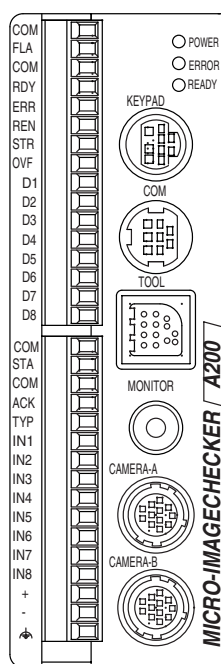
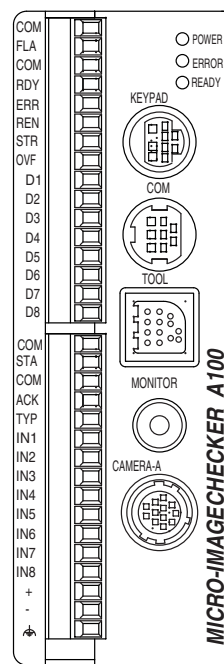


MICRO-IMAGECHECKER A210/A110

Multichecker V2 User's Manual



A210



A110

WARNINGS AND CAUTIONS

To be observed at all times

Read the manual carefully before installing, running, maintaining or inspecting the equipment.

This manual 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.

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

WARNING

- Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
- Do not use this product in areas with inflammable gas. It could lead to an explosion.

CAUTION

- To prevent abnormal exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
- Do not dismantle or remodel the product. It could lead to abnormal exothermic heat or smoke generation.
- Do not touch the terminal while turning on electricity. It could lead to an electric shock.
- Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It might cause exothermic heat or smoke generation.
- Do not undertake construction (such as connection and disconnection) while the power supply is on.
- Connect the wires or connectors securely. The loose connection might cause abnormal exothermic heat or smoke generation.

GENERAL INSTRUCTIONS

Installation Environment

Avoid using the Micro–Imagechecker A210/A110 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 benzene, 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 controller power unit uses non–insulated 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 controller power source is turned off before the input/ output power source.
- If you turn off the input/output power source before the controller power source, the controller unit 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 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.

➡ See 3. *Environment* and *Types* for more information about initialization.

Other Instructions

- Use monitor, monitor cable, keypad, camera and camera cable models and serial numbers specified by Matsushita.
- Do not disassemble, modify, or change internal settings for the Micro-Imagechecker unit or other equipment.
- Setting or changing items other than those that can be set or changed, as described in the product manual and specifications, will result in damage.
- After completing all of the settings for the Micro-Imagechecker, 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.

To USA Customer

- Products sold by Seller are covered by the warranty and patent indemnification provisions in its Terms and Conditions of Sale only.

How to use this manual

Two similar functions on the A110 and A210 have different names, and in this manual, the A-200 naming convention is employed.

These functions are given in the table below.

A110	A210
POS. ADJ. (Position Adjustment)	POS.ROT. ADJ. (Position and Rotation Adjustment)
Matching	Smart Matching

Also, the A210 menu displays are used in this manual.

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1.1 Main Screen



- (1) **Model information**
Shows the name and version number for the controller software you are using.
- (2) **Version**
Version of the software being used.
- (3) **Type and title**
Shows the currently displayed or selected type number.
- (4) **Menu items**
Displays the menu and setting items. The current selection is highlighted.

1. **TYPE**
Allows you to switch or copies the type.
2. **SLICE LEVEL**
Allows you to set the binary level.
3. **CHECKER**
Allows you to set up various check functions as well as Judgment Output and Numerical Calculation.
4. **DATA MONITOR**
Use to set the data displayed for data monitoring.
5. **SPREADSHEETS**
Shows the inspection calculation results in a table.
6. **CONVERSION DATA**
This function is used to replace the number of measured pixels with the actual dimensions.
7. **ENVIRONMENT**
Allows you to select the start method, input and output, and camera.

1.1 Main Screen

8. HIDE SETTING

Allows you to customize the menu display.

9. SAVE DATA

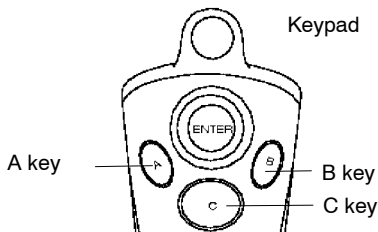
Allows you to save the setup data.

10. SETTING HELP TOOLS

Functions to adjust camera and lighting settings.

(5) Keypad key functions

Displays the keys and functions that can be used with the current menu.

**(6) Image icon**

Displays the type of the currently displayed Image. Press the **B** key to switch images.

➡ Refer to *1.2.1 Keypad* and *1.3.2 Switching the Image Displayed on the Monitor* for details.

(7) Time

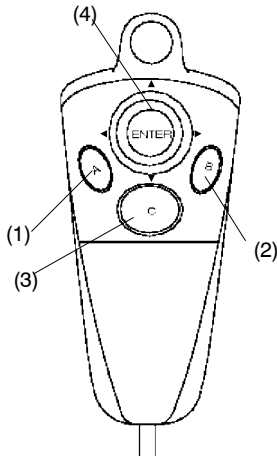
Displays the time required for inspection. It is possible to switch this to **Outputs**.

➡ Refer to *1.3.3 Changing Display Items* for details.

1.2 Keypad

1.2.1 Keypad

All operations and settings for the A210/A110 Multichecker 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**
This is primarily used as the display image mode-switching button. It is used to switch between Gray Scale and Binary and Through, Memory and NG modes.
The type of the image that you switched to is displayed at the bottom of the screen.
➡ Refer to 1.3.2 *Switching the Image Displayed on the Monitor* for details.
- (3) **C button**
This button is used for mode-switching between the display/non-display of menus, icons, checker patterns and so on, as well as for selecting menus, entering numerals, canceling settings, and returning to previous menus.
- (4) **Cursor lever/ENTER button**
This button is used to select menu items, and to draw or move the checker area. When the centre 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.

➡ Refer to 16.12 *Key Emulate*.

1.2 Keypad

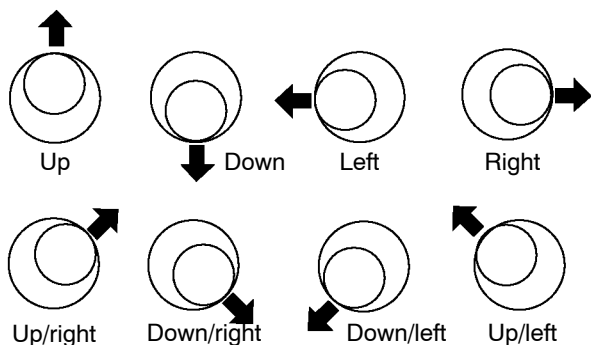
1.2.2 Operating the Cursor lever/ENTER button

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 centre 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, remove your finger from the cursor lever when changing direction.

1.3 Main Screen Operations

1.3.1 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 (Esc.)**.

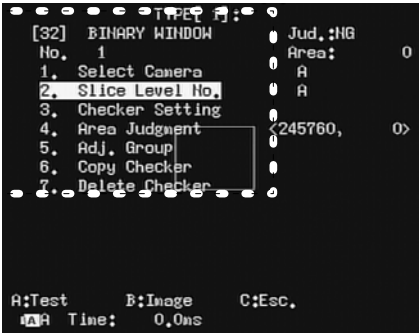
These operations, which are basically the same for all menus, are illustrated below.

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



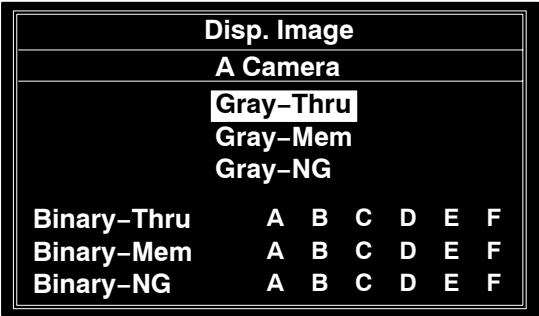
1.3 Main Screen Operations

1.3.2 Switching the Image Displayed on the Monitor

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 in **1. TYPE – 5. Camera/Image** take effect.
The images that can be displayed depend on the settings in **1. TYPE – 4. Capture Camera**.

☞ For details regarding Gray and Binary, refer to *2.6 the Slice Levels/ Binarization Labels*.

☑ **Example: Camera setting A**



Camera image display

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

Gray-Thru:

A: Camera A
B: Camera B (A210 only)

Gray-Mem:

A: Camera A
B: Camera B (A210 only)

Gray-NG:

A: Camera A
B: Camera B (A210 only)

Binary-Thru:

A to F: Slice levels A to F
A: Camera A
B: Camera B (A210 only)

Binary-Mem:

A to F: Slice levels A to F
A: Camera A
B: Camera B (A210 only)

Binary-NG:

A to F: Slice levels A to F
A: Camera A
B: Camera B (A210 only)

- Gray–Thru/Binary–Thru: The image 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: A captured image (same as a memory image).
An image that was inspected and produced results that were outside the range of a certain setting condition (i.e. NG (No Good)).
➡ Refer to *13.4 Judgment Output* for details.

**Note**

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

1.3 Main Screen Operations

1.3.3 Changing Display Items

Select the screen display items for the type that you have selected.
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.
➡ Refer to *3.3.9 Selecting Initial Display Settings* for details.

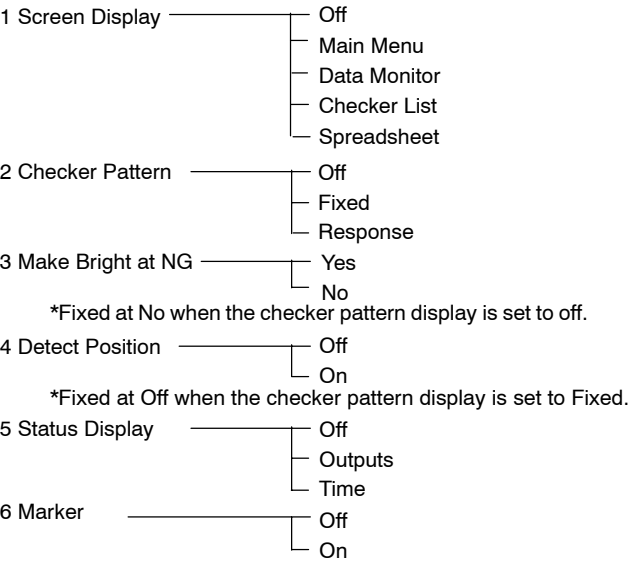
Switching order for the monitor display items

Procedure:

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



- 2. Press **ENTER** to display the selection menus for each item. Use the cursor lever to select the display content.



- 3. Press **ENTER** to confirm your selection. Press **C** to update the monitor display.

Display content

–Screen Display

Select one of **Main Menu**, **Data Monitor**, **Checker List** or **Spreadsheet**, or select **Off** to display nothing.

Main Menu: Displays the menus for performing settings and inspection.

☞ Refer to 21. *Menu Layout*.

Data Monitor: ☞ Refer to 13.6 *Data Monitor*.

Checker List: ☞ Refer to 13.7 *Checker List*.

Spreadsheet: ☞ Refer to 13.5 *Spreadsheets*.

–Checker Pattern

Select the checker pattern display method. Select **Off** if you do not want to display the checker pattern.

☞ For details about the checker pattern, refer to 2.5 *Checker Pattern Display*.

Fixed: The checker pattern is displayed in a fixed position.

Response: The checker pattern display is moved in accordance with the amount of position adjustment.



Notes

- When **Fixed** is selected, if **Detect Position** was set to **On** (display), it 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.

–Make Bright at NG

Checker patterns for NG (No Good) checkers are displayed with high brightness, and checker patterns for OK checkers are displayed with low brightness.



Note

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

–Detect Position

Select whether or not to display the coordinates of the position detected by execution of the checker.



Note

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

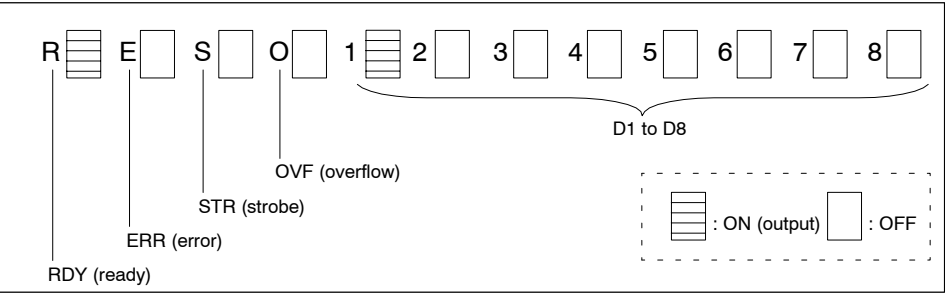
1.3 Main Screen Operations

–Status Display

Select which item (either the **Outputs** or **Time**) is to be displayed on the bottom of the screen. Select **Off** to display nothing.

Outputs: Displays the ON/OFF status of the parallel output (RDY, ERR, STR, OVF and D1 to D8).

Time: Displays the time required for inspection.
This is the time for which the READY signal has been off.



–Marker

Select whether or not to display the set marker.

➡ For details, refer to *15.2 Marker Function*.

1.4 Setting Numerical Values

Move the cursor lever left and right to move the highlighting to the digit to be changed, then 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.

000550 ▲ 000600

000320 ▼ 000318



Example: Changing “4000” to “7900”

004000 ► ► 004000 ▲ ▲ ▲ ▲ 008000 ► 008000 ▼ 007900
ENTER 7900

Changing “4000” to “202”

004000 ► ► 004000 ▼ ▼ ▼ ▼ 000900 ▼ ▼ 000200 ►
► ▲ ▲ 000202 ENTER 202



Point

The upper limit cannot be set to a value less than the lower limit, and the lower limit 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.

1.4 Setting Numerical Values

Chapter 2

Inspection Procedure

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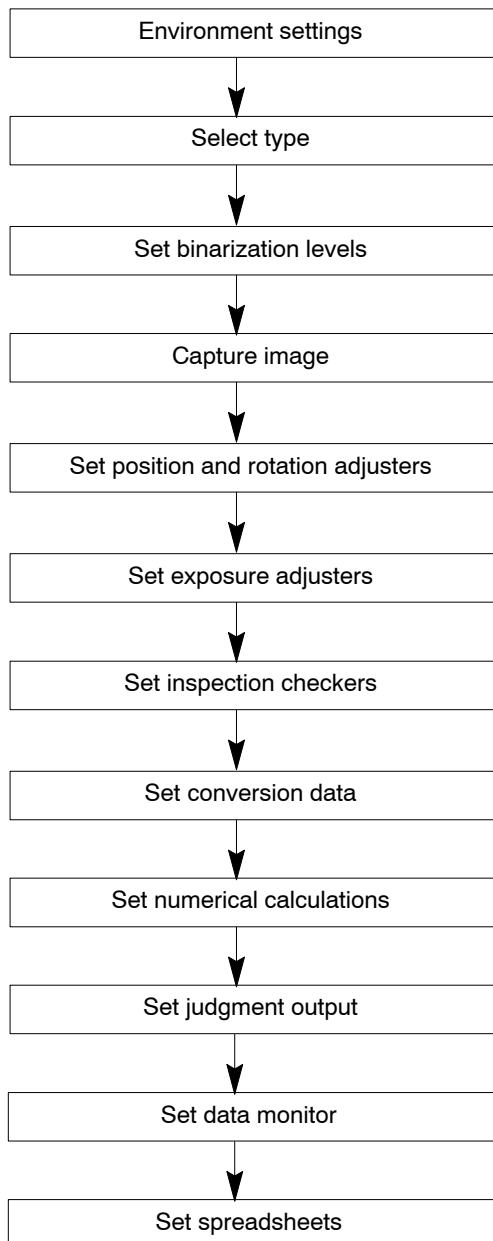
➡ next page

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2.1 Sequence for Checker Setup

The Checker Setting menu includes some items like position and rotation adjustment group number and exposure adjustment group number which 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 Multichecker.



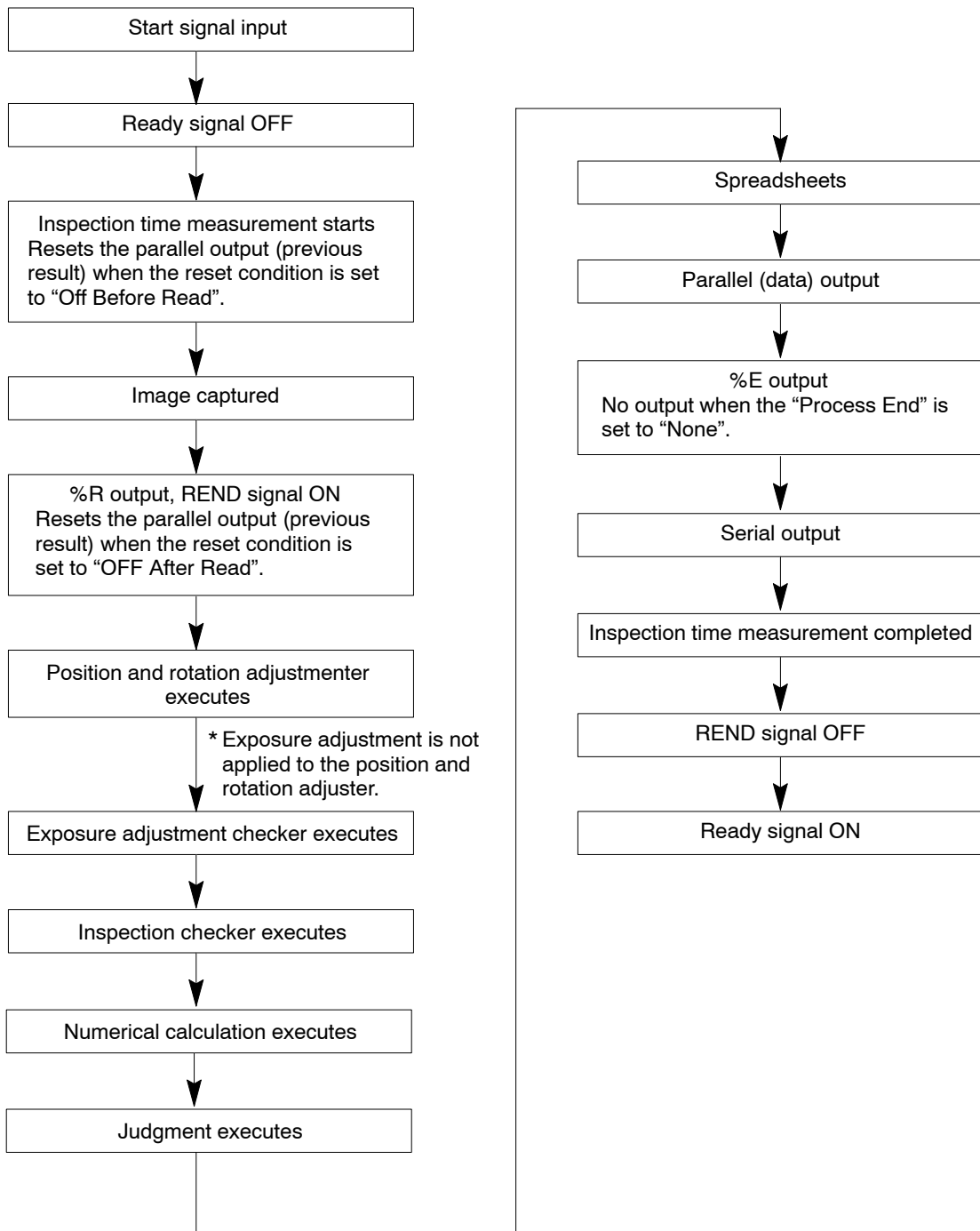
2.2 Inspection Execution Procedures

Broadly broken down, when you initiate an inspection by pressing **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.

2.2 Inspection Execution Procedures

2.2.1 Execution Process Order



2.2 Inspection Execution Procedures

2.2.2 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.

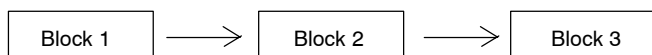
Inspection checker block structure

	Checker Number	
	A210	A110
Block 1	01 to 32	01 to 16
Block 2	33 to 64	17 to 32
Block 3	65 to 96	33 to 48

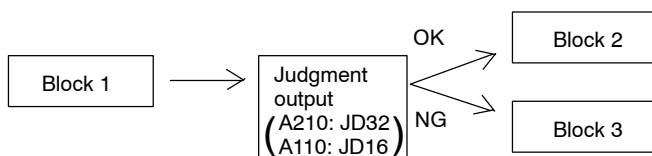
Take the blocks into consideration when setting checkers that will use Autom. Switch (Automatic Switch) and User-Defined modes.

The three execution modes

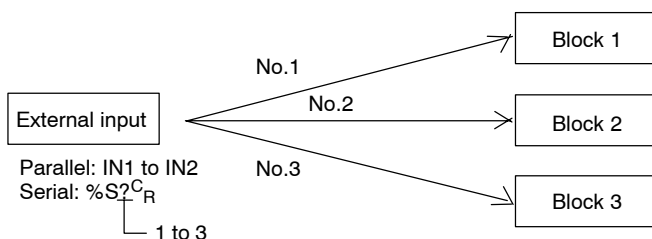
Execute All mode: The checkers for all blocks are executed in order.



Autom. Switch (Automatic Switch) mode: After Block 1 is executed either Block 2 or Block 3 is executed in accordance with specified judgment output results.

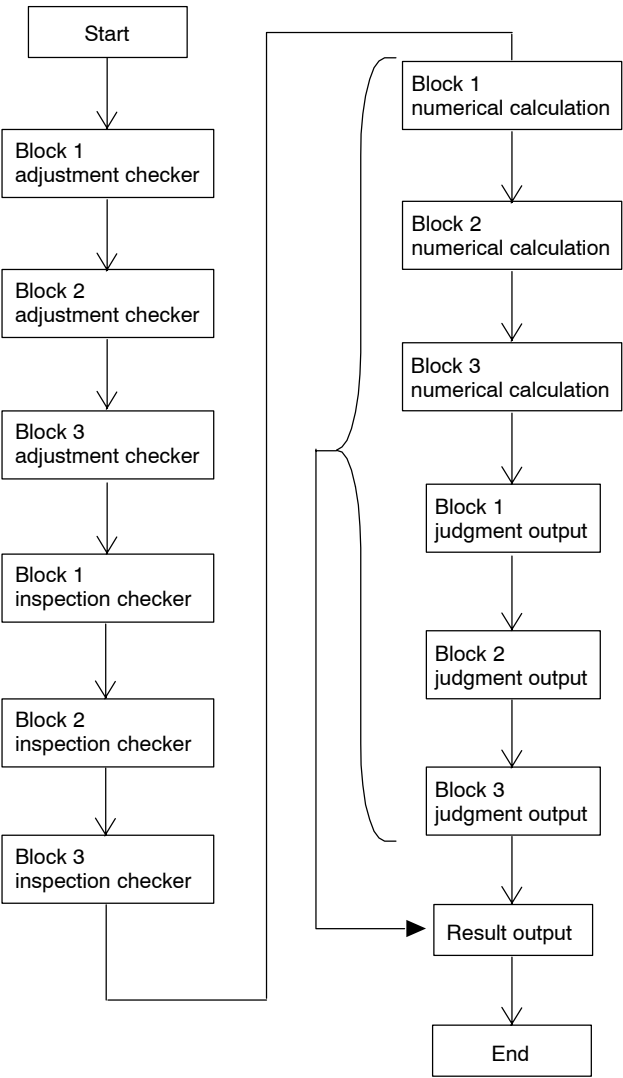


User-Defined mode: Serial or parallel communication is used to specify which block is to be executed.



Execute All mode

The set checkers are executed in order.



2.2 Inspection Execution Procedures

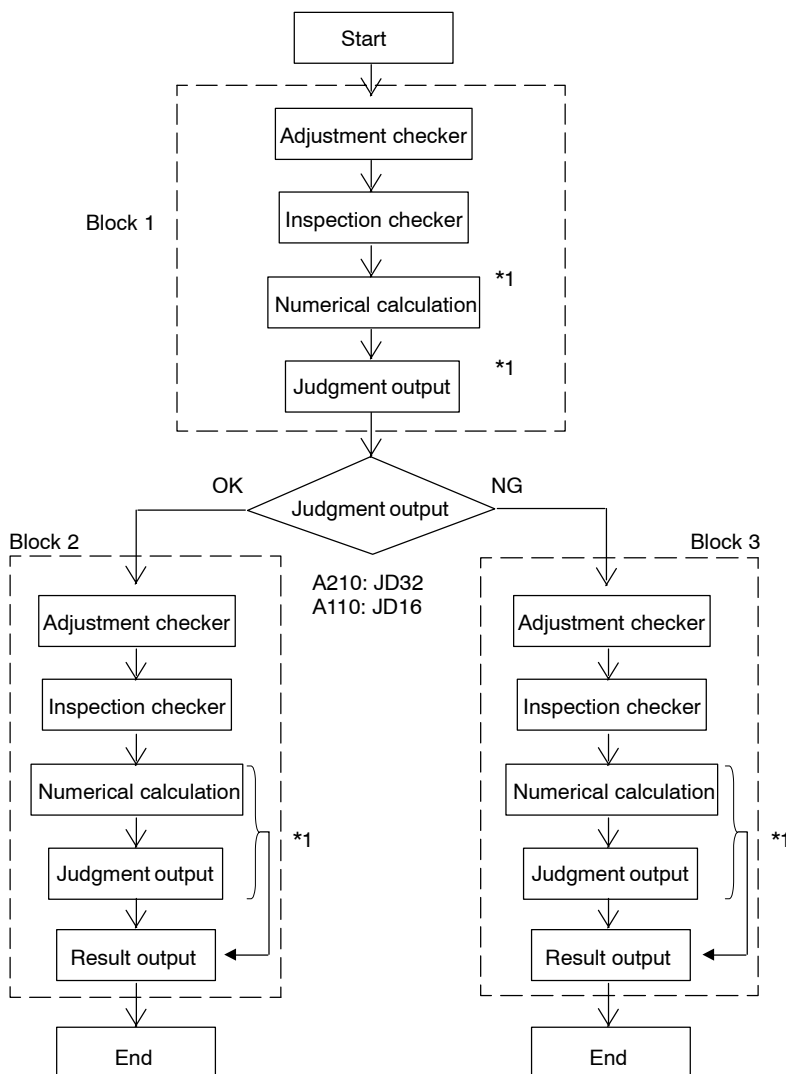
Autom. Switch (Automatic Switch) Mode

The checkers in Block 1 are executed in order, and if the judgment output (JD32 for the A210 and JD16 for the A110) is OK, Block 2 is executed, and if it is NG Block 3 is executed.

Only the executed checker patterns are displayed.

**Notes**

- During test execution, Execute All mode is used, and all checker patterns are displayed.
- In the case of menu operation, Execute All mode is performed by dummy execution, and all checker patterns are displayed.



*1 The Block 1 results are not output. To output a Block 1 result (numerical calculation or judgment output) reference the data from both Block 2 and Block 3.

User-Defined Mode

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



Notes

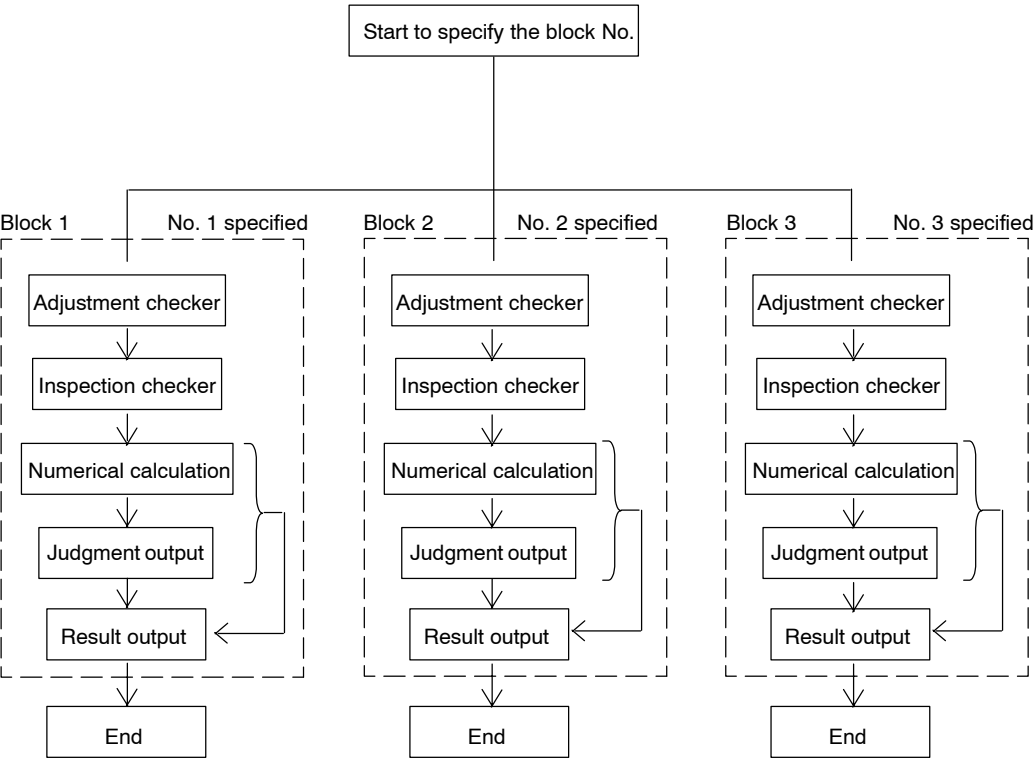
- During test execution, Execute All mode is used, and all checker patterns are displayed.
- In the case of menu operation, Execute All mode is performed by dummy execution, and all checker patterns are displayed.
- The Start Trigger cannot be used with User-Defined mode.

Item	Input or output	Details	Parallel	Serial
			I/O terminal	Command
Execution block specification for User-Defined mode	Input	Specify the block No. (1, 2 or 3)	IN1 to 2 (*)	No. 1 specified: %S1C _R No. 2 specified: %S2C _R No. 3 specified: %S3C _R

*Parallel input block number specification quick reference table.

Execution block number	IN2	IN1
1	OFF	OFF
2	OFF	ON
3	ON	OFF

2.2 Inspection Execution Procedures



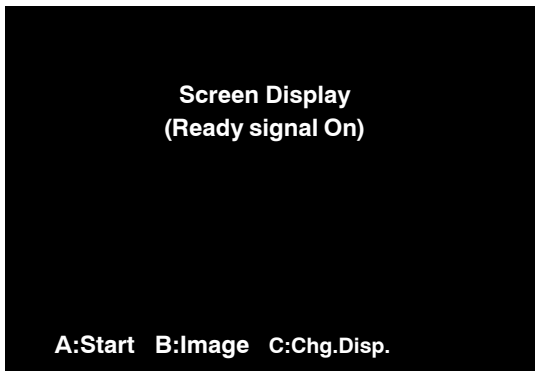
Starting block specification using the keypad when User-Defined mode is selected

Even with no external devices connected, it is possible to use the keypad as follows to specify and execute a block (including external output).

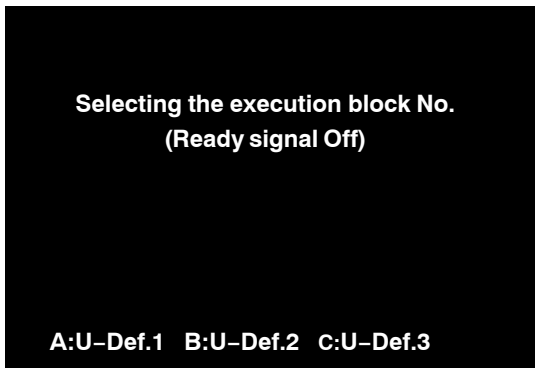
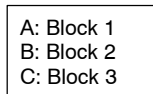
Select **User-Defined** from **1. Type.** – **7. Execution mode.**

Procedure:

1. Press **A** in the main menu.



2. Select a block for execution using the A, B, or C keys.



Inspection will be performed using the specified block number.

3. After execution of inspection by the specified block, you are returned to the screen in step 1. If you wish to execute another block, repeat steps 1. and 2.



Note

If the Start setting is set to *Manual Repeat*, the same block is repeatedly executed.

2.3 Displayed Image and Test Functions

2.3 Displayed Image and Test Functions

The image displayed is normally the image selected from the Display Image menu, but in the Checker setup menu, either a binary image or a gray scale image is displayed automatically according to the type of checker (binary or gray scale). The camera that displays the image is determined by the Select Camera setting for each of the binary checkers. If the binary checker has already been set up, the image is displayed according to the binarization level group for that checker.

The execution sequence when performing a test is position and rotation adjusters, exposure adjuster, line checkers, binary window checkers, gray scale window checkers, binary edge checkers, gray scale edge checkers, then feature extractors and smart matching.

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

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

Execution sequence when inspection is performed by selecting Start is the same as the sequence described above. Start can be selected from the Main menu, Numerical Calculation, Judgment and spreadsheets menus.



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.

2.4 Hiding Images and Menus

Menu display when a checker number is being selected.

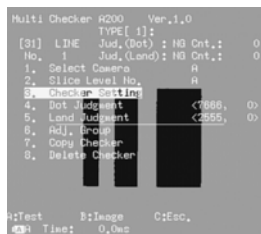
If you select a number for a checker that has already been set, the settings are displayed and the checker pattern is displayed brightly. If you select a number for a checker that has not been set, the settings are not displayed.

Hiding Images and Menus

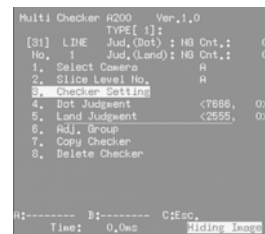
When you select and confirm a checker number, the setup menu for each checker is displayed. The Hide Image and Hide Menu functions are available only when you are working in this menu.

Use the cursor lever to toggle between displaying and hiding the image or the menu.

Hide menu



Hide image



While the image is suppressed, a highlighted “Hiding Image” message is displayed.

In this state, some functions including **A:Test**, **B:Image** and display of results are unavailable for selection.

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.

2.5 Checker Pattern Display

2.5 Checker Pattern Display

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

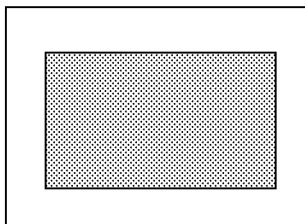
**Note**

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 *YES*, only the checker detecting the reject is displayed brightly. No other checkers have a bright pattern display.

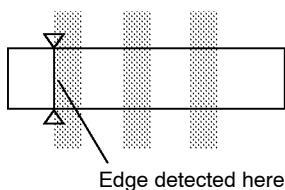
Drawing checker patterns

Exposure adjusters, line checkers, binary window checkers and gray scale window checker

Checker patterns are displayed.

**Example: Binary window checker pattern display****Binary edge checker display**

The checker pattern is displayed along with a straight line joining two triangles to mark the position where an edge was detected. The straight line and triangles are not displayed if no edge is found.

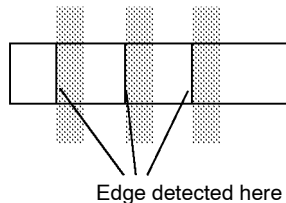
**Example: Binary edge checker pattern display**

Gray scale edge checker display

The checker pattern is displayed along with straight lines to mark the positions where edges were detected. The straight lines are not displayed if no edge is found.



Example: Gray scale edge checker pattern display



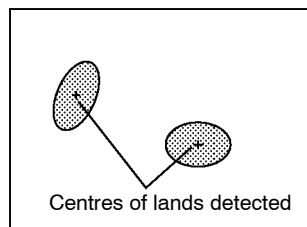
Feature extractor display

The checker pattern is displayed along with “+” marks that show position of the centre of gravity of each land detected. 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



Example: Feature extractor pattern display



Smart Matching

“+” marks are displayed at the positions specified as the output points for the checker pattern and pattern. If no pattern was detected, “+” 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.

Checker pattern display when Autom. Switch (Automatic Switch) and User-Defined modes are selected

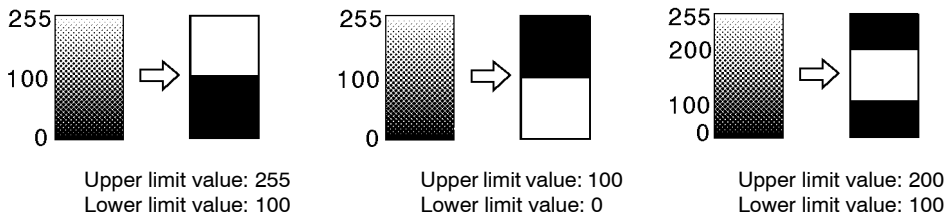
Only the checker pattern for the executed block is displayed.

When **3. Checker** in the main menu is selected, all checkers are executed and all checker patterns are displayed.

2.6 Slice Levels / Binarization Levels

About the binarization

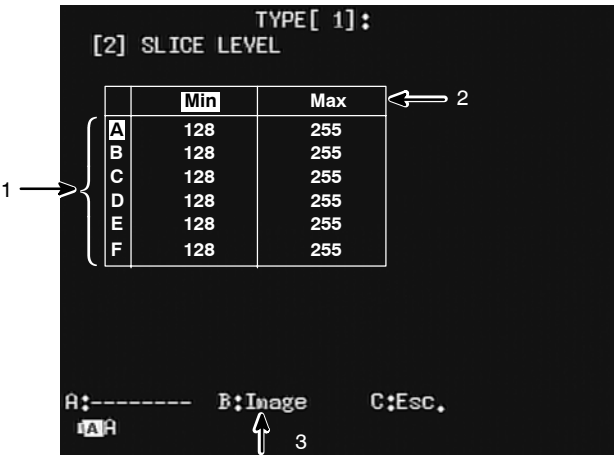
Threshold values are applied to a 256-gradation gray scale image to convert it into a 2-gradation (black and white) image called a “binarized” or “binary” image. Making binarization level settings means setting upper and lower limit values defining “white” and “black”, as shown in the diagrams below.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



With the A210/A110 you can create four 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 setting menu



- A to F (Binary Group)**
Shows the six binary level groups, ABCDEF. You can set binarization levels for each of them individually.
- Maximum, Minimum**
Sets the upper and lower limit value for the slice level.
- B: Image**
The **B** button switches the image displayed on the monitor (between Binary-Through and Binary-Memory).

*Point*

When this menu is displayed, images become binary images.

If you are displaying a live image, the image is made binary, based on the current camera image.

If you set the slice level when Display Memory Image is selected, you can adjust the slice level based on the image in the gray memory, so if you are adjusting the slice level of an object that is moving, it is convenient to make the adjustment after displaying the memory image.

2.6 Slice Levels / Binarization Levels**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 and proceed with entry mode.
You cannot make the upper limit value lower than the lower limit value.
Similarly, 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.
4. Change the binary level values using the cursor lever.
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.
5. If you are changing binarization levels in the same binary level group, repeat steps 3 and 4.
If you are changing binarization levels for a different binary level group, repeat steps 1 through 4.
6. After making the settings, return to the main screen by pressing **C**.

Reference and modify the slice level from an external device

Using serial commands it is possible to reference and modify the slice level.

➡ Refer to *16.9 Referencing and Changing Maximum/Minimum Slice Level Values* for details.



Hint

Gray scale processing and binarization

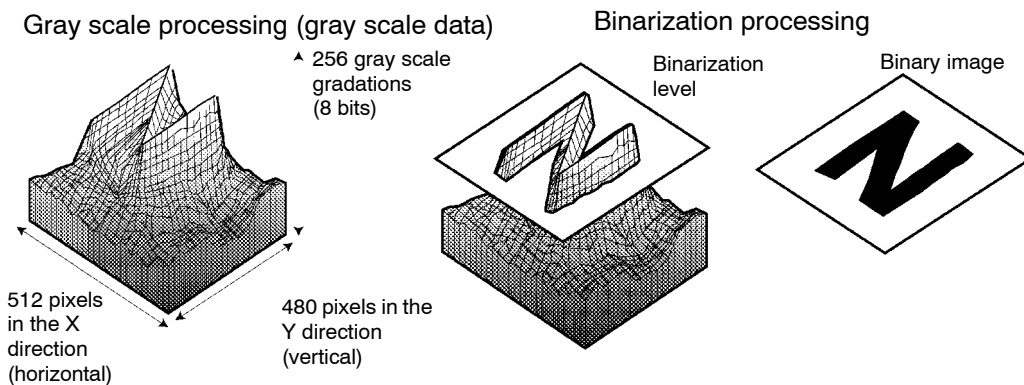
In the A210/A110, the image signal from the camera is stored in the memory in the form of a gray scale image (i.e. a set of image data including brightness data) with 256 gradations. (The A210/A110 has a memory comprising 480×512 pixels, each using 8 data bits to represent 256 gray scale gradations.)

Gray scale processing is employed by the A210/A110 Multichecker for high-precision character verification. The gray scale image is converted directly into brightness data (data concerning conditions and differentials in changes in brightness values) which is then processed.

Because gray scale processing uses brightness data directly, it not only offers a high degree of precision in processing, but also allows detection to be performed reliably even in the face of fluctuations in brightness.

Binarization processing in the A210/A110 is carried out using gray scale memory data. Binarization is a process whereby locations brighter than a specified brightness level are regarded as white, while locations darker than the specified level are regarded as black. The Multichecker uses binarization processing for line checkers, binary window checkers, binary edge checkers and feature extractors.

Because binarization processing uses the gray scale memory, moving objects can be inspected by processing an image held in memory.



2.7 Specifying Position and Rotation Adjustment Group

2.7 Specifying Position and Rotation Adjustment Group

For the A210

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

When changing the group number of a checker to which rotation adjustment has been applied, or when changing the adjuster group which has an angle of rotation, an “Area will be changed. OK?” message is displayed. Select **Yes** to change the group number. The execution position (angle) of the checker adjusted for position or rotation will change at that point.

If you select **No**, the group number will not change.

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

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

For the A110

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

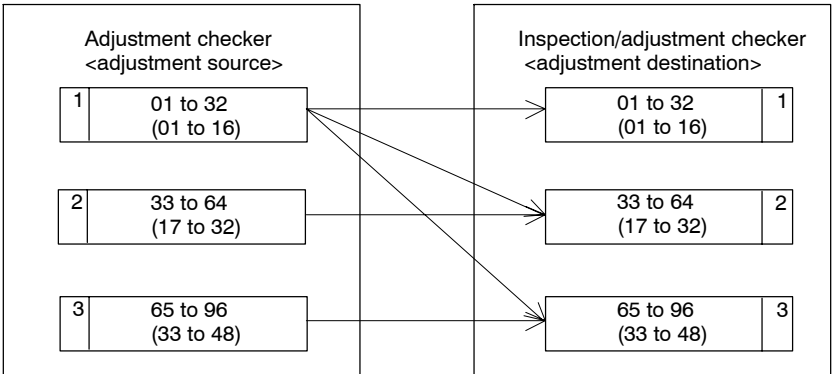
2.7 Specifying Position and Rotation Adjustment Group

 Note

Limitations that apply when an adjustment group is set
When you want to set adjustment groups for the checkers, note that the limitations given on the following page apply regarding the adjustment checkers that can be set.

<Adjustment group setting limitations>

The A110 values are in brackets



It is not possible to adjust in a direction for which there is no arrow shown.

<Adjustment group numbers that can be set for the checker numbers>

The A110 values 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>

2.8 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.)

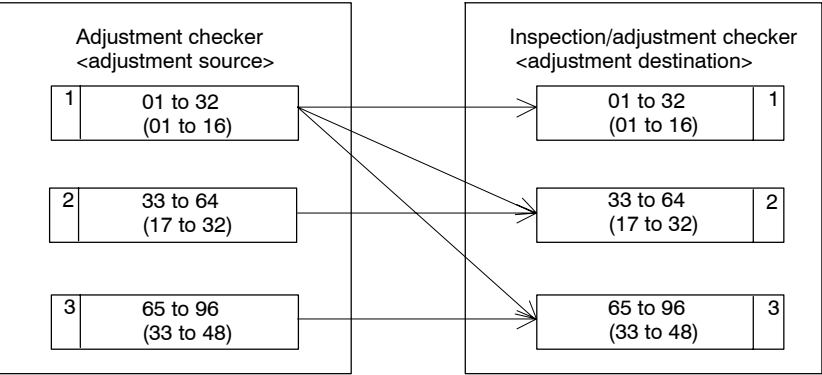
 **Note**

Limitations that apply when an adjustment group is set

When you want to set adjustment groups for the checkers, note that the limitations given on the following page apply regarding the adjustment checkers that can be set.

<Adjustment group setting limitations>

The A110 values are in brackets



It is not possible to adjust in a direction for which there is no arrow shown.

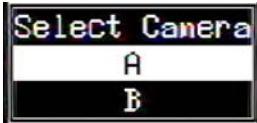
<Adjustment group numbers that can be set for the checker numbers>

The A110 values 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>

2.9 Selecting Camera

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



If only one camera is connected, or if the setting for the 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).

This is fixed at A for the A110.

If you try to select a camera in this case, the following message is displayed.



2.10 Area Setup and Out-of-Area Range Setting

2.10 Area Setup and Out-of-Area Range Setting

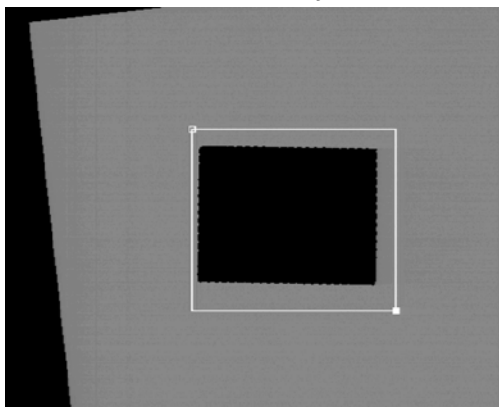
Area coordinates can be set in the ranges X: 0 to 511, Y: 0 to 479. When the area has been set correctly, it is executed at the specified position from the next test. If a checker area is moved, the mask moves with it at the same time.

**Note**

If filtering with a 5×5 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 an attempt is made to set coordinates outside the range available, a “Position is out of image range.” error is displayed and the coordinates return to those before the change was attempted.

For the A210

When the checker for area setup is automatically adjusted for rotation, the display shows the state after adjustment.



The colour of the parts of the screen where there is no image is determined by the Outside Region Value set in the environment settings. (In the case of binary image processing checkers, this also depends on the maximum and minimum setting values for the binary level groups.)

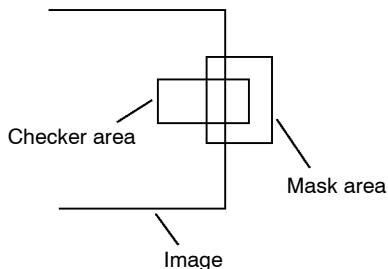
2.10 Area Setup and Out-of-Area Range Setting

In the case of images for which the correction angle is 0° , there are sections where the off-screen area is displayed. Areas cannot be set in these sections.

For checkers that generate an error at execution due to correction resulting in the image moving off the screen, the checker pattern is displayed at the setting position. For the area settings at such times, changes in the area are done from this position. The same applies for the next executed checker at the position of the area setting.

In some cases, due to the next execution position, and depending on the amount of correction, area settings may not be possible, even though they are inside the screen (cases when the setting position cannot be set inside the screen). In such cases, the error message: "Position is out of image range." is displayed.

If the error occurs when you are making area settings, the area coordinates are returned to their original values.



There are some situations in which an error is not generated when a checker is adjusted out of the screen area by a position and rotation adjuster. In these situations, the area setting cannot be made without modification. Move the area to the centre of the screen before setting the area again.

Area setting image display:

- (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.

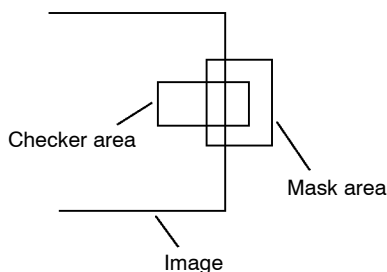
2.10 Area Setup and Out-of-Area Range Setting

For the A110

For checkers that generate an error at execution due to correction resulting in the image moving off the screen, the checker pattern is displayed at the setting position. For the area settings at such times, changes in the area are done from this position. The same applies for the next executed checker at the position of the area setting.

In some cases, due to the next execution position, and depending on the amount of correction, area settings may not be possible, even though they are inside the screen (cases when the setting position cannot be set inside the screen). In such cases, the error message: "Position is out of image range." is displayed.

If the error occurs when you are making area settings, the area coordinates are returned to their original values.



There are some situations in which an error is not generated when a checker is adjusted out of the screen area by a position adjuster. In these situations, the area setting cannot be made without modification. Move the area to the centre of the screen before setting the area again.

Area setting image display:

- (1) Binary checker with filtering specified
The filtered image is displayed.
- (2) Binary checker adjusted with an exposure adjuster
An image with the adjusted binarization level is displayed.

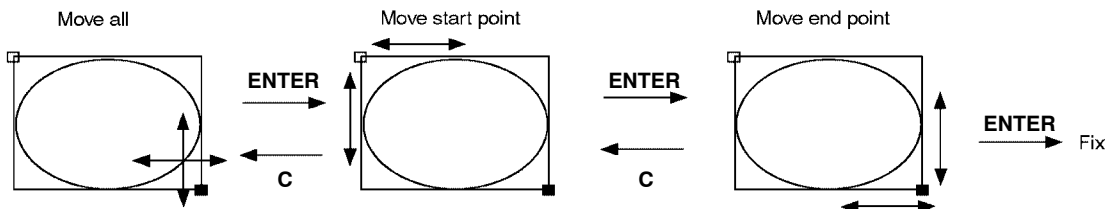
If the conditions in (1) and (2) are satisfied, the image is displayed with all those conditions present.

2.11 Checker Area and Marker Area Setting Method

2.11.1 Rectangle / circle (oval)

Press **ENTER** to switch between Move all, Move start point, Move end point and Fix. Press **C** to go in the opposite direction.

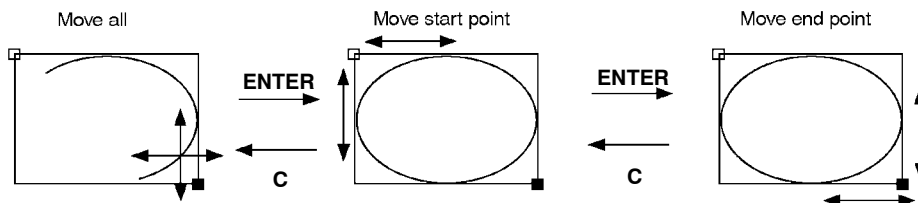
Use the cursor lever to move the whole area, the start point and the end point.



2.11.2 Arc

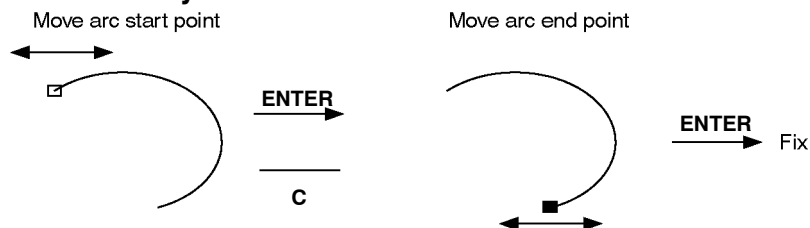
Press **ENTER** to switch between Move all, Move start point, Move end point, Move arc start point, Move arc end point and Fix. Press **C** to go in the opposite direction.

Use the cursor lever to move the whole area, the start point and the end point.



Notes

- When the start point or end point is moved, the shape is automatically converted to from an arc to a circle.



A button: Switches between right and left rotation.

