the output point somewhere within the template area. Press <A:Tmp. Cnt.> to set the point in the center of the area.
5. Set the parameter Search Area
   Set only the area necessary, keeping in mind the effects of the search area size on processing speed.
6. 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.
7. Set data output conditions under Output Unit if necessary
   Consider the scanning resolution and scanning time when setting the search conditions for each step.
8. Set the number of the position adjustment group, if required

CHAPTER 13

Inspection Results and Output

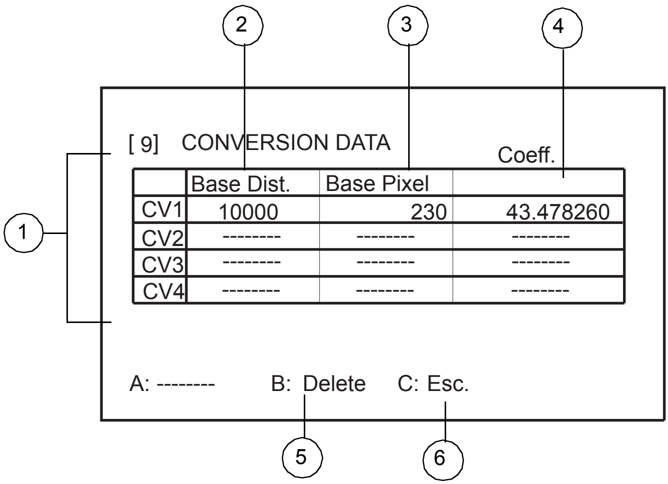
Inspection Results and Output

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 = Reference 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.

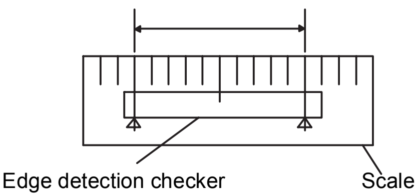
Note **Internally, the system works with integer accuracy. This means that digits after the decimal point are cut off after a calculation. In order to avoid miscalculations, use a coefficient that is large enough. For example, instead of 4.347 use the coefficient 43.47.**

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 **9. 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.”.

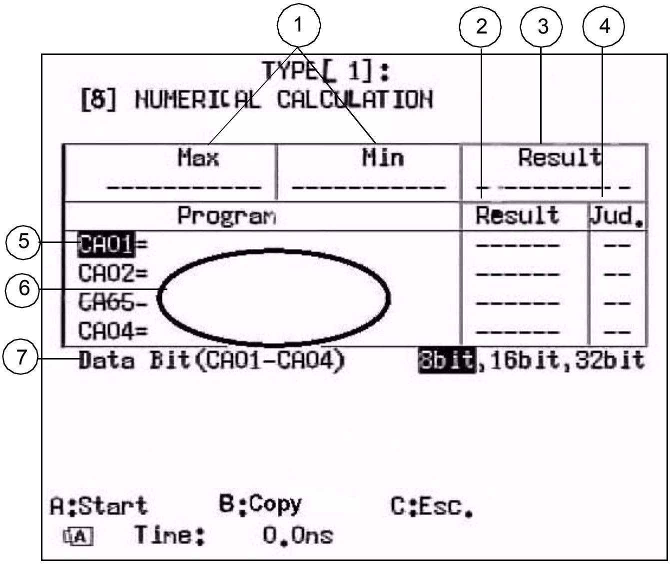
	Base Dist.	Base Pixel	Coeff.
CV1	10000	230	43.478260
CV2	-------	-------	---------
CV3	-------	-------	---------
CV4	-------	-------	---------

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 96 formulas (XUVM110: 48) 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 - 63). 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 CA96) 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 - 16. For available data and operators, see page 13 - 10.

6 **Program**
Displays the set calculation program. A maximum of 90 characters can be set for the program, for example BW01 = four characters.

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.**

You can use the results of three numerical calculation results to save the image when the calculation result is outside the range set by the maximum and minimum values. This is done by setting the option Save Image Mode **in the** Environment **menu to** Lim. Cond. **and defining the limit condition (see page 13 - 28).**

Data Bit

This parameter is only necessary for communication via the parallel interface (see page 16 - 31). It does not influence the calculation accuracy.
You can set the data bits for the formulas for a total of 24 groups in steps of four from CA01 (CA01 to CA04, CA05 to CA08 ..... CA93 to CA96).
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.

<table>
<tr><th>Checker</th><th>Program Symbol</th><th>Checker No. (XUVM110 in brackets)</th><th>Object No.</th><th>Item</th><th>Reference Data</th></tr>
<tr><td rowspan="7">Position/ Rotation Adjustment</td><td rowspan="7">PA</td><td rowspan="7">01 to 96 (01 to 48)</td><td rowspan="3">0</td><td>1</td><td>ΔX (amount of position adjustment in the horizontal direction)</td></tr>
<tr><td>2</td><td>ΔY (amount of position adjustment in the vertical direction)</td></tr>
<tr><td>3</td><td>Δθ (amount of angular rotation adjustment)
(XUVM210 only, see note)</td></tr>
<tr><td rowspan="4">1 to 2 (see note)</td><td>4</td><td>X coordinate (see note)</td></tr>
<tr><td>5</td><td>Y coordinate (see note)</td></tr>
<tr><td>6</td><td>X-axis projection distance (see note)</td></tr>
<tr><td>7</td><td>Y-axis projection distance (see note)</td></tr>
<tr><td rowspan="2">Exposure Adjustment</td><td rowspan="2">EA</td><td rowspan="2">01 to 96 (01 to 48)</td><td rowspan="2">*</td><td>1</td><td>Average gray value</td></tr>
<tr><td>2</td><td>Adjustment amount</td></tr>
<tr><td rowspan="2">Line Checker</td><td rowspan="2">LI</td><td rowspan="2">01 to 96 (01 to 48)</td><td rowspan="2">*</td><td>1</td><td>Number of dots</td></tr>
<tr><td>2</td><td>Number of lands</td></tr>
<tr><td>Binary Window Checker</td><td>BW</td><td>01 to 96 (01 to 48)</td><td>*</td><td>*</td><td>Area value</td></tr>
<tr><td>Gray-Scale Window Checker</td><td>GW</td><td>01 to 96 (01 to 48)</td><td>*</td><td>*</td><td>Average gray value</td></tr>
<tr><td rowspan="4">Binary Edge Checker</td><td rowspan="4">BE</td><td rowspan="4">01 to 96 (01 to 48)</td><td rowspan="4">*</td><td>1</td><td>X coordinate</td></tr>
<tr><td>2</td><td>Y coordinate</td></tr>
<tr><td>3</td><td>X-axis projection distance (see note)</td></tr>
<tr><td>4</td><td>Y-axis projection distance (see note)</td></tr>
<tr><td rowspan="5">Gray-Scale Edge Checker</td><td rowspan="5">GE</td><td rowspan="5">01 to 96 (01 to 48)</td><td>01</td><td>0</td><td>Number of detections (see note)</td></tr>
<tr><td rowspan="4">01 to 99</td><td>1</td><td>Nth X coordinate (multiplied by 10)</td></tr>
<tr><td>2</td><td>Nth Y coordinate (multiplied by 10)</td></tr>
<tr><td>3</td><td>Nth X-axis projection distance (see note)</td></tr>
<tr><td>4</td><td>Nth Y-axis projection distance (see note)</td></tr>
</table>

Checker	Program Symbol	**Checker No.** *(XUVM110 in brackets)*	Object No.	Item	Reference Data
Feature Extraction	FE	01 to 96 (01 to 48)	01	0	Number of detections (see note)
			01 to 99 (see note)	1	Nth area value
				2	Nth center-of-gravity X coordinate (multiplied by 10)
				3	Nth center-of-gravity Y coordinate (multiplied by 10)
				4	Nth projection width X
				5	Nth projection width Y
				6	Nth perimeter length
				7	Nth main axis angle
				8	Nth X-axis projection distance (see note)
				9	Nth Y-axis projection distance (see note)
Smart Matching (XUVM210)	SM	01 to 96	01	0	Number of detections (see note)
			01 to 64	1	Nth correlation value
				2	Nth X coordinate (multiplied by 10)
				3	Nth Y coordinate (multiplied by 10)
				4	Nth detection angle (multiplied by 10)
				5	Nth differential area value
				6	Nth X-axis projection distance (multiplied by 10)
				7	Nth Y-axis projection distance (multiplied by 10)
Matching (XUVM110)	MT	(01 to 48)	01	0	Number of detections (see note)
			01 to 64	1	Nth correlation value
				2	Nth X coordinate (multiplied by 10)
				3	Nth Y coordinate (multiplied by 10)
				4	Nth detection angle (multiplied by 10)
Numerical Calculation	CA	01 to 96 (01 to 48)	*	*	Numerical calculation data register
Previous Numerical Calculation	OCA	01 to 96 (01 to 48)	*	*	Numerical calculation data register (previous result value)

Checker	Program Symbol	Checker No. (XUVM110 in brackets)	Object No.	Item	Reference Data
Spreadsheet	QS	0	*	0	Number of scans
		01 to 40	*	1	OK count
				2	NG count
				3	OK average
				4	NG average
				5	OK dispersion
				6	NG dispersion
				7	OK maximum value
				8	NG maximum value
				9	OK minimum value
				10	NG minimum value
				11	OK range
				12	NG range
Conversion Data	CV	1 to 4	*	1	Factor
				2	Standard distance
				3	Standard number of pixels

Note **"1" indicates standard checker 1, and "2" indicates standard checker 2 (or "1" indicates horizontal checker and "2" indicates vertical checker).**

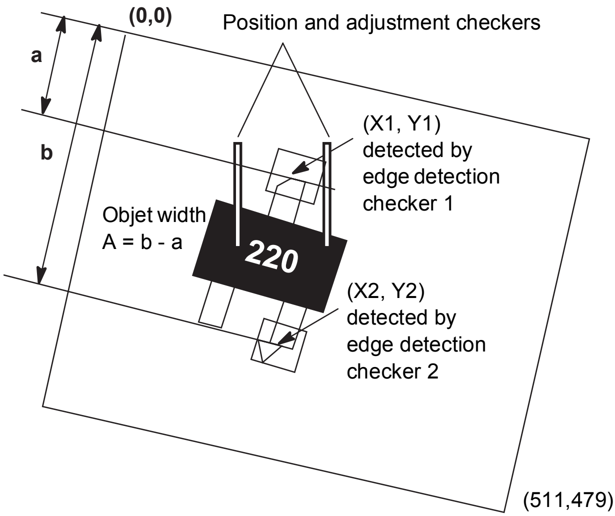
For binary edge checkers the result is as is, and for other checkers it is multiplied by a factor of 10.3)

The number of detections can only be referenced when the Object No. is specified as No. 1.4)

XUVM210 only. The result is multiplied by a factor of 10. Projection distance uses the detected coordinates and the degree calculated by the position and rotation adjustment to rotate the inspection checkers and the axis of coordinates so that it is possible to calculate the distance between two points even if the image has changed position with respect to the original image where the inspection checkers were set, see the following example.

Ex:

Using projection distance to determine the object width



The width A = b - a is calculated with the help of the operator D (absolute value after subtraction), i.e. width A = checker 1 projection y-axis D checker 2 projection y-axis. Set the numerical calculation formula as shown below:

Result

CA01 = GE01014 D GE02014

2162

operator: absolute value of subtraction

216,2 pixels

Gray edge Proj. Y1 axis

Gray edge Proj. Y2 axis)

The object number that can be referenced is restricted according to how you set the option Detection Position.

Option Detection Position is set to	*Effect*
Front	Only Detection No. 1 can be specified.
Front/Rear	Only Detection No. 1 and No. 2 can be specified.
Peak	Only Detection No. 1 can be specified.
Plural	Not restricted (No. 01 to 99).

Operators and symbols that can be used for calculations are as follows:

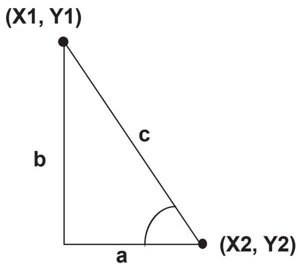
Operators	*Symbol*	*Please note*
Addition	+	
Subtraction	-	
Multiplication	*	
Division	/	
Left bracket	(	
Right bracket	)	
Atan	@	The result is multiplied by 100, example below and page 13 - 23
Root	$	The result is multiplied by 10,000, example below and page 13 - 23
Distance	T	The result is multiplied by 10,000, example below and page 13 - 23
Subtraction Absolute	D	Calculates the absolute value after subtraction
Cosine	&	The result is multiplied by 100, example below and page 13 - 23. The angle used for calculating the cosine/sine needs to be multiplied with 100, unless you use an angle provided by the Atan function, because the function multiplies the resulting angle with 100.
Sine	#	

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 (q) 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 q	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.

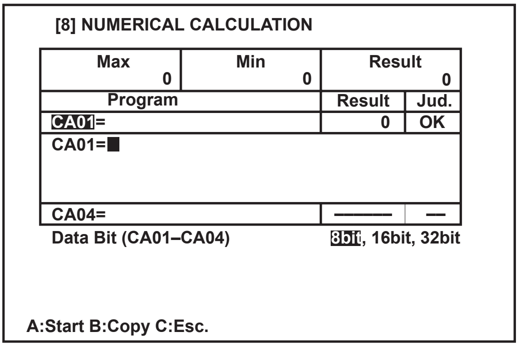
Numerical Calculation Programs

Creating a Program

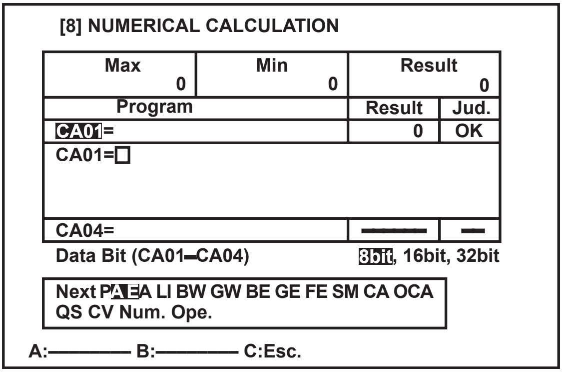
As an example, here we will explain a calculation program that calculates dimensions using the operator D (absolute value of the difference) and the edges detected by gray checkers No. 1 and No. 2. The D operator subtracts two values, and gives the absolute value of the result.
CA01 = absolute value (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 EA LI BW GW BE GE FE
SM CA OCA QS CV Num. Ope.

CHECKER: 2

Next PA EA LI BW GW BE GE FE
SM 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 EA LI BW GW BE GE FE
SM CA OCA QS CV Num. Ope.

Max	Min	Result	
0	0	0	
Program		Result	Jud.
CA01=		0	OK
CA01=GE02011D ■			
CA04=		———	—

Data Bit (CA01–CA04) 8bit, 16bit, 32bit

Max	Min	Result	
0	0	0	
Program		Result	Jud.
CA01=		0	OK
CA01=GE02011DGE01011 ■			
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.

Max	Min	Result	
0000000100	0	0	
Program		Result	Jud.
CA01=GE02011DGE01011		0	OK
CA01=GE0201 DGE01011			
CA04=		———	—

Data Bit (CA01–CA04) 8bit, 16bit, 32bit

Next PA EA LI BW GW BE GE FE SM CA OCA QS CV Num. Ope.

Set the maximum and minimum values.

Max	Min	Result	
100	50	0	
Program		Result	Jud.
CA01=GE02011DGE01011		70	OK
CA02=		———	—
CA03=		———	—
CA04=		———	—

Data Bit (CA01–CA04) 8bit, 16bit, 32bit

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=GE02011DGE01011
```

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=GE02011DGE01011
```

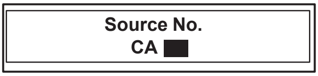
Copying a Program

In the following example we will copy the program set in CA03 to CA04.

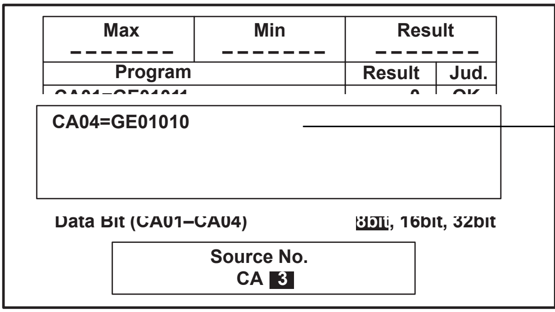
Procedure:

1. Move the cursor to the register number where you want to create the program and select it.

2. Press <B> to display the Copy Source Number selection window.



3. Input and confirm the number of the register where the numerical calculation program that you want to copy is stored.



When you select the copy source number, the calculation formula stored in the source register is displayed in the destination register

4. If you wish to use the copied numerical calculation program as is, press <C> (Return) to register it. If you want to modify the numerical calculation program, press <Enter> to display setting items, and edit it using the same procedure that you would use to create a program (page 13 - 16).

Restrictions

Order of Priority of Operators

Operators are executed in the following order of priority from highest to lowest priority

High (,)
@, $, #, &
*, /, T, D
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

All calculations are performed with 32 bit accuracy. 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 XUVM110/XUVM210 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 16 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
& (cos)	x 1	x 100
# (sin)	x 1	x 100

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 - 25.

`A:OutpContr.B:Delete`

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.

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> and the ”X” mark disappears, enabling numerical calculation output for that program.

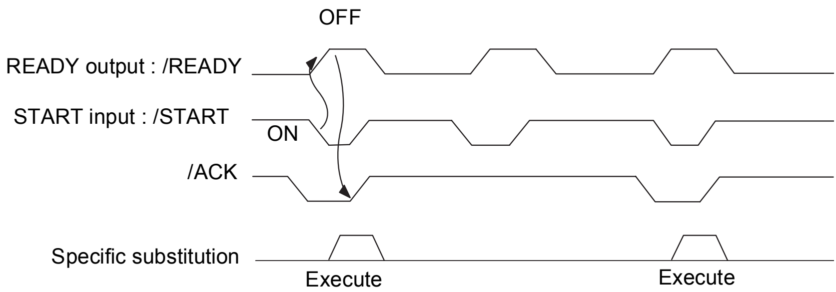
Even if a formula is set and the serial output settings in the **Environment** menu are set to output a numerical calculation, the results of numerical calculation registers that have an ”X” in front of the register number are not output.

