SHARP®

Version 2.3
Produced in July. 2002

Compact image sensor camera

Model name

IV-S20

User's Manual

Applied for software version 2.09 (S2.09)

Thank you for purchasing the SHARP IV-S20 compact image sensor camera. Read this user's manual carefully to thoroughly familiarize yourself with the functions and proper procedures for operation.
Store this user's manual in a safe place. We are confident that the manual will be helpful whenever you encounter a problem.

Important

- This user's manual provides you with information about the IV-S20 softwares version 2.09. All IV-S20 cameras with an S2.09 mark are compatible with software version 2.09. (See page 5-1.)
- For details about the upgrade version of the software, see Appendix 2.

Notes

- This manual was written with the utmost care. However, if you have any questions or inquiries concerning the product, please feel free to contact our dealers or us.
- Copying all or part of this booklet is prohibited.
- The contents of this manual may be revised or modified for improvement without prior notice.

Safety Precautions

Read this user's manual and the attached documents carefully before installing, operating, or performing maintenance and checking, in order to keep the machine working correctly. Make sure you understand all of the equipment details, safety information, and cautions before using this machine, In this user's manual, the safety precautions are divided into "Dangers" and "Cautions" as follows.

Danger : Improper handling is likely to lead to death or serious injury.

Caution : Improper handling may lead to injury or damage to equipment.

Even when only a Caution is given, serious results may occur depending on the circumstances. In all cases, important points are described. Be sure to follow the advice given.

The following symbols are used to prohibit or explain required action.

: This means do not do what is described. For example, prohibited disassembly is shown as  .

: This means an action you must take. For example, a ground connection that must be made is shown as  .

(1) Installation

Caution

- Use only in the environment specified in the catalog, rinstruction manual, and user's manual. Electric shock, fire or malfunction may result if used in high temperature, high humidity, dusty or corrosive atmosphere environments, or if excessive vibration or impact occurs.
- Install only as described in the manual. An improper installation may cause the equipment to fail, breakdown, or malfunction.
- Never leave wire cuttings or any other foreign matter lying about. A fire, breakdown or malfunction may result from objects left near the equipment.

(2) Wiring

Caution

- Do not connect cameras, other than those specified (IV-S20C1/S30C1/S30C2), to the main housing of the IV-S20. Connecting any other camera may damage the IV-S20 or the camera.
- Connect only to the specified power source. Connection to the wrong power source may cause a fire.
- Wiring should be performed by a qualified electrician. Improper wiring may lead to a fire, breakdown or electric shock.

(3) Use

Danger

- Don't touch the terminals while the power is supplied or you may receive an electric shock.
- Assemble an external emergency stop circuit and interlock circuit (outside of the IV-S20 compact image sensor camera). Otherwise a breakdown or damage to the machine may occur due to a problem with the IV-S20.

Caution

- Take special care to follow all safety guidelines, if you are changing the parameters for the operating conditions or performing an "enforced output," "run," or "stop" during operation. Misoperation may damage the machine or cause an accident.
- Turn ON the power supplies in the specified sequence. Turning ON the supplies in the wrong order may lead to a machine breakdown or cause an accident.

(4) Maintenance

Prohibit
- Don't disassemble or modify the camera. Fires, breakdowns or malfunctions may occur, if the camera is disassembled.

Caution
- Turn OFF the power source before connecting or disconnecting the IV-S20. If you don't, electric shocks, malfunctions or breakdowns may occur.

■ Organization of This Manual

The following chart shows the sequence of the chapters to be read for details about each operation.

(Operation)	(Contents)	(Chapters in this manual)
① System design	- Review the system configuration (system equipment, measurement items, installation requirements, etc.).	Chapter 1. Overview Chapter 2. Precautions for Use Chapter 4. System configuration Chapter 6. Installation Conditions and Method Chapter 16. Specifications
② Installation/ assembly	- Make connections, assemble, and wire the system equipment (an IV-S20, camera, peripheral equipment, etc.)	Chapter 5. Part Name and Function Chapter 6. Installation Conditions and Method Chapter 2. Precautions for Use
③ Configuration	- Run the software, and set the input/ output requirements (communication requirements) with the externally connected equipment.	Chapter 7. Setting and Operation Outline Chapter 11. Setting the Input/Output Conditions Chapter 13. Communication (General Purpose Serial Interface) Chapter 14. Computer link
④ Measurement condition settings	- Run the software, and set the measurement requirements. (set the measurement/inspection areas, pass/fail criterie)	Chapter 7. Setting and Operation Outline Chapter 8. Run Menu Conditions and Settings Chapter 9. Setting the Condition of Each Object Type Chapter 10. PC functions
⑤ Miscellaneous settings	- Set as necessary.	Chapter 12. Other Settings and Operation
⑥ Test/ inspection	- Perform an actual test using the requirements you enterd.	Chapters 3, 7 to 12, 13, 14, and Chapter 15. Troubleshooting
⑦ Maintenance	- Procedures for performing ordinary inspections.	Chapter 15. Troubleshooting

Table of contents

Chapter 1: Overview

The IV-S20 compact image sensor camera is equiped with a CCD image sensor, which captures square pixels in full range. Employing this state-of-art device, it can be used to pick up high contrast images at high speed.

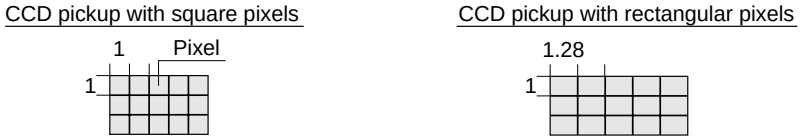
It is also easy to interface to a personal computer and a programmable controller, and it can be used in a variety of production lines such as those for electrical, electronic, semi-conductor or liquid crystal parts as well as for food, chemical, cosmetics, and other production lines.

1-1 Features

[1] Features of the CCD camera

(1) Arrangement of the square pixels

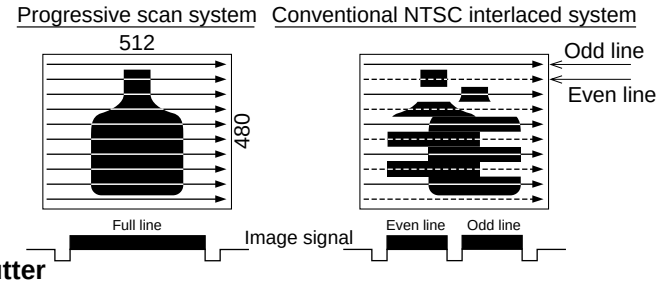
The vertical and horizontal pixel aspect ratio is 1:1, so there is no need for image correction. This allows maximum precision and processing speed.



(2) Full pixel reading (progressive scan)

The IV-S20 employs a full pixel reading system which scans every horizontal lines on the CCD in order. This system does not suffer from reduced image resolution which is caused by the conventional NTSC interlaced system which only reads half the lines in each frame.

- Comparison of capturing moving objects image

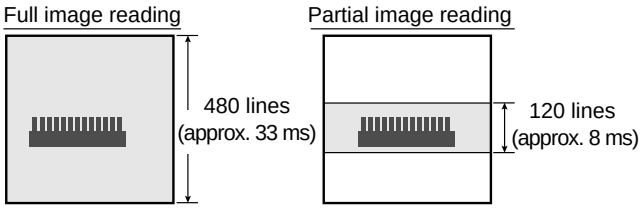


(3) Random shutter

The IV-S20 shutter operation can be triggered by an external signal or by the CCD. It can be used to mesure moving object.

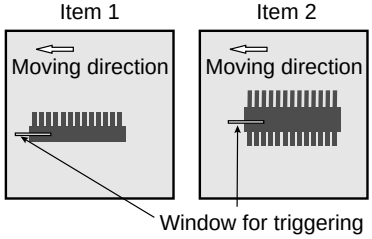
(4) Reading full and partial images

Since the IV-S20 can be used to capture just the part of the image needed for image processing, it can read images at very high speeds.



(5) CCD trigger

The IV-S20 samples a part of the CCD (which can be set to any position with according to item), and it will starts shutter operation when value of the area being monitored exceeds 50%. With this function, there is no need for an additional photo sensor or proximaty sensor. Since the IV-S20 can set the CCD triggering position for each item being processed, it can shorten the time needed to change the items being processed on a production line.



(6) The C mount module and back plane focus can be adjusted

Since the IV-S20 uses a standerd C mount module for installing the lens, it can be used to adjust the back plane focus and is convenient for use with a fixed focus lens or for proximaty shots.

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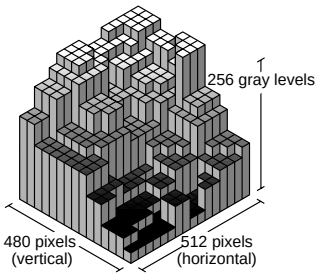
[2] IV-S20 features

(1) Gray scale search using normalization correlation

The IV-S20 processes 256 gray level images using template matching with normalization correlation. This improves inspection and measurement precision without being affected by variations in lighting.

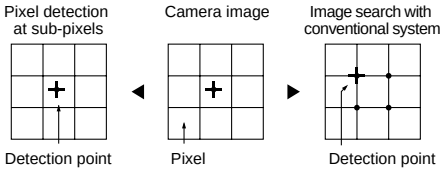


(2) Sub-pixel level precision

When the IV-S20 looks for the position of an object using gray scale search function, it can calculate a finer position than the actual CCD pixel size by interpolation to achieve sub-pixel scale precision.

(3) Simultaneous shutter triggering of two cameras

When a trigger signal is input, two cameras will start their shutter operation at the same time, and transfer the captured image signals at the same time. This can reduce the total processing time for taking simultaneous pictures of moving objects.



(4) 8 kinds of integrated measuring programs, including measurement and inspection functions

The IV-S20 integrates the following measurement programs: Positional deviation, absolute position measurement, matching level inspection, distance and angle measurement, lead inspection, area measurement by binarization, counting by binarization, labeling measurements by binarization, and point measurements. The IV-S20 can process any three measurements from 7 programs, plus positional deviation and absolute position measurements, with one scanned image.

(5) Binarization processing is effective in controlling variations in brightness

Since the binarization process employs a brightness level monitoring function, the threshold value will follow variations in brightness.

(6) Image pre-processing and binary noise elimination function

In order to process images precisely and reliably, the binarization process uses edge emphasis, edge extraction, and leveling operations. To eliminate noise, "binary increase ➡ decrease," "decrease ➡ increase," and "area filters" are available.

(7) Rotation correction

Rotation correction determines the angle for correction by locating two points with a gray scale search and edge detection.

(8) Calculation between images

Calculation of difference between images captured by camera 1 and camera 2, and calculation of differences between a stored standard image and captured images are both possible. Subtraction and absolute difference in value can be used for calculation.

(9) Integrated PC function

The integrated calculation functions of a programmable controller are included so that the IV-S20 can directly output detection and measurement results after calculation external equipment. This can greatly reduce the total processing time and produce cost savings when setting up a system.

(10) High speed programless communication

The IV-S20 has a computer link function and general-purpose serial communication function for communication with external devices. It can have a user settable communication speed up to 115.2 kbps, which contributes to increased processing speed for the whole system.

The computer link function can write the measurement results to an external programmable controller register without any programing.

Using the general-purpose serial communication function, the IV-S20 can execute commands from a host computer, and return the result to the host computer.

(11) Compact

The IV-S20 can be connected to a maximum of two cameras. It is the smallest image processing system in the industry with the dark and light processing capabilities (as of August 1998).

(12) Simultaneous display of two screens

The screen can display two images from two cameras alternately, or simultaneously by dividing the screen into two horizontally. When displaying multiple images, each camera image can be positioned in the upper, middle, or lower views.

(13) Crosshair cursor display

A crosshair cursor is displayed. This cursor is convenient for manual positioning.

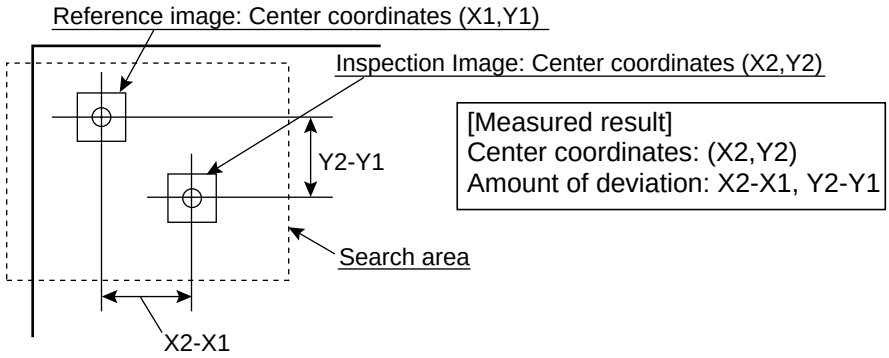
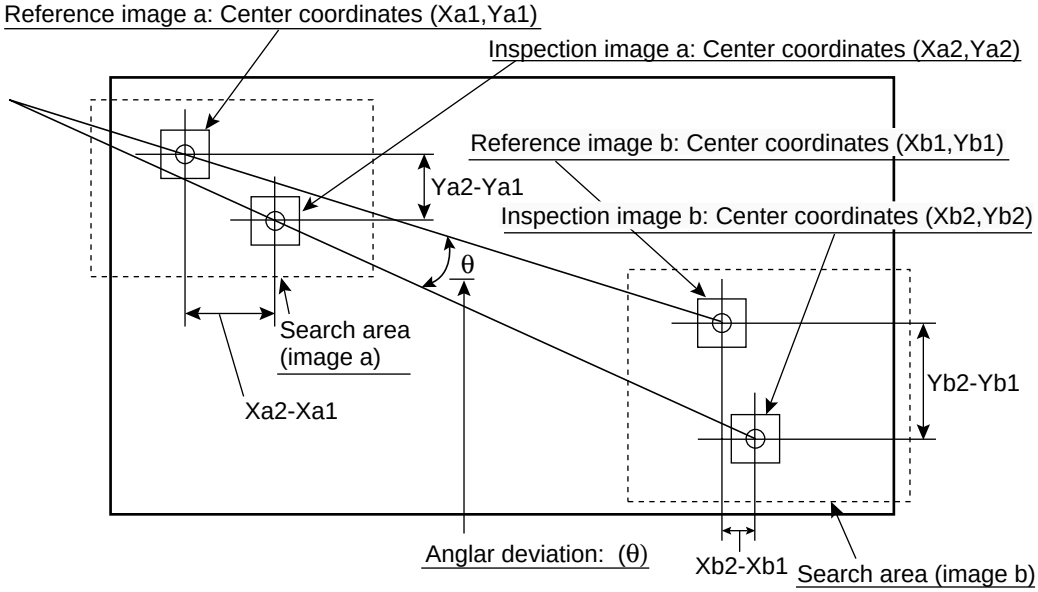
(14) Display language changeable between Japanese and English

Menus and other messages displayed on the screen can be switched between Japanese and English.

1-2 Measurement program

The IV-S20 integrates the following eight measurement programs: Positional deviation, absolute position measurement, matching inspection, distance and angle measurement, lead inspection, area measurement by binary conversion, object counting by binary conversion, labeling measurements by binary conversion, and point measurements.
You can select operating condition parameters to suit your application of the IV-S20.

[1] Positional deviation/absolute position measurement

Purpose	The gray scale search function makes it possible to measure positional deviation as well as the absolute position. · It is also possible to detect the position of sub-pixel units with great accuracy.
Application	Used to determine the position of machine parts and substrates.
Example	[Determining the location of the positioning (the fiducial mark) mark that identifies the position of the substrate] **(1) 1 point search: Detecting the deviation in position in X and Y directions**  [Measured result] Center coordinates: (X2,Y2) Amount of deviation: X2-X1, Y2-Y1 **(2) 2 point search: Determining positional deviation in X and Y directions as well as rotational deviation**  [Measured result] · Center coordinates of image a: (Xa2,Ya2) · Amount of deviation of image a: Xa2-Xa1, Ya2-Ya1 · Center coordinates of image b: (Xb2,Yb2) · Amount of deviation of image b: Xb2-Xb1, Yb2-Yb1 · Deviation angle: (θ) · The deviation angle (θ), determined in the 2 point search, is used to readjust the rotation of the image for measurements 1 to 3.
Detailed instruc-tion	· Operating instruction example ➡ See “3-2 Position measurement.” · Setting measurement program ➡ See “9-3 Positional deviation/absolute position measurement.”

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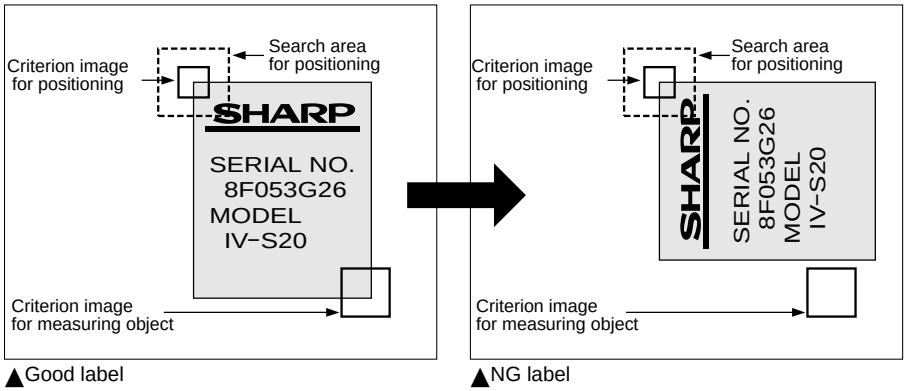
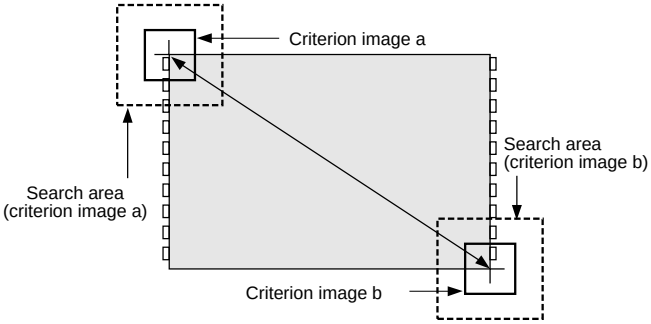
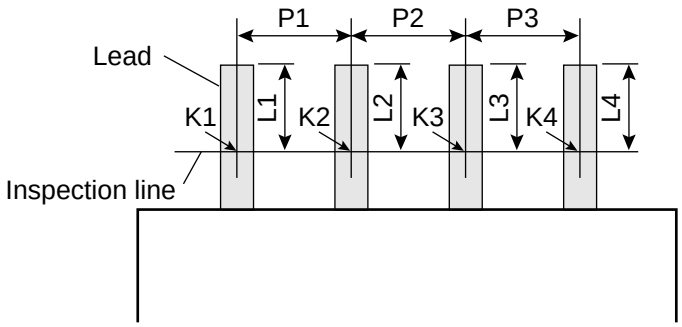
[2] Degree of match for shape and size

Purpose	Compare a good criterion image to an objective image by inspecting matching levels using the garay scale seach function. (Determine whether the port is acceptable or NG by checking similarities between the criterion image and the workpiece image.) A matching level comparison using binary images is also possible.
Application	Detect positional deviation of labels , detect contamination of different parts, inspect the mounting of electronic parts on PC boards, detect mis-print, inspect for missing electric parts such as terminals, and simple letter inspection.
Example	**[Detecting label deviations on packages]**  ・**Inspection procedure** ① Conduct a gray scale search of the criterion image position ② Correct the position of the object being measured from the coordinates for the criterion image obtained in item ① above. ③ If the matching level of the object image is low, the IV-S20 can determine that the label position is NG.
Detailed instruction	・Operating instruction example ➡ See “3-3 Degree of match inspection for shape and size” ・Setting measurement program ➡ See “9-4 Degree of match inspection for shape and size”

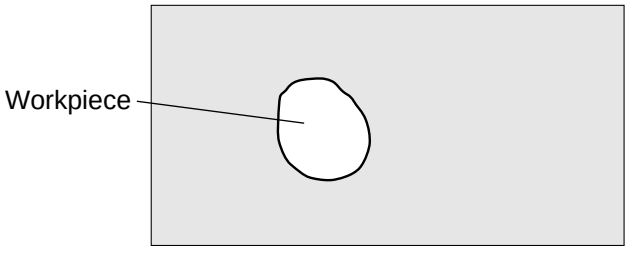
[3] Distance and angle measurement

Purpose	Measure the distance and angle of two point using the center detection function in a gray scale search and the edge detection function, as well as center of gravity detection by
Application	Measurement of mounted electronic parts
Example	**[Measuring IC packages]**  Register criterion image a and b by matching edges of the IC package. ・**Measurement procedure** ① Find the center points of criterion images a and b using a two point gray scale search. ② Determine the distance between the two center points.
Detailed instruction	・Operating instruction example ➡ See “3-4 Distance measurement” ・Setting measurement program ➡ See “9-5 Distance and angle measurement”

[4] Lead inspection

Purpose	Based on positional information obtained from the gray scale search function, inspect the condition of IC leads and connector pins. (No. of detected lead pins: Max. 128 pieces)
Application	Inspect IC leads or connector pins
Example	**[Inspect the layout of the IC leads or connector pins]**  ［**Lead inspection**］ · P1 to P3: Distance between leads · K1 to K4: Mid point of each lead · L1 to L4: Lead length · Number of leads · Detect missing or incorrectly spaced leads · **Inspection procedure** ① Calculate the mid points (K1 to K4) of the leads along the inspection line. ② Look for bent leads by comparing the difference between the maximum and minimum distances of P1 to P3 . ③ Check the maximum and minimum length of the leads (L1 to L4).
Detailed instruction	· Operating instruction example ➡ See “3-5 Lead inspection” · Setting measurement program ➡ See “9-6 Lead inspection”

[5] Area measurement by binary conversion

Purpose	Detect the existence/absence and size of a workpiece when “the workpiece is one point” or “measurement position is fixed.” · Convert the specified pixel area to binary values and measure the size of the white area.
Application	Check for the existence of bearings inserted by a bearing insert machine, prevent contamination of different parts in automobile production lines, determine the type of water-proof caps, check for the existence/absence of bottle labels, inspect the cuircuit traces on PWBs, check for the presence of grease, check for existence of frozen foods.
Example	 **[Measured result]** • Workpiece area **• Inspection procedure** Capture image → Convert to binary values → Measure (area)
Detailed instruction	· Operating instruction example ➡ See “3-1 Area measurement by binary conversion” · Setting measurement program ➡ See “9-7 Area measurement by binary conversion”

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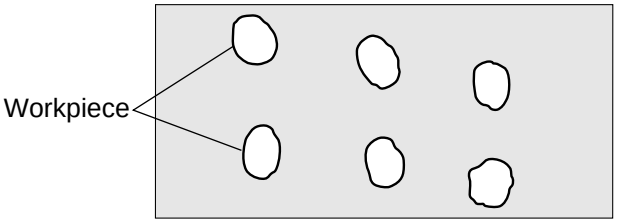
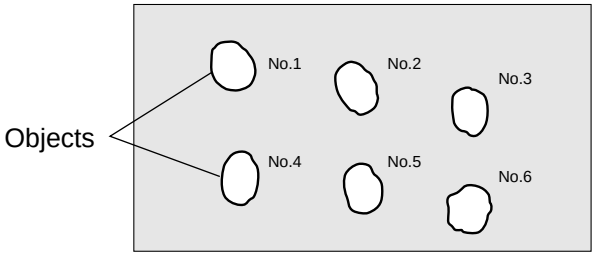
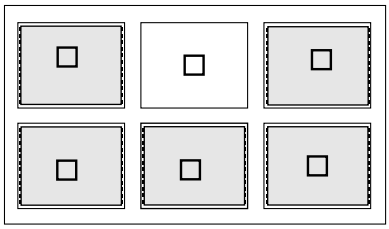
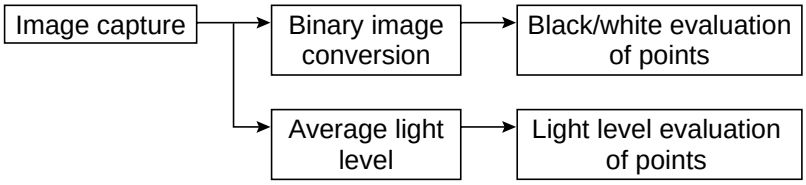
[6] Counting quantities by binary conversion

Purpose	Checks the number of objects (max. 3000 pcs.) when there is more than one object in an image. Measurement of the object's position is optional. - When the specified pixel field has been converted to a binary image, the white areas are measured or identified as separate objects and counted.
Application	Counting pieces of food or parts
Example	 **[Measured result]** Æ Number of workpieces/total area siz - **Inspection procedure** Capture image → Convert to binary values → Measure (quantity, total area size)
Detailed instruction	- Setting measurement program ➡See "9-8 Counting quantities by binary conversion"

[7] Object identification (labeling) by binary conversion

Purpose	When there are several objects and the measuring position is arbitrary, the presence or absence of objects and the size of the objects can be determined. - The specified pixel area is converted to a binary image. The number of objects, total size of the white area (the objects) and the area, center of gravity, main axis angle, fillet diameter, and circumference of each white area can be measured.
Application	Counting the number of food products or parts, measuring the sloped angle or center of gravity of parts, and measuring the size of food products.
Example	**[Measurement of 6 objects]**  **[Measured result]** Æ Object identification (labeling and numbering), number of objects present, total area Æ Area, center of gravity, main axis angle, fillet diameter, and circumference of each object (No.1 to No.6). **- Inspection procedure** Image capture → Convert to binary values → Label (with serial numbers) → Measurement (area, gravity center, spindle axis angle, fillet diameter, and circumference)
Detailed instruction	- Setting measurement program ➡ See "9-9 Object identification by binary conversion"

[8] Existence inspection by point measurement

Purpose	The presence or absence of target objects is examined. · A simple black or white evaluation is made in the specified pixel area of binary images. · The light level in the specified pixel area is averaged, and a decision is made whether or not it is within the specified lightness range in gray scale images.
Applications	Checking the presence or absence of packed parts, inspecting the working condition of LEDs or fluorescent character display tubes, and sorting household electric appliances
Example	**[Inspection at 6 points]**  Number of points (max.) : 128 points at average light levels 256 points in binary images Point size: 2 m x 2n pixels (m, n = 1 to 16) **· Inspection sequence** 
Detailed instruction	• Operating instruction example ➡ See “3-6 Existance inspection by point measurement” • Setting measurement program ➡ See “9-10 Existance inspection by point measuremet”

Chapter 2: Precautions for use

Pay attention to the points below when handling the IV-S20.

(1) Installation

- Each device in the IV-S20 system must be installed in an environment as specified in this manual. (Operating ambient temperature: 0 to 45˚C, operating ambient humidity: 35 to 85%RH (non-condensing.))
- Do not install the devices in the following locations. Installation in any of these locations may cause electrical shock, fire, or malfunction of the devices.
  1. Places exposed to direct sunlight
  2. Places with exposed to corrosive gases
  3. Places with excessive amounts of dust, salt, or metal powder in the air.
  4. Places exposed to water

(2) Installation

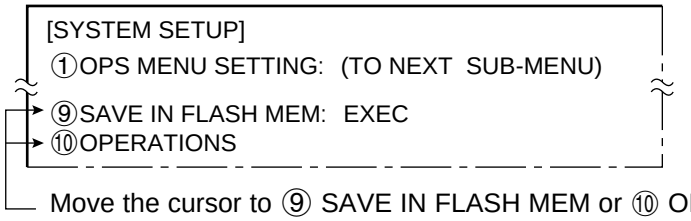
- Make sure to tighten the mounting and terminal screws securely and check everything before supplying power. A loose screw may cause faulty operation.

(3) Power source

- Do not use the IV-S20 (power supply for the IV-S20 main housing) power supply with any other equipment.
- Do not turn OFF the power while the menu is displayed or while communicating with external equipment. Turning OFF the power may erase the data settings.

(4) Data saving

- The data set by using the remote setting key is temporarily stored in the memory (RAM) of the IV-S20. However, it is not stored in the flash memory yet. Therefore, make sure to save the data settings before returning to the operation screen from the [SYSTEM SETUP] menu by pressing the SET key. If you do not save the data, the data will disappear if you turn OFF the power to the IV-S20 main unit or if you change the item numbers to be processed.



Move the cursor to ⑨ SAVE IN FLASH MEM or ⑩ OPERATIONS menu line and press the SET key. The message below will appear on the upper part of the screen. Press the SET key at this point. All of the image data and data settings will be stored in the flash memory.

DATA SAVE? (YES=[SET]/NO=[ESC])

- We recommend that you save the data settings and reference images on a floppy diskette using the data backup tool.

(5) Storing the devices

- Do not put any object on top of any of the devices, or the device may malfunction.

(6) Maintenance

- Be careful not to get any dirt or stains on the CCD surface or camera lens. This may cause mis measurement.

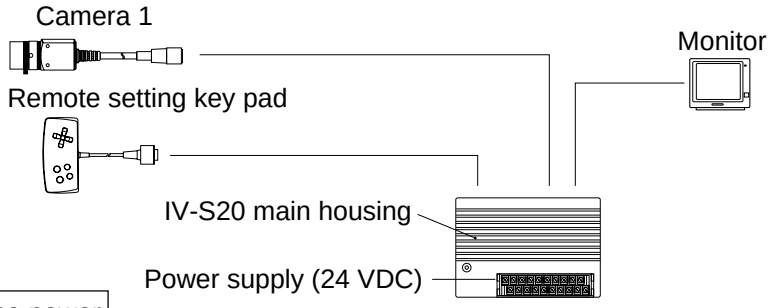
Chapter 3 : Operation Examples

This chapter explains how to operate each measurement program. Be sure you understand the general operation procedures described in this chapter.

[Preparation for operation]

(1) Connection

Before turning ON the power, connect the IV-S20 main housing, the camera, monitor, remote key pad and power supply (24 VDC). Connect the camera to the camera 1 connector (CAMERA 1) on the main housing.
See Chapter 6 "Installation Conditions and Method" for connecting procedures.



(2) Turning ON the power

Turn ON the monitor and the 24 VDC power supply.
The monitor displays the MAIN OPS MENU. (It does not show any images.)

[Procedure for complete initialization]

In sections 3-1 to 3-6, the programs are discussed in their initial configuration.
Before starting any program, perform the following "total initialization" operation.

1. On the MAIN OPS MENU (see the following page), move the cursor to SET-SCRN item using the left and right keys, and press the SET key.
   ⇨The [SYSTEM SETUP] menu will appear.

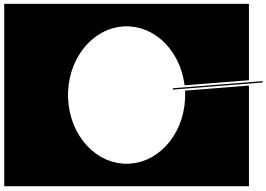
```
[SYSTEM SETUP]
 ①OPS MENU SETTING   (TO NEXT SUB-MENU)
 ②OBJECT TYPE COND   (TO NEXT SUB-MENU)
 ③I/O CONDITIONS     (TO NEXT SUB-MENU)
 ④ADJ. CAM POSITION  (TO NEXT SUB-MENU)
 ⑤DISPLAY MODE       JAPANESE  ENGLISH
 ⑥RECEIVING PARMS    EXEC
 ⑦INIT ALL PARMS     EXEC
 ⑧SELF DIAGNOSTICS   EXEC
 ⑨SAVE IN FLASH MEM  EXEC
 ⑩OPERATIONS
```

2

2. Move the cursor to ⑦INIT ALL PARMS (total initialization) using the up and down keys, and press the SET key.
   ⇨ The INITIALIZE DATA? message will be displayed on the upper area of the screen.
3. Press the SET key. ⇨The system will be initialized.
4. Press the ESC key. ⇨The display will return to the MAIN OPS MENU without initialization.

3-1 Area measurement by binary conversion

An example of area measurement is given using the following object. The area will be measured by counting the number of pixels after binary conversion.



3

(1) Operation on the MAIN OPS MENU (after initialize all conditions)

MAIN OPS MENU

```
(TYPE00)                                   F H  C1ALLC2NO
                                                    VX.X
MEAS.          ms
MEAS0 CAM1 NO

X0~6: □□□□□□□  Y0~7: □□□□□□□□  BUSY:□
MSR-CHNG  REG-CHNG  PC-MONTR  SET-SCRN  MANL-TYP-CHG
                              1
```

1. Move the cursor to SET-SCRN item using the left and right keys, and press the SET key.
   ⇨The [SYSTEM SETUP] menu will be displayed.

(2) Operation on the [SYSTEM SETUP] menu

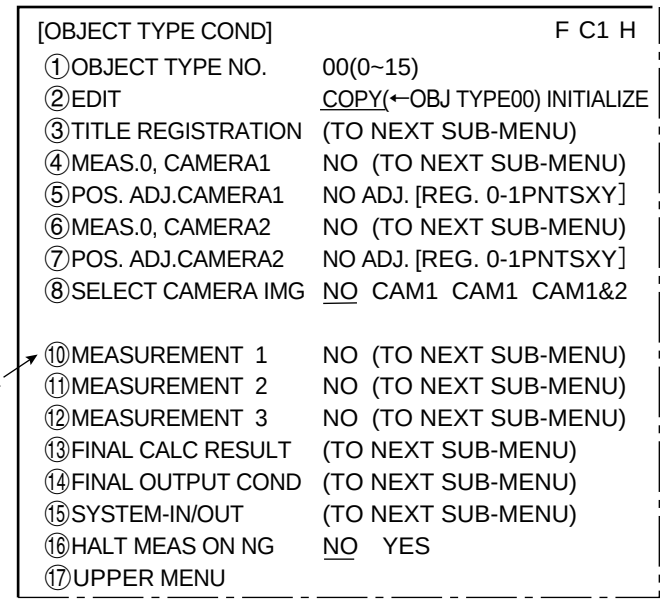
```
[SYSTEM SETUP]                                F C1 H
 ①OPS MENU SETTING   (TO NEXT SUB-MENU)
 ②OBJECT TYPE COND   (TO NEXT SUB-MENU)
 ③I/O CONDITIONS     (TO NEXT SUB-MENU)
 ④ADJ. CAM POSITION  (TO NEXT SUB-MENU)
 ⑤DISPLAY MODE       JAPANESE  ENGLISH
 ⑥RECEIVING PARMS    EXEC
 ⑦INIT ALL PARMS     EXEC
 ⑧SELF DIAGNOSTICS   EXEC
 ⑨SAVE IN FLASH MEM  EXEC
 ⑩OPERATIONS
1
```

1. Move the cursor to ②OBJECT TYPE COND (conditions of object type) using the up and down keys, and press the SET key.
   ⇨The [OBJECT TYPE COND] menu will be displayed.

Continued on the following page

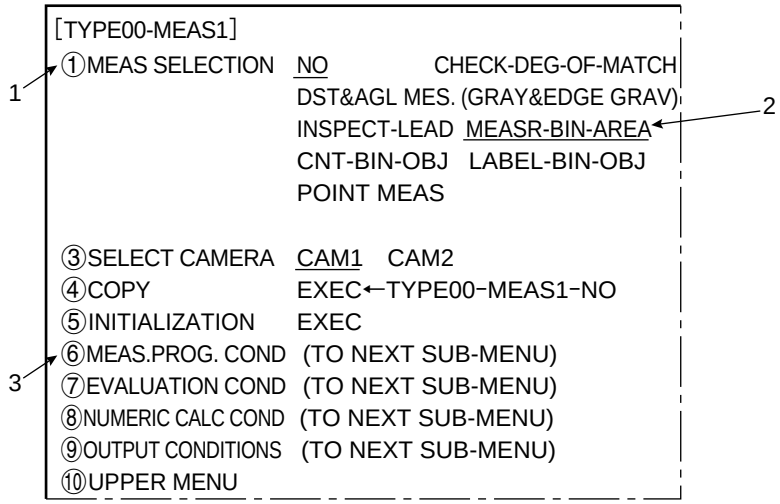
Continued from the preceding page

(3) Operation on the [OBJECT TYPE COND] menu



1. Move the cursor to ⑩MEASUREMENT 1 and press the SET key.
   ⇨ The [TYPE00-MEAS1] (type: 00, measurement: 1) menu will be displayed.

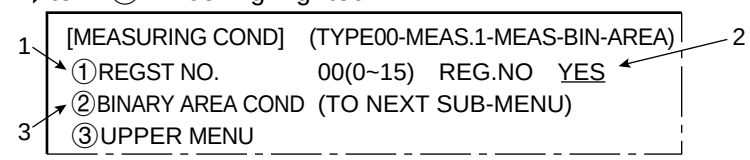
(4) Operation on the [TYPE00-MEAS1] menu



1. Move the cursor to ①MEAS SELECTION (select measurement) and press the SET key.
2. Move the cursor to MEASR-BIN-AREA (area measurement by binary conversion) and press the SET key.
3. Move the cursor to ⑥MEAS.PROG. COND (conditions of measurement program) and press the SET key.
   ⇨ The [MEASURING COND] (measurement condition) menu will be displayed.

(5) Operation on the [MEASURING COND] menu

1. Move the cursor to ①REGST NO. (register number) and press the SET key.
2. Move the cursor to YES, and press the SET key.
   ⇨Item ②will be highlighted.

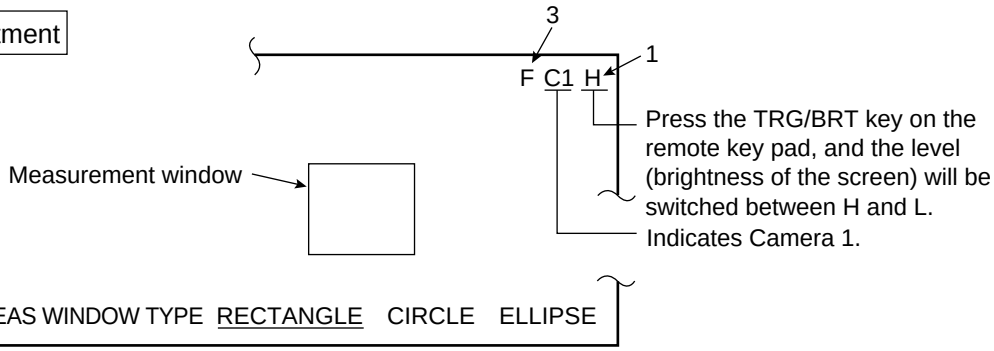


3. Move the cursor to ②BINARY AREA COND (condition for measurement window) with the up and down keys, and press the SET key.
   ⇨ The [BIN.AREA SET] (binary zone setting) menu and a measurement window will be displayed.

Continued on the following page

Continued from the preceding page

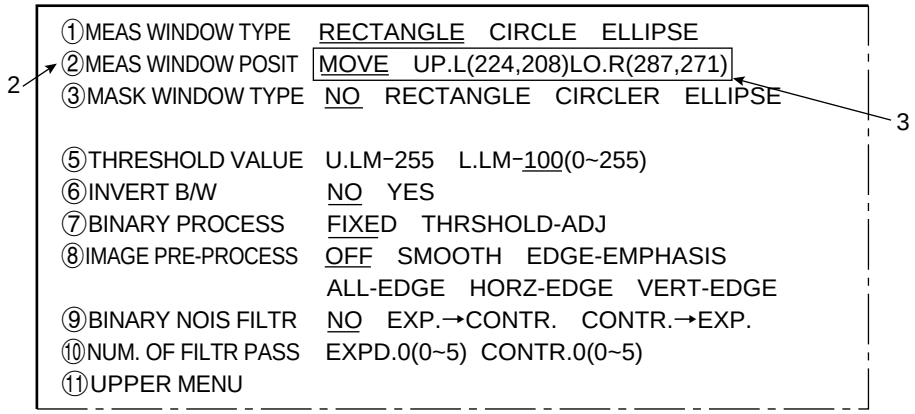
(6) Image adjustment



1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
   - If the image is so bright that the menu is hard to see, press the TRG/BRT key to reduce the brightness of the image. Then, the brightness indicator in the upper right corner of the screen will change from H to L.
2. Adjust the focus and aperture (iris) of the camera lens (see page 5·1), so that the object to be measured is clear and easily distinguished.
3. Press the SEL key to enter the freeze image mode.
   ⇨ The indicator in the upper right corner of the screen will change from T (through) to F (freeze).
   - To set a threshold value during the following binary zone setting procedure, the screen must be in the freeze image mode. (See section 7-2 "Screen specifications" for details about the through/freeze mode.)

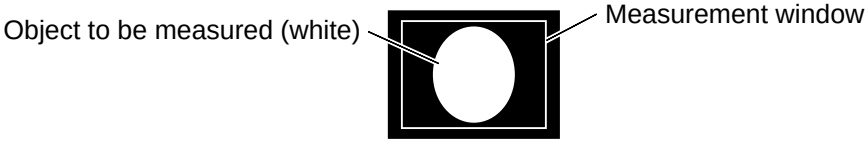
(7) Operation on the [BIN.AREA SET] menu screen (setting a measurement window)

1. Press the ESC key, and all the menus used for [BIN.AREA SET] will be displayed.



   - If the menu overlaps the image to be measured so that further image setting is hindered, press the ESC key. Only item ①will be displayed.
   - A binary image will be displayed in the window.
2. Move the cursor to ②MEAS WINDOW POSIT with the up and down keys, and press the SET key.
3. Surround the image to be measured with a window (rectangle, solid line).
   - Move the cursor to MOVE, UP.L, or LO.R, and press the SET key. Then, position the window. When the position is correct, press the SET key.

MOVE	The white rectangle is moved using the up, down, right or left keys (one pixel at a time).
UP.L	The upper left corner is moved using the up, down, right or left keys (one pixel at a time).
LO.R	The lower right corner is moved using the up, down, right or left keys (one pixel at a time).