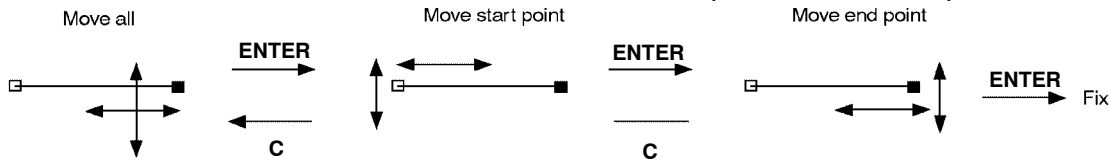
- The arc shape cannot be fixed if any part of the arc is outside the screen area. Make sure to set the arc so that it is all within the screen area.

2.11 Checker Area and Marker Area Setting Method

2.11.3 Line

Press **ENTER** to switch between Move all, Move start point, Move end point and Fix.
Press **C** to go in the opposite direction.

Use the cursor lever to move the whole area, the start point and the end point.


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. (Diagonal lines cannot be set.)

2.11.4 Polygonal line

Press **ENTER** to switch between Move all and Set node. Press **C** to go in the opposite direction.

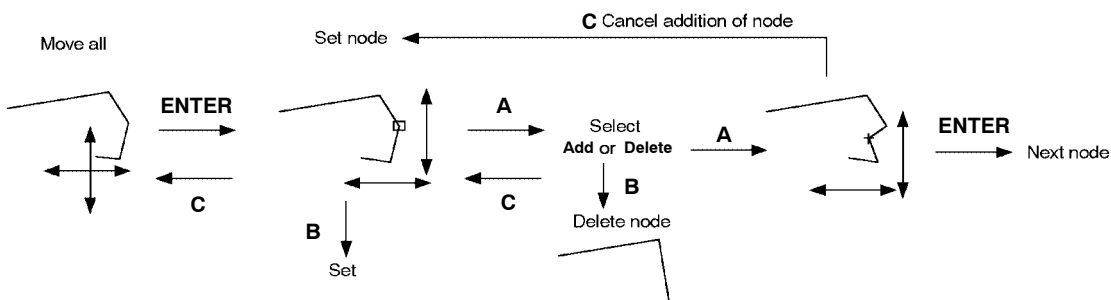
When moving a node, pressing **A** twice adds an additional node, and pressing **A** and **B** deletes a node.

Adding a 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

Delete the selected node. Nodes can be deleted until only the minimum three nodes remain.



2.11 Checker Area and Marker Area Setting Method

2.11.5 Polygon

Press **ENTER** to switch between Move all and Set node. Press **C** to go in the opposite direction.

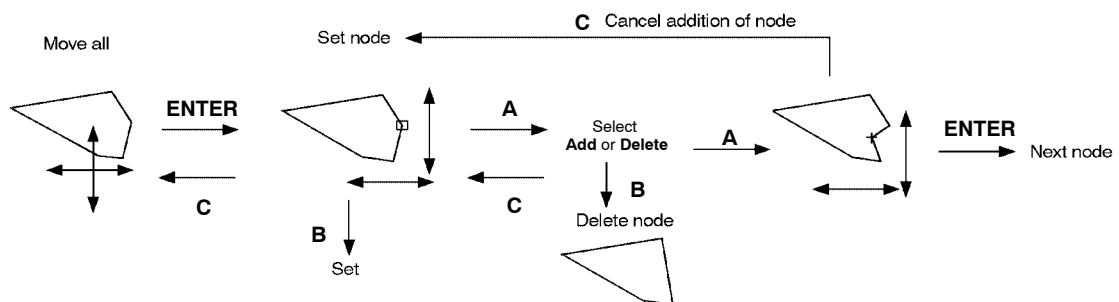
When moving a node, pressing **A** twice adds an additional node, and pressing **A** and **B** deletes a node.

Adding a 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

Delete the selected node. Nodes can be deleted until only the minimum three nodes remain.

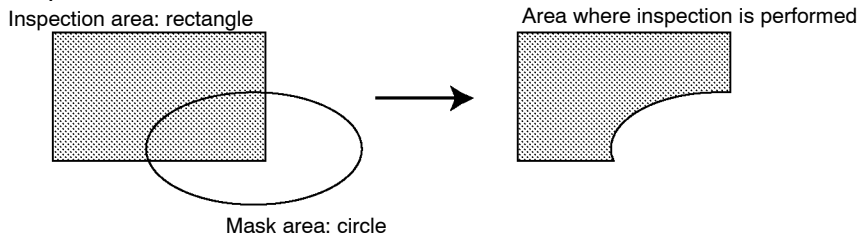


2.12 Setting Masking

2.12 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 or extraction area where inspection or extraction is not performed. Setting a mask area is one way of adapting a checker's inspection area or an extractor's 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 an adjuster.

(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.

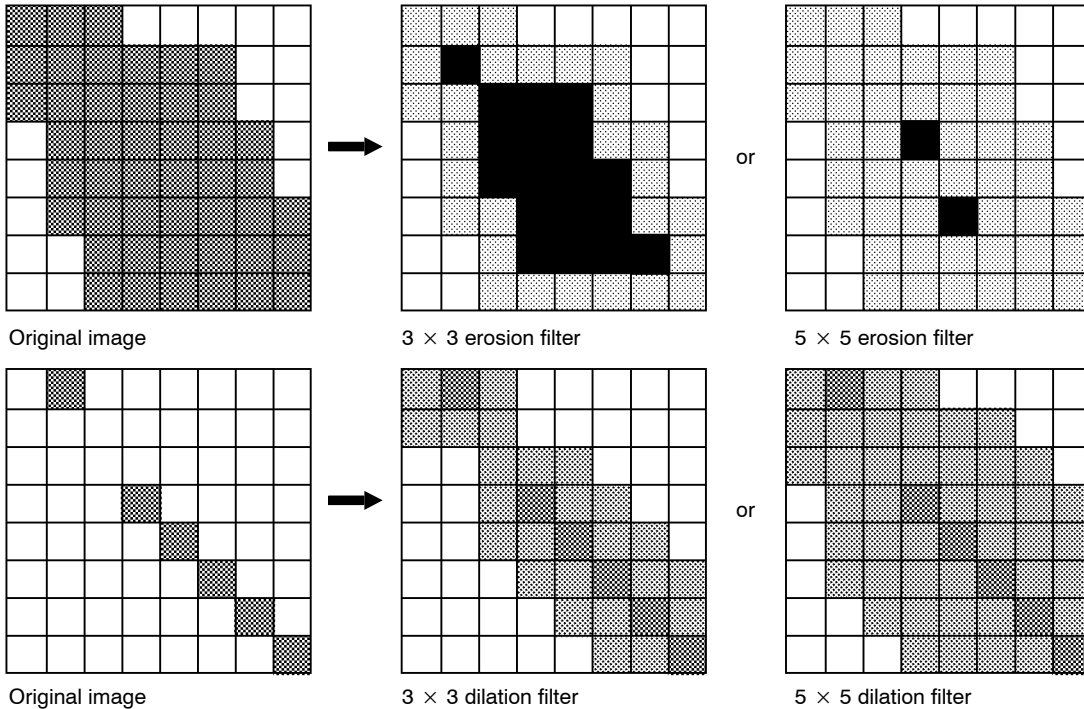
Since the area setting also applies to the next inspection, it is sometimes the case that it is not possible to set the checker within the screen area because of the amount of adjustment. (The setting position cannot be set within the screen.) In this sort of situation, the "Position is out of image range." message is displayed. Move the area to the center of the screen before attempting the shape change again. If the error occurs when the area is set, the coordinates revert to the coordinates before the change was made.

2.13 Filter Setup

You can use filter processing with Smart Matching checkers to eliminate unwanted parts.

Both dilation and erosion filters are available. These filters work on a captured image, performing dilation or erosion before inspection. You can check enlarged and reduced images in the area setting screen for each checker.

Two levels of filtering; 3×3 and 5×5 , are available for both dilation and erosion filters, working on a 3-pixel square or 5-pixel square relative to the original image.



2.14 Changing Shapes

2.14 Changing Shapes

A shape change is applied at the position displayed before the change, with the default size of the changed shape.

A shape cannot be changed if the whole of the inspection area is included within the mask area. The “No searching area exists. Changes can’t be stored.” error message is displayed. Move the area to the center of the screen before attempting the shape change again.

If an attempt is made to change a shape at the edge of the screen and the “Position is out of image range.” message is displayed, move the area to the centre of the screen before attempting the shape change again.

2.15 Entering Upper and Lower Limit Values

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



Example: 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 Judgement <245760, 0>

5. Adj. Gr | Area Judgment

6. Copy C | Max 245760

7. Delete | Min: 0.0

2.16 Copying a Checker

2.16 Copying a Checker

Procedure:

1. Set the number of the checker for the destination.
2. Select **Copy checker**.
3. Set the checker number for the source checker within the same type.

**Note**

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.

4. A message saying, “Data exists in destination, OK to overwrite?” is displayed. Select and confirm **Yes** if you want to copy or **NO** to cancel the copying.

2.17 Deleting a Checker

Procedure:

1. Set the number of the checker to be deleted.
2. Select **Delete checker** and confirm.
3. A message saying, "Delete?" is displayed. Select and confirm **Yes** if you want to delete or **NO** to cancel the deleting.



Note

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

2.17 Deleting a Checker

Chapter 3

Environment and Type

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3.1 Setting Item List

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

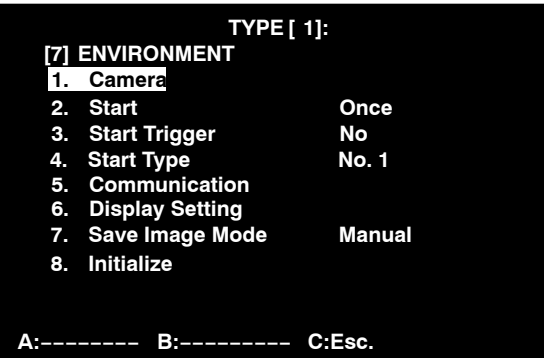
Setting item		Setting menu	Explanation page
Camera settings	Camera mode and type	Environment	3 – 5
	Shutter speed	Environment	3 – 5
	Camera selection (when two are connected)	Type	3 – 21
Scan method	Scan start method	Environment	3 – 6
	Setting the Execution Mode	Type	3 – 27
	Image data save method	Environment	3 – 15, (15 – 3)
Status after power up	Type selection at power up and type switching	Environment	3 – 12
	Camera image selection at power up and type switching	Type	3 – 22
	Display item selection at power up and type switching	Type	3 – 26
Display settings	Screen brightness setting	Environment	3 – 14
	Display item selection at power up	Type	3 – 26
Communication settings	Serial/parallel settings	Environment	3 – 13, (16 – 5)
	Computer Link	Environment	3 – 13, (16 – 56)
Type creation	Create new type	Type	3 – 20
	Input type title	Type	3 – 20
	Delete type settings	Type	3 – 25
	Copy the settings for another type	Type	3 – 24
	Initialize all types (delete all at once)	Type	3 – 28

3.2 Environment Settings (Environment settings common for all types)

3.2 Environment Settings
(Environment settings common for all types)

3.2.1 Menu screen

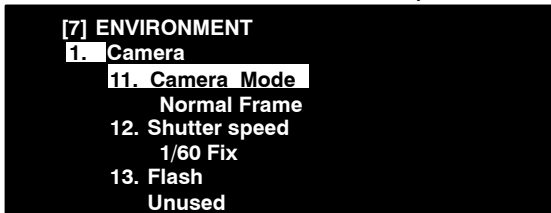
Set environment settings such as the camera mode and shutter speed for use in inspections, and also the I/O settings.



- 1. **Camera**
Set the camera mode and shutter speed.
- 2. **Start**
Set the inspection start method (Once, Manual Repeat or Auto Repeat).
- 3. **Start Trigger**
This function causes the A210/A110 itself to detect whether a target object is inside the inspection region.
- 4. **Start Type**
Set the number of the type that starts up when the power is turned on.
- 5. **Communication**
Set serial, parallel or other communications.
- 6. **Display Setting**
Sets the screen display.
- 7. **Save Image Mode**
Allows you to set up how images are stored.
- 8. **Initialize**
This returns the Environment settings to the original factory settings.

3.2.2 Camera

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



11. Camera Mode

- **Normal Frame**
This is the standard mode for the camera. 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.
- **Double Speed Random Frame**
This is the setting for random shutter camera mode. Use the ANM831 camera. Set the DIP switch 6 on the rear side of the camera to “ON”. Shutter speeds between 1/120 to 1/20,000 are available.
- **Double Speed Random Field**
This is the setting for random shutter camera mode. Use the ANM831 camera. Set the DIP switch 6 on the rear side of the camera to “OFF”. Shutter speeds between 1/120 to 1/20,000 are available.
- **Internal Synchronization mode Frame**
In this mode, the camera uses internal synchronization. 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. 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 1/10,000sec.

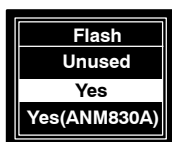
12. Shutter Speed

Set the shutter speed after selecting one the following camera modes:
Normal field, double speed random frame/field, internal sync-mode field.

3.2 Environment Settings (Environment settings common for all types)

13. Flash

Set to **Yes** in the case that you wish to use flash illumination. Set this when you have selected Normal Frame for the camera mode. This initial setting is **Unused**.



Note

If the standard camera being used is the ANM830A, set this to *Yes (ANM830A)*.

3.2.3 Start

Set the inspection start method.

Repeated inspection is only possible with the Main menu (Checker and Spreadsheets), Numerical Calculation menu, Judgment menu and Spreadsheets menu.

– 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 commences 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. After inspection stops, restarting is the same as for Repeat (manual).

	A button	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



Note

If you want to stop the inspection using parallel start signal, input the start signal when the READY signal was turned OFF, and hold the start signal ON until the next READY signal is turned ON. If the external devices cannot recognize that the READY signal was turned OFF, input the start signal when the READ END (REND) signal was turned ON.

3.2.4 Start Trigger

This function causes the A210/A110 to detect whether a target object is inside the inspection region, rather than detecting a signal from some external device.

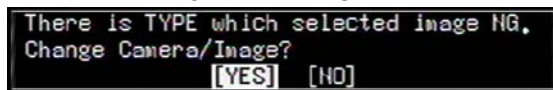
Images are continuously captured until a target object enters the inspection region, and at this point, the inspection checker executes. **POS.ROT. ADJ. Checker No. 1** is used to detect the target object.

The display image 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.



```
There is TYPE which selected image NG.  
Change Camera/Image?  
[YES] [NO]
```

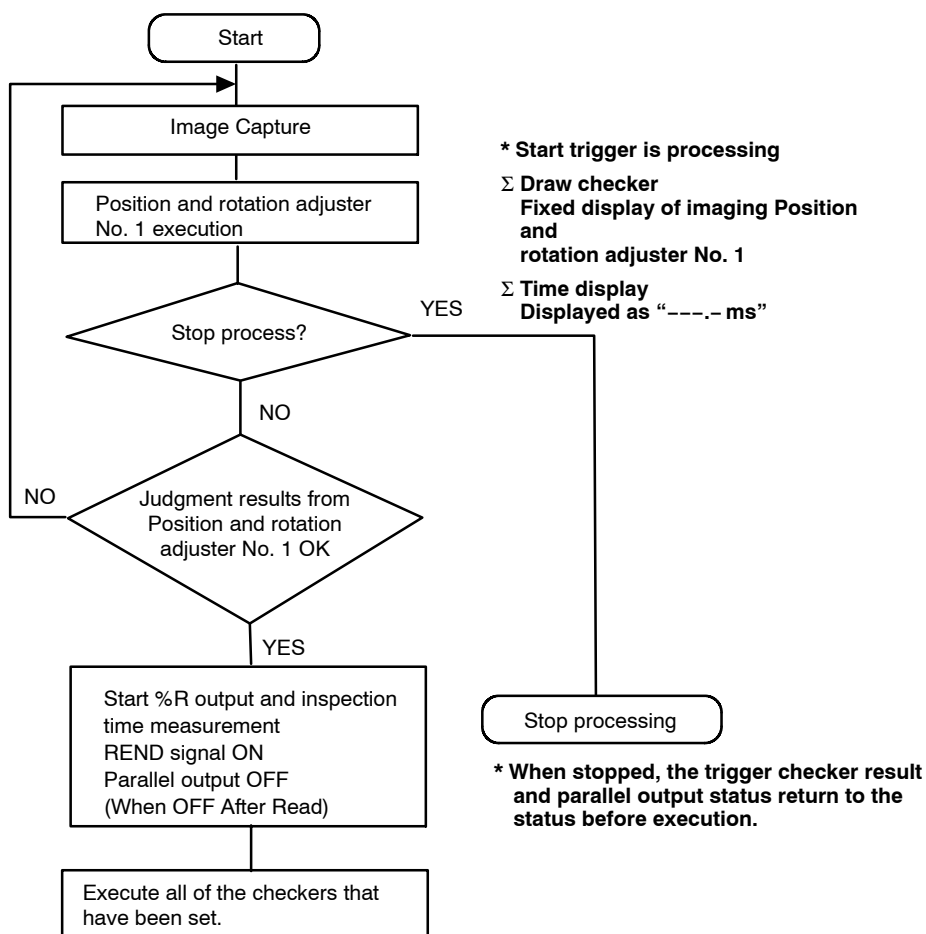
3.2 Environment Settings (Environment settings common for all types)

Stopping the image start trigger process

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

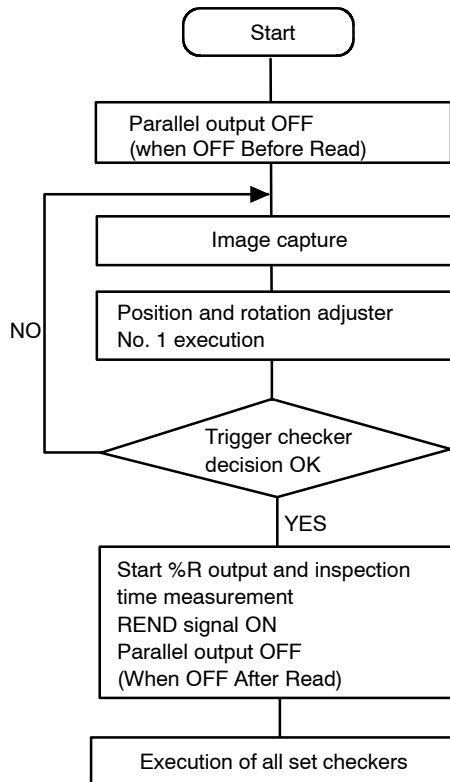
However, since the judgement of whether a keypad or parallel signal input has been made occurs in the tiny amount of time between image captures, stopping may not occur with the input of that moment.

When the process is stopped only 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”.

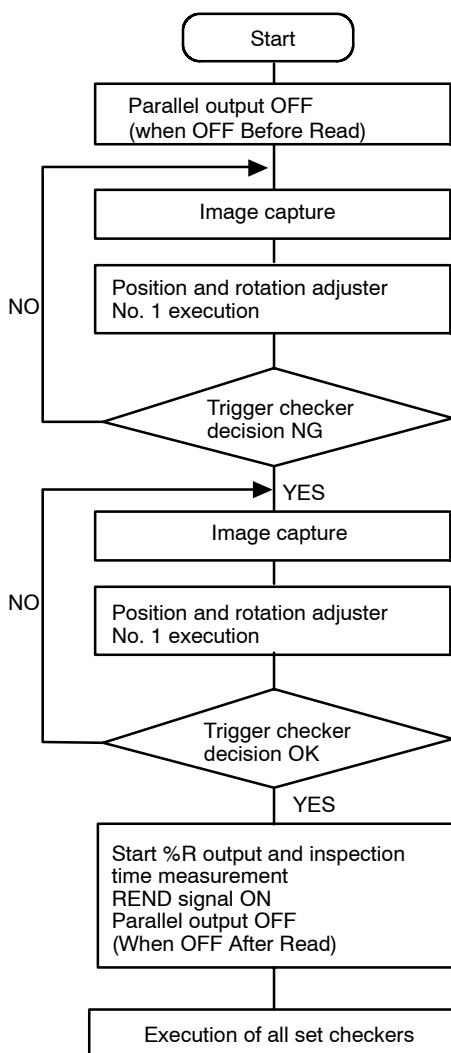


Start trigger action during repeated starting

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

First execution

3.2 Environment Settings (Environment settings common for all types)

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.

3.2 Environment Settings (Environment settings common for all types)

- **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 re-execution is done using the %R command, the trigger checker is executed without any conditions and other checker executions are controlled based on the result. Since repeated executions will not occur, the trigger checker's inherent control actions, OK waiting and NG waiting will not occur.

3.2 Environment Settings (Environment settings common for all types)

3.2.5 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 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 execute a data save using a serial command from an external device.

➡ **Refer to 16.6 Saving Type Data for details.**



Note

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

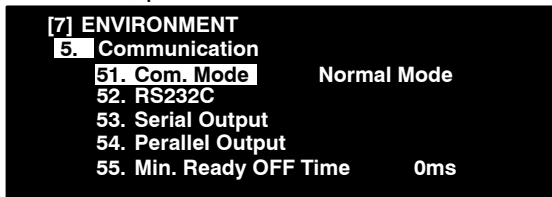
41. Display Message

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 set as the Start Type, the message is not displayed.

3.2.6 Communication

Set serial, parallel or other communications.



51. Communications Mode

Select either **Normal Mode** or **Computer Link** as the communications mode.

52. RS232C

53. Serial Output

54. Parallel Output

Refer to *16.2 Communications Settings* for details.

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).

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.

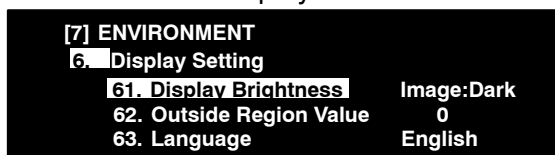
The Ready OFF times are applied in all cases except the following.

- Menu selection.
- Switching images or displays by pressing either B or C.
- Inspection execution initiated using the Start trigger.
- VBT mode.

3.2 Environment Settings (Environment settings common for all types)

3.2.7 Display Setting

Sets the screen display.



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 screen is made darker, but the brightness of the text in the menus etc. remains the same (this setting has no effect on actual inspection).

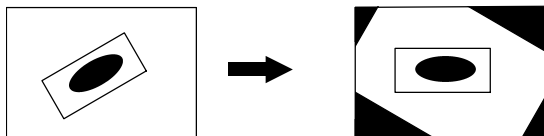
However, this setting only applies to gray images, and the brightness is not changed in the case of binary images.

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 A210)

Displays the image (rotated image) minus the adjustment amount when displaying an area checker with a rotation adjustment amount.

The results of the rotation as well as areas outside the screen are displayed, and you can specify the gray scale value of this area (0 to 255).



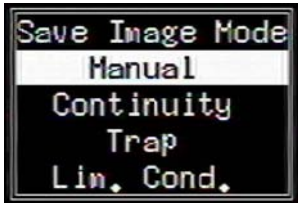
If you are using a gray checker, the specified gray scale value is displayed but if you are using a binary checker, the area will be black or white, according to the slice level that has been set.

63. Language

Switches the menu display language (Japanese or English).

3.2.8 Save Image Mode

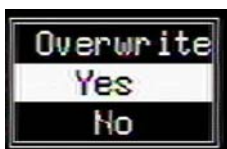
Allows you to set up how images are stored. The maximum number of images that can be stored is 30 for the A210 and 8 for the A110. If you select **Continuity**, **Trap**, or **Lim. Cond.** as the save mode, you can select **Overwrite: Yes** or **No** for the stored image memory for all of the save modes.



- **Manual**
Current Memory Image is stored using the keypad.
- **Continuity**
Stores the image for every inspection.
- **Trap**
Stores the image when the result in the register set for **Trap** in **Judgment** 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 stored is exceeded and the trap conditions are established, and an error message is displayed on the screen.
➡ Refer to *13.4 Judgment Output* for details regarding the Trap function.
- **Limit Condition (Lim. Cond.)**
The image is stored if any one of the upper or lower setting limits of the results of the three optional formulas set as limit conditions are exceeded.
➡ For details regarding setting the limit conditions, refer to *Setting and Deleting Limit Conditions* in *13.3.2 Creating a Numerical Calculation Programme*.

3.2 Environment Settings (Environment settings common for all types)

71. Overwrite



Yes: When the total 30 (A110 = 8) images have been stored in the image store memory, the oldest image is overwritten if there is a trigger to capture more images.

No: When the total 30 (A110 = 8) images have been stored in the image store memory, new images are not stored even if there is a trigger to capture more images.

- **Lock Image**

Sets a lock on individual stored images. If you set a lock, that image can never be overwritten.

- **Save Limit**

The A210 can store up to 30 screen images.

When using both the A and B cameras with the A210, be certain to store in two-screen sets (a maximum of 15 image sets can be stored).

The A110 can store up to 8 screen images.

It is not possible to delete stored images one at a time or switch them. In addition, it is not possible to specify the number under which an image is stored.



Note

Stored images are lost under the following conditions:

- When you switch the power off.
- When you switch to Camera mode (*Camera Settings*) or change the shutter speed.
- When you change the *Image Data Save* settings.
- When you delete, initialize, or copy a type.
- Initialize the Environment settings.
- When you switch the capture camera setting to a different type.

➡ Refer to *15.1 Loading and Storing Image Data* for details.

3.2.9 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.

3.3 Types

3.3 Types

You can register a maximum of 64 sets of inspection condition data for the A210 in the controller (32 for the A110).

This inspection data is called a **TYPE**, and each type is managed by giving it a title. The Type screen allows you to switch between types, copy or delete them, and set how to display them.

3.3.1 Menu Screen



TYPE [1]:

Input the type number. Input any number in the range 1 to 64 for the A210, or 1 to 32 for the A110.

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 type data.

2. Delete Type

Deletes the type data.

3. Input Type Title

Allows you to enter 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.

4. Capture Camera

Set the image capture camera for each type.

5. Camera/Image

Select 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.

6. Menu Setting

The settings made here are used for the display when the selected type is read due to application of power or by the type switch operation.

7. Execution Mode

Select from Execute All Mode, Autom. Switch Mode and User Defined Mode.

➡ Refer to *2.2.2 Execution Modes*.

8. Initialize all Types

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

Rest:

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



Notes

The following restrictions apply to the settings for type data.

- 1. The amount of data for all checkers for all types must not exceed 1280 kbytes (approximately).**
- 2. The total number of checkers set for all types must not exceed 4096 (*1).**

(*1) 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.**

3.3 Types

3.3.2 Creating a New Type Number

Procedure:

1. Input and set the new type number that you wish to create.

3.3.3 Entering a Type Title

Procedure:

2. Select **Input Type Title**.
3. 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
Q	R	S	T	U	V	W	X	4	5
Y	Z	!	#	\$	%	&	'	1	2
<	>	;	:	=	-	,	.	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
Q	R	S	T	U	V	W	X	4	5
Y	Z	!	#	\$	%	&	'	1	2
<	>	;	:	=	-	,	.	0	()
Input is completed									

4. 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
Q	R	S	T	U	V	W	X	4	5
Y	Z	!	#	\$	%	&	'	1	2
<	>	;	:	=	-	,	.	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

3.3.4 Set the Capture Camera

Set the image capture camera for each type (fixed at A for the A110).

Two cameras can be connected to the A210 (camera A and camera B), so select from among the following five possibilities.

- 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, and camera B captures the right half, and the image is composed as a memory (camera) A image.
Only the checkers set for camera A execute.
- AB Horizontal: Camera A captures the top half of the image, and camera B captures the bottom half, and the image is composed as a memory (camera) A image.
Only the checkers set for camera A execute.



Notes

- 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 stored image data (including locked data) is erased.
- In the case that 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, in the case that 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.

3.3 Types

3.3.5 Select the Camera/Image

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**.

Capture Camera settings:
A, AB Vertical, AB Horizontal

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

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

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



Notes

- Select either *Mem* Image or *NG* Image (gray/binary) for inspection execution (for *Thru* Image display, regardless of whether the standard camera or the double-speed random camera is used, the image capture execution time will be longer than normal).
- When *Start Trigger* is set to *YES* or *User-Defined Mode* is selected, *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]

3.3 Types

3.3.6 Switching Between Types

Procedure:

1. Enter the type number for the type you want to switch to and press **C** , and the type is switched and you return to the main menu.



Notes

- 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.

3.3.7 Copying a Type

Procedure:

1. Set a copy destination for the type number.
When changing the capture camera, the stored 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.



Notes

- 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 stored with the copy destination type, including those that are locked, are all deleted.
- When the type was copied, spreadsheets data for the number of scans with the copy destination type, data for the number of errors, and OK and NG data are all reset to zero.

3.3.8 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.

3.3 Types

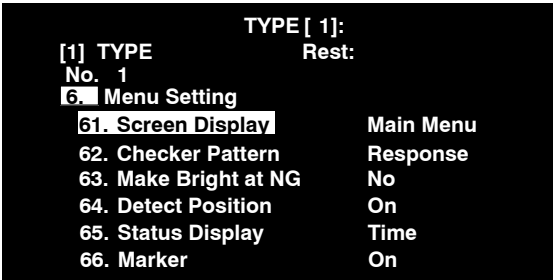
3.3.9 Selecting Initial Display Settings

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 controller power is turned on.

➡ Refer to *1.3.3 Changing Display Items* for details.

Procedure:

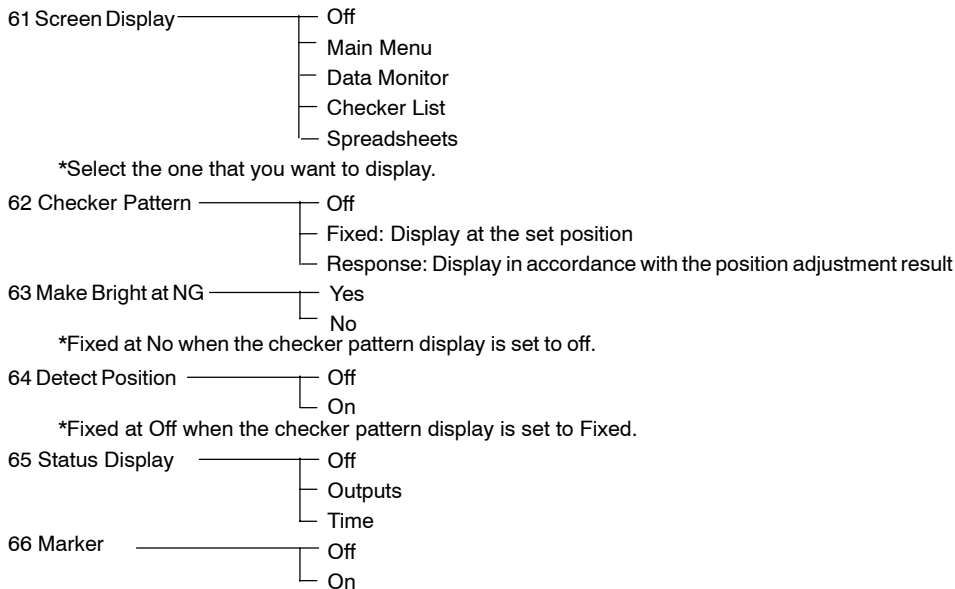
- 1. Set and confirm the type number for setting the initial display.
- 2. Select and confirm **6. Initial Display Settings**.



- 3. Select the item that you want to set, and confirm your selection to display the selection menus.

➡ Refer to *1.3.3 Changing Display Items* for details.

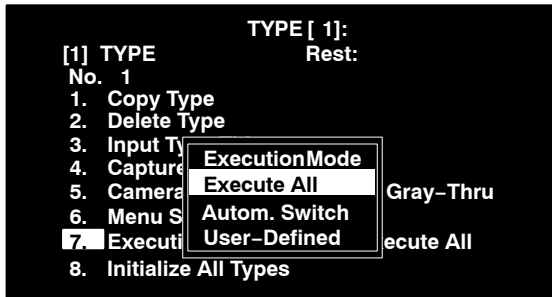
Use the cursor lever to select the display items.



- 4. Press **ENTER** to confirm.

3.3.10 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.

Execute All: Executes all set checkers in numerical order.

Autom. Switch (Automatic Switch): Executes the checkers in Block 1, and then executes either the Block 2 or Block 3 checkers depending on the result of the judgment output.

User-Defined: Executes the checkers in the block specified by external input (serial or parallel).

➡ Refer to 2.2.2 *Execution Modes* for details regarding the execution modes.

The details for each block are as follows.

	Checker Number	
	A210	A110
Block 1	01 to 32	01 to 16
Block 2	33 to 64	17 to 32
Block 3	65 to 96	33 to 48

3.3 Types

3.3.11 Initializing All Type Data

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

Procedure:

1. Select **Initialize all Types** and confirm.
2. A message saying, "CAREFUL! Type data will be lost. OK?" is displayed. Enter **YES** to delete all types. Enter **NO** to go back without deleting.



Note

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

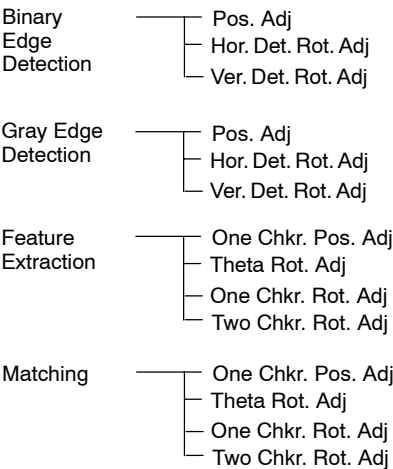
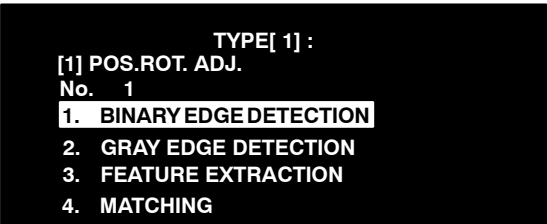
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4.1 Position and Rotation Adjustment

The A210 is equipped with a position and rotation adjustment function (position adjustment only in the case of the A110) for performing position adjustment. You can set up to a maximum of 96 adjustment checkers for the A210, and 48 for the A110. Although the A110 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.



4.1 Position and Rotation Adjustment**Note**

In order to make the appropriate adjustments, the Multichecker 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 Image Checker 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.

4.2 The Various Modes for Position/Rotation Adjustment Checkers

Binary edge checker: Position adjustment

Binary edge checkers are used as the base checkers, calculating adjustments ΔX and ΔY from the results of vertical and horizontal scanning checkers.

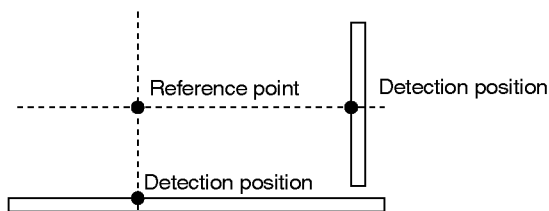
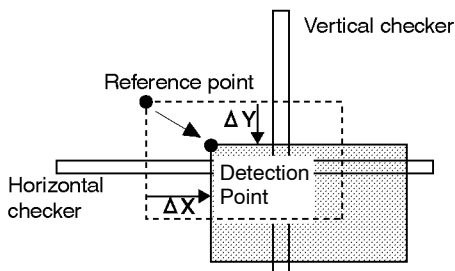
Shapes available are lines and planes, with a mixture of the two being possible.

There is no need to set both the horizontal and vertical base checkers if not required. If only one is set, the adjustment in that direction will be calculated. If both checkers are set, the order of priority can be specified.

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.

With a binary edge checker, the edge detection position is on the top of the checker when scanning in the horizontal direction, and on the left of the checker when scanning in a vertical direction.

The distance between the reference point and the detection point is the amount of adjustment.

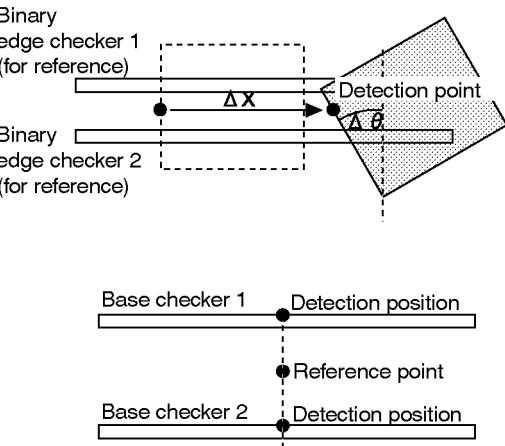


4.2 The Various Modes for Position/Rotation Adjustment Checkers

Binary edge checker: Horizontal detection rotation adjustment (A210 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 centre point of the coordinate obtained by checker 1 and the coordinate obtained by checker 2.



4.2 The Various Modes for Position/Rotation Adjustment Checkers

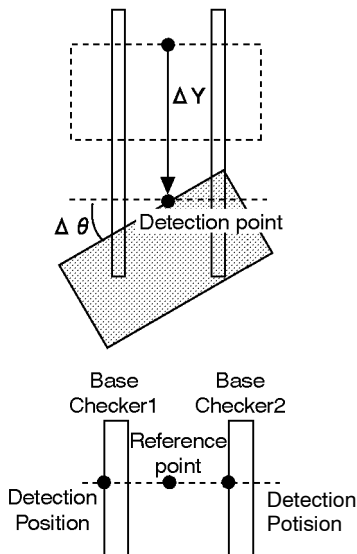
Binary edge checker: Vertical detection rotation adjustment (A210 only)

Binary edge checkers are used as the base checkers, and the amount of adjustment ΔY $\Delta \theta$ (angle of rotation) is calculated from the results of two vertical checkers.

Shapes available are lines and planes, with a mixture of the two being possible.

Since the amount of adjustment is calculated from the results of two base checkers, the reference position cannot be set unless two checkers are set.

The reference point is the centre point of the coordinate obtained by checker 1 and the coordinate obtained by checker 2.



4.2 The Various Modes for Position/Rotation Adjustment Checkers

Gray scale edge checker: Position adjustment

Gray 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.

There is no need to set both the horizontal and vertical base checkers if not required.

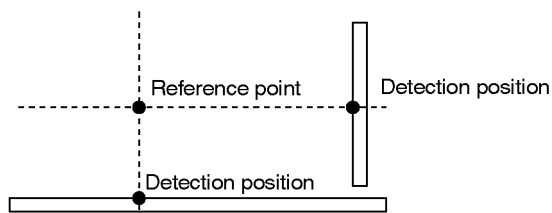
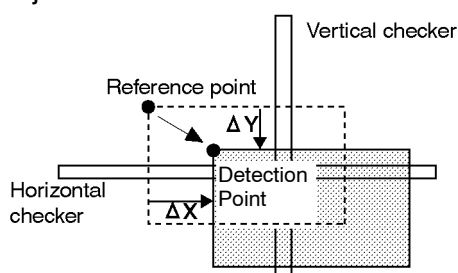
If only one is set, the adjustment in that direction will be calculated.

If both checkers are set, the order of priority can be specified.

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.



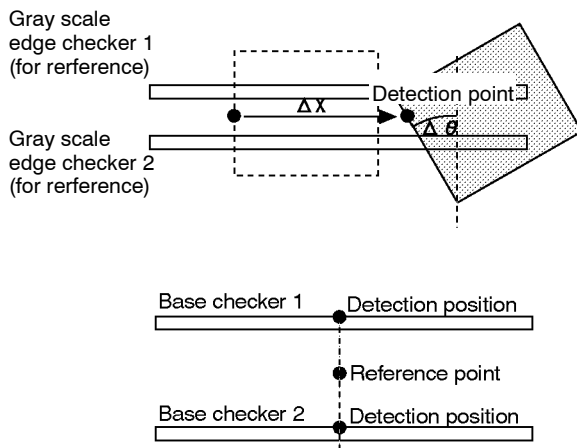
4.2 The Various Modes for Position/Rotation Adjustment Checkers

Gray scale edge checker: Horizontal detection rotation adjustment (A210 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 centre point of the coordinate obtained by checker 1 and the coordinate obtained by checker 2.



4.2 The Various Modes for Position/Rotation Adjustment Checkers

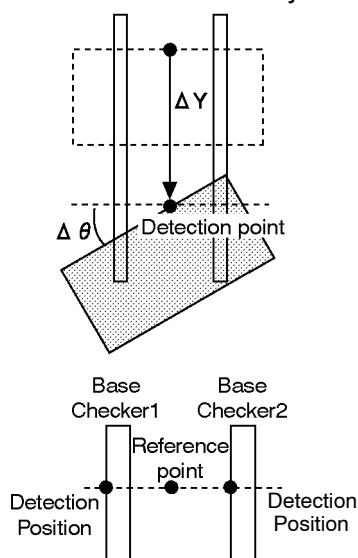
Gray scale edge checker: Vertical detection rotation adjustment (A210 only)

Gray scale edge checkers are used as the base checkers, and the amount of adjustment ΔY $\Delta \theta$ (angle of rotation) is calculated from the results of two vertical checkers.

Shapes available are lines and planes, with a mixture of the two being possible.

Since the amount of adjustment is calculated from the results of two base checkers, the reference position cannot be set unless two checkers are set. Edge detection is performed in Front detection position mode.

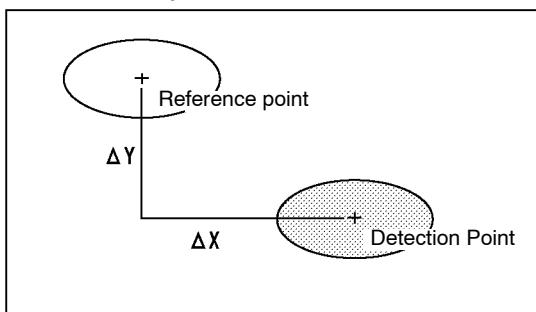
The reference point is the centre point of the coordinate obtained by checker 1 and the coordinate obtained by checker 2.

**Feature extractor: One checker position adjustment**

The amount of adjustment ΔX , ΔY 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 centre of gravity obtained by the feature extractor. Any point can be selected from a maximum of 10 detection results.



4.2 The Various Modes for Position/Rotation Adjustment Checkers

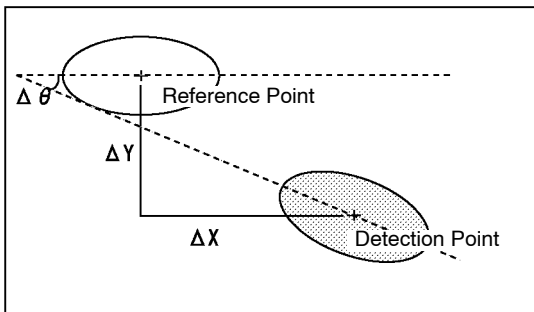
Feature extractor: Theta rotation adjustment (A210 only)

The amount of adjustment ΔX , ΔY , $\Delta\theta$ can be calculated from the results of using a single feature extractor as the base checker.

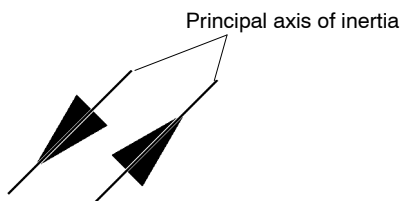
Only rectangle can be set as the shape.

The reference point is the position of the centre of gravity obtained by the feature extractor. Any point can be selected from a maximum of 10 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 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 items shown below.



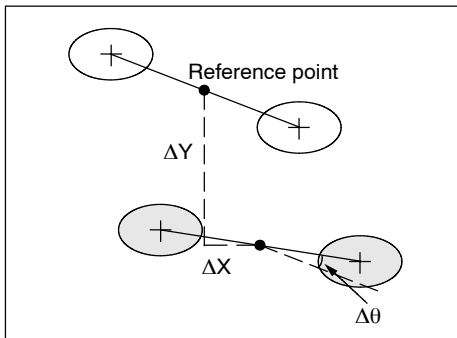
4.2 The Various Modes for Position/Rotation Adjustment Checkers

Feature extractor: One checker rotation adjustment (A210 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.

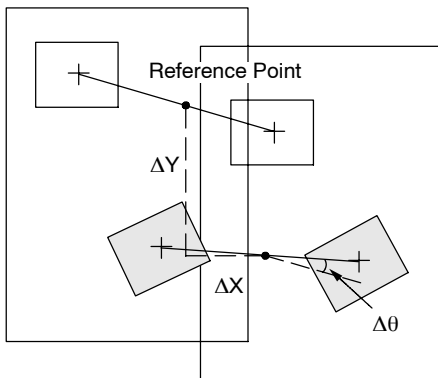
The reference point is the position of the centre of gravity obtained by the feature extractor. Any two points can be selected from a maximum of 10 detection results, and the centre between the two points used as the reference point.

**Feature extractor: Two checker rotation adjustment (A210 only)**

The amount of adjustment ΔX , ΔY , $\Delta\theta$ can be calculated from the results of using two feature extractors as the base checkers.

Only rectangle can be set as the shapes.

From the detection results, set each point one at a time to the location you desire. The mid point becomes the reference point.

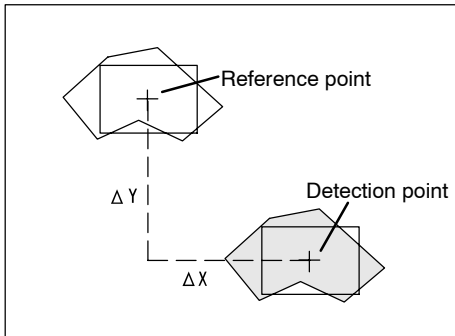


4.2 The Various Modes for Position/Rotation Adjustment Checkers

Matching checker: One checker position adjustment

The amount of adjustment ΔX , ΔY , can be calculated from the results of using a single matching checker as the base checker.

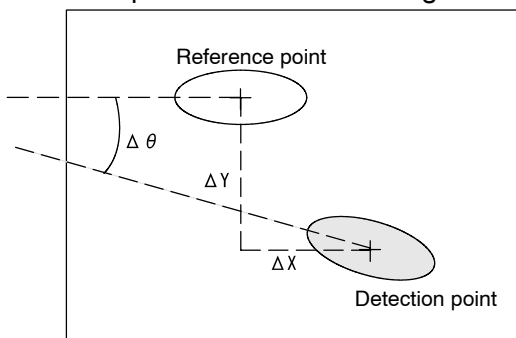
The reference point is the detection position sought using matching, and any one point can be selected from a maximum of 5 detection results.

**Matching checker: Theta rotation adjustment (A210 only)**

The amount of adjustment ΔX , ΔY , $\Delta\theta$ 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.



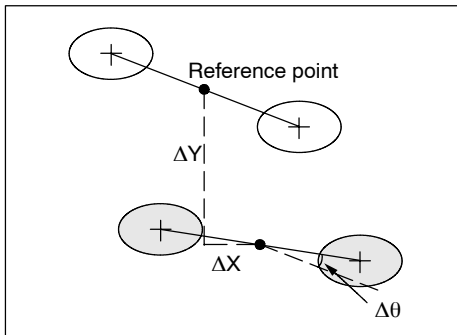
4.2 The Various Modes for Position/Rotation Adjustment Checkers

Matching checker: One checker rotation adjustment (A210 only)

The amount of adjustment ΔX , ΔY , $\Delta\theta$ 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 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 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.

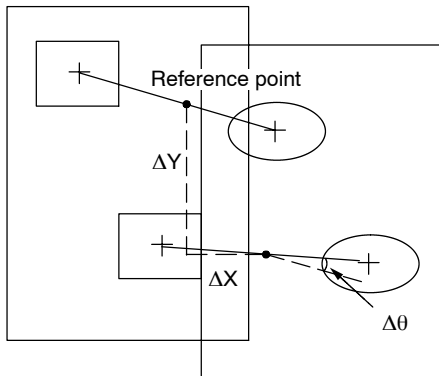


Matching checker: Two checker rotation adjustment (A210 only)

The amount of adjustment ΔX , ΔY , $\Delta\theta$ can be calculated from the results of using two matching checkers as the base checkers.

Set each point from the detection results one point at a time as you wish and their midpoint will be the reference point.

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.

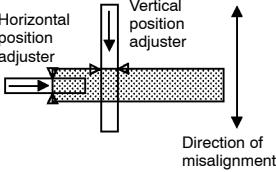
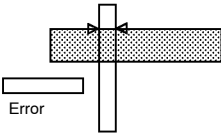
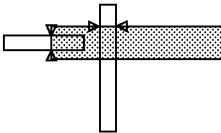
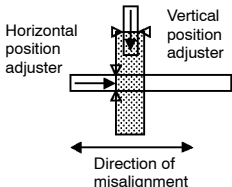
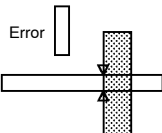
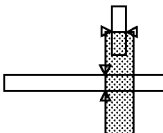
**Note**

The adjustment amount that can be calculated in each mode is as described above, but when you are following a position and rotation adjuster, it does not always work this way. For example, you are look for ΔX and ΔY for the position and rotation adjuster set in Binary Edge: Pos. Adj. mode, but you can also look for $\Delta\theta$ (rotation angle) if it follows a position and rotation adjuster set in Binary Edge: Hor. Det. Rot. Adj. mode.

4.2 The Various Modes for Position/Rotation Adjustment Checkers

Priority

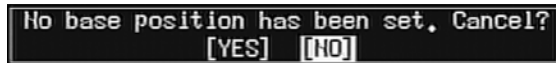
For position adjustment using binary edge checkers, or position adjustment using gray scale edge checkers, the checkers can be prioritized. Either horizontal or vertical direction checkers can be given priority. Whether or not to apply adjustment using a second checker can be determined according to the result of the prioritized checker.

	Checker setting	Priority not specified	Priority specified
Priority to vertical adjustment			 Priority given to vertical adjustment
Priority to horizontal adjustment			 Priority given to horizontal adjustment

Prioritization can be used to prioritize the horizontal checker prevent the vertical checker giving a detection error.

Setting the base position

A position and rotation adjuster is a checker that obtains the amount of adjustment between the coordinates (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 reference point. (If the setting is for a camera image, a new image is captured when the test is conducted.) The following confirmation message is displayed if you attempt to terminate the setting procedure without conducting a test and setting a base position.



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

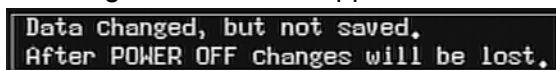
If you select **Yes**, the settings and changed data will be lost. Unless you want to abandon the setup procedure and lose the settings, select **No** and set the reference position.

The base position is automatically 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 A210, 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 base position has been reset, checkers dependent on the adjustment are displayed at the newly adjusted positions.

If an angle of rotation is applied, the following message is displayed.



Data changed, but not saved.
After POWER OFF changes will be lost.

With the A210, for you select **Yes**, dependent checkers are reset at the previous execution position, but at this point they are reset with the angle of inclination disappearing.

Select **No** if you do not want to change the execution positions of dependent checkers. Resetting at the base position is canceled.

4.2 The Various Modes for Position/Rotation Adjustment Checkers**Notes****Conditions for changing execution position:**

- **When position and rotation adjuster (binary edge: position adjustment) 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. Next execution is from the setting position.
- **With the A210, when a dependent checker with rotation angle adjusted is reset:**
The dependent checker is reset with angle 0 close to the previous execution position.

4.3 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.

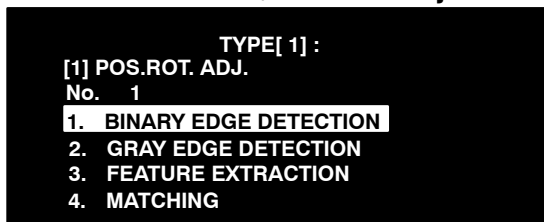
4.3.1 Setting a Position Adjustment Checker that uses Binary Edge Detection

This explains how to use a Binary Edge checker as an adjustment checker. If you are unfamiliar with the operation of Binary Edge checkers, first read *9 Binary Edge Checkers*.

Here we will set checkers for the horizontal and vertical directions, although it is also possible to perform adjustment using just one of them. When using both checkers, you must specify which one has priority.