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 ! GF01
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 XUVM110/XUVM210 resets the READY signal. 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 XUVM110/XUVM210, 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 <Enter> to display the **Condition** menu.

Condition
None
Spec Subst.
Lim. Cond.

3. Select **Spec Subst.** and press <Enter>. The **=** sign will change to a **!** sign. This indicates that specific substitution is set.

```
CA01!GE02011–GE01011
```

Deleting Specific Substitution

1. To delete the specific substitution setting, align the cursor with the “!” position.

2. Press <Enter> to display the **Condition** menu.

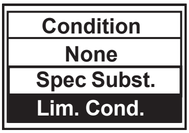
Condition
None
Spec Subst.
Lim. Cond.

3. Select **None** and confirm the selection. The **!** sign will change back to the = sign.

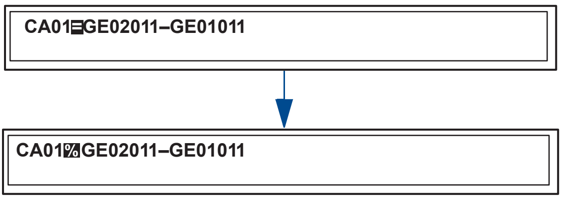
Setting and Deleting a Limit Condition

You can set limits for a numerical calculation program so that the image is saved when the limits set for the registers are exceeded.

1. When creating a numerical calculation program, move the cursor to the = sign of the register for which you want to set limit conditions.
2. Press <Enter> to display the **Condition** menu.



3. Use the cursor lever to select **Limit Condition**, and confirm the selection. The = sign will change to a **%** sign. This indicates that limit condition is set.



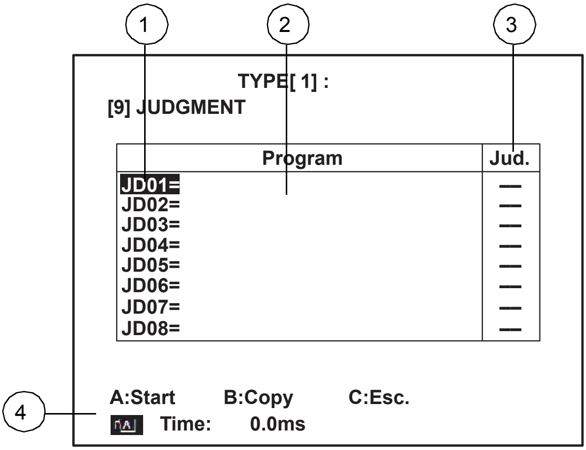
4. To delete the limit condition setting, align the cursor with the % sign, press <Enter> to display the **Condition** menu, select **None** and confirm the selection. The % sign will change back to the = sign.

Note **The maximum number of limit condition settings is three registers per type.**

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 96 registers for the XUVM210, and up to 48 registers for the XUVM110. 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 JR96 (JR01 to JR48 for the XUVM110) are not externally output.**

With Autom. Switch **mode (**see page 2 - 7**), the Block 1 results (XUVM210: JD01 to JD32, XUVM110: JD01 to JD16) cannot be externally output.**

2 **Judgment conditions program**
Displays the judgment conditions program that has been set. The judgment conditions program can be up to 90 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.
<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 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 used	Program symbol	**Checker No.** (XUVM110 in brackets)	Mode	Referenced data
Position/Rotation Adjustment	PA	01 to 96 (01 to 48)	*	
Exposure Adjustment	EA		*	
Line Checker	LI		1	Dots (pixel)
			2	Land
Binary Window Checker	BW		*	
Gray-Scale Window Checker	GW		*	
Binary Edge Checker	BE		*	
Gray-Scale Edge Checker	GE		*	
Feature Extractor	FE		*	
Smart Matching (XUVM210)	SM		*	
Matching (XUVM110)	MT		*	
Numerical Calculation	CA		*	
Precious Numerical Calculation Results	OCA		*	
Judgment Output R register	JR		*	
Judgment Output D register	JD		*	

Because line checkers have both dot and land judgments, you need to select an item number. For the other checker types only the checker number needs selecting.

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.

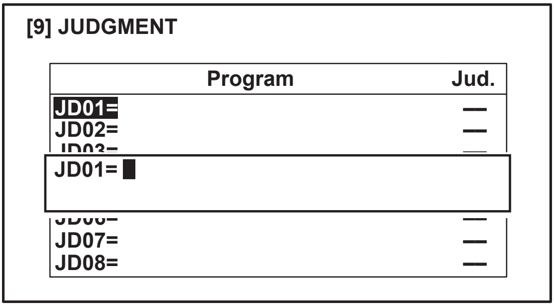
Judgment Programs

Creating a Judgment Program

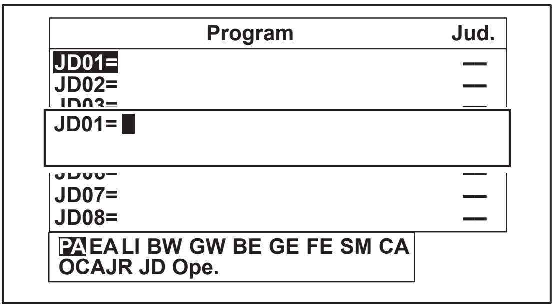
In the judgment condition program example described here, JD01 goes on if the judgment of line checker No. 1 is OK.

Procedure:

1. Align the cursor to select the register number for the judgment program you are going to create and press **<Enter>**.

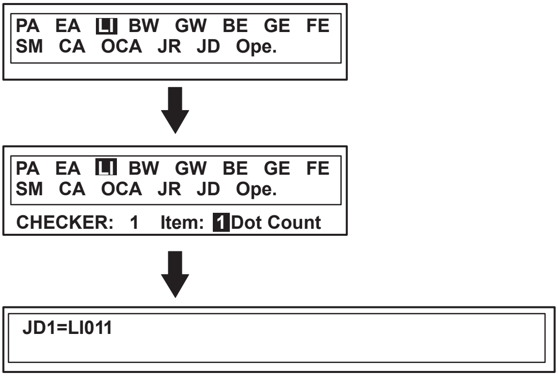


2. From the state shown in step 1 above, press **<Enter>** again. A subwindow is displayed where you select items for input.



Note **Items can only be selected if the corresponding checker results exist.**

3. Next, select the checker results to be referenced.



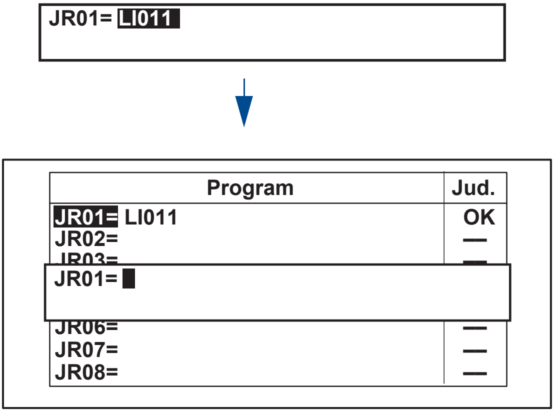
Note **Checker numbers can only be selected if the corresponding checker has been set.**

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.



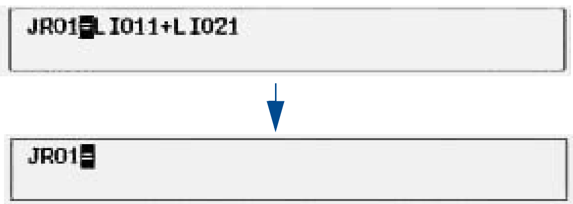
2. To add to a program, characters are inserted in front of the highlight cursor.

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.



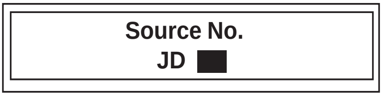
Note **If a trap has been specified for the program, the trap is deleted along with the program.**

Copying a Judgment Program

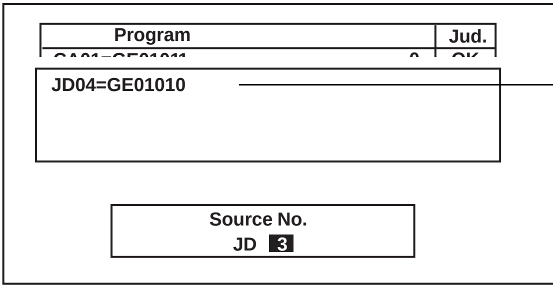
Procedure:

1. Select the register No. of the judgment program you want to create.

2. Press <B> to display the **Copy Source Number** selection window.



3. Input and confirm the number of the register where the judgment condition program that you want to copy is stored.



When you select the copy source number, the judgment condition stored in the source register is displayed in the destination register.

4. If you wish to use the copied judgment condition as is, press **C** (Return) to register it. If you want to modify the judgment condition, press <Enter> to display setting items, and edit it using the same procedure that you would use to create a program (see page 13 - 32).

5. If you wish to use the copied numerical calculation program as is, press <C> (Return) to register it. If you want to modify the numerical calculation program, press <Enter> to display setting items, and edit it using the same procedure that you would use to create a program (see page 13 - 16).

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 90 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.**

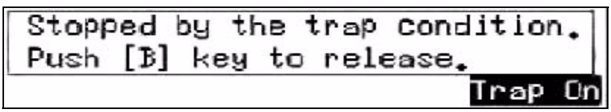
NG Operation

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>.

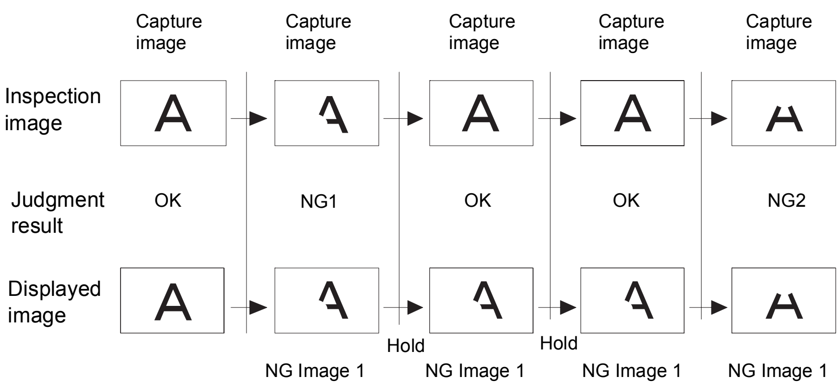
2. If **Save Image Data** is also set for the Trap function in addition to the settings for (1), the memory image at the time the NG occurs is saved (see page 15 - 5). Unlike 1., the READY signal stays on, so it is possible to continue performing inspections after a NG is generated.

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** or **Binary 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:**



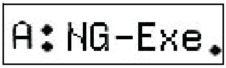
It is also possible to set and change checkers when an NG image is being displayed. However, in the following cases, the NG display image is reset:

- 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

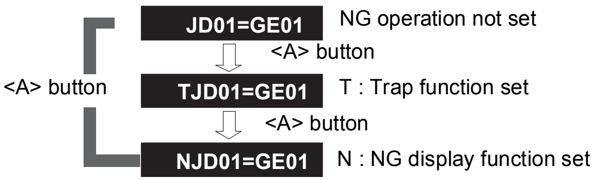
Procedure:

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.

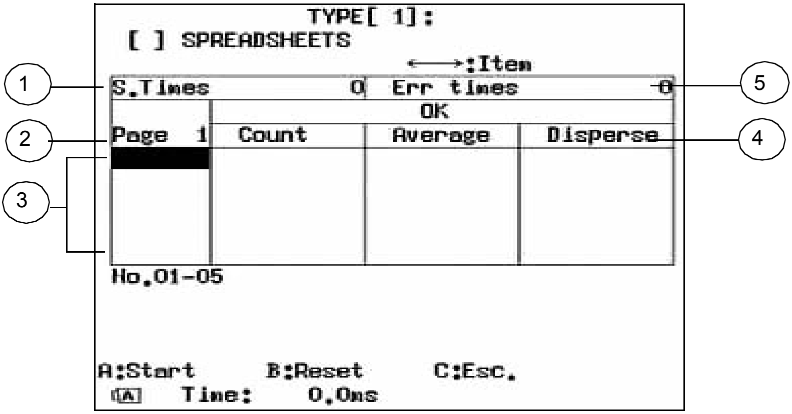
3. Press <A> to display a **T** to the left of the Register No.
   Press it again to display an **N** to the left of the Register No.



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 = $(S((X_n – X_{ave})\ ´\ (X_n – X_{ave})))/n$
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
		3	OK average
		4	NG average
		5	OK dispersion
		6	NG dispersion
		7	OK maximum value
		8	NG maximum value
		9	OK minimum value
		10	NG minimum value
		11	OK range
		12	NG range

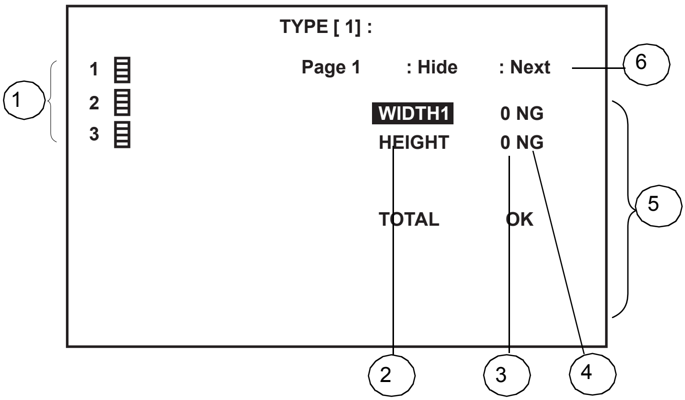
Data Monitor

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 1 - 10**.**
For information on changing the display permanently, see page 3 - 25**.**

The Data Monitor Display

The inspection result values are displayed with their titles. Up to 10 items can be displayed on each page.



1 Status of checker block 1 to block 3 (see page 2 - 7 and figure below)
2 Title (up to 8 characters)
3 Numerical calculation result (up to 6 digits)
4 Numerical calculation judgment result
5 Data display (up to 10 items per page)
6 Move the cursor lever to the right to turn the page and display the next 10 items.

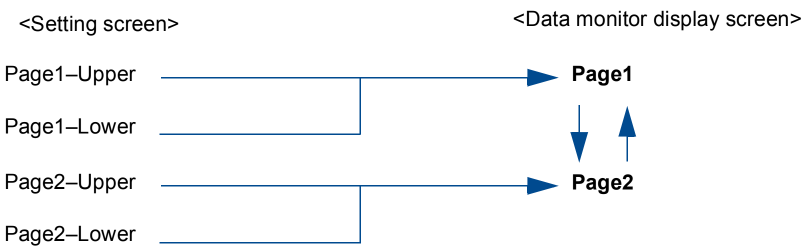
The status of checker block 1 to 3 is indicated as shown below:

▤ : ON ▯ : OFF

Execute All	1 ▤ 2 ▤ 3 ▤	Autom. Switch (Automatic Switch)	1 ▤ 2 ▤ 3 ▯ **or** 1 ▤ 2 ▯ 3 ▤	User–Defined	1 ▤ 2 ▯ 3 ▯ **or** 1 ▯ 2 ▤ 3 ▯ **or** 1 ▯ 2 ▯ 3 ▤

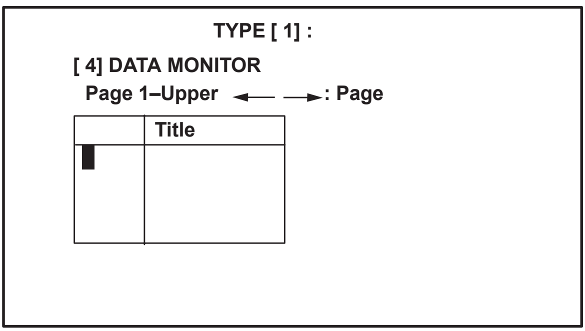
Setting the Data Monitor Display

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:

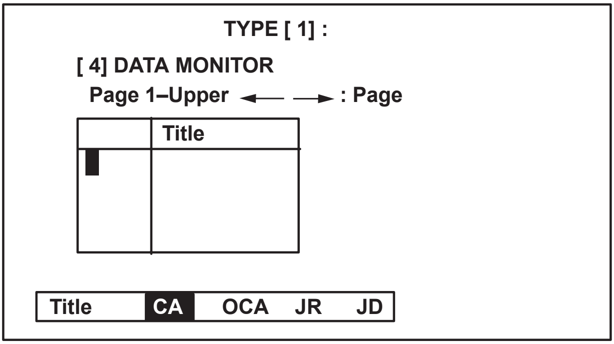


Procedure:

1. Select 4. Data Monitor from the menu and confirm the selection

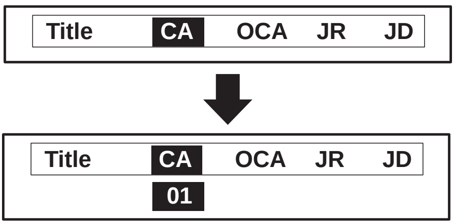


2. Press <Enter> to display the register selection window



3. Use the cursor lever to select the register to display in the Data Monitor and confirm the selection

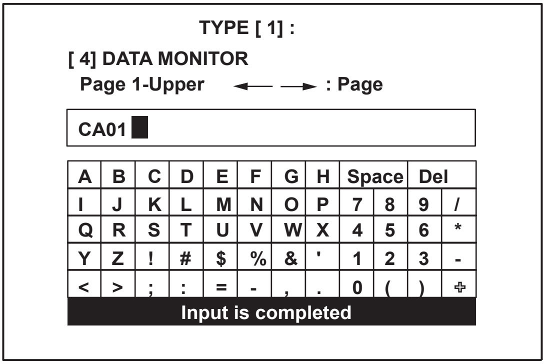
   Example: Select CA01.



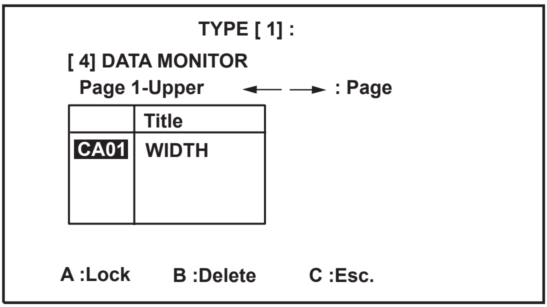
After you select a register, the title input window will appear.