   - After the window position has been defined, press the ESC key.

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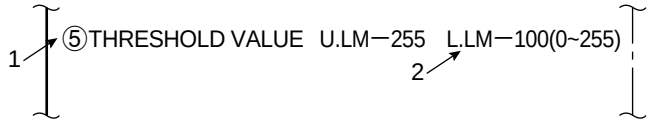
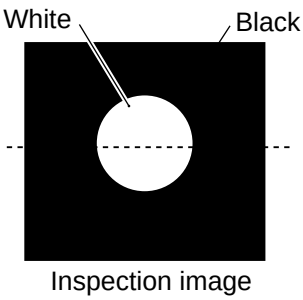
(8) Operation on the [BIN.AREA SET] menu screen (setting an image for binary conversion)

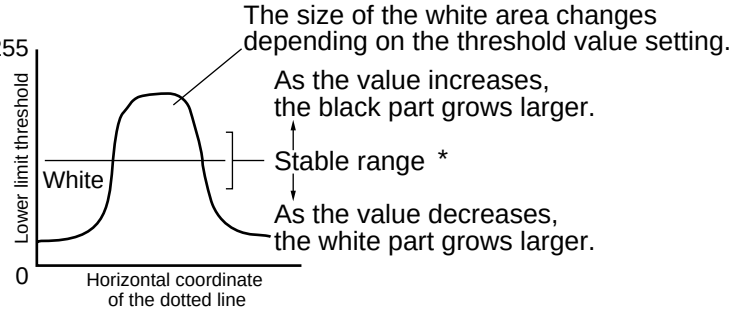


1. Move the cursor to ⑤THRESHOLD VALUE (threshold value) and press the SET key.
2. Move the cursor to L.LM (lower limit) with the left and right keys, and adjust the lower limit threshold value with the up and down keys.

(Adjustment of threshold value)

An example of adjustment is shown below, using a white object on a black background. When the dotted line in the window is converted to a binary image, if the lower limit is set higher, the black part in the binary image will become larger. If the lower limit is set lower, the white part will become larger. Increase and decrease the lower limit value, find the value at which the white part in the binary image starts growing and the value at which the black part starts growing. Then set the lower limit at the value halfway between these points. This will ensure reliable operation.





Changing the lower limit threshold value

[* If the stable range in the lower limit threshold value is less than 20, (actual measurement) measurement errors may occur.]

3. After setting the lower limit, press the SET key.
4. Move the cursor to ⑪UPPER MENU and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] (measurement conditions) menu.
5. On the [MEASURING COND] menu, move the cursor to ③UPPER MENU and press the SET key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (type: 00, measurement: 1) menu.

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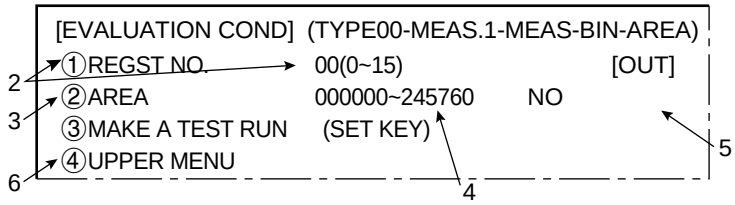
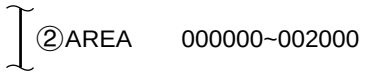
3

(9) Setting the evaluation conditions and results output

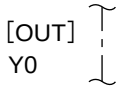
1. On the [TYPE00-MEAS1] (type: 00, measurement: 1) menu, move the cursor to ⑦ EVALUATION COND (evaluation conditions) and press the SET key.
   ⇨ The [EVALUATION COND] menu will be displayed.



2. Move the cursor to ①REGST NO. (register number) and press the SET key. Select the desired number, in this case 00, using the up and down keys, and press the SET key.
3. Move the cursor to ②AREA (size) and press the SET key.
4. Move the cursor to the upper limit value with the left and right keys, and press the SET key.
   - Select the digit you want to change with the left and right keys, and enter the value 002000 with the up and down keys.



   - After defining the upper limit, press the SET key.
5. Move the cursor to OUT (output) with the left and right keys.
   · Select Y0 with the up and down keys, and press the SET key.



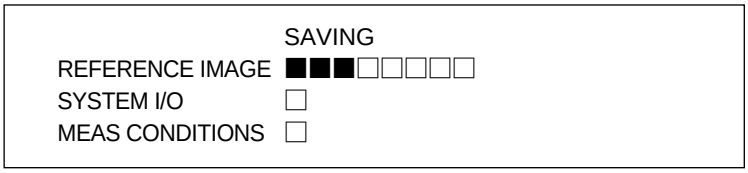
   - After completing the settings, press the ESC key.
6. Move the cursor to ④UPPER MENU and press the SET key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (type :00, measurement: 1) menu.

(10) Returning to the MAIN OPS MENU

1. Press the ESC key.
   ⇨ The screen will return to the [OBJECT TYPE COND] (conditions of object type) menu.
2. Press the ESC key, again.
   ⇨ The screen will return to the [SYSTEM SETUP] menu.
   - Move the cursor to ⑨SAVE IN FLASH MEM (save data in flash memory) or ⑩ OPERATIONS and press the SET key.
     ⇨ The following message will be displayed on the upper part of the screen.

     DATA SAVE? (Do you want to save data ?) (YES=[SET]/NO=[ESC])

   - Press the SET key.
     ⇨ The data saving operation will start, and the progress will be displayed on the bottom of the screen.



     When the data has been saved in the IV-S20 flash memory, the display will change from "SAVING" to "SAVING COMPLETE"

Note:
- If the ESC key is pressed, the settings you entered will not be saved in the IV-S20 flash memory. In this case, if the power to the IV-S20 main housing is turned OFF, or if the type No. is changed, the settings will be deleted.

3. Press the ESC key.
   ⇨ The screen will return to the MAIN OPS MENU.
   - If the cursor was moved to ⑩OPERATIONS in step 2 above, the screen will automatically return to the MAIN OPS MENU.

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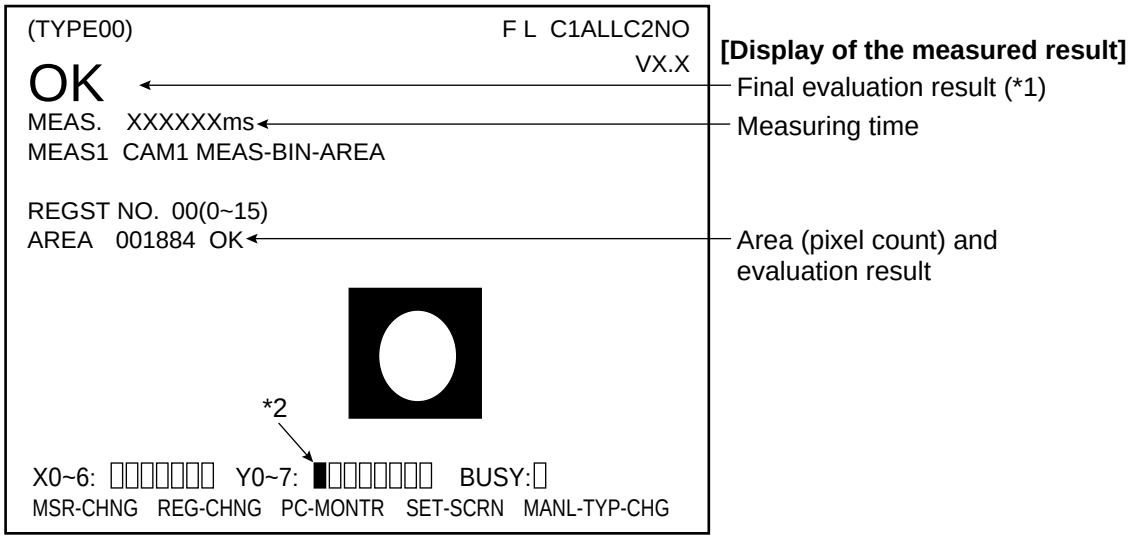
(11) Measuring the area

Press the TRG/BRT key, and the size of the object in the image in the window will be displayed as a pixel count.

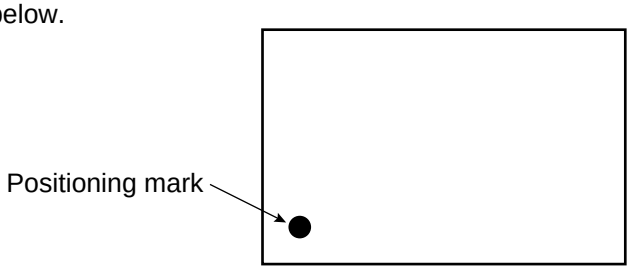


*1 The final evaluation result will be displayed as "OK" in the upper left corner of the screen when all of the items have been evaluated acceptable.
If there is a single unacceptable item, "NG" will be displayed.
When measuring an object area with the binary image, only the size of the object is measured. If the object meets to the conditions specified in step (9) (within the range between the upper and lower limit values), "OK" will be displayed.

*2 When the judgment result is OK, Y0 will be turned ON because we set it that way in step (9), and a filled box ■ will be displayed in the Y0 position at the bottom of the screen. (If the result is NG, an empty box □ will be displayed in the Y0 position at the bottom of the screen.)

3-2 Position measurement

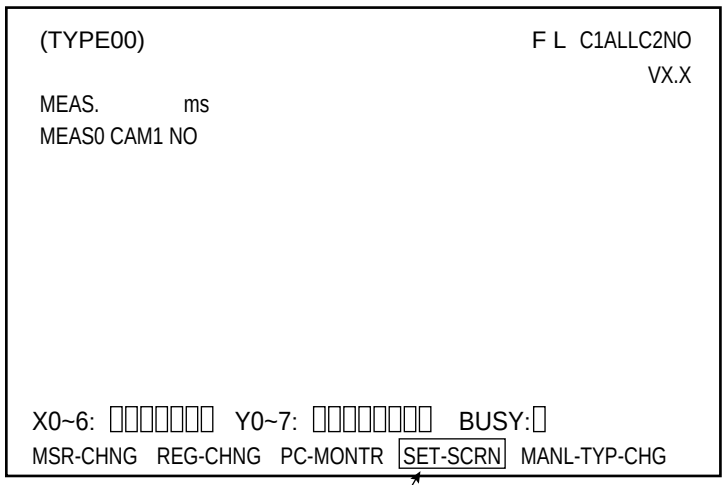
An example of the operation for measuring the deviation (from an absolute position) of a positioning mark is shown below.



3

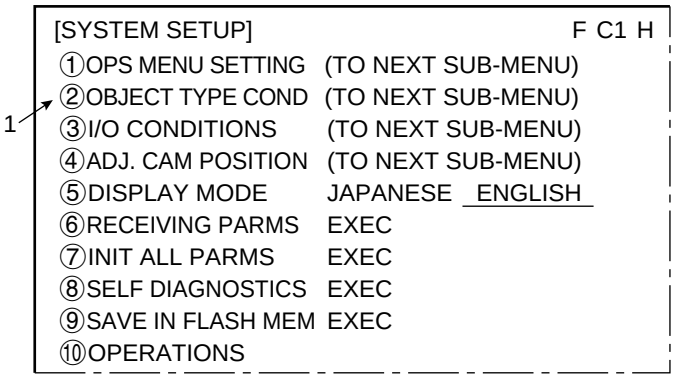
(1) Operation on the MAIN OPS MENU (after initialize all condetions)

MAIN OPS MENU



1. Move the cursor to SET-SCRN item and press the SET key.
   ⇨ The [SYSTEM SETUP] menu will be displayed.

(2) Operation on the [SYSTEM SETUP] menu



1. Move the cursor to ②OBJECT TYPE COND (conditions of object type) and press the SET key.
   ⇨ [OBJECT TYPE COND] menu will be displayed.

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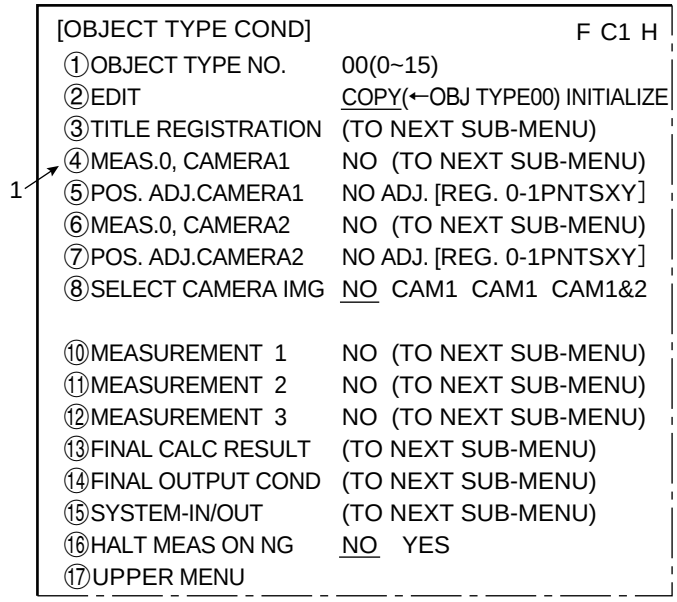
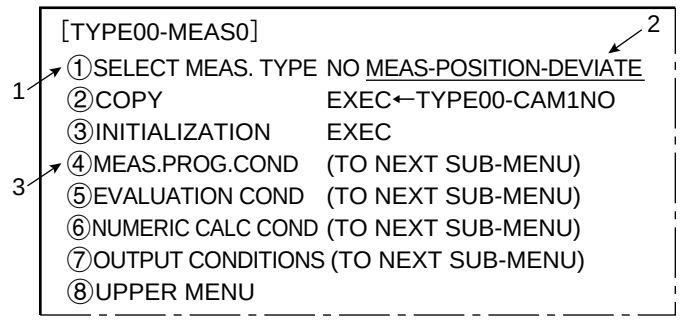
(3) Operation on the [OBJECT TYPE COND] menu



1. Move the cursor to ④MEAS.0, CAMERA1 (measurement 0 (camera 1)) and press the SET key.
   ⇨ The [TYPE00-MEAS0] (type: 00, measurement: 0) menu will be displayed.

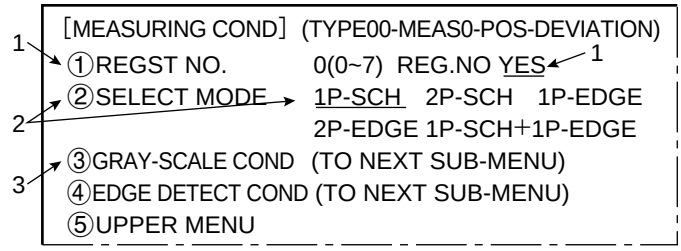
(4) Operation on [TYPE00-MEAS0] menu



1. Move the cursor to ①SELECT MEAS. TYPE (selection of measurement) and press the SET key.
2. Move the cursor to MEAS-POSITION-DEVIATE (measurement of positional deviation) and press the SET key.
3. Move the cursor to ④MEAS.PROG.COND (conditions of measurement program) and press the SET key.
   ⇨ The [MEASURING COND] (measurement condition) menu will be displayed.

(5) Operation on the [MEASURING COND] menu

1. Move the cursor to ①REGST NO. (register number) and press the SET key.
   Move the cursor to YES and press the SET key.
   ⇨ Items ②to ④will be displayed.



2. Move the cursor to ②SELECT MODE and press the SET key. Move the cursor to 1P-SCH (1 point search) and press the SET key.
3. Move the cursor to ③ GRAY-SCALE COND (gray scale search condition) and press the SET key.
   ⇨ The gray scale search matching setting menu, image window, and search window will be displayed.

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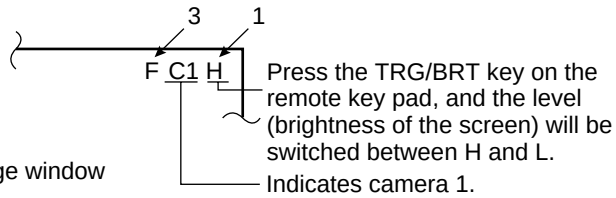
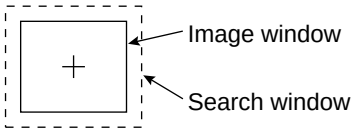
(6) Image adjustment



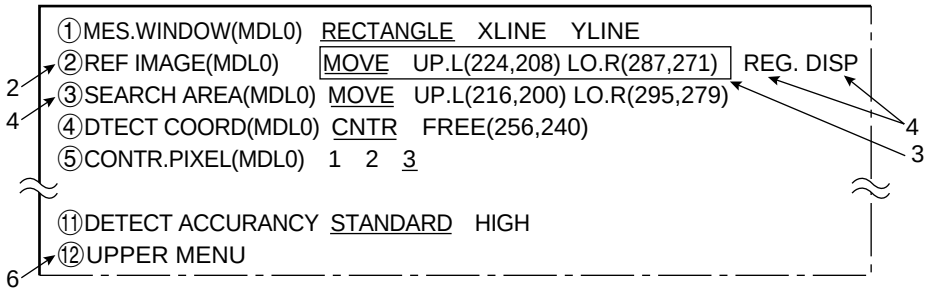


①MEAS WINDOW(MDL0) RECTANGLE X-LINE Y-LINE

1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
   - If the image is so bright that the menu is hard to see, press the TRG/BRT key to reduce the brightness of the image. Then, the brightness indicator in the upper right corner of the screen will change from H to L.
2. Adjust the focus and aperture (iris) of the camera lens (see page 5·1), so that the object to be measured is clear and easily distinguished.
3. Press the SEL key to enter the freeze image mode.
   ⇨ The indicator in the upper right corner of the screen will change from T (through) to F (freeze).
   - To store an image for the following gray scale search matching setting operations, the screen must be in the freeze image mode. (See section 7-2 "Screen specifications" for details about the through/freeze mode.)

(7) Operation for gray scale search matching setting

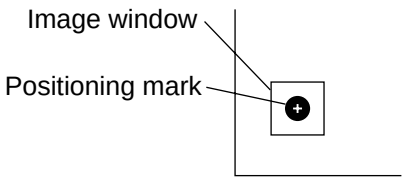
1. Press the ESC key, and all menus to be used for gray scale search matching setting will be displayed.



   - If the menu overlaps the image to be measured so that further image setting is hindered, press the ESC key. Only item ①will be displayed.
2. Move the cursor to ②REF IMAGE (MDL0) (reference image) and press the SET key.
3. Surround the image to be measured with a window (solid line).
   - Move the cursor to MOVE, UP.L, or LO.R and press the SET key. Then, position the window.

MOVE	The white rectangle is moved using the up, down, right or left keys (4 pixels at a time).
UP.L	The upper left corner is moved using the up, down, right or left keys (4 pixels at a time).
LO.R	The lower right corner is moved using the up, down, right or left keys (4 pixels at a time).

   When the position is correct, press the SET key.



   - After the image window position has been defined, move the cursor to REG. (register) with left and right keys, and press the SET key.
   - Move the cursor to DISP (display) with the left and right keys and press the SET key. Then, the stored image will be displayed in the lower right corner of the screen. After checking the image, press the ESC key.

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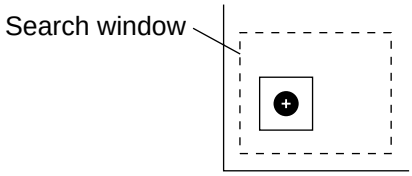
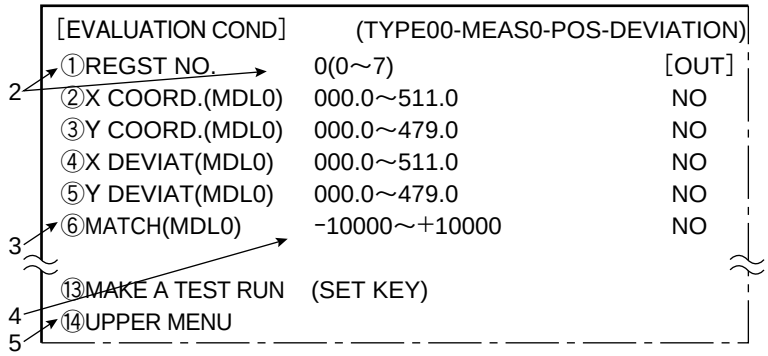
4. Press the ESC key, move the cursor to ③SEARCH AREA (search window) and press the SET key.
5. Create a search window (dotted line) to be used as the search area.
   - The search area is the area within which the new image will be searched for a match with the image stored in step 3. The gray scale search function performs the search operation (see the "Glossary").
   - The procedure for defining the search area is the same as in step 3.



   - After defining the search window size and position, press the ESC key.
6. Move the cursor to ⑫UPPER MENU and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] (measurement conditions) menu.
7. Press the ESC key.
   ⇨ The screen will return to the [TYPE00-MEAS0] (type: 00, measurement: 0) menu.

(8) Operation on the [EVALUATION COND] (evaluation condition) menu

1. Move the cursor to ⑤EVALUATION COND and press the SET key.
   ⇨ The [EVALUATION COND] menu will be displayed.



2. Move the cursor to ①REGST NO. (register number) and press the SET key. Move the number to 0 with the up and down keys, and press the SET key.
3. Move the cursor to ⑥MATCH (MDL0) and press the SET key.
4. Move the cursor to the lower limit position with the left and right keys, and press the SET key.
   - Select the digit to change with the left and right keys, and then set the value to +09000 with the up and down keys.
     (Criteria for a successful match: 90.00% to 100.00%)

   ⑥MATCH(MDL0)： +09000~+10000

   - After defining the lower limit, press the SET key.
5. Press the ESC key, move the cursor to ⑭UPPER MENU and press the SET key.
   ⇨ The screen will return to the [TYPE00-MEAS0] (type: 00, measurement: 0) menu.
6. Press the ESC key.
   ⇨ The screen will return to the [OBJECT TYPE COND] (conditions of object type) menu.

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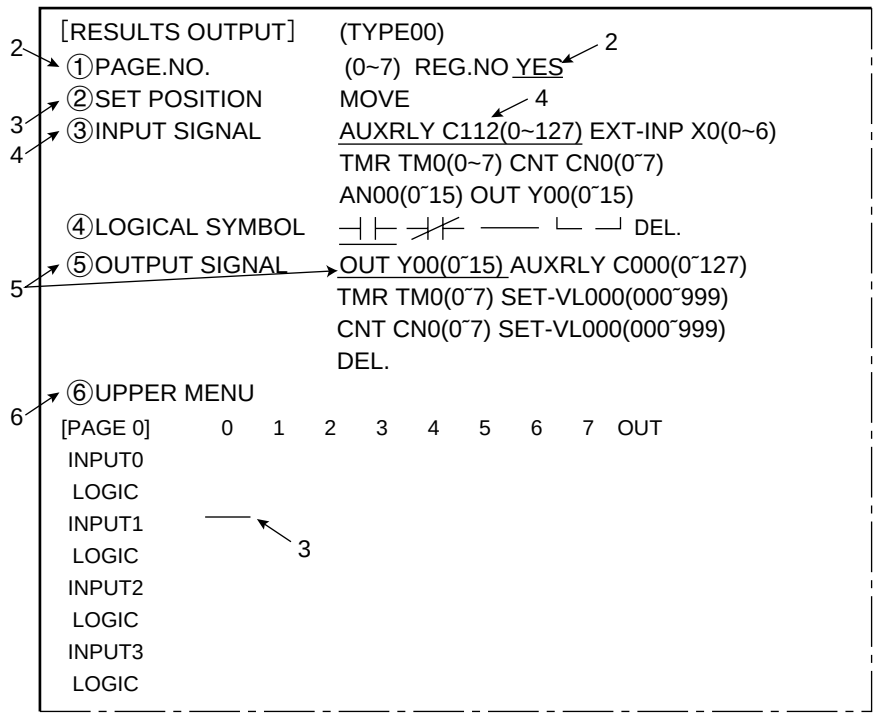
(9) Setting the final evaluation output condition

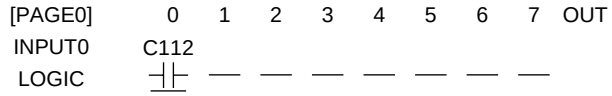
This setting is used to output the result of the final evaluation externally (see page 3-14).

- The final evaluation result is always output to the auxiliary relay C112. When the final evaluation result is OK, C112 is ON, and when the result is NG, it is OFF. The result of final evaluation can be externally output by using the auxiliary relay C112.

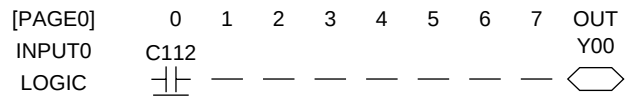
1. On the [OBJECT TYPE COND] (conditions of object type) menu, move the cursor to ⑭ FINAL OUTPUT COND (final output conditions) and press the SET key.
   ⇨ The RESULTS OUTPUT (final evaluation conditions) menu will be displayed.
2. Move the cursor to ①PAGE.NO. (register number) and press the SET key. Move the cursor to YES and press the SET key.
   ⇨ Items ②to ⑤will be displayed.



3. Move the cursor to ②SET POSITION (position to set) and press the SET key.
   - Move the cursor to the 0th column of INPUT 0 for logic setting using the up, down, left and right keys, and press the SET key.
4. Move the cursor to ③INPUT SIGNAL and press the SET key.
   - Select AUXRLY C000 (0 to 127) with the left and right keys, change the setting to "C112" with the up and down keys, and press the SET key.
     ⇨ A logic symbol will be displayed in the 0 column of INPUT 0.



5. Move the cursor to ⑤OUTPUT SIGNAL and press the SET key.
   - Select OUT.Y00 (0 to 15) with the left and right keys. Specify Y00 with the up and down keys, and press the SET key.
     ⇨ A symbol indicating an output coil for INPUT 0 will be displayed.



6. Move the cursor to ⑥UPPER MENU and press the SET key.
   ⇨ The screen will return to the [OBJECT TYPE COND] (conditions of object type) menu.

Continued on the following page

Continued from the preceding page

(10) Returning to the MAIN OPS MENU

1. Press the ESC key.
   ⇨ The screen will return to the [SYSTEM SETUP] menu.
   - Move the cursor to ⑨SAVE IN FLASH MEM (save data in flash memory) or ⑩ OPERATIONS with the up and down keys, and press the SET key.
     ⇨ The following message will be displayed on the upper part of the screen.

     DATA SAVE? (Do you want to save data ?) (YES=[MOVE]/NO=[ESC])

   - Press the SET key.
     ⇨ The data saving operation will start, and the progress will be displayed on the bottom of the screen.

     SAVING
     REFERENCE IMAGE ■■■■□□□□
     SYSTEM I/O □
     MEAS CONDITIONS □

     When the data has been saved in the IV-S20 flash memory, the display will change from "SAVING" to "SAVING COMPLETE."

     Note:
     · If the ESC key is pressed, the settings you entered will not be saved in the IV-S20 flash memory. In this case, if the power to the IV-S20 main housing is turned OFF, or if the type No. is changed, the settings will be deleted.

2. Press the ESC key.
   ⇨ The screen will return to the MAIN OPS MENU.
   - If the cursor was moved to ⑩OPERATIONS in step 1 above, the screen will automatically return to the MAIN OPS MENU.

Continued on the following page

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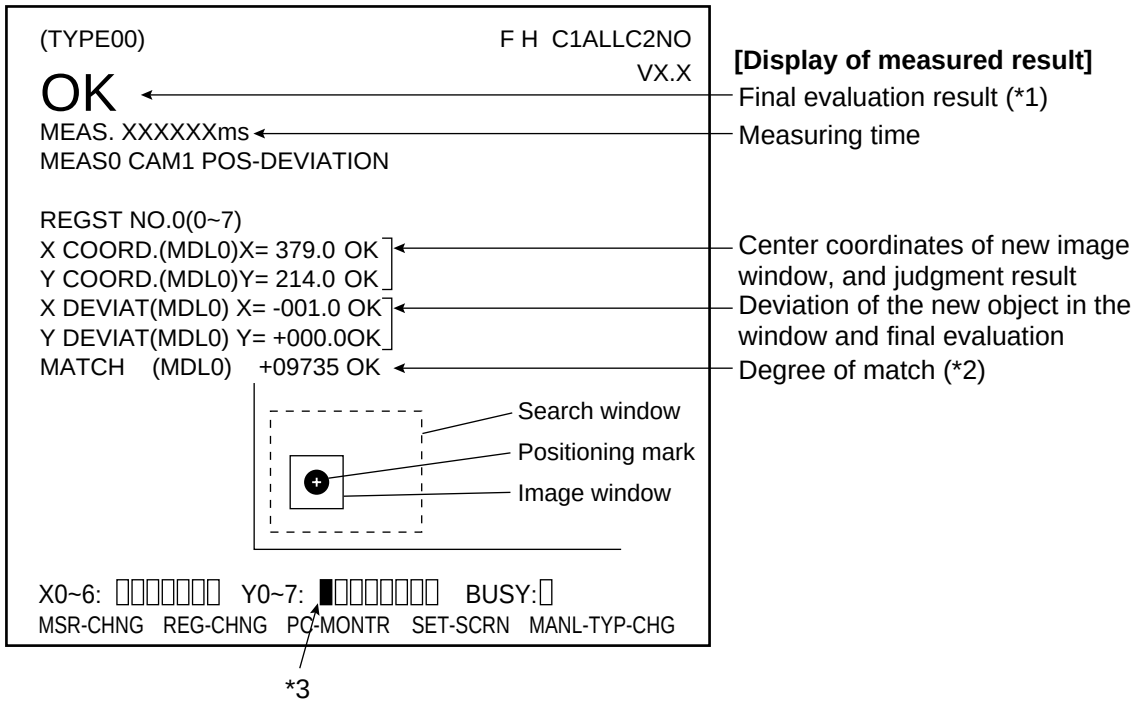
(11) Measuring the positional deviation

Press the TRG/BRT key, and the result of measuring the positional deviation (absolute position) from the stored positioning mark image will be displayed.



*1 The final evaluation result will be displayed as "OK" in the upper left corner of the screen when all of the items have been evaluated acceptable.
If there is a single unacceptable item, "NG" will be displayed.

*2 "MATCH:+09735" means that the degree of match (percentage of pixels that match) between pixels in the new image and the stored image is 97.35%.

[The acceptance and rejection criteria based on the degree of match]

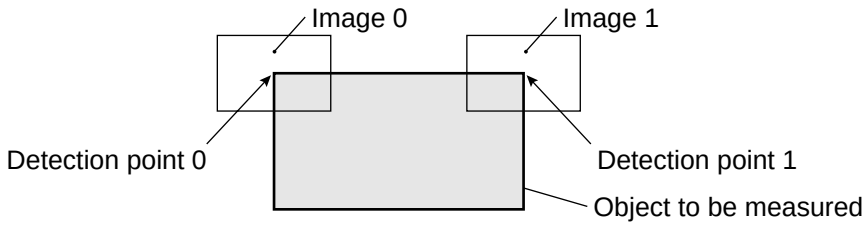
In order to evaluate acceptability based on the degree of match, first an image of a good specimen is stored for reference. Then, an image of defective specimen is compared for degree of match. Finally an image of another good specimen is compared. These comparisons establish the degree of match to be used for setting the limits used for working comparisons.

For example, the degree of match for a non-defective object is 90% or more and that for a defective object is 70% or less, then the threshold value for degree of match can be set to approx. 85%. This allows the evaluation acceptability to be made.

*3 When the final evaluation result is OK, Y0 is turned ON, and a filled box ■ is displayed. (When the result is NG, an empty box □ is displayed.)
When the auxiliary relay C112 is turned ON, Y0 is turned ON according to the condition set in step (9) for final evaluation output.

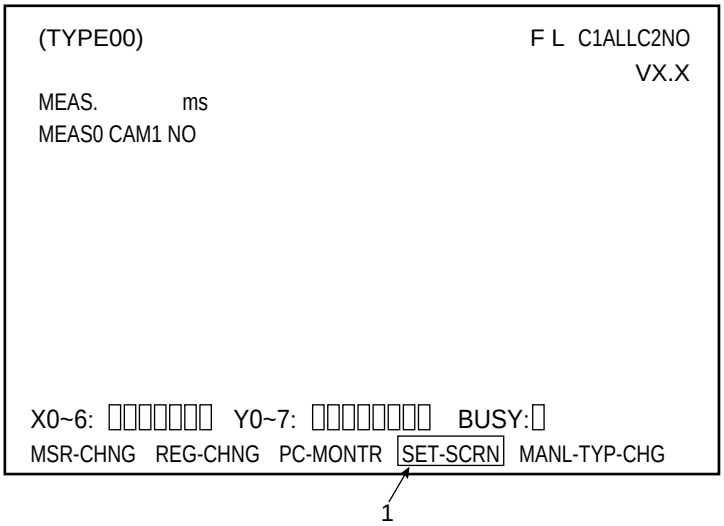
3-3 Degree of match inspection for shape and size

Below is an example of an operation to determine the degree of match of the images 0 and 1, and the coordinates of the detection points with respect to the following object.



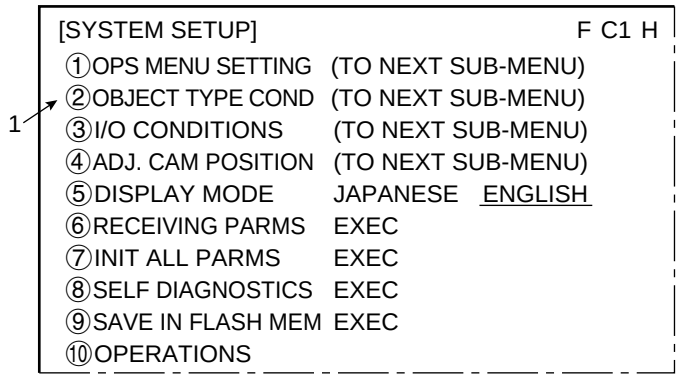
(1) Operation on the MAIN OPS MENU (after initialize all conditions)

MAIN OPS MENU



1. Move the cursor to [SET-SCRN] item and press the SET key.
   ⇨ The [SYSTEM SETUP] menu will be displayed.

(2) Operation on the [SYSTEM SETUP] menu



1. Move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.
   ⇨ The [OBJECT TYPE COND] menu will be displayed.

Continued on the following page

Continued from the preceding page

(3) Operation on the [OBJECT TYPE COND] (conditions of object type) menu

```
[OBJECT TYPE COND]                              F C1 H
 ①OBJECT TYPE NO.        00(0~15)
 ②EDIT                   COPY(←OBJ TYPE00) INITIALIZE
 ③TITLE REGISTRATION     (TO NEXT SUB-MENU)
 ④MEAS.0, CAMERA1        NO  (TO NEXT SUB-MENU)
 ⑤POS. ADJ.CAMERA1       NO ADJ. [REG. 0-1PNTSXY]
 ⑥MEAS.0, CAMERA2        NO  (TO NEXT SUB-MENU)
 ⑦POS. ADJ.CAMERA2       NO ADJ. [REG. 0-1PNTSXY]
 ⑧SELECT CAMERA IMG      NO  CAM1  CAM1  CAM1&2

 ⑩MEASUREMENT  1         NO  (TO NEXT SUB-MENU)
 ⑪MEASUREMENT  2         NO  (TO NEXT SUB-MENU)
 ⑫MEASUREMENT  3         NO  (TO NEXT SUB-MENU)
 ⑬FINAL CALC RESULT      (TO NEXT SUB-MENU)
 ⑭FINAL OUTPUT COND      (TO NEXT SUB-MENU)
 ⑮SYSTEM-IN/OUT          (TO NEXT SUB-MENU)
 ⑯HALT MEAS ON NG        NO   YES
 ⑰UPPER MENU
```

1

1. Move the cursor to ⑩ MEASUREMENT 1 and press the SET key.
   ⇨ The [TYPE00-MEAS1] (type: 00, measurement: 1) menu will be displayed.

(4) Operation on the [TYPE00-MEAS1] menu

```
[TYPE00-MEAS1]
 ①MEAS SELECTION   NO              CHECK-DEG-OF-MATCH
                   DST&AGL MES. (GRAY&EDGE GRAV)
                   INSPECT-LEAD  MEASR-BIN-AREA
                   CNT-BIN-OBJ   LABEL-BIN-OBJ
                   POINT MEAS

 ③SELECT CAMERA    CAM1   CAM2
 ④COPY             EXEC←TYPE00−MEAS1−NO
 ⑤INITIALIZATION   EXEC
 ⑥MEAS.PROG. COND  (TO NEXT SUB-MENU)
 ⑦EVALUATION COND  (TO NEXT SUB-MENU)
 ⑧NUMERIC CALC COND (TO NEXT SUB-MENU)
 ⑨OUTPUT CONDITIONS (TO NEXT SUB-MENU)
 ⑩UPPER MENU
```

1

2

3

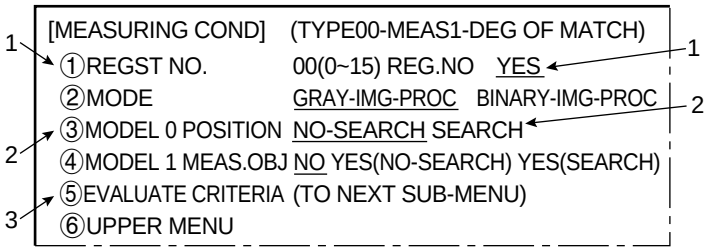
1. Move the cursor to ① MEAS SELECTION (selection of measurement) and press the SET key.
2. Move the cursor to CHECK-DEG-OF-MATCH (degree of match inspection) and press the SET key.
3. Move the cursor to ⑥ MEAS.PROG. COND (conditions of measurement program) and press the SET key.
   ⇨ The [MEASURING COND] (measurement condition) menu will be displayed.

Continued on the following page

Continued from the preceding page

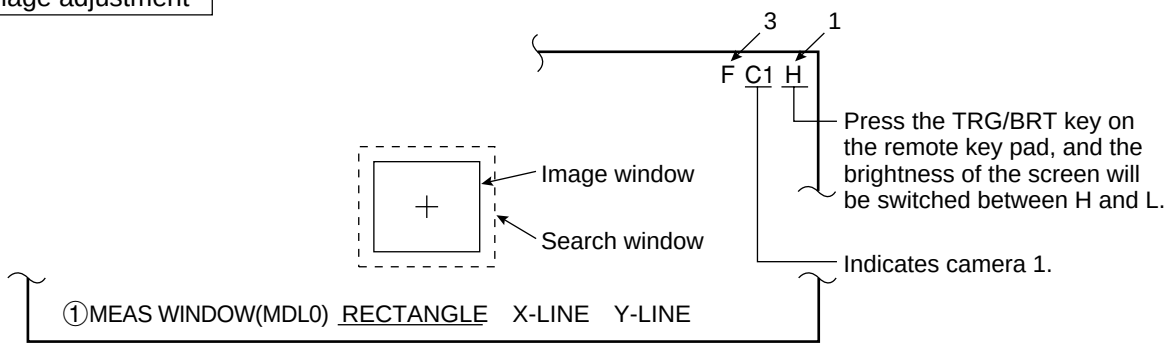
(5) Operation on the [MEASURING COND] (measurement condition) menu

1. Move the cursor to ① REGST NO. (register number) and press the SET key. Move the cursor to YES and press the SET key.
   ⇨ Items ② to ⑤ will be displayed.



2. Move the cursor to ③ MODEL 0 POSITION (model 0, positioning) and press the SET key. Move the cursor to SEARCH and press the SET key.
3. Move the cursor to ⑤ EVALUATE CRITERIA (criteria condition) and press the SET key.
   ⇨ The gray scale search matching setting menu, image window, and search window will be displayed.

(6) Image adjustment



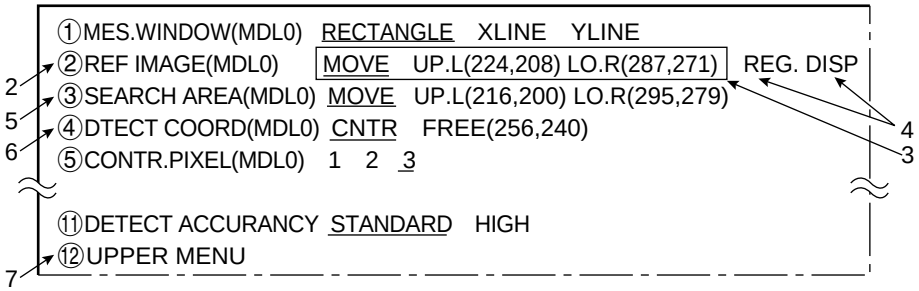
1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
   - If the image is so bright that the menu is hard to see, press the TRG/BRT key to reduce the brightness of the image. Then, the brightness indicator in the upper right corner of the screen will change from H to L.
2. Adjust the focus and aperture (iris) of the camera lens (see page 5-1), so that the object to be measured is clear and easily distinguished.
3. Press the SEL key to enter the freeze image mode.
   ⇨ The indicator in the upper right corner of the screen will change from T (through) to F (freeze).
   - To store an image for the following gray scale search matching setting operations, the screen must be in the freeze image mode. (See section 7-2 "Screen specifications" for details about the through/freeze mode.)

Continued on the following page

Continued from the preceding page

(7) Operation for the gray scale search matching setting (setting the reference image 0)

1. Press the ESC key, and all menus to be used for setting the gray scale search conditions will be displayed.

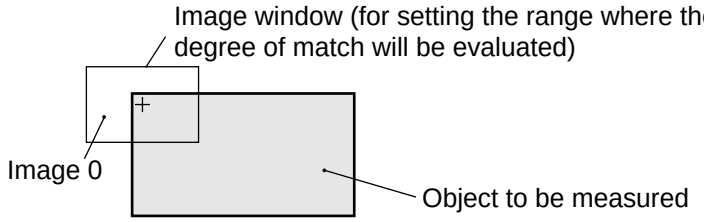


   - If the menu overlaps the image to be measured, so that further image setting is hindered, press the ESC key. Only item ① will be displayed.