Procedure:

1. Select the **Position/Rotation Adjustment Checker** number.



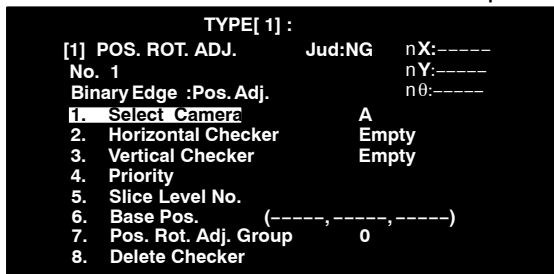
2. Select **BINARY EDGE DETECTION**.



4.3 Setting a Position/Rotation Adjustment Checker

3. Select **Pos. Adj.** (position adjustment).

The setting menu for position adjustment using binary edge detection is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.



1. **Select Camera**

Select either the camera A or camera B image for operating the Position Adjustment checker.

2. **Horizontal Checker**

3. **Vertical Checker**

Use these to create the checker and set items such as the scan conditions.

4. **Priority**

Use this to specify which checker result is to have priority as necessary (either vertical or horizontal).

5. **Slice Level No.**

Select the Slice Level No. for the base checker.

6. **Base Pos.**

Execute a test to register the base position for adjustment.

7. **Pos. Rot. Adj. Group**

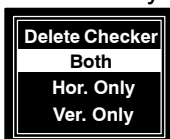
Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.

☞ Refer to 4.4 *Position Adjustment Groups* for details.

8. **Delete Checker**

Use this to delete a checker.

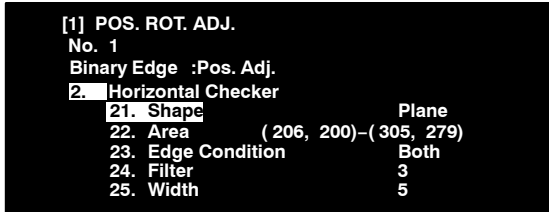
In the case that you have created both vertical and horizontal checkers, select which one you want to delete.

**Note**

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Next perform the checker settings.
 Select either **Vertical Checker** or **Horizontal Checker**.
 The setting procedure is the same for both vertical and horizontal checkers. Here we will set a horizontal checker, so select **Horizontal Checker** to display the Checker Setting menu.



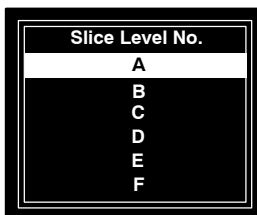
- 21. Shape
- 22. Area
- 23. Edge Condition
- 24. Filter
- 25. Width

Set each of the items.

☞ For details regarding the settings, refer to *9 Binary Edge Checkers*.

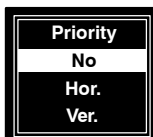
This same menu is displayed when you select **Vertical Checker**.

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



6. Set the priority
 Specify whether the vertical or horizontal checker results are to have priority.
 When you select **Priority**, the following menu is displayed.
 Make the appropriate selection.

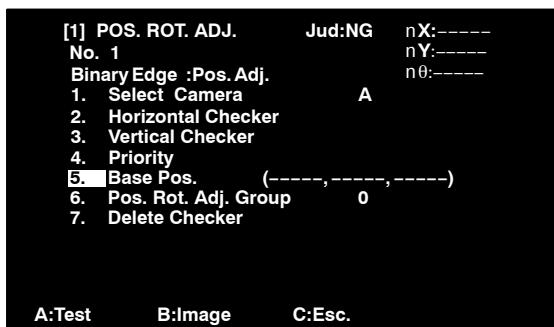
☞ Refer to *Priority* on page 4 – 16 for details.



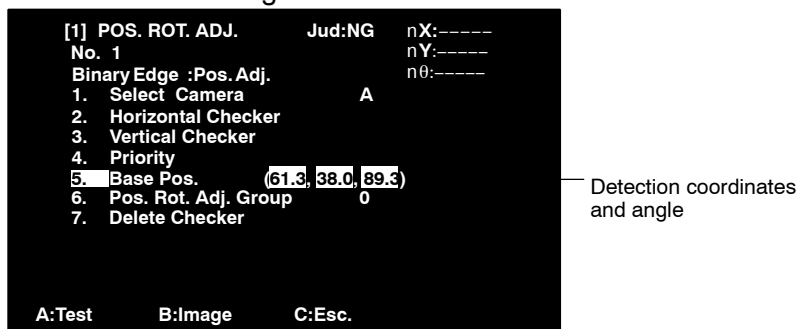
4.3 Setting a Position/Rotation Adjustment Checker

7. Set the base position.

➡ Refer to *Setting the Base Position* on page 4 – 17 for details.



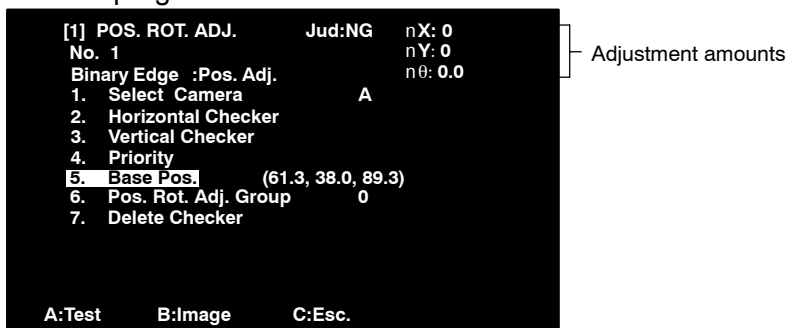
Press the **A** (Test) key to display the current detection coordinates and angle.



Note

Press the **B** (Image) key to check the base position using the image.

Press the **ENTER** key 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.



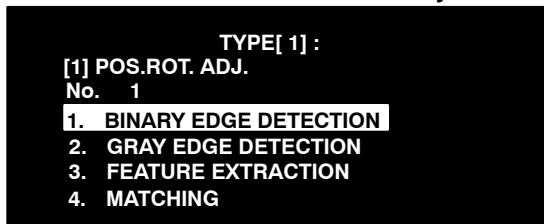
4.3.2 Setting a Horizontal/Vertical Detection Rotation Adjustment Checker that uses Binary Edge Detection (A210 only)

This explains how to use a Binary Edge checker as an adjustment checker.

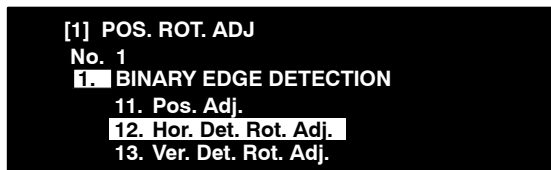
If you are unfamiliar with the operation of Binary Edge checkers, read chapter 9 *Binary Edge Checkers*. The setting method for the two checker types is identical, and you must set two checkers. In this example we will perform the settings for a Horizontal Detection Rotation Adjustment Checker.

Procedure:

1. Select the **Position/Rotation Adjustment Checker** number.



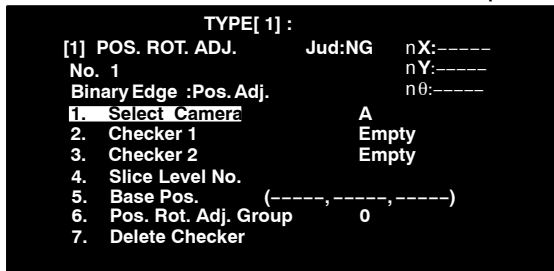
2. Select **BINARY EDGE DETECTION**.



4.3 Setting a Position/Rotation Adjustment Checker

3. Select **Hor. Det. Rot. Adj.** (or **Ver. Det. Rot. Adj.**).

The setting menu for position adjustment using binary edge detection is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.

1. **Select Camera**

Select either the camera A or camera B image for operating the Position Adjustment checker.

2. **Checker 1**3. **Checker 2**

Use these to create the checkers and set items such as the scan conditions.

4. **Slice Level No.**

Select the Slice Level No. for the base checker.

5. **Base Pos.**

Execute a test to register the base position for adjustment.

6. **Pos.Rot. Adj. Group**

Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.

☛ Refer to 4.4 *Position Adjustment Groups* for details.

7. **Delete Checker**

Use this to delete a checker.

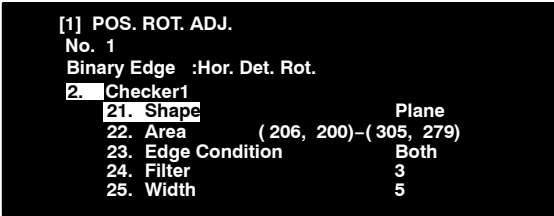
In the case that you have created both vertical and horizontal checkers, select which one you want to delete.

**Note**

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

4.3 Setting a Position/Rotation Adjustment Checker

- 4. Next perform the checker settings.
 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, so select **Checker 1** to
 display the Checker 1 setting menu.



- 21. Shape
- 22. Area
- 23. Edge Condition
- 24. Filter
- 25. Width

Set each of the items.
☛ For details regarding the settings, refer to *9 Binary Edge Checkers*.
This same menu is displayed when you select **Checker 2**.

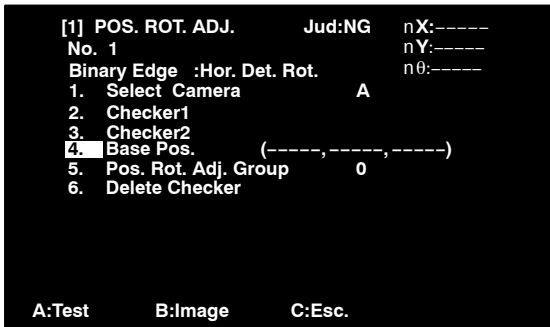
- 5. Set and confirm the Slice Level No..
 Set and confirm the **Slice Level No.** for the base checker.



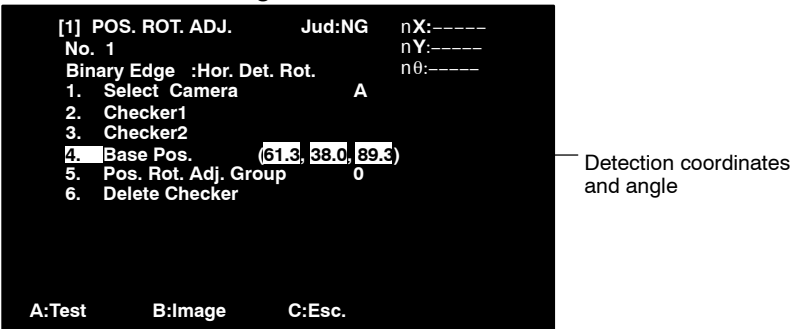
4.3 Setting a Position/Rotation Adjustment Checker

6. Set the base position.

➡ Refer to *Setting the Base Position* on page 4 – 17 for details.

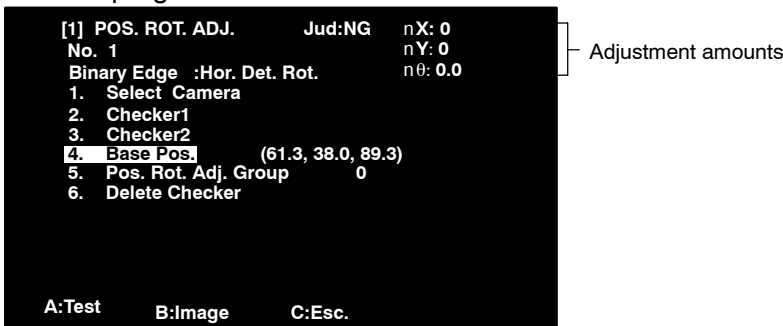


Press the **A** (Test) key to display the current detection coordinates and angle.

**Note**

Press the **B** (Image) key to check the base position using the image.

Press the **ENTER** key 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.



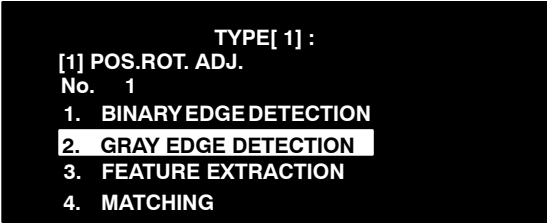
4.3.3 Setting a Position Adjustment Checker that uses Gray Scale Edge Detection

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 checkers, read *10 Gray Scale Edge Checkers*. 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/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 **GRAY EDGE DETECTION**.

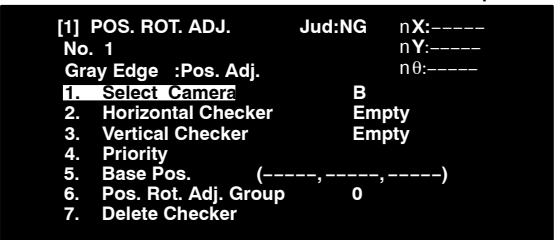


```
[1] POS. ROT. ADJ.  
No. 1  
2. GRAY EDGE DETECTION  
21. Pos. Adj.  
22. Hor. Det. Rot. Adj.  
23. Ver. Det. Rot. Adj.
```

4.3 Setting a Position/Rotation Adjustment Checker

3. Select **Pos. Adj.**

The setting menu for position adjustment using gray edge detection is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.



1. **Select Camera**

Select either the camera A or camera B image for operating the Position Adjustment checker.

2. **Horizontal Checker**

3. **Vertical Checker**

Use these to create the checker and set items such as the scan conditions.

4. **Priority**

Use this to specify which checker result is to have priority as necessary (either vertical or horizontal).

5. **Base Pos.**

Execute a test to register the base point for adjustment.

6. **Pos. Rot. Adj. Group**

Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.

➡ Refer to 4.4 *Position Adjustment Groups* for details.

7. **Delete Checker**

Use this to delete a checker.

In the case that you have created both vertical and horizontal checkers, select which one you want to delete.

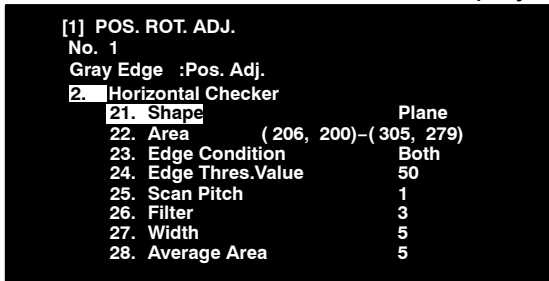


 Note

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Next perform the checker settings. Select either **Vertical Checker** or **Horizontal Checker**. The setting procedure is the same for both vertical and horizontal checkers. Here we will set a horizontal checker, so select **Horizontal Checker** to display the Checker Setting menu.



- 21. Shape
- 22. Area
- 23. Edge Condition
- 24. Edge Thres.Value
- 25. Scan Pitch
- 26. Filter
- 27. Width
- 28. Average Area

Set each of the items.

☛ For details regarding the settings, refer to *10 Gray Scale Edge Checkers*.

This same menu is displayed when you select **Vertical Checker**.

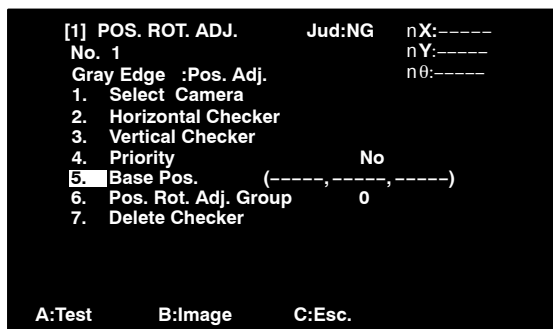
5. Set the priority
Specify whether the vertical or horizontal checker results are to have priority.
When you select **Priority**, the following menu is displayed.
Make the appropriate selection.
☛ Refer to *Priority* on page 4 – 16 for details.



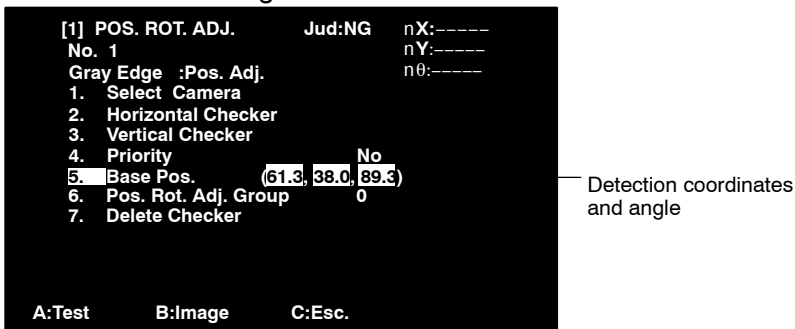
4.3 Setting a Position/Rotation Adjustment Checker

6. Set the base position.

➡ Refer to *Setting the base position on page 4 – 17* for details.

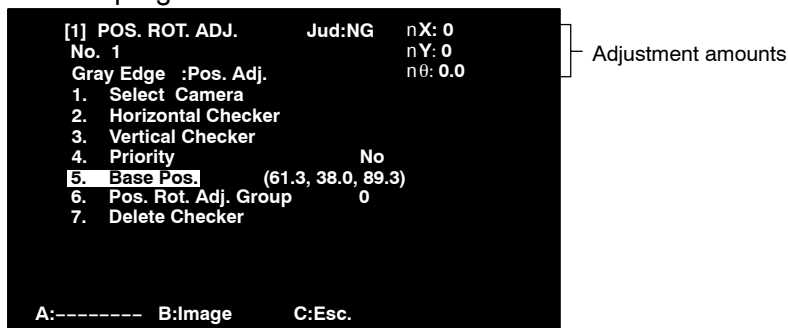


Press the **A** (Test) key to display the current detection coordinates and angle.

**Note**

Press the **B** (Image) key to check the base position using the image.

Press the **ENTER** key 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.

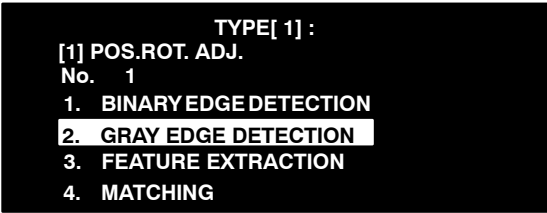


4.3.4 Setting a Horizontal Detection Rotation Adjustment Checker or a Vertical Detection Rotation Adjustment Checker that uses Gray Edge Detection (A210 only)

This explains how to use a Gray Scale Edge checker as an adjustment checker. If you are unfamiliar with the operation of Gray Edge checkers, read *10 Gray Scale Edge Checkers*. 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 **GRAY EDGE DETECTION**.

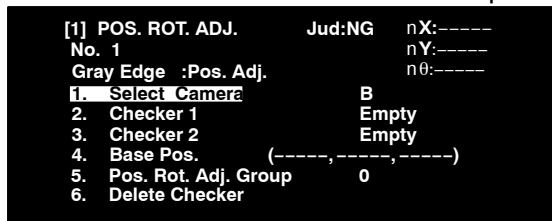


```
[1] POS. ROT. ADJ  
No. 1  
2. GRAY EDGE DETECTION  
21. Pos. Adj.  
22. Hor. Det. Rot. Adj.  
23. Ver. Det. Rot. Adj.
```

4.3 Setting a Position/Rotation Adjustment Checker

3. Select **Hor. Det. Rot. Adj.**

The setting menu for position adjustment using gray edge detection is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.

1. **Select Camera**

Select either the camera A or camera B image for operating the Position Adjustment checker.

2. **Checker 1**3. **Checker 2**

Use these to create the checkers and set items such as the scan conditions.

4. **Base**

Execute a test to register the base point for adjustment.

5. **Pos. Rot. Adj. Group**

Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.

☛ Refer to 4.4 *Position Adjustment Groups* for details.

6. **Delete Checker**

Use this to delete a checker.

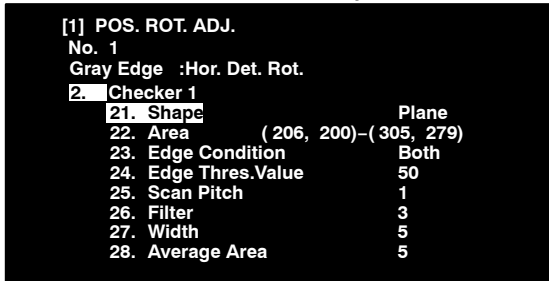
In the case that you have created both vertical and horizontal checkers, select which one you want to delete.

**Note**

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Next perform the checker settings. Select either **Checker 1** or **Checker 2**. The setting procedure is the same for both checkers. Select **Checker 1** to display the Checker 1 setting menu.



- 21. Shape
- 22. Area
- 23. Edge Condition
- 24. Edge Thres.Value
- 25. Scan Pitch
- 26. Filter
- 27. Width
- 28. Average Area

Set each of the items.

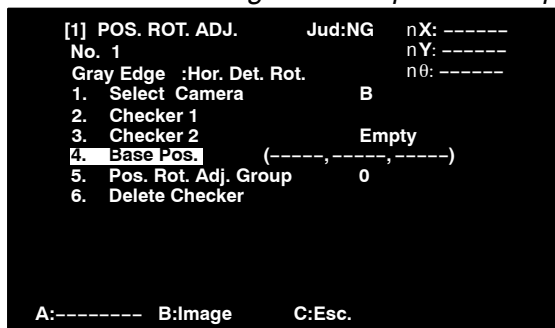
➡ For details regarding the settings, refer to *10 Gray Scale Edge Checkers*.

This same menu is displayed when you select **Checker 2**.

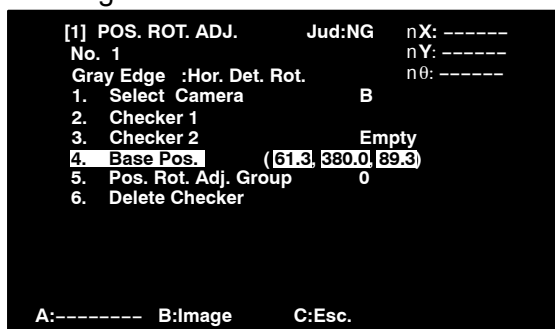
4.3 Setting a Position/Rotation Adjustment Checker

5. Set the base position.

➡ Refer to *Setting the base position on page 4 – 17* for details.



Press the **A** (Test) key to display the current detection coordinates and angle.

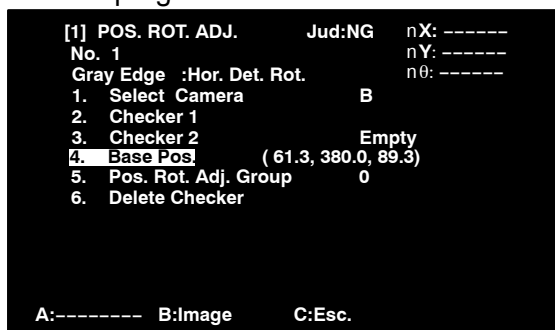


Detection coordinates and angle

**Note**

Press the **B** (Image) key to check the base position using the image.

Press the **ENTER** key 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.



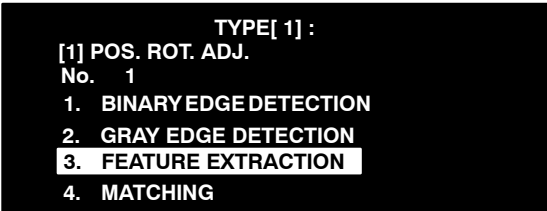
Adjustment amounts

4.3.5 Setting One Checker Position Adjustment Checker that uses Feature Extraction

This explains how to use a Feature Extraction checker as an adjustment checker. If you are unfamiliar with the operation of Feature Extraction checkers, read *11 Feature Extraction*.

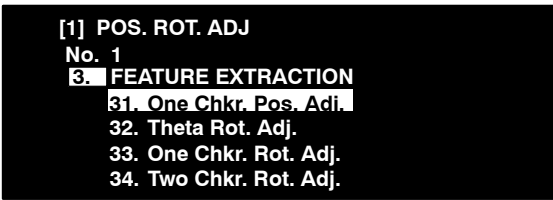
Procedure:

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 **FEATURE EXTRACTION**.

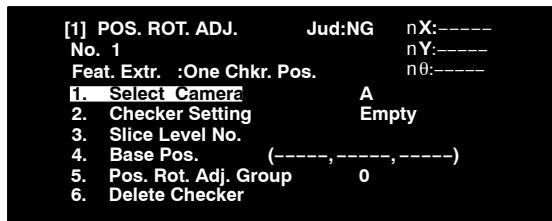


```
[1] POS. ROT. ADJ.  
No. 1  
3. FEATURE EXTRACTION  
31. One Chkr. Pos. Adj.  
32. Theta Rot. Adj.  
33. One Chkr. Rot. Adj.  
34. Two Chkr. Rot. Adj.
```

4.3 Setting a Position/Rotation Adjustment Checker

3. Select **One Chkr. Pos. Adj.**

The setting menu for one checker position adjustment using feature extraction is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.

1. **Select Camera**

Select either the camera A or camera B image for operating the Position Adjustment checker.

2. **Checker Setting**

Use this to create the checker and set items such as the scan conditions.

3. **Slice Level No.**

Select the Slice Level No. for the base checker.

4. **Base Pos.**

Execute a test to register the base point for adjustment.

5. **Pos. Rot. Adj. Group**

Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.

➡ Refer to 4.4 *Position Adjustment Groups* for details.

6. **Delete Checker**

Use this to delete a checker.

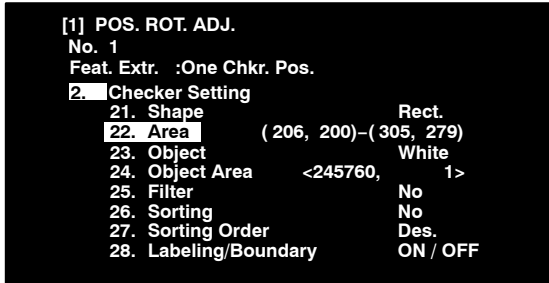
**Note**

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Make the Checker settings.

Select **Checker Setting** to display the checker setting menu.

**21. Shape**

The shape is fixed at Rect. (rectangle) and cannot be changed.

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.

25. Filter

Select whether or not to perform image erosion or dilation.

26. Sorting

Select whether or not to sort the detected regions in order of area, center X coordinate or center Y coordinate.

27. Sorting Order

Select whether the result outputs are to be sorted in ascending or descending order.

28. Labeling/Boundary

Labeling: This function recognizes individual target objects in the case 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 a region are to be inspected or not.

ON: Inspect

OFF: Ignore

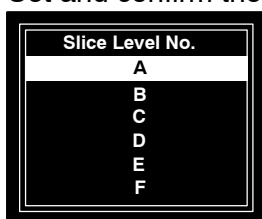
4.3 Setting a Position/Rotation Adjustment Checker

- ☛ For details regarding the Labeling and Boundary functions, refer to *11 Feature Extraction*.

Select from among the following three combinations:

Labeling	/	Boundary
OFF	/	ON
ON	/	OFF
ON	/	ON

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



6. Set the base position.
Select and confirm the **base position**.
Press **A** to display the current detection coordinates, detection angle, and correlation for a maximum of five points.



Select the appropriate base position from the table and 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.

Press **B** to confirm the base position for the image.

Press **C** to cancel the base position.

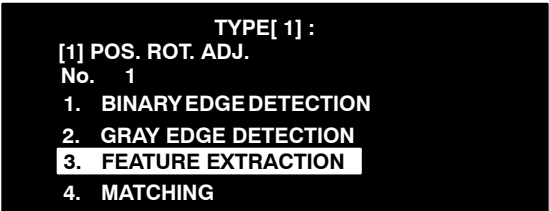
- ☛ Refer to *Setting the Base Position on page 4 – 17* for details.

4.3.6 Setting a Theta Rotation Adjustment Checker that uses Feature Extraction (A210 only)

This explains how to use a Feature Extraction checker as an adjustment checker. If you are unfamiliar with the operation of Feature Extraction checkers, read *11 Feature Extraction*.

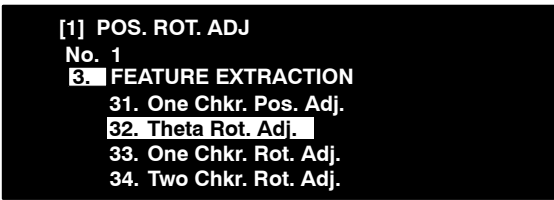
Procedure:

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 **FEATURE EXTRACTION**.

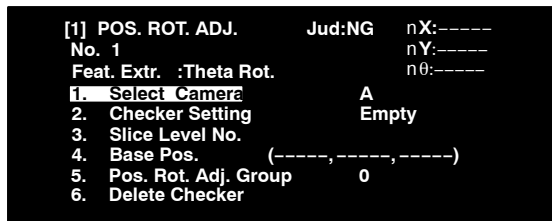


```
[1] POS. ROT. ADJ  
No. 1  
3. FEATURE EXTRACTION  
31. One Chkr. Pos. Adj.  
32. Theta Rot. Adj.  
33. One Chkr. Rot. Adj.  
34. Two Chkr. Rot. Adj.
```

4.3 Setting a Position/Rotation Adjustment Checker

3. Select **Theta Rot. Adj.**

The setting menu for theta rotation adjustment using feature extraction is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.

1. **Select Camera**

Select either the camera A or camera B image for operating the Position Adjustment checker.

2. **Checker Setting**

Use this to create the checker and set items such as the scan conditions.

3. **Slice Level No.**

Select the Slice Level No. for the base checker.

4. **Base Pos.**

Execute a test to register the base point for adjustment.

5. **Pos. Rot. Adj. Group**

Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.

➡ Refer to 4.4 *Position Adjustment Groups* for details.

6. **Delete Checker**

Use this to delete a checker.

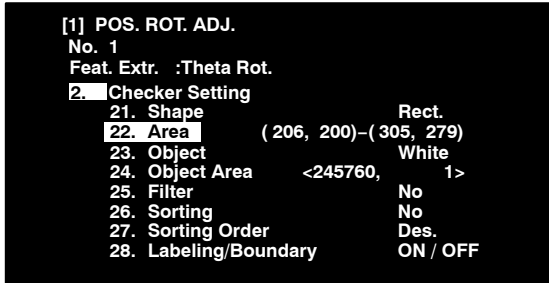
**Note**

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Make the Checker settings.

Select **Checker Setting** to display the checker setting menu.

**21. Shape**

The shape is fixed at Rect. (rectangle) and cannot be changed.

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.

25. Filter

Select whether or not to perform image erosion or dilation.

26. Sorting

Select whether or not to sort the detected regions in order of area, center X coordinate or center Y coordinate.

27. Sorting Order

Select whether the result outputs are to be sorted in ascending or descending order.

28. Labeling/Boundary

Labeling: This function recognizes individual target objects in the case 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 a region are to be inspected or not.

ON: Inspect

OFF: Ignore

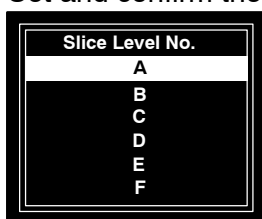
4.3 Setting a Position/Rotation Adjustment Checker

- ➡ For details regarding the Labeling and Boundary functions, refer to *11 Feature Extraction*.

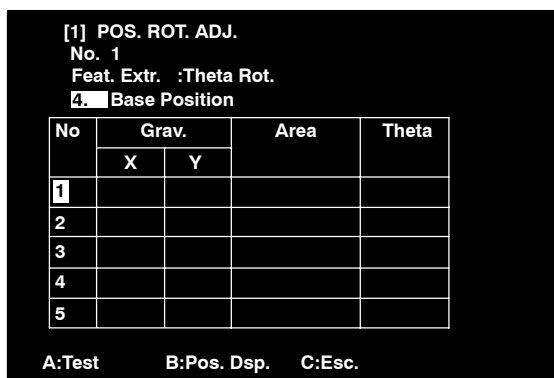
Select from among the following three combinations:

Labeling	/	Boundary
OFF	/	ON
ON	/	OFF
ON	/	ON

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



6. Set the base position.
Select and confirm the **base position**.
Press **A** to display the current detection coordinates, detection angle, and correlation for a maximum of five points.



Select the appropriate base position from the table and 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.

Press **B** to confirm the base position for the image.

Press **C** to cancel the base position.

- ➡ Refer to *Setting the Base Position on page 4 – 17* for details.

4.3.7 Setting One-Checker and Two-Checker Rotation Adjustment Checkers that use Feature Extraction (A210 only)

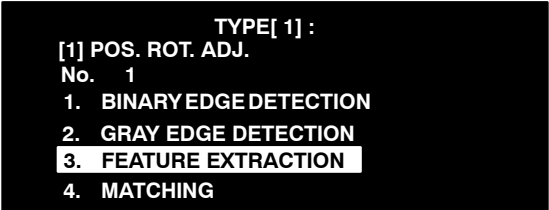
This explains how to use a Feature Extraction checker as an adjustment checker. If you are unfamiliar with the operation of Feature Extraction checkers, read *11 Feature Extraction*.

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**.

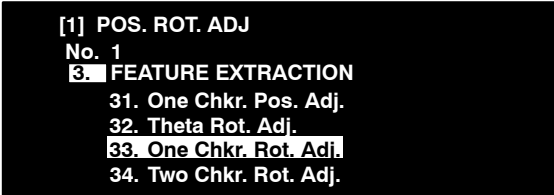
Procedure:

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 **FEATURE EXTRACTION**.

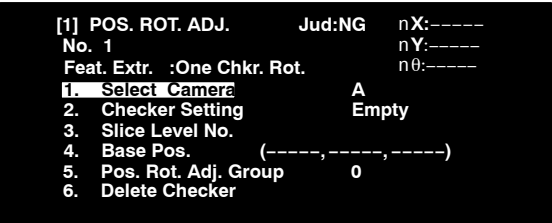


```
[1] POS. ROT. ADJ  
No. 1  
3. FEATURE EXTRACTION  
31. One Chkr. Pos. Adj.  
32. Theta Rot. Adj.  
33. One Chkr. Rot. Adj.  
34. Two Chkr. Rot. Adj.
```

4.3 Setting a Position/Rotation Adjustment Checker

3. Select **One Chkr. Rot. Adj.**

The setting menu for theta rotation adjustment using feature extraction is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.



1. **Select Camera**

Select either the camera A or camera B image for operating the Position Adjustment checker.

2. **Checker Setting**

Use this to create the checker and set items such as the scan conditions.

 Note

In the case of *two-checker rotation adjustment*, *Checker 1* and *Checker 2* are displayed.

3. **Slice Level No.**

Select the Slice Level No. for the base checker.

4. **Base Pos.**

Execute a test to register the base point for adjustment.

5. **Pos. Rot. Adj. Group**

Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.

➡ Refer to 4.4 *Position Adjustment Groups* for details.

6. **Delete Checker**

Use this to delete a checker.

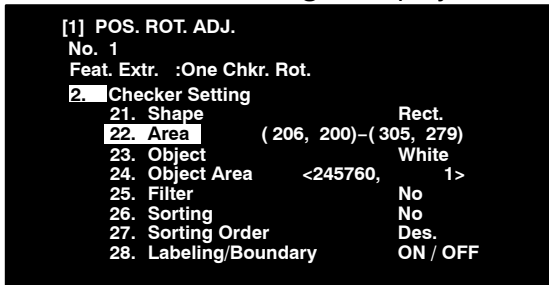
 Note

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Make the Checker settings.

Select **Checker Setting** to display the checker setting menu.

**21. Shape**

The shape is fixed at Rect. (rectangle) and cannot be changed.

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.

25. Filter

Select whether or not to perform image erosion or dilation.

26. Sorting

Select whether or not to sort the detected regions in order of area, center X coordinate or center Y coordinate.

27. Sorting Order

Select whether the result outputs are to be sorted in ascending or descending order.

28. Labeling/Boundary

Labeling: This function recognizes individual target objects in the case 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 a region are to be inspected or not.

ON: Inspect

OFF: Ignore

4.3 Setting a Position/Rotation Adjustment Checker

☞ For details regarding the Labeling and Boundary functions, refer to *11 Feature Extraction*.

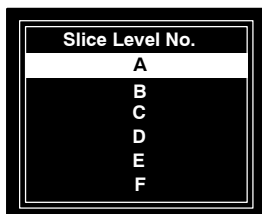
Select from among the following three combinations:

Labeling	/	Boundary
OFF	/	ON
ON	/	OFF
ON	/	ON

**Note**

In the case of *Two-Checker Rotation Adjustment*, *Checker 1* and *Checker 2* are displayed. The menu screens are the same as above.

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



4.3 Setting a Position/Rotation Adjustment Checker

6. Set the base position.
 Select and confirm the **Base Pos**.
 Press **A** to display the current detection coordinates,
 detection angle, and correlation for a maximum of five points.

Select **Ref. Point 1** and **Ref. Point 2** from the table and set them.

[1] POS. ROT. ADJ.
 No. 1
 Feat. Extr. :One Chkr. Rot.
 4. Ref. Point 1

No	Grav.		Area	Theta
	X	Y		
1	125.3	403.4	0.0	0.61
2	250.3	410.8	0.0	0.89
3				
4				
5				

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

[1] POS. ROT. ADJ.
 No. 1
 Feat. Extr. :One Chkr. Rot.
 4. Ref. Point 2

No	Grav.		Area	Theta
	X	Y		
1	125.3	403.4	0.0	0.61
2	250.3	410.8	0.0	0.89
3				
4				
5				

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

Select the appropriate Base Position from the **Ref. Point 1** settings table and press **ENTER** to register the selected coordinates and angle as the base position.
 Switch to the **Ref. Point 2** settings table (use the cursor lever to switch between the tables), select the appropriate Base Position and press **ENTER** to register the selected coordinates and angle as the base position. When you return the setting menu, the adjustment amounts (ΔX , ΔY and $\Delta \theta$) are displayed at the top right of the screen.
 Press **B** to confirm the base position for the image.
 Press **C** to cancel the base position.

☛ Refer to *Setting the Base Position on page 4 – 17* for details.

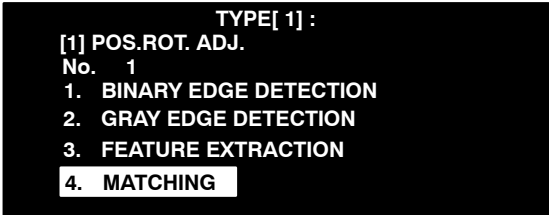
4.3 Setting a Position/Rotation Adjustment Checker

4.3.8 Setting One Checker Position Adjustment that uses Matching

This explains how to use a Matching checker as an adjustment checker.
If you are unfamiliar with the operation of Matching checkers, read *12 Smart Matching*.

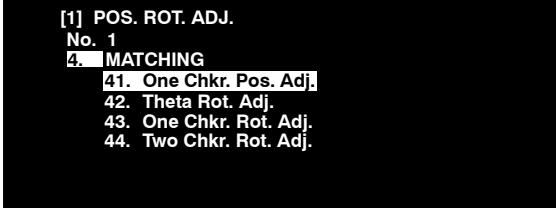
Procedure:

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 **MATCHING**.

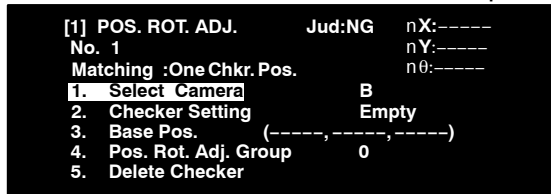


```
[1] POS. ROT. ADJ.  
No. 1  
4. MATCHING  
41. One Chkr. Pos. Adj.  
42. Theta Rot. Adj.  
43. One Chkr. Rot. Adj.  
44. Two Chkr. Rot. Adj.
```

4.3 Setting a Position/Rotation Adjustment Checker

3. Select **One Chkr. Pos. Adj.**

The setting menu for one checker position adjustment using matching is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.

1. **Select Camera**

Select either the camera A or camera B image for operating the Position Adjustment checker.

2. **Checker Setting**

Use this to create the checker and set items such as the scan conditions.

3. **Base Pos.**

Execute a test to register the base point for adjustment.

4. **Pos. Rot. Adj. Group**

Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.

☞ Refer to 4.4 *Position Adjustment Groups* for details.

5. **Delete Checker**

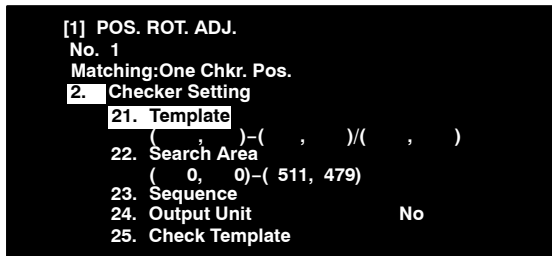
Use this to delete a checker.

**Note**

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Next perform the checker settings.
Select **Checker Setting** to display the setting menu.



21. Template
22. Search Area
23. Sequence
24. Output Unit
25. Check Template

Set each of the items.

- For details regarding the settings, refer to *12.1.2 Checker Setting* and *12.1.4 Check Template* in *12 Smart Matching*.
Note, however, there is no Rotation Setting in Sequence, and no Theta setting in the Sorting item of Output Unit.

4.3 Setting a Position/Rotation Adjustment Checker

5. Set the base position.

Select **Base Pos.**, and press the **A** (Test) key to display the current detection coordinates, detection angles and correlation values (a maximum of five).

[1] POS. ROT. ADJ.				
No. 1				
Matching:One Chkr. Pos.				
3. Base Position				
No	Co. X	Co. Y	Theta	Corre.
1	53.1	308.1	0.0	0.89
2				
3				
4				
5				

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

Select the appropriate position from the table and press the **ENTER** key. The coordinates that you select are registered 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.

Press the **B** key to check the base position using the image.
Press the **C** key to cancel the base position.

➡ Refer to *Setting the base position on page 4 – 17* for details.

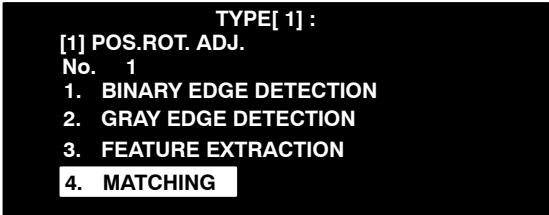
4.3 Setting a Position/Rotation Adjustment Checker

4.3.9 Setting Theta Rotation Adjustment that uses Matching (A210 only)

This explains how to use a Matching checker as an adjustment checker.
If you are unfamiliar with the operation of Matching checkers, read *12 Smart Matching*.

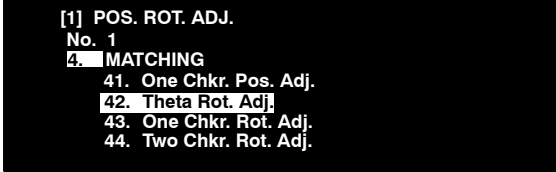
Procedure:

1. Select the **Position/Rotation Adjustment Checker** number.



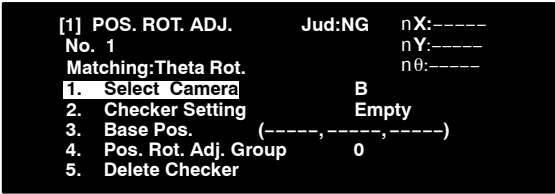
```
TYPE[ 1] :  
[1] POS.ROT. ADJ.  
No. 1  
1. BINARY EDGE DETECTION  
2. GRAY EDGE DETECTION  
3. FEATURE EXTRACTION  
4. MATCHING
```

2. Select **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 Theta Rot. Adj.**
The setting menu for theta rotation adjustment using matching is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.



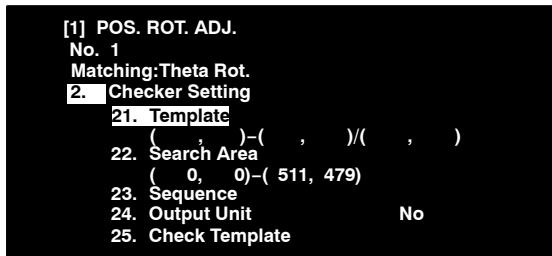
- 1. **Select Camera**
Select either the camera A or camera B image for operating the Position Adjustment checker.
- 2. **Checker Setting**
Use this to create the checker and set items such as the scan conditions.
- 3. **Base Pos.**
Execute a test to register the base point for adjustment.
- 4. **Pos.Rot. Adj. Group**
Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.
☛ Refer to 4.4 *Position Adjustment Groups* for details.
- 5. **Delete Checker**
Use this to delete a checker.

 Note

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Next perform the checker settings.
Select **Checker Setting** to display the setting menu.



21. Template
22. Search Area
23. Sequence
24. Output Unit
25. Check Template

Set each of the items.

- ➡ For details regarding the settings, refer to *12.1.2 Checker Settings* and *12.1.4 Check Template* in *12 Smart Matching*.

4.3 Setting a Position/Rotation Adjustment Checker

5. Set the base position.

Select **Base**, and press the **A** (Test) key to display the current detection coordinates, detection angles and correlation values (a maximum of five).

[1] POS. ROT. ADJ.				
No. 1				
Matching:Theta Rot.				
3. Base Position				
No	Co. X	Co. Y	Theta	Corre.
1	53.1	308.1	0.0	0.89
2				
3				
4				
5				

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

Select the appropriate position from the table and press the **ENTER** key. The coordinates that you select are registered 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.

Press the **B** key to check the base position using the image.
Press the **C** key to cancel the base position.

➡ Refer to *Setting the base position on page 4 – 17* for details.

4.3 Setting a Position/Rotation Adjustment Checker

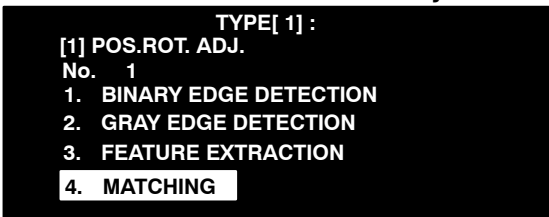
4.3.10 Setting One Checker Rotation Adjustment and Two Checker Rotation Adjustment that uses Matching (A210 only)

This explains how to use a Matching checker for adjustment.

If you are unfamiliar with the operation of Matching checkers, read *12 Smart Matching*. 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.

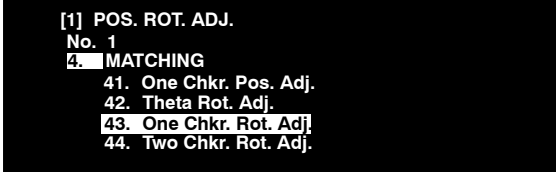
Procedure:

1. Select the **Position/Rotation Adjustment Checker** number.



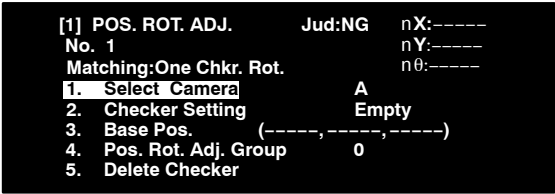
```
TYPE [ 1 ] :  
[1] POS.ROT. ADJ.  
No. 1  
1. BINARY EDGE DETECTION  
2. GRAY EDGE DETECTION  
3. FEATURE EXTRACTION  
4. MATCHING
```

2. Select **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 One Chkr. Rot. Adj.**
The setting menu for one checker rotation adjustment using matching is displayed. Use **Select Camera** to select the camera, and **Delete Checker** to delete the checker as required.



- 1. **Select Camera**
Select either the camera A or camera B image for operating the Position Adjustment checker.
- 2. **Checker Setting**
Use this to create the checker and set items such as the scan conditions.

 Note

In the case of Two Checker Rotation Adjustment, *Checker 1* and *Checker 2* are displayed.

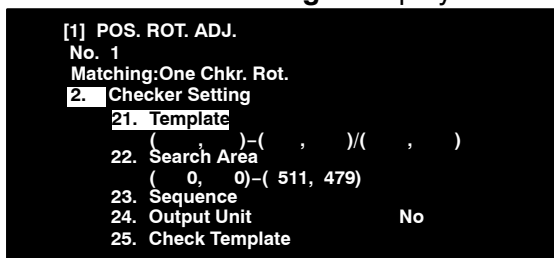
- 3. **Base Pos.**
Execute a test to register the base point for adjustment.
- 4. **Pos.Rot. Adj. Group**
Set which checker is to be used for adjustment in the case that you are using multiple settings for position and rotation adjustment. Select a group number.
➡ Refer to 4.4 *Position Adjustment Groups* for details.
- 5. **Delete Checker**
Use this to delete a checker.

 Note

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

4.3 Setting a Position/Rotation Adjustment Checker

4. Next perform the checker settings.
Select **Checker Setting** to display the setting menu.



- 21. Template
- 22. Search Area
- 23. Sequence
- 24. Output Unit
- 25. Check Template

Set each of the items.

- ☛ For details regarding the settings, refer to *12.1.2 Checker Settings* and *12.1.4 Check Template* in *12 Smart Matching*.
Note, however, there is no Rotation Setting in Sequence, and no Theta setting in the Sorting item of Output Unit.



Note

In the case of *Two-Checker Rotation Adjustment*, *Checker 1* and *Checker 2* are displayed. The menu screens are the same as above.

4.3 Setting a Position/Rotation Adjustment Checker

5. Set the base position.
Select **Base Pos.**, and press the **A** (Test) key to display the current detection coordinates, detection angles and correlation values (a maximum of five).

Set base point 1 and base point 2 from among these.

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

No	Co. X	Co. Y	Theta	Corre.
1	125.3	403.4	0.0	0.61
2	250.3	410.8	0.0	0.89
3				
4				
5				

[1] POS. ROT. ADJ.
No. 1
Matching: One Chkr. Rot.
4. Ref. Point 2 ↔: Ref. Point

No	Co. X	Co. Y	Theta	Corre.
1	125.3	403.4	0.0	0.61
2	250.3	410.8	0.0	0.89
3				
4				
5				

Select the appropriate position for base point 1 from the table and press the **ENTER** key. The coordinates that you select are registered as the base point 1 position.

Switch to the Base Point 2 table and select the appropriate position for base point 2 from the table and press the **ENTER** key. The coordinates that you select are registered as the base point 2 position. Use the arrow keys to switch between the base point 1 and 2 settings.

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

Press the **B** key to check the base position using the image.
Press the **C** key to cancel the base position.

☞ Refer to *Setting the base position* on page 4 – 17 for details.

4.4 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”, so 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 be 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”.



Notes

- **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.**

**Example 1:**

Checker areas R1 and R2 are both given position adjustment group No.1 (G=1), as shown in Figure 1.

Because both checkers use the same position adjustment group the whole workpiece can be inspected reliably with only a single position adjuster, even if the workpiece is misaligned as shown in Figure 2.

(The dotted line rectangles indicate the areas inspected by the checkers.)

Figure 1

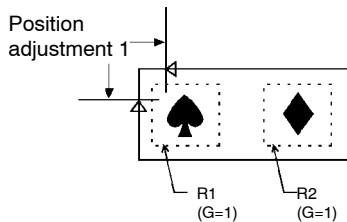
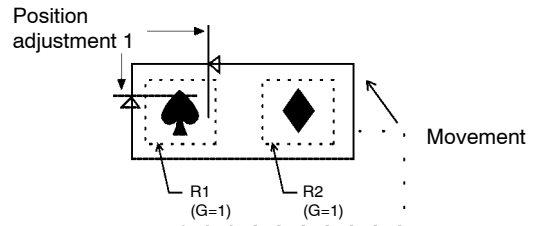
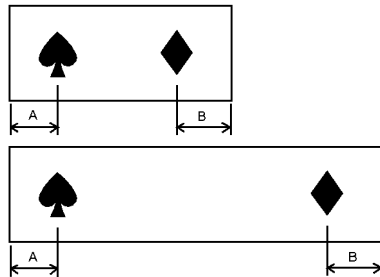


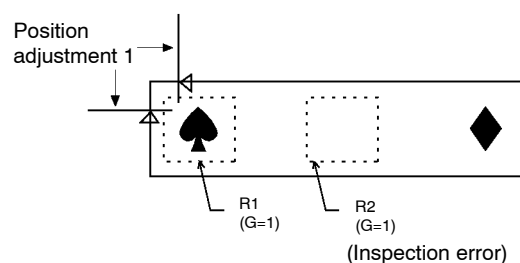
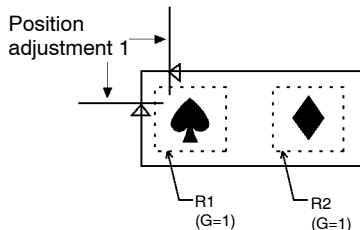
Figure 2

**Example 2:**

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.