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 3 - 20.



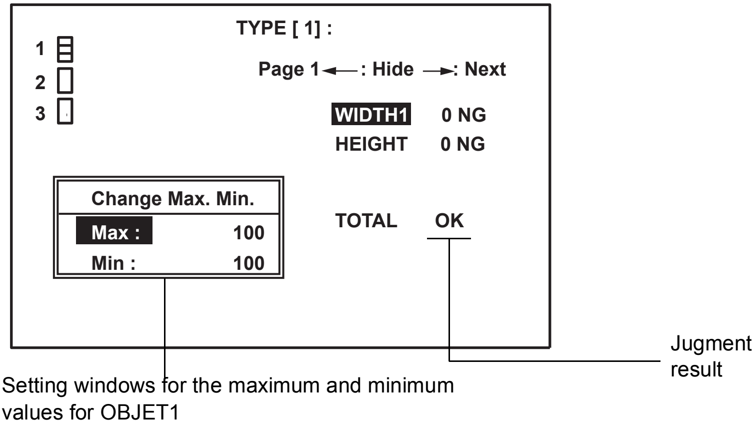
5. When you have finished entering the title, select Input Complete and confirm to display the title that you input



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 1 - 14.

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>

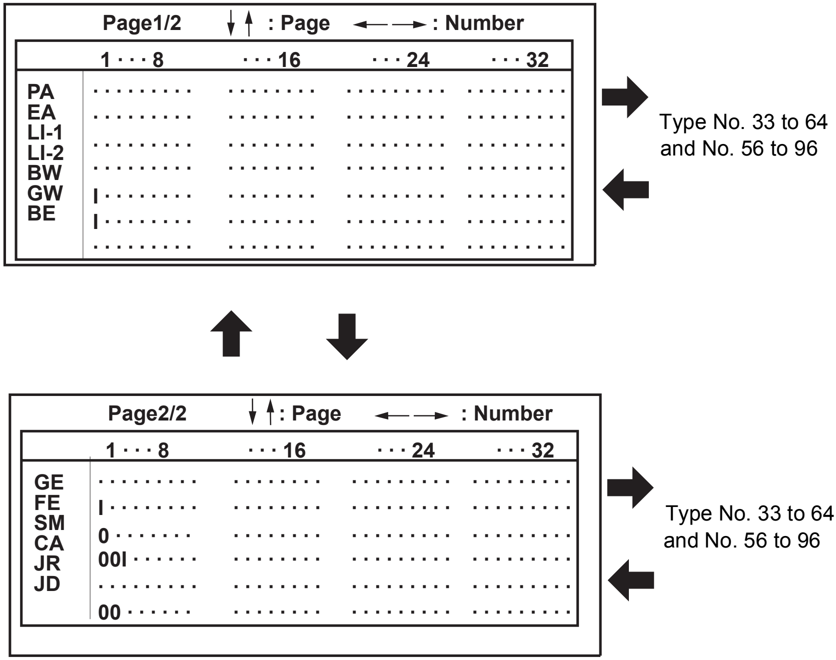
Checker List

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 1 - 10**.**
For information on changing the display permanently, see page 3 - 25**.**

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
	EA	Exposure Adjustment
	LI-1	Line Checker (Dot Judgment)
	LI-2	Line Checker (Land Judgment)
	BW	Binary Window Checker
	GW	Gray-Scale Window Checker
	BE	Binary Edge Checker
2/2	GE	Gray-Scale Edge Checker
	FE	Feature Extraction
	SM	Smart Matching
	CA	Numerical Calculation Register
	JR	Judgment Output (R register)
	JD	Judgment Output (D register)

Use the cursor lever to switch the checker number to display. 32 items are displayed at a time (1 to 32, 33 to 64, and 65 to 96).

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.

```
Now Saving.
Please wait about one minute.
```

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 7. 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

Via the Serial Interface

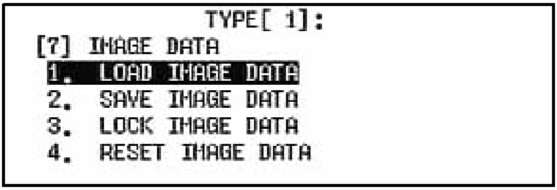
You can use the serial command $\%M^{C}_{R}$ to initiate a data save from an external device. For more details, see page 16 - 42.

CHAPTER 15

Useful Functions

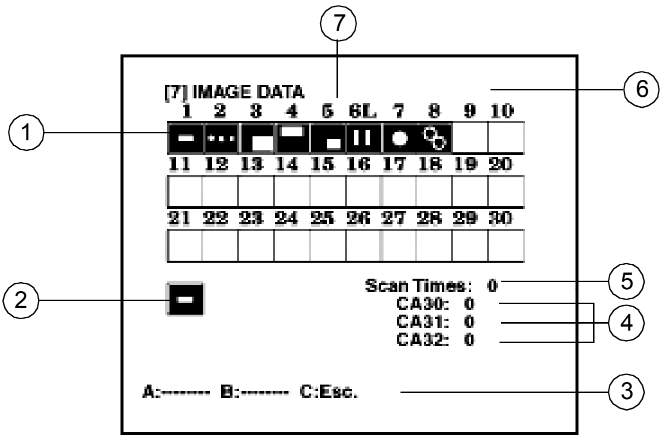
Loading and Saving Image Data

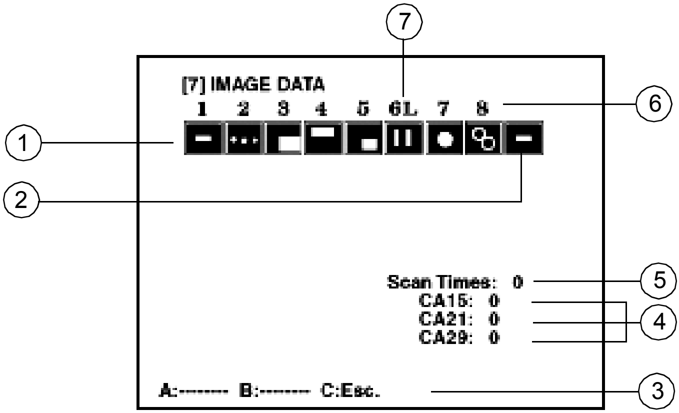
Image data from an image captured by a camera can be saved in memory. Up to 30 screens can be saved for the XUVM210 (8 for the XUVM110).



Load Image Data

Call up saved images. When image data is loaded, 30 reduced-size (8 for the XUVM110) 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 3 - 16).

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**, 30 reduced-size screens (8 for the XUVM110) are displayed.

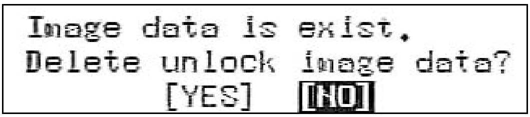
Procedure:

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 on the XUVM210

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:

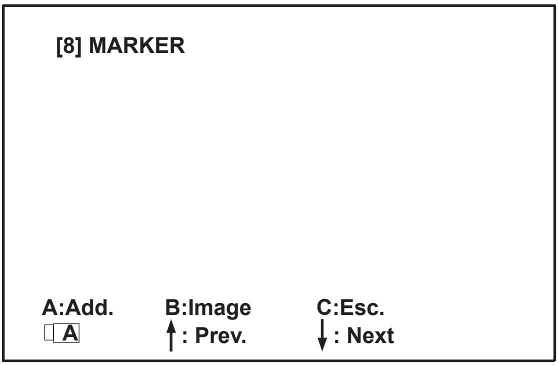
- Do not upload a type that has different camera connection information, or
- Delete all images saved before invoking VBT.

Marker Function

The Marker function allows you to draw lines and shapes such as rectangles and ellipses in the display screen (up to a maximum of eight items). You can use these marker graphics as guides for positioning objects for inspection.

Note **To display markers in this type only, press <C> in the main menu to display the** Change Display **window and set the option** 6. Marker **to ON (**see page 1 - 10**).**

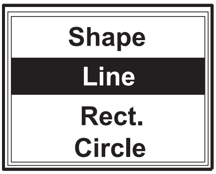
To display markers in all types, change the initial display settings by activating 66. Marker **in the option** 6. Menu Setting **in the** Type **menu (**see page 3 - 25**).**



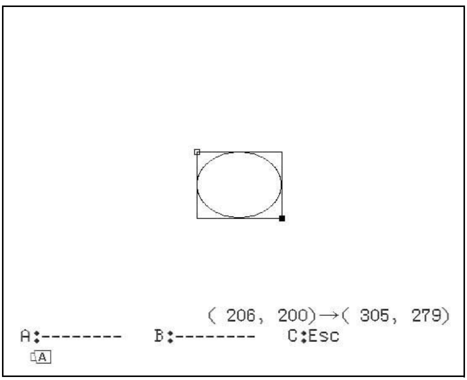
Creating a Marker

Procedure:

1. Make sure you have activated the marker display (see notes above)
2. Select 3. **Checker** from the main menu
3. Select 8. **Marker** from the Checker menu
4. Press **<A>** to add a marker
5. Select either **Line**, **Rect**., **or Circle**

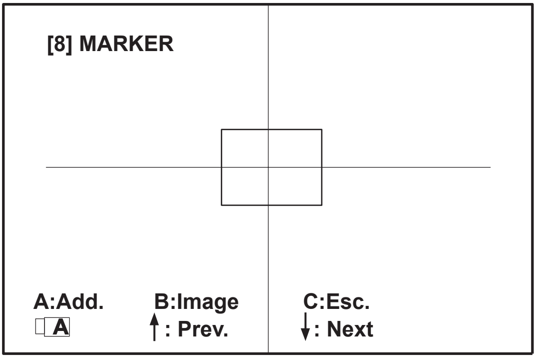


6. Draw the **marker**
   For information on how to set checker and marker areas, see page 2 - 28.

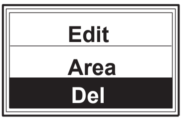


Deleting a Marker

1. **Select the marker to be deleted**
   The currently selected graphic is highlighted (displayed more brightly than the rest).



2. **Press <Enter> to display the setting window**



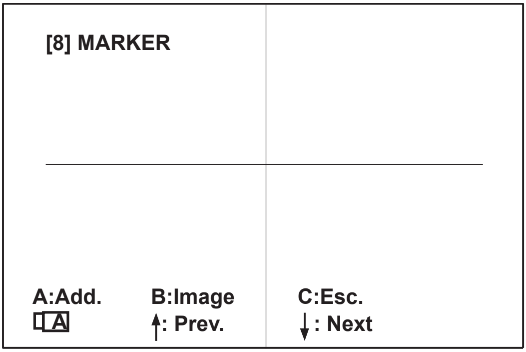
3. **Select** Del (Delete)
   A confirmation window will appear asking you to confirm the deletion.

4. **Select and confirm either** Yes (delete) or No (do not delete)

Moving and Resizing a Marker

Procedure:

1. **Select the marker to edit**
   The currently selected marker graphic is highlighted (displayed more brightly than the rest).



2. **Press <Enter> to display the setting window**

3. **Select** Area
   The start point of the selected marker will be displayed.

4. **Move or resize the marker in the same way as you would when creating a new marker**
   For information on how to move and resize checker and marker areas, see page 2 - 28.

Hide Setting

It is possible to hide and unhide individual operating menu items and setting items. This feature can be used when you do not want to change the setting contents, or when you want to hide unnecessary menu items.
The settings are protected by password. The factory-set original password is ”0000”.

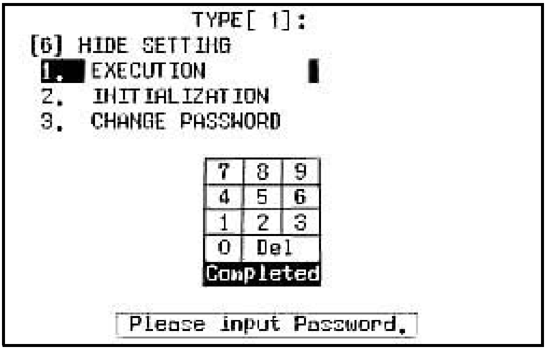
1. Execution
Apply the hide mode to items selected after the password has been input. Items to which the setting is applied will no longer be displayed.

2. Initialization
Restore the default setting on all items to which the hide mode has been applied. The default setting is to show all items.

3. Change Password
Change the set password.

Entering the Password

When you use **6. Hide Setting**, the screen shown below appears. You need to enter a password.



Procedure:

1. Use the cursor lever to enter the password, selecting one character at a time. If you make a mistake, select **Del** and the last character entered will be deleted.

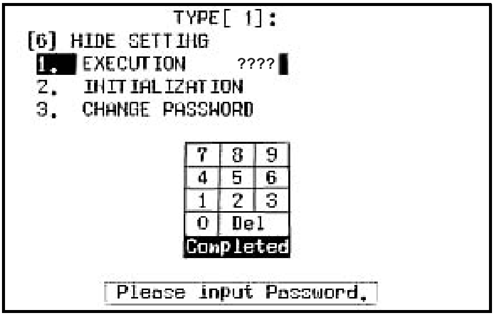
2. After you have entered the entire password, select **Completed**, and press **<Enter>**.

Note	**The password can be between one and ten digits long.**

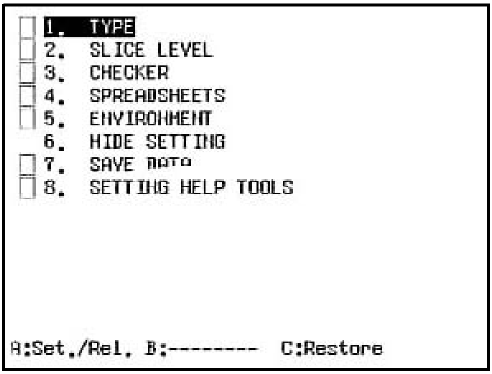
How to Activate Hide Mode

Procedure:

1. Select **Execution** and the following screen appears.



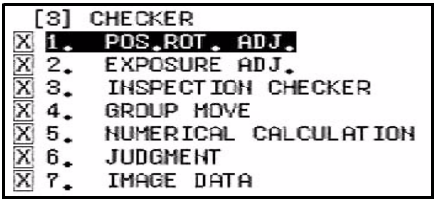
2. Enter the correct password to enter hide mode.



3. If you press <A>, an ”x” will appear in the box to the left of the number of the line where the cursor is placed and Hide mode is activated. Press <A > again to remove the ”x” and cancel the Hide mode setting. Menus marked with the ”x” will not be displayed in normal setup mode.

Handling of Submenus

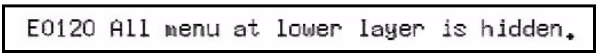
If all the submenu items in a particular menu are marked, the menu itself will be marked automatically.



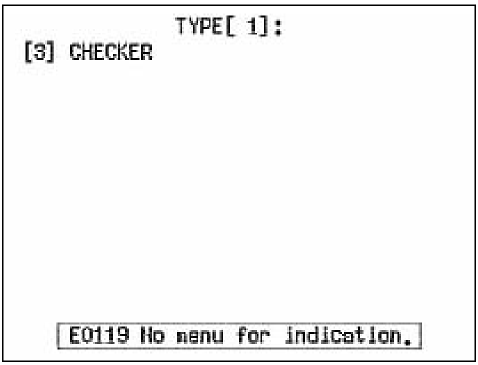
Upper–level menu

An ‘x’ is automatically set in the upper–level menu.

If you attempt to clear the ”x” in the upper-level menu, the following message will be displayed.



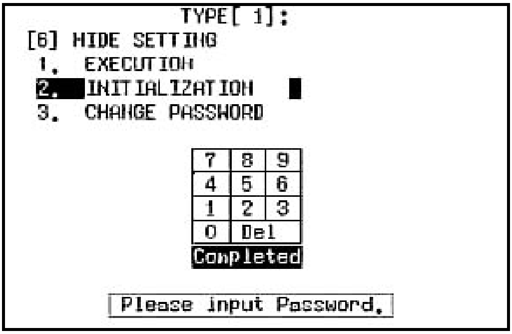
In the main menu, if you access a menu of which all submenus are set to **Hide**, the following message is displayed:



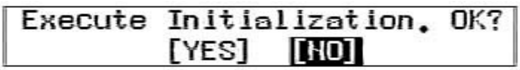
Initializing Hide Setting Information

Procedure:

1. Select **Initialization** and the following screen appears.



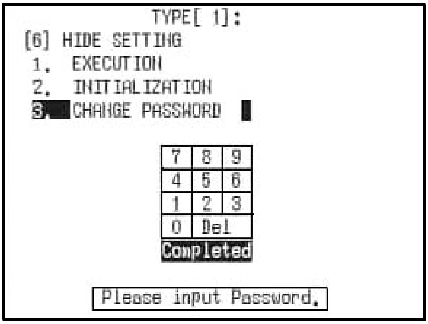
2. Enter the password and you will be asked whether you want to perform an initialization.



Select **YES** to initialize settings. Select **NO** to abort initialization. If you initialize settings, all hide settings are canceled, and all of the menus will be displayed.

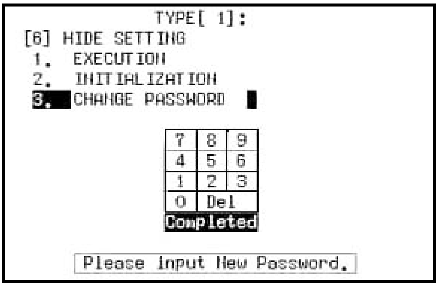
Changing the Password

1. Select **Change Password** and the following message appears.

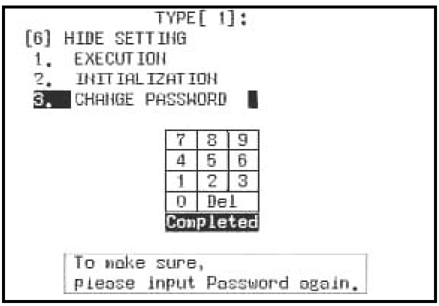


2. Enter the password

3. If the entered password is correct, you will be prompted to enter the new password. Set a password of your choice (between 1 and 10 digits).