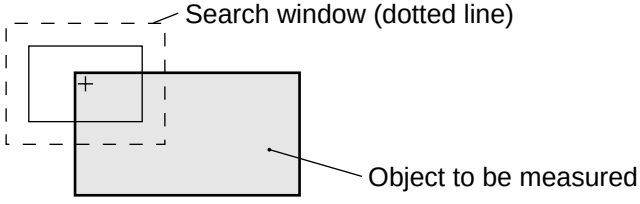
2. Move the cursor to ② REF IMAGE (MDL0) (reference image) with the up and down keys, and press the SET key.
3. Create an image window (solid line) for use as the reference image.
   - Move the cursor to MOVE, UP.L or LO.R with the left and right keys, and press the SET key. Then, position the window.

MOVE	The white rectangle is moved using the up, down, right or left keys (4 pixels at a time).
UP.L	The upper left corner is moved using the up, down, right or left keys (4 pixels at a time).
LO.R	The lower right corner is moved using the up, down, right or left keys (4 pixels at a time).

   When the position is correct, press the SET key.



   - After the image window position has been defined, move the cursor to REG. (register) with the left and right keys, and press the SET key.
   - Move the cursor to DISP (display) with the left and right keys, and press the SET key. Then, the stored image will be displayed in the lower right corner of the screen. After checking the image, press the ESC key.
4. Press the ESC key and move the cursor to ③ SEARCH AREA (search window). Then, press the SET key.
5. Create a search window (dotted line) to be used as the search area.
   - The search area is the area within which the new image will be searched for a match with the image stored in step 2 and 3. The gray scale search function performes the search operation. (see "Glossary").
   - The procedure for defining the search area is the same as in step 3.



   - After defining the search window size and position, press the ESC key.

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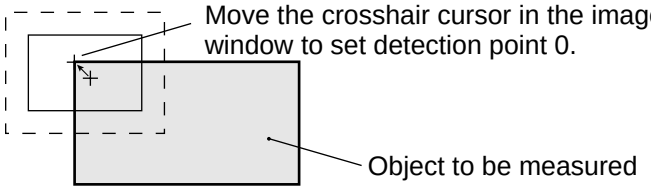
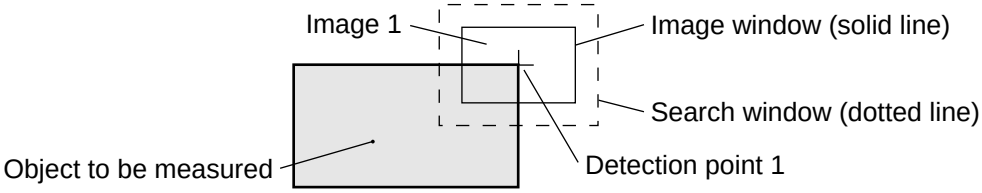
6. Move the cursor to ④ DTECT COORD with the up and down keys, and press the SET key. (If the crosshair cursor does not need to be moved, proceed to step 9.)
   - Move the cursor to "FREE" with the left and right keys, and press the SET key. Move the crosshair cursor to the detection point 0 with the up, down, left and right keys (in units of 1 pixel).



   - After defining the crosshair cursor position, press the SET key and ESC key.
7. Move the cursor to ⑫ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] (measurement condition) menu.

(8) Operation for gray scale search matching setting (setting the image 1)

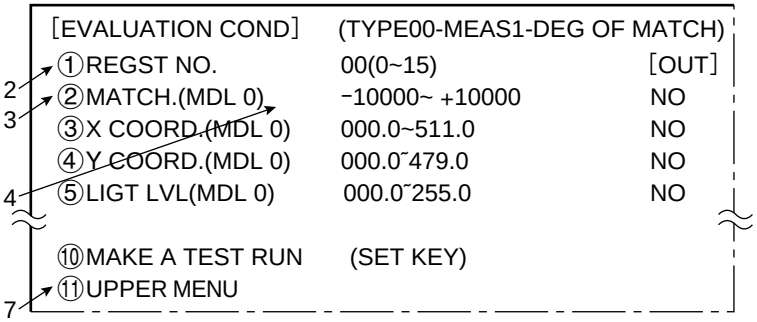
1. On the [MEASURING COND] (measurement condition) menu, move the cursor to ① REGST NO. (register number) with the up and down keys, and press the SET key.
2. Enter the number "01" with the up and down keys, move the cursor to YES with the left and right keys, and press the SET key.
3. Move the cursor to ③ MODEL 0 POSITION (model 0, positioning) with the up and down keys, and press the SET key. Move the cursor to SEARCH (enable search) with the left and right keys, and press the SET key.
4. Move the cursor to ⑤ EVALUATE CRITERIA (criteria conditions) with the up and down keys, and press the SET key.
   ⇨ The gray scale search matching setting menu, image window, and search window, will be displayed.
5. Create a reference image, search area and detection point 1 for image 1, the same as you did when creating them in item (7).



6. Move the cursor to ⑫ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] (measurement conditions) menu.
7. On the [MEASURING COND] (measurement conditions) menu, move the cursor to ⑥ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (type: 00, measurement: 1) menu.

(9) Operation on the [EVALUATION COND] menu

1. Move the cursor to ⑦ EVALUATION COND (evaluation condition) with the up and down keys, and press the SET key.
   ⇨ The [EVALUATION COND] menu will be displayed.



2. Move the cursor to ① REGST NO. (register number) with the up and down keys, and press the SET key. Enter the number 00 with the up and down keys, and press the SET key.
3. Move the cursor to ② MATCH.(MDL0) (degree of match, model 0) with the up and down keys, and press the SET key.

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4. Move the cursor to the lower limit position with the left and right keys, and press the SET key.
   - Select a digit with the left and right keys, and then set the value to +09000 with the up and down keys. (Criteria for a successful match: 90.00% to 100.00%)

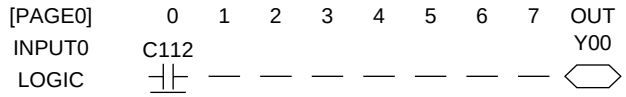
     ②MATCH (MDL 0) +09000~+10000

   - After defining the lower limit, press the SET key and ESC key.
5. Move the cursor to ① REGST NO. (register number) with the up and down keys, and press the SET key. Enter the number "01" with the up and down keys, and press the SET key.
6. Move the criteria for a successful match (90.00% to 100.00%) for registration No.01, the same as you did in steps 3 and 4.
7. Move the cursor to ⑪ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (type: 00, measurement: 1) menu.
8. Press the ESC key.
   ⇨ The screen will return to the [OBJECT TYPE COND] (conditions of object type) menu.

(10) Setting the final evaluation output condition

This setting is used to output the result of the final evaluation externally (see the following page).

- The final evaluation result is always output to the auxiliary relay C112. When the final evaluation result is OK, C112 is ON, and when the result is NG, it is OFF. The result of final evaluation can be externally output by using the auxiliary relay C112.
- The setting procedures are the same as described in item (9) in section 3-2 "Position measurement."



(11) Returning to the MAIN OPS MENU

1. Press the ESC key.
   ⇨ The screen will return to the [SYSTEM SETUP] menu.
   - Move the cursor to ⑨ SAVE IN FLASH MEM (save data in flash memory) or ⑩ OPERATIONS with the up and down keys, and press the SET key.
     ⇨ The following message will be displayed on the upper part of the screen.

     DATA SAVE? (Do you want to save the data ?) (YES=[MOVE]/NO=[ESC])

   - Press the SET key.
     ⇨ The data saving operation will start, and the progress will be displayed on the bottom of the screen.

     SAVING
     REFERENCE IMAGE ■■■■□□□□
     SYSTEM I/O □
     MEAS CONDITIONS □

     When the data has been saved in the IV-S20 flash memory, the display will change from "SAVING" to "SAVING COMPLETE"

     Note:
     · If the ESC key is pressed, the settings you entered will not be saved in the IV-S20 flash memory. In this case, if the power to the IV-S20 main husing is turned OFF, or if the type No. is changed, the settings will be deleted.

2. Press the ESC key.
   ⇨ The screen will return to the MAIN OPS MENU.
   - If the cursor was moved to ⑩ OPERATIONS in step 1, the screen will automatically return to the MAIN OPS MENU.

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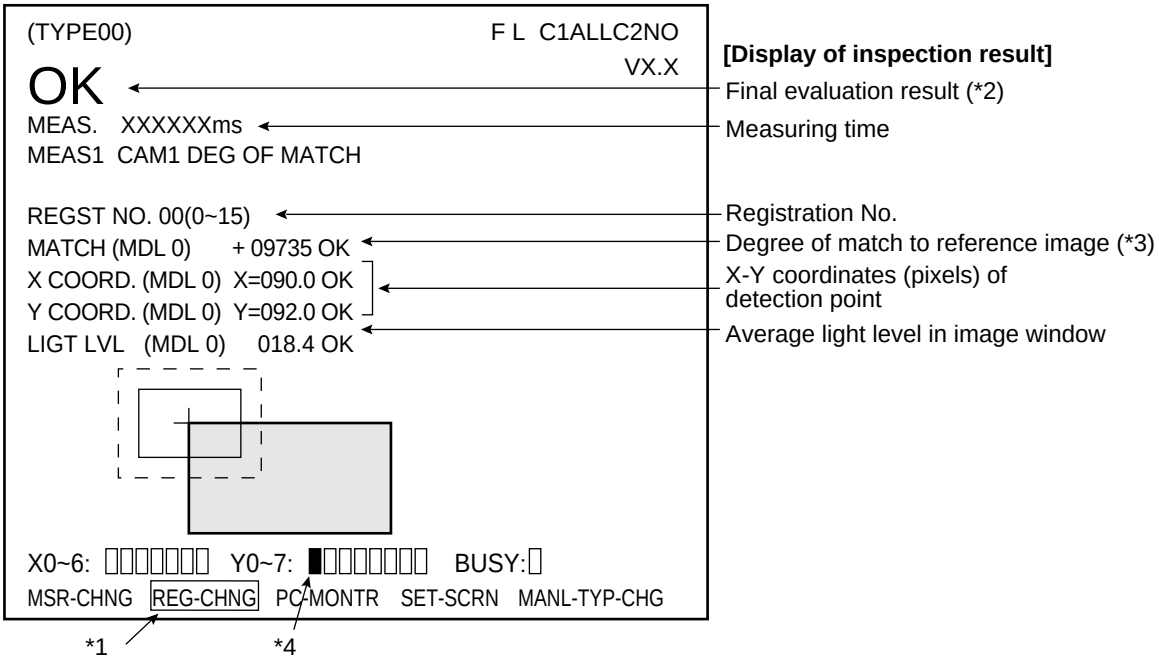
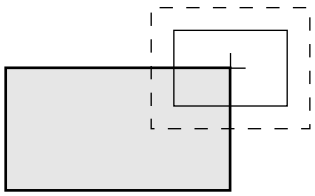
(12) Degree of match inspection

Press the TRG/BRT key, and the inspection result for image 0 (registration No. 00) will be displayed.



*1 Move the cursor to "REG-CHNG" (registration change) with the left and right keys, and press the up or down key. The result of evaluating image 1 (registration No. 01) will be displayed.



*2 The final evaluation result will be displayed as "OK" in the upper left corner of the screen when all of the items have been evaluated as acceptable. If there is a single unacceptable item, "NG" will be displayed.

*3 "MATCH:+09735" means that the degree of match (percentage of pixels that match) between an object image and the reference image is 97.35%.

[The acceptance and rejection criteria based on the degree of match]

In order to evaluate acceptability based on the degree of match, first an image of a good specimen is stored for reference. Then, an image of defective specimen is compared for degree of match. Finally an image of another good specimen is compared. These comparisons establish the degree of match to be used for setting the limits used for working comparisons.

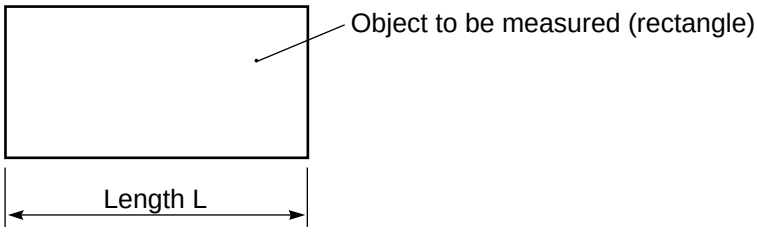
For example, the degree of match for a non-defective object is 90% or more and that for a defective object is 70% or less, then the threshold value for degree of match can be set to approx. 85%. This allows the evaluation acceptability to be made.

*4 When the final evaluation result is OK, Y0 is turned ON, and a filled box ■ is displayed. (When the result is NG, an empty box □ is displayed.)

When the auxiliary relay C112 is turned ON, Y0 is turned ON according to the condition set in step (10) for final evaluation output.

3-4 Distance measurement

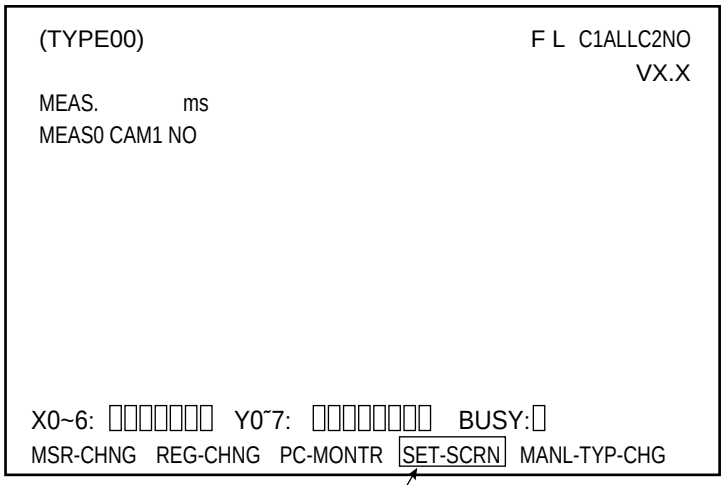
Below is an example of the operation for determining the length L of a target object.



3

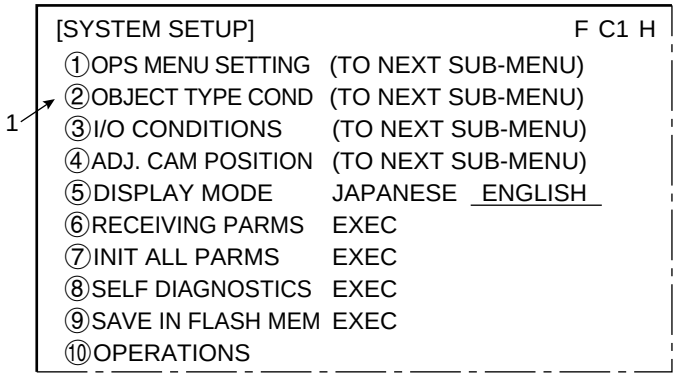
(1) Operation on the MAIN OPS MENU (after initialize all conditions)

MAIN OPS MENU



1. Move the cursor to [SET-SCRN] with the left and right keys, and press the SET key.
   ⇨ The [SYSTEM SETUP] menu will be displayed.

(2) Operation on the [SYSTEM SETUP] menu



1. Move the cursor to ②OBJECT TYPE COND (conditions of object type) with the up and down keys, and press the SET key.
   ⇨ The [OBJECT TYPE COND] menu will be displayed.

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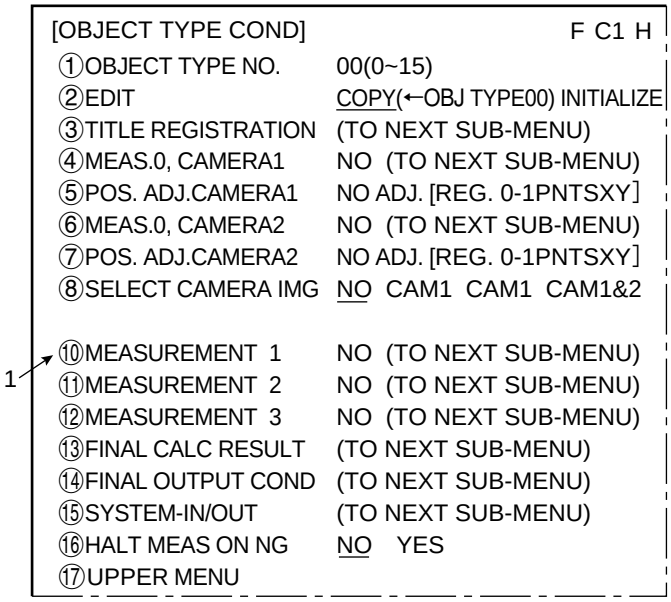
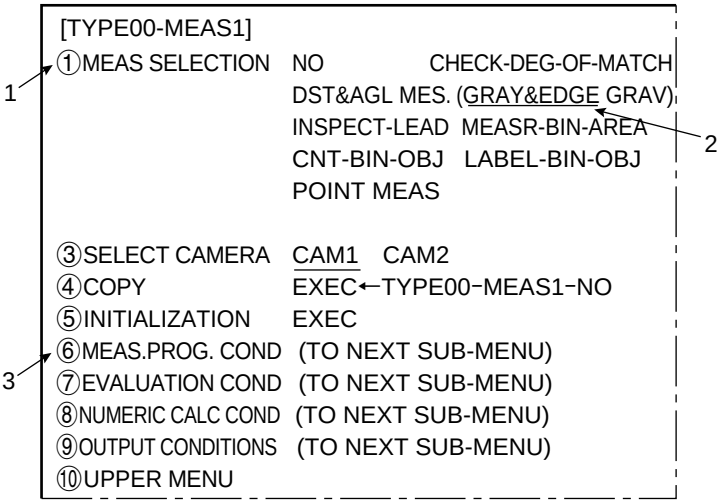
(3) Operation on the [OBJECT TYPE COND] (conditions of object type) menu



1. Move the cursor to ⑩MEASUREMENT 1 with the up and down keys, and press the SET key.
   ⇨ The [TYPE00-MEAS1] (type: 00, measurement: 1) menu will be displayed.

(4) Operation on the [TYPE00-MEAS1] menu



1. Move the cursor to ①MEAS SELECTION (select measurement) with the up and down keys, and press the SET key.
2. Move the cursor to DST&AGL MES. (GRAY&EDGE) (distance and angle measurement, gray scale and adge) with the left and right keys, and press the SET key.
3. Move the cursor to ⑥MES.PRG.COND (conditions of measurement program) with the up and down keys, and press the SET key.
   ⇨ The [MEASURING COND] (measurement condition) menu will be displayed.

Continued on the following page

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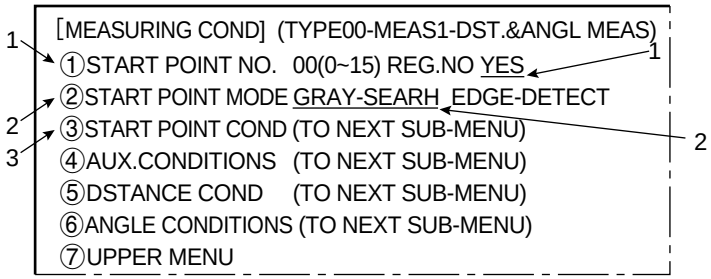
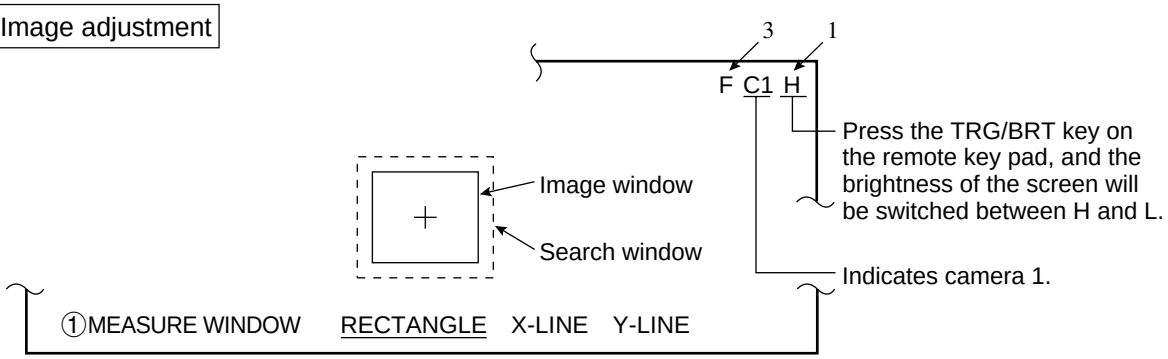
(5) Operation on [MEASURING COND] menu

1. Move the cursor to ①START POINT NO. (starting point number) with the up and down keys, and press the SET key. Enter the number "00," set the cursor to YES with the left and right keys, and press the SET key.
   ⇨ Items ②to ⑥will be displayed.



2. Move the cursor to ②START POINT MODE (starting point mode) with the up and down keys, and press the SET key. Move the cursor to GRAY-SEARH (gray scale search) with the left and right keys, and press the SET key.
3. Move the cursor to ③START POINT COND (start point conditions) with the up and down keys, and press the SET key.
   ⇨ The gray scale search matching setting menu, image window, and search window will be displayed.

(6) Image adjustment



1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
   - If the image is so bright that the menu is hard to see, press the TRG/BRT key to reduce the brightness of the image. Then, the brightness indicator in the upper right corner of the screen will change from H to L.
2. Adjust the focus and aperture (iris) of the camera lens (see page 5-1), so that the object to be measured is clear and easily distinguished.
3. Press the SEL key to enter the freeze image mode.
   ⇨ The indicator in the upper right corner of the screen will change from T (through) to F (freeze).
   - To store an image for the following gray scale search matching setting operations, the screen must be in the freeze image mode. (See section 7-2 "Screen specifications" for details about the through/freeze mode.)

Continued on the following page

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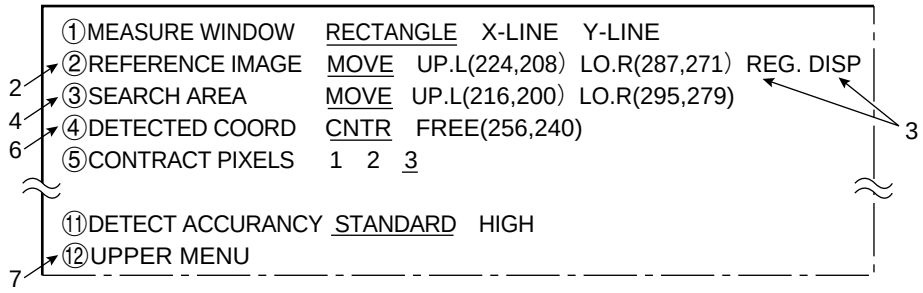
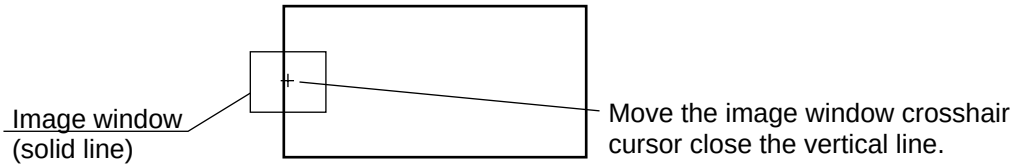
(7) Operation for the gray scale search matching setting (setting the starting point 00)

1. Press the ESC key, and all menus used for the gray scale searh matching setting) will be displayed.

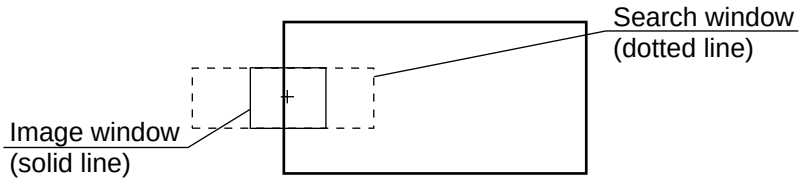


   - If the menu overlaps the image to be measured so that further image settings is hindered, press the ESC key. Only item ①will be displayed.
2. Move the cursor to ②REFERENCE IMAGE (reference image) with the up and down keys, and press the SET key.
3. Create an image window (solid line) for reference image.
   - Move the cursor to MOVE, UP.L, or LO.R with the left and right keys, and press the SET key. Then, position the window.
     When the position is correct, press the SET key.

MOVE	The white rectangle is moved using the up, down, right or left keys (4 pixels at a time).
UP.L	The upper left corner is moved using the up, down, right or left keys (4 pixels at a time).
LO.R	The lower right corner is moved using the up, down, right or left keys (4 pixels at a time).



   - After the image window position has been defined, move the cursor to REG. (registration) with the left and right keys, and press the SET key.
   - Move the cursor to DISP (display) with the left and right keys, and press the SET key. Then, the stored image will be displayed in the lower right corner of the screen. After checking the image, press the ESC key.
4. Press the ESC key, move the cursor to ③SEARCH AREA (search window) with the up and down keys, and press the SET key.
5. Set a search window (dotted line) to be used as a search area.
   - The search area is the area within which the new image will be searched for a match with the image stored in step 3. (see "Glossary").
   - The procedure for defining the search area is the same as in step 3.



     Create a search window with the same height as that of the image window registered in step 3 (because the image window will be moved only in the X-axis direction).
   - After defining the search window size and position, press the ESC key.

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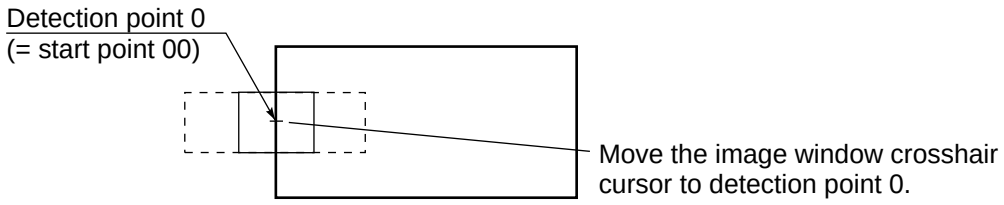
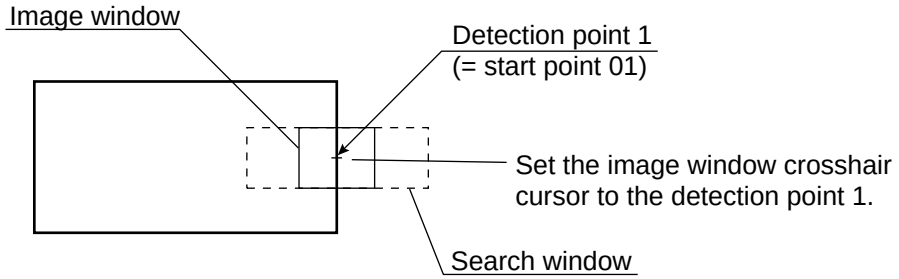
6. Move the cursor to ④DETECTED COORD (position to detect) with the up and down keys, and press the SET key. (If the crosshair cursor does not need to be moved, proceed to step 7.)
   - Move the cursor to FREE with the left and right keys, and press the SET key. Move the crosshair cursor to detection point 0 with the up, down, left and right keys (in units of 1 pixel).



   - After defining the crosshair cursor position, press the SET key and ESC key.
7. Move the cursor to ⑫UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] (measurement condition) menu.

(8) Operation for gray scale search matching setting (setting the starting point 01)

1. On the [MEASURING COND] (measurement condition) menu, move the cursor to ①START POINT NO. (start point number) with the up and down keys, and press the SET key.
2. Move the number to "01" with the up and down keys, move the cursor to YES with the left and right keys, and press the SET key.
3. Move the cursor to ③START POINT COND (start point condition) with the up and down keys, and press the SET key.
   ⇨ The gray scale search matching setting menu, image window and search window will be displayed.
4. Move a reference image and search area for the detection point 1 to be registered as the start point 01 in the same manner as in steps (7)-2 to 6.



   Set the detection point 1 on the same level as the detection point 0 (start point 00) on the Y axis to measure the horizontal distance. The coordinates are displayed on the screen.
5. Move the cursor to ⑫UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] menu.

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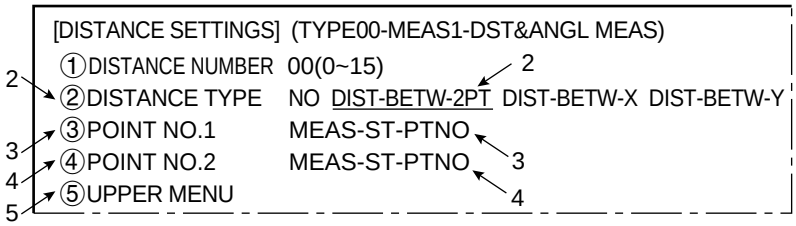
(9) Operation on the DISTANCE SETTINGS (distance conditions) menu (setting the distance No.00)

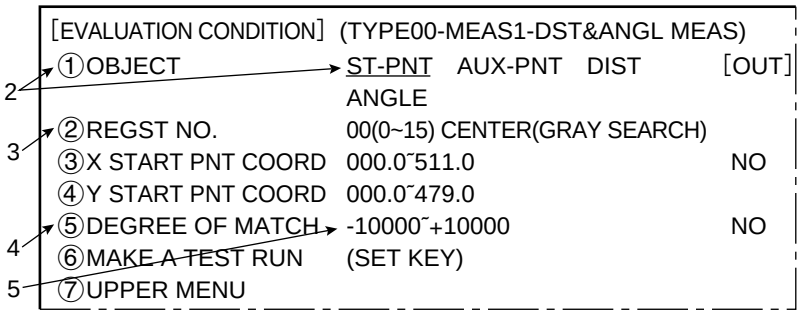
1. On the [MEASURING COND] (measurement condition) menu, move the cursor to ⑤ DSTANCE COND (distance selection) with the up and down keys, and press the SET key.
   ⇨ The [DISTANCE SETTINGS] menu will be displayed.
2. Move the cursor to ②DISTANCE TYPE (distance selection) with the up and down keys, and press the SET key. Move the cursor to DISTANCE-BETWEEN-2PNTS (between two points) with the left and right keys, and press the SET key.
   ⇨ Items ③and ④will be displayed.



3. Move the cursor to ③POINT NO.1 (point 1) with the up and down keys, and press the SET key. Change the measurement start point to "00" with the up and down keys, and press the SET key.
4. Move the cursor to ④POINT NO.2 (point 2) with the up and down keys, and press the SET key. Change the measurement start point to "01" with the up and down keys, and press the SET key.
5. Move the cursor to ⑤UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] (measurement conditions) menu.
6. Press the ESC key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (measurement conditions) menu.

(10) Operation on the [EVALUATION CONDITION] (evaluation conditions) menu

1. Move the cursor to ⑦EVALUATION CONDITION with the up and down keys, and press the SET key.
   ⇨ The EVALUATION CONDITION menu will be displayed.



2. Move the cursor to ①OBJECT with the up and down keys, and press the SET key. Move the cursor to ST-PNT (starting point) with the up and down keys, and press the SET key.
3. Move the cursor to ②REGST NO. (registration) with the up and down keys, and press the SET key. Enter the number "00," and press the SET key.
4. Move the cursor to ⑤DEGREE OF MATCH with the up and down keys and press the SET key.
5. Move the cursor to the lower limit position with the left and right keys, and press the SET key.
   - Select the digit to change with the left and right keys, and then set the value to +09000 with the up and down keys.
     (Criteria for a successful match: 90.00% to 100.00%)

     ⑤ DEGREE OF MATCH. : +09000 ~ +10000

   - After defining the lower limit, press the SET key and ESC key.
6. Move the cursor to ②REGST NO. (register number) with the up and down keys, and press the SET key. Enter the number "01" with the up and down keys, and press the SET key.
7. Move the criteria for successfull match (90.00% to 100.00%) for the registration No.01 in the same manner as in steps 4 and 5.

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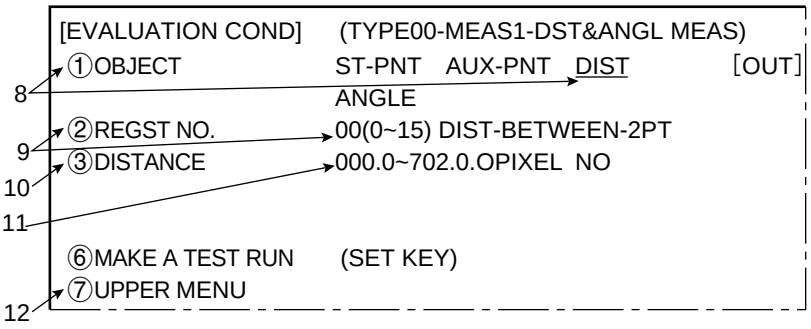
8. Move the cursor to ①OBJECT with the up and down keys, and press the SET key. Move the cursor to DIST (display) with the left and right keys, and press the SET key.



9. Move the cursor to ②REGST NO. (register number) with the up and down keys, and press the SET key. Enter the number "00," and press the SET key.
10. Move the cursor to ③DISTANCE (distance selection) with the up and down keys, and press the SET key.
11. Move the cursor to the lower limit or upper limit, and press the SET key.
    - Select the digits with the left and right keys, and enter the value 280.0 to 300.0 with the up and down keys.
      (Criteria for distance judgement: 280.0 to 300.0 pixels)

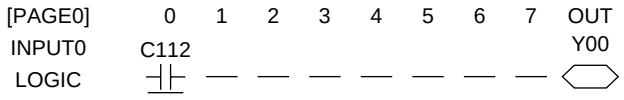
      ③DISTANCE : 280.0~300.0.OPIXEL

    - After defining the lower and upper limits, press the SET key and ESC key.
12. Move the cursor to ⑦UPPER MENU with the up and down keys, and press the SET key.
    ⇨ The screen will return to the [TYPE00-MEAS1] (type: 00, measurement: 1) menu.
13. Press the ESC key.
    ⇨ The screen will return to the [OBJECT TYPE COND] (conditions of object type) menu.

(11) Setting the final evaluation output condition

This setting is used to output the result of the final evaluation externally (see page 3-30).

- The final evaluation result is always output to the auxiliary relay C112. When the final evaluation result is OK, C112 is ON, and when the result is NG, it is OFF. The result of final evaluation can be externally output by using the auxiliary relay C112.
- The setting procedures are the same as described in item (9) in section 3-2 "Position measurement."



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(12) Returning to the MAIN OPS MENU

1. Press the ESC key.
   ⇨ The screen will return to the [SYSTEM SETUP] menu.
   - Move the cursor to ⑨SAVE IN FLASH MEM (save data in flash memory) or ⑩ OPERATIONS with the up and down keys, and press the SET key.
     ⇨ The following message will be displayed on the upper part of the screen.

     DATA SAVE? (Do you want to save data ?) (YES=[MOVE]/NO=[ESC])

   - Press the SET key.
     ⇨ The data saving operation will start, and the progress will be displayed on the bottom of the screen.

     SAVING
     REFERENCE IMAGE ■■■■□□□□
     SYSTEM I/O □
     MEAS CONDITIONS □

     When the data has been saved in the IV-S20 flash memory, the display will change from "SAVING" to "SAVING COMPLETE."

     Note:
     · If the ESC key is pressed, the settings you entered will not be saved in the IV-S20 flash memory. In this case, if the power to the IV-S20 main housing is turned OFF, or if the type No. is changed, the settings will be deleted.

2. Press the ESC key.
   ⇨ The screen will return to the [MAIN OPS NENU].
   - If the cursor is moved to ⑩OPERATIONS in step 1 above, the screen will automatically return to the MAIN OPS MENU.

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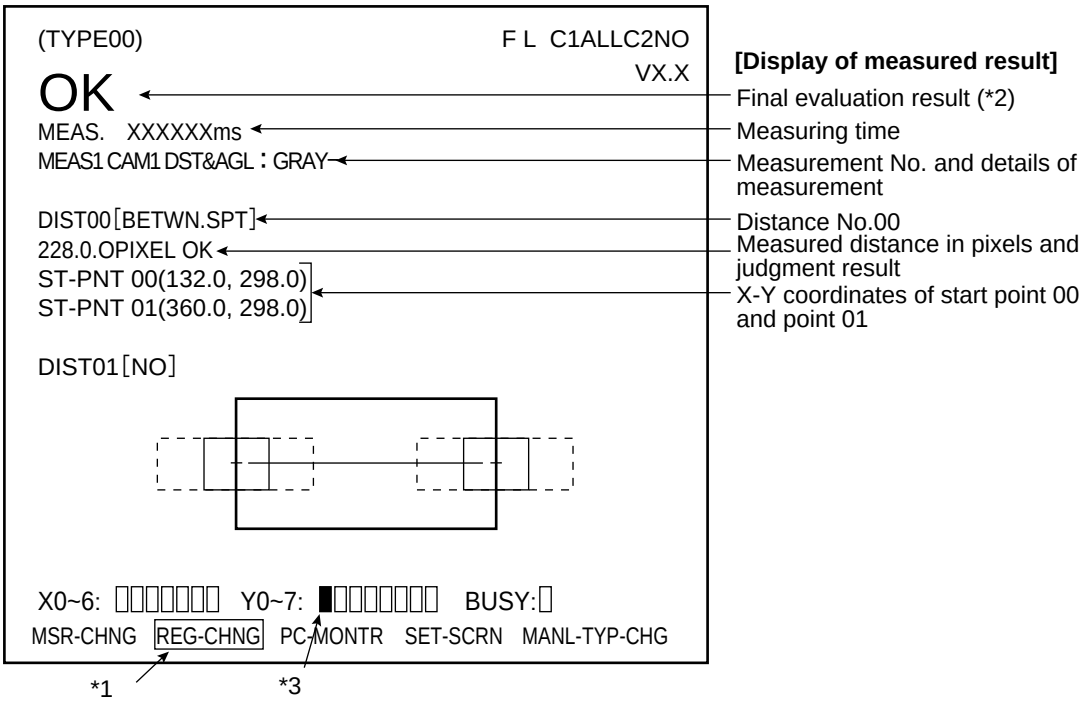
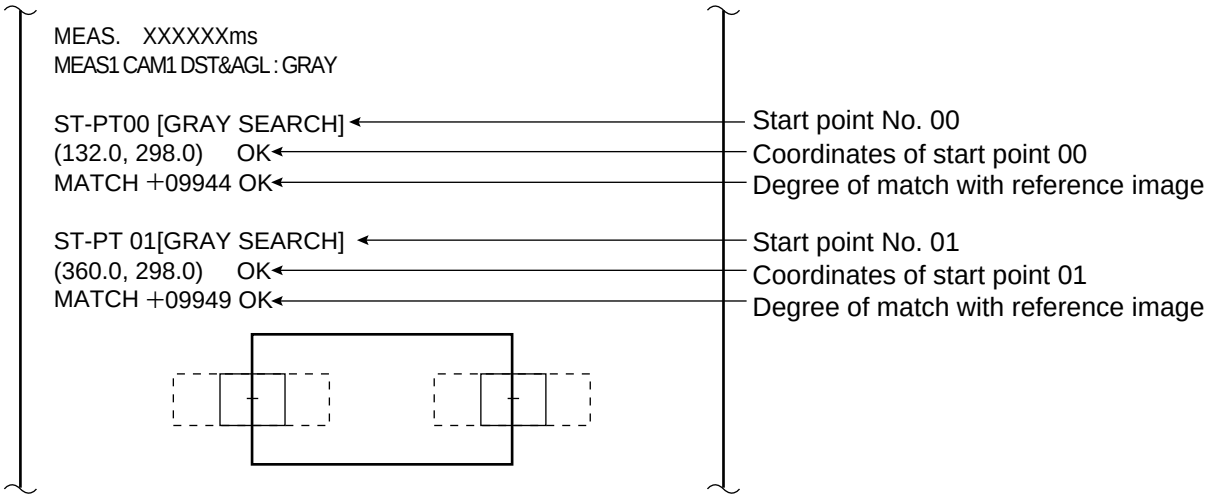
(13) Measuring the distance

Press the TRG/BRT key, and the distance between the specified detection point 0 (start point 00) and detection point 1 (start point 01) and the coordinates of these points will be displayed in pixel.



*1 Move the cursor to REG-CHNG (registration change) with the left and right keys, and press the up or down key. The coordinates of the start point 00 and point 01 and the degree of match with the reference image will be displayed.



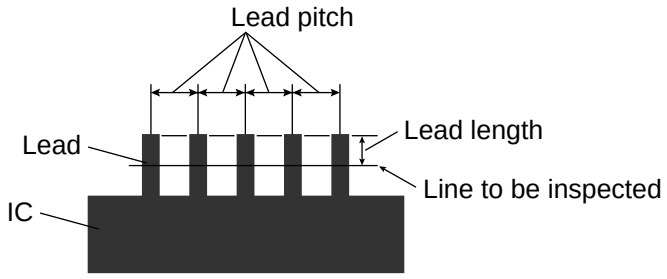
- MATCH:+09944 means that the degree of match (percentage of pixels that match) measurement image and the reference image is 99.44%.

*2 The final evaluation result will be displayed as "OK" in the upper left corner of the screen when all of the items have been evaluated as acceptable. If there is a single unacceptable item, "NG" will be displayed.

*3 When the final evaluation result is OK, Y0 is turned ON, and a filled box ■ is displayed. (When the result is NG, an empty box □ is displayed.)
When the auxiliary relay C112 is turned ON, Y0 is turned ON according to the condition set in step (11) for final evaluation output.