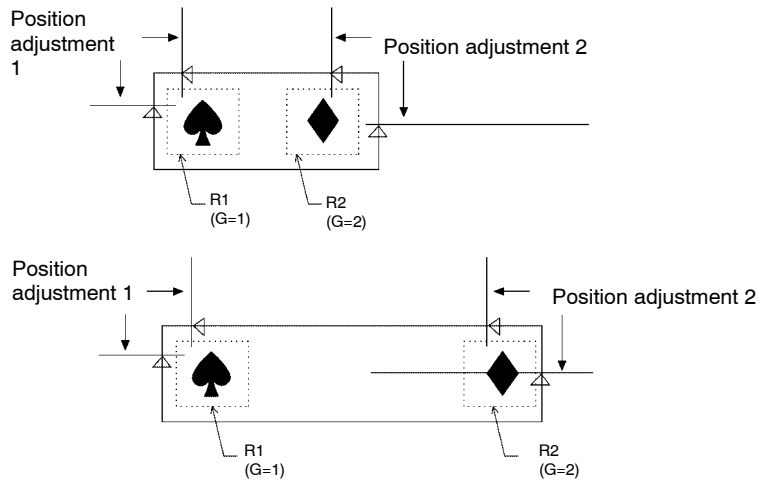


- (1) Inspection using only one group, group No.1 (G=1):
Because only a single position adjustment is performed, the position is only properly adjusted for one of the checkers. The other checker does not inspect the correct position.



4.4 Position Adjustment Groups

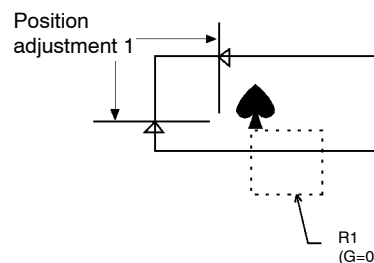
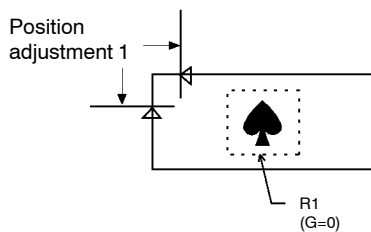
- (2) Inspection using two separate groups, group No.1 (G=1) and No.2 (G=2):
Position adjustment is carried out independently for each checker, so the checkers can move on both sides.

**Example 3:**

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

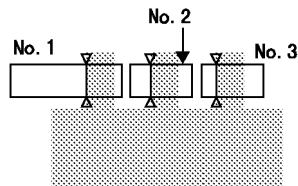
**Note**

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.



**Example 4:**

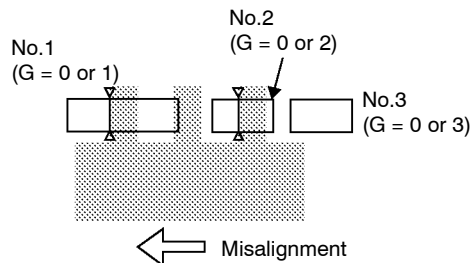
By specifying the position adjustment group number, a position adjuster can be set to adjust the result of an earlier position adjuster (multiple position adjustment). This can be repeated to give several layers of nesting. The example below shows three position adjusters. The numbers represent the position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



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

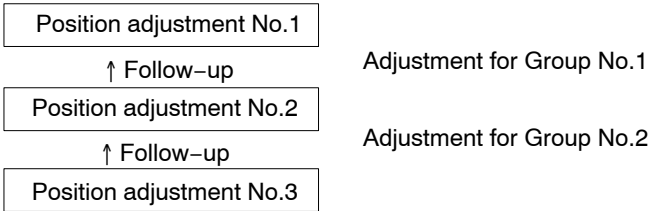
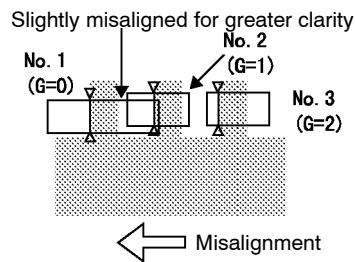
- (1) When the position adjusters have all been set independently:

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.



4.4 Position Adjustment Groups

- (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.



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. (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.

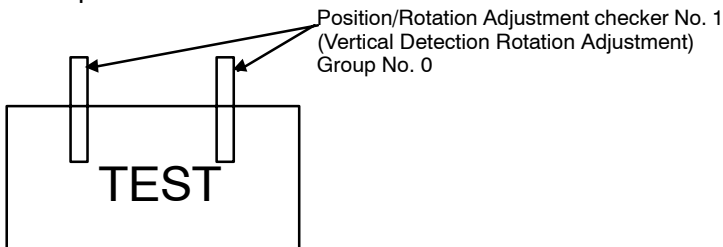
Multiple Position/Rotation Adjustment Checker Settings (A210 only)

With the A210, 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.

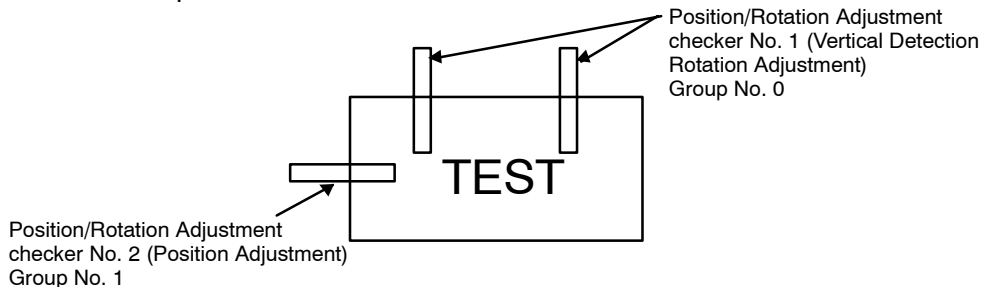
Set a checker in Rotation Adjustment mode and set a Position Adjustment mode checker to follow this. With this type of setting, it is possible to adjust following checkers by the movement adjustment (ΔX and ΔY) and the rotation adjustment ($\Delta\theta$).

Procedure:

1. Create Position/Rotation Adjustment checker No. 1.
2. Create a Gray Edge Vertical Detection Rotation Adjustment checker.
3. Set the Reference checker area and conditions, and set the base position.



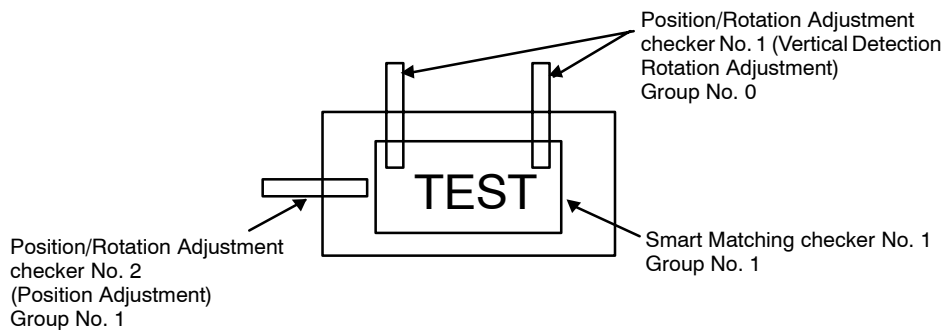
4. Set Position/Rotation Adjustment Group No. 0.
5. Create Position/Rotation Adjustment checker No. 2.
6. Select Gray Edge Position Adjustment mode.
7. Set the Reference checker area and conditions, and set the base position.



8. Set Position/Rotation Adjustment Group No. 1.
9. Create Smart Matching checker No. 1.

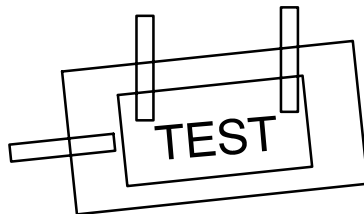
4.4 Position Adjustment Groups

10. Set the area and conditions for the checker.



11. Set Position/Rotation Adjustment Group No. 2.

Upon execution, 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

- 5.1 Exposure Adjustment 5 – 3
 - 5.1.1 Main Menu 5 – 3
 - 5.1.2 Checker Setting 5 – 5
- 5.2 Exposure Adjustment Setup 5 – 6
- 5.3 Example for Exposure Adjustment Setup 5 – 8

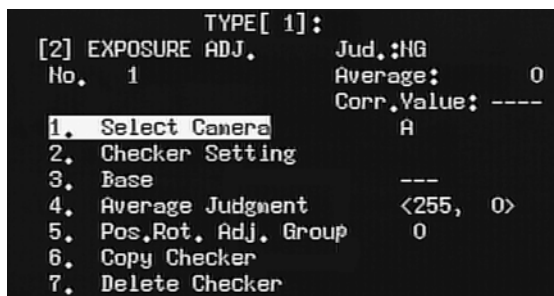
5.1 Exposure Adjustment

In order 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 A210, and up to 48 per type for the A110.

5.1.1 Main Menu



No. (Checker No.)

Set the number of the exposure adjuster to be created.

1. Select Camera

For the A210, 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 in the case of the A110.

2. Checker Setting

Creating the exposure adjuster and setting adjustment coefficient, etc.

3. Base

Set the gray scale inside the area of the exposure adjuster.

The gray scale value "base shades" set is used as the reference value in order to obtain the amount of exposure adjustment.

4. Average Judgment

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

Specify which position and rotation adjuster the exposure adjuster to be created will be adjusted by.

6. Copy Checker

When creating a checker, copy the data from an existing checker.

5.1 Exposure Adjustment

7. Delete Checker

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:

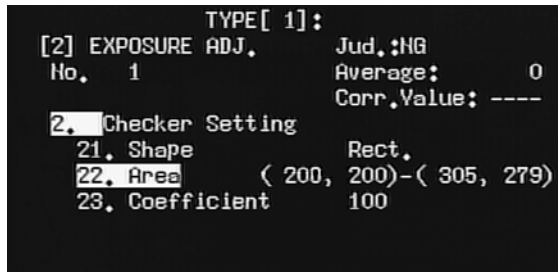
Shows the average value of the brightness data within the set area.

Correlation Value (Corr. Value):

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.

5.1.2 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

Create or move the checker area.

23. Coefficient

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 initial value of the exposure adjustment coefficient is 100%, and it can be set in the range 0 to 200%.

5.2 Exposure Adjustment Setup

5.2 Exposure Adjustment Setup

Procedure:

1. Set the number of the exposure adjuster to be created.
 2. Select **Checker Setting**, then **Area**.
 3. Set the inspection area.
Set the inspection area coordinates in **Area**.
- ☛ See 2.11 *Checker Area Setting Method* for details on area settings.
4. Set how the exposure adjustment will be applied with **Coefficient**.
 5. Select **Base**, then run a test to obtain the average gray scale value.
Select **Base**, then press **ENTER** and the reference gray scale value is displayed as “— — —”.
Press **A: Test**. The reference gray scale value is displayed by a test. Press **ENTER** to set this value as the reference gray scale value.
Press **C** to cancel without setting the gray scale 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.

**Note**

A reference gray scale value must be set.
If a reference gray scale value is not set, exposure adjuster setup cannot be completed.
If you press **C: Esc.** without setting a reference gray scale value , the following message is displayed.

```
No base shades is registered. Cancel?  
[YES] [NO]
```

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**.

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

**Note**

The actual exposure adjustment is not affected by the average gray scale value being outside the range 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.

7. Set a position and rotation adjustment group.

5.3 Example for Exposure Adjustment Setup

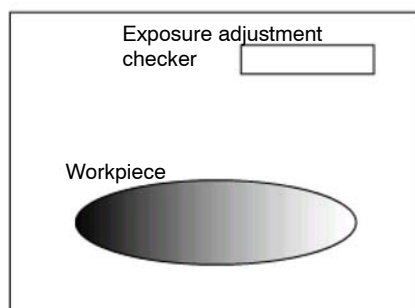
5.3 Example for Exposure Adjustment Setup



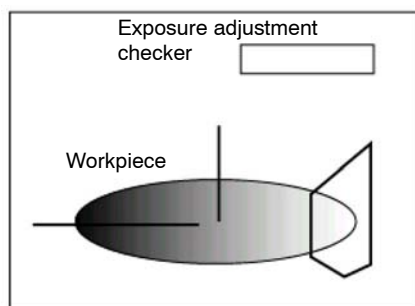
Example: Performing reliable exposure adjustment using the image shown below.

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 . Large changes in exposure due to excessive variations in illumination, etc. In this case the following message will appear: “As a result of the Exposure Adjustment, the slice level exceeds the range (0 to 255) or lower-limit $\geq$ upper-limit.”

Chapter 6

Line Checkers

- 6.1 *Line Checkers* 6 – 3
 - 6.1.1 *Main Menu* 6 – 3
 - 6.1.2 *Checker Setting* 6 – 5
- 6.2 *Line Checker Setup* 6 – 8

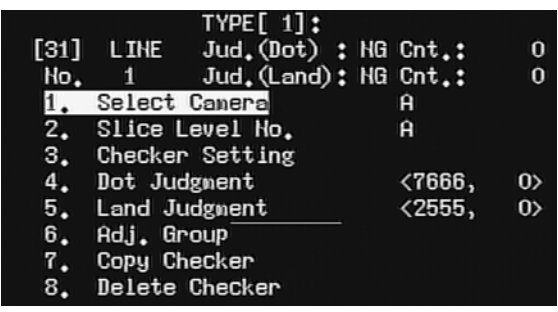
6.1 Line Checkers

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 colour 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 A210, and up to 48 per type for the A110.

6.1.1 Main Menu



No. (Checker No.)

Set the number of the line checker to be created.

1. Select Camera

For the A210, select which camera (A or B) will supply the image on which the line checker is to be activated. This is fixed at A in the case of the A110.

2. Slice Level No.

Select the binary level group for the line checker being created.

3. Checker Setting

Create the line checker and set parameters, etc.

4. Dot Judgment

If the dot count is within the range bounded by the upper and lower limits, the dot judgment considered to be OK (= 1), and 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.

5. Land Judgment

If the land count is within the range bounded by the upper and lower limits, the land judgment considered to be OK = 1, and if the land count exceeds the range, it is considered to be NG = 0.

The dot judgment parameters can be set in the range 0 to 2555.

6. Adjustment Group

Set whether or not the checker being created will be adjusted by a position and rotation adjuster, or exposure adjuster.

6.1 Line Checkers

7. Copy Checker

When creating a checker, copy the data from an existing checker.

8. Delete Checker

Delete a checker.

Dot judgment / Number of dots

The judgment results judged from the dot judgment conditions, and the number of dots counted are shown.

Land judgments / Number of lands

The results judged from the land judgment conditions and the number of lands counted are shown.

6.1.2 Checker Setting

Create the line checker and set parameters, etc.

```

TYPE[ 1]:
[31] LINE Jud.(Dot) : HG Cnt.: 0
No. 1 Jud.(Land): HG 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

Select the shape of the checker area to be created.

32. Area

Create or move the checker area.

33. Dot Count

Select whether to count white pixels or black pixels on the line.

34. Land Count

Select whether to count white lands or black lands (continuous areas of the same colour dot) on the line.

35. Land Filter

Set 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

Set 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

Select whether to apply erosion or dilation processing.

6.1 Line Checkers

*Point***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 colour 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

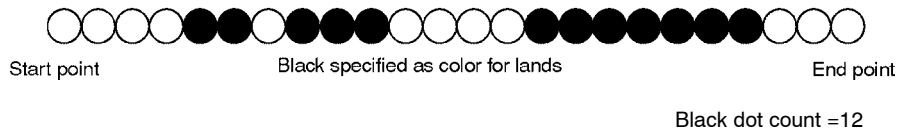
Counting the number of white or black lands on the line. The land filter setting determines how many pixels of the specified colour have to occur consecutively to be regarded as a land and the gap filter setting determines how many pixels of the other colour have to occur consecutively to be regarded 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 colour with the land judgment conditions to judge whether or not the count is within the limits.



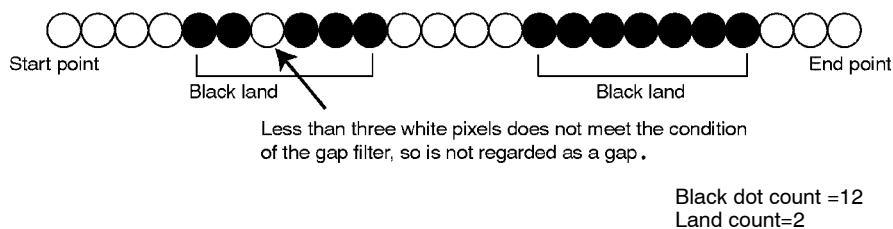
Black dot count =1
Land filter: 6
Gap filter: 4

Land filter and gap filter

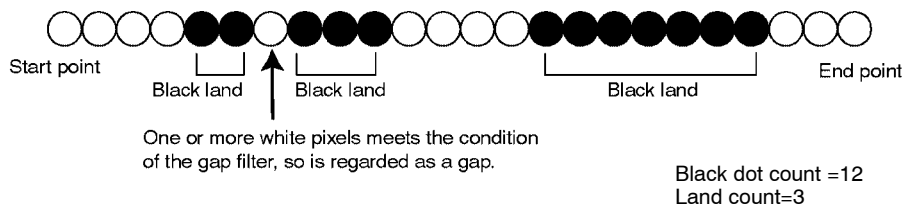
The land and gap filters specify how large a consecutive block of pixels has to be along the line to be counted as a land, and how large a gap there has to be to mark the end of a land. Taking the line below as an example, see how changing the line filter and gap filter settings changes the number of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



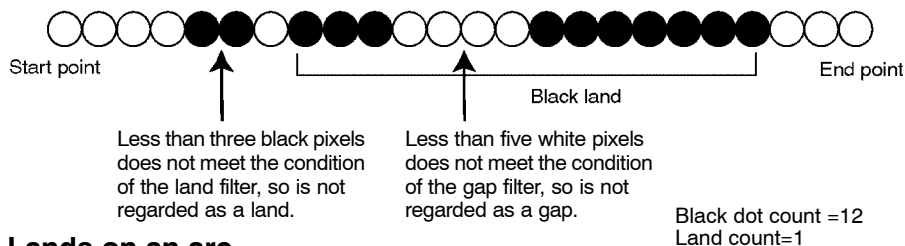
1) Land filter = 2, gap filter = 3



2) Land filter = 2, gap filter = 1

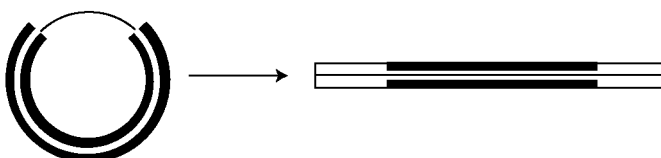


3) Land filter = 3, gap filter = 5



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.



6.2 Line Checker Setup

6.2 Line Checker Setup

Procedure:

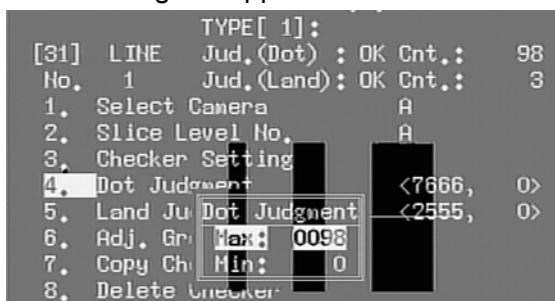
1. Set number of the line checker to be created.
2. Select **Slice Level No.** from the menu and select or confirm the slice level group (A, B, C, D, E or F) to be used by the line checker.
3. Select **Checker Setting**, then **Shape**.
4. Set the inspection area from **Shape**.
5. Select **Area** from the menu and set the coordinates for the inspection area.
- See 2.11 *Checker Area and Marker Area Setting Method* for details of how to set the area.
6. Select **Dot Count** from the menu and set the colour of pixels counted to white or black.
7. Select **Land Count** from the menu and set the colour of pixels counted to white or black.
8. Select **Land Filter** from the menu and set the minimum width for a land.
9. Select **Gap Filter** from the menu and set the minimum gap between lands.



Note

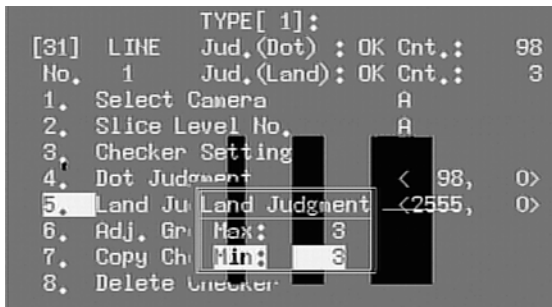
Set the land filter and gap filter values to give the optimum land counts for the purposes of inspection.

10. Select **Filter** from the menu and set the type of filter required.
11. Press **C** to complete checker setup.
12. Select **Dot Judgment** from the menu and set the conditions for number of dots. Press **A** to run a test, and refer to the dot count shown at the top of the screen when setting the upper and lower limits.



13. Select **Land Judgment** from the menu and set the conditions for number of lands.

Press **A** to run a test, and refer to the land count shown at the top of the screen when setting the upper and lower limits.



14. When required, set position and rotation adjuster and exposure adjuster group numbers.

6.2 Line Checker Setup

Chapter 7

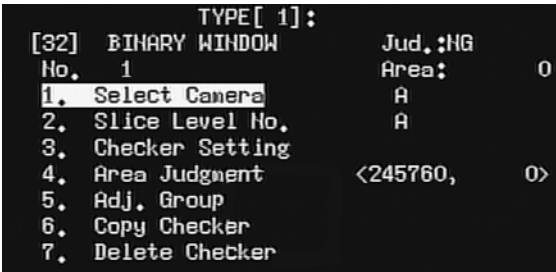
Binary Window Checkers

7.1	<i>Binary Window Checkers</i>	7 – 3
7.1.1	<i>Main Menu</i>	7 – 3
7.1.2	<i>Checker Settings</i>	7 – 5
7.1.3	<i>Select the Adjustment Group</i>	7 – 5
7.2	<i>Binary Window Checker Setup</i>	7 – 6

7.1 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 colour within the area. You can set up to 96 checkers for each type in the case of the A210 (48 for the A110). Binary window checkers can be shaped as rectangles, circles, or polygons, and rectangles, circles and polygons can be used as mask shapes.

7.1.1 Main Menu



No. (Checker No.)

Set the number of the binary window checker to be created.

1. Select Camera

For the A210, select which camera (A or B) will supply the image on which the binary window checker is to be activated. This is fixed at A in the case of the A110.

2. Slice Level No.

Select the binary level group for the binary window checker being created.

3. Checker Setting

Create the binary window checker and set parameters, etc.

4. Area Judgment

Based on the area of the specified colour of pixels detected in the inspection area, set the upper and lower limits to be used for OK / NG judgment.

5. Adjustment Group

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

6. Copy Checker

When creating a checker, copy the data from an existing checker.

7. Delete Checker

Delete the checker.

7.1 Binary Window Checkers

Judgment:

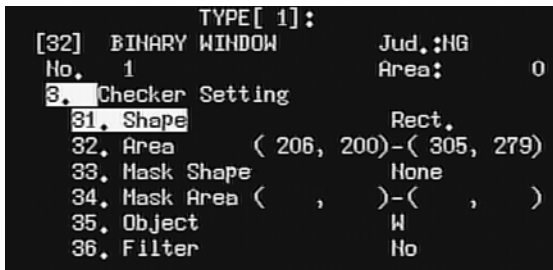
If the area size value detected is within the upper and lower limits of the area size value judgment conditions, the judgment is OK, but if it exceeds the limits, the judgment is NG. An NG judgment is also given if the binary window checker moves outside the screen area in compliance with the position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

Area:

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

7.1.2 Checker Settings

Create the binary window checker and set parameters, etc.



31. Shape

Select the shape for the checker area.

32. Area

Create or move the checker area.

33. Mask Shape

Select the shape for the mask area.

34. Mask Area

Create or move the mask area.

35. Object

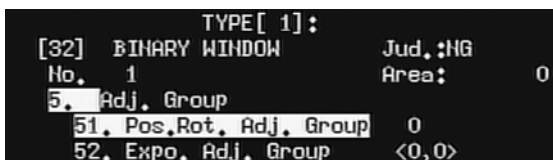
Select whether to process white pixels or black pixels within the inspection area.

36. Filter

Select whether to apply erosion or dilation filtering.

7.1.3 Select the Adjustment Group

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



51. Position and Rotation Adjustment Group

Set which position and rotation adjuster will adjust the binary window checker to be created.

52. Exposure Adjustment Group

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

7.2 Binary Window Checker Setup

Procedure:

1. Set the number of the binary window checker to be created.
 2. For the A210, select which camera (A or B) screen you will move the gray edge detection checker in. This is fixed at A in the case of the A110.
 3. 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 binary window checker.
 4. Select or confirm **Checker Setting**, then **Shape**.
 5. Set or confirm the shape as a rectangle, circle, or polygon.
 6. Select **Area** from the menu and set the coordinates for the checker area.
- ➡ See 2.11 *Checker Area and Marker Area Setting Method* for details on how to create a area.



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. Select **Mask Shape** from the menu and set or confirm the mask shape as a rectangle, circle or polygon.
 8. Select **Mask Area** from the menu and set the coordinates for the mask area.
- ➡ See 2.12 *Setting Masking* for details on how to set the mask area.
9. Select **Object** from the menu and set or confirm the colour to be extracted as white or black.
 10. Select **Filter** from the menu and set or confirm whether to apply dilation or erosion processing.
 11. Select **Area Judgment** from the menu and 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

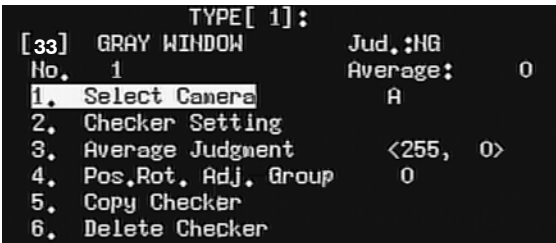
Gray Scale Window Checkers

- 8.1 *Gray Scale Window Checkers* 8 – 3
 - 8.1.1 *Menu Screen* 8 – 3
 - 8.1.2 *Checker Setting* 8 – 4
- 8.2 *Gray Scale Window Checker Setup* 8 – 5

8.1 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 A210, and up to 48 per type for the A110. Area shapes and mask shapes can be either square, circular, or polygonal.

8.1.1 Menu Screen



No. (Checker No.)

Set the number of the gray scale window checker to be created.

1. Select camera

Select 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 in the case of the A110.)

2. Checker Setting

Create the check area and set parameters, etc.

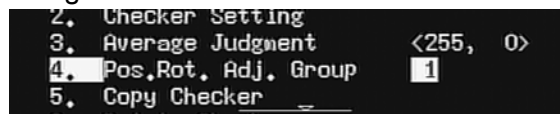
3. Average Judgment

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 value are displayed in the upper right portion of the screen.

8.1 Gray Scale Window Checkers

4. Position and Rotation Adjustment Group.

Set which position and rotation adjuster will adjust the gray scale window checker being created.

**5. Copy Checker**

When creating a checker, copy the data from an existing checker.

6. Delete Checker

Delete the checker.

Judgment:

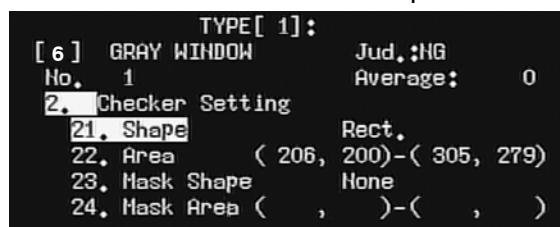
Shows whether or not the value is within the average gray scale value limits.

Average:

The average gray scale value detected is displayed.

8.1.2 Checker Setting

Create the check area and set parameters, etc.

**21. Shape**

Select the shape for the checker area.

22. Area

Create or move the checker area.

23. Mask Shape

Select the shape for the mask area.

24. Mask Area

Create or move the mask area.

8.2 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. Select **Area** from the menu and set the coordinates for the inspection area.
- ➡ See 2.11 *Checker Area and Marker Area Setting Method* for details of how to set the area.



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. Select **Mask Area** from the menu and set the coordinates for the mask area.
- ➡ See 2.12 *Setting Masking* for details of how to set the mask area.
7. Select **Average Judgment** from the menu and 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.

8.2 Gray Scale Window Checker Setup

Chapter 9

Binary Edge Checkers

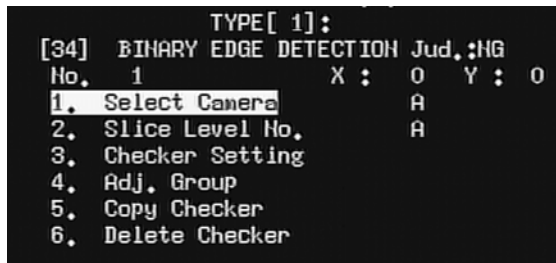
- 9.1 *Binary Edge Checkers* 9 – 3
 - 9.1.1 *Main Menu* 9 – 3
 - 9.1.2 *Checker Setting* 9 – 4
 - 9.1.3 *Select the Adjustment Group* 9 – 7
- 9.2 *Binary Edge Checker Setup* 9 – 8
- 9.3 *Restrictions on Binary Edge Checkers* 9 – 9

9.1 Binary Edge Checkers

Binary edge checkers are use binary processing to detect the edge of an object and give the coordinates of the edge detected.

You can set up to 96 checkers per type for the A210, and up to 48 per type for the A110.

9.1.1 Main Menu



No. (Checker No.)

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

1. Select Camera

For the A210, select which camera (A or B) will supply the image on which the binary edge checker is to be activated. This is fixed at A in the case of the A110.

2. Slice Level No.

Select the binary level group for the binary edge checker being created.

3. Checker Setting

Create the binary edge checker and set parameters, etc.

4. Adjustment Group

Set the adjustment checker that will adjust the binary edge checker to be created.

5. Copy Checker

When creating a checker, copy the data from an existing checker.

6. Delete Checker

Delete the checker.

Judgment:

Shows **OK** if an edge is detected, but **NG** if no edge is detected.

X:, Y: (detection coordinates)

The coordinates of the edge detected are displayed.

9.1 Binary Edge Checkers

9.1.2 Checker Setting

```

TYPE[ 1]:
[34] BINARY EDGE DETECTION Jud.:HG
No. 1 X : 0 Y : 0
3. Checker Setting
31. Shape Plane
32. Area ( 206, 200)-( 305, 279)
33. Direction Hor.
34. Edge Condition W→B
35. Filter 3
36. Width 5

```

31. Shape

Select the shape for the checker area.

32. Area

Create or move the checker area.

33. Direction

Set the scanning direction when plane scanning is selected for the shape. Direction cannot be set when line scanning is selected.

34. Edge Condition

Select 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

Set 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.

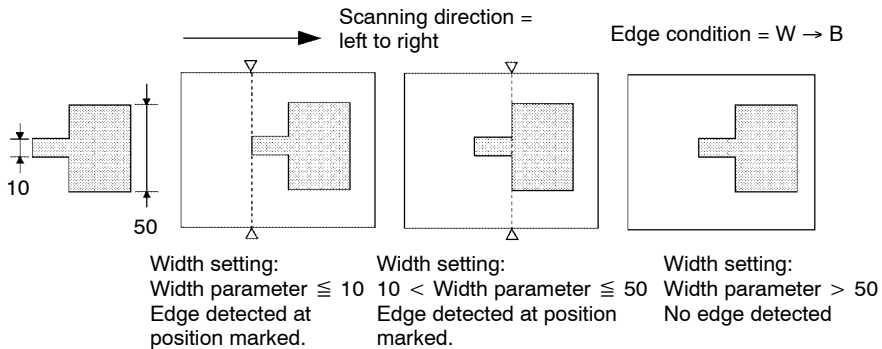
36. Width

Set 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.



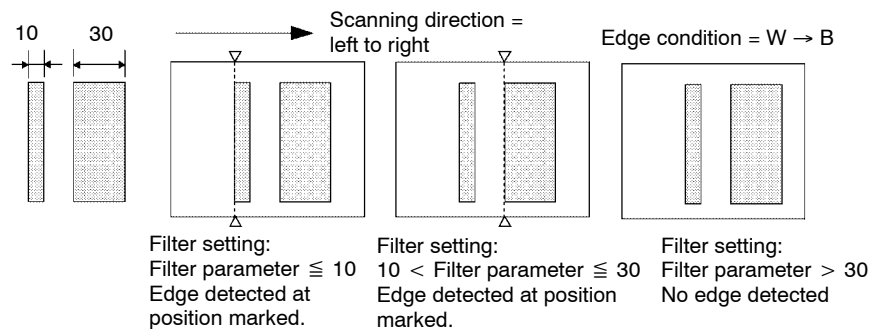
Binary Edge Width and Filter

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.

9.1 Binary Edge Checkers



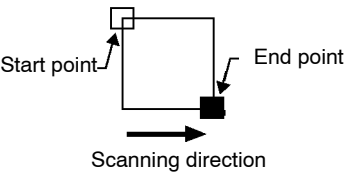
Checker area “start point” / “end point” and edge detection conditions

Checkers are drawn by specifying the “start point” and “end point” of a rectangle. These are displayed on the screen as a transparent square (= start point) and a solid square (= end point). When inspecting the area defined, it is scanned from the start point to the end point.

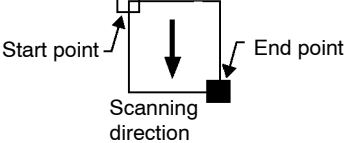
After drawing the checker, specify whether the edge to be detected is a transition from white to black or a transition from black to white.

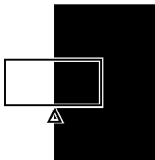
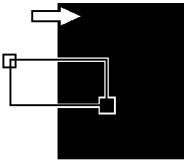
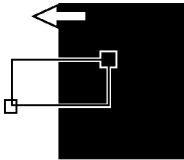
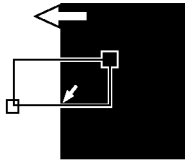
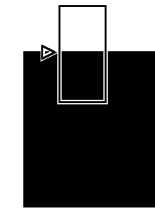
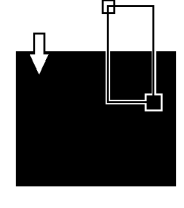
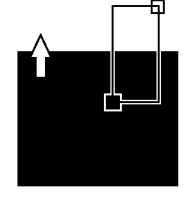
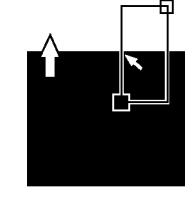
The scanning direction and edge detection condition are vital parameters edge detection. Make sure to set them correctly.

Horizontal scanning



Vertical scanning



Horizontal	W → B 	B → W 	W → B 	B → W 
	Edge detected	Not detected	Not detected	Edge detected
Vertical	W → B 	B → W 	W → B 	B → W 
	Edge detected	Not detected	Not detected	Edge detected

9.1.3 Select the Adjustment Group

Set the adjustment checker that will adjust the binary edge checker to be created.

```
TYPE[ 1]:  
[34] BINARY EDGE DETECTION Jud.:HG  
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

Set which position and rotation adjuster will adjust the binary edge checker being created.

42. Exposure Adjustment Group

Set which exposure adjuster will adjust the binary edge checker being created.

9.2 Binary Edge Checker Setup

Procedure:

1. Set number of the binary edge checker to be created.
2. Select **Checker Setting** from the menu and then **Shape**.
3. Select **Shape** from the menu and select either **line** scanning or **plane** scanning.
4. Select **Area** from the menu and set the coordinates for the inspection area.
 See 2.11 *Checker Area and Marker Area Setting Method* for details of how to set the area.
5. Select **Direction** from the menu and select either horizontal or vertical as the scanning direction.

Notes

- The scanning direction cannot be specified if line scanning has been selected. With line scanning, scanning proceeds along the line from the start point to the end point.
 - 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.

9.3 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 in touch with 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

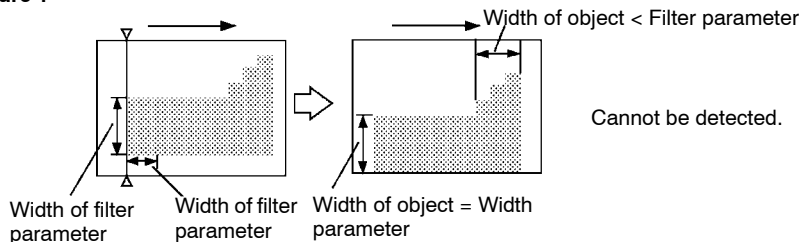
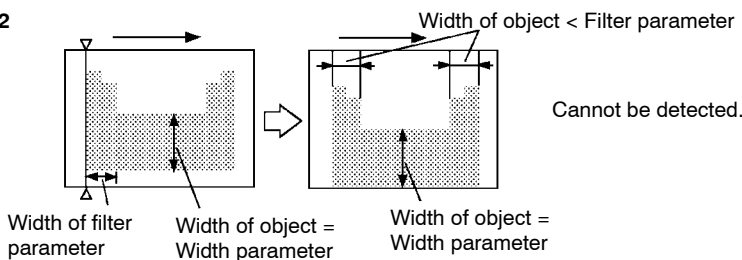


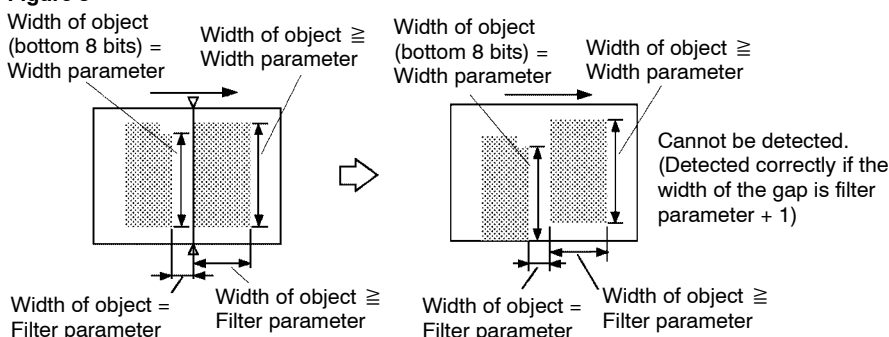
Figure 2



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.

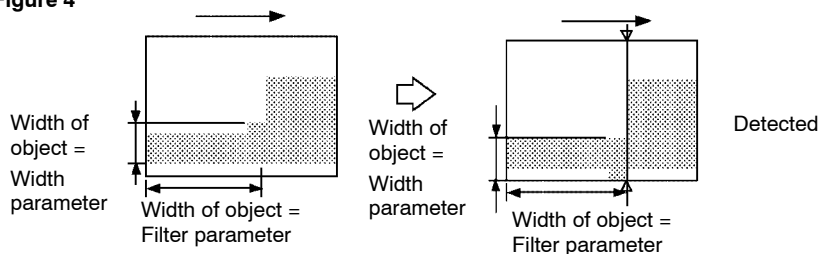
9.3 Restrictions on Binary Edge Checkers

- (B) With a pattern like that shown in the diagram below, if there is a section of the included colour positioned immediately before an area of the excluded colour, and the bottom 8 bits of the width of the object in the width parameter direction are equal to the width parameter, and moreover, if the object is in touch with 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 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 is a little smaller than the actual gap.

- (C) In detecting a region of the uncounted colour, if the counted colour area at the point where the filter conditions are met is in touch with 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 colour 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 Checkers

- 10.1 Gray Scale Edge Checkers 10 – 3*
 - 10.1.1 Menu Screen 10 – 3*
 - 10.1.2 Checker Setting 10 – 4*
 - 10.1.3 Result 10 – 11*
- 10.2 Gray Scale Edge Checker Setup 10 – 13*

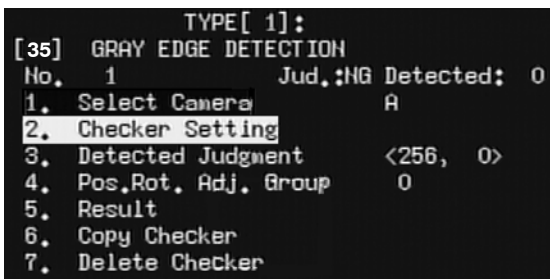
10.1 Gray Scale Edge Checkers

Gray scale edge checkers use gray scale processing for precision detection of changes in gray scale (outlines, boundaries, etc.). They are capable of detecting edge coordinates with sub-pixel 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 A210, and up to 48 per type for the A110.

10.1.1 Menu Screen



No. (Checker No.)

Set the number of the gray scale edge checker to be created.

1. Select Camera

Select which camera (A or B) will supply the image on which the gray scale edge checker is to be activated.

(This is fixed at A in the case of the A110.)

2. Checker Setting

Set the checking area and set parameters, etc.

3. Detected Judgment

Set 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. Positon and Rotation Adjustment Group

Set which position and rotation adjuster will adjust the gray scale edge checker being created.

5. Result

Display result information for up to 99 detected edges.

6. Copy Checker

When creating a checker, copy the data from an existing checker.

7. Delete Checker

Delete the checker.

10.1 Gray Scale Edge Checkers

10.1.2 Checker Setting

Set the gray checking area and set parameters, etc.

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

21. Shape

Select the shape for the checker area.

22. Direction

Select the scanning direction for the checker being created.
This parameter is not displayed when line scanning is selected.

23. Scan Method

Select the scan method for the checker being created.
This parameter is not displayed when line scanning is selected.



Point

Scanning Method

Two different scanning methods are supported for gray scale edge checkers: Single and projection. The default is single.

Single scanning is a method which is beneficial for detecting edges on workpieces where the edges are not straight lines (degraded or rounded edges, or uneven surfaces).

Projection scanning is a method which enables the reliable detection of edges that are present, even if the surface of an object is rough, the gray scale image is grainy, and individual edges do not stand out.

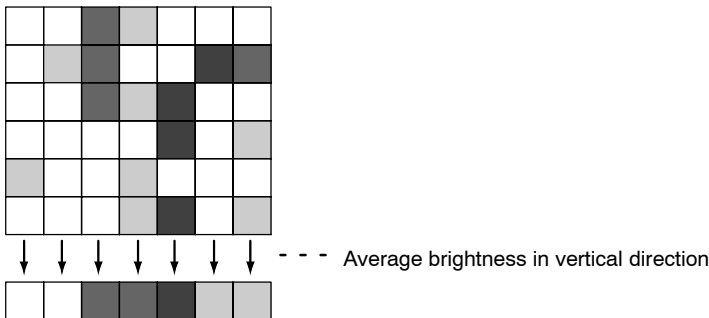
– Single scanning

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, and it is relatively unaffected by noise, enabling reliable edge detection.

– Projection scanning

Projection scanning is a method for images where the gray scale image is grainy and individual edges do not stand out well. 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.

Images that have undergone projection scanning can be confirmed from **Result**.



10.1 Gray Scale Edge Checkers

24. Area

Create or move the checker area.

The area cannot be set to a size of less than 7 pixels in the scanning direction. The “Illegal checker area size.” error will appear.

25. Edge Condition

Set the edge conditions for the checker being created.

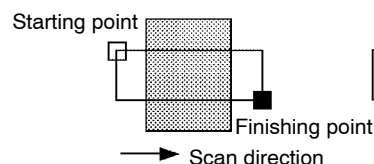
A gray scale edge checker scans from start point to end point, detecting edges in the image under inspection where light changes to dark, or where dark changes to light, or both.

The edges are detected at locations meeting the conditions set for the edge threshold value.

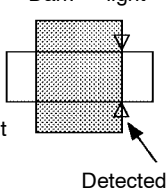
The default setting is **Both**. When set to **Both**, the filter, width and average area functions work on both light to dark edges and dark to light edges, enabling edges with positive and negative differentials to be detected.



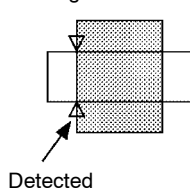
Point

Edge condition**Detection direction = horizontal**

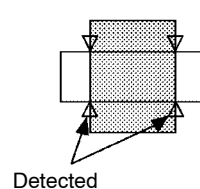
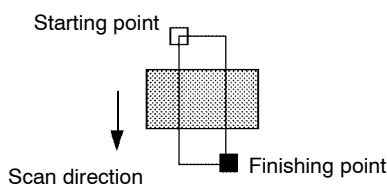
Dark → light



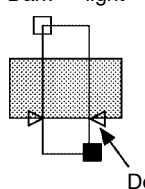
Light → dark



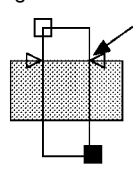
Both

**Detection direction = vertical**

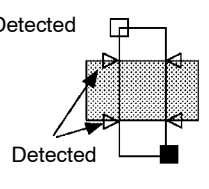
Dark → light



Light → dark

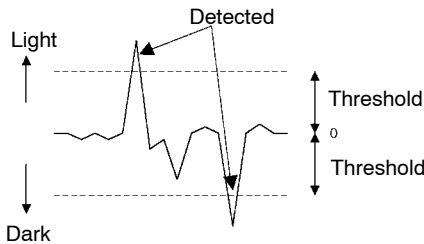


Both

**26. Edge Threshold Value**

Set the edge threshold values for the checker being created.

A gray scale edge checker performs differential processing on a gray scale image to detect edges. Changes in brightness of the gray scale image are processed as differential data. After processing, the data can be represented as a graph with peaks like those shown in the diagram. When the graph slants upwards, the gray scale level is changing from dark to light. The dotted line on the vertical axis of this graph is the threshold value (expressed in 256-gradation gray scale). Only peaks which reach the threshold value are detected as edges. Set the threshold value with reference to the differential values of the edges so that only the required edges are detected.



27. Condition

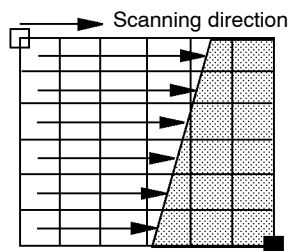
Set the processing conditions for the checker being created.

TYPE[1]:	
[5] GRAY EDGE DETECTION	
No. 1	Jud.:HG Detected: 0
2. Checker Setting	
27. Condition	
271. Scan Pitch	3
272. Filter	3
273. Width	5
274. Average Area	5

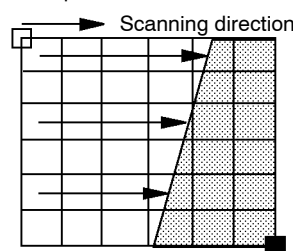
271. Scan Pitch (Only for individual scans)

Set the interval in terms of pixels in the scanning direction at which scanning is performed in the inspection area. The initial value is 1. Setting a wide pitch makes inspection faster, but there is a greater interval between the sections examined. If the pitch is set wider than the scanning area, only a single line is scanned.

Scan pitch = 1



Scan pitch = 2



272. Filter

The filter function is a function that 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.

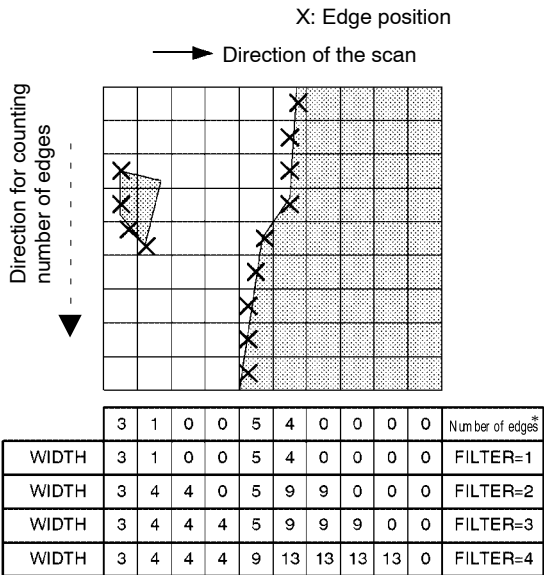
273. Width (can only be set for individual scans)

The width function 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.

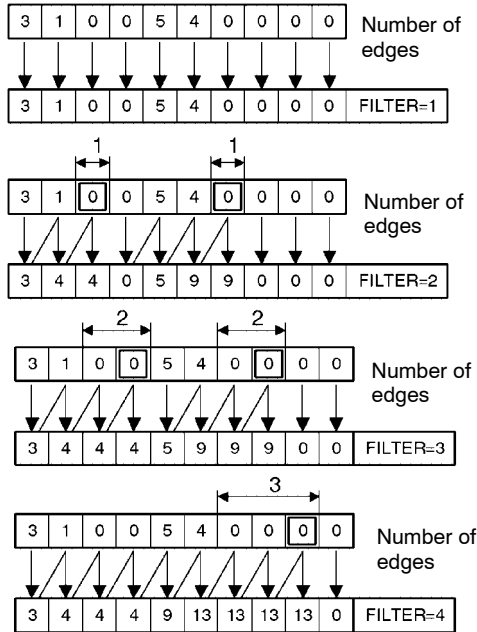
10.1 Gray Scale Edge Checkers



Point
Filter/Width

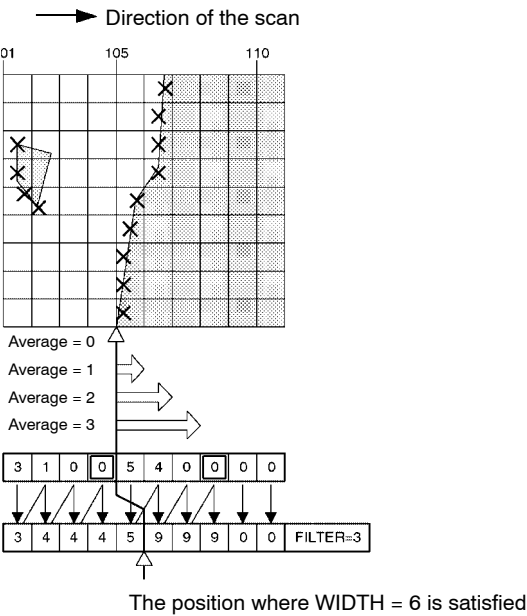


* Number of edges = count of edges detected for each individual scan line.



In the above example, with FILTER = 2 and WIDTH = 7, the 6th column is detected.

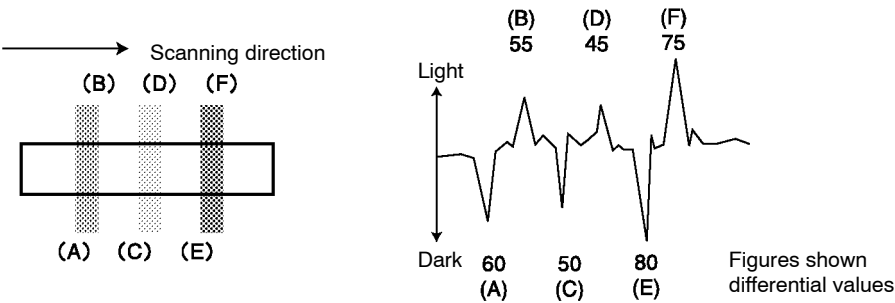
274. Average Area (can only be set for individual scans)
Set the range for averaging, starting from the edge position that fulfills the filter/width conditions.



10.1 Gray Scale Edge Checkers

28. Detect Position

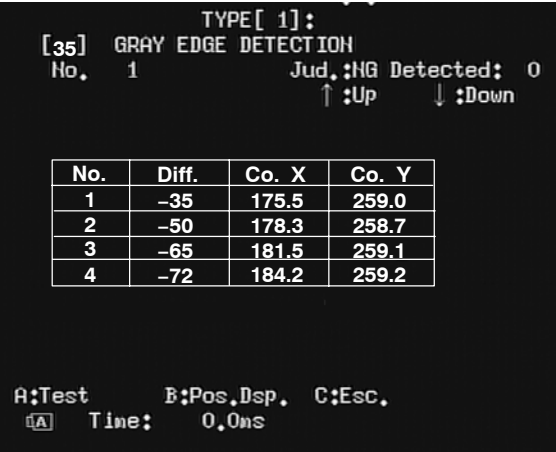
Set the edge detection point of the checker to be created.