4. You will be prompted to enter the new password a second time for confirmation. Enter the new password again. If you make a mistake entering the new password, the password will not be changed.



If You Forget Your Password
Please contact your local branch of Telemecanique.

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 **3. Checker** from the main menu.

2. Select **4. Group Move** from the **Checker** menu.

```
                TYPE[ 1]:
[4] GROUP MOVE
 No.  00
 1.   EXPOSURE ADJ.           Yes
 2.   LINE                    Yes
 3.   BINARY WINDOW           Yes
 4.   GRAY WINDOW             Yes
 5.   BINARY EDGE DETECTION   Yes
 6.   GRAY EDGE DETECTION     Yes
 7.   FEATURE EXTRACTION      Yes
 8.   SMART MATCHING          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 32 for the XUVM210	Move all checkers adjusted by the specified position and rotation adjustment group number.
1 to 4 for the XUVM110	

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

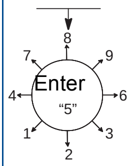
Available Functions for Parallel and Serial Interface

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 - 28		
Start Execute All/Autom. Switch inspection	Input	Specific substitution formula not executed	STA (START)	16 - 28		16 - 24
	Input	Specific substitution formula executed	ACK + STA (START) signal (hold ACK until RDY goes OFF)	16 - 28		16 - 24
	Input	Re-inspect (image capture: not executed)	IN6 (no image capture specified)+STA	16 - 28		16 - 24
Start User-Defined (specified block) inspection	Input	Specific substitution formula not executed	IN1 to IN2 (block specified)+STA	16 - 28	$\%S?^{C}_{R}$ (?=1 to 3)	16 - 24
	Input	Specific substitution formula executed	IN1 to IN2 (block specified) +IN6 +STA (hold ACK until RDY OFF)	16 - 28	$\%P?^{C}_{R}$ (?=1 to 3)	16 - 24
	Input	Block specification: Re-inspect (image capture: not executed)	IN1 to IN2 (block specified) +IN6 (reinspect specified) +STA	16 - 28	$\%R?^{C}_{R}$ (?=1 to 3)	16 - 24
Image capture complete	Output	Image capture only complete	REN (REND)	16 - 35	$\%R^{C}_{R}$	16 - 24

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	See page	Command	See page
Output inspection data	Output	Inspection complete (before data output)			%E$^{C}{}_{R}$	16 - 24
	Output	Judgment output	D1 to D8 (For D9 and after, handshaking using the ACK signal and the STROBE signal is required.)	16 - 32	Example: 002148030912$^{C}{}_{R}$ or 21,4803,912$^{C}{}_{R}$ etc.	16 - 25
	Output	Numerical data	D1 to D8 (Handshaking using the ACK signal and the STROBE signal is required.)	16 - 33		16 - 25
Slice Level No. (Group A to F) A=1, B=2...F=6	Input	Refer to max. and min. limits			%L?$^{C}{}_{R}$ (?=1 to 6)	16 - 58
	Output	Response to reference			%L?,n,n$^{C}{}_{R}$ (?=1 to 6)	16 - 58
	Input	Change max. and min. limits			%T?,n,n$^{C}{}_{R}$ (?=1 to 6)	16 - 58
	Output	Change complete			%T?,n,n$^{C}{}_{R}$ (?=1 to 6)	16 - 58
Gray-Scale Edge Threshold	Input	Refer to threshold value			%K??(,n)$^{C}{}_{R}$ (??=01 to 96)	16 - 61
	Output	Response to reference			%K??,n,n$^{C}{}_{R}$ (??=01 to 96)	16 - 61
	Input	Change threshold value			%G??,n(,n)$^{C}{}_{R}$ (??=01 to 96)	16 - 61
	Output	Change complete			%G??,n,n$^{C}{}_{R}$ (??=01 to 96)	16 - 61
Smart Matching Checker re-registration	Input	Specification of Smart Matching checker No. + Re-registration signal	IN1 to 7 (Smart Matching checker No.) + IN8 (Re-registration signal)	16 - 45		
	Output	Switching complete	Confirm by RDY (READY) signal OFF to ON transition.	16 - 42		

Item	*Input or output*	*Details*	*Parallel* I/O terminal	*Parallel* See page	*Serial* Command	*Serial* See page
Numerical Calculation	Input	Refer to max. and min. limits			$\%F??^{C}_{R}$ (??=01 to 96)	16 - 63
	Output	Response to reference			$\%F??,n,n^{C}_{R}$ (??=01 to 96)	16 - 63
	Input	Change max. and min. limits			$\%N??,n,n^{C}_{R}$ (??=01 to 96)	16 - 64
	Output	Change complete			$\%N??,n,n^{C}_{R}$ (??=01 to 96)	16 - 64
Switch Type	Input	Specification of type No. to switch to + switching signal	IN1 to 6 + TYPE	16 - 40	$\%X??^{C}_{R}$ (??=01 to 64)	16 - 40
	Output	Switching complete	Confirm by RDY (READY) signal OFF to ON transition.	16 - 40	$\%Y??^{C}_{R}$ (??=01 to 64)	16 - 40
Save Type Data	Input	Save data instruction			$\%M^{C}_{R}$	16 - 42
	Output	Save complete			$\%M^{C}_{R}$	16 - 42
Camera switching	Input	Easy mode (switching between A and B)	IN7	16 - 56		
		Details mode (A or B, Thru or Memory))	IN1 to 2 (Image specification) + IN7 (Switching signal	16 - 56	$\%I?^{C}R$ (??=0 to 3)	16 - 55
	Output	Switching complete	Confirm by RDY (READY) signal OFF to ON transition	16 - 56	$\%I^{C}R$ (for switching with **Details** mode only)	16 - 55

Item	*Input or output*	*Details*	*Parallel*		*Serial*	
			I/O terminal	See page	Command	See page
Spreadsheets	Input	Spreadsheet reset			%Q^{C}R	16 - 19
	Output	Reset complete			%Q^{C}R	16 - 19
Key Emulate	Input	Cursor lever (8 directions)			STX Key codeETX 	16 - 65
	Input	<Enter> key input			STX5ETX	
	Input	<A>,< B>, and <C> Input key			STX Key code ETX A Key: A B Key: B C Key: C	

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
5.  Communication
    51.  Com. Mode          Normal Mode
    52.  RS232C
    53.  Serial Output
    54.  Parallel Output
    55.  Min. Ready Off Time   0 ms
    56.  Key Emulate       No
```

51. Com. Mode
see section below.

52. RS232C
see page 16 - 11

53. Serial Output
Settings required for communication via the serial interface (see page 16 - 13).

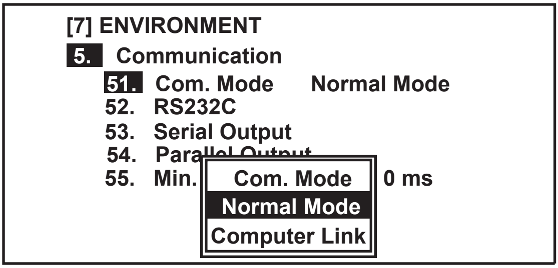
54. Parallel Output
Settings required for communication via the parallel interface (see page 16 - 16).

55. Min. Ready OFF Time
It is possible to use serial or parallel communication to set the minimum time that the Ready signal is OFF for (range 0 to 1000ms in 10ms steps). For detailed information, see page 16 - 38.

56. Key Emulate
Select this when you will perform menu selections and settings using serial commands rather than using the keypad (see page 16 - 65).

Com. Mode

Select **Computer Link** if you will be using the Computer Link function to communicate with a PLC (for example, Telemecanique PLC). Otherwise, select **Normal Mode** or **Computer Link**.



Setting	*Details*
Normal Mode	Perform communication using the proprietary VISION CONTROLLER protocol. All commands are available for use (see page 16 - 19).
Computer Link	With this mode you match the communications protocol to that of a specific PLC (Telemecanique, Series 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 Computer Link requires parallel signals (see page 16 - 67).

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
 52. RS232C
     521. Baud rate (bps)   19200
     522. Length            8
     523. Stop Bit          1
     524. Parity            None
     525. Flow Control      None
```

521.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 **Computer 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).**

522.Length

Sets the number of data bits in each byte. You can select a 7-bit or 8-bit length. For **Computer Link** mode, set the length to the PLC's data length setting.

523.Stop Bit

Selects the number of stop bits in each byte (either 1 or 2). For **Computer Link** mode, set to the same as the PLC's stop bit setting.

524.Parity

Selects the type of parity checking to use to check the data. The selection options are None, Odd, or Even. For **Computer Link** mode, set the parity to the PLC's parity check setting.

525.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 **51. Com. Mode** to **Normal Mode** and select **53. 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
53. Serial Output
    531.Output          11Colum (1-11)
    532.Inval. Digit    Repl. 0
    533.Read End        None
    534.Process End     None
    535.Numerical Calc. None
    536.Judgment        None
```

531.Output

Sets the number of digits in the output data (setting range: 1 to 11).

532.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 **531. Output**.

533.Read End

Selects whether or not to perform serial output of the image capture complete signal (%R).

534.Process End

Selects whether or not to perform serial output of the inspection complete signal (%E).

535.Numerical Calc.

Selects whether or not to perform serial output of results of numerical calculations.

536.Judgment

Selects whether or not to perform serial output of the judgment results.

Serial Output Settings for Computer Link

The screen below will appear when you have set **51. Com. Mode** to **Computer Link** and select **53. Serial Output** to set the output conditions for the serial interface. Here you select the data, signals and format for performing serial communication using Computer Link.

```
[7] ENVIRONMENT
53. Serial Output
     531.  Type No Register      0
     532.  Top Data Register   0
     533.  Timeout      5000ms
     534.  Output     16bit
     535.  Numerical Calc.      None
     536.  Judgment      None
     537.  PLC Type      MODBUS
```

531.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.

532.Top Data Register

Sets the top register number for use when outputting data to PLC. The setting range is 0 to 9999.

533.Timeout

Sets the maximum time to wait for a response after outputting data to the PLC, or after requesting a type switching number.

534.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.

535.Numerical Calculation
Sets whether or not to output the numerical calculation results.

536.Judgment
Sets whether or not to output the judgment results.

537.PLC Type
Sets the PLC type (Telemecanique PLC and models from some other manufacturers are available).

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
 54. Parallel Output
  541. Handshake        Yes
    5411. Timeout       5000ms
    5412. Delay Time    300ms
    5413. Numerical Calc.   None
    5414. Judgment      Out
  542. Reset Cond.        Latch
  543. Setting Template     No
  544. Disp. Img. Change     Easy Mode
```

541.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 **5411 Timeout** to **5414 Judgment** as well.

5411.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.

5412.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

5413. 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).

5414.Judgment

Selects whether or not to output judgment results if handshaking is performed.

Note **If you use handshaking,** 5413. Numerical Calc. **and** 5414. Judgment **cannot both be set to** None**. One of the two must be set for output.**

542.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 - 35.

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).

543.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.

544. 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 - 53.

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 XUVM110/210	Execute All/Autom. Switch start inspection command	Numerical calculation for specific substitution not executed.
%P $^{C}{}_{R}$ (*1)	External device to XUVM110/210	Execute All/Autom. Switch start inspection command	Numerical calculation for specific substitution executed.
%R $^{C}{}_{R}$ (*1)	External device to XUVM110/210	Execute All/Autom. Switch reinspect 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.
%S? $^{C}{}_{R}$ (*1)	External device to XUVM110/210	User-Defined start inspection command (block specification)	Numerical calculation formula for specific substitution is not executed. Block numbers are 1 to 3.
%P? $^{C}{}_{R}$ (*1)	External device to XUVM110/210	User-Defined start inspection command (block specification)	Numerical calculation formula for specific substitution is executed. Block numbers are 1 to 3.
%R? $^{C}{}_{R}$ (*1)	External device to XUVM110/210	User-Defined/ Reinspect command	Checker is executed without image capture. Numerical calculation formula for specific substitution is not executed.
%R $^{C}{}_{R}$	XUVM110/210 to external device	Capture end command	Capture end command not output if **533. Read End** (Normal mode) in the **Environment** menu is set to **None**.
%E $^{C}{}_{R}$	XUVM110/210 to External device	Inspection end command	Inspection end command not output if **534. Process End** in the **Environment** menu is set to **None**.
Example: 1012341234 $^{C}{}_{R}$	XUVM110/210 to External device	Inspection data	Changes according to menu items 531 to 536 in Normal mode. Output sequence is judgment, then numerical calculation data.

Data	Transmission	Function	Notes
%X?? ${}^{C}{}_{R}$	External device to XUVM110/210	Type switching command	Type switch numbers are from 01 to 64 (01 to 32 for the XUVM110).
%Y?? ${}^{C}{}_{R}$	XUVM110/210 to External device	Type switching end command	Output when type switching ends normally.
%M ${}^{C}{}_{R}$	External device to XUVM110/210	Type data save command	Saves the type data.
%M ${}^{C}{}_{R}$	XUVM110/210 to External device	Save complete command	Output when saving of the type data is completed normally.
%L? ${}^{C}{}_{R}$	External device to XUVM110/210	Slice level maximum and minimum value reference command	Checks the maximum and minimum values of the slice levels A to F (corresponding to 1 to 6).
%L?, [minimum], [maximum] ${}^{C}{}_{R}$	XUVM110/210 to External device	Slice level maximum and minimum value notification command	Output in response to the slice level maximum and minimum value reference command.
%T?,[minimum], [maximum] ${}^{C}{}_{R}$	External device to XUVM110/210	Slice level maximum and minimum value modify command	Modifies the maximum and minimum values of the slice levels A to F (corresponding to 1 to 6).
%T?,[minimum], [maximum] ${}^{C}{}_{R}$	XUVM110/210 to External device	Modification complete command	Output when modification of the slice level maximum and minimum values is completed normally.
%K??,[type] ${}^{C}{}_{R}$	External device to XUVM110/210	Gray-scale edge threshold value reference command	References the gray scale edge threshold value. Register numbers are from 01 to 96 (01 to 48 for the XUVM110).
%K??, [type], [thres. value] ${}^{C}{}_{R}$	XUVM110/210 to External device	Gray-scale edge threshold value notification command	Output in response to the gray scale edge threshold reference command.
%G??, [thres. value], [type] ${}^{C}{}_{R}$	External device to XUVM110/210	Gray-scale edge threshold value modify command	Modifies the gray-scale edge threshold value. Registers numbers are from 01 to 96 (01 to 48 for the XUVM110).
%G??,[thres. value], [type] ${}^{C}{}_{R}$	XUVM110/210 to External device	Modification complete command	Output when modification of the gray-scale edge threshold value is completed normally.
%N??, [minimum], [maximum] ${}^{C}{}_{R}$	External device to XUVM110/210	Change command for numerical calculation maximum and minimum values	Changes the maximum and minimum values for a numerical calculation. Register numbers are 01 to 96 (01 to 48 for the XUVM110).

Data	Transmission	Function	Notes
%N??, [minimum], [maximum] $^{C}_{R}$	XUVM110/210 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 XUVM110/210	Reference command for numerical calculation maximum and minimum values	References the maximum and minimum values for a numerical calculation. Register numbers are 01 to 96 (01 to 48 for the XUVM110).
%F??, [minimum], [maximum] $^{C}_{R}$	XUVM110/210 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 XUVM110/210	Camera change command	Changes the display camera.
%I $^{C}_{R}$	XUVM110/210 to External device	Camera change complete command	Output when the camera change was completed normally.
%Q $^{C}_{R}$ (*1)	External device to XUVM110/210	Spreadsheets data reset command	Clears spreadsheet scanning and error counts, averages, dispersions, maximum and minimum values, and ranges.
%Q $^{C}_{R}$	XUVM110/210 to External device	Spreadsheets data reset answer command	Output after spreadsheet reset has been completed.
%Z $^{C}_{R}$	XUVM110/210 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.
%U $^{C}_{R}$	XUVM110/210 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.

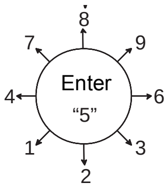
Note **Perform serial communications using the main menu when READY = ON.**

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.

Key Emulate

Data	*Transmission*	*Notes*	
STX <u>Key code</u> ETX (1 to 9, A to C)	External device to XUVM110/210		A Key: A B Key: B C Key: C

Note **No response is returned from the XUVM110/210.**

For more details, see page 16 - 65.

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="2">IN1 to 2
User-Defined execution Block No. specification register</td><td rowspan="6">IN1 to 6
Type No. specification register for type switching (the timing for the type switch depends on the TYP signal input)</td><td rowspan="6">IN1 to 7
Smart matching checker No. specification register for template re-registration
XUVM210: Smart matching No. = 01 to 96
XUVM110: Smart matching No. = 01 to 48</td><td rowspan="2">IN1 to 2
Camera/Image specification when the option 544. Disp. Img Change is set to Details.</td></tr>
<tr><td>IN2</td></tr>
<tr><td>IN3</td><td rowspan="6"></td><td rowspan="4"></td></tr>
<tr><td>IN4</td></tr>
<tr><td>IN5</td></tr>
<tr><td>IN6</td></tr>
<tr><td>IN7</td><td rowspan="2"></td><td colspan="2">The IN7 function changes depending on the settings of the option 54. Parallel Output in 5. Communication in the Environment menu. If the option 543. Template Setting is set to No, IN7 is used to switch the camera display (IN1 to IN6 can be used for template re-registration, see page 16 - 38).</td></tr>
<tr><td>IN8</td><td>IN8
Template re-registration signal</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 5. **Communication**