3-5 Lead inspection

An example of the operations used to inspect IC lead pitches is given below.



(1) Operation on the MAIN OPS MENU (after initialize all conditions)

MAIN OPS MENU

```
(TYPE00)                                   F L  C1ALLC2NO
                                                    VX.X
MESR.          ms
MESR0 CAM1 NO




X0~6: □□□□□□□  Y0~7: □□□□□□□□  BUSY:□
MSR-CHNG  REG-CHNG  PC-MONTR  SET-SCRN  MANL-TYP-CHG
                              1
```

1. Move the cursor to [SET-SCRN] with the right and left keys, and press the SET key.
   ⇨ The [SYSTEM SETUP] menu will be displayed.

(2) Operation on the [SYSTEM SETUP] menu

```
[SYSTEM SETUP]                                F C1 H
①OPS MENU SETTING   (TO NEXT SUB-MENU)
②OBJECT TYPE COND   (TO NEXT SUB-MENU)
③I/O CONDITIONS     (TO NEXT SUB-MENU)
④ADJ. CAM POSITION  (TO NEXT SUB-MENU)
⑤DISPLAY MODE       JAPANESE  ENGLISH
⑥RECEIVING PARMS    EXEC
⑦INIT ALL PARMS     EXEC
⑧SELF DIAGNOSTICS   EXEC
⑨SAVE IN FLASH MEM  EXEC
⑩OPERATIONS
1
```

1. Move the cursor to ② OBJECT TYPE COND (conditions of object type) with the up and down keys, and press the SET key.
   ⇨ The [OBJECT TYPE COND] menu will be displayed.

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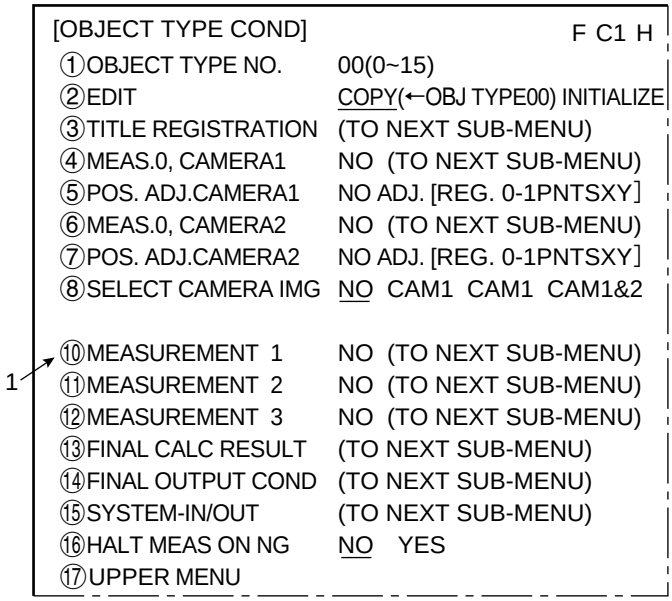
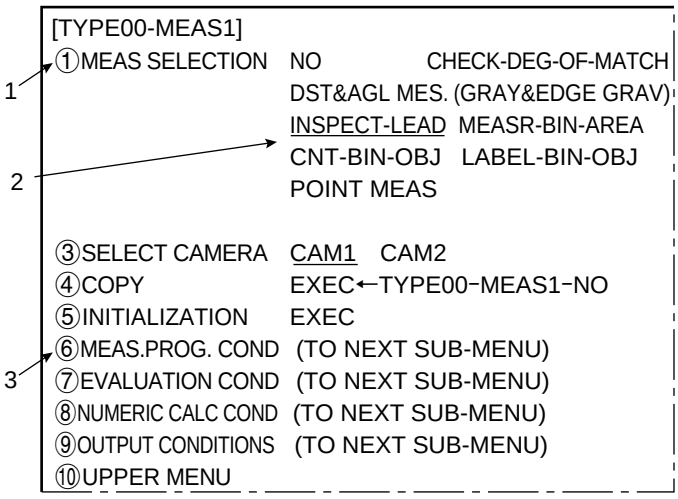
(3) Operation on the [OBJECT TYPE COND] (conditions of object type) menu



1. Move the cursor to ⑩ MEASUREMENT 1 with the up and down keys, and press the SET key.
   ⇨ The [TYPE00-MEAS1] (type: 00, measurement: 1) menu will be displayed.

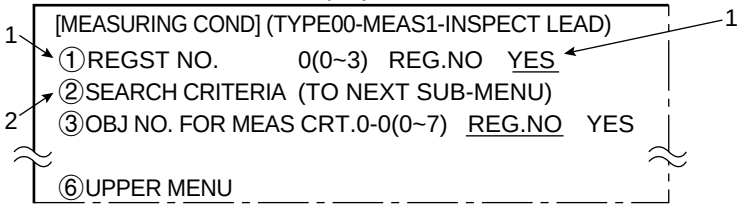
(4) Operation on the [TYPE00-MEAS1] menu



1. Move the cursor to ① MEAS SELECTION (selection of measurement) with the up and down keys, and press the SET key.
2. Move the cursor to INSPECT-LEAD (lead inspection) with the right and left keys, and press the SET key.
3. Move the cursor to ⑥ MES.PRG.COND (conditions of measurement program) with the up and down keys, and press the SET key.
   ⇨ The [MEASURING COND] (measurement condition) menu will be displayed.

(5) Operation on the [MEASURING COND] menu

1. Move the cursor to ① REGST NO. (registration number) with the up and down keys, and press the SET key. Move the cursor to YES with the right and left keys, and press the SET key.
   ⇨ The item ② will be displayed.



2. Move the cursor to ② SEARCH CRITERIA (criteria search condition) with the up and down keys, and press the SET key.
   ⇨ The gray scale search matching setting menu, image window, and search window will be displayed.

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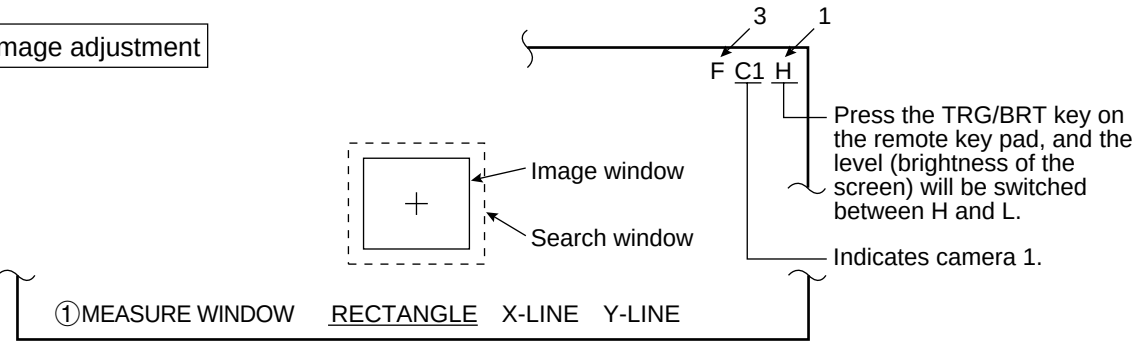
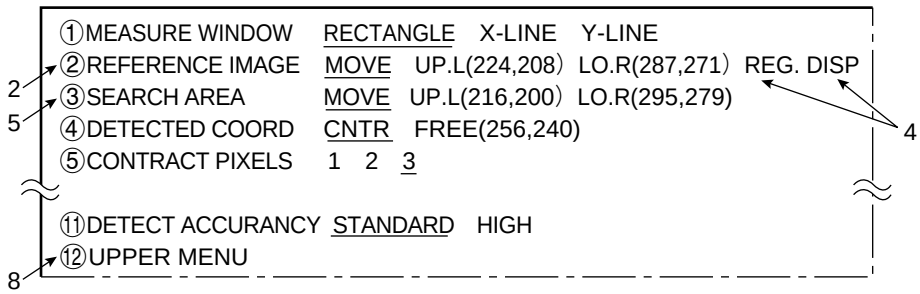
(6) Image adjustment



1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
   - If the image is so bright that the menu is hard to see, press the TRG/BRT key to reduce the brightness of the image. Then, the brightness indicator in the upper right corner of the screen will change from H to L.
2. Adjust the focus and aperture (iris) of the camera lens (see p.5-1), so that the object to be measured is clear and easily distinguished.
3. Press the SEL key to enter the freeze image mode.
   ⇨ The indicator in the upper right corner of the screen will change from T (through) to F (freeze).
   - To store an image for the following gray scale search matching setting operations, the screen must be in the freeze image mode. (See section 7-2 "Screen specifications" for details about the through/freeze mode.)

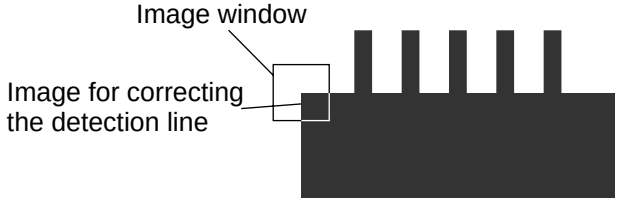
(7) Operation for the gray scale search matching setting

1. Press the ESC key, and all of the menus used for setting the gray scale search conditions will be displayed.



   · If the menu overlaps the image to be measured so that further image setting is hindered, press the ESC key. Only item ① will be displayed.
2. Move the cursor to ② REFERENCE IMAGE using the up and down keys, and press the SET key.
3. Surround the image for correction of detection line in the image window (solid line).
   - Move the cursor to MOVE, UP.L or LO.R with the right and left keys, and press the SET key. Then, position the window.
     When the position is correct, press the SET key.

MOVE	The white rectangle is moved using the up, down, right or left key (4 pixels at a time).
UP.L	The upper left corner is moved using the up, down, right or left key (4 pixels at a time).
LO.R	The lower right corner is moved using the up, down, right or left key (4 pixels at a time).



4. After the image window position has been defined, move the cursor to REG. (registration) with the right and left keys, and press the SET key.
   - Move the cursor to DISP (display) with the left and right keys, and press the SET key. Then, the stored image will be displayed in the lower right corner of the screen. After checking the image, press the ESC key.

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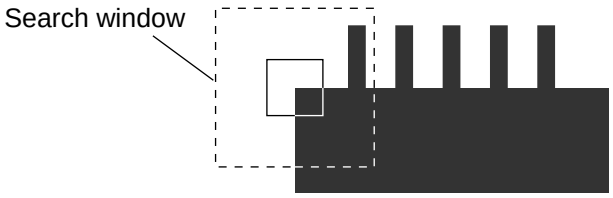
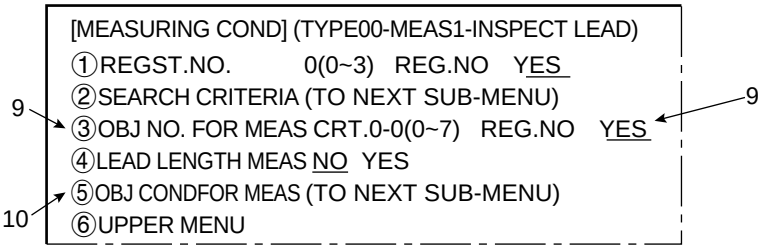
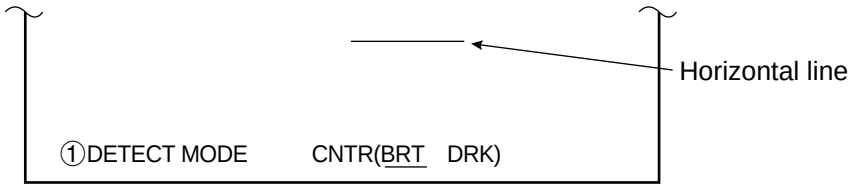
5. Press the ESC key, move the cursor to ③ SEARCH AREA (search window) with the up and down keys, and press the SET key.
6. Create a search window (dotted line) to be used as the search area.
   - The search area is the area within which the new image will be searched for a match with the image stored in step 3. The gray scale search function performs the search operation (see "Glossary").
   - The procedure for defining the search area is the same as in step 3.



7. After defining the search window size and position, press the ESC key.
8. Move the cursor to ⑫ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] (measurement condition) menu.
9. On the [MEASURING COND] menu, move the cursor to ③ OBJ NO.FOR MEAS with the up and down keys, and press the SET key. Move the cursor to "YES" with the right and left keys, and press the SET key.
   ⇨ The items ④ and ⑤ will be displayed.



10. Move the cursor to ⑤ OBJ CONDFOR MEAS (object conditions) with the up and down keys, and press the SET key.
    ⇨ The object condition setting menu and a horizontal line will be displayed.



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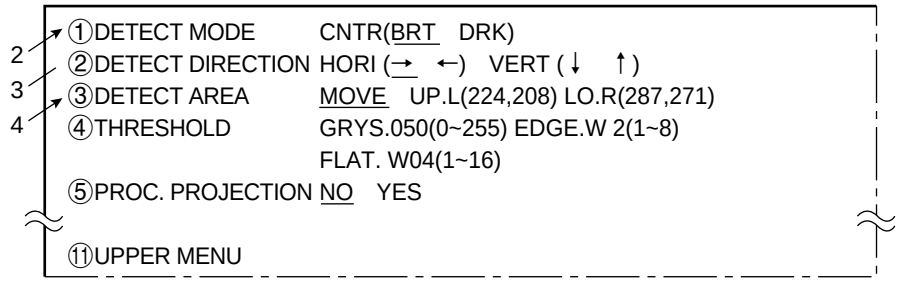
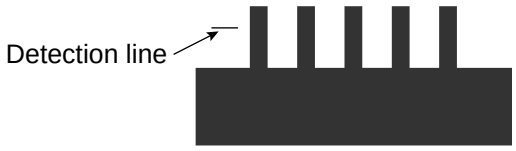
(8) Operation for setting the object conditions

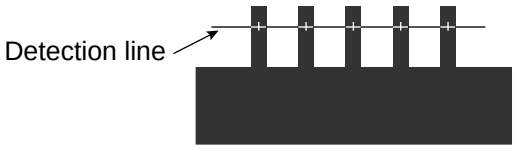
1. Press the ESC key, and all of the menus used for setting the edge detection condition will be displayed.



2. Move the cursor to ① DETECT MODE (detection mode) with the up and down keys, and press the SET key. Move the cursor to CNTR (DRK) (center, dark) with the left and right keys, and press the SET key.
3. Move the cursor to ② DETECT DIRECTION (detection direction) with the up and down keys, and press the SET key. Move the cursor to HORI (horizontal) (➡) with the left and right keys, and press the SET key.
4. Move the cursor to ③ DETECT AREA (detection window) with the up and down keys, and press the SET key. Move the cursor to MOVE with the left and right keys, and press the SET key.
   - Move the detection line to the left of the lead to be measured with the up, down, left and right keys.



   - When the position of the line is correct, press the SET key.
5. Move the cursor to LO.R (lower right) with the left and right keys, and press the SET key.
   - Extend the detection line to the right lead with the right key.



   - When the position is correct, press the SET key and ESC key.
6. Move the cursor to ⑪UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [MEASURING COND] (measurement conditions) menu.
7. Press the ESC key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (type: 00, measurement: 1) menu.

Continued on the following page

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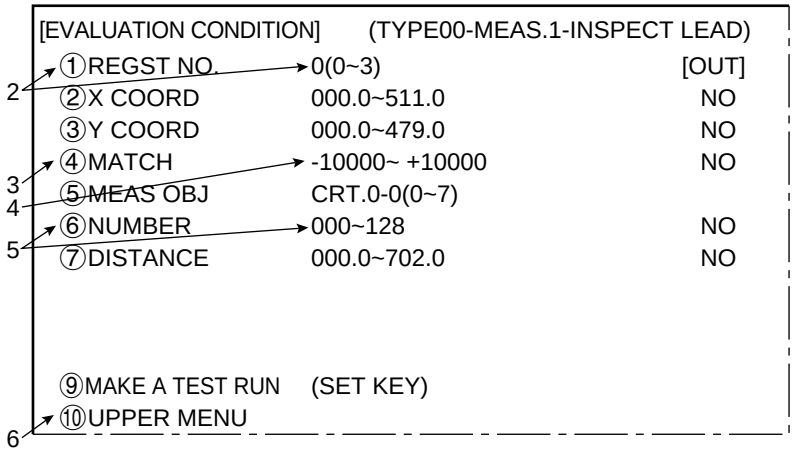
(9) Operation on the [EVALUATION CONDITION] (evaluation condition) menu

1. Move the cursor to ⑦ EVALUATION CONDITION with the up and down keys, and press the SET key.
   ⇨ The [EVALUATION CONDITION] menu will be displayed.



2. Move the cursor to ① REGST NO. (registration number) with the up and down keys, and press the SET key. Enter the number "0" with the up and down keys, and press the SET key.
3. Move the cursor to ④ MATCH (degree of match) with the up and down keys, and press the SET key.
4. Move the cursor to the lower limit position with the right and left keys, and press the SET key.
   - Select a digit with the right and left keys, and then set the value to +09000 with the up and down keys.
     (Criteria for successful match: 90.00% to 100.00%)

     ④MATCH : +09000~ +10000

   - After defining the lower limit, press the SET key and ESC key.
5. Move the cursor to ⑥ NUMBER with the up and down keys, and press the SET key.
   - Move the cursor to the lower limit position with the right and left keys, and enter the value to "005" with the up and down keys.
   - Move the cursor to the upper limit position with the right and left keys, and enter the value to "005" with the up and down keys.

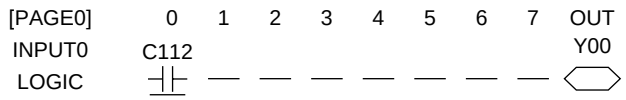
     ⑥NUMBER : 005~005

   - After defining the lower and upper limit, press the SET key.
6. Move the cursor to ⑩ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (type: 00, measurement: 1) menu.
7. Press the ESC key.
   ⇨ The screen will return to the [OBJECT TYPE COND] (conditions of object type) menu.

(10) Setting the final evaluation output condition

This setting is used to output the result of the final evaluation externally (see the following page).

- The final evaluation result is always output to the auxiliary relay C112. When the final evaluation result is OK, C112 is ON, and when the result is NG, it is OFF. The result of final evaluation can be externally output by using the auxiliary relay C112.
- The setting procedures are the same as described in item (9) in section 3-2 "Position measurement."



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(11) Returning to the MAIN OPS MENU

1. Press the ESC key.
   ⇨ The screen will return to the [SYSTEM SETUP] menu.
   - Move the cursor to ⑨ SAVE IN FLASH MEM (save data in flash memory) or ⑩ OPERATIONS with the up and down keys, and press the SET key.
     ⇨ The following message will be displayed on the upper part of the screen.

     DATA SAVE? (Do you want to save data ?) (YES=[MOVE]/NO=[ESC])

   - Press the SET key.
     ⇨ The data saving operation will start, and the progress will be displayed on the bottom of the screen.

     SAVING
     REFERENCE IMAGE ■■■■□□□□
     SYSTEM I/O □
     MEAS CONDITIONS □

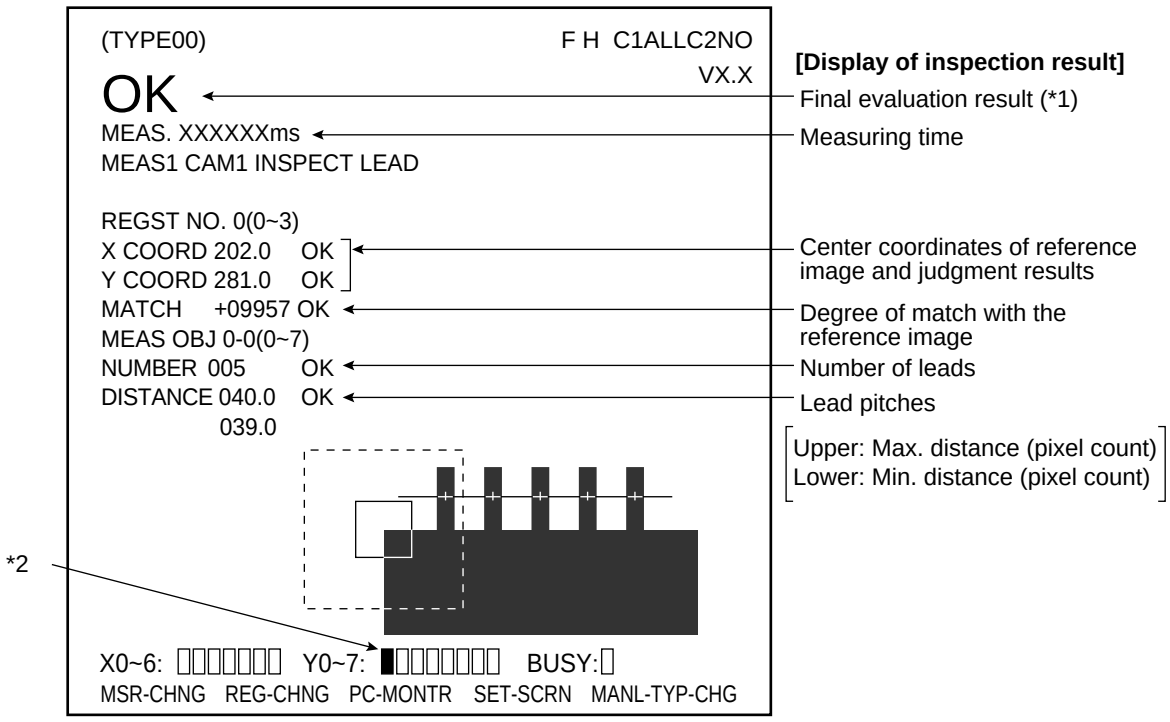
   When the data has been saved in the IV-S20 flash memory, the display will change from "SAVING" to "SAVING COMPLETE."

   Note:
   · If the ESC key is pressed, the settings you entered will not be saved in the IV-S20 flash memory. In this case, if the power to the IV-S20 main housing is turned OFF, or if the type No. is changed, the settings will be deleted.

2. Press the ESC key.
   ⇨ The screen will return to the MAIN OPS MENU.
   - If the cursor was moved to ⑩ OPERATIONS in step (11) above, the screen will automatically return to the MAIN OPS MENU.

(12) Inspecting the lead

Press the TRG/BRT key, and the number of leads, lead pitches (max. and min. distances), the center coordinates and the degree of match with the reference image will be displayed.

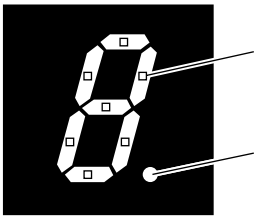


*1 The final evaluation result will be displayed as "OK" in the upper left corner of the screen when all of the items have been evaluated acceptable. If there is a single unacceptable item, "NG" will be displayed.

*2 When the final evaluation result is OK, Y0 is turned ON, and a filled box ■ is displayed. (When the result is NG, an empty box □ is displayed.)
When the auxiliary relay C112 is turned ON, Y0 is turned ON according to the condition set in step (10) for final evaluation output.

3-6 Existence inspection by point measurement

Shown below is an example of an operation for checking the existence of an object by detecting whether the points are white or not.



(7-segment display)

(1) Operation on the MAIN OPS MENU (after initialize all conditions)

MAIN OPS MENU

```
(TYPE00)                                F L  C1ALLC2NO
                                                 VX.X
MEAS.          ms
MEAS0 CAM1 NO

X0~6: □□□□□□□  Y0~7: □□□□□□□□  BUSY:□
MSR-CHNG  REG-CHNG  PC-MONTR  SET-SCRN  MANL-TYP-CHG
                              1
```

1. Move the cursor to [SET-SCRN] with the left and right keys, and press the SET key.
   ⇨ The [SYSTEM SETUP] menu will be displayed.

(2) Operation on the [SYSTEM SETUP] menu

```
[SYSTEM SETUP]                              F C1 H
①OPS MENU SETTING   (TO NEXT SUB-MENU)
②OBJECT TYPE COND   (TO NEXT SUB-MENU)
③I/O CONDITIONS     (TO NEXT SUB-MENU)
④ADJ. CAM POSITION  (TO NEXT SUB-MENU)
⑤DISPLAY MODE       JAPANESE  ENGLISH
⑥RECEIVING PARMS    EXEC
⑦INIT ALL PARMS     EXEC
⑧SELF DIAGNOSTICS   EXEC
⑨SAVE IN FLASH MEM  EXEC
⑩OPERATIONS
```

1

1. Move the cursor to ② OBJECT TYPE COND (condition of object type) with the up and down keys, and press the SET key.
   ⇨ The [OBJECT TYPE COND] menu will be displayed.

Continued on the following page

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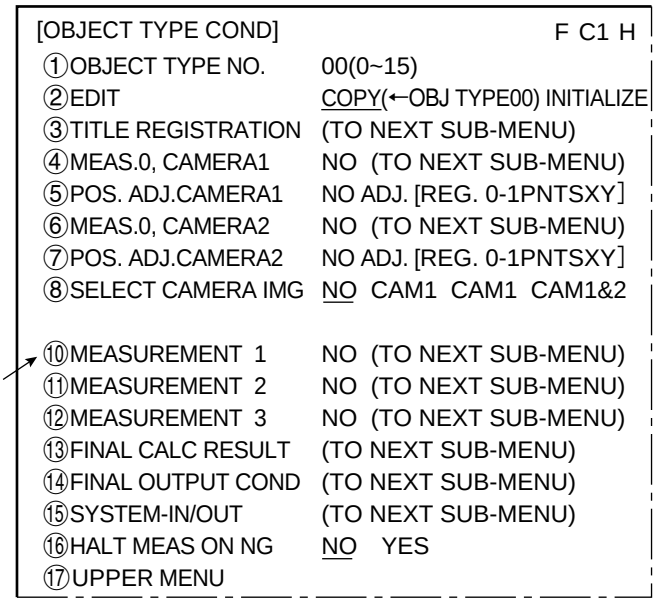
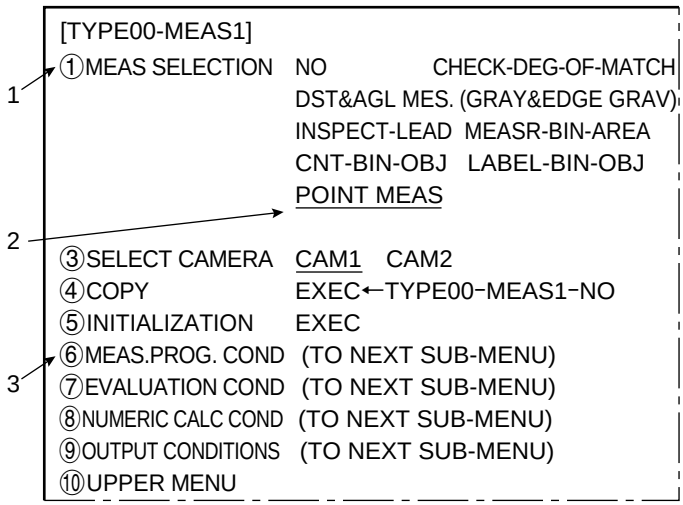
(3) Operation on the [OBJECT TYPE COND] (conditions of object type) menu



1. Move the cursor to ⑩ MEASUREMENT 1 with the up and down keys, and press the SET key.
   ⇨ The [TYPE00-MEAS1] (type: 00, measurement: 1) menu will be displayed.

(4) Operation on the [TYPE00-MEAS1] menu



1. Move the cursor to ① MEAS SELECTION (select measurement) with the up and down keys, and press the SET key.
2. Move the cursor to POINT MEAS (point measurement) with the left and right keys, and press the SET key.
3. Move the cursor to ⑥ MES.PRG.COND (conditions of measurement program) with the up and down keys, and press the SET key.
   ⇨ The [MEASURING COND] (measurement condition) menu will be displayed.

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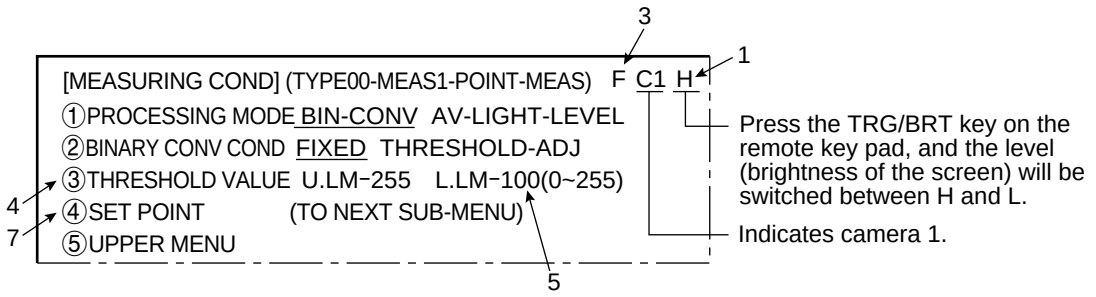
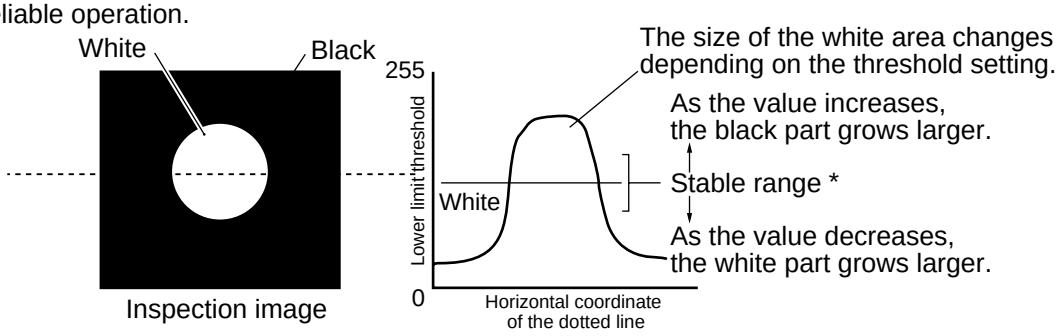
(5) Operation on the [MEASURING COND] menu (image adjustment)



1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
   - If the image is so bright that the menu is hard to see, press the TRG/BRT key to reduce the brightness of the image. Then, the brightness indicator in the upper right corner of the screen will change from H to L.
2. Adjust the focus and aperture (iris) opening of the camera lens (see page 5-1), so that the object to be measured is clear and easily destinguished.
3. Press the SEL key to enter the freeze image mode.
   ⇨ The indicator in the upper right corner of the screen will change from T (through) to F (freeze).
   - To store a threshold value in the following step, the screen must enter the free image mode. (See section 7-2 "Screen specifications" for the through/freeze mode.)
4. Move the cursor to ③ THRESHOLD VALUE (threshold value) with the up and down keys, and press the SET key.
   ⇨ An binary image of the reference object will be displayed.
5. Move the cursor to the lower limit with the left and right keys, and adjust the lower limit threshold value with the up and down keys.

(Adjustment of threshold)

An example of adjustment is shown below, using a white object on a black background. When the dotted line in the window is converted to a binary image, if the lower limit is set higher, the black part in the binary image will become larger. If the lower limit is set lower, the white part will become larger. Increase and decrease the lower limit value, find the value at which the white part in the binary image starts growing and the value at which the black part starts growing. Then set the lower limit at the value halfway between these points.This will ensure reliable operation.



Changing the lower limit threshold

[* If the stable range in the lower limit threshold is less than 20, (actual measurement) measurement errors may occur.]

6. After setting the lower limit, press the SET key.
7. Move the cursor to ④ SET POINT (setting point) and press the SET key.
   ⇨ The point setting menu will be displayed.

Continued on the following page

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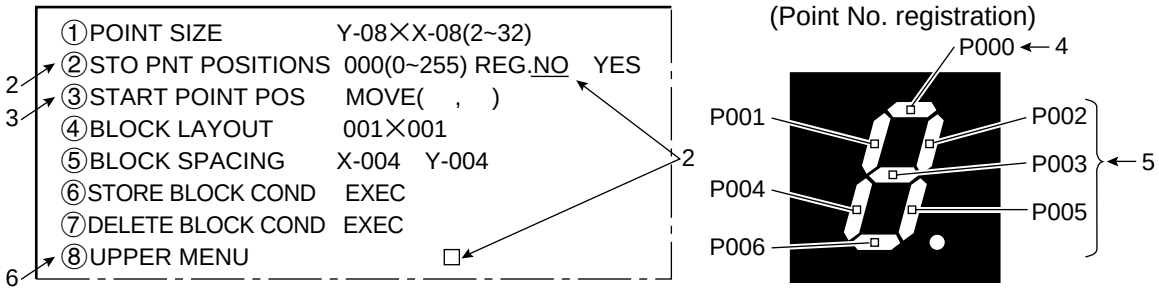
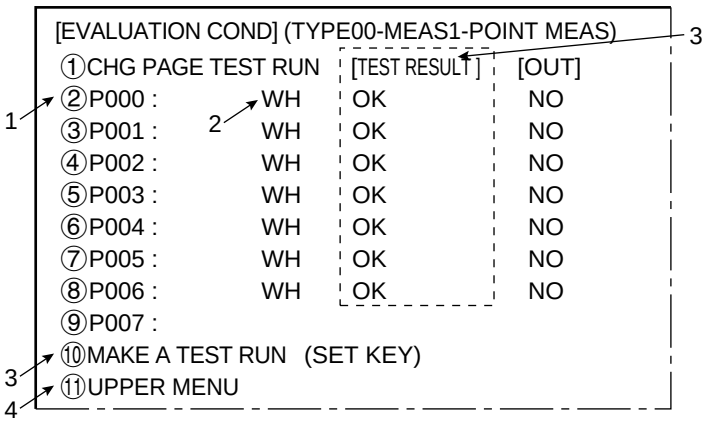
(6) Operation for point setting

1. Press the ESC key, and all of the menus to be used for point setting will be displayed.



2. Move the cursor to ② STO PNT POSITIONS (point registration, individual) with the up and down keys, and press the SET key. Move the cursor to YES with the left and right keys, and press the SET key.
   ⇨ The window (8 pixels x 8 pixels) for point No. 000 will start blinking.
3. Move the cursor to ③ START POINT POS (point position, starting) with the up and down keys, and press the SET key.
4. Move the window for point No. P000 to the desired position in the object and press the SET key.
   ⇨ The binary image will be displayed in the window according to the conditions set in item (5).
5. Move the cursor to ② STO PNT POSITIONS (point registration, individual) with the up and down keys, and press the SET key. Enter the number "001" with the up key. Move the cursor to "YES" with the right key, and press the SET key.
   - Move the window for point No. P001 the same as in steps 3 and 4, and press the SET key.
   - Create windows for point Nos. P002 to P006 the same way.
6. Move the cursor to ⑧ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to [MEASURING COND] (measurement condition) menu.
7. On the [MEASURING COND] menu, move the cursor to ⑤ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (type: 00, measurement: 1) menu.
8. On the [TYPE00-MEAS1] menu, move the cursor to ⑦ EVALUATION COND (evaluation condition) with the up and down keys, and press the SET key.
   ⇨ The [EVALUATION COND] menu will be displayed.

(7) Operation on the [EVALUATION COND] (evaluation condition) menu



1. Move the cursor to ② P000 with the up and down keys, and press the SET key.
2. Select WH (white) with the up and down keys, and press the SET key.
   - Specify WH (white) for point No. P001 to P006 the same as in steps 1 and 2.
   - In this operation, the images (binary images) in the windows at point No. P000 to P006 are checked to see if they are white or black. If they are all white, the program can decide that the object exists.
3. Move the cursor to ⑩ MAKE A TEST RUN with the up and down keys, and press the SET key. A test will be executed, and the test result (OK/NG) will be displayed.

Continued on the following page

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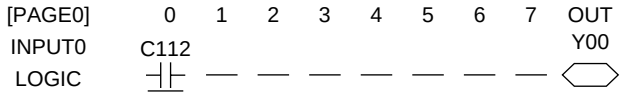
4. Move the cursor to ⑪ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [TYPE00-MEAS1] (type: 00, measurement: 1) menu.
5. Press the ESC key.
   ⇨ The screen will return to the [OBJECT TYPE COND] (conditions of object type) menu.

(8) Setting the final evaluation output condition

This setting is used to output the result of the final evaluation externally (see the following page).

- The final evaluation result is always output to the auxiliary relay C112. When the final evaluation result is OK, C112 is ON, and when the result is NG, it is OFF. The result of final evaluation can be externally output by using the auxiliary relay C112.
- The setting procedures are the same as described in item (9) in section 3-2 "position measurement."



(9) Returning to the MAIN OPS MENU

1. Press the ESC key.
   ⇨ The screen will return to the [SYSTEM SETUP] menu.
   - Move the cursor to ⑨ SAVE IN FLASH MEM (save data in flash memory) or ⑩ OPERATIONS with the up and down keys, and press the SET key.
     ⇨ The following message will be displayed on the upper corner of the screen.

     DATA SAVE? (Do you want to save data ?) (YES=[MOVE]/NO=[ESC])

   - Press the SET key.
     ⇨ The data saving operation will start, and the progress will be displayed on the bottom of the screen.

     SAVING
     REFERENCE IMAGE ■■■■□□□□
     SYSTEM I/O □
     MEAS CONDITIONS □

   When the data has been saved in the IV-S20 flash memory, the display will change from "SAVING" to "SAVING COMPLETE."

   Note:
   · If the ESC key is pressed, the settings you entered will not be saved in the IV-S20 flash memory. In this case, if the power to the IV-S20 main housing is turned OFF, or if the type No. is changed, the settings will be deleted.

2. Press the ESC key.
   ⇨ The screen will return to the MAIN OPS MENU.
   - If the cursor was moved to ⑩ OPERATIONS in step 1, the screen will automatically return to the [MAIN OPS MENU].

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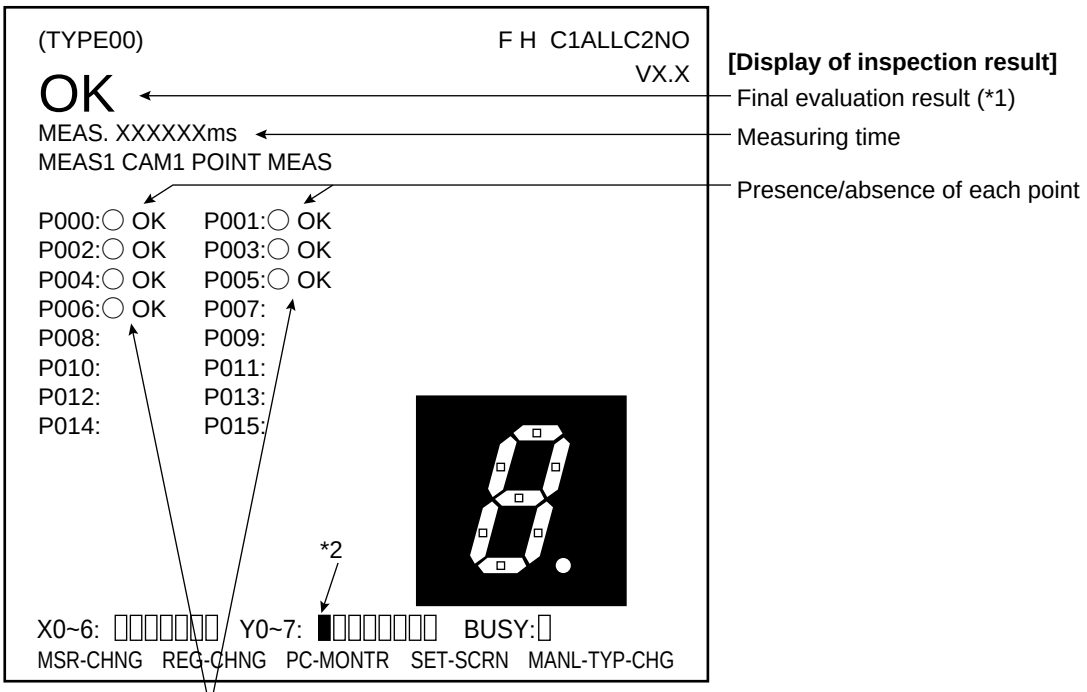
(10) Existence inspection

Press the TRG/BRT key, and "OK" or "NG" will be displayed to indicate the result of the evaluation of the color (white or black according to the setting in step (7)-2) at each point from P000 to P006.



"○OK" is shown the points P000 to P006 to indicate that the inspected object is white and the result is OK.

Object color \ Expected condition (OK)	White	Black
White (display○)	OK	NG
Black (display●)	NG	OK

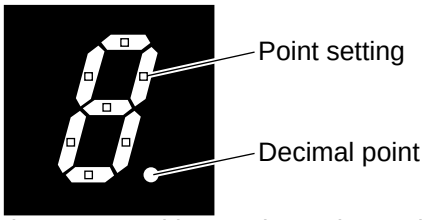
← OK/NG evaluation result

*1 The result of the final evaluation will be displayed as "OK" in the upper left corner of the screen when all of the points have been judged acceptable. If a single point has been judged unacceptable, "NG" will be displayed.

*2 When the final evaluation result is OK, Y0 is turned ON, and a filled box ■ is displayed. (When the result is NG, an empty box □ is displayed.)
When the auxiliary relay C112 is turned ON, Y0 is turned ON according to the condition set in step (8) for final evaluation output .

3-7 Position correction (example of point measurement)

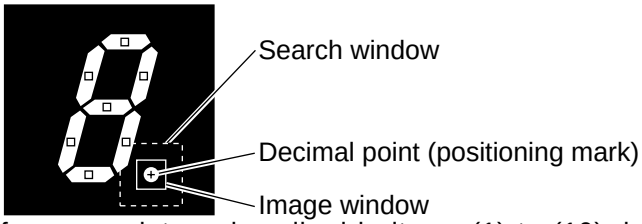
In the setting example shown in section 3-6 "Existence inspection by point measurement," points were set on the segment of number display (the object to be measured), and the each of the points was checked for the correct condition.