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

10.1.3 Result

Display result information for up to 99 detected edges.



A: Test

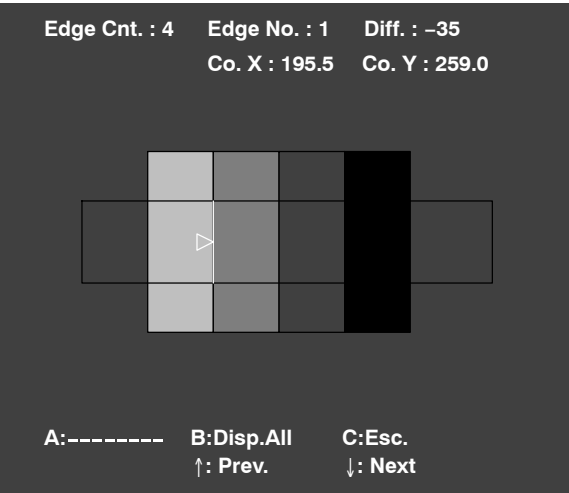
- In camera mode: Captures an image from the camera and inspects it.
- In memory mode: Inspects a current memory image without capturing a new image from the camera.
- Displays the results after inspection.

B: Pos. Dsp.

After deleting the display of results, display the detected edge position and the edge data (coordinates and differential value). Pressing **C** returns to the display of results.

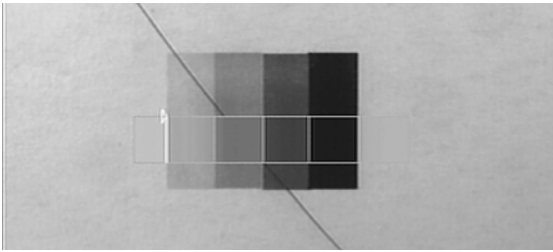
C: Esc.

Pressing **C** returns to the display of results.



10.1 Gray Scale Edge Checkers

With projection scanning, the image resulting from projection processing is displayed.

**B: Disp. All**

Display the positions of all the edges detected as a pattern.

C: Esc.

Pressing **C** returns to the display of results.

↑: 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.

10.2 Gray Scale Edge Checker Setup

Procedure:

1. Set the number of the gray scale edge checker to be created.
2. For the A210, select which camera (A or B) screen you will move the gray scale edge checker in. This is fixed at A in the case of the A110.
3. Select **Checker Setting**, then **Shape**.
4. Select **Shape** from the menu and select either line scanning or plane scanning.
5. Select either horizontal or vertical as the scanning direction.
6. Select projection scanning or single scanning as the scanning method.



Note

With line scanning, direction and scanning method cannot be selected.

7. Select **Area** from the menu and set the coordinates for the inspection area.



See 2.11 *Checker Area and Marker Area Setting Method* for details of how to set the area.



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 differential value changes from light to dark, or dark to light, or both.
9. At **Edge Thres. Value**, set the differential value threshold for the edge that you want to detect.
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. With reference to the detection count at the top of the screen, set the upper and lower limits at **Detected Judgment**.
13. Select the position and rotation adjustment group number.

10.2 Gray Scale Edge Checker Setup

Chapter 11

Feature Extraction

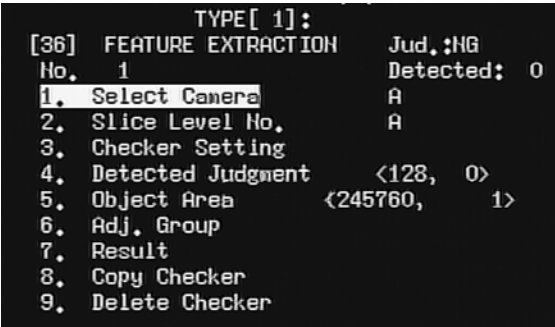
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11.1 Feature Extraction

A feature extractor is used by creating a checker area as required for the area to be inspected, and inspecting the area to count the number of specified objects and to detect their Feature (areas, centres of gravity, perimeter lengths, projection widths, principal axes, etc.). The feature extraction function is effective for detecting objects whose positions, attitudes, and numbers are not known in advance. The values for features obtained can be used independently or in combinations to judge the shapes of objects directly. The shapes available for feature extractors are rectangle, circle and polygon, and the shapes available for masks are also rectangle, circle and polygon. Up to a maximum of 128 lands can be detected. (Numerical calculations can only use up to 99 results.)

You can set up to 96 checkers per type for the A210, and up to 48 per type for the A110.

11.1.1 Main Menu



No. (Checker No.)

Setting for the number of the feature extractor to be created.

1. Select Camera

For the A210, 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 in the case of the A110.

2. Slice Level No.

Select the binarization level group for the feature extractor being created.

3. Checker Setting

Create the feature extractor and set judgment conditions, etc.

4. Detected Judgment

Set judgment of good products and rejects on the basis of upper and lower limits on the number of objects extracted.

5. Object Area

Set 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 $\geq$ lower limit).

11.1 Feature Extraction

6. Adjustment Group

Set whether or not the checker being created will be adjusted by a position and rotation adjuster, or exposure adjuster.

7. Result

Display a table of information about the detected lands, up to a maximum of 99 lands.

8. Copy Checker

When creating a checker, copy the data from an existing checker.

9. Delete Checker

Delete the checker.

11.1.2 Checker Setting

Create the feature extractor and set judgment conditions, etc.

```

TYPE[ 1]:
[36] FEATURE EXTRACTION      Jud.:NG
No. 1                        Detected: 0
3. Checker Setting
31. Shape                    Rect.
32. Area                    ( 206, 200)-( 305, 279)
33. Mask Shape              None
34. Mask Area ( , )-( , )
35. Object                  W
36. Condition
37. Output Unit             No

```

31. Shape

Select the shape for the feature extractor area.

32. Area

Create or move the feature extractor area.

33. Mask Shape

Select the shape for the mask area.

34. Mask Area

Create or move the mask area.

35. Object

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

36. Condition

Set the conditions for the feature extractor.

37. Output Unit

Set the conditions for the feature extractor.

```
TYPE[ 1]:  
[36] FEATURE EXTRACTION      Jud.:HG  
No. 1                        Detected: 0  
3. Checker Setting  
37. Output Unit  
371. Sorting                 No  
372. Sorting Order           Des.
```

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



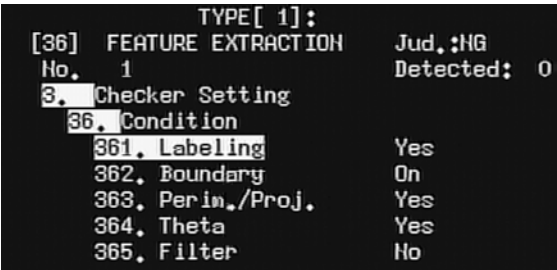
Note

Only set the processing conditions and data output conditions which are required. Requiring all conditions increases processing time.

11.1.3

Condition Setting

Set the conditions for feature extractor.



361. Labeling

Within the feature extraction area, each block of the colour being inspected (black or white) is individually recognized and its data handled individually.

Labeling: Yes

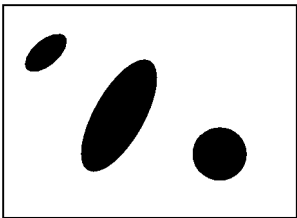
Handle each of the separate block of the colour being inspected as individual lands within the feature extraction area. Count of lands and individual land information are available.

Labeling: No

Total all the objects of the colour 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 centre 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: No

The three objects are handled as one, and the overall area is obtained.

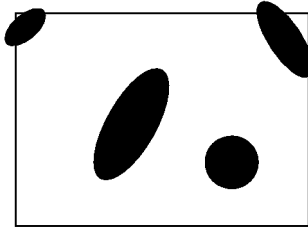
Labeling: Yes

The three objects are handled as one, 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

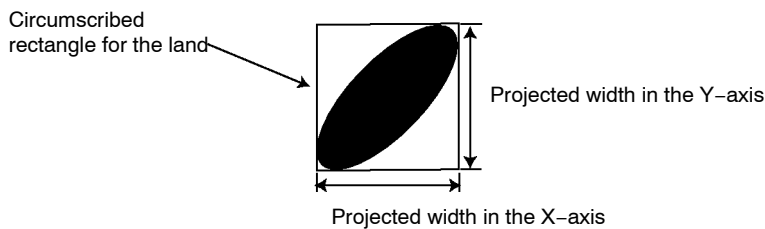
Object detected: 4

(Labeling must be set to **Yes**.)

363. Perimeter and Projection Width (Perim./Proj.)

Select 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**.

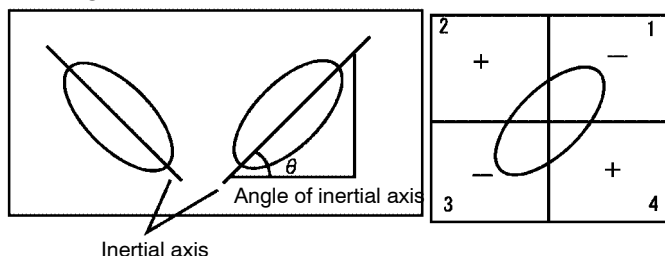


11.1 Feature Extraction

364. Theta

Select 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.



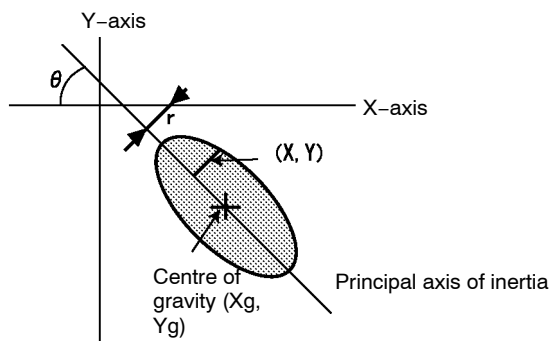
Point

Inertial axis

If the rotational inertia moments (moment of inertia about the centre of gravity) of straight lines passing through the centre of gravity (X_g, Y_g) 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 axis 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 centre 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 an axis is reported, the data will not be reliable.

No error message is displayed if an axis cannot be found or if the angle of the principal axis approaches 180 degrees.

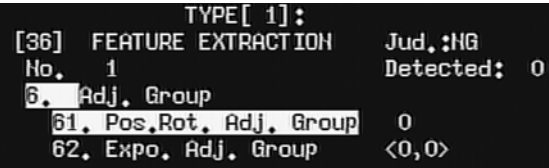
If theta is set to *Yes*, the pattern displayed at the detection position rotates in accordance with the angle of the principal axis. It does not rotate if theta is set to *No*, or if a value for theta could not be obtained.

365. Filter

Select whether or not to apply erosion or dilation filters to the image.

11.1.4 Select The Adjustment Group

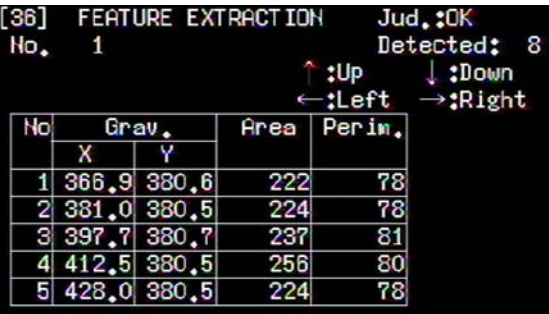
Set whether or not the checker being created will be adjusted by a position and rotation adjuster, or exposure adjuster.



61. Position and Rotation Adjustment Group
- Set which position or rotation adjuster the feature extractor will be adjusted by.
62. Exposure Adjustment Group
- Set which exposure adjuster the feature extractor will be adjusted by.

11.1.5 Result

Display a table of information about the detected lands, up to a maximum off 99 lands.



- A: Test
- In camera mode:
- Capture a new image from the camera and perform an inspection.
- In memory mode:
- Perform an inspection on a image from memory without capturing a new image from the camera.
- Display the results after inspection.

11.1 Feature Extraction

**B: Disp. All**

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

C: Esc.

Pressing **C** returns to the display of results.

↑: Prev.

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

↓: Next

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

11.2 Output Values for Detection Results

11.2 Output Values for Detection Results

Parameter	Output value	Display on screen	Output precision
Grav.X	0 to 5110	0 to 511.0	× 10
Grav.Y	0 to 4790	0 to 479.0	× 10
Perim.	0 to 245760	0 to 245760	× 1
Area	0 to 245760	0 to 245760	× 1
Theta	−899 to 900, 1800*	−89.9 to 90.0, 180.0*	× 10
Proj.X	1 to 511	1 to 511	× 1
Proj.Y	1 to 479	1 to 479	× 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, detect how many of the specified objects are within the area. Up to 128 objects can be detected.

b: Centre coordinates of object

Detects the position of the centre of gravity.

With labeling:

Centre of gravity coordinates can be measured for each individual land meeting the area limits for detection.

Without labeling:

Measures overall centre 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 colour 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 colour meets the area limits for detection.



Notes

- If the number of lands extracted exceeds 128, the “Number of lands exceeds 128.” error message 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 “Labeling buffer overflow. Make the area smaller.” message is displayed. If this occurs, make the feature extractor area smaller.

11.3 Feature Extraction Setup

11.3 Feature Extraction Setup

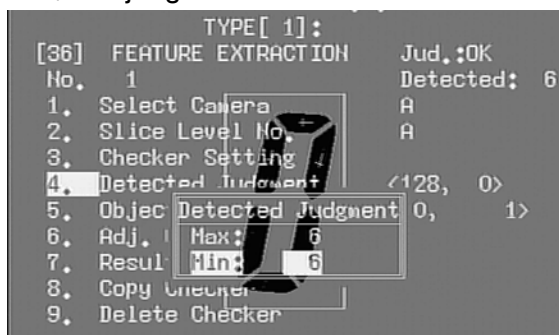
Procedure:

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**, then **Shape**
 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.
- See 2.11 *Checker Area and Marker Area Setting Method* for details of how to set the area.

Note

Circular / elliptical areas must be set so that the X-coordinate difference between start point and end point is an odd number of pixels.

6. Set the mask area to rectangle, circle or polygon from **Mask Shape**.
 7. Select **Mask Area** from the menu and set the coordinates for the mask area.
- See 2.12 *Setting Masking*, for details of how to set the mask area.
8. Select **Object** from the menu and set the colour to be extracted 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. Select **Condition**.
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. Select **Detected Judgment** from the menu and referring to the area values displayed at the top of the screen, set the upper and lower limits to be used for OK / NG judgment.



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

Chapter 12

Smart Matching

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 - 12.1.4 *Check Template* 12 – 15
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12.1 Smart Matching

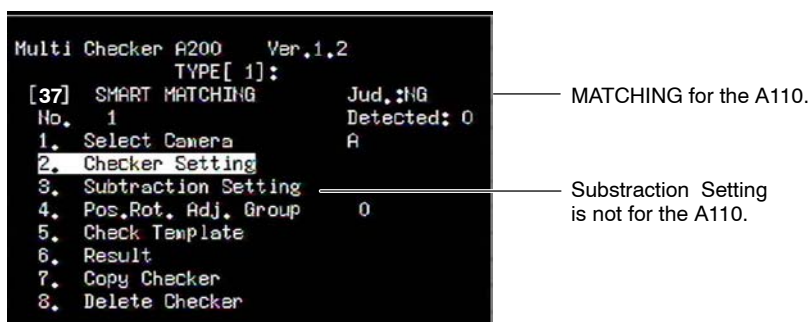
This function is called **Smart Matching** on the A210 and **Matching** on the A110. In this manual, only the term **Smart Matching** is used. The smart matching checker registers a pre-set base image, and detects images similar to that registered image (called a “template”) from the checker area. The correlation value represents the degree of similarity to the template an image must have to be detected.

You can set up to 96 per type for the A210 and up to 48 per type for the A110.

It is possible to re-register template images using input from external equipment.

➡ Refer to *16.7 Template (Smart matching) Re-registration*.

12.1.1 Menu Screen



No. (Checker No.)

Set the number of the matching checker to be created.

1. Select Camera

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

(This is fixed at A in the case of the A110.)

2. Checker Settings

Create the matching checker and set the checker conditions.

3. Subtraction Settings

Set the parameters for the subtraction settings.

4. Position and Rotation Adjustment Group

Set which position and rotation adjuster will correct the matching checker to be created.

5. Check Template

You can verify the set template image and the compressed image being processed.

6. Result

Displays the inspection results.

7. Copy Checker

When creating a checker, copy the data from an existing checker.

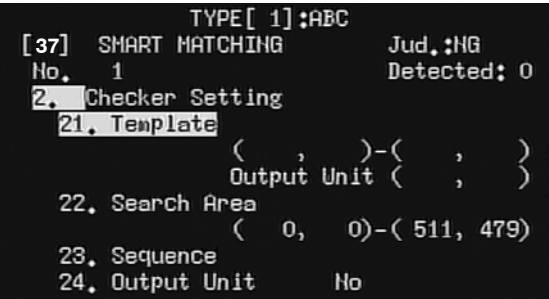
8. Delete Checker

Delete a checker.

12.1 Smart Matching

12.1.2 Checker Settings

Create the matching checker and set the checker conditions.



21. Template

Register the template image that will serve as the checker base. Set a square area for the checker base. 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 centre of the area.

22. Search Area

Set 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 photographed image as the search area will slow down the image processing, please set the search area as the necessary range. Position adjustments make it possible to set a very limited search area. Even in a very small search area, designating the smart matching checker as a position adjustment group number allows the inspection to be performed without deviating from the target object.

23. Sequence

Set the matching search conditions. Detailed conditions can be set for the sequence in which the search is to be executed.

Multi Checker A100 Ver.1.0
TYPE[1]:
[37] MATCHING Jud.:NG
No. 1 Detected: 0
2. Checker Setting
23. Sequence Judgment Result

Step	Acc.	Cnt.	Cor.	Cnt.	Cor.
1ST	16	1	0.60	0	0.00
2ND	8	1	0.60	0	0.00
3RD	4	1	0.60	0	0.00
4TH	2	1	0.60	0	0.00
5TH	S	1	0.60	0	0.00
Rotation Angle	0	Acc.	1		

Step

Select the step of the sequence that sets the search conditions. There are five steps (1st to 5th). Set the search conditions for each step.

Accuracy (Acc.)

Adjust 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 (sub pixels) 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 (make the value small), 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 sub pixels. Once you set a step at an accuracy of 1 pixel or sub pixels, additional steps cannot be set. For example, if you set the 3rd step at 1 pixel or sub pixels, you cannot set the 4th and 5th steps.

Judgment conditions (Judgment)

– Number (Cnt.)

Set the upper limit of the number of detected objects. The checker will detect a number of objects similar to the template within the number set here. However, the number of detected objects cannot be set to exceed the previous step. The maximum number of detected objects is 64.

– Correlation value (Cor.)

The correlation value reflects the degree of similarity between the template and the search object. If the correlation value is large, only objects with a high degree of similarity will be detected. If it is small, even objects with a low degree of similarity will be detected. The checker will search for objects with a degree of similarity greater than the correlation value set here.

The setting range for the correlation value is 0.01 to 1.00. The default value is 0.60.

12.1 Smart Matching**Detection results (Result)**

- Number **(Cnt.)**
Shows the results of the search based on sequence, that is, 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 Imagechecker rotates the template within the angle range set in the rotation settings (± 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 Imagechecker rotates the template at each angle set here, compares it to the object, and finally detects the rotation angle.



Example: When no rotation angle is set (angle range: 0)

Multi Checker A200 Ver.1.2
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.



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

Multi Checker A200 Ver.1.2
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.

 Notes**Search accuracy**

- The search accuracy of the smart matching checker can be set to $\pm 16, 8, 4, 2$, or 1 pixel, or to sub pixels in each processing step.

The smart matching checker compresses the template image and searches the search area, and the degree of compression used in conducting the search is set by setting the search accuracy (by setting $\pm$ a certain number of pixels or sub pixels). 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 16×16 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 sub pixel 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 Imagechecker can search the template image most effectively.

The search is performed in five steps. In the 1st step (± 16 pixels), the Imagechecker 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 change fine-tune the settings to adjust the processing time and accuracy.

When the Imagechecker 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 sub pixel level, the output can be obtained at the sub pixel level regardless of whether the 1st or 5th step is set at sub pixels. If you set the 1st step at sub pixels, the search will take an extremely long time.

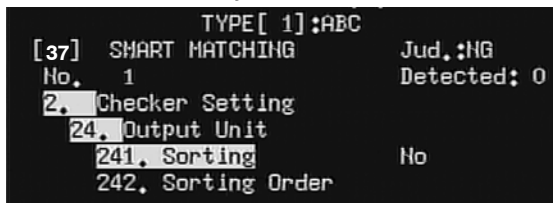
However, since it is possible to shorten the search time without compromising final output accuracy by setting sub pixels in the 5th step, we recommend reducing the search time by setting and adjusting the sequencing, and confirming the final search accuracy.

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.

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.

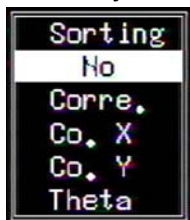
24. Output Unit

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



241. Sorting

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



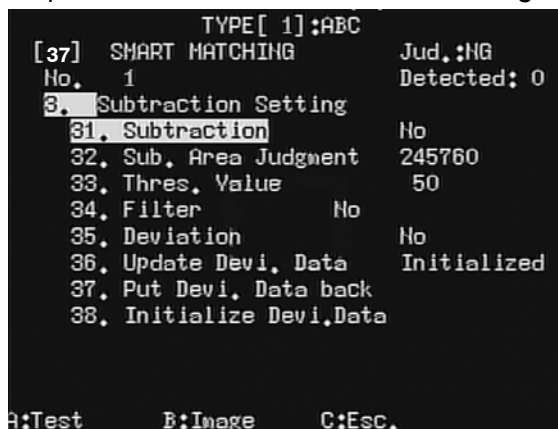
242. Sorting Order

Select whether to sort in ascending or descending order.

12.1 Smart Matching

12.1.3 Subtraction Settings (A210 only)

Set the parameters for the subtraction settings.

**31. Subtraction**

Set whether or not to perform subtraction processing. The items cannot be changed.

32. Subtracted Area Judgment

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

33. Threshold Value

A threshold value is applied when converting the gray scale difference between the template and detected area into black and white. The threshold value can be set in the range 0 to 255.

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.

➡ See 2.13 *Filter Setup* for details on filters.

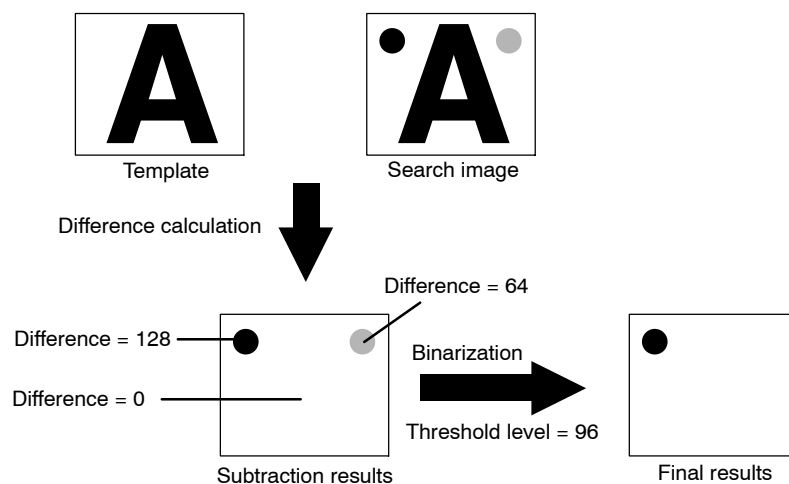
35. Deviation

Set whether or not to perform deviation processing. To perform deviation processing, the subtraction processing must be set to execute, **Yes**. If the Imagechecker is not set to perform deviation processing, deviation data cannot be updated, restored, or reset.

Subtraction processing

Performs subtraction processing on the points detected by the 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:

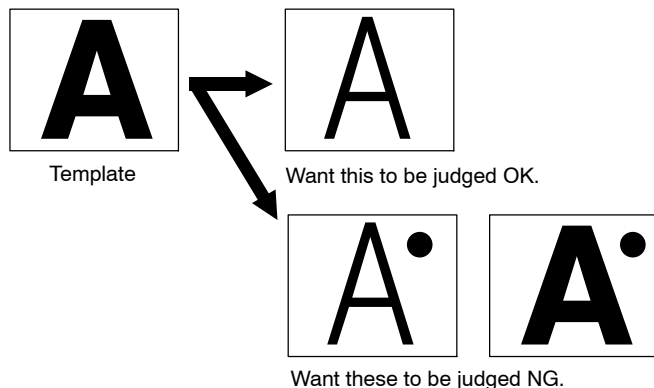
The Imagechecker calculates the difference in brightness between the search image ($f(x,y)$) and the template ($g(x,y)$). If the absolute value of the difference is larger than the threshold level (th), the result will be 1; if it is smaller, the result will be 0. It will search for the number of pixels 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.



12.1 Smart Matching

Deviation processing

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 Imagechecker 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: $128 > \text{threshold value: } 96$) 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: $128 \times \text{deviation: } 0.75 = 96 \leq \text{threshold value}$), and are not recognized as abnormalities. On the other hand, abnormalities that exceed the threshold value (difference: $128 \times \text{deviation: } 1.0 = 128 > \text{threshold value}$) are recognized as such.

Area where the outline fluctuates due to the workpiece. Difference = 128

Deviation = 0.75

• Deviation = 1.0

Deviation data

Subtraction calculations

(Deviation $\times$ difference)

Threshold value = 96
Binarization

OK

$$(\text{Deviation} \times \text{difference}) \leq \text{threshold value}$$

NG

$$(\text{Deviation} \times \text{difference}) > \text{threshold value}$$

NG

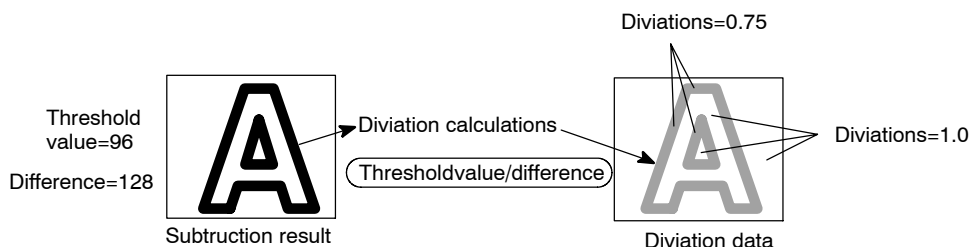
Final result

12.1 Smart Matching

36. Update Deviation Data

Updates 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

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

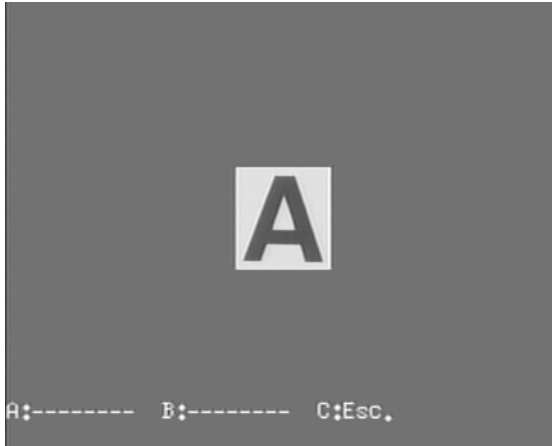
38. Initialize Deviation Data

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.

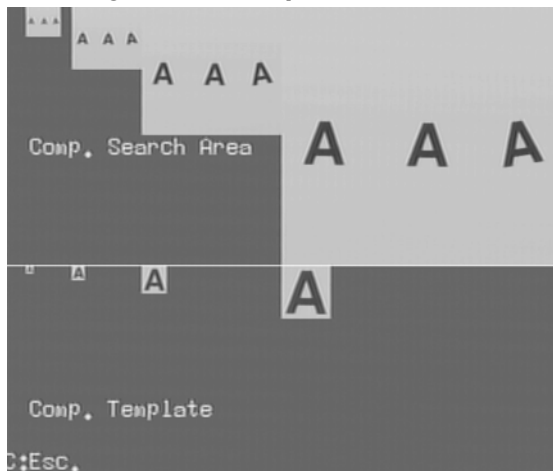
12.1.4 Check Template

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**.



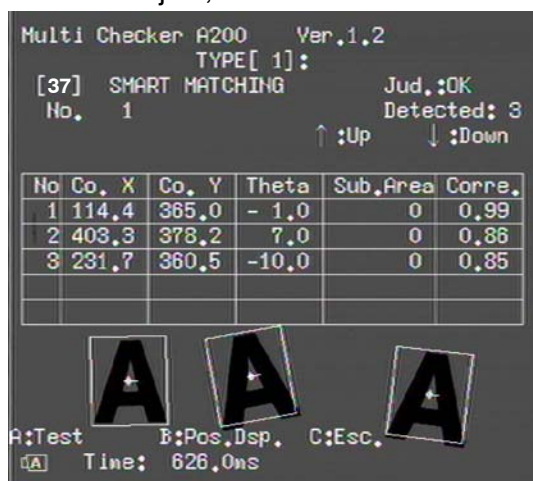
Verify the search area compressed image and the template compressed image by selecting **Check Template** and then **Middle Step**.



12.1 Smart Matching

12.1.5 Result

Displays the inspection results. Displays 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.

A: Test

Execute a test.

B: Pos. Dsp.

Display a representation of the image you took.

C: Esc.

Return to the previous menu.



12.2 Smart Matching Checker Setup

For the A210

1. Set the number of the matching checker to be created.
2. From **Select camera**, 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 centre of the area.
6. Set the search area.
Set only the area necessary, keeping in mind the effects of the search area size on processing speed.
7. Set the 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 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.
9. Enter subtraction settings if necessary.
Select **Subtraction** from the menu and select **Yes**.
10. Set the subtracted area judgment.
Set the upper limit value for the area of detected pixels from the subtraction result (the number of pixels up to which the result is 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 filters if necessary.
You can select whether to apply only an erosion filter (3×3 or 5×5 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. Set deviation processing if necessary.
14. Set the number of the position and rotation adjustment group.

12.2 Smart Matching Checker Setup

For the A110

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 centre of the area.
5. Set the search area.
Set only the area necessary, keeping in mind the effects of the search area size on processing speed.
6. Set the 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 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.

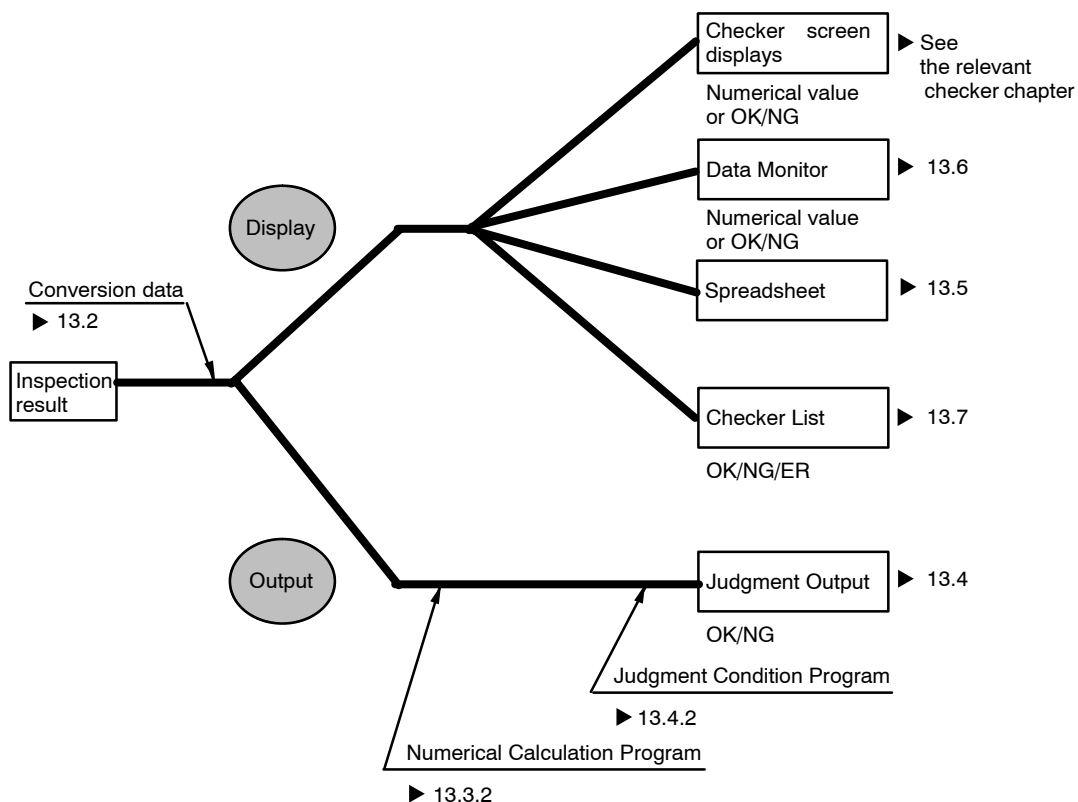
Chapter 13

Inspection Results and Output

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13.1 Inspection Results and Output

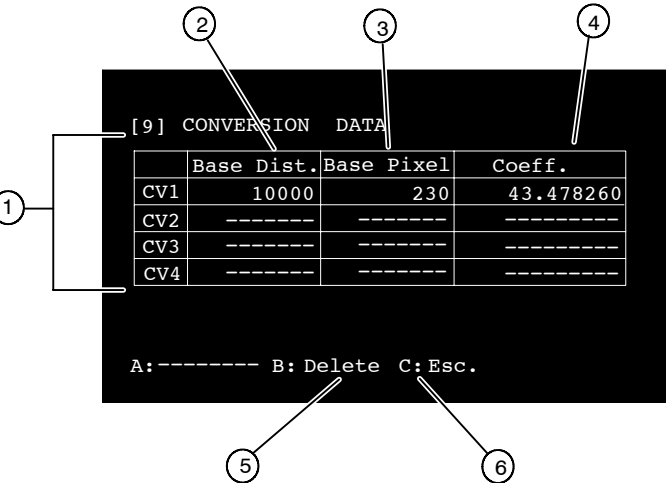
In addition to displaying inspection results on the screen, it is also possible to output them to external equipment and to perform numerical calculations on the results and create judgment programs to judge the results.



13.2 Conversion Data

13.2.1 Conversion Data

This function is useful when you wish to replace the number of measured pixels with the actual dimensions. You can set up to four sets of conversion data for one controller, so it is possible to set them separately for the vertical and horizontal directions and to use for conversion of units.



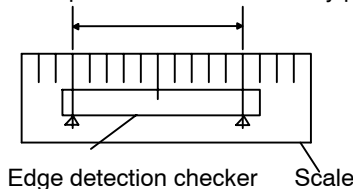
- Conversion Data No.**
Conversion data can be used in numerical calculations. Specify this number when you wish to use the conversion data in a formula.
- Reference Distance**
Input the actual dimension, measured on the screen using a scale or calipers, that is to be used for the reference distance. Input a number of up to seven digits (1 to 9999999).
- Pixels**
Measure the reference distance, and input the number of pixels. Input a number of up to seven digits (1 to 9999999).
- 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.
$$\text{Scale} = \text{Reference Distance} / \text{Pixels}$$
- B: Delete**
To delete an input, select it and press the **B: Delete** button.
- C: Exit**
Returns you to the previous menu.

13.2.2 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: 1000um = how many pixels



2. Select **CONVERSION DATA** from the Menu screen, input the number for the conversion data (CV01 to CV04), and press **ENTER**. First, input the distance between the scale measurement gradations as the **Reference 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.

	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 (reference distance, number of pixels, and scale factor) 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 the **B: Delete** button.

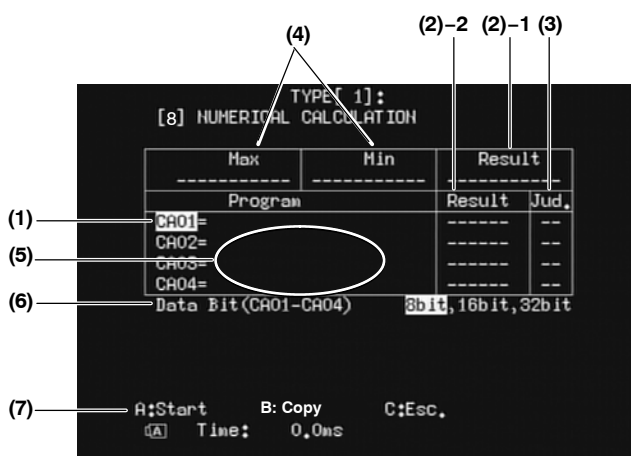
13.3 Numerical Calculation

13.3 Numerical Calculation

13.3.1 About Numerical Calculations

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 for each type (48 formulas for the A110). 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.

Numerical calculation Setting menu



(1) **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.

(2)-1 **Calculation result**

Displays the result of the numerical calculation

(2)-2 **Calculation result**

Displays the result of the numerical calculation

However, if the result exceeds eight digits, "*****" is displayed.

(3) **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. Displays the result of judgment.

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.

(4) **Maximum/Minimum**

Displays the upper and lower limits for the numerical calculation result.

You can use the Serial command to set and refer to the maximum and minimum values from an externally connected piece of equipment.

- ➡ Refer to *16.11 Referencing and Changing the Maximum and Minimum Limits for Numerical calculations* for details.

(5) **programs**

Displays the set calculation program.

A maximum of 90 characters can be set for the program.

Ex. BW01 = four characters

(6) **Data Bit**

Sets the data length for when you will output numerical calculation results using parallel output.

(7) **Key pad**

Start:

Press **A** to capture a new image and perform an inspection, outputting parallel and serial signals in accordance with I/O settings.

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, external start signals can also be accepted.

13.3 Numerical Calculation

Data Bit

Sets the data length for when you will output numerical calculation results using parallel output. Select 8, 16 or 32 bits in accordance with the range of numerical values that you will output. However, it is only possible to set one data length for the four registers that are displayed at one time (e.g. if CA01 to CA04 are displayed, it is not possible to set CA01 to 8 bits and CA02 to 16 bits).

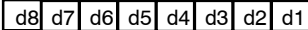
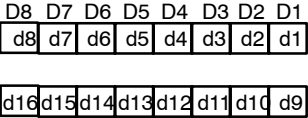
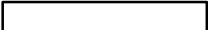
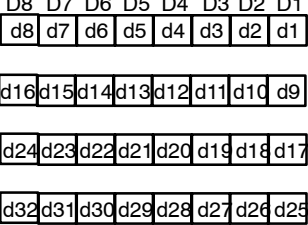
The ranges that can be handled by the different data-bit sizes are as follows:

8-bit: 0 to 255

16-bit: 0 to 65535

32-bit: -2147483648 to 2147483647.

External output registers that are not set are skipped during output.

Output data length	Output port (output pin No.)
8-bit data d8 d1 	(output pin No.) D8 D7 D6 D5 D4 D3 D2 D1 
16-bit data d16 d1 	(output pin No.) D8 D7 D6 D5 D4 D3 D2 D1 
32-bit data d32 d1 	(output pin No.) D8 D7 D6 D5 D4 D3 D2 D1 

Data and operators that can be referenced

- ➡ Refer to 13.3.4 Symbols used by Numerical Calculation Programs for the various checker items that can be used in calculations.

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

Addition: +	Left brace: (
Subtraction: -	Right brace:)
Multiplication: *	sin: #
Division: /	cos: &
	Atan: @
	Root: \$
	Distance: T
	Subtraction absolute: D

Output control function

Use this when there are calculation result registers (with numerical values and judgment results) that you do not want to output using parallel or serial communications.

➡ Refer to *page 13 – 17, Setting and Canceling Output Control*.



Example: 1

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.



Example: 2

XCA01 = X direction distance ← output suppressed

XCA02 = Y direction distance ← output suppressed

CA03 = angle calculated using CA01 and CA02

When output control is set for CA01 and CA02, only the CA03 result is externally output.

13.3 Numerical Calculation

Specific substitution function

When a specific substitution is specified, the numerical calculations are only executed when there is a specific start signal for the parallel or serial signal. "ER" is displayed if an error occurs during calculation or if the value of a checker that has not be set is specified.

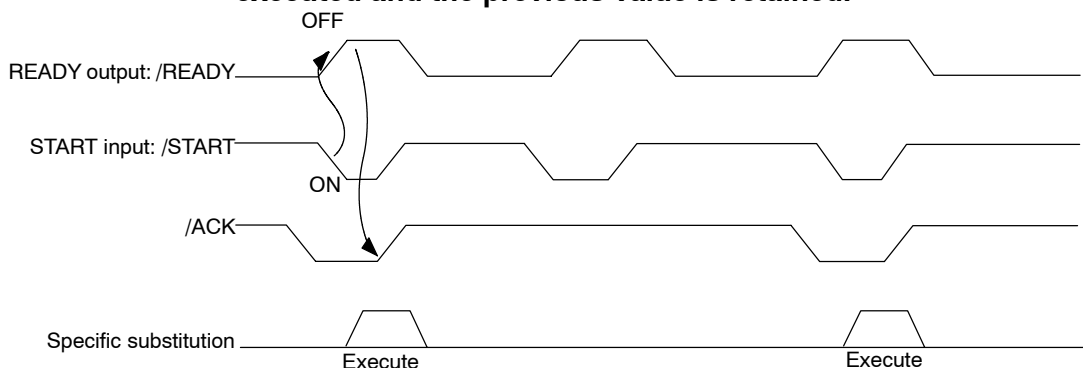
**Example:**

CA01 ! GE01011

CA02 = CA01 – GE02011

If numerical calculations are set as shown above, then as can be seen from the timing chart below, the CA02 calculation is not executed when there is no ACK signal input from the parallel input.

When the specific substitution flag is off, the calculation is not executed and the previous value is retained.



Whether or not the specific substitution calculation is executed is determined by whether or not the ACK signal remains ON from before the START signal is received until the READY signal goes OFF.

Setup is possible when setting numerical calculation programs regardless of whether the ACK signal is ON or OFF. Specific substitution can also be executed from the serial interface with the %P command.

**Note**

Even when the specific substitution is executed, it is not written to the F-ROM.

Screen Hold Condition Setting Function

You can use this function to hold screens corresponding to the results of three numerical calculation results.

When you have specified a **limit condition**, the screen is held if the calculation result is outside the range set by the maximum and minimum values. Set the Screen Data **Save Condition** in **Environment to Limit Condition**, and set the limit conditions into the register.

- ➡ Refer to *page 13 – 18, Setting and Deleting a Limit Condition.* for details regarding how to set limit conditions into a register.

Gray scale edge mode

The Detection No. that can be referenced is restricted according to the Detect Position mode.

- * 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)

13.3 Numerical Calculation

Atan, Root, Distance

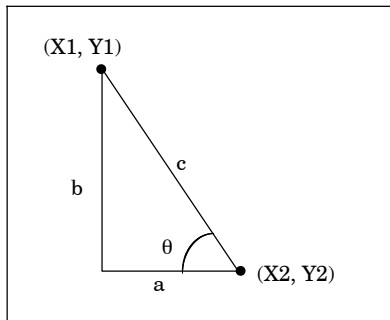
Atan is denoted by "@" and root is denoted by "\$". Atan and root can be utilized in calculations using ordinary calculation methods.

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.



Example: The two coordinates of the locations in the diagram detected by a gray scale edge checker can be used with the Root (\$), Distance (T) and Atan (@) functions to calculate the angle (θ) and the length of each side.



Side a: CA01 = X2 – X1

Side b: CA02 = Y2 – Y1

Side c: Using the Root (\$) function:

CA03 = \$(CA01*CA01 + CA02*CA02) (Pythagoras's theorem)

Using the Distance (T) function:

CA03 = CA01TCA02)

In both cases, the result is output multiplied by 10000.

Angle θ : CA04 = @(CA02*10000/CA01)

In the case of the Atan formula, the input is multiplied by 10000, and the result is output multiplied by 100.

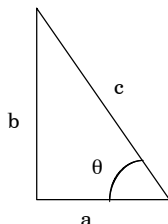
Pythagoras's theorem

$$c^2 = a^2 + b^2$$

$$c = \sqrt{a^2 + b^2}$$

Trigonometry

$$\text{Angle } \theta = \tan^{-1} (b/a)$$



13.3.2 Creating a Numerical Calculation program

Creating a Calculation 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 = Gray Edge checker No. 1 D Gray Edge checker No. 2

Procedure:

1. Align the cursor to select the register number for the calculation program you are going to create.

Max	Min	Result	
0	0	0	0
Program		Result	Jud.
CA01=		0	OK
CA01=			
CA04=		-----	--
Data Bit (CA01-CA04)		3bit, 16bit, 32bit	

A:Start .B:Copy C:Esc.

2. From the state shown in step 1 above, press **ENTER** again. A sub-window is displayed for selection of parameters to be input.

Max	Min	Result	
0	0	0	0
Program		Result	Jud.
CA01=		0	OK
CA01=			
CA04=		-----	--
Data Bit (CA01-CA04)		3bit, 16bit, 32bit	

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

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



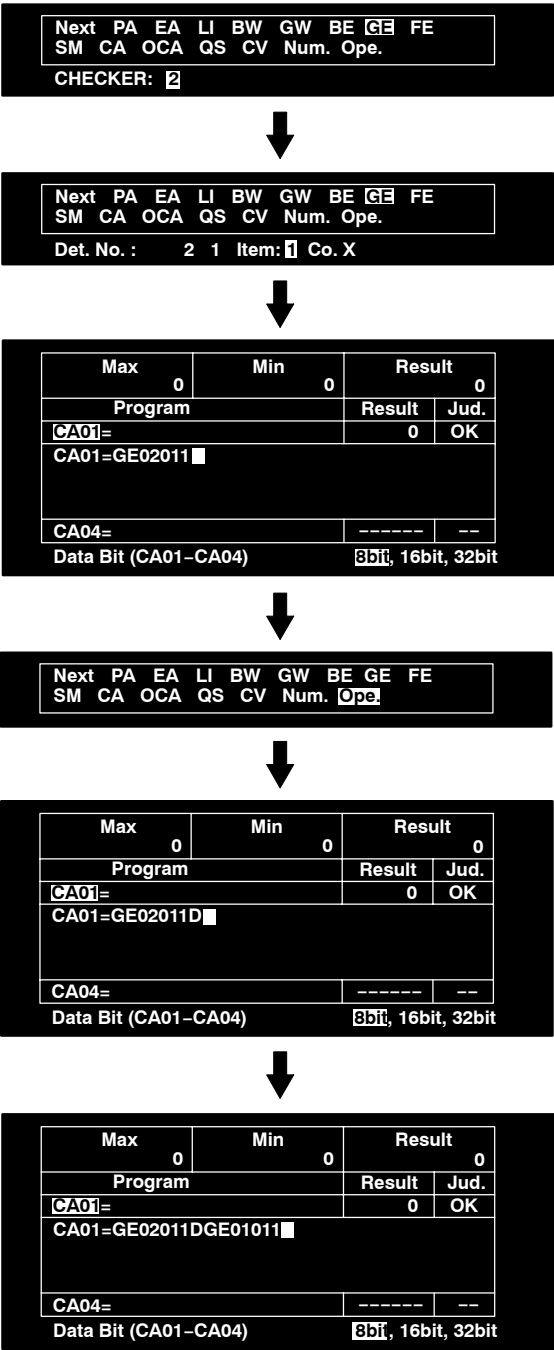
Note

With the exception of QS, if no checker data exists, selection is not possible.

Next cannot be selected if there is no other program, or if a program error occurs.

13.3 Numerical Calculation

3. Next, select the parameters to be referenced using the cursor lever.



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 press **Yes**. To discard the information input select **No**.

To cancel, press **C**.



5. Set the upper and lower limit values. Select **Next** on the sub-window to move the cursor to the Max field.

Max 0000000100	Min 0	Result 0	
Program		Result	Jud.
CA01=GE02011DGE01011		0	OK
CA01=GE02011DGE01011			
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 100	Min 50	Result 0	
Program		Result	Jud.
CA01=GE02011DGE01011		0	OK
CA02=		-----	--
CA03=		-----	--
CA04=		-----	--
Data Bit (CA01-CA04)		8bit, 16bit, 32bit	

To Revise a program During Input

Procedure:

1. Set the numerical calculation program register No., use the cursor lever to move the highlight cursor to the incorrect item and press **B** to delete the item.

CA01=GE02011DGE01011

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

CA01=GE02011+GE01011

13.3 Numerical Calculation

To Delete a program**Procedure:**

1. Select the register No. of the program you want to delete.
2. Use the cursors to move the highlight cursor to the “=” location, then press **B** to delete the program.

**Copying a program**

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

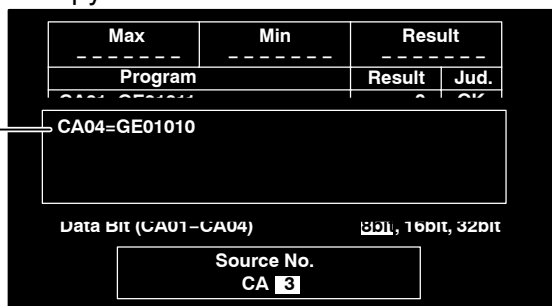
Procedure:

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.

Setting and Canceling 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 No. of the program you do not want to output.
2. Use the cursor lever to move the highlight cursor to any location other than "=", then press **A**. An "X" mark is displayed at the left of the register No.

A:OutpContr. B:Delete

XCA01=~~GE02011~~-GE01011

3. If a register has been specified for output control, but you want to change the setting so that it can be output, move the highlight cursor to any location other than "=", then press **A** again and the "X" mark disappears, enabling numerical calculation output for that program.

CA01=~~GE02011~~-GE01011

Even if a formula is set, and the Serial Output settings in the Environment menu are set to output a numerical calculation, the results of numerical calculation registers that have an "x" is displayed in front of the register are not output.

13.3 Numerical Calculation

Setting and Deleting a Specific Substitution

When creating a numerical calculation program, move the cursor to the = sign of the register for which you want to set specific substitution and press **ENTER** to display the Condition window.

Condition
None
Spec Subst.
Lim. Cond.

Use the cursor lever to select **Spec Subst.**, and confirm the selection. The = sign will change to a ! sign. This indicates that specific substitution is set.

To delete the specific substitution setting, use the same procedure to cursor lever to display the Condition window, select **None** and confirm the selection. The ! sign will change back to the = sign.

CA01=GE02011-GE01011



CA01!GE02011-GE01011

Setting and Deleting a Limit Condition

When creating a numerical calculation program, move the cursor to the = sign of the register for which you want to set limit conditions for holding the screen and press **ENTER** to display the Condition window.

Condition
None
Spec Subst.
Lim. Cond.

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.

To delete the limit condition setting, use the same procedure to cursor lever to display the Condition window, select **None** and confirm the selection. The % sign will change back to the = sign.

CA01=GE02011-GE01011



CA01%GE02011-GE01011

**Note**

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

13.3.3 Restrictions Applying to Numerical Calculations

Calculation Order

If a division is used in a calculation program, there is sometimes a remainder, and in that case, the digits after the decimal point are discarded. This rounding-off is done not only when all the calculations are finished, but also during the calculation, in accordance with the priority order for arithmetical calculations. Therefore, if a division is to be carried out in the course of calculation, try to put this program last if at all possible. Compare the results of the two examples below.



Example:

1: CA05=CA01/2*100 (when CA01 = 3)

$$\text{CA01}/2 = 3/2 = 1.5$$

Since the decimal parts of numbers are discarded, 1.5 becomes 1.

$$\text{CA01}/2 \times 100 = 1 \times 100 = 100$$

Therefore the result of this calculation is CA05 = 100.