```
[7] ENVIRONMENT
 5.  Communication
      51.  Com. Mode      Normal Mode
      52.  RS232C
      53.  Serial Output
      54.  Parallel Output
```

Make the following settings.

3. **Set the optio**n 51. Com. Mode to Normal Mode
   In this example, we will use **Normal Mode** (for details, see page 16 - 9). If you use **Computer Link**, see page 16 - 14.

4. **Select the option** 52. RS232C
   For details on the settings, see page 16 - 11.

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 - 11).

6. **Check that READY = ON**

7. **Start the inspection with one of the commands from the table below**

Command Mode	*[%S$^{C}_{R}$]*	*[%P$^{C}_{R}$]*	*[%R$^{C}_{R}$]]*
Execute All Autom. Switch User-Defined	Image capture + checker execution	Image capture + checker execution + specific substitution	Checker execution (reinspect the same image)

Note **In** User-Defined **mode, you need to specify the checker block to be executed. The commands are [%S?$^{C}_{R}$], [%P?$^{C}_{R}$], and %R?$^{C}_{R}$], with the ? representing the checker block number (1 to 3).**

The following commands are output only if **535. Numerical Calc** and/or **536. Judgment** in the option **53. Serial Output** are set to **Output**.

%R$^{C}_{R}$ Output timing:After completion of image capture

%E$^{C}_{R}$ Output timing:After completion of inspection and before result output (output immediately before the result data)

Output Examples

The output format of the results changes depending on the settings in **53. Serial Output**.

Ex:

Serial output, when 532. Inval. Digit = Del and no error occurs in numerical calculation

JD01=ON
JD02=OFF
CN01=2513
CN02=325
CN03=-15
CN04=98

Inspection results

[7] ENVIRONMENT
53. Serial Output

531.	**Output**	**4Colum (1-11)**
532.	**Inval. Digit**	**Del**
533.	**Read End**	**None**
534.	**Process End**	**None**
535.	**Numerical Calc.**	**Output**
536.	**Judgment**	**Output**

Output settings

1,0,2513,325,-15,98$^{C}_{R}$

Serial output

Ex:

Serial output, when 532. Inval. Digit = Del and an error occurs in numerical calculation

Inspection results

JD01=ON
JD02=OFF
CN01=2513
CN02=e (An error occured during calculation)
CN03=-15
CN04=98

Output settings

[7] ENVIRONMENT
53. Serial Output

531.	**Output**	**4Colum (1-11)**
532.	**Inval. Digit**	**Del**
533.	**Read End**	**None**
534.	**Process End**	**None**
535.	**Numerical Calc.**	**Output**
536.	**Judgment**	**Output**

Serial output

1,0,2513,e,-15,98$^{C}{}_{R}$

Ex:

Serial output, when 531. Output = 4Column(1-11) and 532. Inval. Digit = Repl.0 and no error occurs in numerical calculation: XUVM110/210 fills in zeros until number of digits specified in 531. Output is reached. Values are not separated by commas

Inspection results

JD01=ON
JD02=OFF
CN01=2513
CN02=325
CN03=-15
CN04=98

Output settings

[7] ENVIRONMENT
53. Serial Output

531.	Output	4Colum (1-11)
532.	Inval. Digit	Repl. 0
533.	Read End	None
534.	Process End	None
535.	Numerical Calc.	Output
536.	Judgment	Output

Serial output

1,0,2513,0325,-015,0098$^{C}{}_{R}$
CN01 CN02 CN03 CN04
JD02
JD01

Ex:

Serial output, when 531. Output = 4Column(1-11) and 532. Inval. Digit = Repl.0 and an error occurs in numerical calculation. XUVM110/210 fills in zeros until number of digits specified in 531. Output is reached for all results. With errors, the zeros are replaced by spaces until number of digits specified in 531. Output is reached.

JD01=ON
JD02=OFF
CN01=2513
CN02=e (An error occured during calculation)
CN03=-15
CN04=98

Inspection results

[7] ENVIRONMENT
53. Serial Output

531.	Output	4Colum (1-11)
532.	Inval. Digit	Repl. 0
533.	Read End	None
534.	Process End	None
535.	Numerical Calc.	Output
536.	Judgment	Output

Output settings

1025130325_ _ _e0098$^{C}_{R}$

Serial output

The zeros are replaced with spaces.

Inspection Using the Parallel Interface

Procedure:

1. From the main menu, select 7. **Environment**
2. Select 5. **Communication**

```
[7] ENVIRONMENT
 54. Parallel Output
   541.  Handshake                     Yes


   542.  Reset Cond.                   Latch
   543.  Setting Template              No

   544.  Disp. Img. Change   Details Mode
```

Make the following settings.

3. **Set the option** 541. Handshake
4. **If you have set the option** 541. Handshake = No, **go to step 6**
5. If you have set the option 541. Handshake = Yes, set the options 5411. Timeout, 5412. Delay Time, 5413. Numerical Calc., and 5414. Judgment Output as required
   For details on the available settings for these options, see page 16 - 16.
6. Confirm that the parallel interface outputs the READY signal
7. Start inspection by inputting the START signal as indicated in the table below

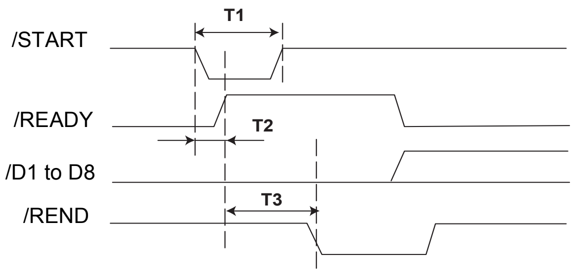
Execution mode	*Details*	*Input signal*
Execute All/Autom. Switch	Specific substitution formula: Not executed	STA (START)
	Specific substitution formula: Executed	ACK + STA signal (hold ACK until READY OFF)
	Reinspect (image capture: Not executed)	IN6 (no image capture specified) + STA
User-Defined (block specification)	Specific substitution formula: Not executed	IN1 to IN2 (block specified) + STA
	Specific substitution formula: Executed	ACK + IN1 to IN2 (block specified) + IN6+ STA (hold ACK until READY OFF)
	Group specification reinspection (image capture: Not executed)	IN1 to IN2 (block specified) + IN6 (reinspect specified) + STA

8. If you work with the execution mode User-Defined, you need to specify the checker block to be executed

Execution block number	*IN2*	*IN1*
1	OFF	OFF
2	OFF	ON
3	ON	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 JD96 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.

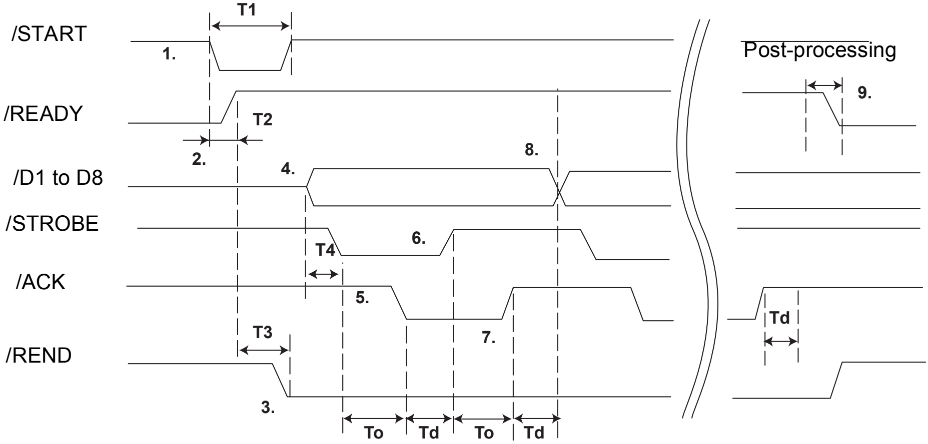
Numerical data is output in sequence from the least-significant byte. Negative values are output as two's complement only if the output data length is 32 bits; in the case of 16-bit or 8-bit data, overflow occurs.

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 **5411. Timeout** and **5412. Delay Time** in the parallel communication settings in the **Environment** menu.
To=20ms to 20000ms
Td=30μs to 200μs

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:

Cycle 2n+0

D8	D7	D6	D5	D4	D3	D2	D1
JD08	JD07	JD06	JD05	JD04	JD03	JD02	JD01

Cycle 2n+1

D8	D7	D6	D5	D4	D3	D2	D1
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** 536. Judgment (**serial output) or** 5414. 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 535. Numerical Calc. **(serial output) or** 5413. 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 24 groups (CA01 to CA04, CA05 to CA08, CA09 to CA12 ... CA93 to CA96). 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

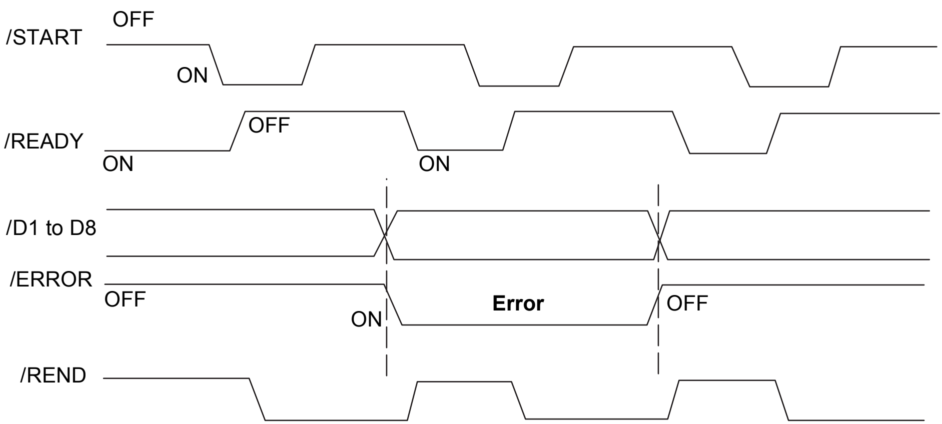
overflow flag goes ON).
8 bits: 0 to 255
16 bits: 0 to 65535
32 bits: -2147483648 to 2147483647

Timing of Output Data Switching

For the switching timing of the output data, select from among one of the following three selections from option **542. Reset Conditions**:

- Hold until the next inspection result (Latch),
- Switch OFF after image capture, or
- Switch OFF before image capture.

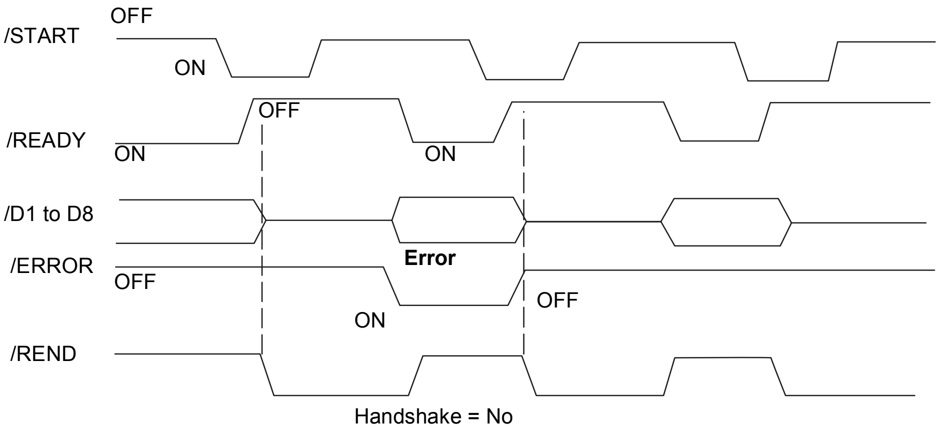
Latch
With this setting, the data is continuously output. After each inspection, the output values remain ON until the next inspection sends new results to the parallel interface.



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

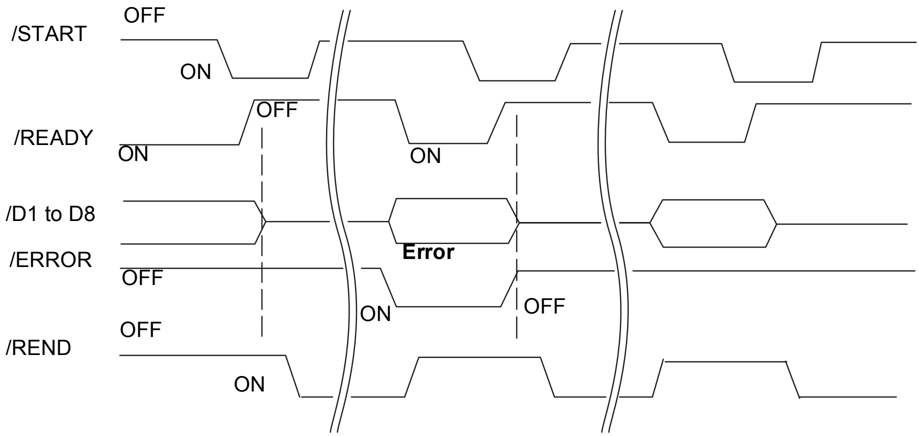
With this setting, the data output is switched OFF after image capture. After an image is captured, the outputs are all set to OFF, and the data is output when inspection ends.



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 6 + TYPE	16 - 40	%X??$^{C}{}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 40
	Output	Switching complete	Confirmation by OFF-to-ON transition of the RDY (READY) signal.	16 - 40	%Y??$^{C}{}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 40

Common Settings for Serial and Parallel Communication