However, the object to be measured is not always located exactly at the preset points. To deal with this problem, use the position correction function. Then, the preset coordinates of the points are corrected according to positional deviation of the actual object, and the measurement can be carried out correctly.

(1) Set the points using item (1) to (10) in section 3-6 "Existence inspection by point measurement"

(2) Using the decimal point in a 7-segment display as a positioning mark



- Move the reference point as described in items (1) to (10), in section 3-2 "Position measurement."
  After the setting, move the cursor to [SET-SCRN] on the MAIN OPS MENU, and press the SET key.
  ⇨ The [SYSTEM SETUP] menu will be displayed. Move the cursor to ②OBJECT TYPE COND (conditions of object type) and press the SET key.
  ⇨ The [OBJECT TYPE COND] menu will be displayed.

(3) Operation on the [OBJECT TYPE COND] (conditions of object type) menu

[OBJECT TYPE COND]	F C1 H
①OBJECT TYPE NO.	00(0~15)
②EDIT	COPY(←OBJ TYPE00) INITIALIZE
③TITLE REGISTRATION	(TO NEXT SUB-MENU)
④MEAS.0, CAMERA1	NO (TO NEXT SUB-MENU)
⑤POS. ADJ.CAMERA1	NO ADJ. [REG. 0-1PNTSXY]
⑥MEAS.0, CAMERA2	NO (TO NEXT SUB-MENU)
⑦POS. ADJ.CAMERA2	NO ADJ. [REG. 0-1PNTSXY]
⑧SELECT CAMERA IMG	NO CAM1 CAM1 CAM1&2
⑩MEASUREMENT 1	NO (TO NEXT SUB-MENU)
⑪MEASUREMENT 2	NO (TO NEXT SUB-MENU)
⑫MEASUREMENT 3	NO (TO NEXT SUB-MENU)
⑬FINAL CALC RESULT	(TO NEXT SUB-MENU)
⑭FINAL OUTPUT COND	(TO NEXT SUB-MENU)
⑮SYSTEM-IN/OUT	(TO NEXT SUB-MENU)
⑯HALT MEAS ON NG	NO YES
⑰UPPER MENU	

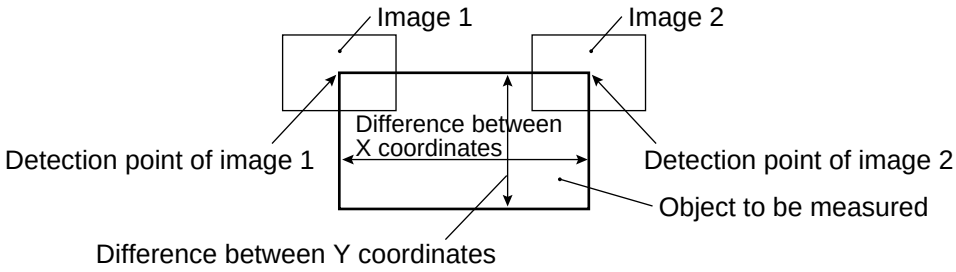
1 → ⑤POS. ADJ.CAMERA1 (NO ADJ. [REG. 0-1PNTSXY])
2 → NO ADJ. [REG. 0-1PNTSXY]

1. Move the cursor to ⑤POS. ADJ.CAMERA1 (position correction) with the up and down keys, and press the SET key.
2. Move the cursor to REG.0-1PNTSXY (registration: 0-1, first point: XY) with the right, left, up and down keys, and press the SET key. (Correction of X-Y coordinates).
3. Move the cursor to ⑰UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The [SYSTEM SETUP] menu will be displayed. Move the cursor to ⑩OPERATIONS with the up and down keys, and press the SET key.
   ⇨ The MAIN OPS MENU will be displayed.

This completes the settings for position correction using a deviation measurement. Run the program, and the preset point coordinates will be moved according to the actual position of the decimal point. Then the point inspection will be conducted.

3-8 Use of numeric calculations (example of shape and size inspection)

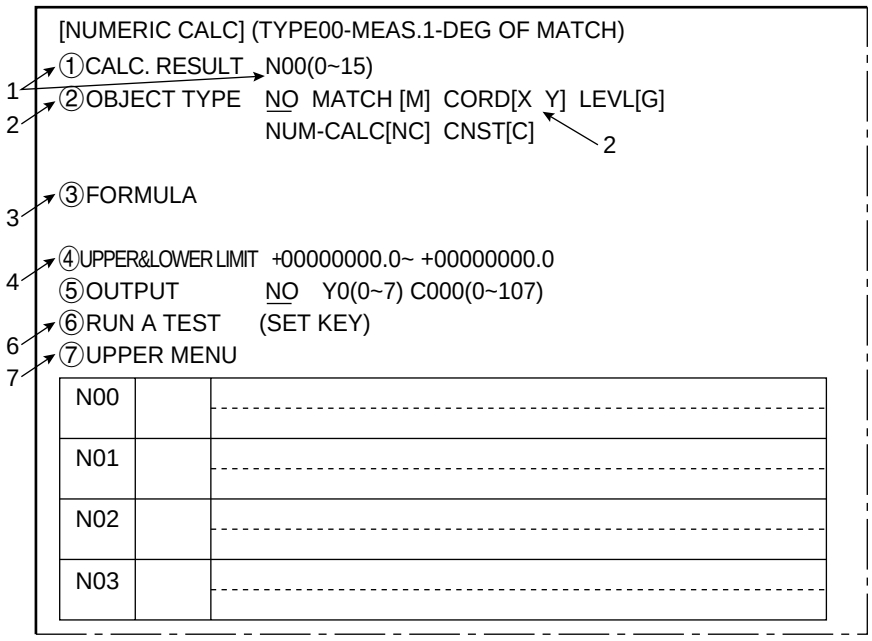
Shown below is an example of the operation for evaluating and outputting the differences in the X-Y coordinates between the points in images 1 and 2, based on the result of numeric calculations. This example uses the example from section 3-3 "Degree of match inspection for shape and size."



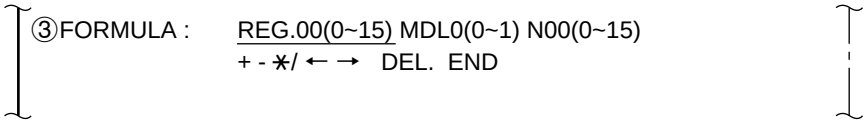
(1) Create the images following the instructions of items (1) to (8), in 3-3 “Degree of match inspection for shape and size”

- After creating the images, move the cursor to ③ NUMERIC CALC COND on the matching level inspection menu, and press the SET key.
  ⇨ The [NUMERIC CALC] (numeric calculation) menu will be displayed.

(2) Operation on the [NUMERIC CALC] (numeric calculation) menu



1. Move the cursor to ① CALC. RESULT (calculation result) with the up and down keys, and press the SET key. Enter "N00" with the up and down keys, and press the SET key.
2. Move the cursor to ② OBJECT TYPE with the up and down keys, and press the SET key. Move the cursor to CORD [X] (coordinate [X]) with the left and right keys, and press the SET key.
   ⇨ The details of item ③ FORMULA will be displayed.



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3. Move the cursor to ③ FORMULA with the up and down keys, and press the SET key.
   - Move the cursor to REG.00 (0 ~ 15) with the left and right keys, and enter "01" with the up and down keys.
   - Move the cursor to MDL0 (0 ~ 1) with the left and right keys, enter "0" with the up and down keys, and press the SET key.
     ⇨ 01X0 will be displayed in the formula field.

N00	[X]	01X0 +00000000.0~ +00000000.0

   01X0 means model registration No.01 (image 1), and X coordinate of the detection point and model.
   - Move the cursor to "-" with the left and right keys, and press the SET key.
     ⇨ A dash - will be displayed in the formula field.
   - Move the cursor to REG.01 (0 ~15) and enter "00."
   - Move the cursor to MDL0 (0 ~ 1) and press the SET key.
     ⇨ 00X0 will be displayed in the formula field.

N00	[X]	01X0 - 00X0 +00000000.0 ~ +00000000.0

   00X0 means registration No.00 (image 0), X coordinate of the detection point and model.
   - Press the ESC key.
4. Move the cursor to ④ UPPER&LOWER LIMIT with the up and down keys, and press the SET key.
   - Move the cursor to the upper limit with the left and right keys, and press the SET key. Select a digit with the left and right keys. Enter the number +0160.0 with the up and down keys, and press the SET key.

④UPPER&LOWER LIMIT : +00000000.0~ +00000160.0
Upper limit

   - Move the cursor to the lower limit with the left and right keys, and press the SET key. Select a digit with the left and right keys. Enter the number +0140.0 with the up and down keys, and press the SET key.

④UPPER&LOWER LIMIT : +00000140.0~ +00000160.0
Lower limit

   - Press the ESC key.
     ⇨ +00000140.0 to +00000160.0 will be displayed in the upper and lower limit fields.
5. Move the cursor to ① CALC.RESULT with the up and down keys, and press the SET key. Enter "N01" and press the SET key.
   · As described in steps 2 to 4, enter 01Y0-00Y0 in the formula field, and enter +00000090.0 to +00000095.0 in the upper and lower limit fields.

N00	[X]	01X0 - 00X0 +00000140.0~ +00000160.0
N01	[Y]	01Y0 - 00Y0 +00000090.0~ +00000095.0

6. Move the cursor to ⑥ RUN A TEST with the up and down keys, and press the SET key.
   - Press the SET key once more. Then, the settings will be stored, and the test will be executed
     ⇨ The results of the evaluation (OK/NG) based on the calculation formulas will be displayed.

N00	[X]	01X0 - 00X0 +00000140.0~ +00000160.0 +00000147.0 OK
N01	[Y]	01Y0 - 00Y0 +00000090.0~ +00000095.0 +00000091.0 OK

OK: When the test result based on the formula is within the specified range
NG: When the test result based on the formula is out of the specified range

7. Move the cursor to ⑦ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The [TYPE00-MEAS1] menu will be displayed.

Continued on the following page

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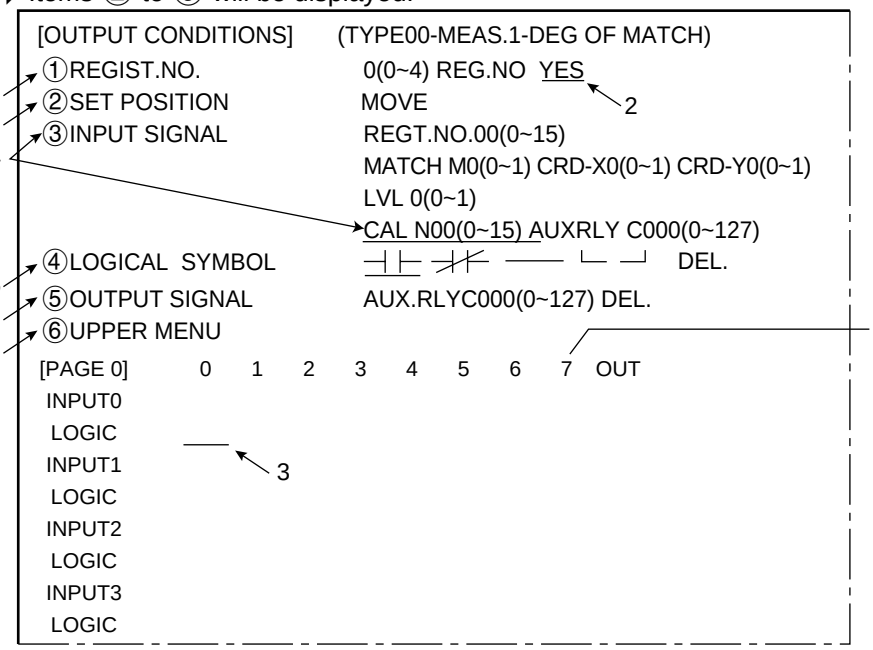
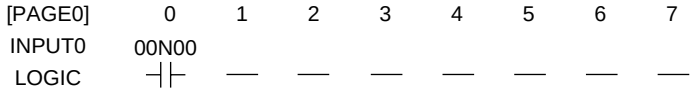
(3) Operation on the [OUTPUT CONDITIONS] menu

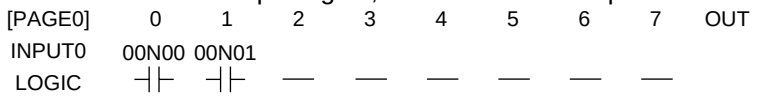
1. On the [TYPE00-MEAS1] menu, move the cursor to ⑨ OUTPUT CONDITIONS (output conditions) with the up and down keys, and press the SET key.
   ⇨ The [OUTPUT CONDITIONS] menu will be displayed.
2. Move the cursor to ① REGIST.NO. (register number) with the up and down keys, and press the SET key. Move the cursor to "YES" with the left and right keys, and press the SET key.
   ⇨ Items ② to ⑥ will be displayed.



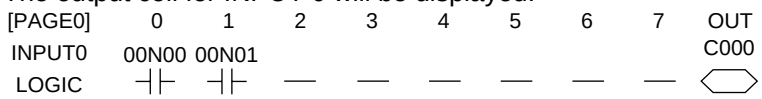
3. Move the cursor to ② SET POSITION with the up and down keys, and press the SET key.
   - Move the cursor to the 0th column of INPUT 0 for logic setting using the up, down, left and right keys, and press the SET key.
4. Move the cursor to ③ INPUT SIGNAL with the up and down keys, and press the SET key.
   - Move the cursor to CAL N00 (0 to 15) with the left and right keys, enter CAL N00 with the up and down keys, and press the SET key.
5. Move the cursor to ④ LOGICAL SYMBOL with the up and down keys, and press the SET key.
   - Move the cursor to "-||-" and press the SET key.
     ⇨ The logical condition will be displayed in the 0th column of INPUT 0.



   - 00N00 means the results of the calculation N00, entered on the [NUMERIC CALC] menu, for registration No.00.
6. Move the cursor to ② SET POSITION (setting position) with the up and down keys, and press the SET key. Move the cursor to the 1st column of INPUT 0 for logic setting using the left and right keys, and press the SET key.
   · Enter CAL. N01 as an input signal, as described in steps 4 and 5.



7. Move the cursor to ⑤ OUTPUT SIGNAL with the up and down keys, and press the SET key.
   - Specify C000 for the auxiliary relay number with the up and down keys, and press the SET key.
     ⇨ The output coil for INPUT 0 will be displayed.



8. Move the cursor to ⑥ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [OBJECT TYPE COND] (conditions of object type) menu.

Continued on the following page

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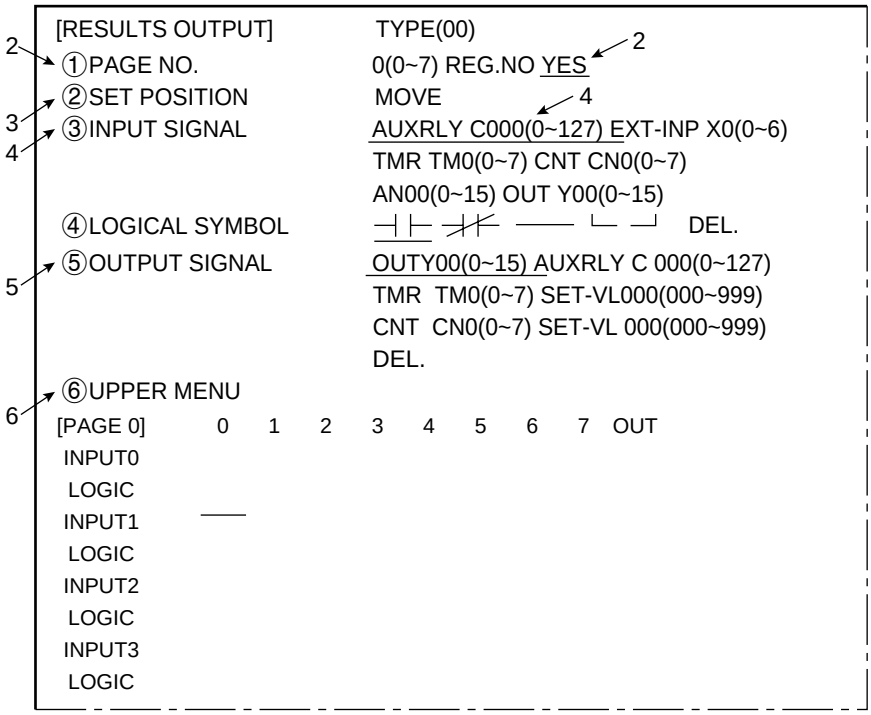
(4) Operation for item, ⑭ RESULTS OUTPUT (final output conditions), on the [OBJECT TYPE COND] menu

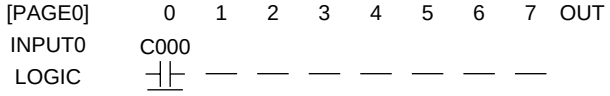
1. On the [OBJECT TYPE COND] menu, move the cursor to ⑭ RESULTS OUTPUT with the up and down keys, and press the SET key.
   ⇨ The RESULTS OUTPUT (final evaluation output condition) menu will be displayed.

2. Move the cursor to ① PAGE NO. with the up and down keys, and press the SET key. Move the cursor to "YES" with the left and right keys, and press the SET key.
   ⇨ Items ② to ⑤ will be displayed.

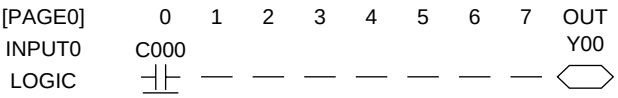


3. Move the cursor to ② SET POSITION with the up and down keys, and press the SET key.
   - Move the cursor to the 0th column of INPUT 0 for logic setting using the up, down, left and right keys, and press the SET key.

4. Move the cursor to ③ INPUT SIGNAL with the up and down keys, and press the SET key.
   - Move the cursor to AUXRLY C000 (0 ~ 127) (auxiliary relay C000) with the left and right keys, specify C000 with the up and down keys, and press the SET key.
     ⇨ The logic symbol will be displayed in the 0th column of INPUT 0.



5. Move the cursor to ⑤ OUTPUT SIGNAL with the up and down keys, and press the SET key.
   - Select "OUTY00(0 to 15)" with the left and right keys, enter "00" with the up and down keys, and press the SET key.
     ⇨ The output coil for INPUT 0 will be displayed.



6. Move the cursor to ⑥ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [OBJECT TYPE COND] menu.

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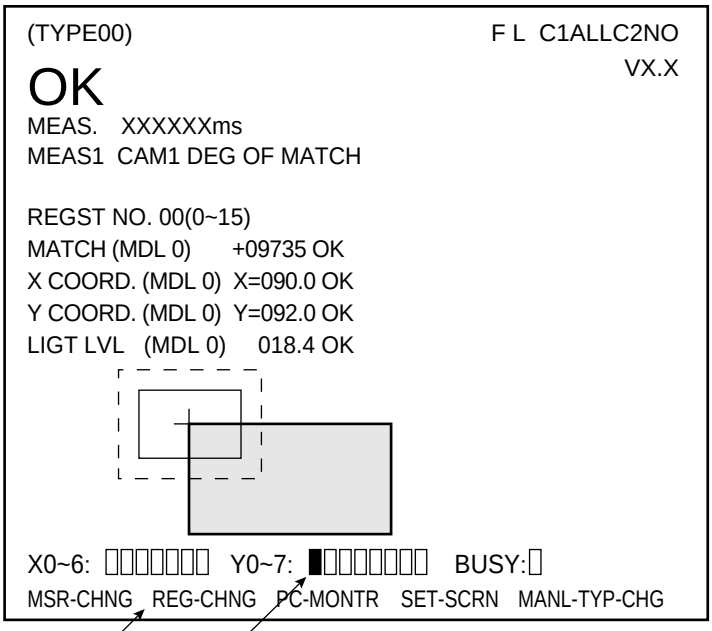
(5) Returning to the MAIN OPS MENU

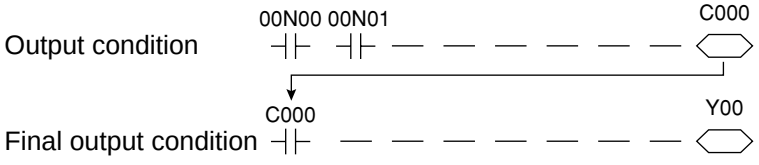
1. Press the ESC key.
   ⇨ The [SYSTEM SETUP] menu will be displayed.
2. Move the cursor to ⑨ SAVE IN FLASH MEM (save data in flash memory) or ⑩ OPERATIONS with the up and down keys, and press the SET key. Press the SET key once more.
   ⇨ The set data will be saved in the IV-S20 flash memory, and the screen will return to the MAIN OPS MENU.

(6) Degree of match inspection

Press the TRG/BRT key, and the difference in the X-Y coordinates of the detection points in images 1 and 2 will be calculated. The results will be evaluated and output.



* If the difference between X/Y coordinates is within the range set on the numeric calculation menu, Y0 will be turned ON, and a filled box ■ will be displayed. If the difference is not within the range, Y0 is turned OFF, and an empty box ■ will be displayed.

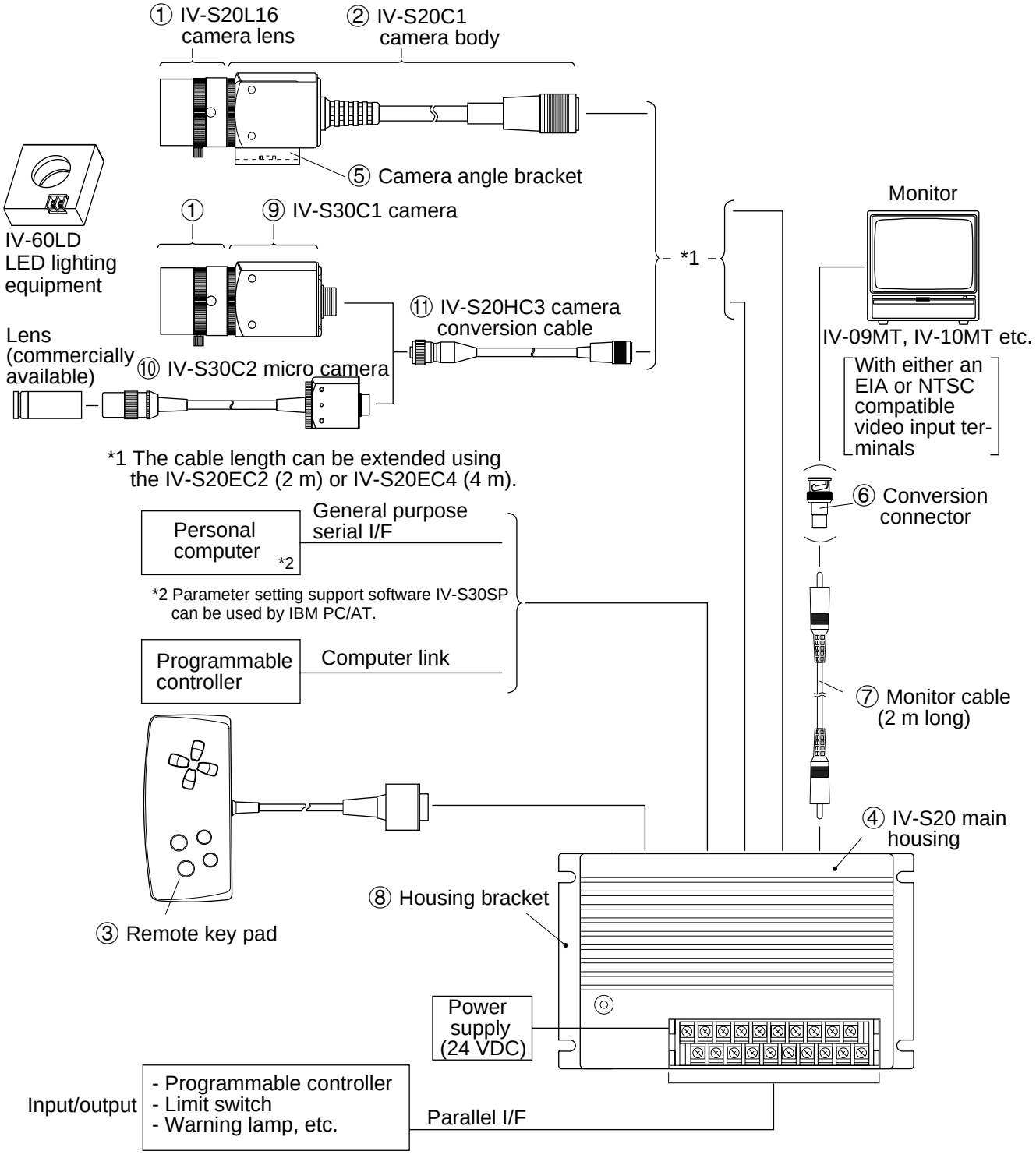


· If the result is within the range, 00N00 and 00N01 are turned ON (OK), the auxiliary relay C000 will be turned ON, and output Y00 will be turned ON.

* Move the cursor to REG-CHNG (registration change), and press the up or down key. Then, the results of the numeric calculation will be displayed.

Chapter 4: System Configuration

4-1 Basic system configuration



- The IV-S20 series includes the IV-S20, IV-S20N, IV-S20M, IV-S20C1, IV-S30C1/C2, IV-S20L16, and IV-S20EC2/EC4. Configurations varies with each model (see the following page). Place your order according to your system configuration.
  Ex.: When two cameras are connected (the IV-S20L16 lense is used), 1 set each of the IV-S20, IV-S20C1 and IV-S20L16 are needed.
- Up to two cameras can be connected to the IV-S20 main housing (camera 1 and camera 2). However, it is possible to connect only one camera. In this case, the camera must be connected in the camera 1 position.
- The numbers in circles correspond to the component numbers shown on the following page.

■ Product configuration

The product configurations of IV-S20, IV-S20N, IV-S20M etc., are listed below.
(The numbers in circles correspond to the component numbers shown in the previous page.)

Model (type)	Components	
IV-S20	· IV-S20 main housing (④) 1 set · Camera body (②: IV-S20C1) 1 set	
	Accessories	· Camera lens (①: IV-S20L16) 1 pc. · Remote key pad (③) 1 pc. · Camera angle bracket (⑤) 1 pc. · Housing bracket (⑧) 2 pcs. · Monitor cable (⑦) 1 pc. · Conversion connector (⑥)1 pc. · D-sub connector 1 pc. (9-pin D-sub, male, rock screw M2.6 : communication connector for the IV-S20 main housing) · Screw (M 3 x 6, for securing angle bracket) 6 pcs. · Instruction manual 1 set
IV-S20N	· IV-S20 main housing (④) 1 set · Camera body (②: IV-S20C1) 1 set	
	Accessories	· Remote key pad (③) 1 set. · Camera angle bracket (⑤) 1 pc. · Housing bracket (⑧) 2 pcs. · Monitor cable (⑦) 1 pc. · Conversion connector (⑥) 1 pc. · D-sub connector 1 pc. (9-pin D-sub, male, rock screw M2.6 : communication connector for the IV-S20 main housing) · Screw (M 3 x 6, for securing angle bracket) 6 pcs. · Instruction manual 1 set
IV-S20M	· IV-S20 main housing (④) 1 set	
	Accessories	· Housing bracket (⑧) 2 pcs. · Monitor cable (⑦) 1 pc. · Conversion connector (⑥) 1 pc. · D-sub connector 1 pc. (9-pin D-sub, male, rock screw M2.6 : communication connector for the IV-S20 main housing) · Screw (M 3 x 6, for securing angle bracket) 6 pcs. · Instruction manual 1 set
IV-S20C1	· Camera body (②) 1 set	
	Accessories	· Camera angle bracket 1 pc. · Screw (M 3 x 6, for securing angle bracket) 2 pcs.
IV-S30C1	· Camera (⑨) 1 set	
	Accessories	· Camera angle bracket 1 pc. · Screw (M 3 x 6, for securing angle bracket) 2 pcs.
IV-S30C2	· Micro camera (⑩) 1 set	
	Accessories	· Camera angle bracket 1 pc. · Camera head angle bracket 1 pc. · Screw (M 3 x 6) 3 pcs. · Instruction manual 1 set

Model (type)	Components	
IV-S20L16	Camera lens (①) 1 pc.	
IV-S20EC2	Extension camera cable (2 m) 1 pc.	
IV-S20EC4	Extension camera cable (4 m) 1 pc.	
IV-S20HC3	Camera conversion cable (⑪: 3 m) 1 pc.	
IV-09MT *1	Monochrome monitor (9 type) 1 pc.	
	Access-ory	Instruction manual 1 set
IV-10MT /10MTV /10MTK *2	1 LCD monitor IV-10MT: Pair chassis type IV-10MTV: With a mounting frame IV-10MTK: With a remote keypad integrating frame	
	Access-ories	· AC adapter (with the IV-10MT/10MTV/10MTK) 1 pc. · Installation brackets (with the IV-10MTV/10MTK) 4 pcs. · Cable (with the IV-10MTK) 1 pc. · Instruction manual (with the IV-10MT/10MTV/10MTK) 1 set
IV-60LD *3	· LED lighting equipment (main body) 1 set	
	Access-ories	· Camera angle bracket 1 pc. · Screw (M 3 x 6, for securing camera/angle bracket) 6 pcs. · Instruction manual 1 set
IV-S30SP *4	· Parameter setting support software for IV series (CD-ROM) 1 pc.	
	Access-ories	· RS-232C communication cable (1.5 m) 1 pc. · USB cable (3 m) 1 pc. · User registration card 1 sheet · Instruction manual 1 set

*1 An explanation of the monochrome monitor IV-09MT in detail is shown in page 16-6 of IV-09MT instruction manual.
*2 An explanation of the LCD monitor IV-10MT/10MTV/10MTK in detail is shown in IV-10MT/10MTV/10MTK instruction manual.
*3 An explanation of the LED lighting equipment IV-60LD in detail is shown in pages 6-2 and 16-7 of IV-60LD instruction manual.
*4 An explanation of the parameter setting support software IV-S30SP in detail is shown in page 7-14 of IV-S30SP instruction manual.

4-2 System configuration examples

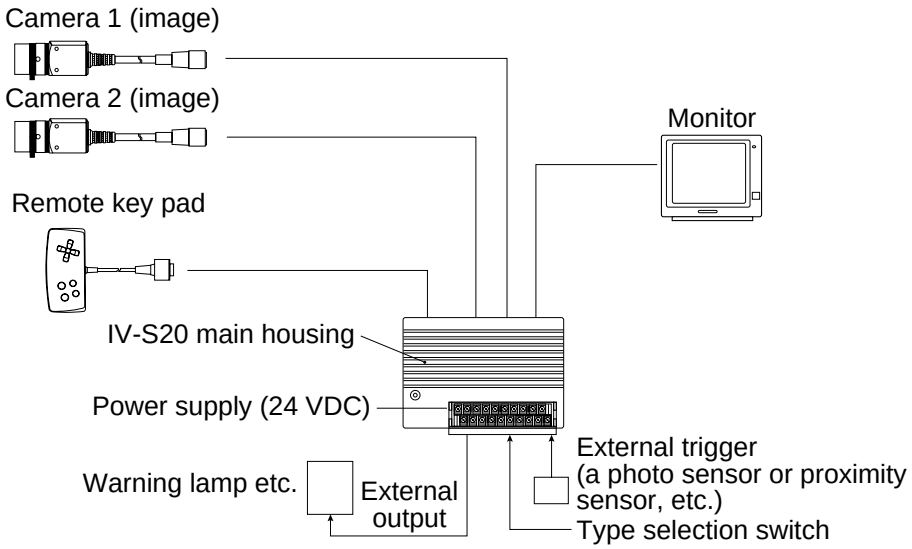
This section outlines the system configurations for measurement using an external trigger, such as measurement using a photo sensor, measurement using CCD trigger, and measurement triggered by a command from a personal computer.
See Chapter 11 "Setting the Input/Output Conditions" for the details about the settings.

[1] System configuration example for measurement triggered by an external trigger, such as a photo sensor

(1) When IV-S20 is used in a stand-alone mode

- Purpose/application

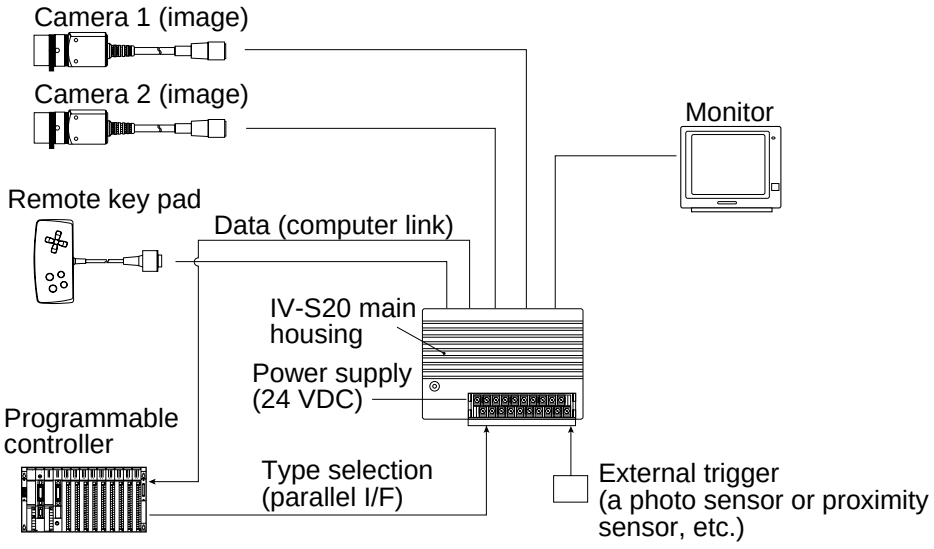
Measurement is started by an external trigger (a photo sensor or proximity sensor), and the measurement result is output externally (warning lamp). The object type number is selected by an external switch.



(2) When a programmable controller is connected

- Purpose/application

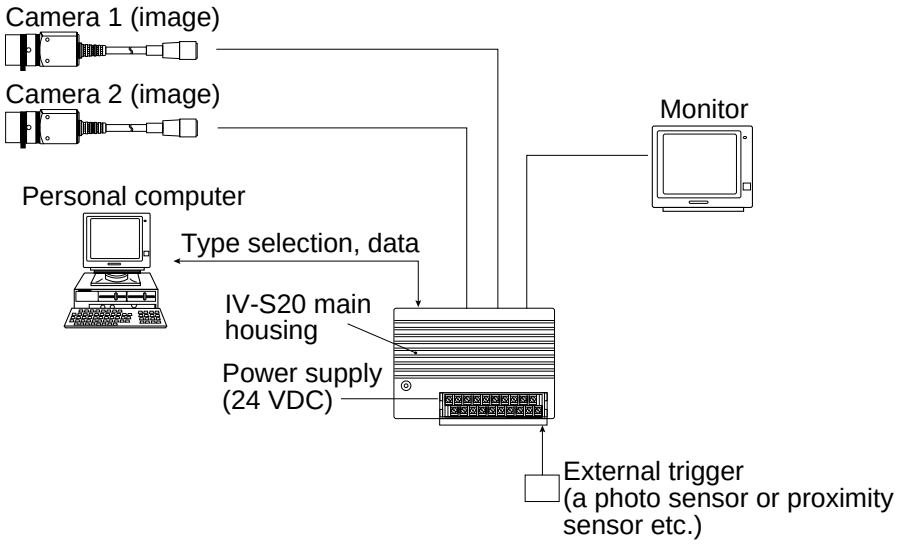
Measurement is started by an external trigger (a photo sensor or proximity sensor), and the measurement data is output to a programmable controller. The object type number is selected by the programmable controller.



(3) When a personal computer is connected

- Purpose/application

Measurement is started by an external trigger (a photo sensor or proximity sensor etc.), and the measurement data is output to a personal computer. The object type number is selected by the personal computer.



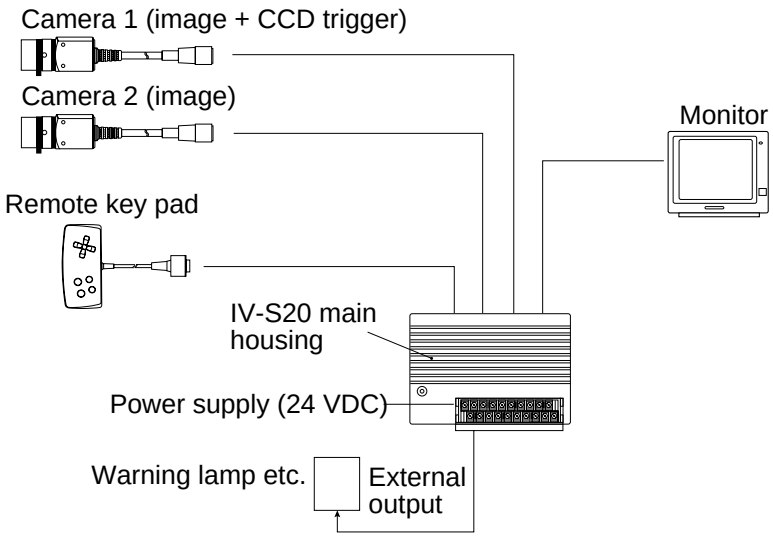
[2] System configuration example for measurement triggered by the internal CCD sensor trigger

The internal CCD trigger can be used with camera 1, but with camera 2.

(1) When IV-S20 is used in a stand-alone mode

- Purpose/application

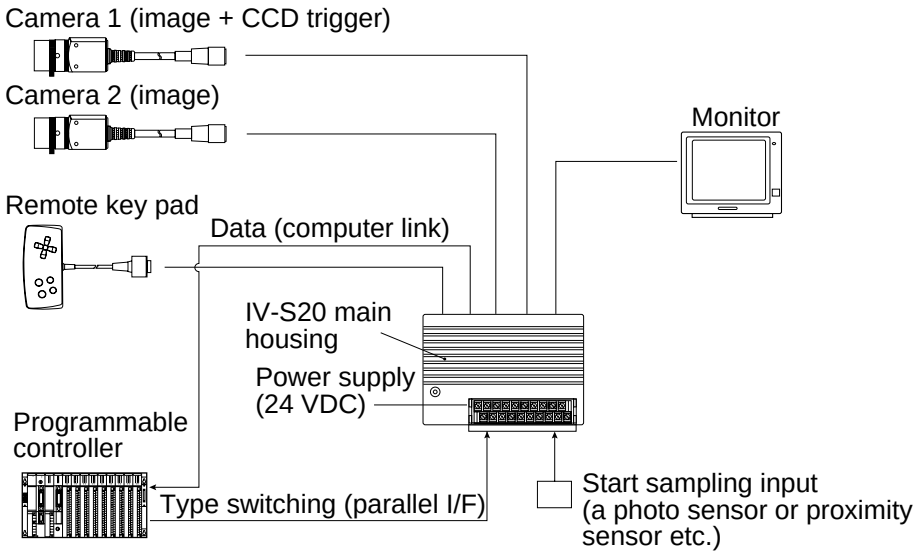
Measurement is started by a CCD trigger, and the measurement result is output externally (warning lamp etc.). In this case, sampling operation is automatically started.



(2) When a programmable controller is connected

- Purpose/application

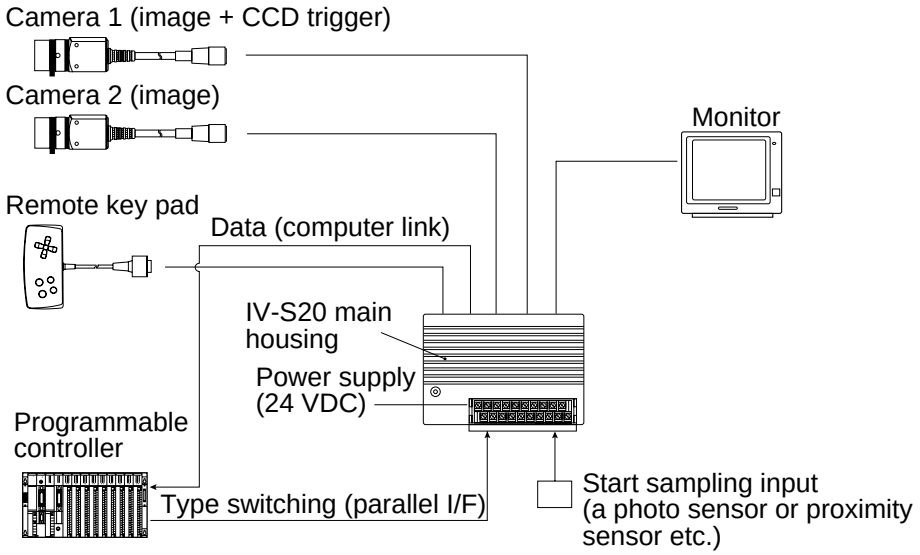
Measurement is started by a CCD trigger (sampling start input: a photo sensor etc.), and the measurement data is output to a programmable controller. The object type number is selected by the programmable controller.