2: CA05=CA01*100/2 (when CA01 = 3)

$$\text{CA01} \times 100 = 3 \times 100 = 300$$

$$\text{CA01} \times 100 / 2 = 300 / 2 = 150.$$

Therefore the result of this calculation is CA05 = 150.

Number of Digits in Numerical Calculations

Numerical calculations can operate on numbers in the range -2147483648 to 2147483647.

Constants can be specified in the range -65535 to 65535.

If an overflow (if the number exceeds the permissible range) occurs during calculation, an error output is output from the parallel port at that point.

If the final result of numerical calculation is outside the range -2147483648 to 2147483647, then an error output is output from the parallel port.

In either of these cases the result of calculation is "0".

If the results of calculation are output through the serial interface, they are output as the error output "e".

Division by Zero

If the denominator in a division is "0", or if it references a value of "0", then the output of calculation is "0", but an error output is output from the parallel port at the same time. If the results of calculation are output through the serial interface, they are output as the error output "e".

Order of Use of CA Registers (numerical calculation registers)

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. (Calculations on CA registers are carried out in ascending order of register number.)

13.3 Numerical Calculation

**Example: Correct:** $CA01 = GW01 + GW02$ $CA02 = CA01 / 2$ **Incorrect:** $CA01 = CA02 / 2$ $CA02 = GW01 + GW02$ **Calculation of Negative Values**

If a negative constant is used in a program, it must be enclosed in brackets ().

**Example: 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.

	Input value	Output value
# (sin)	× 100	× 10000
& (cos)	× 100	× 10000
@ (atan)	× 10000	× 100
\$ (root)	× 1	× 10000
T (distance)	× 1	× 10000

Order of Priority of Operators

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

High	(,)
↓	@, \$, #, &
	*, /, T, D
Low	+, -

Note on incorporation of efficient of conversion data into the calculation

When coefficient of conversion data is incorporate into a calculation, the A210 actually performs calculation as follows:

$$CA01 = A * CV11$$

$$= A * \text{Base distance} / \text{Base pixels}$$

In the calculation above, if “A * Base distance” exceeds the values that can be used for the numeric calculation, $(-(2^{31}) \text{ to } (2^{31}-1))$, an ERROR signal will be output. This is because overflow error occurs, and the numeric calculation is not performed properly.

Base distance of less than 99999999 (7 digits) can be set as conversion data, but in this case, if “A” in the calculation above is substituted with more than 215, the calculation result will exceed $-(2^{31}) - (2^{31}-1)$.

Therefore, if the data multiplied by a coefficient (calculation results of the numeric calculation prior to incorporation of conversion data) provably exceed 215, adjust the number of base distance of conversion data to avoid an overflow error when the conversion data are incorporated into the numeric calculation above.

13.3.4 Symbols Used by Numerical Calculation programs

Checker	Program Symbol	Checker Number (A110 in brackets)	Object No.	Mode	Reference Data
Position/ Rotation Adjustment	PA	01 to 64 (01 to 48)	0	1	ΔX (amount of position adjustment in the horizontal direction)
				2	ΔY (amount of position adjustment in the vertical direction)
				3	$\Delta \theta$ (amount of angular rotation adjustment) (A210 only) (*2)
			1 to 2 (*1)	4	X coordinate (*3)
				5	Y coordinate (*3)
				6	X-axis projection distance (*6)
				7	Y-axis projection distance (*6)
Exposure Adjustment	EA	01 to 96 (01 to 48)	*	1	Average gray value
				2	Adjustment amount
Line Checker	LI	01 to 96 (01 to 48)	*	1	Number of dots
				2	Number of lands
Binary Window Checker	BW	01 to 96 (01 to 48)	*	*	Area value
Gray Scale Window Checker	GW	01 to 96 (01 to 48)	*	*	Average gray value
Binary Edge Checker	BE	01 to 96 (01 to 48)	*	1	X coordinate
				2	Y coordinate
				3	X-axis projection distance (*6)
				4	Y-axis projection distance (*6)
Gray Scale Edge Checker	GE	01 to 96 (01 to 48)	01	0	Number of detections (*4)
			01 to 99	1	Nth X coordinate (*2)
				2	Nth Y coordinate (*2)
				3	Nth X-axis projection distance (*6)
				4	Nth Y-axis projection distance (*6)
Feature Extraction	FE	01 to 96 (01 to 48)	01	0	Number of detections (*4)
			01 to 99	1	Nth area value
				2	Nth center-of-gravity X coordinate (*2)
				3	Nth center-of-gravity Y coordinate (*2)
				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 (*6)
				9	Nth Y-axis projection distance (*6)

Notes: *1: "1" indicates Standard Checker 1, and "2" indicates Standard Checker 2
(or "1" indicates Horizontal Checker and "2" indicates Vertical Checker).

*2: The result is multiplied by a factor of 10.

*3: For Binary Edge the result is as is, and for other it is multiplied by a factor of 10.

*4: The number of detections can only be referenced when the Object No. is specified as No. 1.

*6: A210 only. The result is multiplied by a factor of 10.

13.3 Numerical Calculation

Checker	Program Symbol	Checker Number (A110 in brackets)	Object No.	Mode	Reference Data
Smart Matching (A210)	SM	01 to 96	01	0	Number of detections (*4)
			01 to 64	1	Nth correlation value
				2	Nth X coordinate (*2)
				3	Nth Y coordinate (*2)
				4	Nth detection angle (*2)
				5	Nth differential area value
				6	Nth X-axis projection distance (*2)
				7	Nth Y-axis projection distance (*2)
Matching (A110)	MT	01 to 48	01	0	Number of detections (*4)
			01 to 64	1	Nth correlation value
				2	Nth X coordinate (*2)
				3	Nth Y coordinate (*2)
Numerical Calculation	CA	01 to 96 (01 to 48)	*	*	Numerical calculation data register
Previous Numerical Calculation Result	OCA	01 to 96 (01 to 48)	*	*	Numerical calculation data register (previous value)
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 (*5)
				6	NG dispersion (*5)
				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

Notes:

*2: The result is multiplied by a factor of 10.

*4: The number of detections can only be referenced when the Object No. is specified as No. 1.

*5: The result is multiplied by a factor of 100

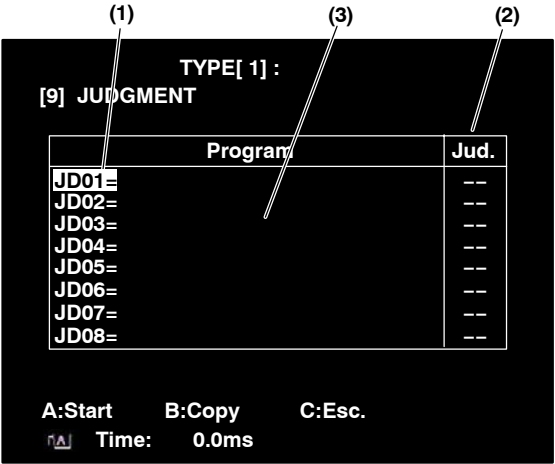
13.4 Judgment Output

13.4.1 About 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.



1. Output register No.

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 A210, and up to 48 registers for the A110. 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 A110) are not externally output.
- With Autom. Switch (Automatic Switch) mode, the Block 1 results (A210: JD01 to JD32, A110: JD01 to JD16) cannot be externally output.

2. Judgment

Displays the judgment result for the set judgment conditions (OK, NG, or ER).

3. Judgment conditions program

Displays the judgment conditions program that has been set. The judgment conditions program can be up to 90 characters in length.

13.4 Judgment Output

A: Start

Press **A** to capture an image. The image is then inspected, and, depending on the I/O settings, the judgment result signal is output on the parallel or serial interface.

**Note**

In screens that display *A: Start*, external start signals can also be accepted.

B: Copy

When you are creating a program, it is possible to copy a program set in another register and use it.

Judgment output menu

The judgment output menu includes the following contents:

PA	EA	LI	BW	GW	BE	GE	FE
SM	CA	OCA	JR	JD	Ope.		
CHECKER: 1 Item: 1 Dot Count							

Checker, register

PA (position and rotation adjuster)	FE (feature extractor)
EA (exposure adjuster)	SM (smart matching in the case of the A210)
LI (line checker)	MT (matching in the case of the A110)
BW (binary window checker)	CA (numerical calculation)
GW (gray scale window checker)	OCA (previous numerical calculation result)
BE (binary edge checker)	JR (judgment output R register)
GE (gray scale edge checker)	JD (judgment output D register)

Operators

The following operators are used.

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.

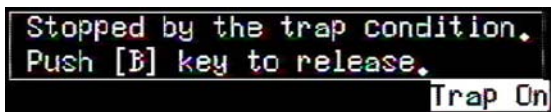
NG Operation

When a “NG” result is generated in a Judgment register (i.e. the conditions were not satisfied) you can execute one of the two functions described below (Trap or NG Display). Each type can only be set in some registers, and if you execute a data save, the settings will be stored even if the power is switched off.

1. 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 following message 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** in the Environment menu is also set for the Trap function in addition to the settings for (1), the memory image at the time the NG occurs is stored.

➡ See 15.1 *Loading and Storing Image Data* for details.

Unlike (1), the READY signal stays on, so it is possible to continue performing inspections after a NG is generated.

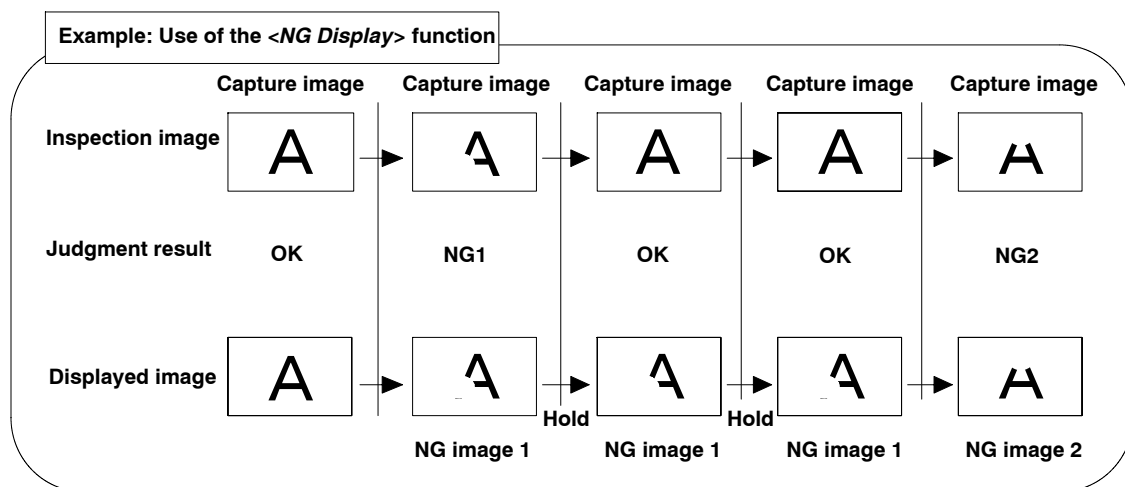
2. NG Display function

If you execute an inspection from the main menu and (when the result of the specified judgment output is NG), this function just displays the image. This is done if you have set an **N** (NG indicator) in the judgment register, and **Gray NG** for the display image.

This cannot be used when the capture camera is set to **AB**.

When the conditions for a judgment register that has an **N** (NG Display) set for it become NG, the image is displayed on the monitor, and, subsequently, the monitor display image is only updated when another NG occurs (i.e. the current NG image is displayed until the next NG occurs under the same register conditions). The monitor only displays the NG image, and inspections are executed on a new image.

13.4 Judgment Output



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

- The **B** button is pressed to switch display images
- The type is switched
- The power is switched off

13.4.2 Creating a Judgment program

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

Procedure:

- 1. Align the cursor to select the register number for the calculation program you are going to create and press **ENTER**.

[9] JUDGMENT

Program	Jud.
JD01=	--
JD02=	--
JD03=	--
JD01=	
JD06=	--
JD07=	--
JD08=	--

- 2. From the state shown in step 1 above, press **ENTER** again. A sub-window is displayed for selection of parameters to be input.

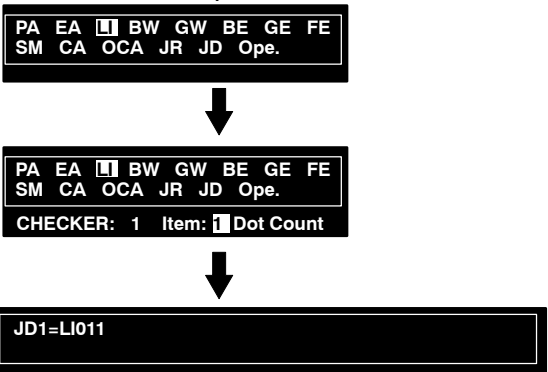
Program	Jud.
JD01=	--
JD02=	--
JD03=	--
JD01=	
JD06=	--
JD07=	--
JD08=	--

PA EA LI BW GW BE GE FE
SM CA OCA JR JD Ope.

 Note

This cannot be selected if no checker data exists.

- 3. Next, select the parameters to be referenced.



Checker numbers cannot be selected if the checker does not exist.

13.4 Judgment Output

- After entry is complete, press **C**.
A confirmation message asks if you wish to register the changes you have made. To register the changes press **Yes**. To discard the information input select **No**.
To cancel, press **C**.

**To Revise Judgment Conditions****Procedure:**

- 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.



Program	Jud.
JD01=LI011	--
JD02=	--
JD03=	--
JD04=	--
JD05=	--
JD06=	--
JD07=	--
JD08=	--

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

To Delete Judgment Conditions**Procedure:**

- Select the register No. of the judgment program you want to delete.
- 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 condition

Procedure:

1. Move the cursor to the register number where you want to create the judgment condition 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 judgment condition program that you want to copy is stored.

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

4. If you wish to use the copied judgment condition 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.

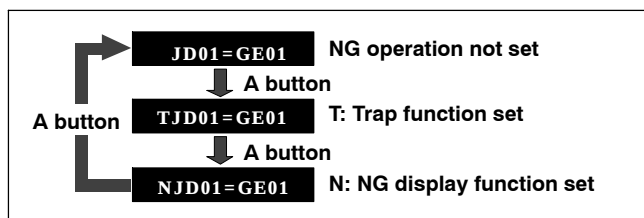
13.4 Judgment Output

Setting and Canceling NG Operation (Trap function/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.

**Example: Judgment with Different Judgment Conditions**

The table below shows examples of judgement with different judgment conditions

+		Judgment	*		Judgment	#		Judgment	/	Judgment
OK	OK	OK	OK	OK	OK	OK	OK	NG	OK	NG
OK	NG	OK	OK	NG	NG	OK	NG	OK	NG	OK
NG	OK	OK	NG	OK	NG	NG	OK	OK		
NG	NG	NG	NG	NG	NG	NG	NG	NG		

Judgment result is ER if the judgment register could not be referenced.

Order of priority of operators is as follows:

High (,) /
↓ *

low +

13.4.3 Restrictions Applying to Judgments

1. Order of use of JR and JD registers (judgment output registers)

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. (Calculations on CA registers are carried out in ascending order of register number.) Also, it is not possible to reference a JD register with a JR register.



Example:

Correct: $JD01 = PA01 + PA02$
 $JD02 = JD01 * PA02$

Incorrect: $JD01 = JD02 * PA02$
 $JD02 = PA01 + PA02$

2. Number of terms in a program

A single program can have up to 90 characters, and up to a maximum of 16 terms.

3. Conditions for using NOT (/)

NOT (/) cannot be specified with braces.



Example:

Correct: / PA01

Incorrect: / (PA01)
 / (PA01 + PA02)

13.4 Judgment Output

13.4.4 Symbols Used by Judgment programs

Note: The checker numbers in brackets are for the A110.

Checker used	Program symbol	Checker No.	Mode	Referenced data
Position/Rotation Adjustment	PA	01 to 96 (01 to 48)	*	
Expasure 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 (A210)	SM		*	
Matching (A110)	MT		*	
Numerical Calculation	CA		*	
Precious Numerical Calculation Results	OCA		*	
Judgement Output R register	JR		*	
Judgement Output D register	JD		*	

13.5 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 be able to see a particular image, change to the required image before entering the Spreadsheets menu.

TYPE[1]:				
[3] SPREADSHEETS				
←:Item				
(1) S.Times	0	Err times	0	(2)
OK				
(5) Page 1	Count	Average	Disperse	(4)
GE0101	39	10415	16.50	
(3)				
Ho,01-05				
A:Start B:Reset C:Esc.				
Time: 0.0ms				

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 2,147,483,647 Scans that exceed this maximum will not be counted.

2. Error Times

Counts the number of errors generated (number of times that the parallel error signal was output).

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.

13.5 Spreadsheets

4. Data items

- Count:** Counts the OK and NG judgments of the designated checker data.
- Average:** Records the average of the OK and NG judgments of the designated checker data.
- Dispersal:** Records the dispersal value of the OK and NG judgments of the designated checker data. The dispersal value is calculated from the following formula:
$$\text{Dispersal value} = (\sum((X_n - X_{ave}) \times (X_n - X_{ave}))) / n$$
- Maximum:** Shows the maximum number of OK and NG judgments for the designated 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.

Three items can be displayed on the monitor at one time (either Count, Average and Variance, or Max. Value, Min. Value, and Range). To switch the display, move the cursor to the reference checker location, and use the cursor arrow buttons to change.

5. 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, it is comprised of eight pages.

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 on the type being displayed. 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.
- This data is cleared when you switch types or switch off the power.
- Note that the displayed value is reset when you switch the type. The results for each type are stored in the QS register.

You can perform numerical calculations on the final data. 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

13.6 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 to be displayed.

You can register up to 20 items (10 items/page x 2 pages) with titles (of up to 8 characters/symbols). Use **4. Data Monitor** to set the items to be displayed, then use the **Menu Setting** item in **1. Type** to set the Screen Display to **Data Monitor**.

13.6.1 The Data Monitor display

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

TYPE [1] :

Page 1 ← : Hide → : Next

1 ☐

2 ☐

3 ☐

WIDTH1 0 NG

HIGHT 0 NG

TOTAL

OK

Turn page

Data display
(10 items per page)

Title (8 characters)

Numerical calculation judgment result

Numerical calculation result
(up to 6 digits)

Block 1 to Block 3 status

☐ : On ☐ : Off

Execute All 1 ☐

2 ☐

3 ☐

Autom. Switch
(AutomaticSwitch) 1 ☐

2 ☐

3 ☐

or

1 ☐

2 ☐

3 ☐

User-Defined 1 ☐

2 ☐

3 ☐

or

1 ☐

2 ☐

3 ☐

or

1 ☐

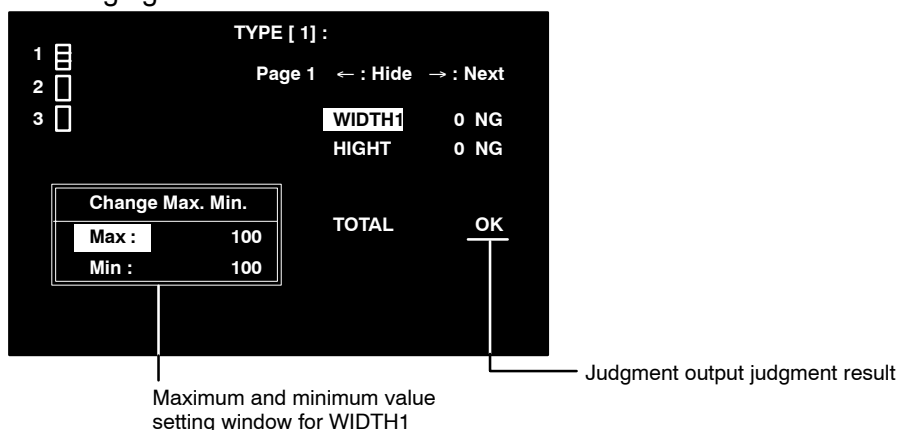
2 ☐

3 ☐

Press **Next** to change the screen and display the next 10 items.

13 – 36

– Changing the maximum and minimum values from the Data Monitor.



Press **ENTER** with the register title highlighted to display the setting window for the maximum and minimum values, and use this to make the settings.

It is also possible to use the Lock function to prevent the maximum and minimum values from being able to be changed.

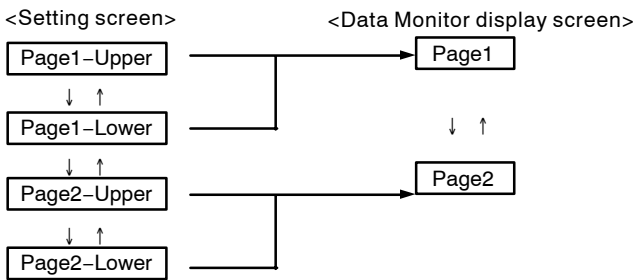


Note

Refer to 1.3.3 Changing Display Items and 3.3.9 Selecting Initial Display Settings for details.

13.6.2 Data Monitor display setting procedure

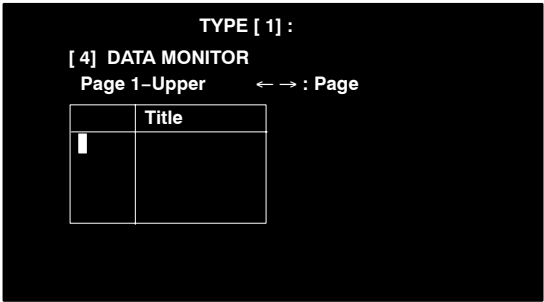
The following example shows how to select data for display and set a title. Up to five items of data can be set for each screen. The relationship between the setting screen and the Data Monitor display screen is as follows.



Setting new display items

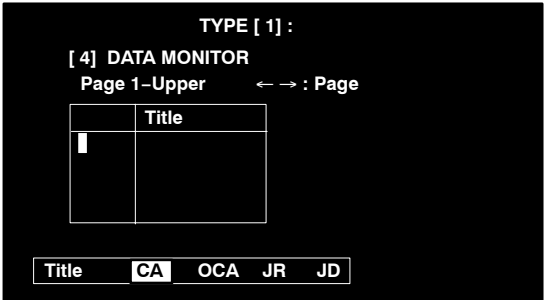
Procedure:

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



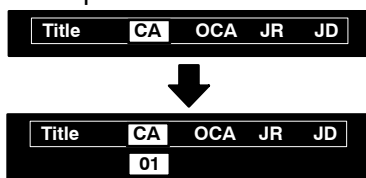
Use the arrows to change the screen and display the setting screen for the following five data items.

- 2. Press **ENTER** to display the register selection window.

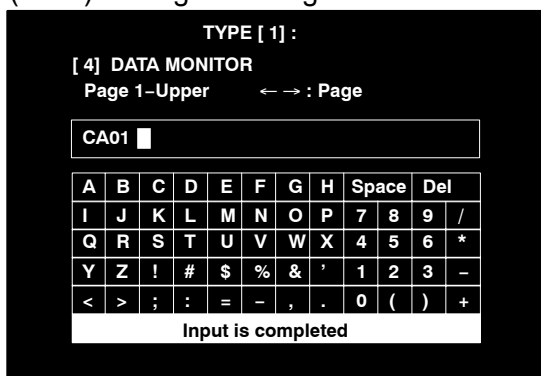


- Use the cursor lever to select the register to display in the Data Monitor and confirm the selection.

Example: Select CA01.



- After you select a register, the title input window will appear. Input a title of up to eight characters in length. The default (initial) setting is the register name.



Input: Use the cursor lever to select and confirm the characters to input.

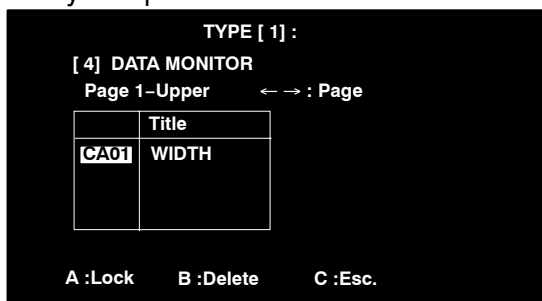
Space: Use the cursor lever to select **Space** and confirm to input a space.

Delete the previous character:

Use the cursor lever to select and **Del** and confirm to delete the previous character.

13.6 Data Monitor

- When you have finished entering the title, use the cursor lever to select **Input Complete** and confirm to display the title that you input.



<A :Lock>

It is possible to lock the maximum and minimum values so that they cannot be changed from the Data Monitor.

Press **A** with the register highlighted to lock the setting values (an “L” will be displayed to the left of the item). To unlock, press **A** again.



<B :Delete>

Press **ENTER** with the register highlighted to delete a display item, then press **B**.

Editing display item titles

Use the following procedure to edit the titles of display items.

Procedure:

- Align the cursor with the item that you want to change and press **ENTER** to display the register selection window.
- Use the cursor lever to select and confirm **Title**.



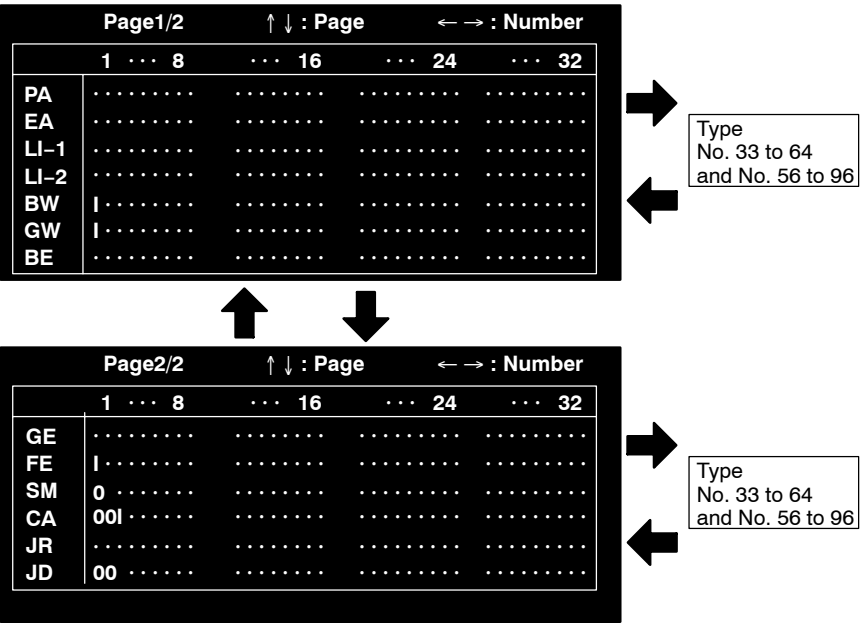
- The title input window will appear. Edit the title in the same way as you would input a new title.

13.7 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.
Set the main screen display to **Checker List** (refer to *1.3.3 Changing Display Items* and *3.3.9 Selecting Initial Display Settings* for details).

32 status items are displayed for each checker as shown in the diagram below.

- 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.

13.7 Checker List

Page 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
Page 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

14.1 *Save Data* 14 – 3

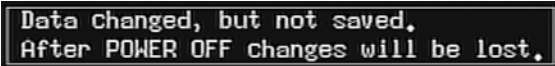
14.1 Save Data

Saves the settings.

If setting data is not saved, any changes made will be lost when the power is turned off.

Procedure for saving data

When checker and other settings are newly changed, 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 following cases are exceptions to this:

- When making settings using the setting help tools.
- When switching types and “Start Type” is set to No.1.
- When switching types and “Start Type” is set to “Last store type No.”, but “Display message” is set off.

Press **ENTER** at Save Data, and 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]

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. Do not use the keypad, serial or parallel communications, or cut the power while this message is on the screen.



Now Saving.
Please wait about one minute.

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.

14.1 Save Data**Note**

The following data is not saved in the F-ROM when data is saved:

- Images saved using the *SAVE DATA* menu.
- Results of executing checkers (judgments/detection values)
- Results of calculations specified for specific substitution of numerical calculation
- Accumulated data count values
- Spreadsheets values

Saving data using serial communication

You can use the serial command %M^C_R to initiate a data save from an external device.

➡ Refer to *16.6 Saving Type Data* for details.

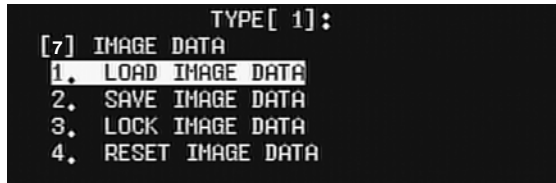
Chapter 15

Useful Functions

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15.1 Loading and Storing Image Data

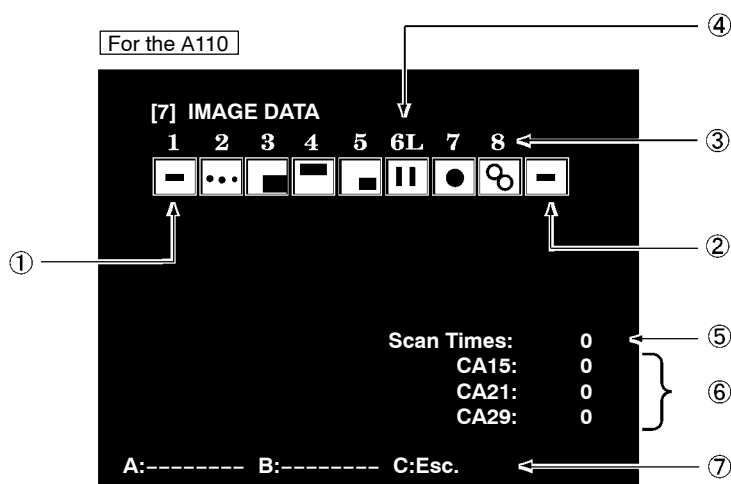
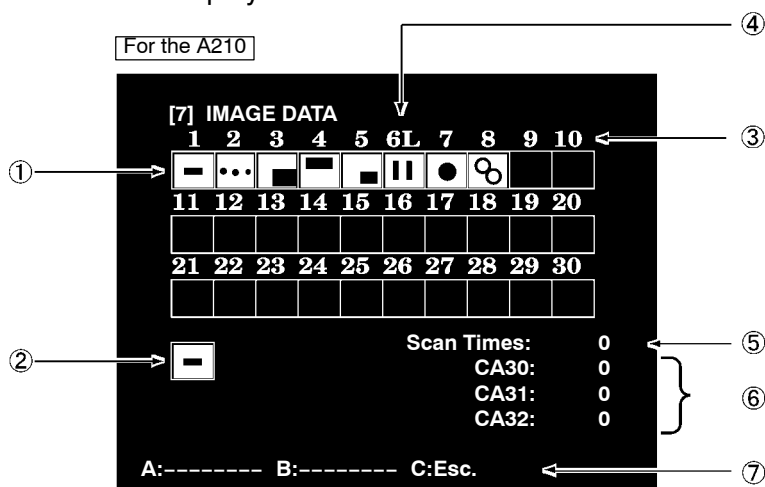
Image data from an image captured by a camera can be stored in memory. Up to 30 screens can be stored for the A210 (8 for the A110). However, image data is only stored while the power is on, so all data will be lost if the power is cut. A stored image can be reloaded and displayed. You can also set and run a checker on a loaded screen (in-memory screen).



15.1 Loading and Storing Image Data

15.1.1 Load Image Data

Call up stored images. When image data is loaded, 30 reduced-size (8 for the A110) screens are displayed. Move the cursor over to load the desired image.



- (1) Image reduction display area.
- (2) Displays the current image.
- (3) Shows the index number of the image. The smaller the number, the older the image.
- (4) This "L" marking will appear if the lock is set on the image.
- (5) Shows the number of scans when the highlighted image was stored.
(Will not be displayed when the cursor is highlighting the current image.)
- (6) 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).

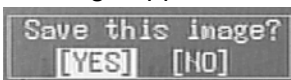
(7) Press **C** to return to the previous image.

Method for loading image data

Use the cursor lever to move the cursor to select the image you want to load, and press **ENTER**. The selected image will be loaded, and you will return to the previous screen.

15.1.2 Store Image Data

Store the currently–displayed image. If you select **SAVE IMAGE DATA**, the following message appears:



If you select **Yes**, the image being displayed is stored. If you select **No**, the image is not stored.



Note

After the current image is stored (without capturing the image), it is not possible to store the same image again. The following message will be displayed if you try to do this.



You can select from among four methods Manual/Continuity/Trap/Limit condition for storing images. Set the method in the Environment menu.

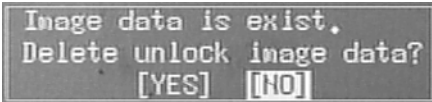
15.1.3 Lock Image Data

Lock and unlock stored images. When using the Lock Image Data function, as when using the Load Image Data function, 30 reduced–size screens (8 for the A110) are displayed. Move the cursor to set or remove a lock on a desired image. Select the image, and then press **A** to set or remove a lock. The **ENTER** button does not work in the Lock Image Data screen.

15.1 Loading and Storing Image Data

15.1.4 Reset Image Data

Delete a stored image. This saved images that do not have a lock flag set on them. When you select **RESET IMAGE DATA**, the following message appears:



Select **Yes** to delete all unlocked images. Select **No** to abort deletion.

15.1.5 Conditions for deleting image data

When the processes listed below are performed, all images are cleared, including locked images.

- Power off
- Change camera mode (camera setting)
- Change the Save Image Data setting
- Delete/Initialize/Copy type
- Initialize the environment settings
- Switch the capture camera setting to a different type

15.1.6 Hints for restoring images using VBT Ver. 2 (Vision Backup Tool Ver. 2)

When restoring images using VBT Ver. 2 (Vision Backup Tool Ver. 2), there is no distinction between cameras 1 and 2, 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 camera 2 is restored to the type of current camera 1.
- When the type of camera 1 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 stored before invoking VBT Ver. 2 (Vision Backup Tool Ver. 2).

15.2 Marker Function

15.2 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.

To display a marker you must set Marker to On.

- Refer to *1.3.3 Changing Display Items* and *3.3.9 Selecting Initial Display Settings* for details.

To use the Marker function, select **3. Checker** – **8. Marker** from Screen Display.

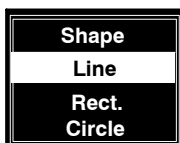


A (Add)

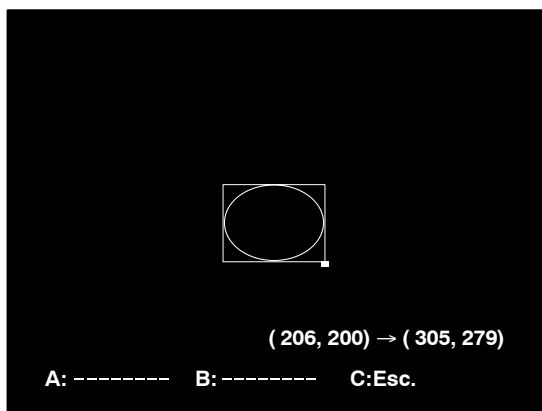
Press **A** to draw a new marker graphic.

Creating a new marker.

1. Press **A** (Add) to display the shape selection window.
2. Select either **Line**, **Rect.**, or **Circle**.

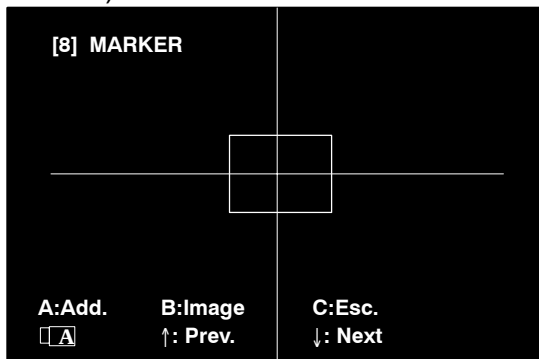


3. Draw the marker .
 - Refer to *2.11 Checker Area and Marker Area Setting Method* for details.

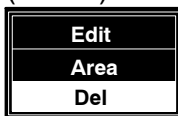


Deleting a marker

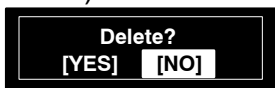
1. Select the marker to be deleted.
Use the cursor lever to select the graphic. The currently selected graphic is highlighted (displayed more brightly than the rest).



2. Press **ENTER** to display the setting window and select **Del** (Delete).



3. A confirmation window will appear asking you to confirm the deletion. Select and confirm either **Yes** (delete) or **No** (do not delete).



15.2 Marker Function

Moving and resizing a marker**Procedure:**

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



2. Press **ENTER** to display the setting window and select **Area**.



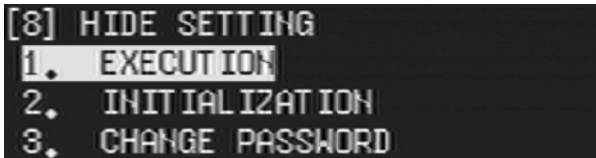
3. The start point of the selected marker will be displayed. Move or resize the marker in the same way as you would when creating a new marker.

15.3 Hide Setting

15.3.1 Hide Setting

It is possible to hide and unhide individual operating menu items and setting items. This feature can be used when you don't 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 setting to items selected after the password has been input. Items to which the setting is applied will no longer be displayed.

2. Initialization

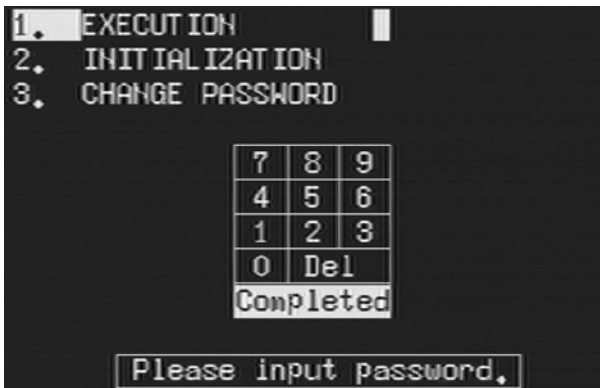
Restore the default setting on all items to which the hide setting had been applied. The default setting is to show all items.

3. Change Password

Change the set password.

Input password

When the hide setting is applied, the following password input screen appears.



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. After you have entered the entire password, select **Completed**, and press **ENTER**.



Note

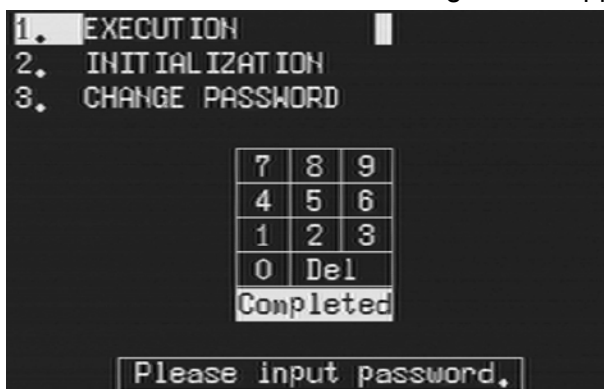
You can set the password to anything between one and ten digits.

15.3 Hide Setting

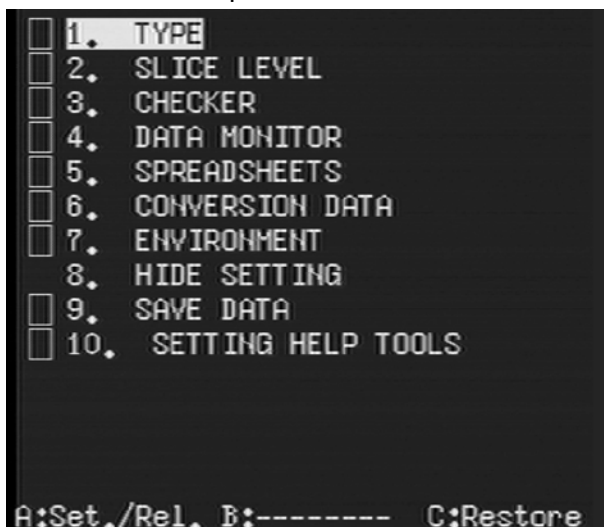
15.3.2 Entering Hide Settings Mode

Procedure:

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



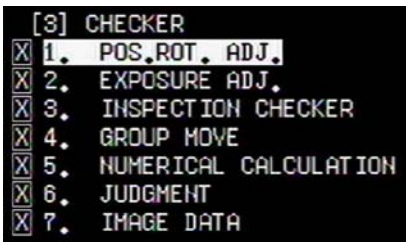
2. Enter the correct password to enter hide settings mode.



3. If you press **A**, an “×” will appear in the box to the left of the number of the line where the cursor is placed and Hide is set. Press **A** again to remove the “×” and cancel the Hide setting. Menus marked with the “×” will not be displayed in normal settings mode.

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

Lower-level menu



Upper-level menu

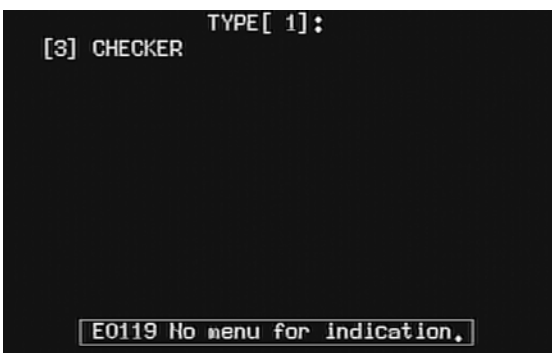


An 'x' is automatically set in the upper-level menu.

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

```
E0120 All menu at lower layer is hidden.
```

Also, if you select from an upper-level menu for which all lower-level menu settings are set to **Hide**, the following message is displayed and selection is not possible.

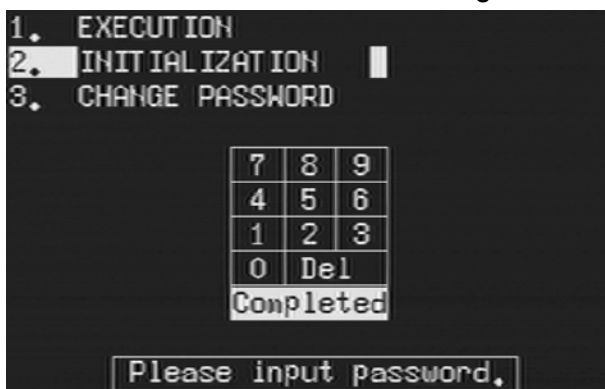


15.3 Hide Setting

15.3.3 Initializing Hide Setting Information

Procedure:

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



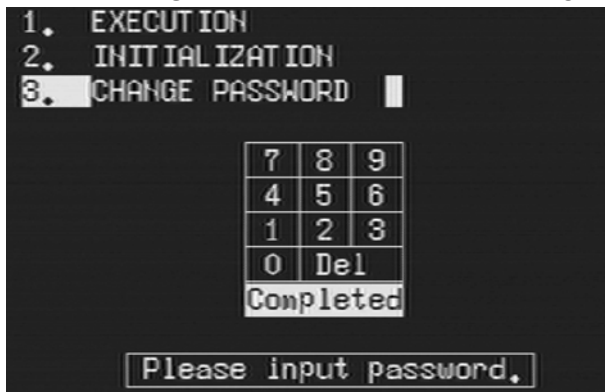
2. Enter the password and you will be asked whether you want to perform an initialization.



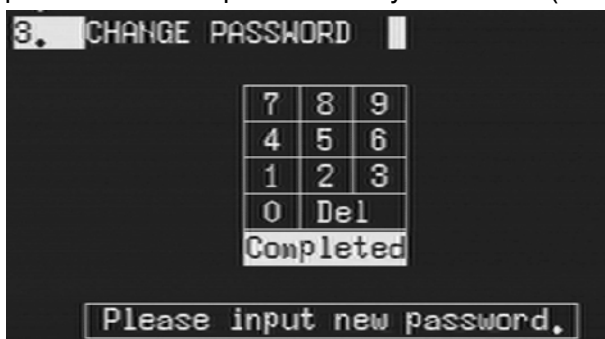
Press **Yes** to initialize settings. Press **No** to abort initialization. If you initialize settings, all hide settings are canceled, and all of the menus will be displayed.

15.3.4 Changing Password

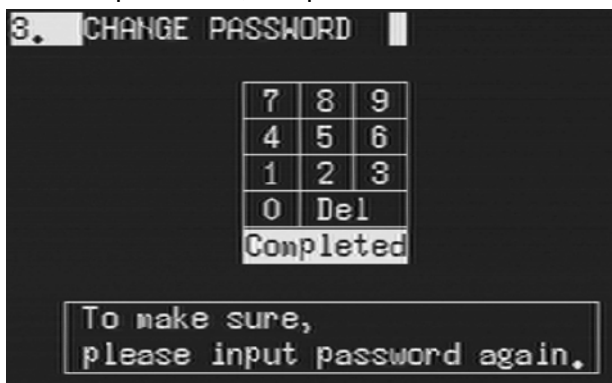
1. Select **Change Password** and the following message appears.



2. 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).



3. 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

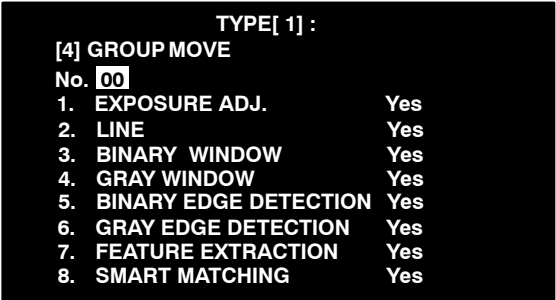
Please contact Matsushita Electric Works.

15.4 Executing a 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 **GROUP MOVE** from the Checker menu.



Group No.

Set the position and rotation adjustment group number for the checkers to be moved as a group.

0: Move all checkers with position and rotation adjustment group set to “0”.

1 to 96 (1 to 48 for the A110): Move all checkers adjusted by the specified position and rotation adjustment group number.

Type of checker

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**.

2. If necessary, press **A** to capture an image.
3. 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 move by Group Move.

4. 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.
5. 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.
6. Press **ENTER** to complete the group move.



Notes

- **All results are cleared for checkers which have been group moved.**
Since the position the checkers are moved to 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, an “Position is out of image range.” error message 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.**
 - When the checkers being moved are adjusted by a position and rotation adjuster to 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 to 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.

15.4 Executing a Group Move

Chapter 16

Communications (Serial and Parallel)

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16.11.1	<i>Items related to serial communication</i> ...	16 – 52
16.11.2	<i>Referencing the maximum and minimum values</i>	16 – 52
16.11.3	<i>Changing the maximum and minimum value</i>	16 – 53
16.12	<i>Key Emulate</i>	16 – 54
16.12.1	<i>Items related to serial/parallel communications</i>	16 – 54
16.12.2	<i>Communication Settings</i>	16 – 54
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16.13	<i>Computer Link</i>	16 – 56
16.13.1	<i>Outline</i>	16 – 56
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16.1 Communications Function

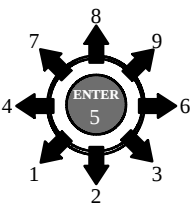
The Multichecker is equipped with both serial(2 channels) and parallel ports. With these ports you can control the Multichecker using a PLC or computer. The things that can be controlled differ depending on whether you are using serial or parallel communication.

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Inspection preparation complete	Output	Inspection preparations complete (waiting for the next start signal)	RDY (READY) signal ON	16 – 24		
Start Execute All/Autom. Switch inspection	Input	Specific substitution formula not executed	STA (START)	16 – 24		
	Input	Specific substitution formula executed	ACK + STA (START) signal (hold ACK until RDY goes off)	16 – 24	%P ^C _R	16 – 22
	Input	Re-inspect (image capture: not executed)	IN6 (no image capture specified)+STA	16 – 24	%R ^C _R	16 – 22
Start User-Defined (specified block) inspection	Input	Specific substitution formula not executed	IN1 to IN2 (block specified) +STA	16 – 24	%S? ^C _R (?=1 to 3)	16 – 23
	Input	Specific substitution formula executed	IN1 to IN2 (block specified) +IN6 +STA (START) signal (hold ACK until RDY OFF)	16 – 24	%P? ^C _R (?=1 to 3)	16 – 23
	Input	Block specification: Re-inspect (image capture: not executed)	IN1 to IN2 (block specified) +IN6 (reinspect specified) +STA	16 – 24	%R? ^C _R (?=1 to 3)	16 – 23
Image capture complete	Output	Image capture only complete	REN (REND)	16 – 29	%R ^C _R	16 – 23
Output inspection data	Output	Inspection complete (before data output)			%E ^C _R	16 – 23
	Output	Judgment output			Ex: 002148030912 ^C _R or 21,4803,912 ^C _R etc.	16 – 23
	Output	Numerical data	D1 to D8 (Handshaking using the ACK signal and the STROBE signal is required.)	16 – 27		16 – 23

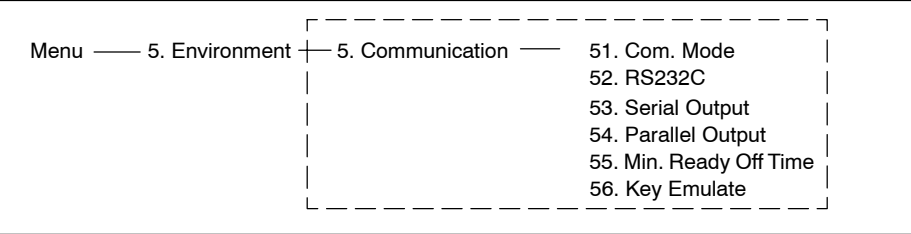
16.1 Communications Function

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
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 – 48
	Output	Response to reference			%L?,n,n ^{C_R} (?=1 to 6)	16 – 48
	Input	Change max. and min. limits			%T?,n,n ^{C_R} (?=1 to 6)	16 – 49
	Output	Change complete			%T?,n,n ^{C_R} (?=1 to 6)	16 – 49
Gray Scale Edge Threshold	Input	Refer to threshold value			%K??,(n) ^{C_R} (?=01 to 96)	16 – 50
	Output	Response to reference			%K??,n,n ^{C_R} (?=01 to 96)	16 – 50
	Input	Change threshold value			%G??,n,(n) ^{C_R} (?=01 to 96)	16 – 51
	Output	Change complete			%G??,n,n ^{C_R} (?=01 to 96)	16 – 51
Smart Matching checker Re-registration	Input	Specification of Smart Matching checker No. + Re-registration timing	IN1 to 7 (Smart Matching checker No.) + IN8 (Re-registration timing)	16 – 37		
	Output	Switching complete	Confirm by RDY (READY) signal off to on transition.	16 – 38		
Numerical calculation	Input	Refer to max. and min. limits			%F?? ^{C_R} (?=01 to 96)	16 – 52
	Output	Response to reference			%F??,n,n ^{C_R} (?=01 to 96)	16 – 52
	Input	Change max. and min. limits			%N??,n,n ^{C_R} (?=01 to 96)	16 – 53
	Output	Change complete			%N??,n,n ^{C_R} (?=01 to 96)	16 – 53
Switch type	Input	Specification of Product No. to switch to + switching timing	IN1 to 6 + TYPE	16 – 32	%X?? ^{C_R} (?=01 to 64)	16 – 32
	Output	Switching complete	Confirm by RDY (READY) signal off to on transition.	16 – 32	%Y?? ^{C_R} (?=01 to 64)	16 – 32
Save Type Data	Input	Save data instruction			%M ^{C_R}	16 – 34
	Output	Save complete			%M ^{C_R}	16 – 34

16.1 Communications Function

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Camera switching	Input	Easy mode (switching between A and B)	IN7	16 – 46		
		Detailed mode (A or B, Thru or Memory)	IN1 to 2 (Image specification) + IN7 (Switching timing)	16 – 46	%I ^C _R (??=0to3)	16 – 45
	Output	Switching complete	Confirm by RDY (READY) signal off to on transition.	16 – 46	%I ^C _R (for switching with Detailed mode only)	16 – 45
Spreadsheets	Input	Spreadsheet reset			%Q ^C _R	13 – 34
	Output	Reset complete			%Q ^C _R	13 – 34
Key Emulate	Input	Direction key (8 directions)			STX Key code ETX ↓ 	16 – 54
	Input	ENTER key input			STX5ETX	
	Input	A, B, and C key input			STX Key code ETX ↓ A Key: A B Key: B C Key: C	

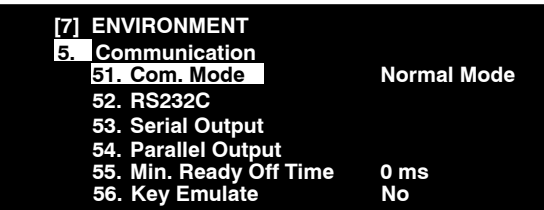
16.2 Communication Settings



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.