```
[7] ENVIRONMENT
 5.  Communication
     51.  Com. Mode       Normal Mode
     52.  RS232C
     53.  Serial Output
     54.  Parallel Output
     55.  Min. Ready Off Time   0 ms
```

Set the option **55. Min. Ready OFF Time** (0 to 10000ms 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.

The Ready OFF times are applied in all cases except the following:

- The cursor is inside an editing menu, e.g. the checker setting menu
- When the menus for switching images or displays are active (i.e. when you press either <B> or <C> from the main menu)
- When the option **3. Start Trigger** is activated
- When you are in Vision Backup Tool mode (see page 17 - 3)

Type Switching Using Serial Communication

The commands %X01$^{C}_{R}$ to %X64$^{C}_{R}$ are used for type switching (with the XUVM110, the commands are %X01$^{C}_{R}$ to %X32$^{C}_{R}$). 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

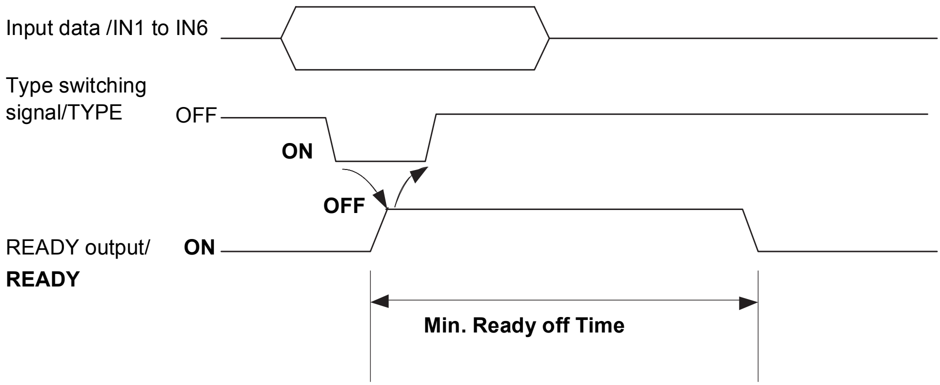
How to Specify the Type Number

Specify the value of the type number as being the actual type number minus 1, and apply it as BIN data at IN1 to IN6. With the XUVM110, apply it as BIN data at IN1 to IN5.

Type Number BIN Data Lookup Table

No.	IN6	IN5	IN4	IN3	IN2	IN1
1	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	OFF	OFF	OFF	OFF	ON
3	OFF	OFF	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	OFF	ON	ON
5	OFF	OFF	OFF	ON	OFF	OFF
6	OFF	OFF	OFF	ON	OFF	ON
7	OFF	OFF	OFF	ON	ON	OFF
62	ON	ON	ON	ON	OFF	
63	ON	ON	ON	ON	ON	
64	ON	ON	ON	ON	ON	

Timing Chart



1. After setting the type number in the input data (IN1 to IN6), 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.

Saving Type Data

Availability for Parallel and Serial Interface

Item	*Input or output*	*Details*	*Parallel*		*Serial*	
			I/O terminal	See page	Command	See page
Save type data	Input	Save data instruction			$\%M^{C}{}_{R}$	16 - 42
	Output	Save complete			$\%M^{C}{}_{R}$	16 - 42

Input the input command after confirming that the READY signal has been output from the parallel interface.

Saving Type Data Using Serial Communication

Use the following command to execute a data save.

Input $[\%M^{C}{}_{R}]$

If the data saved normally, the following command is output.

Output $[\%M^{C}{}_{R}]$

If the data could not be saved for some reason, the following command is output.

Output $[\%Z^{C}{}_{R}]$

In this case, resend the data save command until the save complete command is output. If you switch the power off before you receive the save complete message, the changed data will be lost.

Note **Never switch off the power to the unit while it is in the process of saving data. This can cause data loss and may destroy the system and make the unit impossible to restart.**

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.

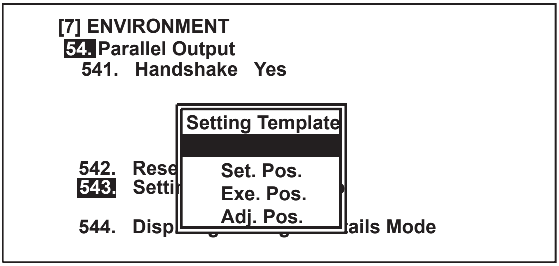
Availability for Parallel and Serial Interface

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 IN7 (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		

Note **If IN7 is used to specify the Smart Matching Checker No., it is not possible to switch camera images (for details on switching camera images,** see page 16 - 16**).**

Settings in the Communication Menu

Select from among three re-registration methods. Perform the settings in the **Environment** menu. Use the option **5. Communication**, then select **54. Parallel Output** and **543. 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 IN7. With the XUVM110, specify data in IN1 to IN6 (matching checker No. 1 to 48).

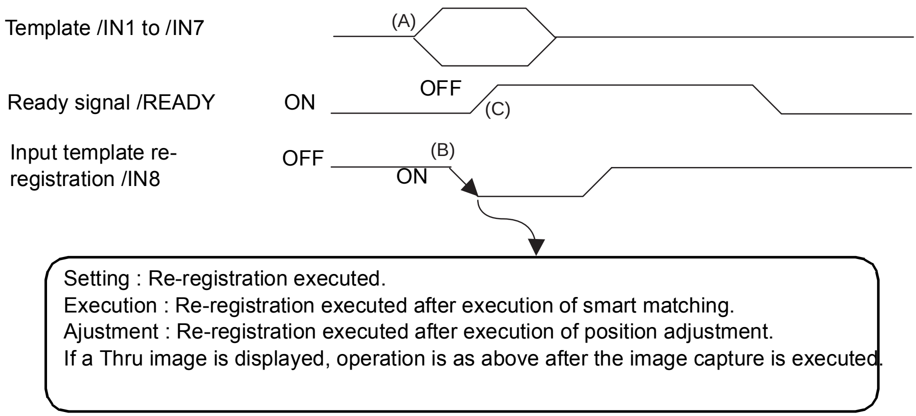
Note **With the XUVM210, use a smart matching checker number that can be specified with IN1 to IN6 (No. 1 to 64) if you use IN7 for changing the camera display (option** 544. Chg. Camera Display**,** see page 16 - 16**).**

Smart Matching Number BIN Data Lookup Table

Smart Matching No.	*IN7*	*IN6*	*IN5*	*IN4*	*IN3*	*IN2*	*IN1*
1	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	OFF	OFF	OFF	OFF	OFF	ON
3	OFF	OFF	OFF	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	OFF	OFF	ON	ON
5	OFF	OFF	OFF	OFF	ON	OFF	OFF
6	OFF	OFF	OFF	OFF	ON	OFF	ON
7	OFF	OFF	OFF	OFF	ON	ON	OFF
8	OFF	OFF	OFF	OFF	ON	ON	ON
9	OFF	OFF	OFF	ON	OFF	OFF	OFF
10	OFF	OFF	OFF	ON	OFF	OFF	ON
11	OFF	OFF	OFF	ON	OFF	ON	OFF
94	ON	OFF	ON	ON	ON	OFF	
95	ON	OFF	ON	ON	ON	ON	
96	ON	OFF	ON	ON	ON	ON	

Timing Charts for Template Re-registration

Setting, Execution, Position Adjustment, and Re-registration Area Display = NO

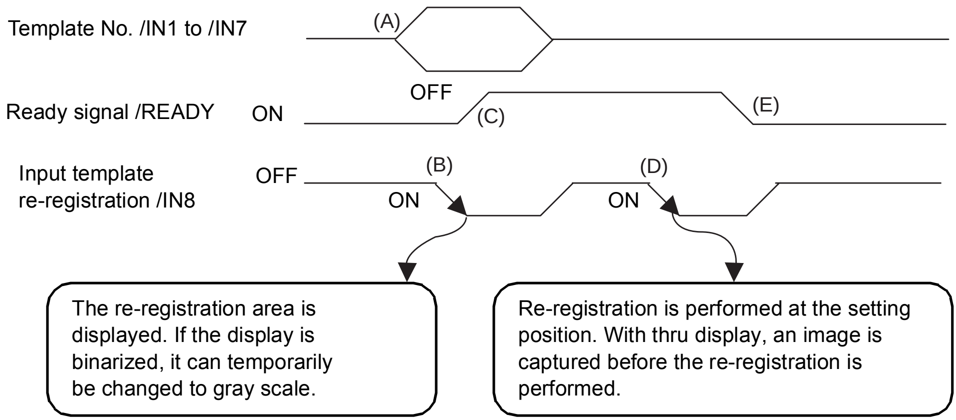


(A):When READY is ON, input the template number, IN1 to IN7.

(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 IN7.

(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.

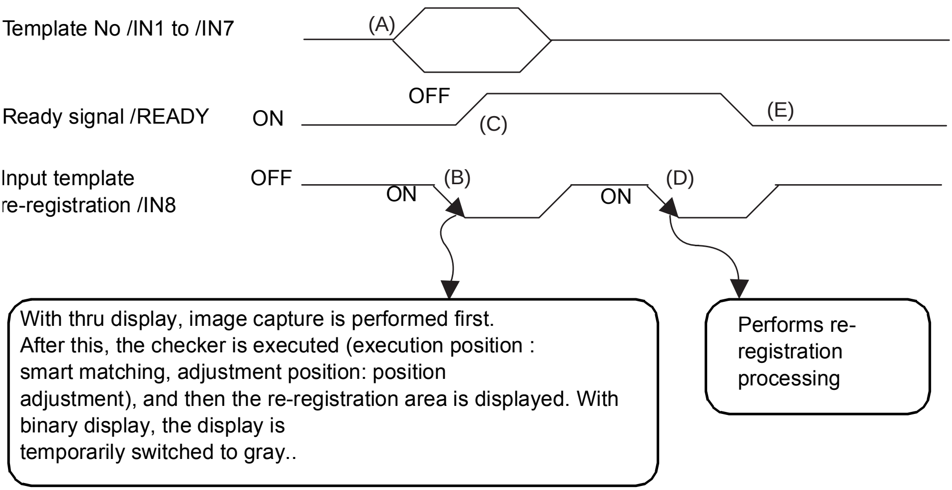
(D):While READY is OFF, input IN8 again.

(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 on IN1 to IN7.

(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, re-input IN8.

(E):After the template image re-registration area disappears, the template image is updated, and the READY signal goes ON.

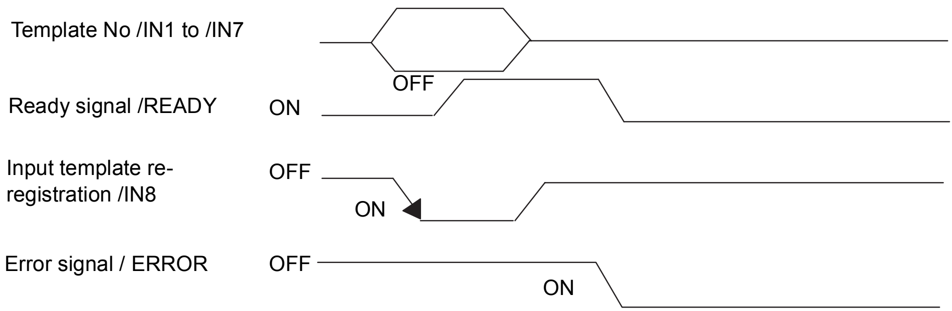
Typical causes of an error occurring at this point:

- 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

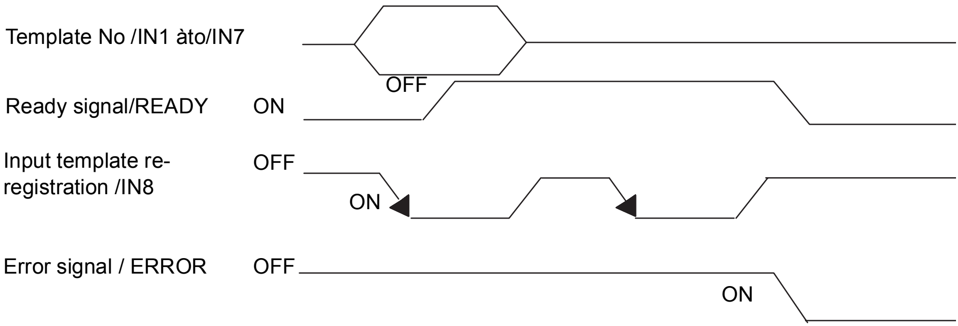
- You specified a non-existent checker.
- The specified checker number is set for an image from a camera other than that set for the capture camera.
- The result of number of detected objects from execution of the smart matching checker was 0.

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 (XUVM210 Only)

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:

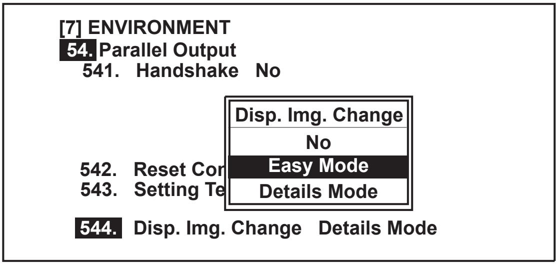
- Main menu
- Numerical calculation
- Judgment, and
- Spreadsheets

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 - 40		
		Details mode (switching between A and B, and Thru and Mem)	IN1 to IN2 (Image specification) + IN7 (switching signal)	16 - 40	$\%I?^{C}_{R}$ (??=0 to 3)	16 - 40
	Output	Switching complete	Confirm by RDY (READY) signal OFF to ON transition.	16 - 40	$\%I^{C}_{R}$	16 - 40

Settings in the Communication Menu

Perform the settings in the **Environment** menu. Use the option **5. Communication**, then select **54. Parallel Output** and **544. 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**. Select **No** if you want to perform template re-registration with a smart matching checker and the checker number is > 64.

Note **If you perform template re-registration with a smart matching checker number > 64, it is not possible to switch the camera using the parallel interface because IN7 will be needed to specify the smart matching checker number.**

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

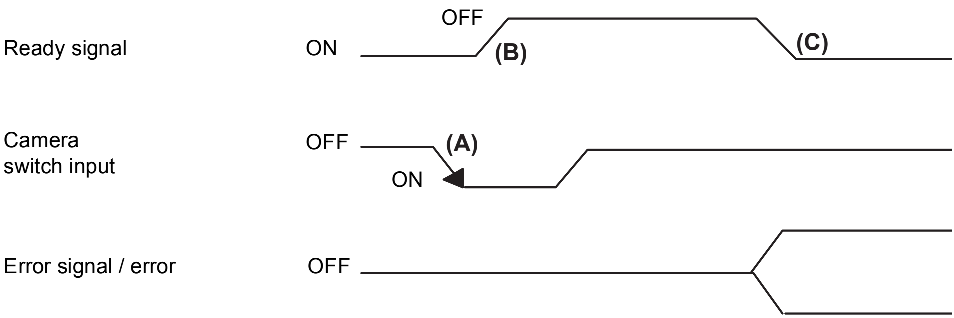
After executing switching, the following commands are returned.

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



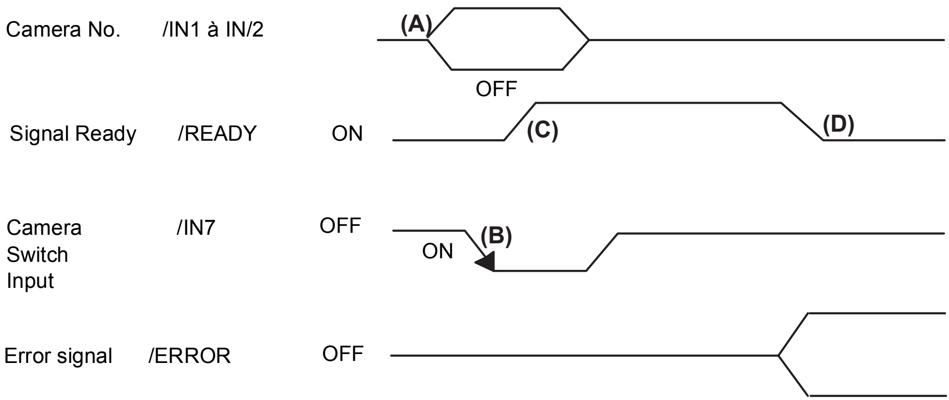
(A):With the READY signal ON, input IN7 from the external device.
(B):The OFF-to-ON transition of IN7 is detected, and the READY signal goes OFF.
(C):After the camera has switched, the READY signal goes ON (if a display switch error is generated, the ERROR flag goes ON at the same time as the READY signal).

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 Slice Level Max/Min Values

Availability for Parallel and Serial Interface

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	See page	Command	See page
Slice Level No. (Group A to F) A=1, B=2...F=6	Input	Reference maximum and minimum values (limits)			%L?$^{C}_{R}$ (?=1 to 6)	16 - 58
	Output	Response to reference			%L?,n,n$^{C}_{R}$ (?=1 to 6)	16 - 58
	Input	Change maximum and minimum values			%T?,n,n$^{C}_{R}$ (?=1 to 6)	16 - 59
	Output	Change complete			%T?,n,n$^{C}_{R}$ (?=1 to 6)	16 - 59

Input the input command after confirming that the READY signal has been output from the parallel interface.

Referencing Maximum and Minimum Values for Slice Levels

Input

%L? $^{C}_{R}$

Slice level No. (A = 1, B = 2, C = 3, D = 4, E = 5 and F = 6)

The following is output if the slice level value is referenced normally.

Output

%L?, n , n $^{C}_{R}$

Maximum Value (1 to 255)

Minimum Value (0 to 254)

Slice level No. (A = 1, B = 2, C = 3, D = 4, E = 5 and F = 6)

Changing Maximum and Minimum Values for Slice Levels

Input

%L?, n , n $^{C}{}_{R}$

Maximum Value (1 to 255)

Minimum Value (0 to 254)

Slice level No. (1 to 6)

The following is output if the slice level value is changed normally.

Output

%L?, n , n $^{C}{}_{R}$

Maximum Value (1 to 255)

Minimum Value (0 to 254)

Slice level No. (1 to 6)

Reference and Change Edge Threshold Values

When using an inspection checker or gray-scale edge detection checker for position adjustment, it is possible to reference and modify the gray-scale edge detection threshold values 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
Gray-Scale Edge Detection Threshold	Input	Reference threshold value			%K??(,n)$^{C}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 61
	Output	Response to reference			%K??,n,n$^{C}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 61
	Input	Change threshold value			%G??,n(,n)$^{C}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 62
	Output	Change complete			%G??,n,n$^{C}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 62

Input the input command after confirming that the READY signal has been output from the parallel interface.

Referencing the Threshold Value

0 : Gray-Scale Edge Checker (can be omitted, see page 16 - 19)
1 : Position Adjustment 1 (Horizontal/Checker 1)
2 : Position Adjustment 2 (Vertical/Checker 2)

Input

%K??, n C_R

Type specification

Checker no.
(01 to 96 for XUVM210, 01 to 48 for XUVM110)

The following is output if the gray-scale edge detection threshold value is referenced normally.

Output

%K??,n, n C_R

The set threshold value (1 to 255)
The set type (output even if the setting 0 was omitted in the request)
Checker No.
(01 to 96 for XUVM210, 01 to 48 for XUVM110)

Changing the Threshold Value

0 : Gray-Scale Edge Checker (can be omitted if type 0 = inspection checker)
1 : Position Adjustment 1 (Horizontal/Checker 1)
2 : Position Adjustment 2 (Vertical/Checker 2)

Input

%G??, n, n $^{C}{}_{R}$

Type specification

Threshold value (1 to 255)

Checker No.
(01 to 96 for XUVM210, 01 to 48 for XUVM110)

Specify the threshold value in the format 1 to 255. Leave out leading zeroes.

Ex:

To change the threshold value to 50:
Correct: %G01,50,0
False: %G01,050,0

The following is output if the gray-scale edge detection threshold value is changed normally.

Output

%G??,n, n $^{C}{}_{R}$

The set type (output even if the setting 0" was omitted in the request)

The set threshold value

Checker No.
(01 to 96 for XUVM210, 01 to 48 for XUVM110)

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 96 for XUVM210, 01 to 48 for XUVM110)	16 - 64
	Output	Response to reference			%F??,n,n$^{C}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 64
	Input	Change max. and min. limits			%N??,n,n$^{C}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 64
	Output	Change complete			%N??,n,n$^{C}_{R}$ (??=01 to 96 for XUVM210, 01 to 48 for XUVM110)	16 - 64

Input the input command after confirming that the READY signal has been output from the parallel interface.

Referencing the Maximum and Minimum Values

Input

%F?? $^{C}{}_{R}$

Register No. (two. Digits **: 01 to 96)**

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 96)

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 96)

The following is output if the maximum and minimum values for the numerical calculation are changed normally.

Output

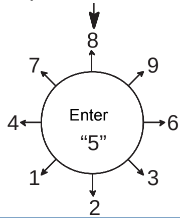
%N??,n, n $^{C}{}_{R}$

Maximum value
Minimum value
Register No.
(two digits: 01 to 96)

Key Emulate

It is possible emulate keyboard operations by inputting serial commands from an external device to the serial interface (COM/TOOL).

Availability for Parallel and Serial Interface

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	See page	Command	See page
Key Emulate	Input	Direction key (8 directions)			STX Key Code ETX 	16 - 65
	Input	<Enter> key input			STX5EXT	
	Input	<A>,< B>, and <C> key input			STX Key Code E TX A Key : A B Key : B C Key : C	

No response is returned from the XUVM110/210 to input commands.

Settings in the Communication Menu

Perform the settings in the **Environment** menu. Use the option **5. Communication**, then set **56. Key Emulate** to **Yes**. The default setting is No. It is not possible to input commands unless you make this setting.

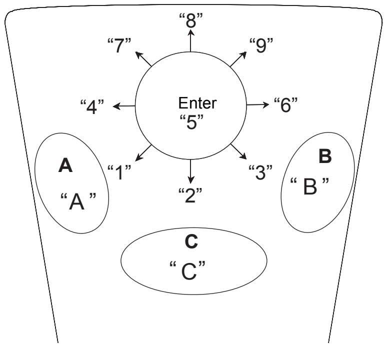
[7] ENVIRONMENT
5. Communication
51. Com. Mode Normal Mode
52. RS232C
53. Serial Output
54. Parallel Output
55. Min. Ready Off Time 0 ms
56. Key Emulate No

Key Emulate
No
Yes

Serial Commands

The following three bytes of binary data forms one set.
Start code (STX (=0´02)) + key code (see table below) + end code ETX (=0´03)).

Keypad function	*Keycode*	*Hexadecimal*
Up	“8”	0x38
Down	“2”	0x32
Left	“4”	0x34
Right	“6”	0x36
A	“A”	0x41
B	“B”	0x42
C	“C”	0x43
Enter	“5”	0x35
Right + Up	“9”	0x39
Right + Down	“3”	0x33
Left + Up	“7”	0x37
Left + Down	“1”	0x31



The keycodes are in inverted commas

Ex:

Moving the cursor lever down and pressing <Enter> corresponds to the following serial command.

0x020x320x030x020x350x03

Press lever down <Enter> key

Note **The <A> key function to stop repeated inspection execution is not available when you use the key emulation to input the command <A>. Switch off/on repeated inspection execution with the option** 2. Start **to** Manual Rep. **or** Auto Rep. **in the** Environment **menu.**

Computer 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,

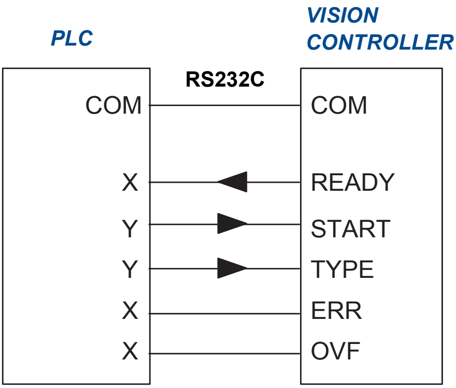
Limitations in Computer Link Mode

Except for key emulation 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 slice level values
- Referencing and changing the gray-scale edge threshold value
- Referencing and changing the maximum and minimum values for numerical calculations
- Initiating a type data save from an external device
- Resetting the spreadsheet from an external device

Connection to a PLC

Connection to the CCU and CPU COM Port of the Telemecanique PLC.

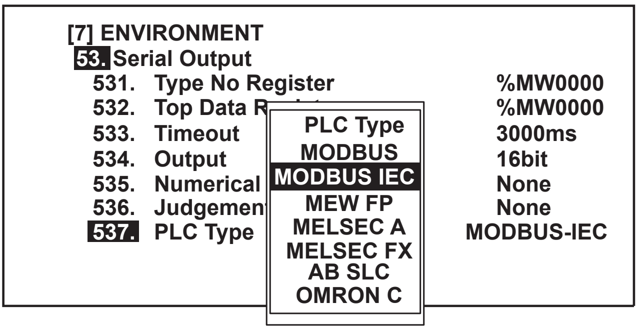


Procedure:

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 inter face in the hardware exploitation guide regarding RS232C connection

Setting the PLC Type

In the **7. Environment** menu, select **53. Serial Output** and set **537. PLC Type** as required.



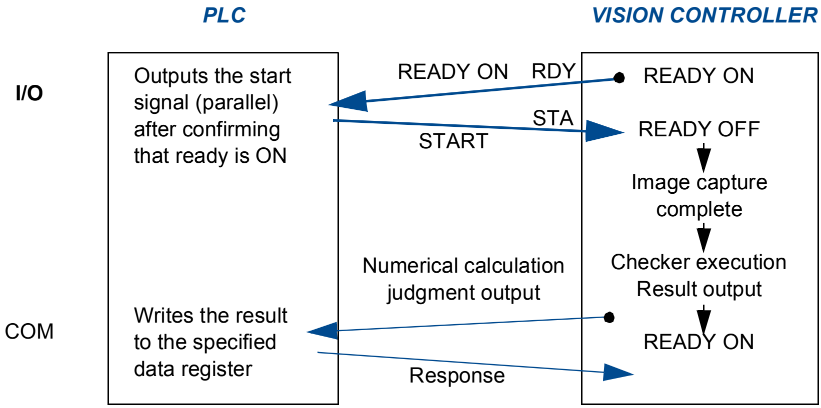
The examples in this guide refer to the Telemecanique PLCs. If you are using one of the other PLCs, refer to this guide and the following table.

Note **Specify slave adress = 1 in the PLC.**
The values in the sub-menus 535 and 536 must be "Output".

Setting in 537. 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 XUVM110/210 VISION CONTROLLER Hardware exploitation guide for details regarding connection to the PLC RS-232C 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 XUVM110/210

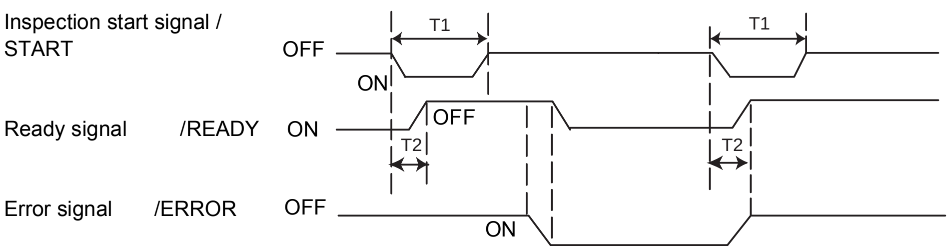
Inspection Result Output



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.

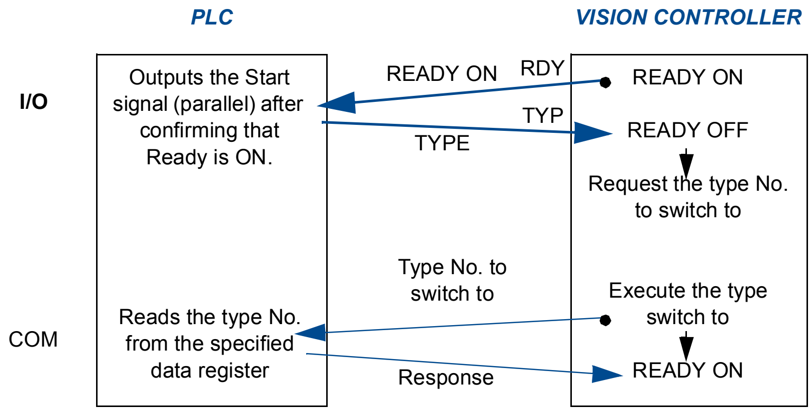
Response:
Function code = 90 (10+80)
Data field = 02

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).

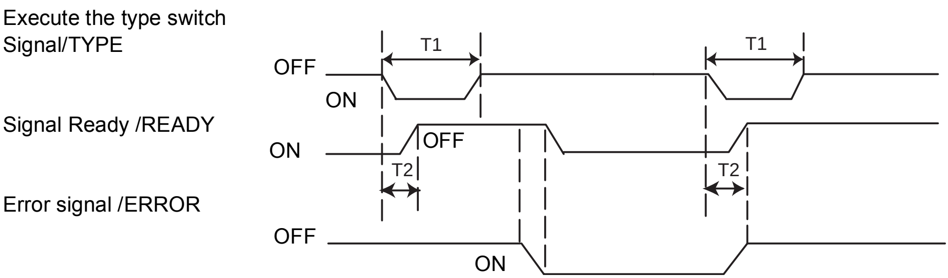
Type Switching



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 **5. Communication** from the **Environment** menu.

Option name	*Suboption name*	*Setting*
51. Com. Mode		Computer Link
52. RS232C	521. 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).
	522. Length	Select either 7 bits or 8 bits, but use the same value as the PLC ”Data length” setting.
	523. Stop Bit	Select either 1 bit or 2 bits, but use the same value as the PLC ”Stop bits” setting.
	524. Parity	Select either None, Even, or Odd, but use the same value as the PLC ”Parity check” setting.
	525. Flow Control	Sets the handshake flow control method. Select either None or Xon/Xoff.
53. Serial Output	531. Type No Register	Specify a data register number (in the range 0 to 9999) for performing the PLC type switch request.
	532. Top Data Register	Specify a start data register number (in the range 0 to 9999) for when data is output to the PLC.
	533. Timeout	Sets the timeout for the response after output of data to the PLC and the response to a type switch number request.
	534. 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.
	535. Num. Calculation	Set whether or not to output the numerical calculation result.
	536. Judgment	Set whether or not to output the judgment result.
	542. 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	Computer 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

51. Communication modeComputer link
52. RS232C
    - 521. Baud rate (bps) 19200
    - 522. Length 8
    - 523. Stop Bit 1
    - 524. Parity None
53. Serial Output
    - 532. Top Data Register 1
    - 534. Output 16bit
    - 535. Numerical calculation Out
    - 536. Judgment Out
    - 537. PLC Type Modbus IEC 11 31

PLC communication settings

PLC system register settings (COM port)

No. 412 COM port selection	Computer 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

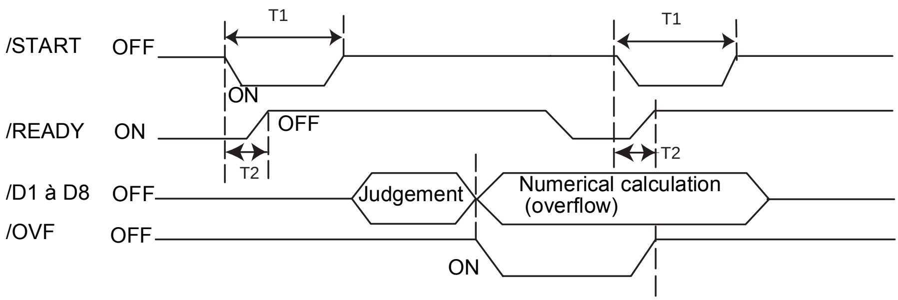
1	%MW1	1	00E1	1 word (hex)
2	%MW2	2	1234	1 word integer (decimal)
3	%MW3	3	–12	1 word integer (decimal)
4	%MW4	4	0	1 word integer (decimal)
5	%MW5	5	56	1 word integer (decimal)
6	%MW6	6	0	1 word integer (decimal)
7	%MW7	7	0	1 word integer (decimal)
8	%MW8	8	0	1 word integer (decimal)
9	%MW9	9	0	1 word 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**	Judgement (D1 à 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)

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 - 7).

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 XUVM110/210 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 XUVM110/210 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 Computer Link**. Parallel output conforms to the** Computer 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.

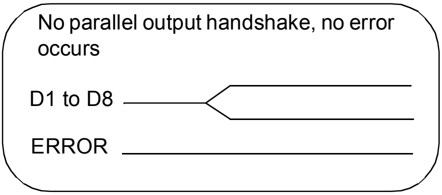
Errors will occur in the numerical calculation register or judgment output register when:
The numerical calculation register and judgment output register output up to the last register number for which a formula is set (excluding numerical calculation output control).

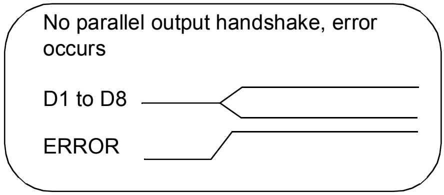
Numerical calculation register
- When a referenced checker does not exist.
- When a formula is not registered in the referenced numerical calculation register.
- When a 32-bit overflow occurs during calculation.
- When a zero divide occurs during calculation.

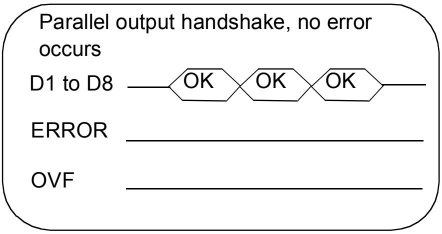
Judgment output register
- When a referenced checker does not exist.
- When a formula is not registered in the referenced numerical calculation register or judgment output register.
- When a numerical calculation register or judgment output register that has generated an error is referenced.

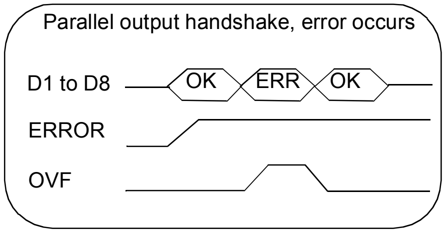
Camera switching error conditions
- If you attempt to switch cameras using one of the following methods when the setting for
  4. Capture Camera in the **Type** menu is something other than AB.
- The “Easy” switch (camera A to/from camera B) signal was input.
- With the capture camera set at either A, 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.

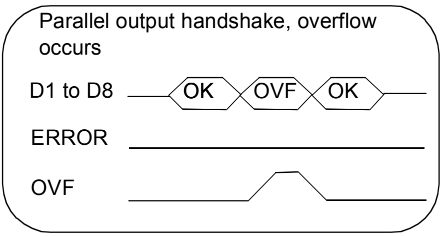
Timing Chart for Errors











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 then 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 **10. Setting Help Tools** from the main menu. The screen shown below will appear.