(3) When a personal computer is connected

- Purpose/application

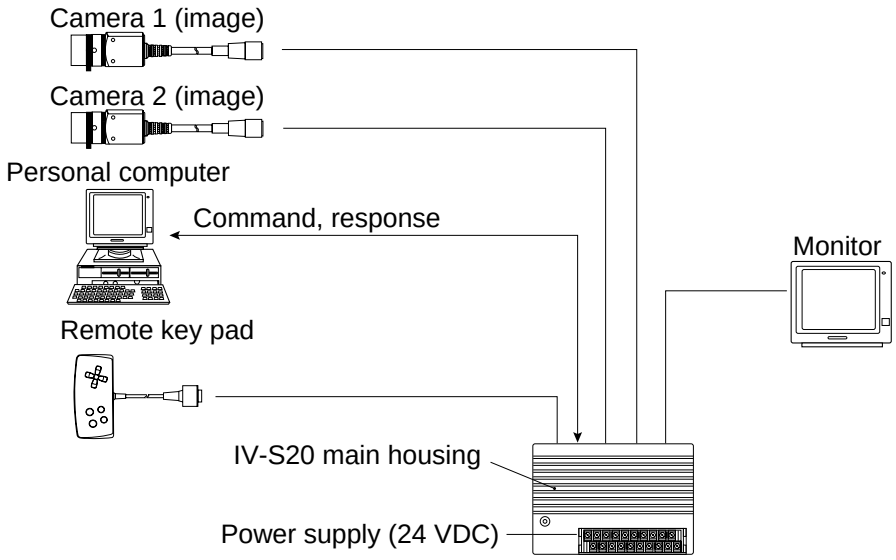
Measurement is started by a CCD trigger (sampling start input: personal computer), and the measurement data is output to a personal computer. The object type number is selected by the personal computer.



[3] System configuration example for measurement triggered by a command from a personal computer

- Purpose/application

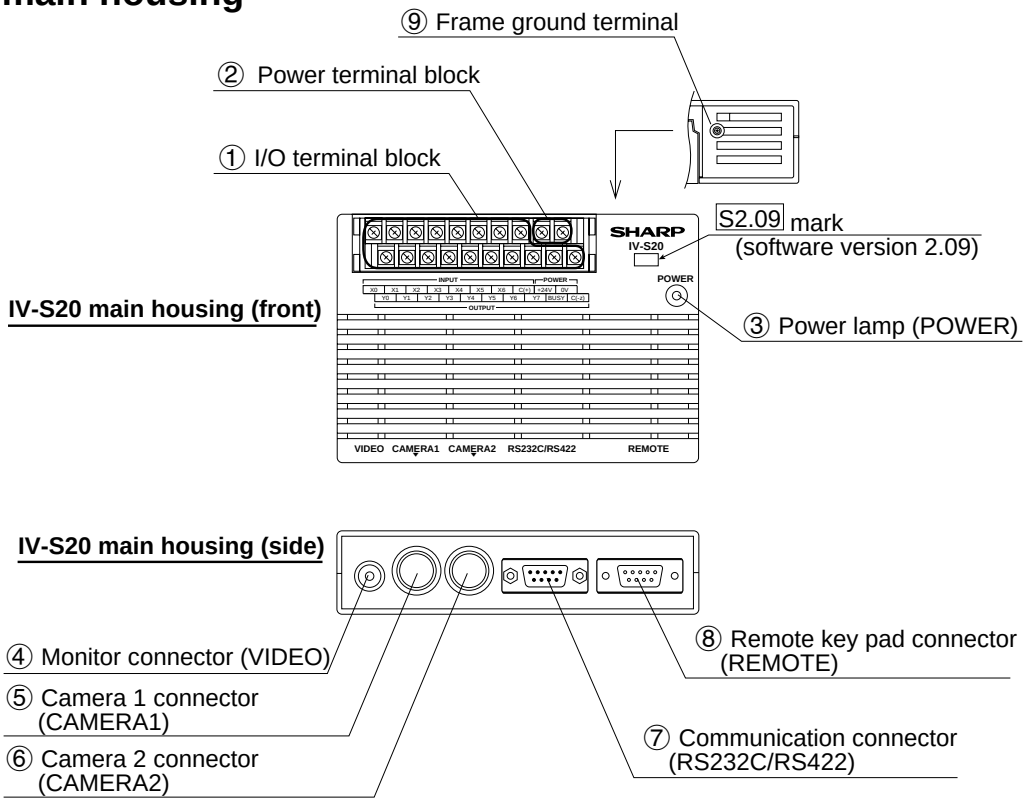
Measurement is started by a trigger from a personal computer, and the measurement data is output to the personal computer. The object type number is selected by the personal computer.



Chapter 5: Part Names and Functions

This section describes the names and functions of the IV-S20 main housing, the camera (camera lens , camera body, and camera cable), and the remote key pad which comprise the IV-S20 system. See section 6-2 and 6-3 for details about the housing brackets, camera angle bracket, and conversion connector.

5-1 IV-S20 main housing

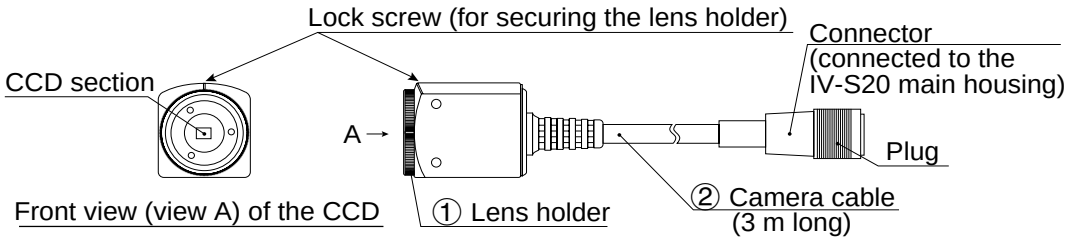


	Name	Function
①	I/O terminal block [INPUT: X0 to X6, C (+) OUTPUT: Y0 to Y7, BUSY, C (—)]	The block has 7 input terminals and 9 output terminals. - External devices are connected to these terminals for input and output (parallel I/F). ➡ See page 6-14.
②	Power terminal block (POWER: ＋24V, 0V)	Commercially available constant-voltage power supply (24 V DC ± 10%, 350 mA or more) is connected here. ➡ See page 6-12.
③	Power lamp (POWER)	When the power is applied to the IV-S20 main housing, the green lamp will light.
④	Monitor connector (VIDEO)	A monitor is connected here. - The monitor connector is an RCA jack.
⑤	Camera 1 connector (CAMERA1)	The camera cable connector is connected here. - The camera connected to the CAMERA 1 position is camera 1, and the camera connected to the CAMERA 2 position is camera 2.
⑥	Camera 2 connector (CAMERA2)	
⑦	Communication connector (RS232C/RS422: 9-pin, D-sub, female, rock screw M2.6)	This connector is used to connect a personal computer for communications (general purpose serial I/F) or to connect a programmable controller for a computer link. ➡ See page 6-16.
⑧	Remote key pad connector (REMOTE)	The remote key pad connector is used to make selections from the menues on the screen (to set parameters). It is connected here.
⑨	Frame ground terminal	Be sure to ground the housing frame ground terminal together with the frame ground of the constant-voltage power supply in accordance with class 3 grounding procedures. ➡ See page 6-12.

5-2 Camera section

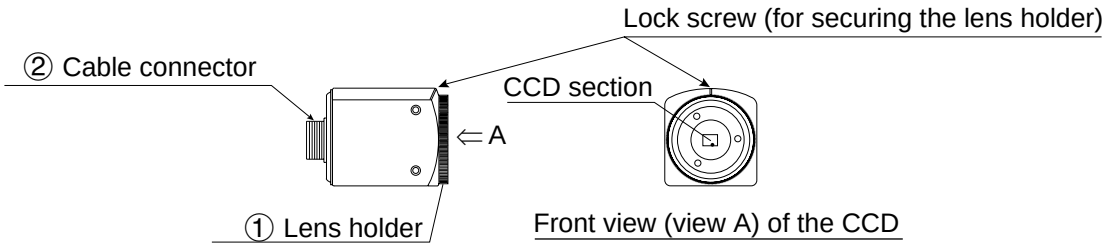
[1] Camera

(1) Camera body (IV-S20C1)



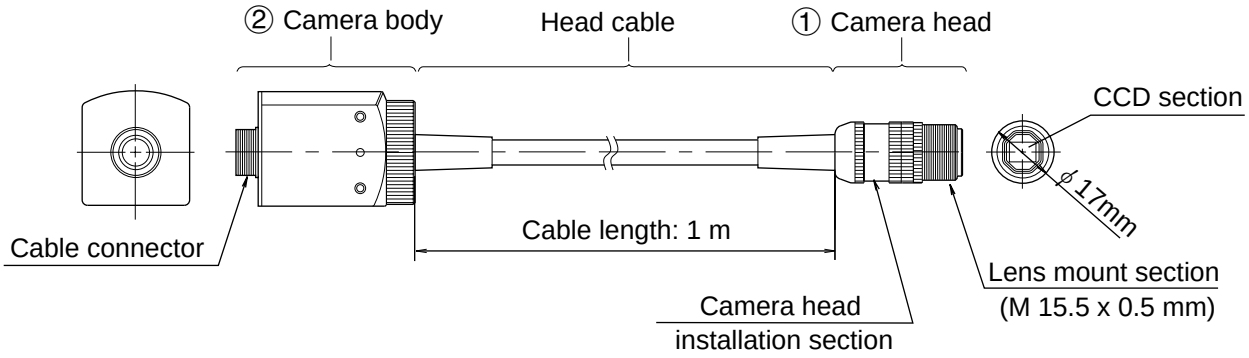
	Name	Function
①	Lens holder	The holder is used to make fine adjustment to the distance (back plane focus) between the CCD section and camera lens using a focus fixed lens. (The distance has been adjusted before shipment. Usually, it does not need to be adjusted.) - To adjust it, loosen the upper lock screw, and turn the lens holder counter-clockwise. The maximum allowable distance is 1.5 mm.
②	Camera cable	The cable is 3 m long. - Extension camera cables (IV-S20EC2 : 2 m and IV-S20EC4 : 4 m) are available.

(2) Camera (IV-S30C1)



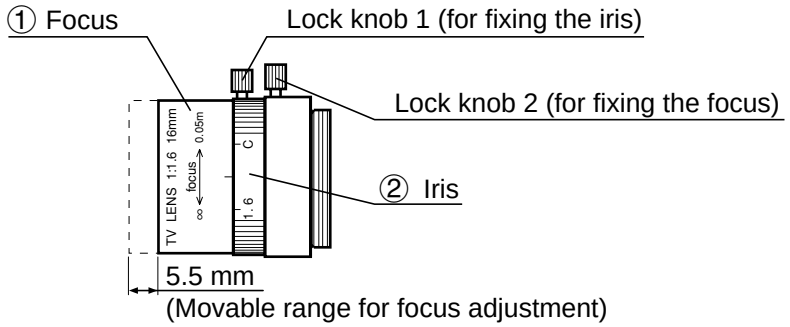
	Name	Function
①	Lens holder	The holder is used to make fine adjustment to the distance (back plane focus) between the CCD section and camera lens using a focus fixed lens. (The distance has been adjusted before shipment. Usually, it does not need to be adjusted.) - To adjust it, loosen the upper lock screw, and turn the lens holder counter-clockwise. The maximum allowable distance is 1.5 mm.
②	Cable connector	Connect this connector to the camera conversion cable (IV-S20H3).

(3) Micro camera (IV-S30C2)



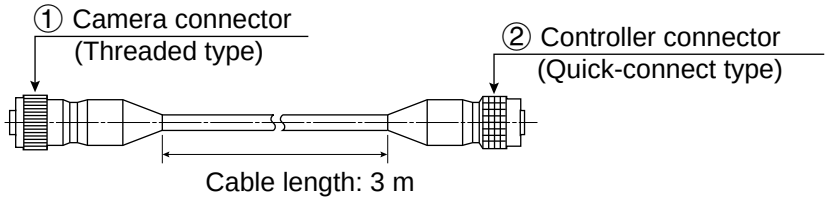
	Name	Function
①	Camera head	Install a lens (commercially available). - The maximum outside diameter of the camera head is ø17 mm. The lens mount bracket is M15.5 x 0.5 mm.
②	Camera body	Connect the camera using the IV-S20H3 camera conversion cable.

[2] Camera lens : IV-S20L16



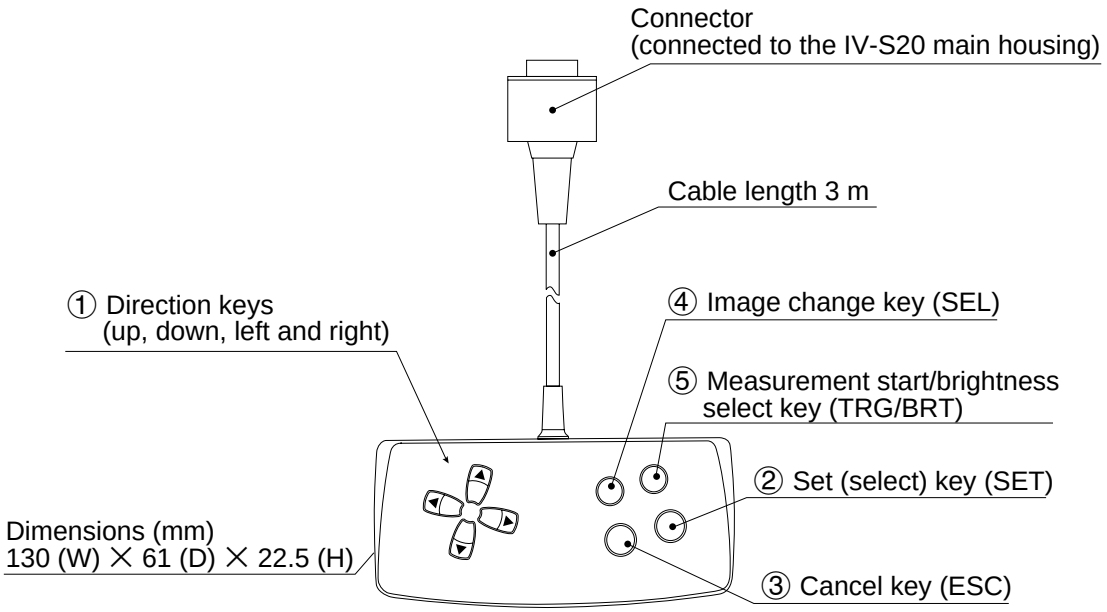
	Name	Function
①	Focus	To focus an image. - The focal length (distance from an object) is 50 mm to infinity (from the front of lens).
②	Iris	To adjust the image brightness. - The iris aperture can be set from 1.6 to closed.

[3] Camera conversion cable: IV-S20HC3



	Name	Function
①	Camera connector	Connect to a connector of camera cable (IV-S30C1/C2/C3/C4).
②	Controller connector	Connect to camera 1 connector or camera 2 connector of the IV-S20 main body.

5-3 Remote key pad



	Key name	Function	Contents
①	Direction keys (up, down, left and right)	Selecting an item on a menu screen	See section 7-9
		Setting a window	
		Setting a value	
②	Set (select) key (SET)	Determine a highlighted item	
		Determine the setting value	
③	Cancel key (ESC)	Returning a setting to its original state before being changed	
		Returning to the previous menu	
④	Image change key (SEL)	Switching the image mode between the through mode and the freeze mode (see page 7-8)	
⑤	Measurement start/brightness select key (TRG/BRT)	Start measurement input	
		Switching the brightness level (H and L)	

Chapter 6: Installation Conditions and Method

6-1 Installation conditions

[1] Lighting equipment

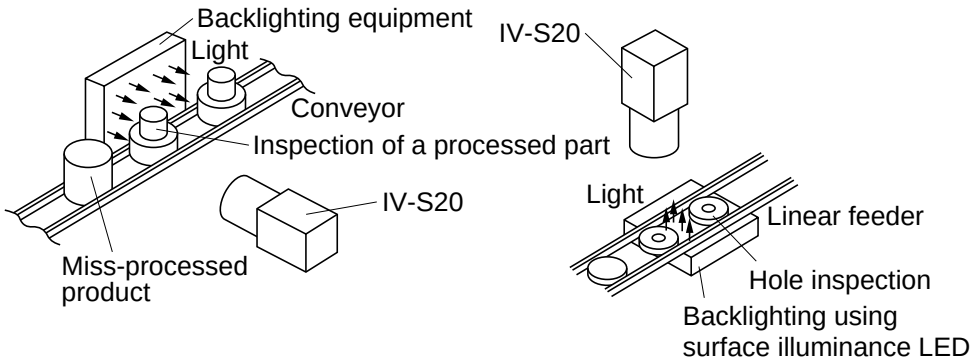
Lighting for the workpieces is an important factor in image processing. The lighting conditions affect the measurement results. Select the proper lighting equipment.

- Make sure there is uniform illumination of the whole measurement field where object images will be taken.
- Use flicker-free lighting equipment, such as a high frequency fluorescent lamps or halogen lamps.
- Consult us about the right lighting equipment for your application.

[Backlighting]

Light should uniformly illuminate the field behind an object, so that the IV-S20 measure the object with it's shadow. Since the shadow picture will be converted to binary values, reliable measurements can be executed.

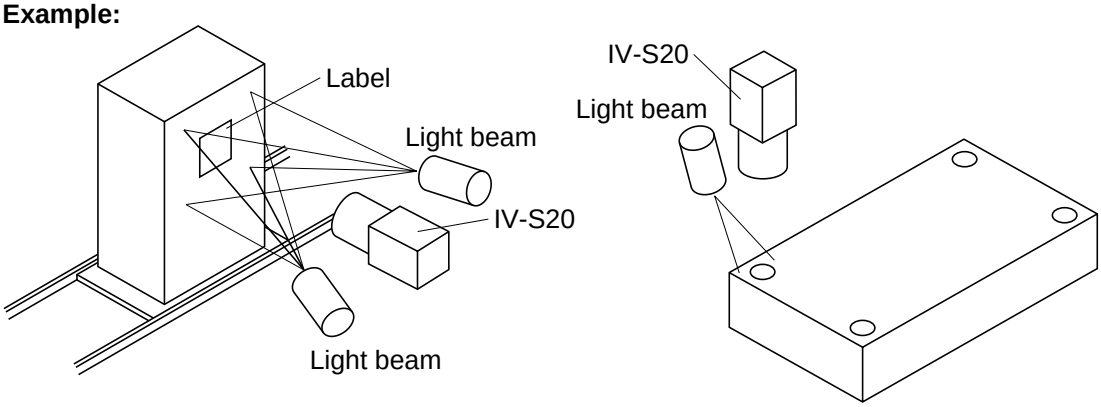
Example:



[Reflective lighting]

A light shone on the front of an object with angle will be reflected, and the IV-S20 will pick up the reflected light. If too much light is reflected, such as from a metallic surface or similar materials, a proper image may not be obtained.

Example:



Label detection

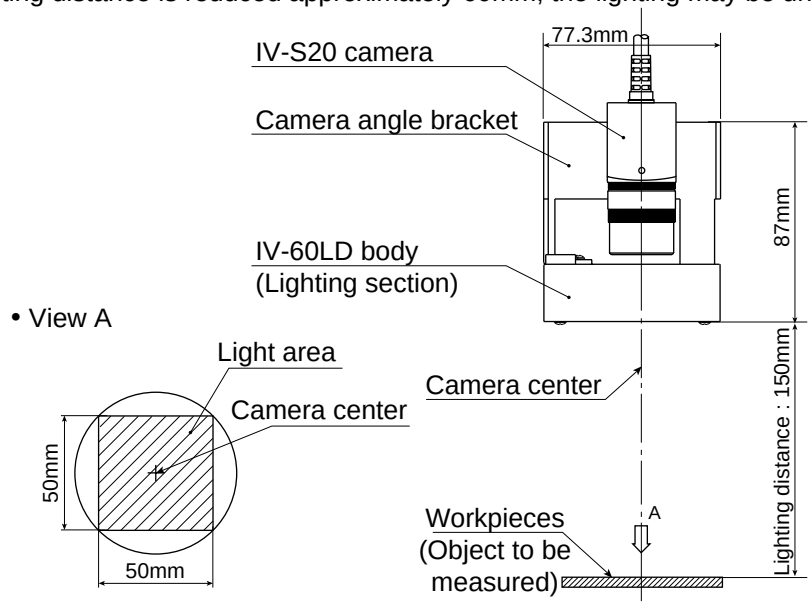
Measurement of the center coordinates of a hole

■ When using the IV-60LD

This paragraph describes how to use Sharp IV-60LD LED lighting equipment. For details about the installation and wiring of the IV-60LD, see the instruction manual.

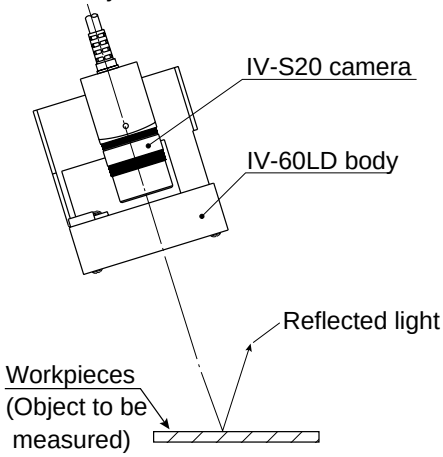
The distance between the IV-60LD and an object (distance at which to install lighting equipment) should be approximately 150mm, and the lit area is approximately 50mm × 50mm.

If the lighting distance is reduced approximately 60mm, the lighting may be uneven.



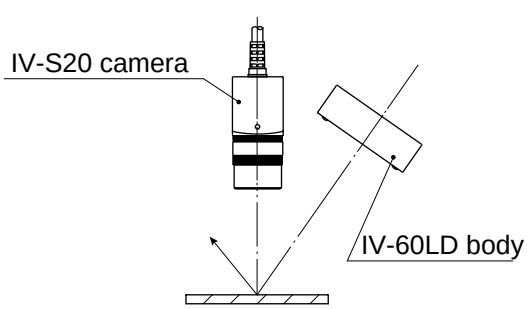
When the light is projected from above the object and if reflection off the object influences the image processing, try the following countermeasures.

①Tilt the camera center axis (within a range that does not affect the image processing) to move away from the light reflected from the object.

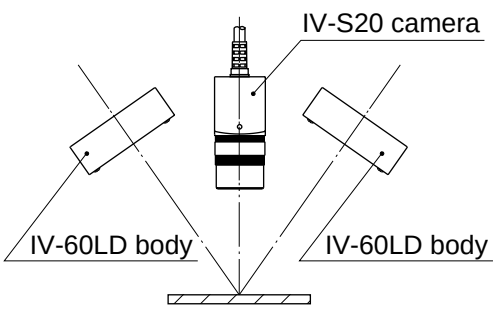


②Separate the camera from the lighting equipment. Install the IV-60LD lighting equipment so that it will shines from an angle that prevents creation of the reflection.

- One light



- Two lights

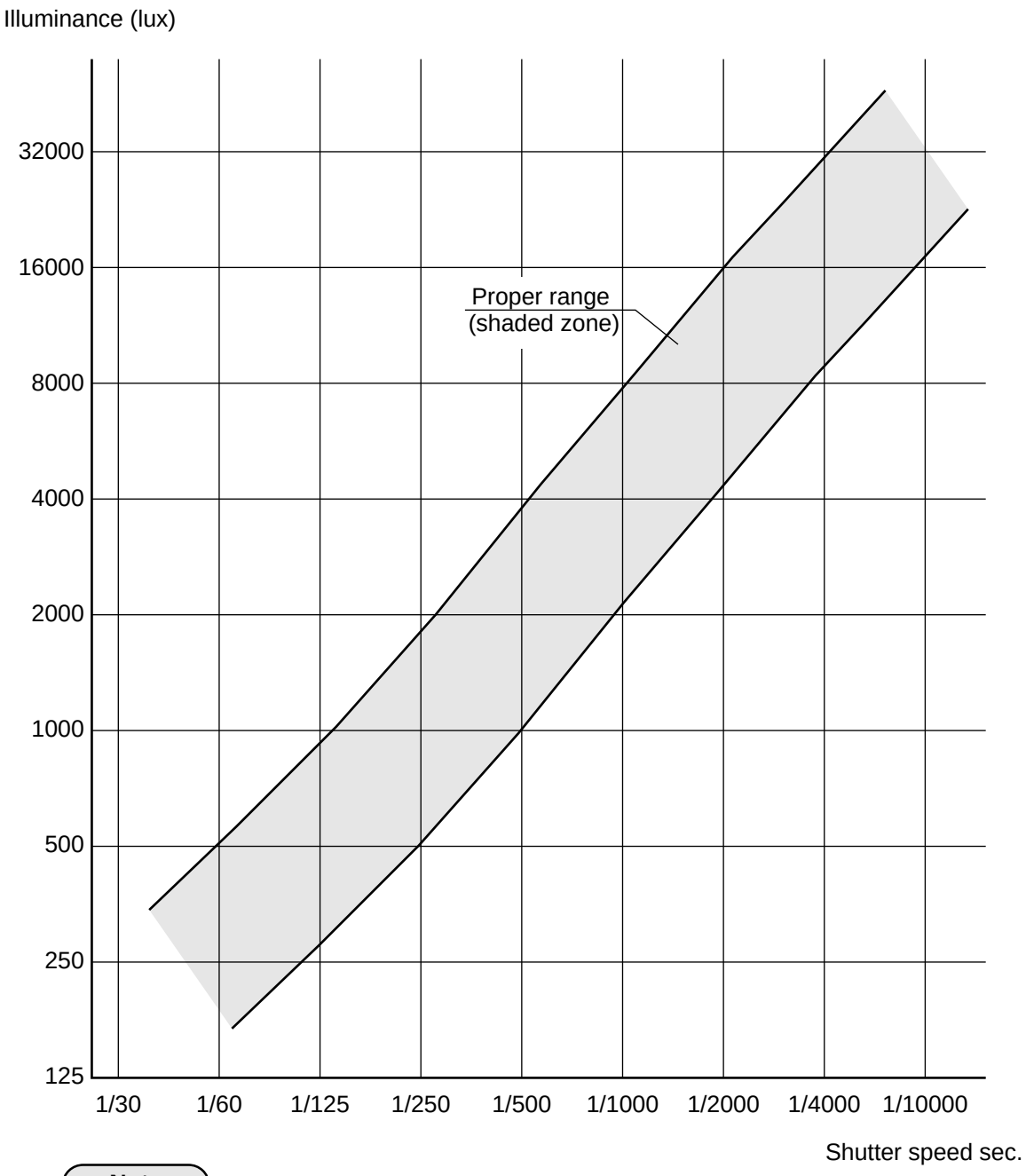


[2] Illuminance and shutter speed

The illuminance provided by the lighting equipment and the shutter speed must be set within the proper range.

- The following graph shows the relation between illuminance and shutter speed for the IV-S20L16 camera lens (focal length 16 mm) with an aperture setting of f = 1.6.
  Determine the proper amount of illuminance and the correct shutter speed, by referring to this graph. Adjust the aperture as necessary.
- To measure a moving object, or to increase the image processing speed, set the shutter speed to 1/1000 sec. or 1/2000 sec. or faster. However, an extremely high shutter speed will require intense lighting, thereby increasing the cost.

Relation between illuminance and shutter speed [IV-S20L16 camera lens (focal length 16 mm) with an aperture setting of f = 1.6]

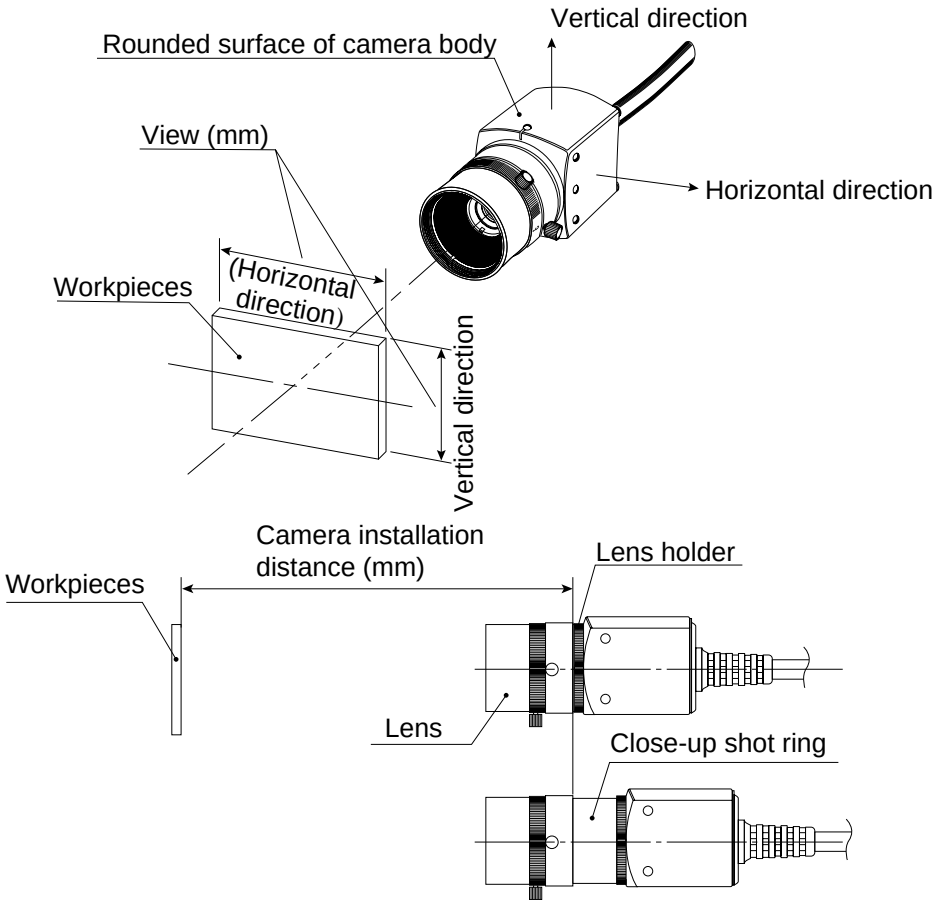


Note

- The standard relationship between illuminance and shutter speed is given above for reference. When actually installing the equipment, make sure the proper combination is used for the actual system.

[3] Optimum lens and resolution

The optimum lens for your system can be selected, based on the camera installation distance and the field of view (workpiece size).



There is a relationships as shown on page 6-6 and 6-7, among the camera installation distance, the field of view (in the vertical/horizontal direction), the lens focal length f, the aperture setting, the focal length, and the resolution.

[Example]

When the camera installation distance is 500 mm and the field of view (in the horizontal direction) is 110 mm, the optimum lens can be selected as described in the following procedure. The required information is taken from the table on page 6-6.

Camera installation distance (mm)	Lens focal length f=16mm			
	View (mm)		Focal length	Resolution
	Vertical	Horizontal	(mm)	(μm)
450	96.3	102.8	16.6	200.7
500	107.4	114.6	16.5	223.9
600	129.6	138.3	16.4	270.1

① ②

③

① Selecting the lens focal length, and aperture (f - stp setting)

Follow the line for a camera installation distance of 500 mm for the view (in the horizontal direction) that is closest to 110 mm, which is 114.6 mm. A 114.6 mm field of view is shown in the column for a lens focal length, f, of 16 mm. Therefore, a lens with focal length of 16 mm is considered to be optimum.

② Considering the focal length

The actual focal length, 16.5 mm, is longer than the lens focal length, f = 16 mm, by 0.5 mm. However, if the camera installation distance of 500 mm is within the focal range (distance from an object) of the actual lens (f = 16 mm), you can use it.

1. The focus range of the IV-S20L16 camera lens (f = 16 mm) built into the IV-S20 is from 50 mm to infinity. Therefore, the camera installation distance of 500 mm is within the focal range, and the IV-S20L16 lens can be used.
2. When another lens (with a focal range of 16 mm) is used, if its focal range exceeds 500 mm, install a commercially available C mount close-up shot ring. Use a ring that is 0.5 mm thick (16.5 - 16 = 0.5 mm).

③ Resolution

When the displayed image fills the whole monitor screen, and the view (in the horizontal direction) is 114.6 mm wide, the resolution is 223.9 μm.

$$\frac{114.6\text{mm}}{512(\text{pixelcount})} \fallingdotseq 223.9\ \mu\text{m}$$

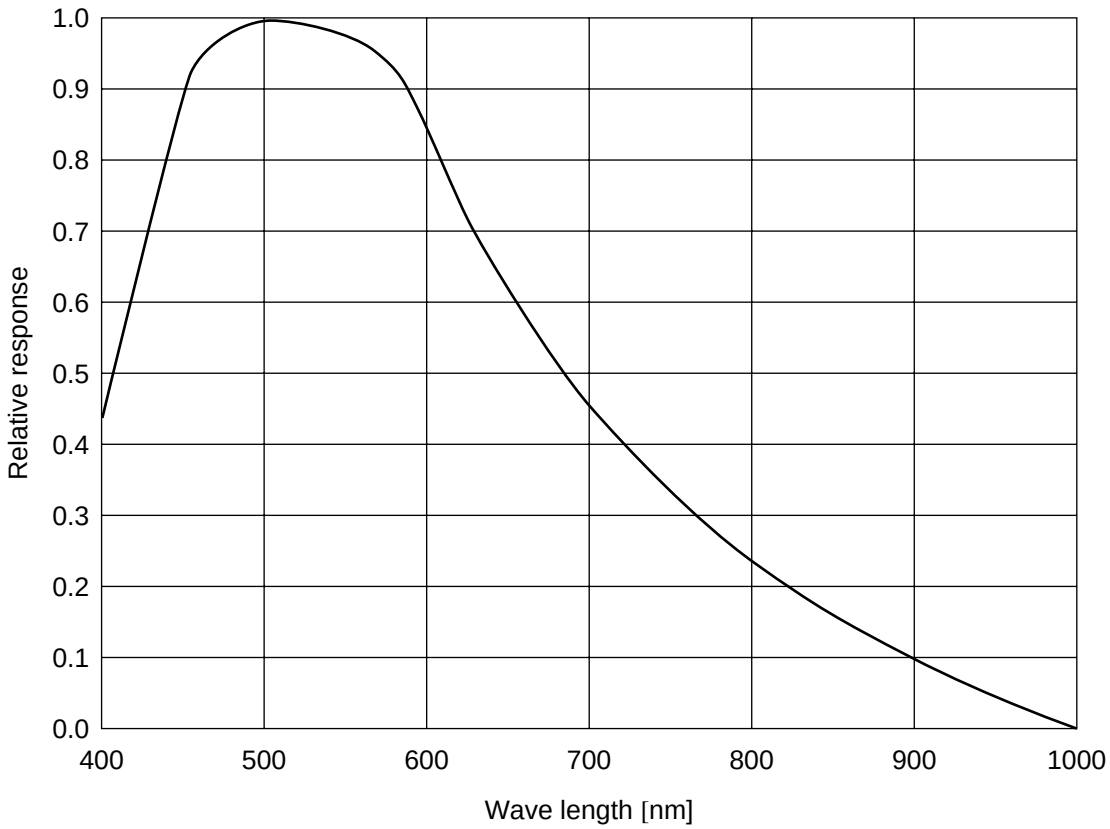
See "Glossary" for the diefinition of resolution.

Notes

- The values shown in the tables on page 6-5 and 6-6 are only reference data for installation. These values may vary, according to the characteristics of lenses you are using. When using any lens, check the data using the actual equipment.
- If you want to use a camera lens other than the IV-S20L16, buy a lens with a C type lens base. (The IV-S20L16 has a C type lens base.)
- A lens with too short focal length (f = 4.2 mm or 8 mm) will distort the edges of the field of view.

The spectral sensitivity characteristics of the CCD element used in the CCD camera are listed below.

- Spectral sensitivity characteristics of the CCD element



· Relation among the camera installation distance, the field of view, and the focal length

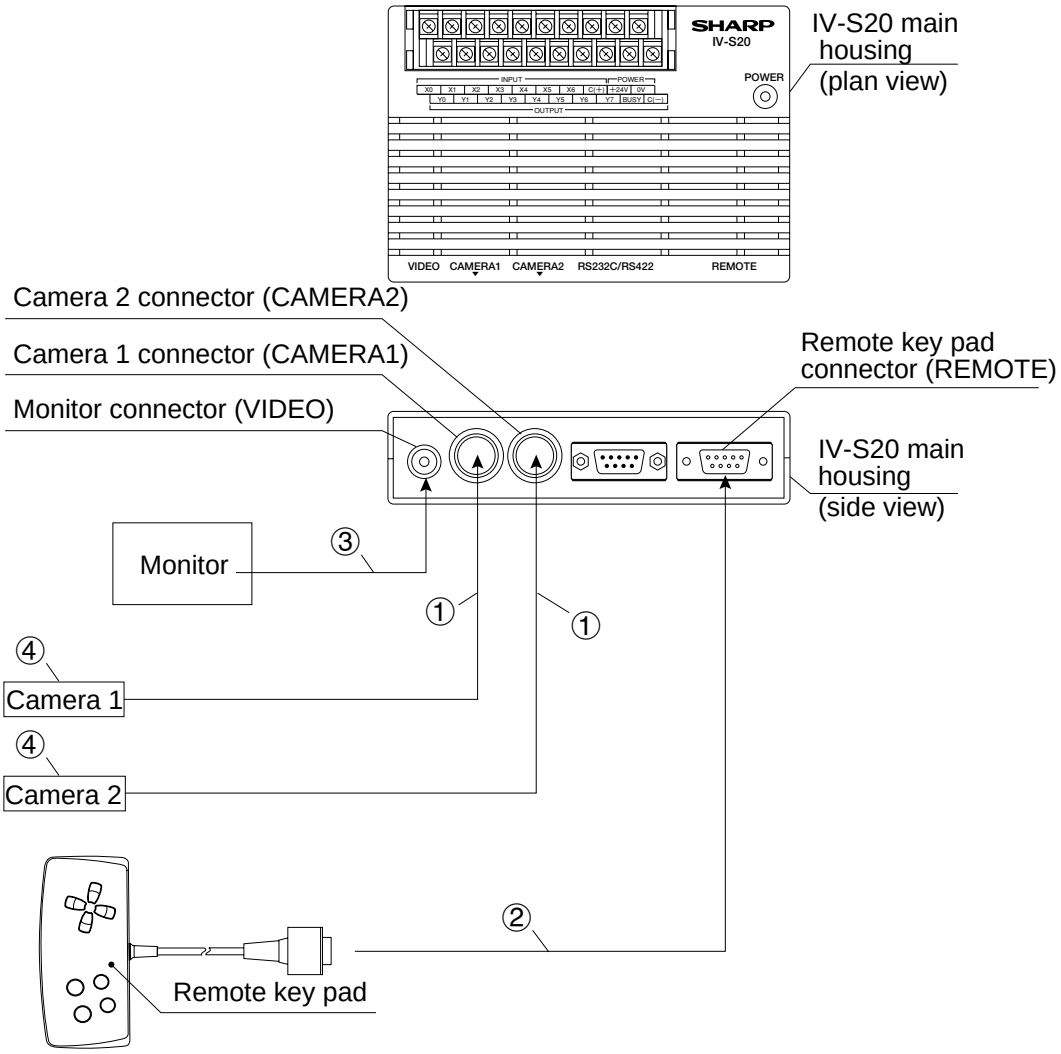
Camera installation distance (mm)	Lens focal length f=4.2mm				Lens focal length f=8mm				Lens focal length f=16mm				Lens focal length f=25mm			
	View (mm)		Focal length	Resolution	View (mm)		Focal length	Resolution	View (mm)		Focal length	Resolution	View (mm)		Focal length	Resolution
	Vertical	Hori-zontal	(mm)	(μm)	Vertical	Hori-zontal	(mm)	(μm)	Vertical	Hori-zontal	(mm)	(μm)	Vertical	Hori-zontal	(mm)	(μm)
55	39.7	42.4	4.9	82.8	14.2	15.2	10.0	29.6	–	–	–	–	–	–	–	–
60	44.0	46.9	4.8	91.6	16.4	17.5	9.7	34.2	9.8	10.4	21.8	20.4	5.0	5.3	42.9	10.4
70	52.4	55.9	4.7	109.2	20.9	22.3	9.4	43.5	12.0	12.8	20.7	25.0	6.4	6.8	38.9	13.3
80	60.9	65.0	4.7	126.9	25.3	27.0	9.1	52.7	14.2	15.2	20.0	29.6	7.8	8.3	36.4	16.3
90	69.3	74.0	4.6	144.5	29.7	31.7	9.0	62.0	16.4	17.5	19.5	34.2	9.2	9.9	34.6	19.2
100	77.8	83.0	4.6	162.1	34.2	36.5	8.8	71.2	18.6	19.9	19.0	38.9	10.7	11.4	33.3	22.2
120	94.7	101.0	4.5	197.3	43.1	45.9	8.7	89.7	23.1	24.6	18.5	48.1	13.5	14.4	31.6	28.1
140	111.6	119.1	4.5	232.6	51.9	55.4	8.5	108.2	27.5	29.4	18.1	57.4	16.3	17.4	30.4	34.0
160	128.5	137.1	4.4	267.8	60.8	64.9	8.5	126.7	32.0	34.1	17.8	66.6	19.2	20.5	29.6	40.0
180	145.5	155.2	4.4	303.1	69.7	74.4	8.4	145.2	36.4	38.8	17.6	75.9	22.0	23.5	29.0	45.9
200	162.4	173.2	4.4	338.3	78.6	83.8	8.4	163.7	40.8	43.6	17.4	85.1	24.9	26.5	28.6	51.8
250	204.7	218.3	4.3	426.4	100.8	107.5	8.3	210.0	51.9	55.4	17.1	108.2	32.0	34.1	27.8	66.6
300	246.9	263.4	4.3	514.5	123.0	131.2	8.2	256.2	63.0	67.3	16.9	131.4	39.1	41.7	27.3	81.4
350	289.2	308.5	4.3	602.6	145.2	154.9	8.2	302.5	74.1	79.1	16.8	154.5	46.2	49.3	26.9	96.2
400	331.5	353.6	4.3	690.7	167.4	178.6	8.2	348.7	85.2	90.9	16.7	177.6	53.3	56.8	26.7	111.0
450	373.8	398.7	4.3	778.8	189.6	202.2	8.1	395.0	96.3	102.8	16.6	200.7	60.4	64.4	26.5	125.8
500	416.1	443.9	4.3	866.9	211.8	225.9	8.1	441.2	107.4	114.6	16.5	223.9	67.5	72.0	26.3	140.6
600	500.7	534.1	4.3	1043.1	256.2	273.3	8.1	533.8	129.6	138.3	16.4	270.1	81.7	87.1	26.1	170.2
700	585.2	624.3	4.2	1219.3	300.6	320.6	8.1	626.3	151.8	162.0	16.4	316.4	95.9	102.3	25.9	199.8
800	669.8	714.5	4.2	1395.5	345.0	368.0	8.1	718.8	174.0	185.7	16.3	362.6	110.1	117.5	25.8	229.4
900	754.4	804.7	4.2	1571.7	389.4	415.4	8.1	811.3	196.2	209.3	16.3	408.9	124.3	132.6	25.7	259.0
1000	838.9	894.9	4.2	1747.9	433.8	462.7	8.1	903.8	218.4	233.0	16.3	455.1	138.5	147.8	25.6	288.6
1100	923.5	985.1	4.2	1924.1	478.2	510.1	8.1	996.3	240.6	256.7	16.2	501.4	152.7	162.9	25.6	318.2
1200	1008.1	1075.4	4.2	2100.3	522.6	557.5	8.1	1088.8	262.8	280.4	16.2	547.6	166.9	178.1	25.5	347.8
1300	1092.7	1165.6	4.2	2276.5	567.0	604.8	8.1	1181.3	285.0	304.1	16.2	593.9	181.2	193.2	25.5	377.4
1400	1177.2	1255.8	4.2	2452.7	611.4	652.2	8.0	1273.8	307.2	327.7	16.2	640.1	195.4	208.4	25.5	407.0
1500	1261.8	1346.0	4.2	2628.9	655.8	699.5	8.0	1366.3	329.4	351.4	16.2	686.4	209.6	223.6	25.4	436.6
1600	1346.4	1436.2	4.2	2805.1	700.2	746.9	8.0	1458.8	351.6	375.1	16.2	732.6	223.8	238.7	25.4	466.2
1700	1430.9	1526.4	4.2	2981.3	744.6	794.3	8.0	1551.3	373.8	398.8	16.2	778.9	238.0	253.9	25.4	495.8
1800	1515.5	1616.6	4.2	3157.5	789.0	841.6	8.0	1643.8	396.0	422.5	16.1	825.1	252.2	269.0	25.4	525.4
1900	1600.1	1706.9	4.2	3333.7	833.4	889.0	8.0	1736.3	418.2	446.2	16.1	871.4	266.4	284.2	25.3	555.0
2000	1684.7	1797.1	4.2	3509.9	877.8	936.4	8.0	1828.8	440.4	469.8	16.1	917.6	280.6	299.3	25.3	584.6
2500	2107.5	2248.1	4.2	4390.9	1099.8	1173.2	8.0	2291.3	551.4	588.2	16.1	1148.9	351.6	375.1	25.3	732.6
3000	2530.4	2699.2	4.2	5271.9	1321.8	1410.0	8.0	2753.9	662.4	706.6	16.1	1380.2	422.7	450.9	25.2	880.6
3500	2953.2	3150.3	4.2	6152.9	1543.8	1646.8	8.0	3216.4	773.4	825.1	16.1	1611.4	493.7	526.7	25.2	1028.7
4000	3376.1	3601.4	4.2	7033.9	1765.8	1883.6	8.0	3678.9	884.4	943.5	16.1	1842.7	564.8	602.5	25.2	1176.7
4500	3798.9	4052.4	4.2	7914.9	1987.8	2120.4	8.0	4141.4	995.4	1061.9	16.1	2074.0	635.8	678.2	25.1	1324.7
5000	4221.8	4503.5	4.2	8795.9	2209.8	2357.2	8.0	4604.0	1106.4	1180.3	16.1	2305.2	706.8	754.0	25.1	1472.7
5500	4644.7	4954.6	4.2	9676.9	2431.8	2594.0	8.0	5066.5	1217.4	1298.7	16.0	2536.5	777.9	829.8	25.1	1620.7
6000	5067.5	5405.6	4.2	10557.9	2653.8	2830.9	8.0	5529.0	1328.4	1417.1	16.0	2767.7	848.9	905.6	25.1	1768.7
6500	5490.4	5856.7	4.2	11438.9	2875.8	3067.7	8.0	5991.5	1439.4	1535.5	16.0	2999.0	920.0	981.4	25.1	1916.7
7000	5913.2	6307.8	4.2	12319.9	3097.8	3304.5	8.0	6454.1	1550.4	1653.9	16.0	3230.3	991.0	1057.1	25.1	2064.7
7500	6336.1	6758.9	4.2	13200.9	3319.8	3541.3	8.0	6916.6	1661.4	1772.3	16.0	3461.5	1062.0	1132.9	25.1	2212.7