➡ Refer to items 16.5 to 16.11 for further details regarding type switching and template re-segmentation for smart matching using communications.

16.2.1 The Communication Menu



51. Com. Mode
52. RS232C
53. Serial Output

Settings required for serial communication.
54. Parallel Output

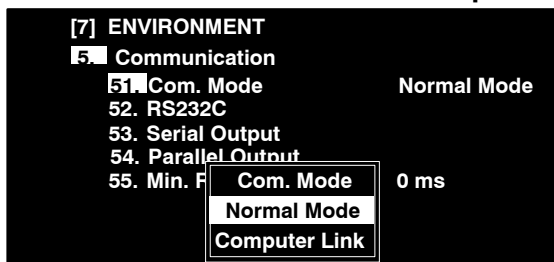
Settings required for parallel communication.
55. Min. Ready OFF Time

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).
56. Key Emulate

Select this when you will perform menu selections and settings using serial commands rather than using the keypad.

16.2.2 Com. Mode

Select either **Normal Mode** or **Computer Link** for performing serial communications.



Normal Mode

Perform communication using the proprietary Image Checker protocol.

All commands are available for use (*1).

Computer Link

With this mode you match the communications protocol to that of a specific PLC (Matsushita Electric Works PLC–FP Series, Mitsubishi PLC–A Series and FX Series, or Omron PLC–C Series) for inspection data output and reading the Type No. when switching types.

However, the Normal Mode commands cannot be used (*1) because communication using parallel signals is required.

☛ For details regarding Computer Link mode, refer to *16.13 Computer Link*.

*1 Refer to *16.3.1 Serial Command Table*.

16.2 Communication Settings

16.2.3 RS232C

Set the RS232C parameters in order to use serial communication.

[7] ENVIRONMENT

52. RS232C

521. Baudrate (bps)	9600
522. Length	8
523. Stop Bit	2
524. Parity	None
525. Flow Control	None

521. Baud rate (bps)

Select the transmission speed for communications (bps).

There are 8 transmission speeds available: 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200.

522. Length

Select the number of data bits in each byte (either 7 or 8).



Note

Some computers do not support transmission speeds of 19200bps or greater (in some cases, communication will not work despite the fact that the settings are available).

523. Stop Bit

Select the number of stop bits in each byte (either 1 or 2).

524. Parity

Select the type of parity checking to use to check the data. The selection options are None, Odd, or Even.

525. Flow Control

Set the method of handshake flow control. The selection options are None or Xon/Xoff.

**Point****What is flow control?**

During high-speed serial communication, overflow can 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.

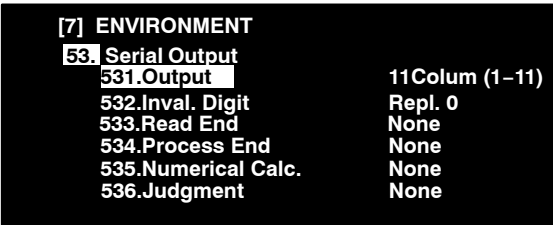
There are two types of flow control: soft flow and hard flow. Soft flow controls the data flow using an XON/XOFF code embedded in the transmitted data, while hard control uses the RTS/CTS signal. Generally, soft flow is used when the transmitted data contains only text, and hard flow is used for binary data.

However, neither type of flow control can completely prevent all errors, and overflows may also be generated due to processing on the computer side. If this happens, either switch to a faster computer, or decrease the baud rate (communication speed).

16.2 Communication Settings

16.2.4 Serial Output Settings (Normal Mode)

Select the data, signals and format for performing serial communication using Normal Mode.



- 531. Output**
Set the number of digits in the output data (setting range: 1 to 11).
- 532. Inval. Digit**
Set 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 Output setting.
- 533. Read End**
Select whether or not to perform serial output of the Image Capture Complete signal (%R).
- 534. Process End**
Select whether or not to perform serial output of the Inspection Complete signal (%E).
- 535. Numerical Calc.**
Select whether or not to perform serial output of results of numerical calculations.
- 536. Judgment**
Select whether or not to perform serial output of the judgment results.

16.2.5 Serial Output Settings (Computer Link)

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	MEW FP

531. Type No. Register

Specify 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 stored in the register number specified here.

Example:

If the type register setting is 1, and the value stored in register DT1 is 5, then, when the TYPE signal is input, the type will be switched to No. 5.

532. Top Data Register

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

533. Timeout

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

534. Output

Set the bit length for the output data to either 16 or 32 bits.

535. Numerical Calculation

Set whether or not to output the numerical calculation results.

536. Judgment

Set whether or not to output the judgment results.

537. PLC Type

Set the PLC type (Matsushita Electric Works PLC-FP Series 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 Imagechecker will output the OVF (overflow) signal, and will output the required portion of data as zeros. Be sure to monitor the OVF signal.

16.2 Communication Settings

16.2.6 Parallel Output Settings

Perform the following settings in order use parallel communication.

- Select the data to be output.
- Select the data output and reset methods.
- Select the methods for re-registering the Smart Matching template and for switching the camera.

[7] ENVIRONMENT	
54. Parallel Output	
541. Handshake	
5411. Timeout	Yes
5412. Delay Time	5000ms
5413. Numerical Calc.	300μs
5414. Judgment	None
	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 items 5411 to 5414 as well.

5411. Timeout (To)

In the case that handshaking will be 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 Imagechecker. 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 increments.

5413. Numerical Calculation

Select whether or not to output the results of numerical calculation in the case that When handshaking is being 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.

➡ Refer to *13.3 Numerical Calculation* for details.

5414. Judgment

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

**Note**

If you will use handshaking, it is not possible to set both “5413. Numerical Calc.” and “5414. Output” for no output. One of the two must be set for output.

542. Reset Cond.

Select one of the following three methods for resetting the parallel output data.

Latch (factory setting): Hold until output of the next inspection result.

Off after image capture: Reset (OFF) after completion of the next inspection image capture.

Off before image capture: Reset (OFF) before starting the next inspection image capture (after detecting the start signal).

➡ For a detailed timing chart, refer to *Data Switching Timing* (page 16 – 29).

543. Setting Template

Set whether or not to re-register the Smart Matching template using parallel input, and select one of the following four execution methods.

No: Do not re-register, even if the re-register signal is input.

Setting position: Execute re-registration at the position that the template area was set.

Execution position: Execute the matching checker, and re-register at the detected position (or the position with the highest correlation in the case that multiple objects are detected).

Adjustment position: Execute the Position Adjustment checker, and perform re-registration at the position where the template area was first set within the corrected search area.

➡ Refer to *16.7 Template (Smart Matching) Re-registration* for details.

16.2 Communication Settings**544. Disp. Img. Change**

This switches the camera image displayed on the monitor using parallel input. There are three switching methods.

No: Select **No** in the case that you will perform template reregistration with Smart Matching checker No. 64 and after on the A210. In this case, it is not possible to switch camera images using IN7.

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 IN2 and IN2, and the specified image (Thru or Memory) when IN7 goes on.

➡ Refer to *16.8 Switching Display Camera* for details regarding the timing chart and the method for specifying IN1 and IN2.

16.3 Serial/Parallel Communication Command Tables

16.3.1 Serial Command Table

* ICH in the Data Direction column indicates the A210/A110 Image Checkers.

Data	Transmission	Function	Notes
%S C_R (*1)	External device to ICH	Execute All/Autom. Switch start inspection command	Numerical calculation for specific substitution not executed.
%P C_R (*1)	External device to ICH	Execute All/Autom. Switch start inspection command	Numerical calculation for specific substitution executed.
%R C_R (*1)	External device to ICH	Execute All/Autom. Switch reinspect command	Checkers executed without capturing a new image. Numerical calculation for specific substitution not executed.
%S? C_R (*1)	External device to ICH	User-Defined (block specification) start inspection command	Numerical calculation formula for specific substitution is not executed. Block numbers are 1 to 3.
%P? C_R (*1)	External device to ICH	User-Defined (block specification) start inspection command	Numerical calculation formula for specific substitution is executed. Block numbers are 1 to 3.
%R? C_R (*1)	External device to ICH	User-Defined/Reinspect command	Checker is executed without image capture. Numerical calculation formula for specific substitution is not executed.
%R C_R	ICH to external device	Capture end command	Capture end command not output if "533. Read End" in the environment menu is set to "None".
%E C_R	ICH 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	ICH to External device	Inspection data	Changes according to menu items 531 to 536. Output sequence is judgment, then numerical calculation data.
%X?? C_R	External device to ICH	Type switching command	Type switch numbers are from 01 to 64 (01 to 32 for the A110).
%Y?? C_R	ICH to External device	Type switching end command	Output when type switching ends normally.
%M C_R	External device to ICH	Type data save command	Saves the type data.
%M C_R	ICH to External device	Save complete command	Output when saving of the type data is completed normally.
%L? C_R	External device to ICH	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	ICH 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 ICH	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	ICH to External device	Modification complete command	Output when modification of the slice level maximum and minimum values is completed normally.
%K?? C_R	External device to ICH	Gray scale edge threshold value reference command	References the gray scale edge threshold value. Registers numbers are from 01 to 96 (01 to 48 for the A110).

16.3 Serial/Parallel Communication Command Tables

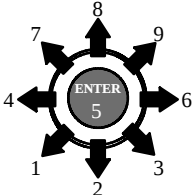
Data	Transmission	Function	Notes
%K??, [thres. value] C _R	ICH to External device	Gray scale edge threshold value notification command	Output in response to the gray scale edge threshold reference command.
%G??, [minimum], [maximum] C _R	External device to ICH	Gray scale edge threshold value modify command	Modifies the gray scale edge threshold value. Registers numbers are from 01 to 96 (01 to 48 for the A110).
%G??, [minimum], [maximum] C _R	ICH 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 ICH	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 A110).
%N??, [minimum], [maximum] C _R	ICH 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 ICH	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 A110).
%F??, [minimum], [maximum] C _R	ICH 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 ICH	Camera change command	Changes the display camera.
%I C _R	ICH to External device	Camera change complete command	Output when change of the camera was completed normally.
%Q C _R (*1)	External device to ICH	Spreadsheets data reset command	Clears spreadsheet scanning and error counts, averages, dispersions, maximum and minimum values, and ranges.
%Q C _R	ICH to External device	Spreadsheets data reset answer command	Output after spreadsheet reset has completed.
%Z C _R	ICH 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	ICH 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, such as the Numerical Calc., Output, and Spreadsheets menus are displayed.

 Notes

- Perform serial communications using the main menu with **READY** in the on state.
- Transmission of data at speeds of 19,200bps or greater is not supported by some hardware and/or software, and may not work correctly. Be certain to test the transmission under actual operating conditions before use.
- 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.

16.3.2 Key Emulate

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

 Note

No response is returned from the A210/A110.

16.3 Serial/Parallel Communication Command Tables

16.3.3 Parallel Signal Allocation Table

Signal		Allocation			
Output	RDY (READY)	Inspection preparation complete			
	ERR (ERROR)	Error signal			
	REN (REND)	Image capture complete			
	STR (STROB)	Data output complete signal when handshaking is executed			
	OVF (OVERFLOW)	Output signal when numerical calculation overflow occurs			
	D1 to D8	Inspection result output signal (judgment output or numerical calculation)			
Input	STA (START)	Start signal (inspection timing instruction signal)			
	ACK	– Data reception complete signal when handshaking is executed – “ACK + STA” specifies execution of the specific substitution formula when inspection starts			
	TYP (TYPE)	Product switch execution timing			
	IN1	IN1 to 2	IN1 to 6 Type No. specification register for Type switching (switch timing is by TYP signal input)	IN1 to 7 Smart Matching Checker No. specification register for template reregistration A210: Smart Matching No. = 01 to 96 A110: Smart Matching No. = 01 to 48	IN1 to 2 Camera/Image specification when the display camera switch setting is Details.
	IN2	User-Defined execution Block No. specification register			
	IN3				
	IN4				
	IN5				
	IN6	No image capture specification for re-inspection			
	IN7			The IN7 function changes depending on the Environment – Parallel Settings selection. If Template Reregistration is set to No, IN7 is used to switch the camera display (IN1 to IN6 can be used for template reregistration).	
IN8	IN8 Template reregistration timing				

16.4 Inspection Execution and Result Output Procedures

This section explains how to initiate an inspection and output results using communications.

16.4.1 Items related to serial/parallel communications

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Inspection preparation complete	Output	Inspection preparations complete (waiting for the next start signal)	RDY (READY) signal ON	16 – 24		
Start Execute All/Autom. Switch inspection	Input	Specific substitution formula not executed	STA (START)	16 – 24	%S ^C _R	16 – 22
	Input	Specific substitution formula executed	ACK + STA (START) signal (hold ACK until RDY goes off)	16 – 24	%P ^C _R	16 – 22
	Input	Re-inspect (image capture: not executed)	IN6 (no image capture specified)+STA		%R ^C _R	16 – 22
Start User-Defined (specified block) inspection	Input	Specific substitution formula not executed	IN1 to IN2 (block specified) +STA	16 – 24	%S? ^C _R (?=01 to 3)	16 – 23
	Input	Specific substitution formula executed	IN1 to IN2 (block specified) +IN6 +STA (START) signal (hold ACK until RDY OFF)	16 – 24	%P? ^C _R (?=01 to 3)	16 – 23
	Input	Block specification: Re-inspect (image capture: not executed)	IN1 to IN2 (block specified) +IN6 (reinspect specified) +STA	16 – 24	%R? ^C _R (?=01 to 3)	16 – 23
Image capture complete	Output	Image capture only complete	REN (REND)	16 – 29	%R ^C _R	16 – 23
Output inspection data	Output	Inspection complete (before data output)			%E ^C _R	16 – 23
	Output	Judgment output	D1 to D8 (For D9 and after, handshaking using the ACK signal and the STROBE signal is required.)	16 – 25	Ex: 002148030912 ^C _R or 21,4803,912 ^C _R etc.	16 – 23
	Output	Numerical data	D1 to D8 (Handshaking using the ACK signal and the STROBE signal is required.)	16 – 27		16 – 23

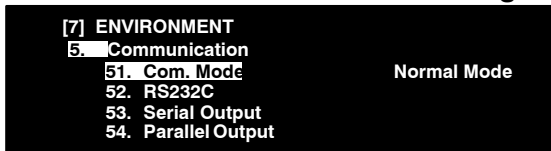
Input the input command after confirming that the READY signal has been output from the parallel port.

16.4 Inspection Execution and Result Output Procedures

16.4.2 Inspection Using Serial Communications

Procedure:

1. Perform the communications settings.



Make the following settings.

51. Com. Mode

Select Computer Link in the case that you will be using the Computer Link function to communicate with a PLC (for example, FP Series PLC manufactured by Matsushita Electric Works). Otherwise, select Normal Mode.

52. RS232C

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.

53. Serial Output

If you selected Computer Link as the setting for setting item 51. (Com. Mode), refer to *16.13 Computer Link*.

If you selected Normal Mode, set the following items.

- Output data: Judgment output and numerical calculations
- Output format: Output digits and processing for invalid digits
- Signals: Presence of the image capture complete output (Process End, %R^C_R) and inspection complete output (Read End, %E^C_R) signals.

2. Start the inspection

Input the following commands in accordance with the application/execution mode after confirming that the READY signal has been output from the parallel port (inspection preparation complete signal).

[%S^C_R]: Image capture + checker execution (specific substitution formula not executed)

[%P^C_R]: Image capture + checker execution + specific substitution

[%R^C_R]: Checker execution (image capture and specific substitution formula not executed)

Execution mode: Execute All/Autom. Switch

[%S^C_R]: Image capture + checker execution

[%P^C_R]: Image capture + checker execution + specific substitution

[%R^C_R]: Checker execution (reinspect)

Execution mode: User-Defined

%S?^C_R:

? = Block No. (1 to 3)

%P?^C_R:

? = Block No. (1 to 3)

%R?^C_R:

? = Block No. (1 to 3)

}

Application is same as for Execute All and Autom. Switch

3. The following commands are output only in the case that the Serial Output Setting is 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)

Inspection result output example

The output format of the results changes depending on the settings in item 53. (Serial Output).

Inspection result example

JD01 = ON

JD02 = OFF

CA01 = 2513

CA02 = 325

CA03 = -15

CA04 = 98

Serial output setting example 1

[7] ENVIRONMENT

53. Serial Output

531. Output

4Column (1-11)

532. Inval. Digit

Del

533. Read End

None

534. Process End

None

535. Numerical Calc.

Output

536. Judgment

Output

→

1,0,2513,325,-15,98^C_R

(If an error occurs with the numerical calculation, an “e” is output.)

Example:1,0,2513,e,-15,98^C_R

Serial output setting example 2

[7] ENVIRONMENT

53. Serial Output

531. Output

4Column (1-11)

532. Inval. Digit

Repl. 0

533. Read End

None

534. Process End

None

535. Numerical Calc.

Output

536. Judgment

Output

→

1 0 2513 0325 -015 0098^C_R

JD01

JD02

CA01

CA02

CA03

CA04

(If an error occurs with the numerical calculation, an “e” is output.)

Example: 1025130325_ _e0098^C_R

↑

The zeros are replaced with spaces.

16.4 Inspection Execution and Result Output Procedures

16.4.3 Inspection Using Parallel Communication

Procedure:**1. Perform the communications settings.**

[7] ENVIRONMENT	
54. Parallel Output	
541.Handshake	Yes
542.Reset Cond.	Latch
543.Setting Template	No
544.Disp. Img. Change	Details Mode

541. Handshake

Set the handshaking (Yes/No), and set the data output selection and Type in the case that the setting is Yes.

When set to Yes, also set the following:

5411 Timeout

5412 Delay Time  Refer to the time chart on page 16 – 26.

5413 Numerical Calculation (Output/None)

5414 Judgment Output (Output/None)

2. Start inspection

After confirming output of the READY signal from the parallel port, input the START signal as indicated in the table below.

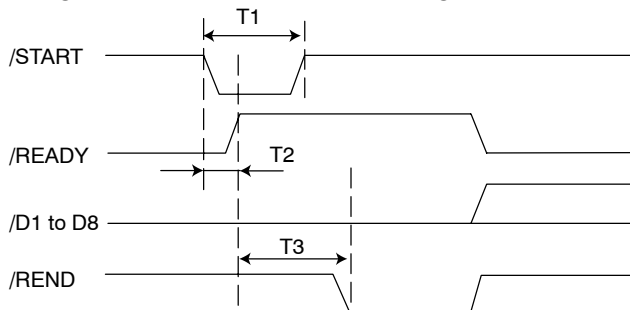
Item	Details	Input terminal
Execute All/Autom. Switch start inspection	Specific substitution formula: Not executed	STA (START)
	Specific substitution formula: Executed	ACK + STA signal (hold ACK until READY OFF)
	Reinspect (image capture: Not executed)	IN6 (no image capture specified) + STA
User-Defined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

Block No. specification BIN data lookup table for user-defined execution

Block No.	IN2	IN1
1	OFF	OFF
2	OFF	ON
3	ON	OFF

– About Parallel Communications**Parallel communications without handshaking**

Judgment results are output using JD01 to JD08.



T1: START signal width (1ms min.)

T2: Response time with respect to START signal (1ms max.)

T3: The image capture time differs depending on the camera that you connect.

**Note**

The JR01 to JR96 and JD09 to JD96 numerical calculations and judgment results are not output.

Parallel communications with handshaking

- 1) 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.
- 2) Numerical data is output in sequence from the least-significant byte. Negative values are output as two's complement only in the case that 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

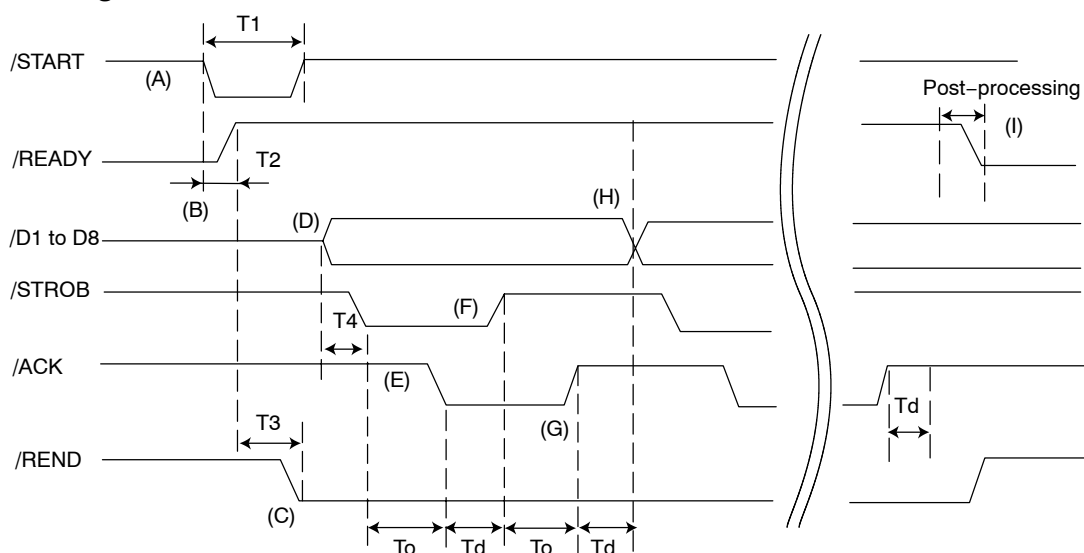
16.4 Inspection Execution and Result Output Procedures

Notes

- If an overflow occurs, the number represented by the specified 8-bit range and the OVF signal (overflow flag) are output simultaneously (e.g. if the register number result is “257” (10000001 binary), “1” and the overflow signal are output).
- For registers where an error (ER) was generated for a judgment output or numerical calculation, the value output is 0.

– Timing Chart with Handshaking

1 Timing chart



T1: Width of START signal (1ms min.)

T2: Response time with respect to the START signal (1ms max.)

T3: Image capture time (varies according to camera type and shutter speed)

T4: Time from the output of results to the STROB turning on (1ms max.)

To: Timeout time

Td: Delay time (Includes signal confirmation time.)

Set “To: timeout time” and “Td: delay time” in the Parallel Output in the Environment menu.

To = 20ms to 20000ms

Td = 30μs to 200μs

(A): Confirm that READY is on, and input the START signal (1ms min.).

(B): When the START signal is input, READY goes off, and the image is captured.

(C): When the image capture is completed, the REND signal goes on.

(D): Output data (D1 to D8) is output, and then STROB is output (1 ms max. later).

- (E): When you have confirmed that STROB on, switch ACK on.
At this point, if ACK does not go from off to on within the timeout period (T_o), handle this as a timeout and abort communication.
- (F): After confirming that ACK is on, wait for T_d , and then turn STROB off.
- (G): After confirming that STROB is off at the external device, switch ACK off.
- (H): After confirming that ACK is off, wait for T_d for the next data (D1 to D8) output.
Repeat for the number of times required for the amount of data.
- (I): After the required number of data output cycles, confirm that ACK is off, wait for T_d , perform checker drawing and other post processing, and then switch READY to on.
At the same time, REND will change to off.

– Data Bit Assignment

In the case of 8-bit data:

Judgment output bit assignment

(in the case that one or more of JD09 to JD16 has been specified)

First time

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

Second time

D8	D7	D6	D5	D4	D3	D2	D1
JD16	JD15	JD14	JD13	JD12	JD11	JD10	JD09

Bit assignment

Numerical calculation bit assignment

In the case of 8-bit output data:

D8	D7	D6	D5	D4	D3	D2	D1
7	6	5	4	3	2	1	0

In the case of 16-bit output data:

Cycle $2n+0$

D8	D7	D6	D5	D4	D3	D2	D1
7	6	5	4	3	2	1	0

Cycle $2n+1$

D8	D7	D6	D5	D4	D3	D2	D1
15	14	13	12	11	10	9	8

In the case of 32-bit output data:

Cycle $2n+0$

D8	D7	D6	D5	D4	D3	D2	D1
7	6	5	4	3	2	1	0

Cycle $2n+1$

D8	D7	D6	D5	D4	D3	D2	D1
15	14	13	12	11	10	9	8

Cycle $2n+2$

D8	D7	D6	D5	D4	D3	D2	D1
23	22	21	20	19	18	17	16

Cycle $2n+3$

D8	D7	D6	D5	D4	D3	D2	D1
31	30	29	28	27	26	25	24

16.4 Inspection Execution and Result Output Procedures

**Notes**

- To output judgment results, set Environment – Parallel Output – Judgment to “Out” (even with this setting, zeros are output once).
- When outputting numerical calculation results, set Environment – Parallel Output – Numerical Calc. to “Out” (even with this setting, if there are no numerical calculations set, the data will be output once as zeros, regardless of the data width).
- For judgment output, handshaking is performed until the data has been output from the last specified external output register (JD).
- For numerical calculations, CA registers that have not been set, and CA registers that perform output control are skipped (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 range that can be handled by each of these data lengths is 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

– Data Switching Timing

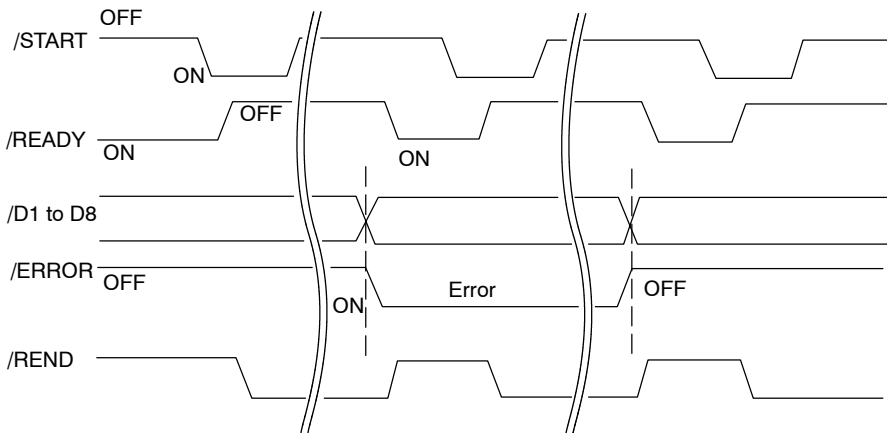
Select from among one of the following three selections from item 542. (Reset Cond.):

- (1) Hold (latch)
- (2) Off after image capture
- (3) Off before image capture

Latch

With this setting, the data is continuously output.

The data is switched at the point when an inspection finishes (accordingly, if the previous inspection result is on, and the current inspection result is also on, the data stays on continuously, and is not switched off).



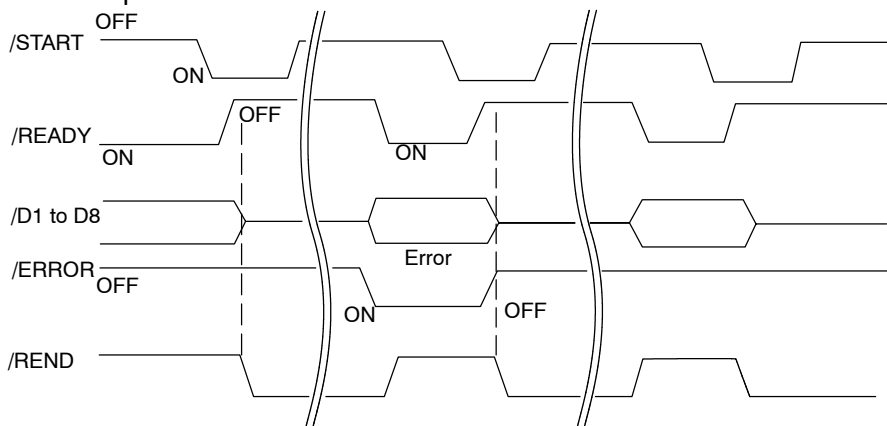
Note

The timing of the Error output going off when an error has occurred is synchronized with the output data (D1 to D8).

Off after read

With this setting, the data output is switched off after image capture.

After an image is captured, the previous outputs are all set to off, and the data is output when inspection ends.



16.4 Inspection Execution and Result Output Procedures

 Note

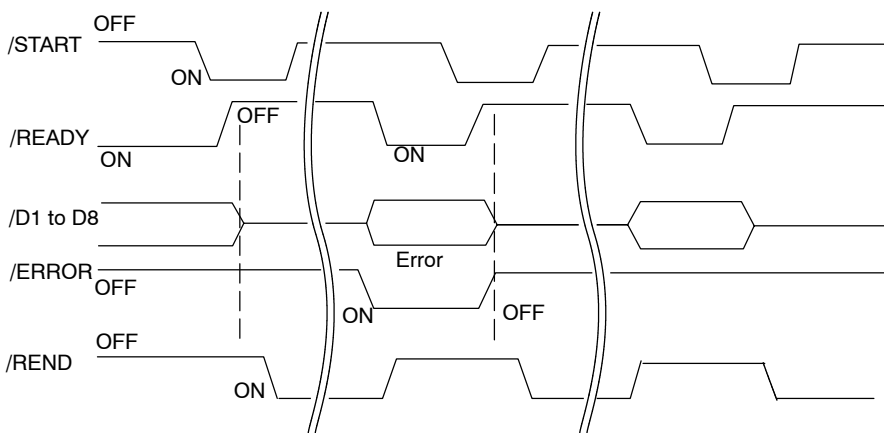
The timing of the Error output going off when an error has occurred is synchronized with the REND output going on.

Off before read

With this setting, the data output is switched off before image capture.

Before an image is captured (when the READY signal goes off after the START signal is detected), the previous outputs are all set to off, and the data is output when inspection ends.

This method 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).

16.5 Type Switching

The following explanation tells you how to switch types using external equipment.

16.5.1 Items related to serial/parallel communications

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Switch type	Input	Type switch number specification + switch timing	IN1 to 6+TYPE	16 – 32	%X?? ^{C_R} (??=01 to 64)*	16 – 32
	Output	Switching complete	Confirmation by off to on transition of the RDY (READY) signal.	16 – 32	%Y?? ^{C_R} (??=01 to 64)*	16 – 32

*In the case of the A110, “??” is 01 to 32.

16.5.2 Common setting items for serial and parallel

[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 following items.

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).

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.

- Menu selection.
- Switching images or displays by pressing either B or C.
- Inspection execution initiated using the Start trigger.
- VBT mode.

16.5 Type Switching

16.5.3 Type switching using serial communication

The commands %X01^{C_R} to %X64^{C_R} are used for type switching (in the case of the A110, 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).

16.5.4 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 store it as BIN data in IN1 to IN6.

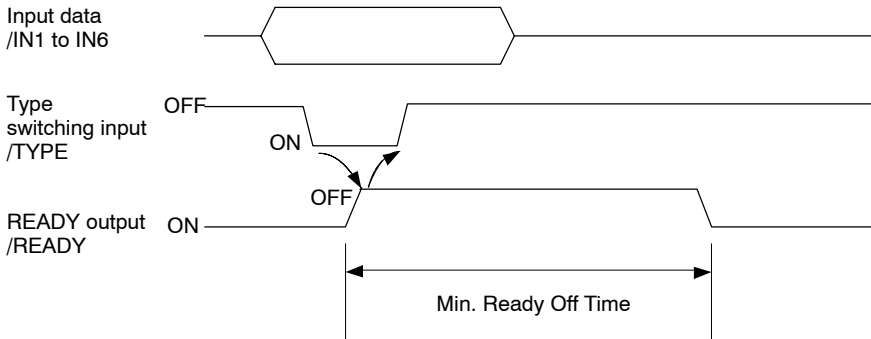
In the case of the A110, store it as BIN data in IN1 to IN5.

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	ON
63	ON	ON	ON	ON	ON	OFF
64	ON	ON	ON	ON	ON	ON

Timing chart

Specify the type number as being the actual type number minus 1 and as BIN data.



- After setting the type number in the input data registers (IN1 to IN6), set TYPE to on.
- After TYPE goes on, READY goes off, and the type will switch.
- Confirm that READY output has gone off, and then switch TYPE to off.
- Ready goes on when the type switch timing is complete.

16.5.5 Points of caution regarding type switching

- 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.
- Be sure to turn off the signal used for specifying a product type number before you execute inspection next time. If the signal for specifying a product type number has been already input when start signal is input, the following special inspections may be executed.
 - IN1, IN2: Inspection by way of specifying the block number in User-Defined mode.
 - IN6: Re-inspection without execution if image capture

16.6 Saving Type Data

16.6.1 Items related to serial and parallel communication

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Save type data	Input	Save data instruction			%M ^C _R	16 – 34
	Output	Save complete			%M ^C _R	16 – 34

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

16.6.2 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 in this state, your new 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.

16.7 Template (Smart matching) Re-registration

16.7.1 Serial and Parallel Re-registration

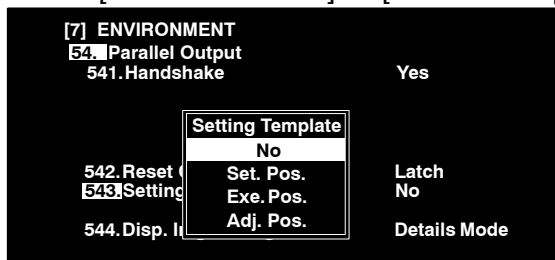
Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Smart Matching Template re-registration	Input	Smart matching number specification + Re-registration timing	IN1 to IN7 (Smart Matching No. specification) + IN8 (Re-registration timing)	16 – 37		
	Output	Switching complete	Confirm by RDY (READY) signal off to on transition.	16 – 38		

Note: If IN7 is used as the Smart Matching Checker No., it is not possible to switch camera images.
➡ Refer to 16.2.6 Parallel Output Settings for details.

16.7 Template (Smart matching) Re-registration

16.7.2 Communication Settings

Select **[Communication]** → **[Parallel Output]** → **[Setting Template]**.



Set the following:

- Whether or not to perform re-registration.
- The execution method.

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 cancelled.

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.

16.7.3 Re-registration Method

Specifying the Smart Matching No.

Subtract “1” from the actual inspection checker number, convert to BIN data, and specify on IN1 to IN7. In the case of the A110, specify data in IN1 to IN6 (Matching No. 1 to 48).



Note

With the A210 this is IN1 to IN6 if **544. Chg. Camera Display** is set.

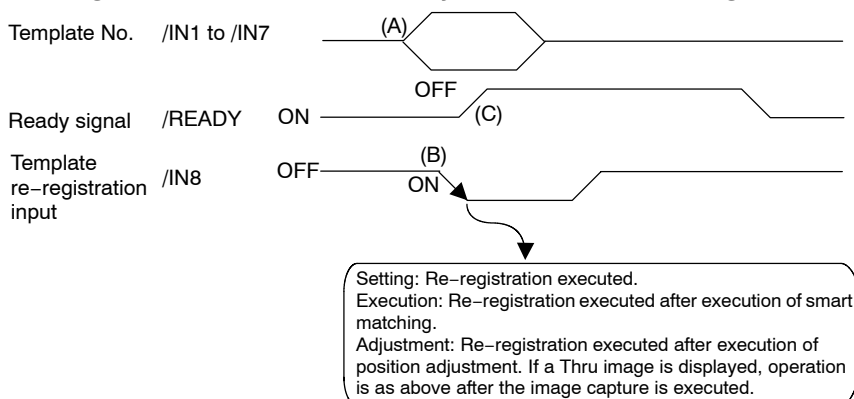
➡ Refer to *16.2.6 Parallel Output Settings* for details.

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	ON
95	ON	OFF	ON	ON	ON	ON	OFF
96	ON	OFF	ON	ON	ON	ON	ON

16.7 Template (Smart matching) Re-registration

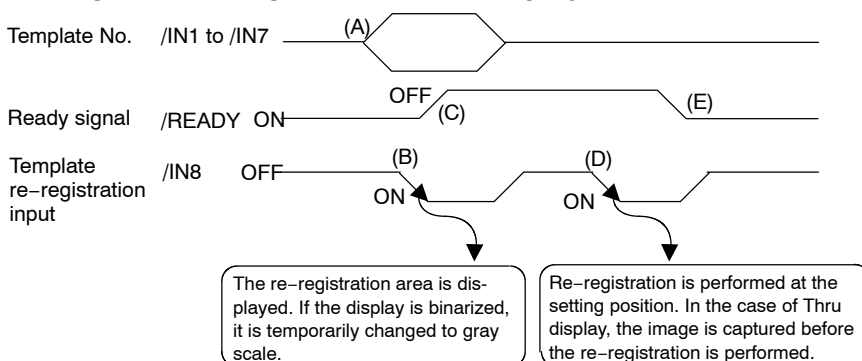
– Timing Chart

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 (*1), processing is cancelled and an ERROR signal is output.

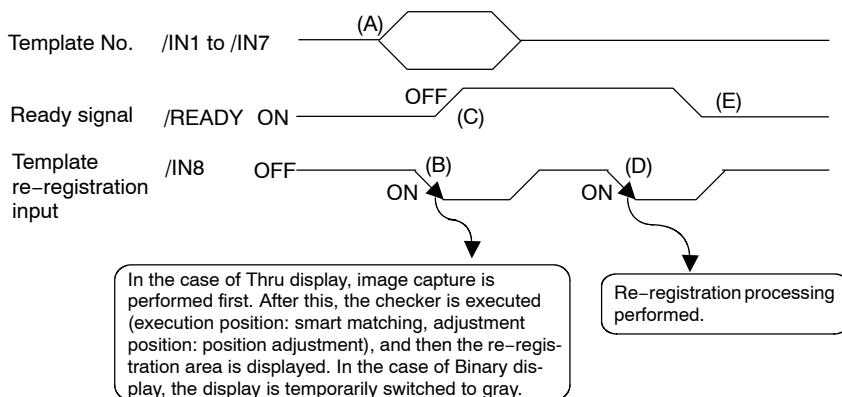
(D): While READY is off, input IN8 again.

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

(*1) 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 (*1), processing is cancelled and an ERROR signal is output.

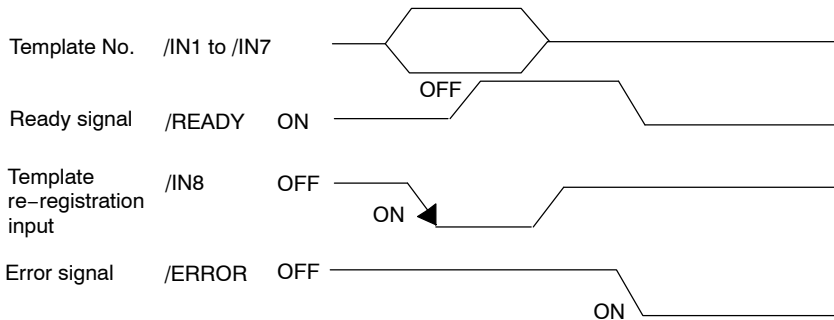
(D): While READY is off, re-input IN8.

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

(*1) 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.

16.7 Template (Smart matching) Re-registration

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

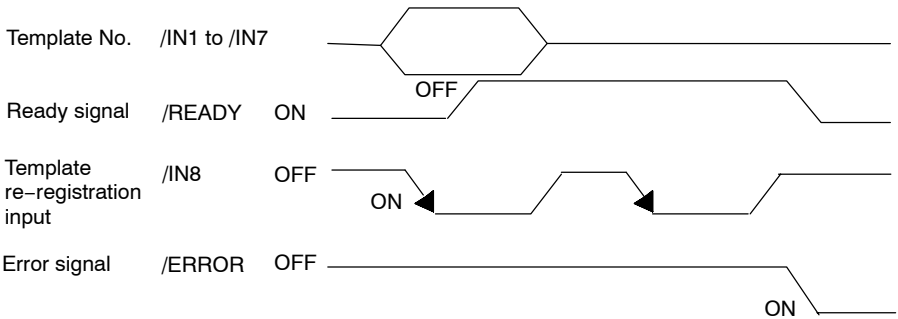
- You specified a non-existent checker.
- The specified checker number is set for an image from a camera other than that set for the capture camera.
- The result of number of detected objects from execution of the smart matching checker was 0.

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.

16.7 Template (Smart matching) Re-registration**16.7.4 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.

**Notes**

- **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.**

16.8 Switching the Display Camera (A210 only)

16.8 Switching the Display Camera (A210 only)

This function uses external input (serial or parallel) to switch the camera image displayed on the monitor.

Switching execution time: Approximately 270ms max.

The execution time is heavily influenced by the following settings, so confirm in actual operation.

- Camera type (Standard/Double-speed random)
- Camera settings (Frame/Field)
- The display camera images before and after switching

Screens for which switching is possible

Switching is possible for the following screens when the READY signal is on.

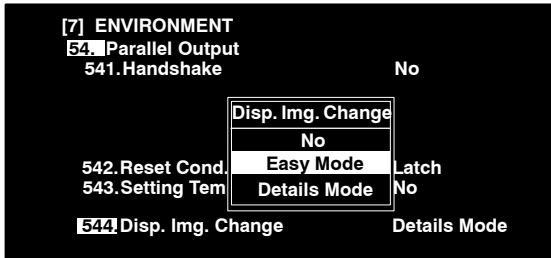
- Main screen (Screen displayed when the power is switched on, including when the Simple Spreadsheet is displayed)
- Numerical calculation
- Judgment output
- Simple Spreadsheet

16.8.1 Serial/Parallel Settings

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Camera switching	Input	Easy mode (switching between A and B)	IN7	16 – 46		
		Detailed mode (switching between A and B, and Thru and Mem)	IN1 to IN2 (Image specification) + IN7 (switching timing)	16 – 46		
	Output	Switching complete	Confirm by RDY (READY) signal off to on transition.	16 – 46	%I ^{C_R}	16 – 45

16.8.2 Communication Settings

Select [Communication] → [544. Parallel Output].



Select the camera switching method.

- If you will not specify an image, and will switch between camera A and camera B, select Easy.
- If you will specify an image and a camera, select Detailed.
- Select No if you will perform template reregistration with Smart Matching checker No. 64 and after on the A210. In this case, it is not possible to switch the camera using parallel.

16.8.3 Using Serial Input to Switch the Display Camera

Use the following commands to switch the display:

[%I0^{C_R}]: Switch to camera A – Image “Thru”

[%I1^{C_R}]: Switch to camera B – Image “Thru”

[%I2^{C_R}]: Switch to camera A – Image “Mem”

[%I3^{C_R}]: Switch to camera B – Image “Mem”

After executing switching, the following commands are returned.

[%I^{C_R}]: Switching was executed normally

[%Z^{C_R}]: Switching could not be done

→ Check the camera switching settings and the capture camera settings.

[%U^{C_R}]: An invalid command was sent

→ An invalid command (e.g. %I4^{C_R}) was sent.

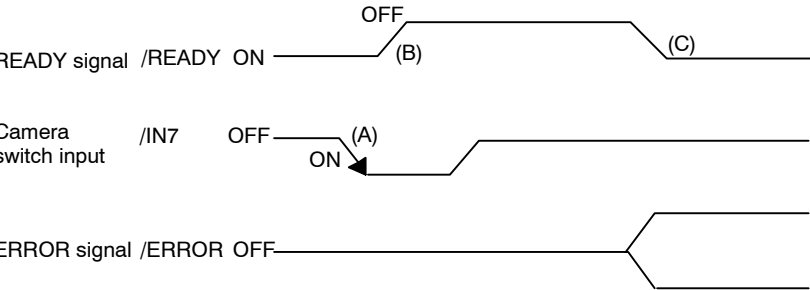
16.8 Switching the Display Camera (A210 only)

16.8.4 Using Parallel Input to Switch the Display Camera

Parallel port in Easy Mode

Data input port	IN7 = Timing for switching the display camera
Data output port	READY = Ready signal Data output port ERROR = Error flag

Timing chart for camera switching in Easy Mode



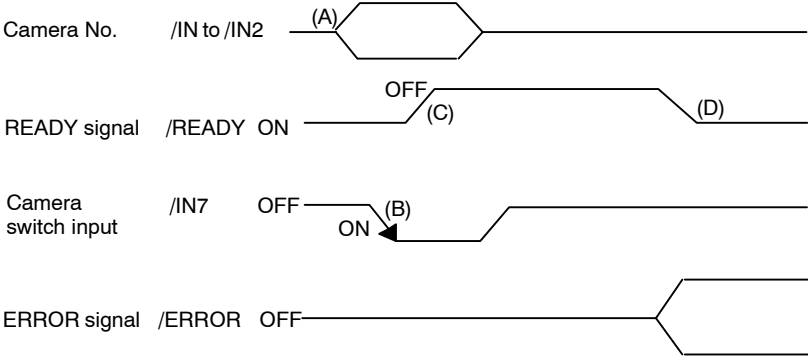
- (A): With the READY signal on, input IN7 from the external device.
- (B): The falling edge (off to on) of IN7 is detected, and the READY signal goes off.
- (C): After the camera has switched, the READY signal goes on (if a display switch error is generated, the ERROR flag goes on at the same time as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

Camera number and parallel port for Detailed 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 = Display switch timing IN1 to IN2 = Camera image designation No.
Data output port	READY = Ready signal ERROR = Error flag

Camera switching timing chart for Detailed Mode



- (A): Input the Camera No. from the external device.
- (B): With the READY signal on, input IN7 from the external device.
- (C): The falling edge (off to on) 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).

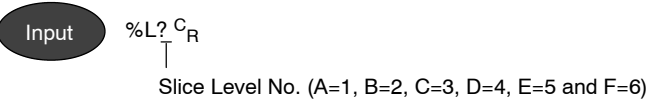
16.9 Referencing and Changing Maximum/Minimum Slice Level Values

16.9.1 Items related to serial communication

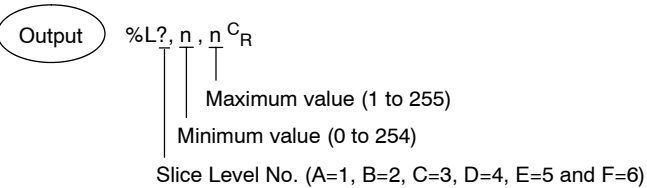
Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Slice Level No. (Group A to F) A=1, B=2...F=6	Input	Refer to max. and min. limits			%L? ^{C_R} (?=1 to 6)	16 – 48
	Output	Response to reference			%L?,n,n ^{C_R} (?=1 to 6)	16 – 48
	Input	Change max. and min. limits			%T?,n,n ^{C_R} (?=1 to 6)	16 – 49
	Output	Change complete			%T?,n,n ^{C_R} (?=1 to 6)	16 – 49

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

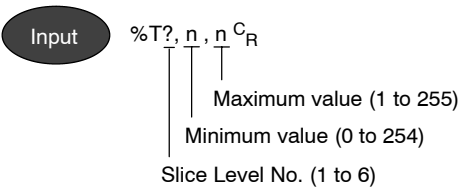
16.9.2 Referencing the maximum and minimum values



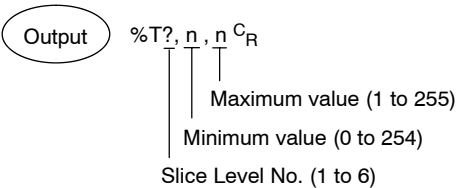
The following is output if the Slice Level value is referenced normally.



16.9.3 Changing the maximum and minimum values



The following is output if the Slice Level value is changed normally.



16.10 Referencing and Changing Gray Scale Edge Threshold Values

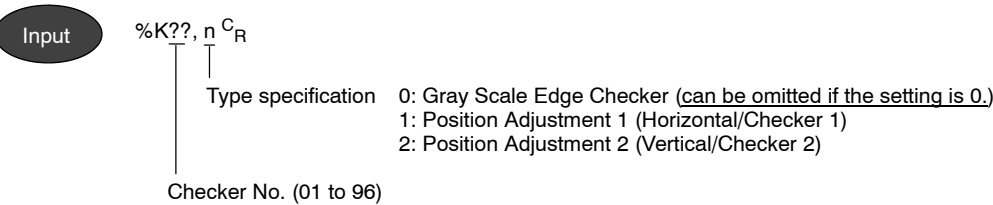
When using an inspection checker or gray scale edge checker for position adjustment, it is possible to reference and modify the gray scale edge threshold values from an external device.

16.10.1 Items related to serial communication

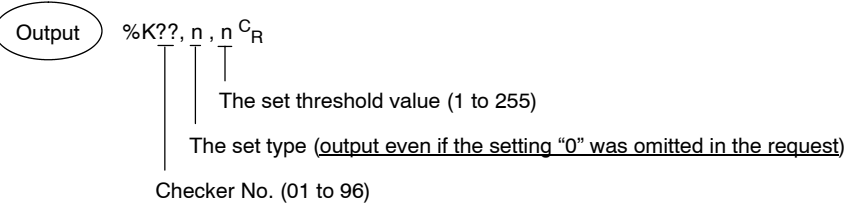
Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Gray Scale Edge Threshold	Input	Refer to threshold value			%K??,(n) ^{C_R} (??=01 to 96)	16 – 50
	Output	Response to reference			%K??,n,n ^{C_R} (??=01 to 96)	16 – 50
	Input	Change threshold value			%G??,n,(n) ^{C_R} (??=01 to 96)	16 – 51
	Output	Change complete			%G??,n,n ^{C_R} (??=01 to 96)	16 – 51

- Input the input command after confirming that the READY signal has been output from the parallel port.
- The range for ?? for the A110 is 01 to 48.

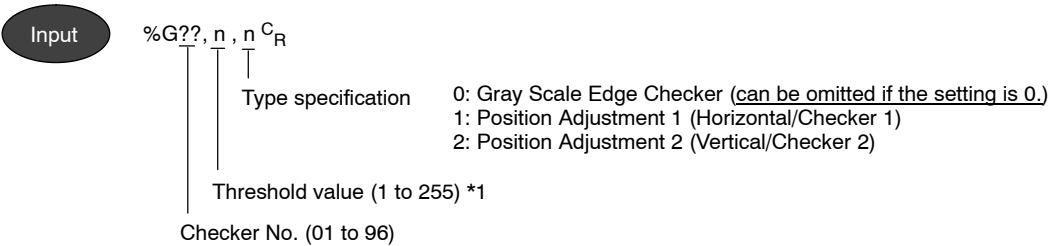
16.10.2 Referencing the threshold value



The following is output if the Gray Scale Edge Threshold value is referenced normally.



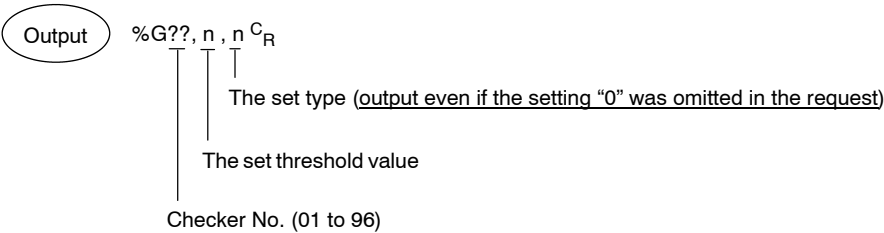
16.10.3 Changing the threshold value



*1 Specify the threshold value in the format 1 to 255.

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

The following is output if the Gray Scale Edge Threshold value is changed normally.