```
[10] SETTING HELP TOOLS
     Lighting Adjustment
 2.  Focus
 3.  Aperture
 4.  Threshold Level
 5.  Multi Threshold
 6.  Image Profile
 7.  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. **Threshold Level**
   Helps you adjust the binarization threshold value to obtain the desired image when there is a good crisp black/white contrast.

5. **Multi Threshold**
   Helps you adjust the upper and lower threshold values to obtain the desired image if the black/white contrast is not so good or if you need to select a specific gray value.

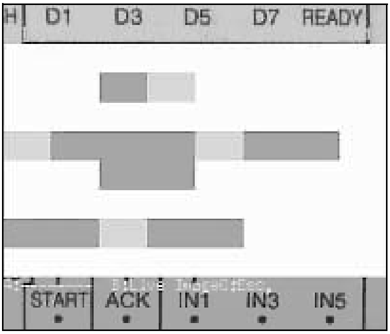
6. **Image Profile**
   Displays a gray-scale graph for a specified line on the image.

7. **In Out Monitor**
   Checks the parallel interface by displaying input states and forcing output states. Useful for checking the connections with external devices.

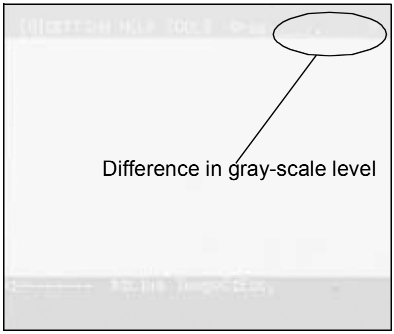
Lighting Adjustment

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

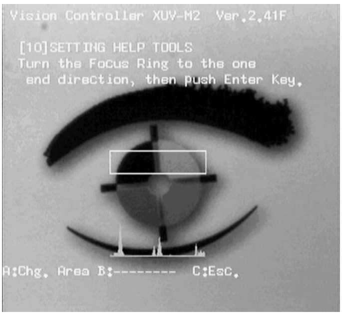


Figure b

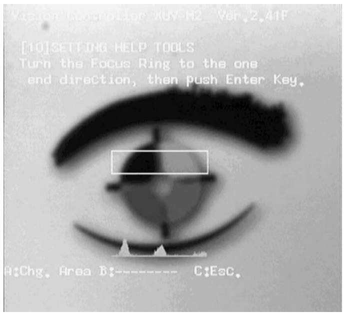


Figure c

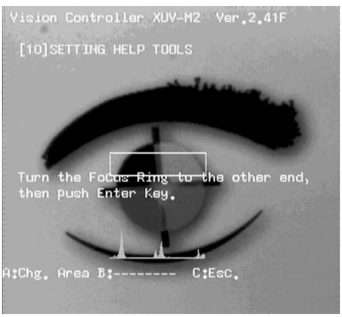
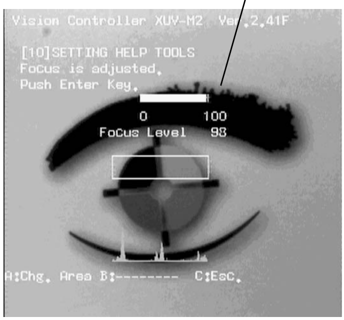


Figure d

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

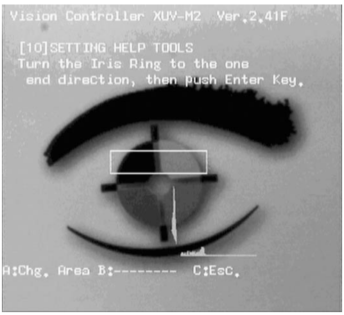


Figure b

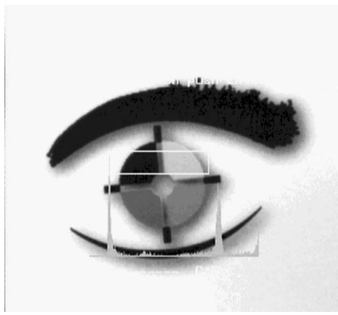


Figure c

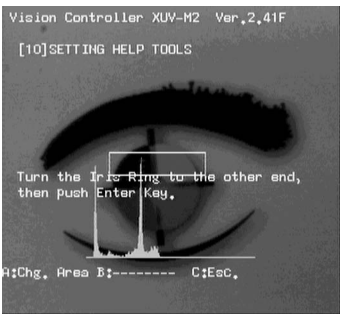
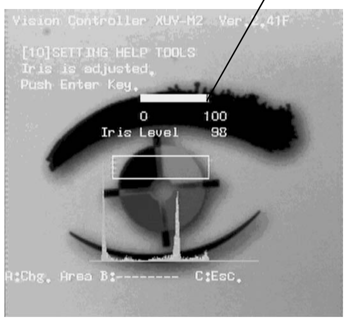


Figure d

Bar graph



Threshold Level

Automatically calculates the recommended threshold level. The threshold level setting help tool is used when there is a clear distinction (i.e. a good contrast) between black and white.

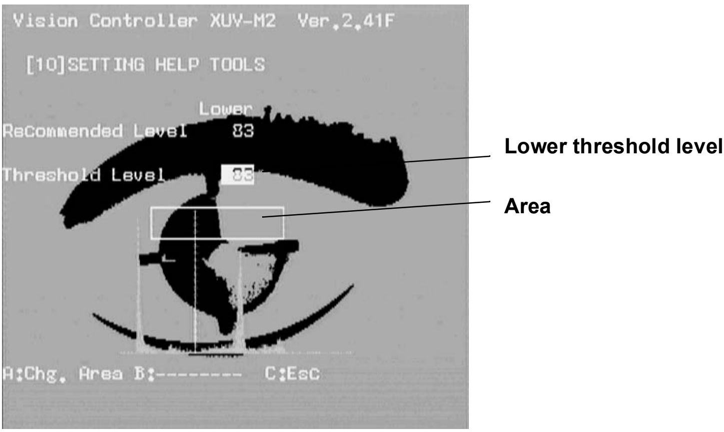
Note **With regard to the values recommended here, the binary level setting is not automatically done, so set the displayed values as the binary level settings.**

Procedure:

1. Select 4. Threshold Level, and a screen such as the one below is displayed. Press <A: Chg. Area> to set the area of the image for extraction.

2. After a few seconds, the lower value for the recommended threshold level is displayed as shown below, and the image produced by utilizing that threshold level is displayed. The upper threshold for the image on the screen is 255, and the lower threshold is the value displayed.

3. Use the cursor lever for fine adjustment of the threshold level.



Multi Threshold

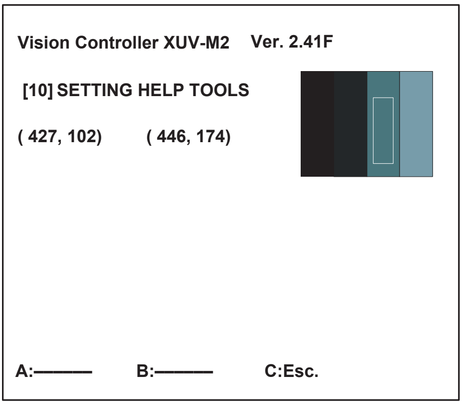
Use this option to calculate the recommended threshold level automatically.