Camera installation distance (mm)	Lens focal length f=35mm				Lens focal length f=50mm				Lens focal length f=75mm			
	View (mm)		Focal length	Resolution	View (mm)		Focal length	Resolution	View (mm)		Focal length	Resolution
	Vertical	Hori-zontal	(mm)	(μm)	Vertical	Hori-zontal	(mm)	(μm)	Vertical	Hori-zontal	(mm)	(μm)
55	—	—	—	—	—	—	—	—	—	—	—	—
60												
70												
80	4.6	4.9	62.2	9.5								
90	5.6	6.0	57.3	11.6								
100	6.6	7.0	53.8	13.7								
120	8.6	9.2	49.4	18.0	3.3	3.6	103.2	7.0				
140	10.7	11.4	46.7	22.2	4.8	5.1	87.3	9.9				
160	12.7	13.5	44.8	26.4	6.2	6.6	78.7	12.9				
180	14.7	15.7	43.4	30.7	7.6	8.1	73.4	15.8				
200	16.7	17.9	42.4	34.9	9.0	9.6	69.7	18.8				
250	21.8	23.3	40.7	45.5	12.6	13.4	64.1	26.2				
300	26.9	28.7	39.6	56.0	16.1	17.2	61.0	33.6	8.8	9.3	105.4	18.3
350	32.0	34.1	38.9	66.6	19.7	21.0	59.0	41.0	11.1	11.9	98.9	23.2
400	37.0	39.5	38.4	77.2	23.2	24.8	57.6	48.4	13.5	14.4	94.7	28.1
450	42.1	44.9	38.0	87.7	26.8	28.6	56.6	55.8	15.9	16.9	91.8	33.1
500	47.2	50.3	37.6	98.3	30.3	32.4	55.9	63.2	18.2	19.5	89.6	38.0
600	57.3	61.2	37.2	119.5	37.4	39.9	54.7	78.0	23.0	24.5	86.6	47.9
700	67.5	72.0	36.8	140.6	44.5	47.5	54.0	92.8	27.7	29.6	84.6	57.7
800	77.6	82.8	36.6	161.8	51.6	55.1	53.4	107.6	32.4	34.6	83.2	67.6
900	87.8	93.6	36.4	182.9	58.8	62.7	53.0	122.4	37.2	39.7	82.2	77.5
1000	97.9	104.5	36.3	204.0	65.9	70.2	52.7	137.2	41.9	44.7	81.4	87.3
1100	108.1	115.3	36.2	225.2	73.0	77.8	52.4	152.0	46.6	49.8	80.7	97.2
1200	118.2	126.1	36.1	246.3	80.1	85.4	52.2	166.8	51.4	54.8	80.2	107.1
1300	128.4	136.9	36.0	267.5	87.2	93.0	52.0	181.6	56.1	59.9	79.7	116.9
1400	138.5	147.8	35.9	288.6	94.3	100.6	51.9	196.4	60.9	64.9	79.4	126.8
1500	148.7	158.6	35.8	309.8	101.4	108.1	51.8	211.2	65.6	70.0	79.1	136.7
1600	158.8	169.4	35.8	330.9	108.5	115.7	51.6	226.0	70.3	75.0	78.8	146.5
1700	169.0	180.2	35.7	352.0	115.6	123.3	51.5	240.8	75.1	80.1	78.5	156.4
1800	179.1	191.1	35.7	373.2	122.7	130.9	51.4	255.6	79.8	85.1	78.3	166.3
1900	189.3	201.9	35.7	394.3	129.8	138.5	51.4	270.4	84.5	90.2	78.2	176.1
2000	199.4	212.7	35.6	415.5	136.9	146.0	51.3	285.2	89.3	95.2	78.0	186.0
2500	250.2	266.9	35.5	521.2	172.4	183.9	51.0	359.2	113.0	120.5	77.4	235.3
3000	300.9	321.0	35.4	626.9	207.9	221.8	50.9	433.2	136.6	145.8	76.9	284.7
3500	351.6	375.1	35.4	732.6	243.5	259.7	50.7	507.2	160.3	171.0	76.7	334.0
4000	402.4	429.2	35.3	838.4	279.0	297.6	50.6	581.2	184.0	196.3	76.4	383.3
4500	453.1	483.4	35.3	944.1	314.5	335.5	50.6	655.2	207.7	221.5	76.3	432.7
5000	503.9	537.5	35.2	1049.8	350.0	373.4	50.5	729.2	231.4	246.8	76.2	482.0
5500	554.6	591.6	35.2	1155.5	385.5	411.3	50.5	803.2	255.0	272.1	76.0	531.3
6000	605.4	645.8	35.2	1261.2	421.1	449.1	50.4	877.2	278.7	297.3	76.0	580.7
6500	656.1	699.9	35.2	1367.0	456.6	487.0	50.4	951.2	302.4	322.6	75.9	630.0
7000	706.8	754.0	35.2	1472.7	492.1	524.9	50.4	1025.3	326.1	347.8	75.8	679.4
7500	757.6	808.1	35.2	1578.4	527.6	562.8	50.3	1099.3	349.8	373.1	75.8	728.7

6-2 Connection, installation, and wiring of IV-S20 main housing

[1] Connection

Connect the cameras (up to 2 cameras), remote key pad, and monitor to the IV-S20 main housing.



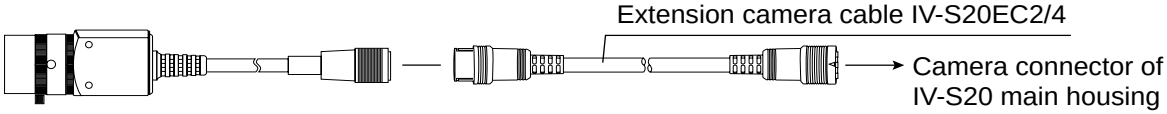
① Connect the camera cable connectors to the camera 1 (CAMERA1) and camera 2 (CAMERA2) connectors on the IV-S20 main housing. => See page 6-19, 6-23, and 6-27.

Note: Only connect or disconnect the camera connectors while the power is OFF.

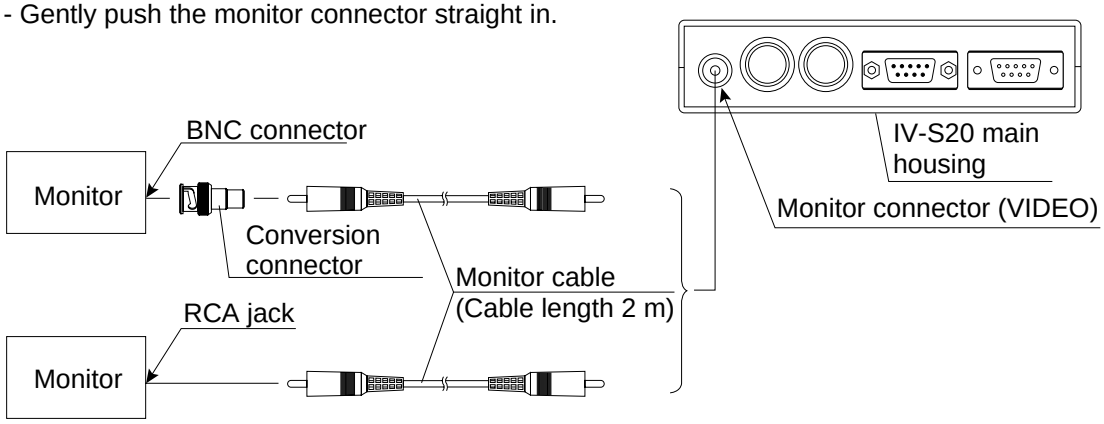
- Push the convex side of the connector into the concave side of the mating connector. When the connector is all the way on, it clicks.
- To disconnect the connector, hold the plug of the connector, and pull it straight out.
- A camera connected to the camera 1 connector (CAMERA1) is treated as camera 1 by this system, and a camera connected to the camera 2 connector (CAMERA2) is treated as camera 2.

Note: You must have a camera connected to the camera 1 connector.

- The camera cable length is 3m. If you need a longer cable, order extension camera cable IV-S20EC2 (cable length 2m) or IV-S20EC4 (cable length 4m).



② Plug the remote key pad connector into the connector (REMOTE) on the IV-S20 main housing.
③ Connect the monitor to the monitor connector (VIDEO: RCA jack) on the IV-S20 main housing using the monitor cable (supplied with the IV-S20, IV-S20N, and IV-S20M) and a conversion connector (supplied with IV-S20, IV-S20N, and IV-S20M). If the monitor has an RCA jack, the conversion connector is not required.
- Use a monitor with either an EIA or NTSC compatible video input terminal.
- Gently push the monitor connector straight in.



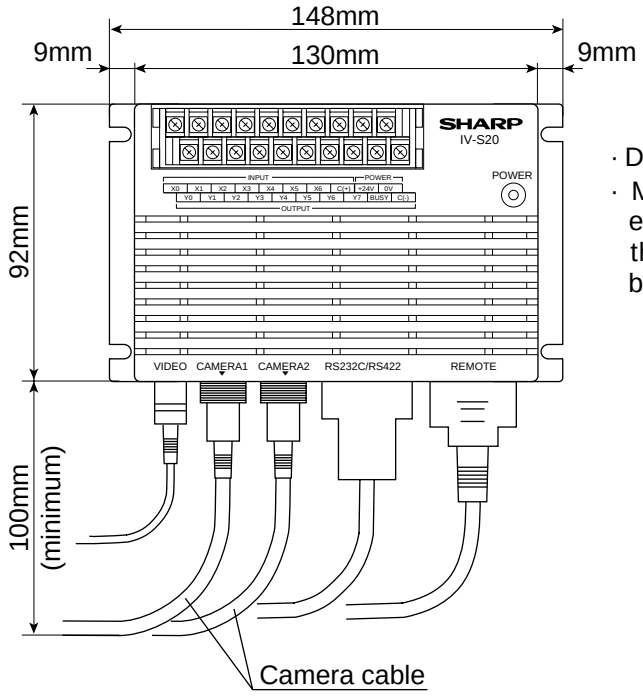
- If you need a monitor cable longer than 2 m, you can purchase a one at a video store.

④ For details about connecting and installing the camera, see page 6-19 and after.

6

■ Leave enough space around the IV-S20

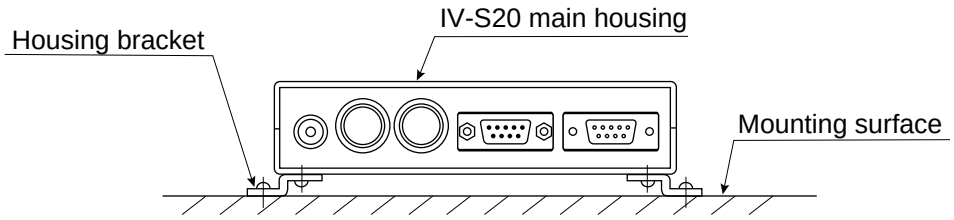
In order to connect camera cables, the remote key pad cable, monitor cable and D-sub connector to the IV-S20, the following space (min.) is required.



· Do not bend the camera cables repeatedly.
· Make sure the installation location allows enough space for the input/output wires going to the I/O terminal block and the power terminal block on the IV-S20.

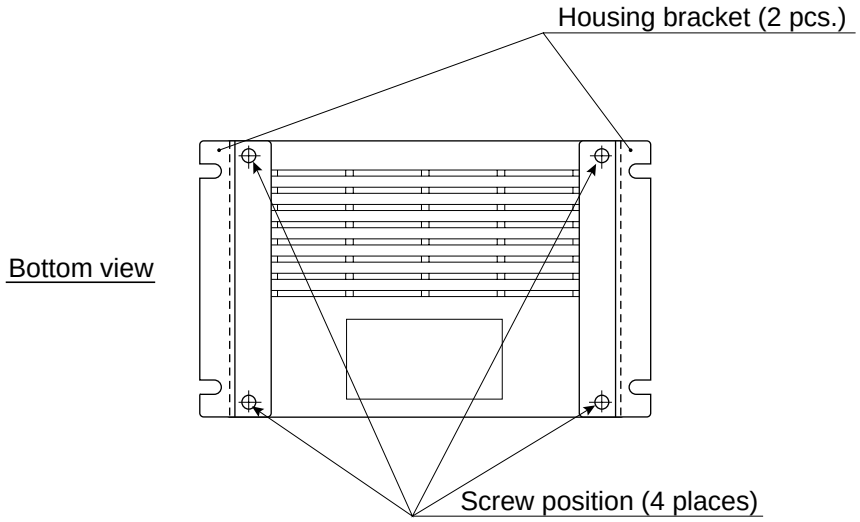
[2] Installation

To install the IV-S20 main housing, secure the bottom of the housing on the mounting surface with the two main housing brackets (supplied with the IV-S20, IV-S20N.)

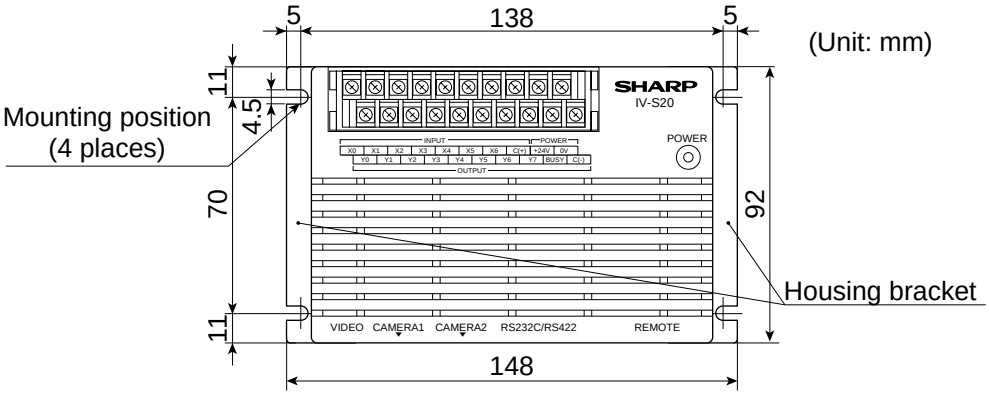


■ Mounting procedure

① Attach the two housing brackets on the bottom of the IV-S20 main housing.
Four screws (M 3 x 6) are supplied with the IV-S20, IV-S20N, and IV-S20M to attach the brackets.



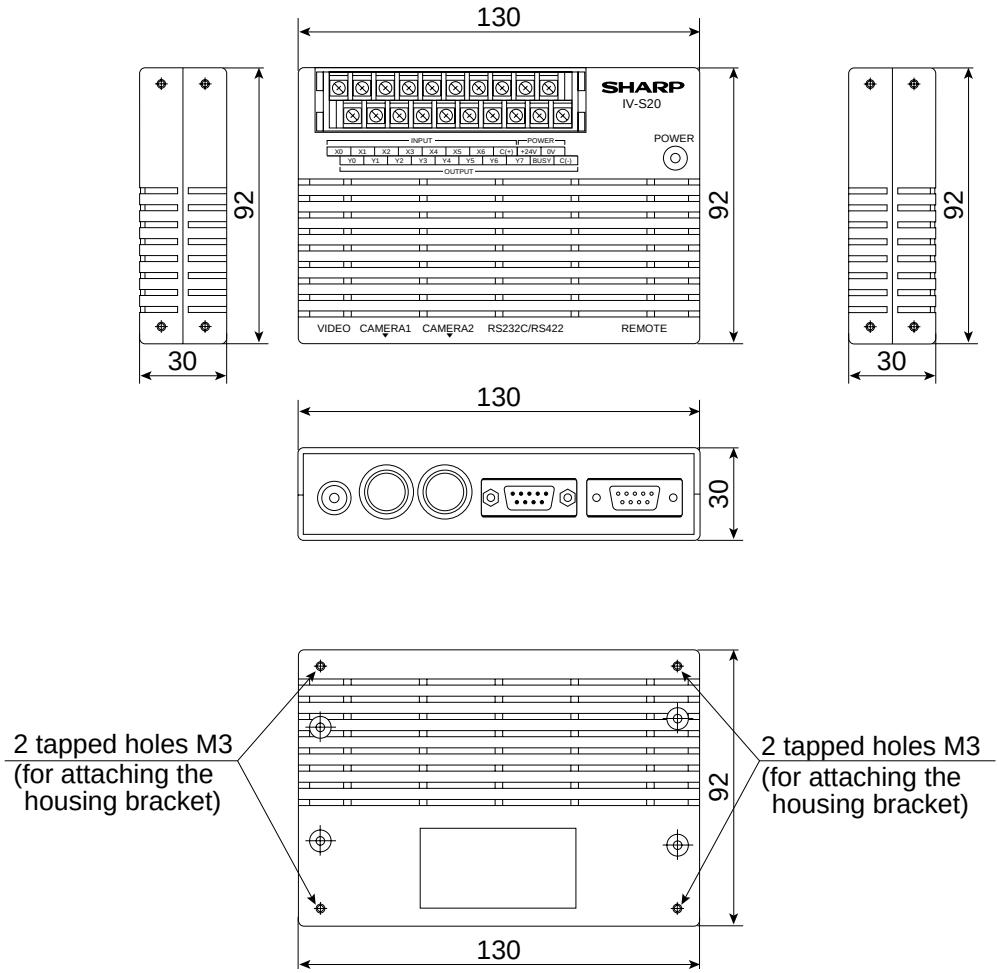
② Secure the housing on the mounting surface with the brackets.



The external dimensions of the housing brackets and the IV-S20 main housing are shown on the following page.

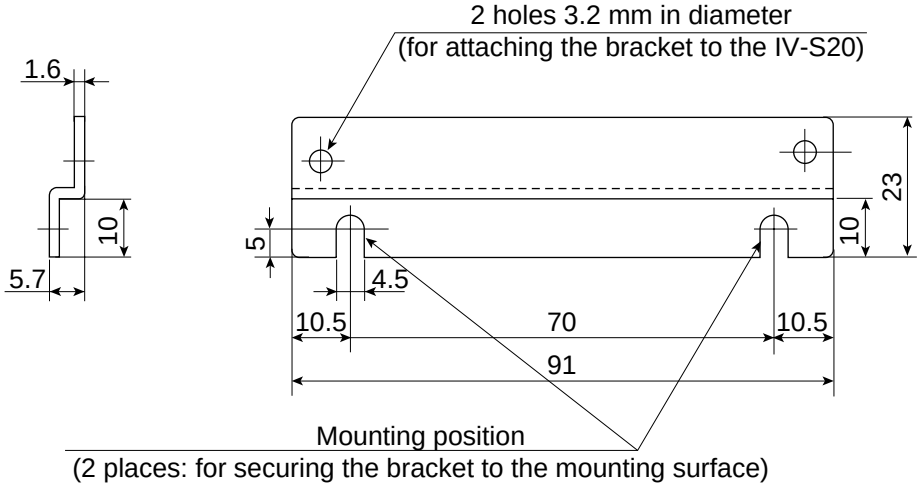
● External dimensions of IV-S20 main housing

(Unit: mm)



● External dimensions of housing bracket

(Unit: mm)

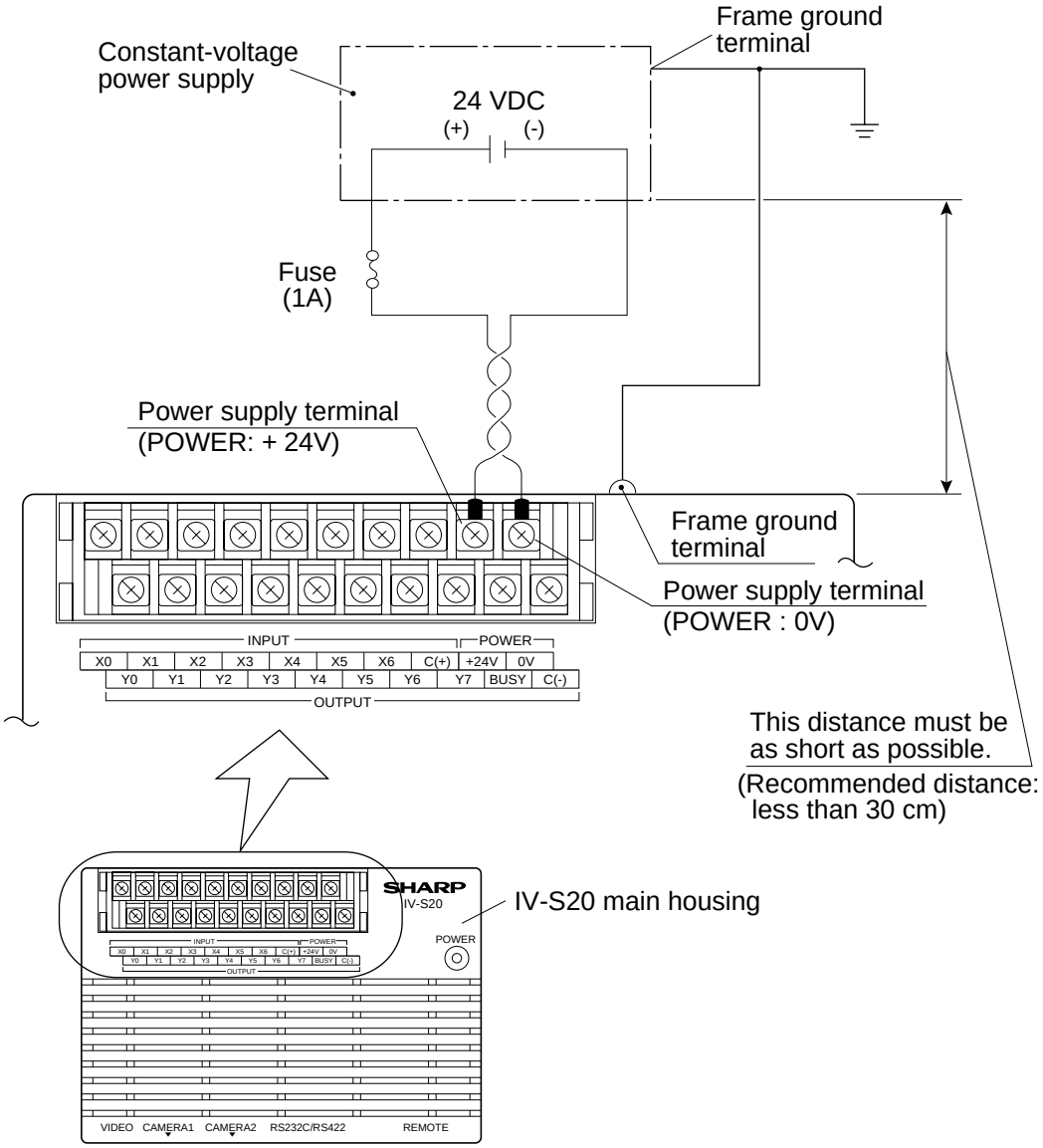


[3] Connecting a power supply

Connect a commercially available constant-voltage power supply to the power terminals (POWER: +24 V, 0 V) on the IV-S20 main housing.

Use a 24 VDC ± 10%, 350 mA or more constant-voltage power supply.

- Use an individual power supply to supply power to the IV-S20 main housing. If the power supply is used to power other equipment, measurement errors may occur.
- Check the polarity of the power supply terminals, +24 V and 0 V. If power is supplied with the polarity inverted, the IV-S20 main housing may be damaged.
- Only connect or disconnect the camera cable and other equipment while the power is OFF.



Note

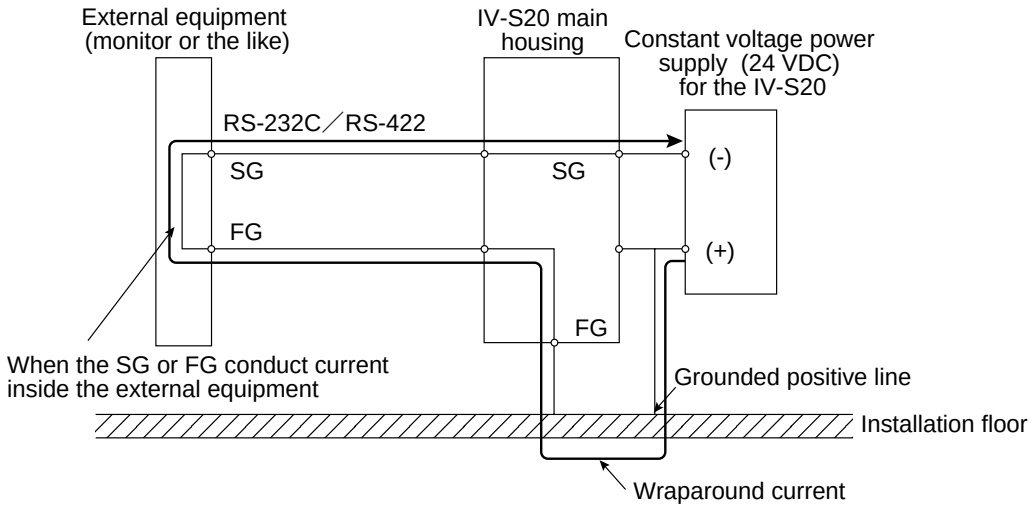
To improve the noise resistance of the constant-voltage power supply connected to the IV-S20 main housing, observe the following precautions.

- Ground the FG terminal of the constant-voltage power supply according to the class 3 grounding.
- The power line between the IV-S20 main housing and the constant-voltage power supply must be as short as possible. (Recommended distance: less than 30 cm)
  Do not run the power supply line near any noise generating sources, such as electric motor lines.
- Use twisted-pair wire for the power supply line.

Note

The constant voltage power supply (24VDC) connected to the IV-S20 main housing should not be ground its positive terminal.

- If the positive terminal of the constant voltage power supply is grounded while using external equipment connected to the SG or FG terminals, the short circuit shown below will be created. This circuit will let a large current flow through the SG line inside the IV-S20, and may destroy the circuit, or cause smoke or a fire.



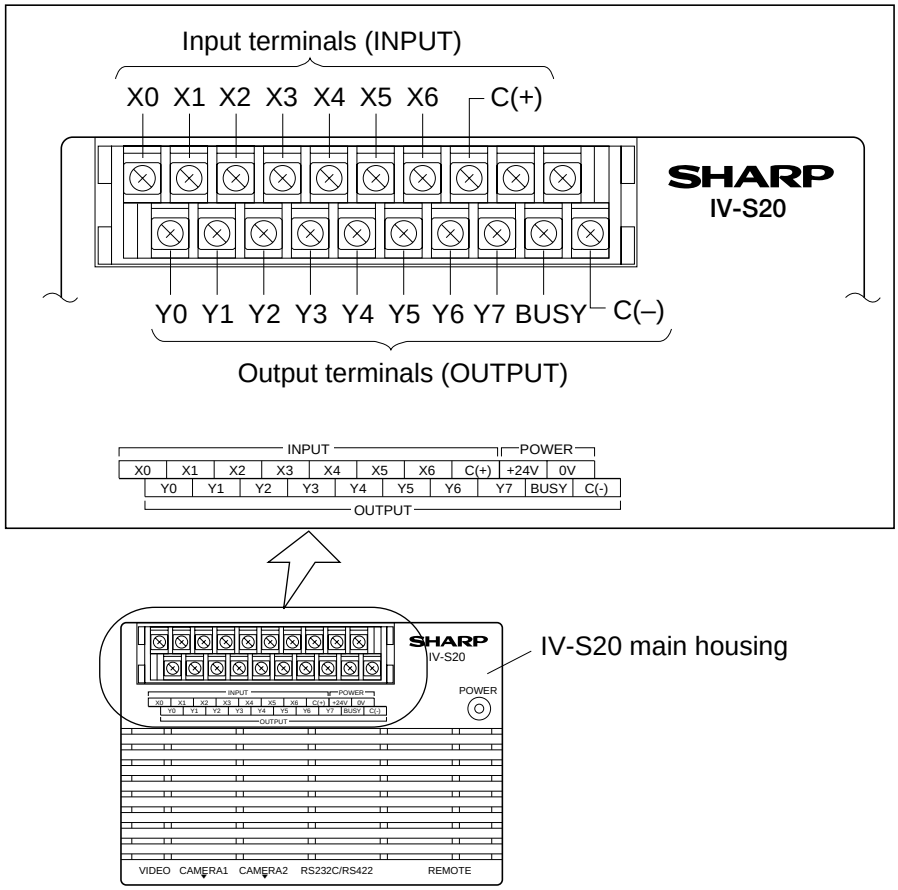
- If the positive terminal of the 24 VDC power supply must be grounded for facility construction reasons, make sure to provide an independent power supply (exclusively for use with the IV-S20) which does not ground either the positive or negative terminals.

[4] Connecting to the input/output terminals (parallel I/F)

7 input terminals and 9 output terminals are available on the input/output terminal block on the IV-S20 main housing.

The input terminal block has INPUT terminals X0 to X6 and C (+), and the output terminal block has OUTPUT terminals Y0 to Y7, BUSY and C (-).

■ **Input/output terminal block on the IV-S20 main housing**



(1) Input terminals (INPUT) X0 to X4

X0	- Measurement start input/output setting condition *1 ⇨ External input - Measurement start input/output setting condition *2 ⇨ Measurement start input
X1 to 4	- Measurement start input/output setting condition *1 ⇨ External input - Measurement start input/output setting condition *2 ⇨ Object type input (0 to 15)

Object type	X4	X3	X2	X1	Object type	X4	X3	X2	X1
0	OFF	OFF	OFF	OFF	8	ON	OFF	OFF	OFF
1	OFF	OFF	OFF	ON	9	ON	OFF	OFF	ON
2	OFF	OFF	ON	OFF	10	ON	OFF	ON	OFF
3	OFF	OFF	ON	ON	11	ON	OFF	ON	ON
4	OFF	ON	OFF	OFF	12	ON	ON	OFF	OFF
5	OFF	ON	OFF	ON	13	ON	ON	OFF	ON
6	OFF	ON	ON	OFF	14	ON	ON	ON	OFF
7	OFF	ON	ON	ON	15	ON	ON	ON	ON

	Input/output condition setting (See Chapter 11.)
*1	Measurement start input I/F = General purpose serial interface signal
	Measurement start input I/F = CCD trigger CCD sampling start = General purpose serial interface signal or auto detect (edge or level)
*2	Measurement start input I/F = Parallel
	Measurement start input I/F = CCD trigger, CCD sampling start = Parallel interface

(2) Input terminals (INPUT) X5 and X6

X5	Parallel selection input (External input/reference image registration etc. and measurement number specification (lower bits)) Specify in item ⑤PARALLEL INPUTX5 on the [I/O SETTINGS] menu.
X6	Parallel selection input (External input/image change etc. and measurement number specification (upper bits)) Specify in item ⑥PARALLEL INPUTX6 on the [I/O SETTINGS] menu.

[When X5 and X6 are used to specify a measurement number]

Measurement to be executed	X6	X5
Measurement 0	OFF	OFF
Measurement 0&1	OFF	ON
Measurement 0&2	ON	OFF
Measurement 0&3	ON	ON

(See page 11-1 and 11-2.)

(3) Output terminals (OUTPUT) Y0 to Y7 and BUSY

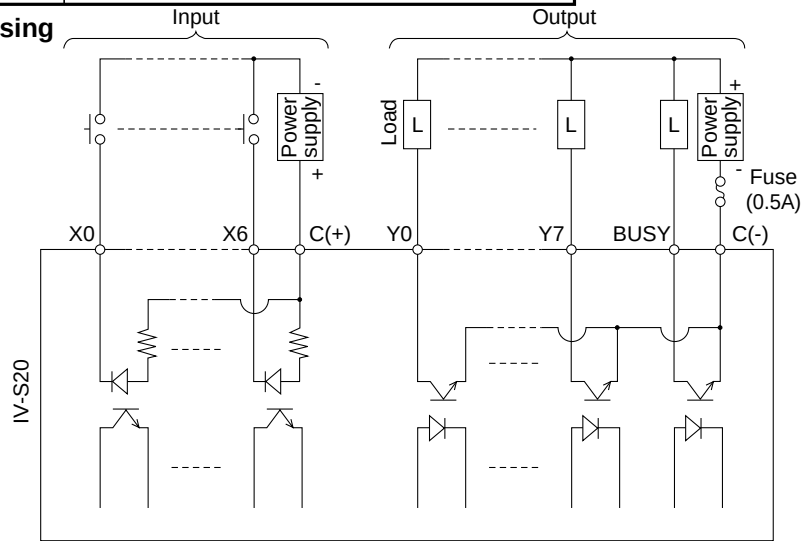
Y0 to Y7	Result of logical calculation output - Specify in item ⑭FINAL OUTPUT COND on the [OBJECT TYPE COND] menu. => See page 10-8 to 13.
BUSY	When "BUSY" is active, this terminal outputs an ON signal while the IV-S20 is executing the measurement and opening the all set menu. When "READY" is active, this terminal outputs an ON signal while the IV-S20 is waiting for a trigger. - To specify "BUSY" or "READY," go to item ⑦OUTPUT STATUS in the "I/O SETTINGS" menu. Seetings => See page 11-1. Time chart, etc. => See page 11-4 to 11-15.

(4) Input/output port

The input/output terminals are isolated by photocouplers, to prevent malfunctions due to noise. Use them within the rated range. The specifications of the input/output ports are listed below.

Item		Rating
Input	Rated input voltage	12/24 VDC
	Input voltage range	10.5 to 26.4 VDC
	Input voltage level	ON: 10.5 V or less OFF: 5 V or more
	Input current level	ON: 3 mA or less OFF: 1.5 mA or more
	Input impedance	3.3 k ohm
Output	Rated output voltage	12/24 VDC
	Load voltage range	10.5 to 27 VDC
	Rated max. output current	20 mA DC
	Output type	NPN transistor, open collector
	ON voltage drop	1.2 V or less (20 mA)
	Isolation method	Isolated by photocoupler
Response time		1 ms or less (OFF to ON, ON to OFF)

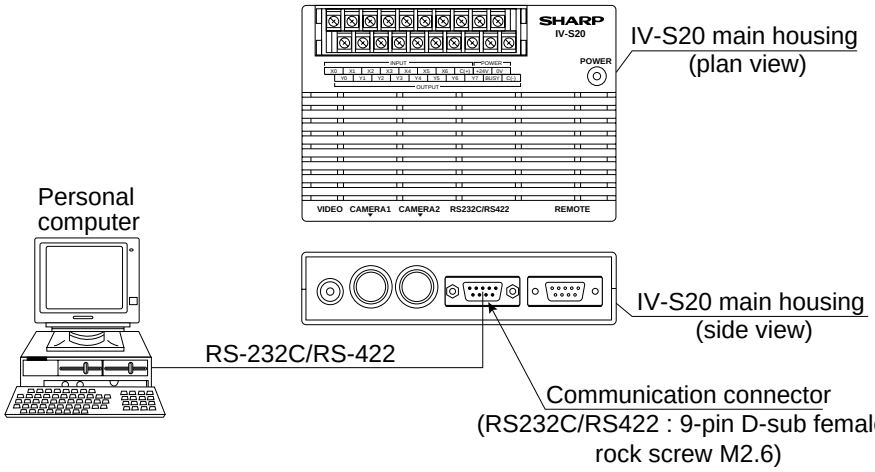
(5) Wiring to IV-S20 main housing



[5] Connection for communications with personal computer (general purpose serial I/F)

Connect a personal computer to the communication connector (RS232C/RS422) on the IV-S20 main housing.

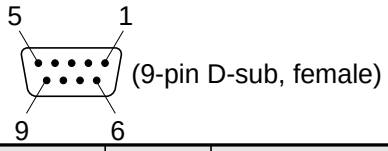
A 9-pin D-sub, male connector is included with the IV-S20, IV-S20N, and IV-S20M.



6

(1) When communicating through the RS-232C port

- IV-S20 pin arrangement of the communication connector (for RS-232C)



Communication standard	Pin No.	Signal name	Details	Direc-tion
RS-232C	2	RD	Received data (personal computer ⇨ IV-S20)	Input
	3	SD	Transmitted data (IV-S20 ⇨ personal computer)	Output
	5	SG	Signal ground	–
Connector shield		FG	Frame ground	–

Personal computer

DOS/V, IBM-PC		
	PC98 series	
9-pin D-sub Pin No.	25-pin D-sub Pin No.	Signal name
Connector case	Connector case	FG
3	2	SD
2	3	RD
5	7	SG
7	4	RS
8	5	CS
6	6	DSR
1	8	CD
4	20	DTR

Communication connector on the IV-S20
(RS232C/RS422: 9-pin D-sub)

Pin No.	Signal name	Function
Connector case	FG	Frame ground
2	RD	Received data
3	SD	Transmitted data
5	SG	Signal ground
1	FL1	Memory protection 1
6	FL2	Memory protection 1

*(RS-232C)

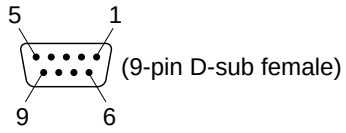
*The maximum length of the communication cable depends on the communication speed.