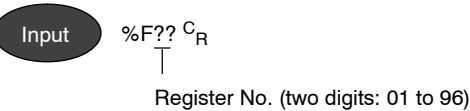
16.11 Referencing and Changing Maximum/Minimum Numerical Calculation Values

16.11.1 Items related to serial communication

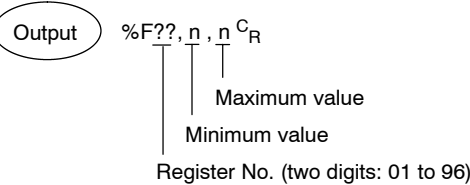
Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Numerical calculation	Input	Refer to max. and min. limits			%F?? ^{C_R} (??=01 to 96)	16 – 52
	Output	Response to reference			%F??,n,n ^{C_R} (??=01 to 96)	16 – 52
	Input	Change max. and min. limits			%N??,n,n ^{C_R} (??=01 to 96)	16 – 53
	Output	Change complete			%N??,n,n ^{C_R} (??=01 to 96)	16 – 53

- Input the input command after confirming that the READY signal has been output from the parallel port.
- The range for ?? for the A110 is 01 to 48.

16.11.2 Referencing the maximum and minimum values



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



If you specify a register that has not been set, %Z^{C_R} (Error) is output.

16.11.3 Changing the maximum and minimum value



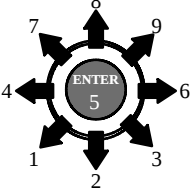
The following is output if the maximum and minimum values for the numerical calculation are changed normally.



16.12 Key Emulate (for Ver. 2.3 or later)

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

16.12.1 Items related to serial/parallel communications

Item	Input or output	Details	Parallel		Serial	
			I/O terminal	Ref. page	Command	Ref. page
Key Emulate	Input	Direction key (8 directions)			STX Key code ETX ↓ 	16 – 54
	Input	ENTER key input			STX5ETX	
	Input	A, B, and C key input			STX Key code ETX ↓ A Key: A B Key: B C Key: C	

No response is returned from the A210/A110 to input commands.

16.12.2 Communication Settings

Set Key Emulate in Environment – Communications 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

52. RS232C

53. Serial Output

54. Parallel Output

55. Min. Ready Off Time

56. Key Emulate

Normal Mode

0 ms

No

Key Emulate

No

Yes

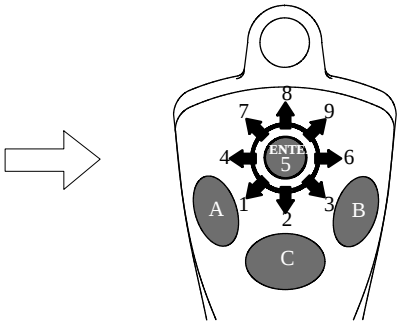
16.12.3 Serial Commands

The following three bytes of binary data forms one set.

Start code (STX (=0x02)) + key code (see diagram below) + end code ETX (=0x03))

Key code list

Up	: '8'(0x38)	Right + Up	: '9'(0x39)
Down	: '2'(0x32)	Right + Down	: '3'(0x33)
Left	: '4'(0x34)	Left + Up	: '7'(0x37)
Right	: '6'(0x36)	Left + Down	: '1'(0x31)
A	: 'A'(0x41)		
B	: 'B'(0x42)		
C	: 'C'(0x43)		
Enter	: '5'(0x35)		



The external device receives no response (output for receive response) for the input command above from the A210/A110.

The contents of the inverted commas are the key codes.

Example: Command when the Down key is entered followed by the ENTER key.

0x020x320x030x020x350x03

Down keyENTER key

Note

When the A key command is input using key emulation, it is not possible to stop repeated inspection execution.

16.13 Computer Link

16.13 Computer Link

16.13.1 Outline

This is a communications mode that has protocols that allow the Image Checker to communicate with certain programmable logic controllers (hereafter PLC).

- Because the Image Checker 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 Image Checker can read the PLC registers, all the PLC has to do is to write values to its own registers, and issue the timing instruction (TYPE) in order to initiate a type switch.

Available PLCs for Computer Link

Manufacture	Model (series) name	Available device	Device No.
Matsushita Electric Works, Ltd.	FP series	DT	0 to 9999
Mitsubishi Electric Corporation	A series, Qseries (Support for “Type 4”)	D	
	FX series		
OMRON Corporation	C series, CV series, CS1 series	D/DM	
Allen–Bradley	SLC500	N7	

Limitations that apply when Computer Link mode is selected

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

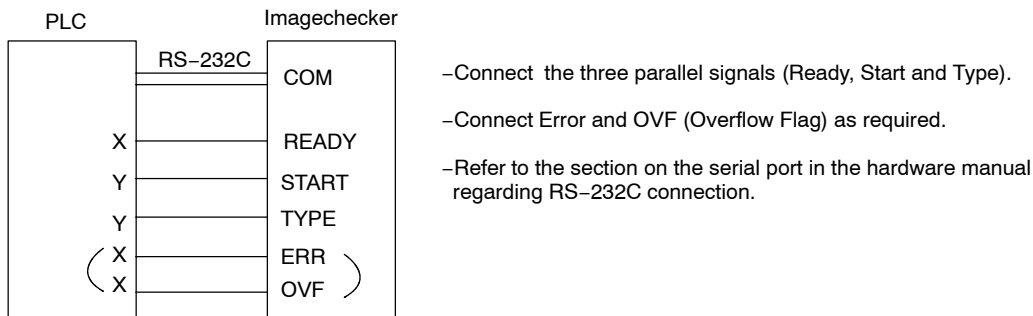


Note

VB T Ver. 2 is only compatible with the Tool port.

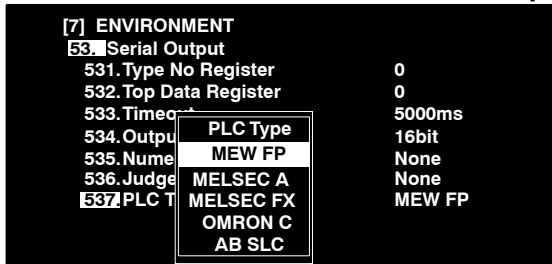
16.13.2 Connection to a PLC

Connection to the CCU or CPU COM Port of the Matsushita Electric Works FP Series PLC.



Setting the PLC type

Select **7. Environment – 53. Serial Output** and set **537. PLC Type**.



537. PLC Type

MEW FP: Matsushita Electric Works FP Series PLC

MELSEC A: Mitsubishi MELSEC–A Series PLC, Q series PLC
(Support for “Type 4”)

MELSEC FX: Mitsubishi MELSEC–FX Series PLC (*1)

OMRON C: Omron SYSMAC–C Series PLC

AB SLC: Allen–Bradley SLC500 PLC (*2)

The examples in this manual refer to the Matsushita Electric Works FP Series PLCs. If you are using one of the other PLCs, refer to this manual and note the following points.

- Refer to the A210/A110 Multichecker Hardware Manual 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.

16.13 Computer Link

(*1) Store “0” in the register for specifying communication format
Register for specifying communication format: D8120 (or D5420)

(*2) Restrictions that apply when the Allen–Bradley SLC500 is used.

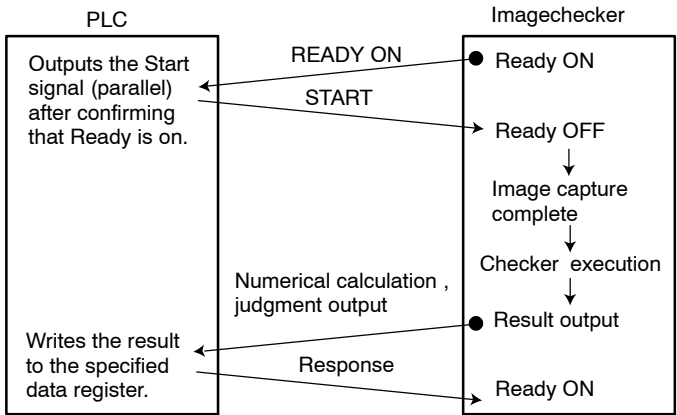
Use the following PLC settings:

Duplicate Detect:	OFF
ACK Timeout (×20 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).

16.13.3 Communication

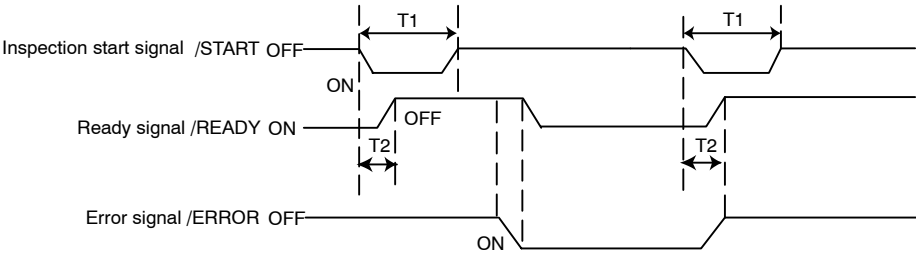
1 Inspection result output



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: %EE!6103
BCC

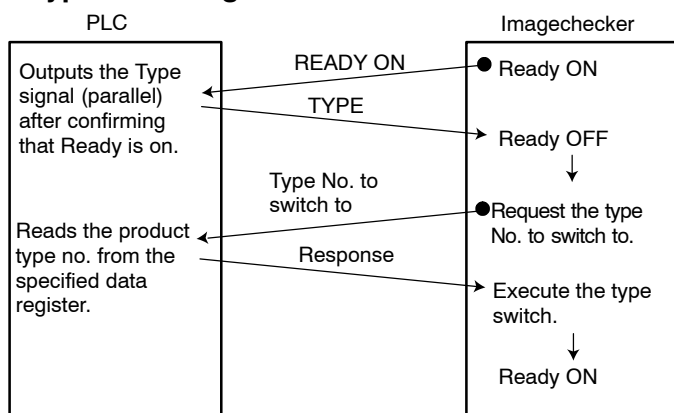
If the communication times out, the Error signal is output and Ready goes on.



T1: START signal width (1ms min.)
T2: Response time with respect to the START signal (within 1ms).

16.13 Computer Link

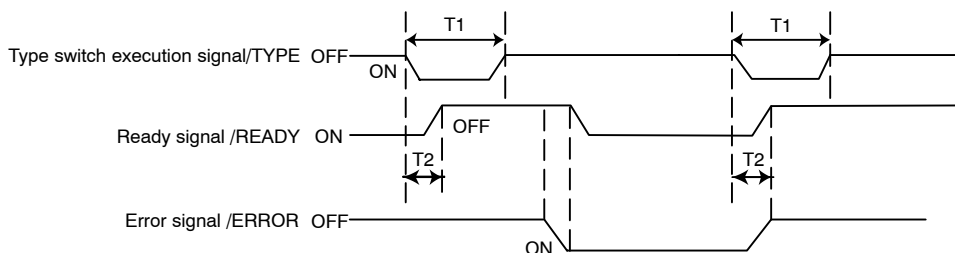
2 Type switching



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: %EE!6103
BCC

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).

16.13.4 Communication Settings

Imagechecker communication settings

[7] Environment

51. Com. mode: Computer Link

52. RS232C

521. Baud rate (bps): set to the same as the PLC "Communication speed setting"

The units for the communication transmission speed are in bits per second. There are eight possible settings (1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200).

522. Length: set to the same as the PLC "Data length" setting

Set the number of bits used to represent one character of data. Select either 7 bits or 8 bits.

523. Stop Bit: set to the same as the PLC "Stop bits" setting

Set the number of bits for the signal that identifies the end of the data. Select either 1 bit or 2 bits.

524. Parity: set to the same as the PLC "Parity check" setting

Set type of parity check for the appended parity bit that is used to check that transmission was correct. Select either None, Even, or Odd.

525. Flow Control

Set 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 product 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

Set 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.

16.13 Computer Link

535. Numerical 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

Operation: Computer link

Data length: Set to same as the ICH "Bit length"

Parity check: Set to same as the ICH "Parity"

Stop bits: Set to same as the ICH "Stop bits"

Stop code: C_R

Start code: No STX

Communication speed setting: Set to same as the ICH "Transmission speed"

FP2 (COM port) communication example**– Description of result output from the Imagechecker**

<Numerical calculation results>	<Judgment output >
CA01=1234	JD01=ON
CA02=-12	JD02=Not set
CA03=Not set	JD03=OFF
CA04=56	JD04=OFF
CA05 and on =Not set	JD05 and on =Not set

– Communication conditions

Transmission speed: 9600

Bit length: 8

Stop bits: 2

Parity: Odd

– Communication settings

<ImageChecker communication settings>

[7] Environment

51. Communication mode	Computer link
52. RS232C	
521. Baudrate (bps)	9600
522. Length	8
523. Stop Bit	2
524. Parity	Odd
53. Serial Output	
532. Top Data Register	1
534. Output	16
535. Numerical calculation	Out
536. Judgment	Out
537. PLC Type	MEW FP

<PLC communication settings>

PLC system register settings (COM port)

No. 412 Communication mode	Computer link
No. 413 Transmission format	
Data length	8 bit
Parity check	Odd
Stop bits	2
Stop code	C _R
Start code	No STX

No. 412 Communication speed setting 9600

*Use the DIP switches to make the data length, parity, and stop bit settings for the FP2 (CCU).

16.13 Computer Link

PLC data monitor

Register No.	Value (Hex.)	Description	Data	
		Bit 15 ←————→ Bit 0		
1	00E1	0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 1	Judgment	JD04-JD01
2	04D2	The value 1234 is stored.	Numeric Calculation	CA01
3	FFF4	The value -12 is stored.		CA02
4	0000	The value 0 is stored.		CA03 (Not set)
5	0038	The value 56 is stored.		CA04

Concept:

Four Judgment data are stored per word. The data of JD02 is not set, but “E” is output because the data before and after JD02 are set.

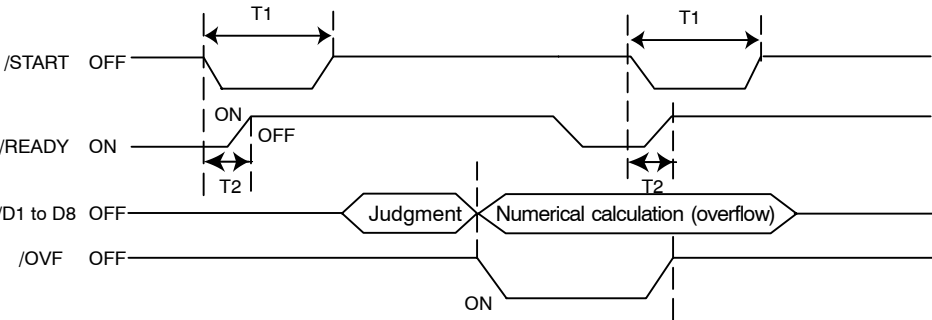
Only the data of Numeric Calculation that are set to output. (In the case where the data of CA01, CA02, or CA04 is out of the range between -32768 and +32767, “0” is stored in the registers 2 to 5.)

When “Data Type” is set to “32-bit”, four Judgment data are stored per word as described above. But the data of Numeric Calculation is stored in two words (in this case, lower bytes are stored in the registers with smaller numbers).

Timing chart for when an overflow occurs

If a numerical calculation overflows (exceeds 32 bits, or exceeds 16 bits in 16-bit mode), the OVF signal is output and the data block required for the numerical calculation is output as zeros.

* For the case that the selection is set to “OFF After Read”



T1: START signal width (1ms min.)

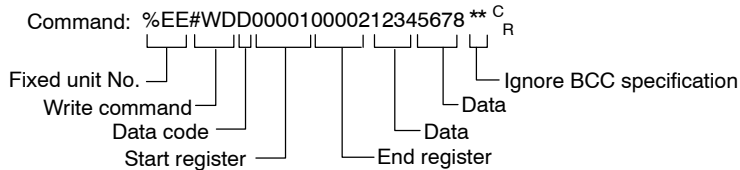
T2: Response time with respect to the START signal (within 1ms.)



Point

[Example]**Matsushita Electric Works FP series PLC****Write to PLC command**

The basic format for the command to write to the PLC is as follows.



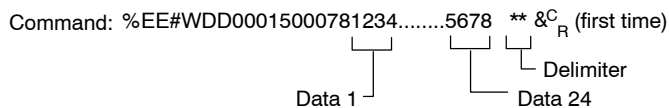
Response: %EE\$WDBCC^{C_R} (Command receive complete)

As the maximum number of bytes for one PLC frame is 118, when the amount of data (number of words) to be written exceeds 24, the format for the command is as follows.



Example:

To write 64 words starting from the data register number 15.



Response: %EEBCC&^{C_R} (transmit request)

Command: %EE26data block**&^{C_R} (second time)

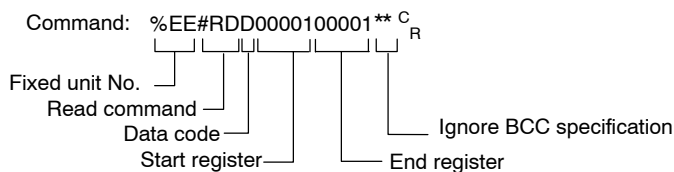
Response: %EEBCC&^{C_R} (transmit request)

Command: %EE14data block**&^{C_R} (third time)

Response: %EE\$WDBCC^{C_R} (command receive complete)

Read from PLC command

Use the following command to read from the PLC.



Response: %EE\$RD1234BCC^{C_R} (command receive complete)

Query data (reversal of upper and lower positions is required)

16.13 Computer Link

Chapter 17

Vision Backup Tool Ver. 2

17.1 *Vision Backup Tool Ver. 2* 17 – 3

17.1 Vision Backup Tool Ver. 2

The Vision Backup Tool Ver. 2 (VBT Ver. 2) 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 stored in the Imagechecker from a computer.

Communications environment

Communications environment settings on the Imagechecker 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

The conditions under which VBT Ver. 2 (Vision Backup Tool Ver. 2) will operate are basically shown in “A: Start”. It can only be used when type switching from an external device is possible, that is, under the following conditions:

- Under main menu conditions
- When the checker list is displayed
- When spreadsheets are displayed

However, if you enter spreadsheets or numerical calculations/judgment output from the menu, “A: Start” will start, and you will not be able to enter VBT Ver. 2 mode.

Transmission data

Data that can be transmitted with VBT Ver. 2 are as follows:

- Type data (by type or all together)
- Environment data (settings on the Environment menu)
- Hide Settings information
- Store Image Data (single screen units)

Operations

The transfer to VBT Ver. 2 mode is conducted entirely at the computer. If you shift to VBT Ver. 2 mode, the menu disappears, and the READY signal goes OFF.

➡ See the computer’s VBT Ver. 2 Help for additional information.

Warnings

You can restore desired types and images using VBT Ver. 2, but if the image data is stored and there is a camera-related discrepancy between the original type information and the restored type information, VBT Ver. 2 will not operate properly after that restoration.

➡ See *15.1 Loading and Storing Image Data* for additional information.

17.1 Vision Backup Tool Ver. 2**Method for making a forced return from VBT Mode**

If due to some problem, you cannot return from VBT Mode, press the **A** and **B** buttons on the keypad at the same time to force a return.

Copying the setting data in the A210/A110V1 to A210/A110V2

You cannot copy the setting data in the A210V1 (or A110V1) to the A210V2 (or A110V2) using Vision Backup Tool.

You need to get the special data conversion software that we provide free of charge. Please contact us.

Since you cannot copy the setting data in the A210V1 (or A110V1) to the A210V2 (or A110V2) using Vision Backup Tool, you need to do that using the special data conversion software that we provide free of charge. Please contact us to obtain the software.

The following devices are also required for data conversion:

- A210V1 (or A110V1)
(The setting data are converted while being backed up with the data conversion software. The *.cpm files that have been backed up with the Vision Backup Tool cannot be converted.)
- A210V2 (or A110V2)
- A PC in which data conversion software is installed
- RS-232C cable (ANM81103)

Refer to the operating instruction for the data converter (Readme.txt) for more information.

Chapter 18

Error Output

18.1 Error Processing 18 – 3

18.2 Error Signal Output Conditions (Parallel) 18 – 4

18.1 Error Processing

If a problem occurs when using the A210/A110 Multichecker V2 for inspection, an error signal is output. In this happens, check the error result and perform appropriate processing on the external equipment.

18.2 Error Signal Output Conditions

Type switching

- When, by parallel input, attempting to switch to a type that has not been set.

Data output when handshaking is not performed during execution

- When an error occurs in the numerical calculation register or judgment register.
- When image capture 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-bit)
- When the numerical calculation register set for output overflows or result of calculation is negative.
(Output data length: 8-bit, 16-bit)
- When an error occurs in the numerical calculation register set for output.



Notes

With parallel output when communication mode is set to standard:

- If an error occurs, judgment and numerical calculation outputs are 0.

With serial output when communication mode is set to standard:

- 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.

Example: When the camera settings and the connected camera do not match.

- When the image is not captured successfully.

Note

E0071: Abnormality occurred on the camera or the controller.
If the error message appears during inspection, the following problems may be occurring:

- a: The camera that cannot be used in the camera mode set by selecting “ENVIRONMENT” > “Camera” is connected. For example, a standard camera (ANM831) is connected in Double Speed Random Frame mode.
- b: Incomplete insertion of the camera cable
Turn the power off and try to insert the camera cable completely (until it clicks) again.
- c: Breaking of the camera cable
- d: Failure of the camera
- e: Failure of A210/A110

If that error message still appears after checking problems “a” and “b” and executing inspection again, the problems “c”, “d” or/and “e” may be occurring.

Save data error

- When data is not saved properly, and writing original stored 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.

18.2 Error Signal Output Conditions

- 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.



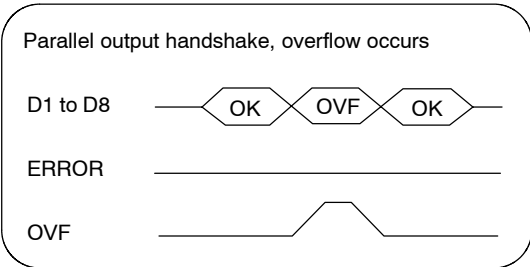
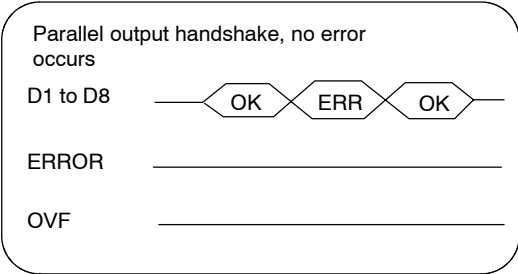
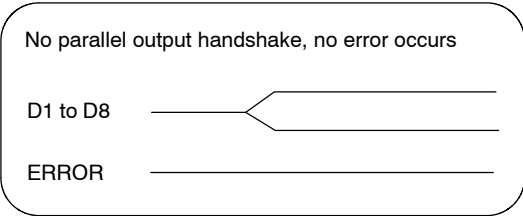
Note

If you want to check the errors for numeric calculation, judgment output, or each checker, display a list of checkers. Refer to “Checker List” in section 13.7 for more details.

Camera switching error conditions

- If you attempt to switch cameras using one of the following methods with a setting for **Type Menu – Capture Camera** 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, handshaking starts and the error signal turns on at the same time.

When there is an error in the numerical calculations, OVF (overflow signal) turns on only when the register in which the error occurred is output.

18.2 Error Signal Output Conditions

Chapter 19

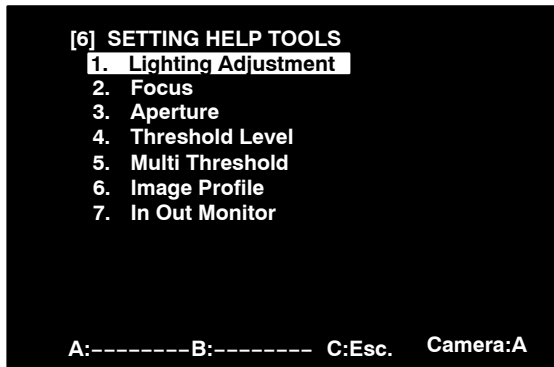
The Setting Help Tools

19.1	<i>Use Setting Help Tools to Adjust Settings Before Inspecting</i>	19 – 3
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19.1 Use Setting Help Tools to Adjust Settings Before Inspecting

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, binarization threshold level and similar parameters.

Select **SETTING HELP TOOLS** from the main menu. The screen shown below will appear.



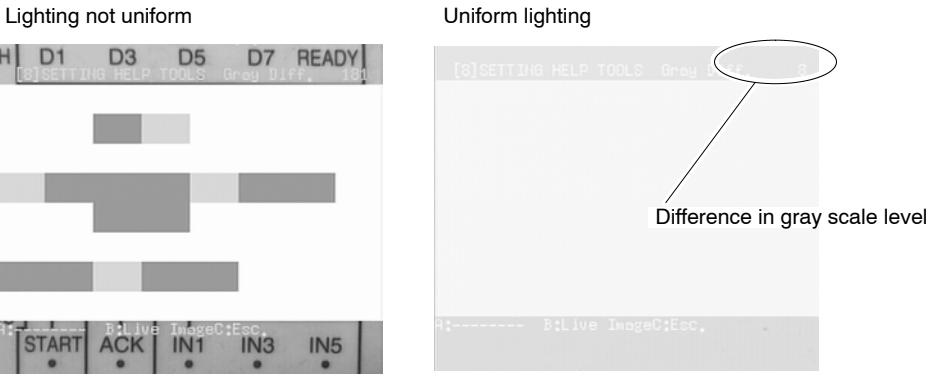
The Setting Help Tools menu provides the following functions.

- 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 when black/white contrast is not so good.
- 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.

19.1 Use Setting Help Tools to Adjust Settings Before Inspecting

1. 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.



2. Focus

Helps you adjust the focus correctly by watching a bar graph on the screen while turning the focus ring on the camera lens.

- 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.

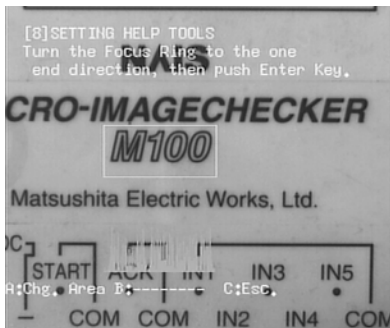


Figure b.

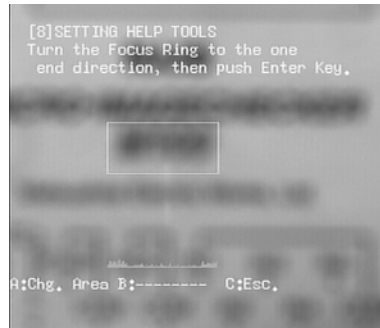


Figure c.

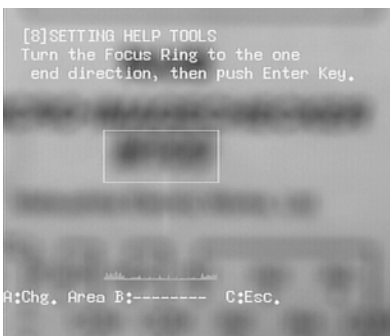
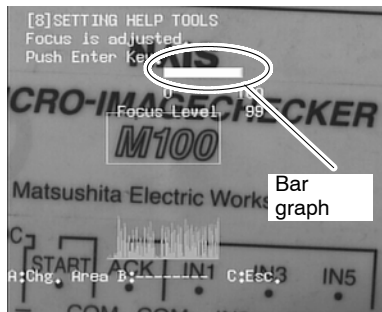


Figure d.



19.1 Use Setting Help Tools to Adjust Settings Before Inspecting

3. Aperture

Helps you adjust the aperture correctly by watching a bar graph on the screen while turning the iris ring on the camera lens.

- 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.

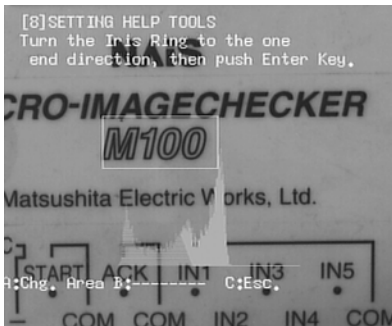


Figure b.

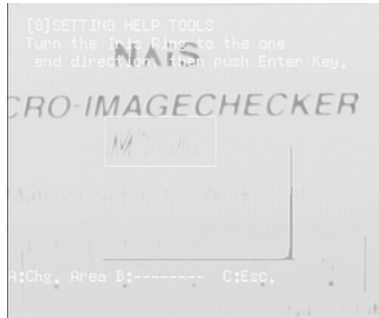


Figure c.

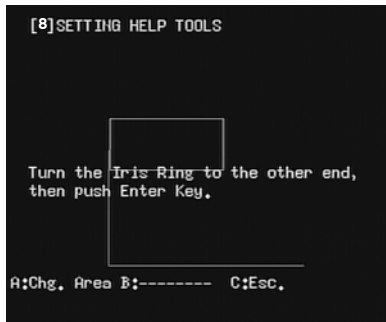
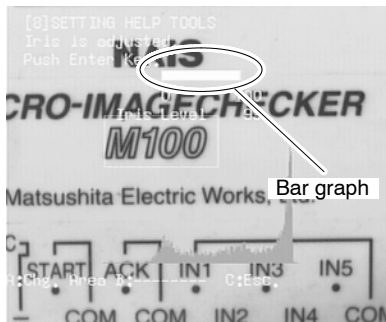


Figure d.



4. Threshold Level

Recommended threshold level is automatically calculated.

The threshold level setting help tool is used when there is good contrast with a clear distinction 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.

- 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.



19.1 Use Setting Help Tools to Adjust Settings Before Inspecting

5. Multi Threshold

Recommended threshold level is automatically calculated.

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.

- 1) Select **5. Multi Threshold**, and press **A: Chg. Area** to set the area of the image for extraction.



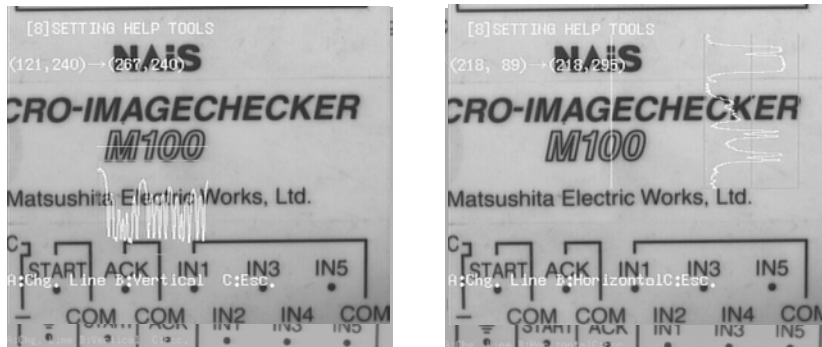
- 2) After a few seconds, the recommended values for upper and lower threshold levels are displayed.
- 3) Use the cursor lever for fine adjustment of the threshold levels.



6. Image Profile

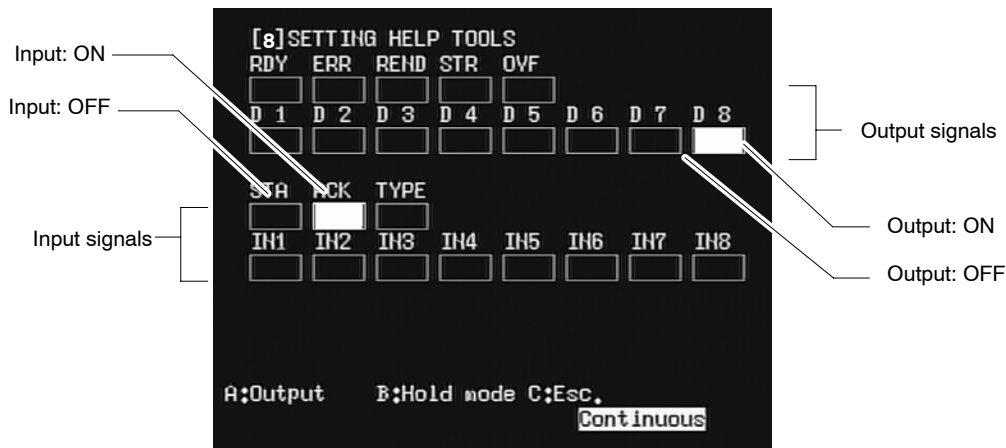
Displays a graph of gray scale distribution along a line specified on the image.

Select **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.



7. 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 A210/A110 is connected to an external device.



Forced output

Press **A: Output** and use the cursor lever to move the cursor to any of the output signals **RDY** (Ready), **ERR** (Error), **REHD**, **STR** (Start), **OVF** (Over flow) 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 Latch and Auto.

Latch: When the input signal goes ON, the display goes ON and remains ON when the input signal goes off again.

Auto: The display only goes ON while the input signal is ON.

19.1 Use Setting Help Tools to Adjust Settings Before Inspecting

Chapter 20



Specifications

20.1 Specifications 20 – 3

20.1 Specifications

		A210 Multichecker V2	A110 Multichecker V2
CPU		32-bit RISC CPU (high-speed processing version)	32-bit RISC CPU
Frame memory		512 × 480 (pixels) × 256 gradations	512 × 480 (pixels) × 256 gradations
Operator interface		Menu selection by specialized keypad	
Monitor display		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)	
Processing	Gray scale	8bit 256 gradations	
	Binarization	6 groups of binary processing from the gray scale memory (upper and lower threshold settings)	
Number of types		64 Types	32 Types
Execution mode specification		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	
Inspection	Position/ position and rotation adjustment	96/type (max.) Position and rotation adjustment function	48/type (max.) X-Y position adjustment function
		Priority adjustment Multi-stage adjustment Sequence setting by matching/gray scale edge/binary edge or feature extraction detection.	
	Exposure adjustment	96/type (max.)	48/type (max.)
		Shape:rectangular Binarization adjusts according to changes in the gray scale data Gray scale mean value detection/judgement	
	Smart matching/ matching (sub-pixel processing)	Smart matching = 96/type (max.) ; Equipped with post-detection differential processing function	Matching = 48/type (max.)
		Sub-pixel 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 (A210) = judgement learning function by the smart template	
	Gray scale edge detection (sub-pixel processing)	96/type (max.)	48/type (max.)
		Scanning method = individual/projection Gray scale filter/width function Detection by sub-pixel 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/centre 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.)

20.1 Specifications

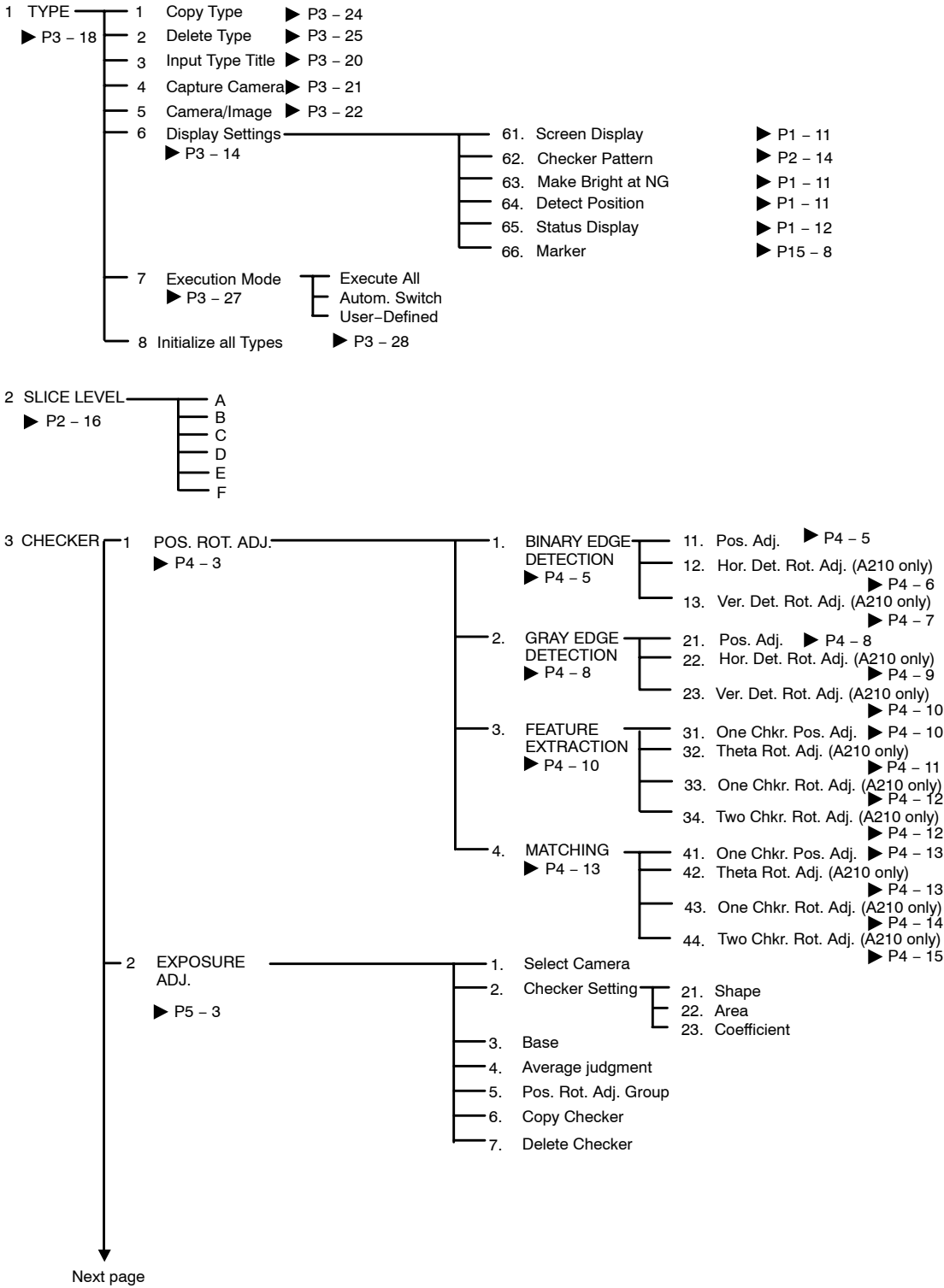
		A210 Multichecker V2	A110 Multichecker V2
External interface	Serial	RS232C = 2ch (max.115200bps) Matsushita Electric Works PLC FP series CCU compatible Compatible with Mitsubishi A/FX Series PLC, Omron C Series PLC and Allen-Bradley PLC.	
	Parallel	Input = 11 points Output = 14 points Removable screw-down terminal block	
Inspection start		Image trigger (timing sensor unnecessary) External sensor timing Repeat start	
Other specifications	Display functions	Display item suppressing function (menu display hide function) Image suppress function when setting checkers Image rotation function when setting checkers (A210) Clearly display reject location Rotational adjustment angle display (A210) 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	Image store function	30 screens	8 screens
		Store/load function for inspection image (all screens/problem screens) Store images for reinspection/resetting Windows-PC image store/load function	
	Debugging	Trap function Image store function	
	Setup help	Focus setup Aperture setup Lighting adjustment Gray scale profile monitor Recommended slice level display Input monitor Enforce output	
Moving object inspection		Double-speed random camera (progressive)/flash/electronic shutter used	
Camera support		Double-speed random camera (progressive) = ANM831 Standard camera = ANM832 Composite video (NTSC) input used (however the connection requires one port)	
Number of support 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

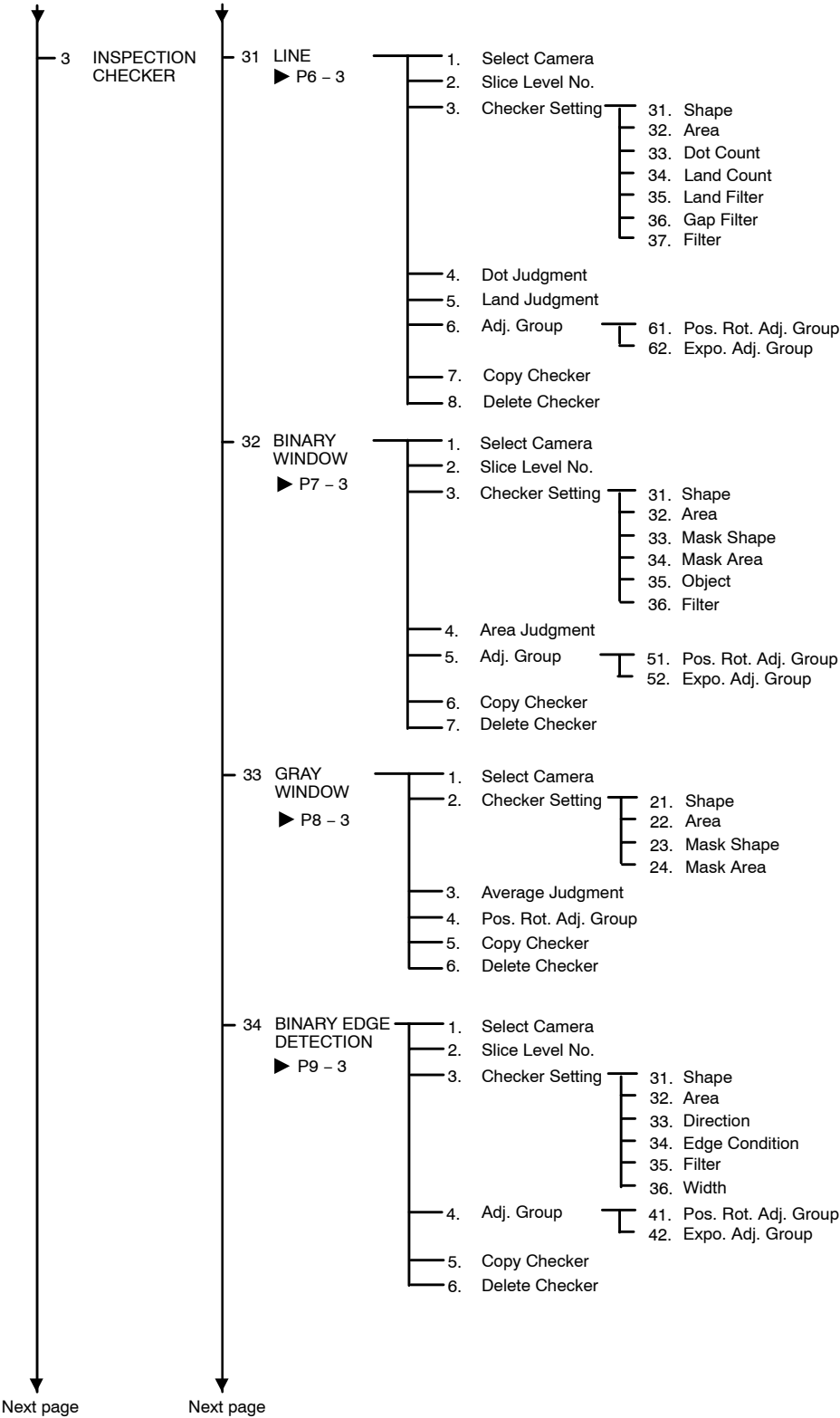
Menu Layout

21.1 Menu Layout 21 – 3

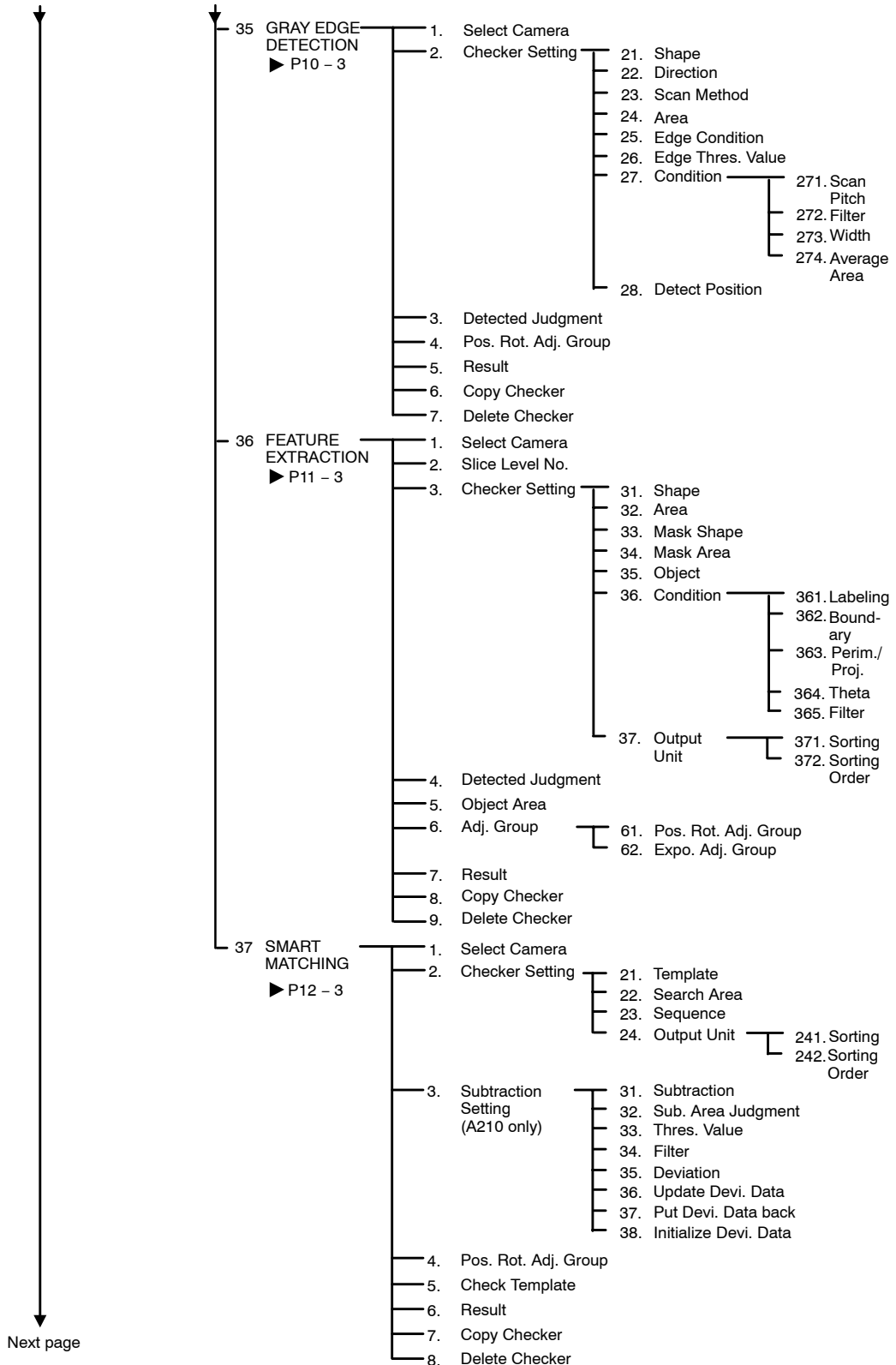
21.1 Menu Layout

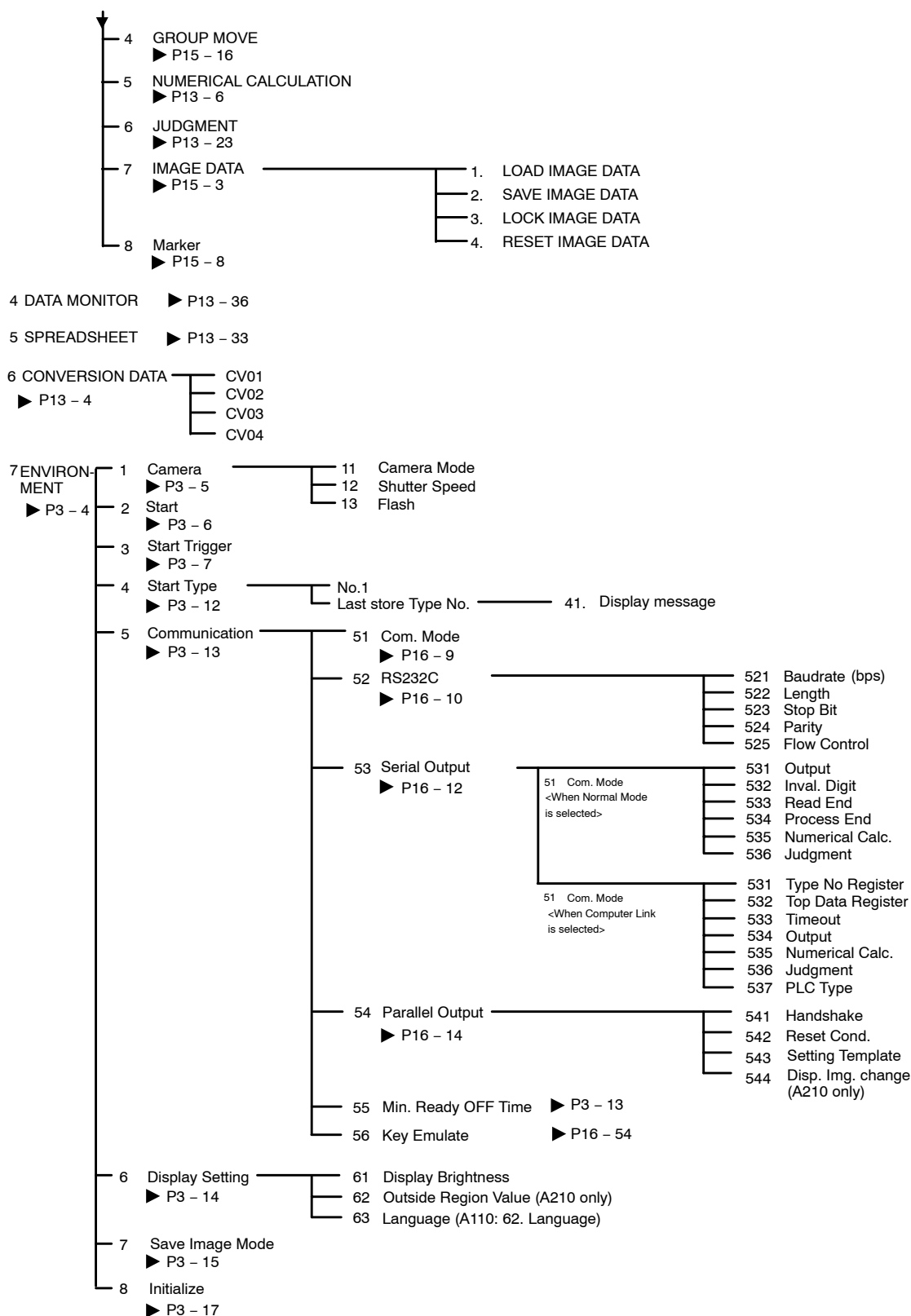


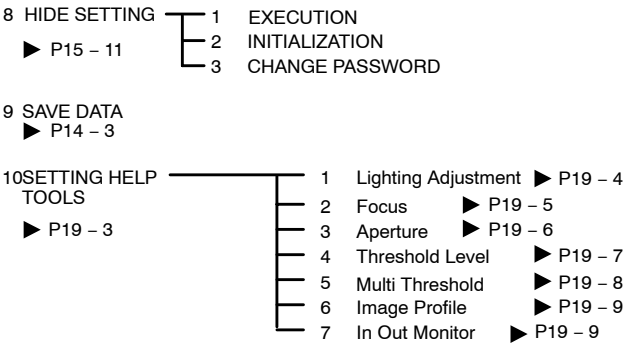
21.1 Menu Layout



21.1 Menu Layout







21.1 Menu Layout

Manual revision history

Manual No.	Issue date	Description of changes
—	Jun. 2001	First edition
—	Jul. 2001	Revised
ARCT1F325E	Oct. 2001	Printed and bound edition 2nd edition Additional · Key Emulate function
ARCT1F325E-1	Jun. 2002	3rd edition
ARCT1F325E-2	Jan. 2003	4th edition
ARCT1F325E-3	Mar. 2004	5th edition
ARCT1F325E-4	Sep. 2005	6th edition · Correction of errors
ARCT1F424E	Sep. 2006	First edition · Revision associated with a change of the brand (NAiS to Panasonic) · Correction of errors