The multi threshold level tool is used when the distinction between black and white is unclear in images with grays and other intermediate colors. The image produced by utilizing the recommended threshold levels is displayed as white on the screen.

Note **With regard to the values recommended here, the binary level setting is not automatically done, so set the displayed values as the binary level settings.**

Procedure:

1. Select 5. Multi Threshold, and press <A: Chg. Area> to set the area of the image for extraction.



2. After a few seconds, the recommended values for upper and lower threshold levels are displayed.

3. Use the cursor lever for fine adjustment of the threshold levels.

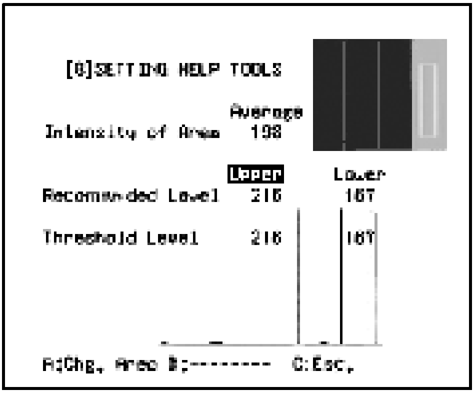
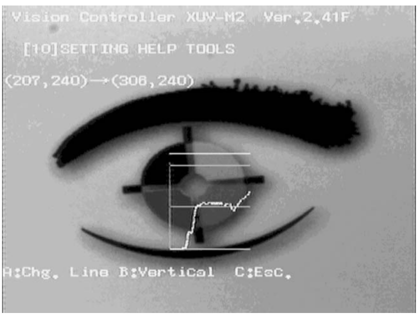
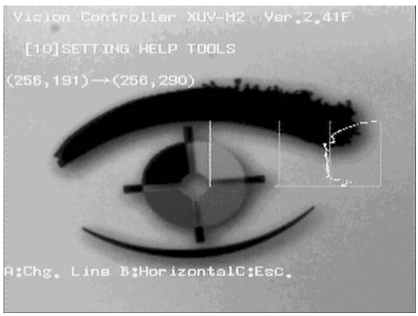


Image Profile

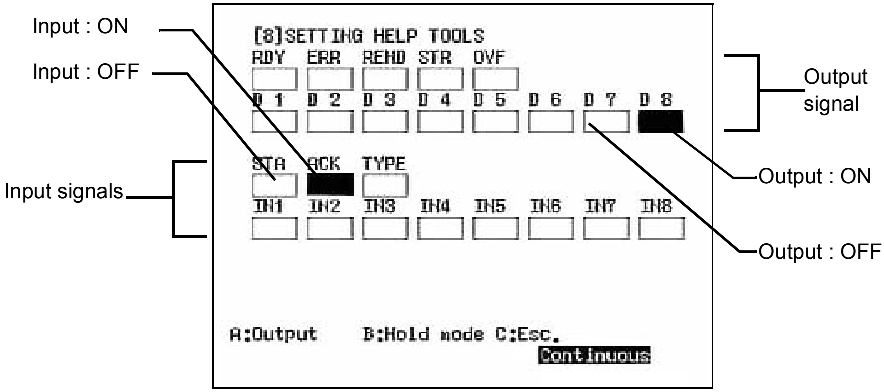
Displays a graph of gray-scale distribution along a line specified on the image. Select 6. Image Profile, and a straight line and corresponding graph are displayed on the screen as shown below. Press <A> to draw a straight line at the point you wish to be graphed. Press <B> to switch the line to a vertical 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 XUVM110/210 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

<table>
<tr><th colspan="2"></th><th>XUVM210 VISION CONTROLLER</th><th>XUVM110 VISION CONTROLLER</th></tr>
<tr><td colspan="2">CPU</td><td>32-bit RISC CPU
(high-speed processing version)</td><td>32-bit RISC CPU</td></tr>
<tr><td colspan="2">Frame memory</td><td>512 x 480 (pixels) x 256 gradations</td><td>512 x 480 (pixels) x 256 gradations</td></tr>
<tr><td colspan="2">Operator interface</td><td colspan="2">Menu selection by specialized keypad</td></tr>
<tr><td colspan="2">Monitor display</td><td colspan="2">Change between gray-scale memory/gray-scale through/ binary memory (A/B/C/D/E/F)/binary through (A/B/C/D/E/F)/ Gray NG/Binary NG (A/B/C/D/E/F)</td></tr>
<tr><td rowspan="2">Processing</td><td>Gray-scale</td><td colspan="2">8-bit 256 gradations</td></tr>
<tr><td>Binarization</td><td colspan="2">6 groups of binary processing from the gray-scale memory (upper and lower threshold settings)</td></tr>
<tr><td colspan="2">Number of types</td><td>64</td><td>32</td></tr>
<tr><td colspan="2">Execution mode specification</td><td colspan="2">Execute All: execute all set checkers
Autom. Switch: Switch and execute checkers based on judgment output results
User-Defined: Specify and execute checker at start input</td></tr>
<tr><td rowspan="6">Inspection</td><td rowspan="2">Position/ position and rotation adjustment</td><td>96/type (max.)
Position and rotation adjustment function</td><td>48/type (max.)
X-Y position adjustment function</td></tr>
<tr><td colspan="2">Priority adjustment Multi-stage adjustment
Sequence setting by matching/gray-scale edge/binary edge or feature extraction detection.</td></tr>
<tr><td rowspan="2">Exposure adjustment</td><td>96/type (max.)</td><td>48/type (max.)</td></tr>
<tr><td colspan="2">Shape: rectangular Binarization adjusts according to changes in the gray-scale data
Gray-scale mean value detection/judgement</td></tr>
<tr><td rowspan="2">Smart matching/ matching (subpixel processing)</td><td>Smart matching = 96/type (max.);
Equipped with post-detection differential processing function</td><td>Matching = 48/type (max.)</td></tr>
<tr><td colspan="2">Subpixel accurate multiple detection matching by gray-scale correlation processing
Rotation by raster detection and raster detection position ($30 degrees)
Output = number of detected items/correlation numbers/ position/angle
Teaching registered changes can be imported from external source
Smart matching (XUVM210) = judgement learning function by the smart template</td></tr>
</table>

		XUVM210 VISION CONTROLLER	XUVM110 VISION CONTROLLER
Inspection	Gray-scale edge detection (subpixel processing)	96/type (max.)	48/type (max.)
		Scanning method = individual/projection Gray-scale filter/ width function Detection by subpixel unit Detection position = forepoint/forepoint and afterpoint/ largest differential/multiple edge	
	Gray-scale window	96/type (max.)	48/type (max.)
		Shape: rectangular/polygonal or oval Mask shape: rectangular/polygonal or oval Gray-scale mean value detection/judgement	
	Feature extraction	96/type (max.)	48/type (max.)
		Shape = rectangular/polygonal or oval Mask shape = rectangular/polygonal or oval Image filtering Labeling Output values: counter/center of gravity (to one decimal place)/area projection width/principle axis angle	
	Binary window	96/type (max.)	48/type (max.)
		Shape = rectangular/polygonal or oval Mask shape = rectangular/polygonal or oval Image filtering White/black pixel number count/judgment	
	Binary edge detection	96/type (max.)	48/type (max.)
		Shape = line/plane Filter/width functions Forepoint edge detection	
	Line	96/type (max.)	48/type (max.)
		Shape = straight line/polygonal line/circle or arc Image filters White/black pixel number count/judgment	
	Conversion data	4/unit	
		Reference distance No. of reference pixels Scale factor	
	Numerical calculations	96/type (max.)	48/type (max.)
		4 arithmetic calculations Sine Cosine Arctangent Root Distance-between-points Projection (X, Y) axis Special substitutions Reference to previous data Output control	
	Judgement output	External output (D) register = 96/type (max.) Internal judgement (R) register = 96/type (max.)	External output (D) register = 48/type (max.) Internal judgement (R) register = 48/type (max.)
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	
Inspection start		Image trigger (timing sensor unnecessary) External sensor timing Repeat start	

		XUVM210 VISION CONTROLLER	XUVM110 VISION CONTROLLER
Other specifications	Display functions	Display item suppressing function (menu display hide function) Image suppress function when setting checkers Image rotation function when setting checkers (XUVM210) Clearly display reject location Rotational adjustment angle display (XUVM210) Numerical calculations results display Image filtering display function Accumulated data display Display list of checkers	
	Marker function	8 graphics (line, rectangle or ellipse)/type (max.) can be registered for display on the main screen.	
Setup tools	Setup tools	30 screens	8 screens
		Save/load function for inspection image (all screens/ problem screens) Save images for reinspection/resetting Windows-PC image save/load function	
	Debugging	Trap function Image save function	
	Setup help	Focus setup Aperture setup Lighting adjustment Gray-scale profile monitor Recommended slice level display Input monitor Enforce output	
Moving object inspection		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 Two-camera vertical/ horizontal partition possible	1
Operating voltage		24V DC less than 0.9A	24V DC less than 0.7A
Setup data backup		Setup data can be saved to a Windows PC using the Vision Backup-Tool Ver. 2	

CHAPTER 21

Menu Layout

Menu Layout

- 1 TYPE
  see page 3 - 18
  - 1 Copy type — see page 3 - 24
  - 2 Delete type — see page 3 - 25
  - 3 Input type title — see page 3 - 20
  - 4 Capture camera — see page 3 - 21
  - 5 Camera / image — see page 3 - 22
  - 6 Display settings
    see page 3-21
    - 61. Screen display — see page 1 - 12
    - 62. Checker pattern — see page 2 - 17
    - 63. Make bright at NG — see page 1 - 12
    - 64. Detect position — see page 1 - 12
    - 65. Status display — see page 1 - 12
    - 66. Marker — see page 1 - 12
  - 7 Execution mode
    see page 3 - 15
    - Execute All
    - Autom. Switch
    - User-defined
  - 8 Initialize all types
    see page 3 - 27

- 2 SLICE LEVEL
  see page 2 - 19
  - A
  - B
  - C
  - D
  - E
  - F

- 3 CHECKER
  - 1 POS. ROT. ADJ.. see page 4 - 3
    - 1 BINARY EDGE DETECTION see page 4 - 5
      - 11 Pos. Adj. see page 4 - 5
      - 12 Hor. Det. Rot. Adj. (XUVM210 onl see page 4 - 6)
      - 13 Ver. Det. Rot. Adj.(XUVM210 only see page 4 - 7)
    - 2 GRAY EDGE DETECTION see page 4 - 8
      - 21 Pos. Adj. see page 4 - 8
      - 22 Hor. Det. Rot. Adj. (XUVM210 only see page 4 - 9)
      - 23 Ver. Det. Rot.Adj (XUVM210 only) see page 4 - 10)
    - 3 FEATURE EX TRACTION see page 4 - 11
      - 31 Pos. Adj. see page 4 - 11
      - 32 Theta Rot. Adj. see page 4 - 12
      - 33 One Chkr. Rot. Adj. (XUVM210 only) see page 4 - 13)
      - 34 Two Chkr. Rot. Adj. (XUVM210 only) see page 4 - 14)
    - 4 MATCHING see page 4 - 15
      - 41 Pos. Adj. see page 4 - 15
      - 42 Pos. Adj. Rot (XUVM210 only) see page 4 - 16)
      - 43 Pos. Adj/Rot. 2 Obj. 1 Chkr (XUVM210 only) see page 4 - 17)
      - Rot. 2 Obj. 2 Chkr (XUVM210 only) see page 4 - 18)
  - 2 EXPOSURE ADJ see page 5 - 3
    - 1 Select camera
    - 2 Checker setting
      - 21 Shape
      - 22 Area
      - 23 Coefficient
    - 3 Base
    - 4 Average judgment
    - 5 Pos. Rot. Adj. Group
    - 6 Copy checker
    - Delete checker

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- 3 INSPECTION CHECKER
  - 31 LINE see page 6 - 3
    - 1 Seclect camera
    - 2 Slice level No.
    - 3 Checker setting
      - 31 Shape
      - 32 Area
      - 33 Dot Count
      - 34 Land Count
      - 35 Land Filter
      - 36 Gap Filters
      - 37 Filter
    - 4 Dot Judgment
    - 5 Land Judgment
    - 6 Adj. Group
      - 61 Pos. Rot. Adj. Group
      - 62 Exposure Adj. Group
    - 7 Copy Checker
    - 8 Delete Checker
  - 32 BINARY WINDOW see page 7 - 3
    - 1 Select Camera
    - 2 Slice Level No.
    - 3 Checker Setting
      - 31 Shape
      - 32 Area
      - 33 Mask Shape
      - 34 Mask Area
      - 35 Object
      - 36 Filter
    - 4 Area Judgment
    - 5 Adj. Group
      - 51 Pos. Rot. Adj. Group.
      - 52 Exposure Adj. Group
    - 6 Copy Checker
    - 7 Delete Checker

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- 33 GRAY WINDOW see page 8 - 3
  - 1 Select Camera
  - 2 Checker Setting
    - 21 Shape
    - 22 Area
    - 23 Mask Shape
    - 24 Mask Area
  - 3 Average Judgment
  - 4 Pos. Rot. Adj. Group
  - 5 Copy Checker
  - 6 Delete Checker
- 34 BINARY EDGE DETECTION see page 9 - 3
  - 1 Select Camera
  - 2 Slice Level No
  - 3 Checker Setting
    - 31 Shape
    - 32 Area
    - 33 Direction
    - 34 Edge Condition
    - 35 Filter
    - 36 Width
  - 4. Adj. Group.
    - 41. Pos. Rot. Adj. Group
    - 42. Exposure Adj. Group
  - 5. Copy Checker
  - 6. Delete Checker

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- 35 GRAY EDGE DETECTION page 10 - 3
  - 1 Select Camera
  - 2 Checker Setting
    - 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 Area
    - 28 Detect Position
  - 3 Detected Judgment
  - 4 Pos. Rot. Adj. Group
  - 5 Result
  - 6 Copy Checker
  - 7 Delete Checker
- 36 FEATURE EXTRACTION page 11 - 3
  - 1 Select Camera
  - 2 Slice Level No.
  - 3 Checker Setting
    - 31 Shape
    - 32 Area
    - 33 Mask Shape
    - 34 Mask Area
    - 35 Object
    - 36 Condition
      - 361 Labeling
      - 362 Boundary
      - 363 Perim./Proj.
      - 364 Theta
      - 365 Filter
    - 37 Output Unit
      - 371 Sorting
      - 372 Sorting Order
  - 4 Detected Judgment
  - 5 Object Area
  - 6 Adj. Group
    - 61 Pos. Rot. Adj. Group
    - 62 Exposure Adj. Group
  - 7 Result
  - 8 Copy checker
  - 9 Delete Checker

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- 37 SMART MATCHING page 12 - 3
  - 1 Select Camera
  - 2 Checker Setting
    - 21 Template
    - 22 Search Area
    - 23 Sequence
    - 24 Output Unit
      - 241 Sorting
      - 242 Sorting Order
  - 3 Subtraction Setting (XUVM210 only)
    - 31 Subtraction
    - 32 Sub. Area Judgment
    - 33 Thres. Value
    - 34 Filter
    - 35 Deviation
    - 36 Update Deviation Data
    - 37 Put Deviation Data Back
    - 38 Initialiser écart données
  - 4 Pos. Rot. Adj. Group
  - 5 Check Template
  - 6 Result
  - 7 Copy Checker
  - 8 Delete Checker
- 4 GROUP MOVE see page 15 - 18
- 5 NUMERICAL CALCULATION see page 13 - 7
- 6 JUDGMENT see page 13 - 29
- 7 IMAGE DATA see page 15 - 3
  - 1 LOAD IMAGE DATA
  - 2 SAVE IMAGE DATA
  - 3 LOCK IMAGE DATA
  - 4 DELETE IMAGE DATA
- 8 MARKER see page 15 - 8

4 DATA MONITOR see page 13 - 43

5 SPREADSHEET see page 13 - 40

6 CONVERSION DATA see page 13 - 4
- CV01
- CV02
- CV03
- CV04

- 7 ENVIRON-MENT see page 3 - 4
  - 1 CAMERA see page 3 - 5
    - 11 Camera Mode
    - 12 Shutter
    - 13 Flash
  - 2 START see page 3 - 7
  - 3 START Trigger see page 3 - 13
  - 4 Start Type see page 3 - 13
    - Nr.1
    - Last Store Type No.
      - 41 Display message
  - 5 Communication see page 3 - 14
    - 51 Com. Mode page 16 - 10
    - 52 RS232C page 16 - 11
      - 521 Baudrate (bps)
      - 522 Length
      - 523 Stop Bit
      - 524 Parity
      - 525 Flow Control
    - 53 Serial Output page 16 - 13
      - 51 Com. Mode = normal page 16 - 13
        - 531 Output
        - 532 Inval. Digit
        - 533 Read End
        - 534 Process End
        - 535 Numerical Calc.
        - 536 Judgmentt
      - 51 Com. Mode = Computer Link page 16 - 14
        - 531 Type No. Register
        - 532 Top Data Register
        - 533 Timeout
        - 534 Output
        - 535 Numerical Calc.
        - 536 Judgment
        - 537 PLC Type
    - 54 Parallel Output page 16 - 16
      - 541 Handshake
      - 542 Reset condition
      - 543 Setting Template
      - 544 Disp. Img. Change (XUVM210 only)
    - 55 Min. Ready OFF Time see page 3 - 14
    - 56 Keypad Emulate page 16 - 65
  - 6 Display Setting see page 3 - 15
    - 61 Display Brightness
    - 62 Outside Region value (XUVM210 only)
    - 63 Langage (XUVM110 : 62. Sprache)
  - 7 Save image Mode see page 3 - 16
  - 8 Initialise see page 3 - 17

8 HIDE SETTING
see page 15 - 12

- 1 EXECUTION
- 2 INITIALIZATION
- 3 CHANGE PASSWORD

9 SAVE DATA
see page 14 - 3

10 SETTING HELP TOOLS
see page 19 - 3

1 Lighting adjustment	page 19 - 5
2 Focus	page 19 - 6
3 Aperture	page 19 - 7
4 Threshold Level	page 19 - 8
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6 Image Profile	page 19 - 10
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