Communication speed (kbps)	Cable length
9.6, 19.2	15 m or less
38.4, 57.6, 115.2	2 to 3 m

· Conduct a communication test before using the devices for measurements.

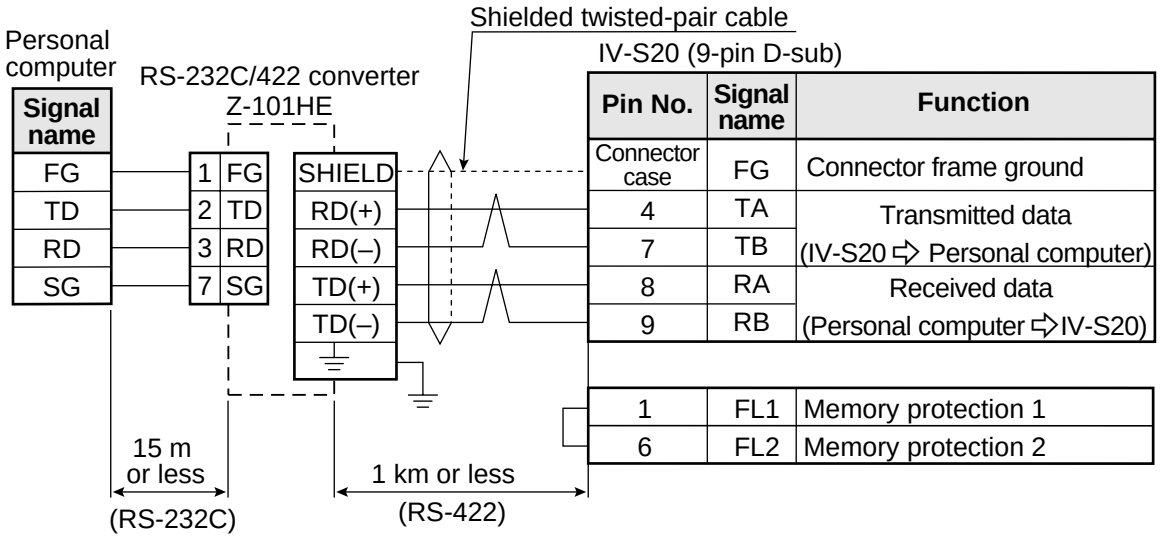
(2) When communicating through the RS-422

Specify the 4-wire or 2-wire RS-422 system on the [SERIAL COMM.] menu (see page 11-17).

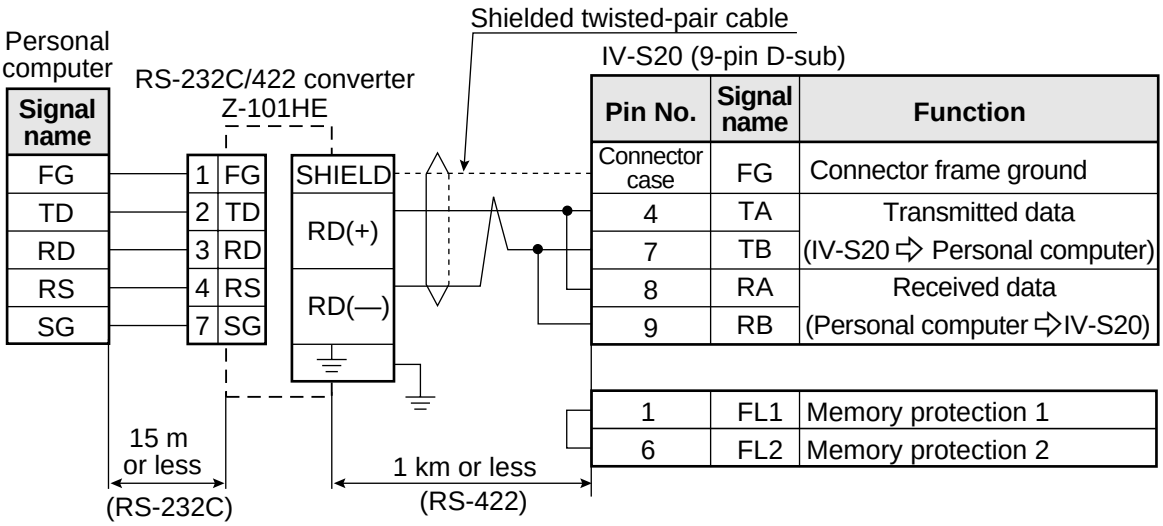


Communication standard	Pin No.	Signal name	Details	Direction
RS-422	4	TA	Transmitted data (IV-S20 ⇨ Personal computer)	Output
	7	TB		
	8	RA	Received data (Personal computer ⇨ IV-S20)	Input
	9	RB		
Connector field		FG	Frame ground	–

① 4-wire system

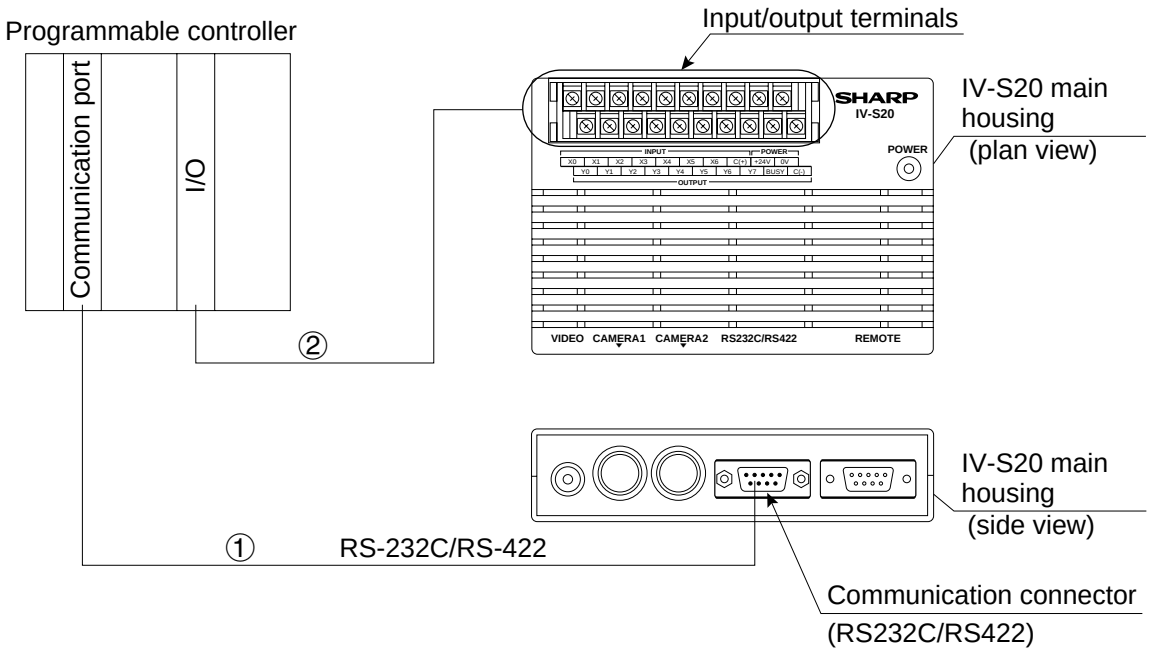


② 2-wire system



[6] Connecting a programmable controller using the computer link function

Connect a programmable controller to the communication connector (RS232C/RS422) and the input/output terminals on the IV-S20 main housing.



①Connect the computer link connector (RS-232C/RS-411) of a programmable controller to the communication connector (RS232C/RS422: 9-pin D-sub, female) on the IV-S20 main housing.

- See Chapter 14 "Computer Link" for details about the procedure for connecting to specific manufacturers' controllers.
  (The pin arrangement of the communication connector on the IV-S20 main housing is shown on page 6-16 to 6-17.)
- In the case of RS-232C, the maximum communication cable length depends on the communication speed.

Communication speed	Cable length
9.6, 19.2	15 m or less
38.4, 57.6, 115.2	2 to 3 m

Conduct a communication test before using the devices for measurements.

②Connect the input/output terminals of the programmable controller to the input/output terminals on the IV-S20 main housing.

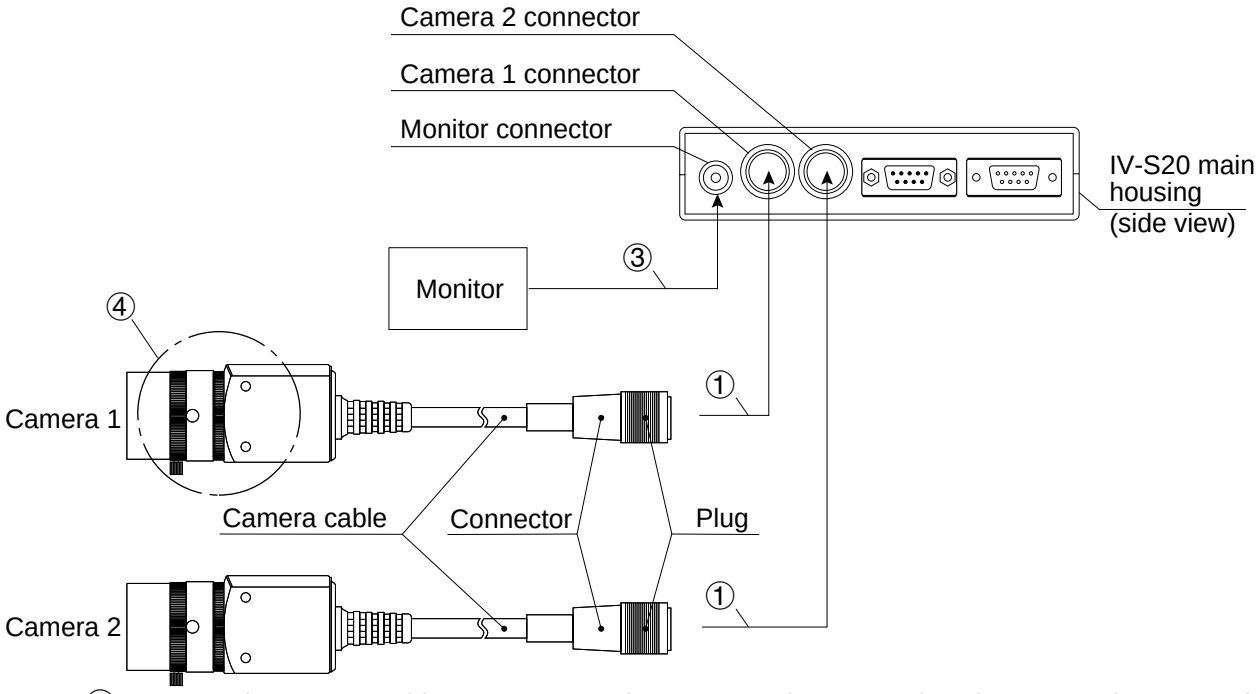
- See item [4] "Connecting to the input/output terminals (parallel I/F)" for details about wiring procedure.

6-3 Connection and installation methods of camera (IV-S20C1, IV-S30C1/C2)

[1] Connecting and installation to the IV-S20C1

(1) Connection

Connect the cameras (up to 2 cameras), remote key pad, and monitor to the IV-S20 main housing.

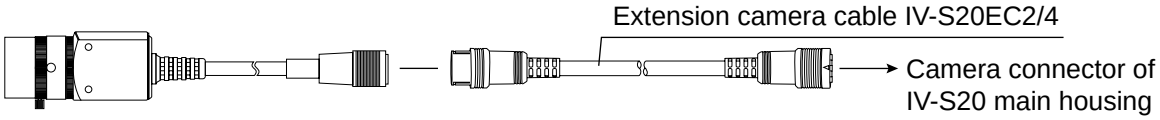


① Connect the camera cable connectors to the camera 1 (CAMERA1) and camera 2 (CAMERA2) connectors on the IV-S20 main housing.
Note: Only connect or disconnect the camera connectors while the power is OFF.

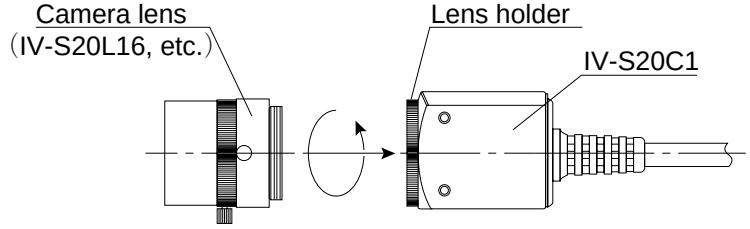
- Push the convex side of the connector into the concave side of the mating connector. When the connector is all the way on, it clicks.
- To disconnect the connector, hold the plug of the connector, and pull it straight out.
- A camera connected to the camera 1 connector (CAMERA1) is treated as camera 1 by this system, and a camera connected to the camera 2 connector (CAMERA2) is treated as camera 2.

Note: You must have a camera connected to the camera 1 connector.

- The camera cable length is 3m. If you need a longer cable, order extension camera cable IV-S20EC2 (cable length 2m) or IV-S20EC4 (cable length 4m).



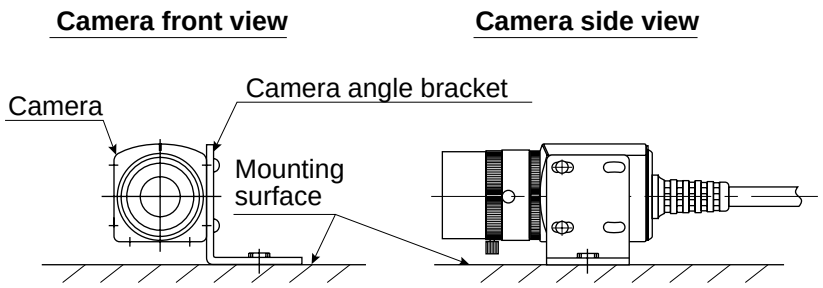
② Screw and the IV-S20L16 camera lens on the lens holder of the camera body, and secure it in place.



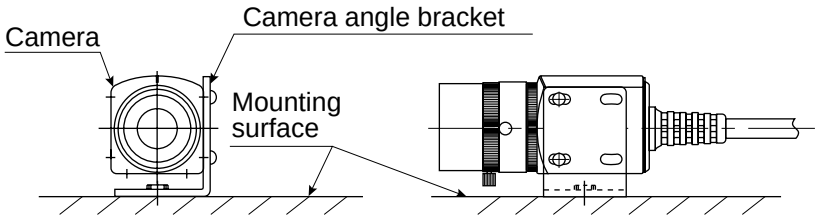
(2) Installing the camera body

Attach the IV-S20C1 camera body on the mounting surface with the camera angle bracket (supplied with the IV-S20, IV-S20N and IV-S20C1).

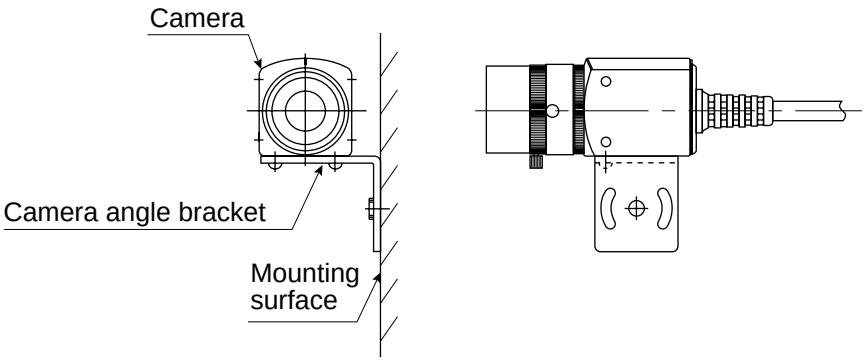
· Installation example 1



· Installation example 2



· Installation example 3



■ Installation procedure

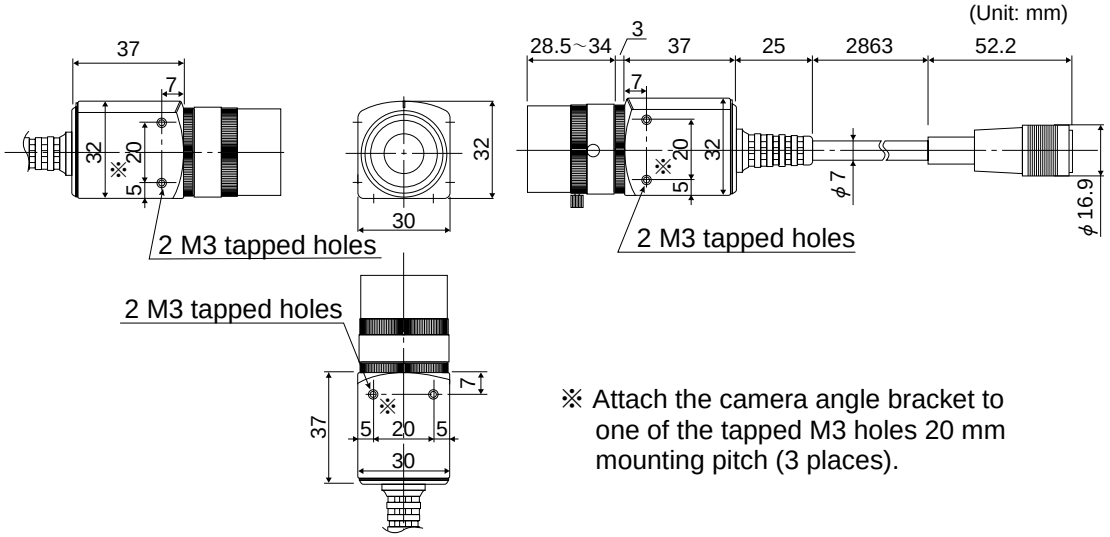
① Attach the camera angle bracket to the tapped M3 hole on the camera body (20 mm mounting pitch: one of three holes). Two screws (M 3 x 6) are supplied with the IV-S20, IV-S20N and IV-S20C1 for attaching the angle.

② Attach the camera controller angle to the mounting surface with the slotted holes 3.2 mm wide (20 mm mounting pitch) or 1/4-20 UNC threaded hole.

The external dimensions of the camera angle bracket , camera body, and extension camera cable are shown on the following page.

● External dimensions of camera body (IV-S20C1) and camera lens (IV-S20L16)

(Unit: mm)

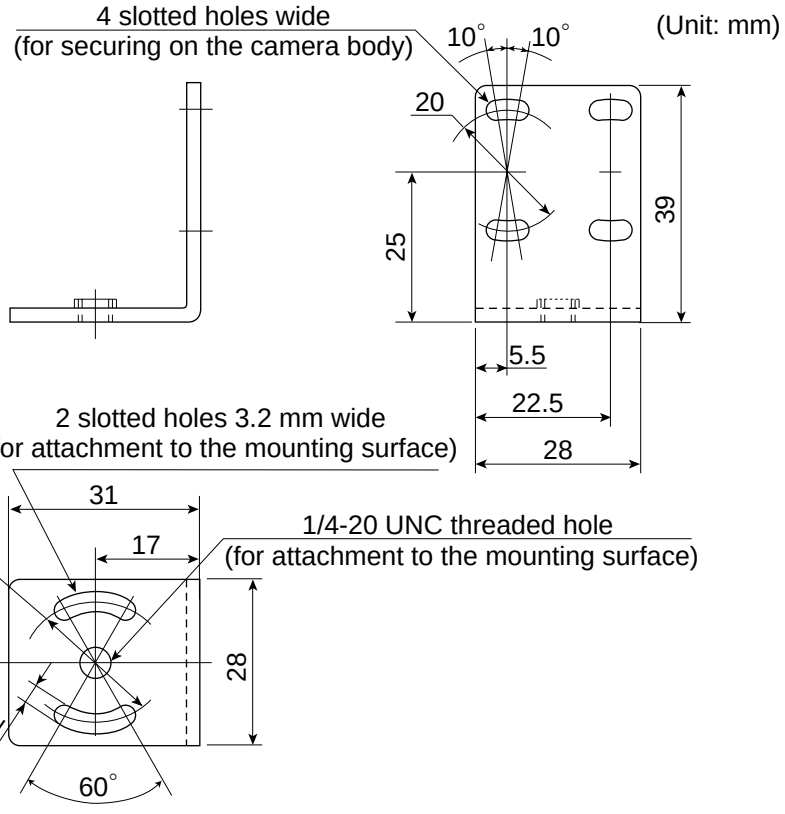


※ Attach the camera angle bracket to one of the tapped M3 holes 20 mm mounting pitch (3 places).

6

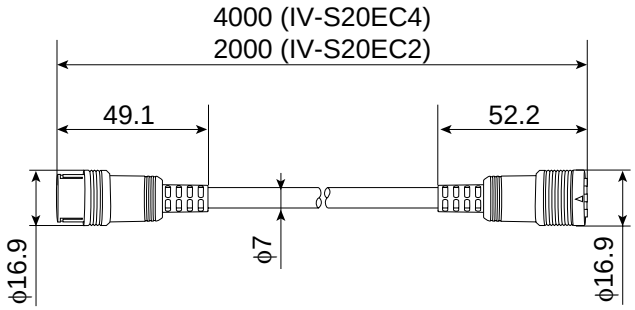
● External dimensions of camera angle bracket

(Unit: mm)



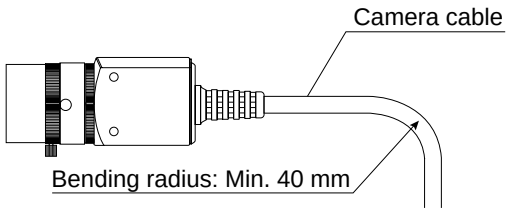
● **External dimensions of extension camera cable (IV-S20EC2/4)**

(Unit: mm)



Note

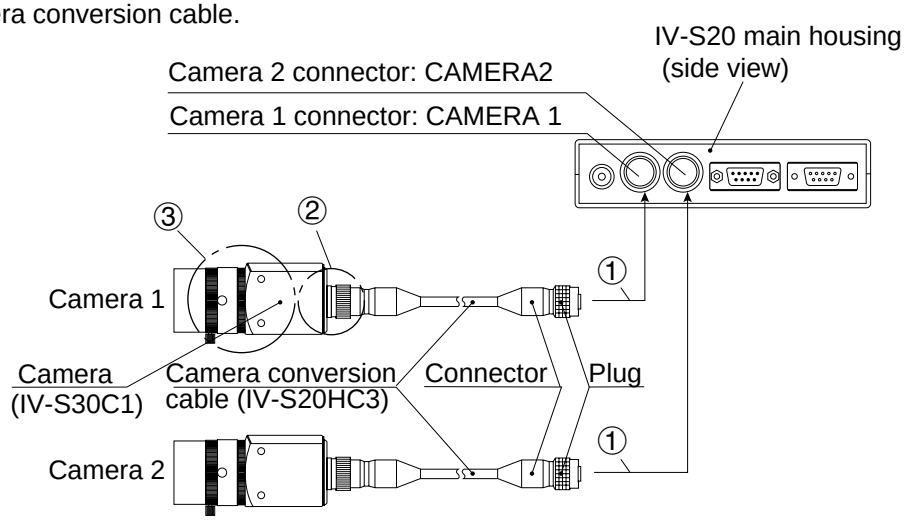
- When the camera cable and extension camera cable (IV-S20EC2/4), leading to the camera body (IV-S20C1), is bent, its bending radius should be longer than 40 mm.
  If the camera cable will be bent repeatedly during operation, design the cable layout so that the bending radius is 75 mm or more and use components that can be flexed up to 2 million times.



[2] Installing and connecting the IV-S30C1

(1) Connections

Up to two IV-S30C1 cameras can be connected to the IV-S20 main housing using the IV-S20HC3 camera conversion cable.



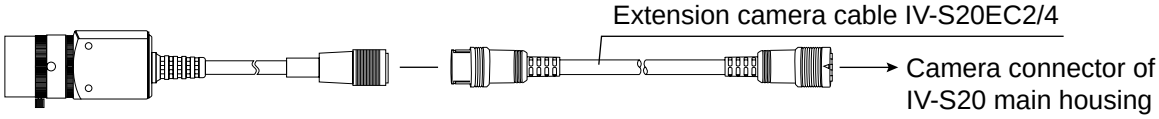
① Connect the IV-S20HC3 camera cable(s) to the CAMERA 1 and CAMERA 2 connectors on the IV-S20 main housing.

Note: Only connect or disconnect the camera connectors while the power is OFF.

- Push the convex side of the connector into the concave side of the mating connector. When the connector is all the way on, it clicks.
- To disconnect the connector, hold the plug of the connector, and pull it straight out.
- A camera connected to the camera 1 connector (CAMERA1) is treated as camera 1 by IV-S20 system, and a camera connected to the camera 2 connector (CAMERA2) is treated as camera 2.

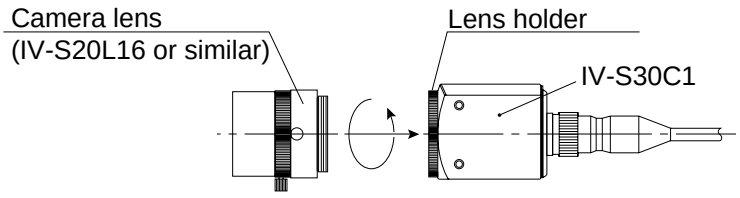
Note: You must have a camera connected to the camera 1 connector.

- The IV-S20HC3 camera cable is 3m long. If you need a longer cable, order extension camera cable IV-S20EC2 (cable length 2m) or IV-S20EC4 (cable length 4m).



② Plug the other end of the IV-S20HC3 camera conversion cable into the IV-S30C1, and tighten the securing ring on the plug housing.

③ Screw the IV-S20L16 camera lens (or similar) into the lens holder on the IV-S30C1until it is secure.

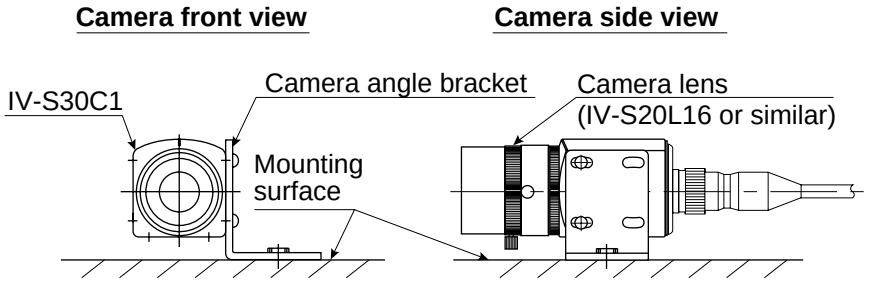


-

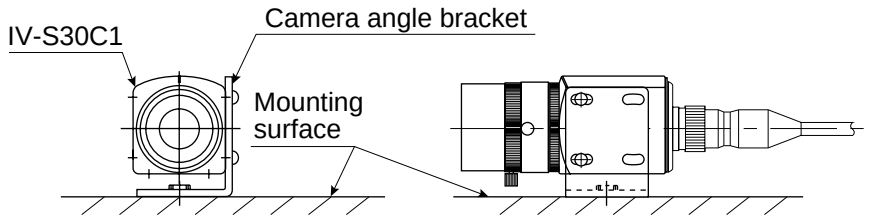
(2) Installation

Attach the IV-S30C1 camera on the mounting surface with the camera angle bracket (supplied with the camera).

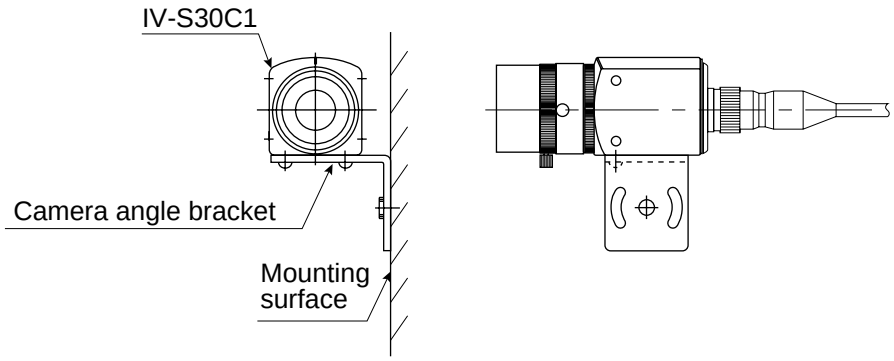
- Installation example 1



- Installation example 2



- Installation example 3



■ Installation procedure

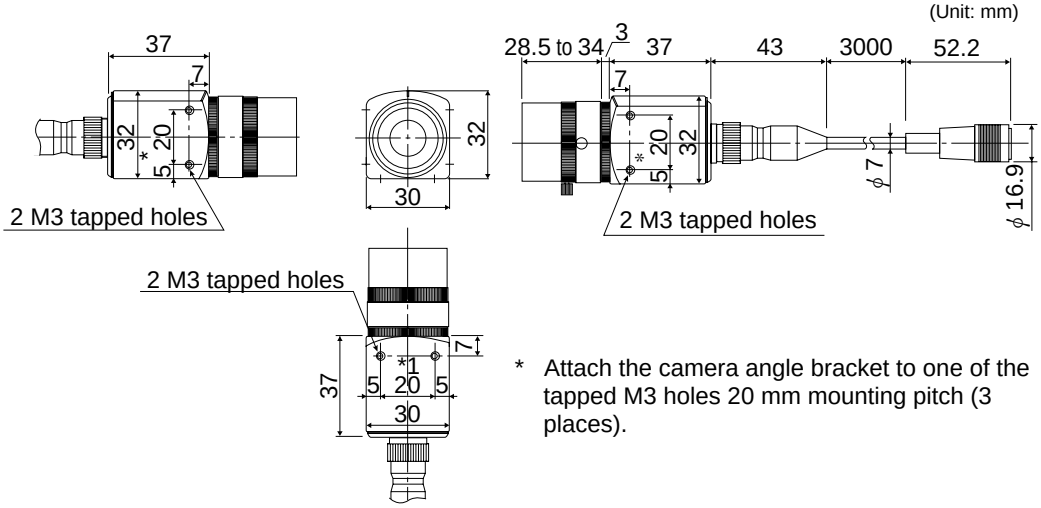
① Attach the camera angle bracket to the tapped M3 hole on the camera body (20 mm mounting pitch: one of three holes). Two screws (M 3 x 6) are supplied with the camera for attaching the angle.

② Attach the camera controller angle to the mounting surface with the slotted holes 3.2 mm wide (20 mm mounting pitch) or 1/4-20 UNC threaded hole.

The external dimensions of the camera angle bracket and camera body are shown on the following page.

- External dimensions when the IV-S20L16 camera lens and IV-S30C1 camera are connected to the IV-S20HC3 camera conversion cable.

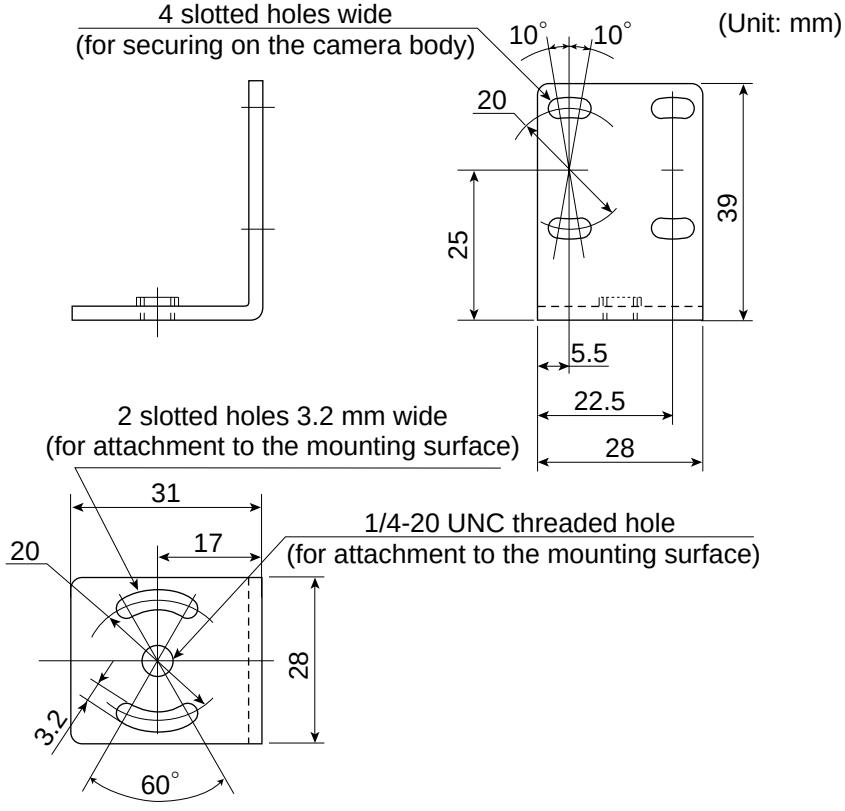
(Unit: mm)



* Attach the camera angle bracket to one of the tapped M3 holes 20 mm mounting pitch (3 places).

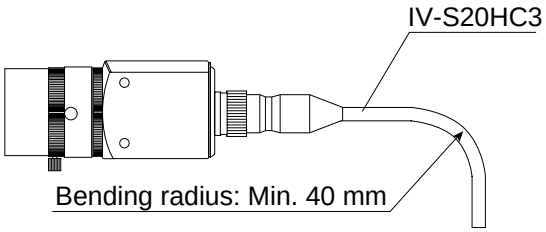
- External dimensions of camera angle bracket

(Unit: mm)



Note

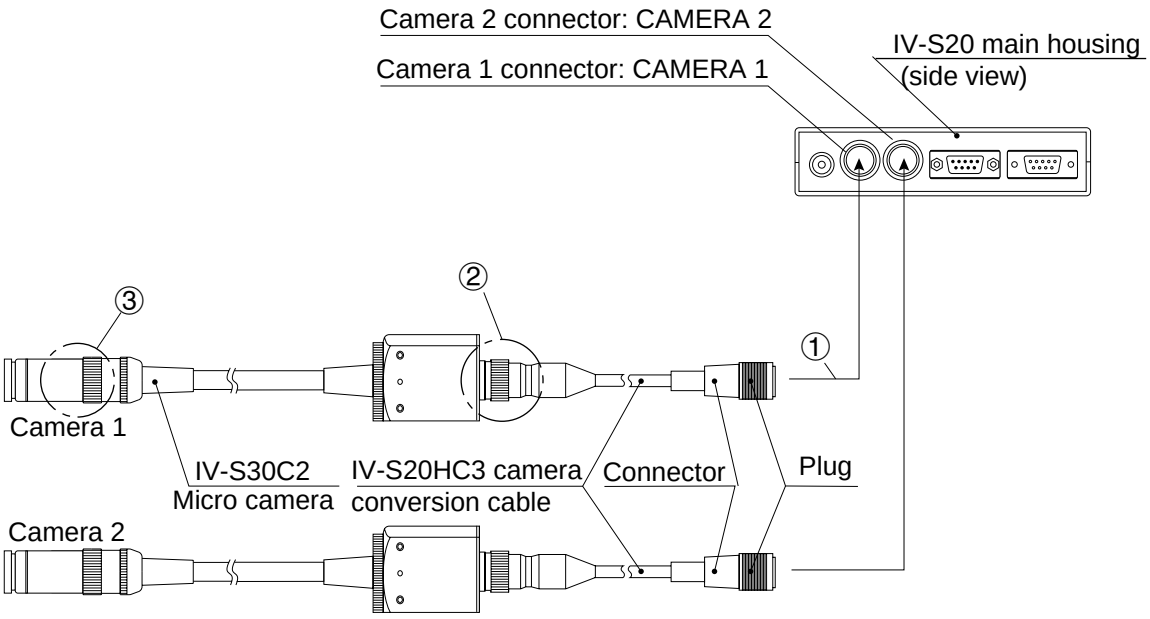
- When the IV-S20HC3 camera conversion cable is bent, its bending radius should be larger than 40 mm. If the IV-S20HC3 camera conversion cable will be bent repeatedly during operation, design the cable layout so that the bending radius is 75 mm or more and use components that can be flexed up to 2 million times.



[3] Installing and connecting the IV-S30C2

(1) Connections

Up to two IV-S30C2 micro cameras can be connected to the IV-S20 main housing using the IV-S20HC3 camera conversion cables.



① Connect the camera cable(s) to the CAMERA 1 and CAMERA 2 connectors on the controller.

Note 1: Make sure to turn OFF the power before connecting or disconnecting the cameras.

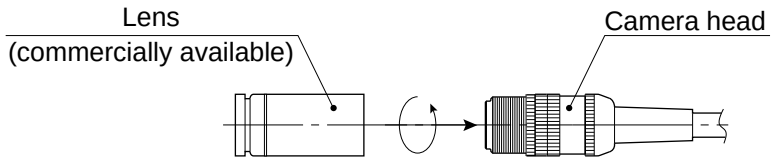
- To connect them, match the keyed portion of the connectors and press in. When they are firmly connected, you will hear a click.
- To unplug a connector, hold the plug housing and pull it straight out.
- Any camera plugged into the CAMERA 1 connector will be system camera 1 and any camera plugged into the CAMERA 2 connector will be system camera 2 in the IV-S20 system.

Note 2: Make sure to connect a camera to CAMERA 1.

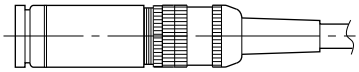
- The camera cable is 3 m long. If you need a longer cable, purchase the IV-S20EC2 camera extension cable (2 m) or the IV-S20EC4 camera extension cable (4 m).

② Plug the camera connector on the IV-S20HC3 camera conversion cable into the cable connector on the IV-S30C2 camera and screw it down to secure the connection.

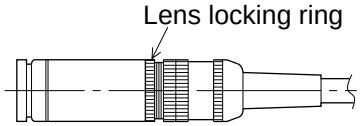
③ Screw a commercially available lens into the camera head of the IV-S30C2.



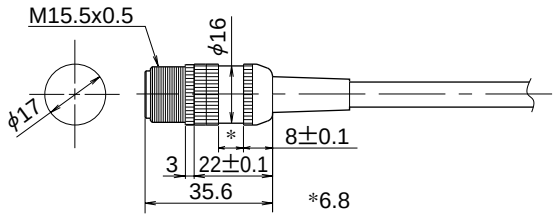
1. Screw the lens in until the camera image is focused.



2. Secure the lens using the lens locking ring on the camera head

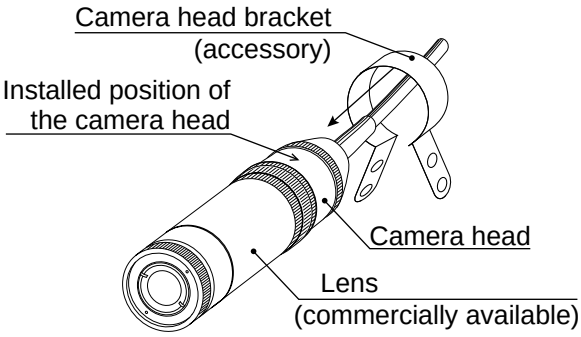


• External dimensions of the IV-S30C2 camera head (Unit: mm)

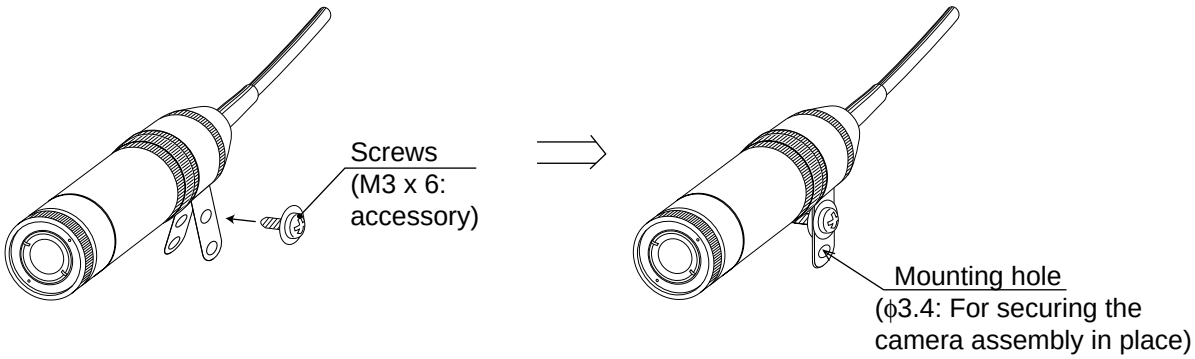


(2) Installation of the camera head

① Put the camera head through the bracket (supplied with the IV-S30C2) from the cable side and slide the camera head into position.

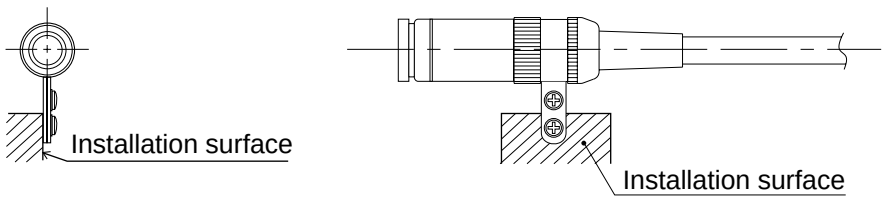


② Secure the camera head bracket using the M3x6 screws that come with the IV-S30C2.



③ Secure the camera head assembly in place using the mounting hole (ø3.4) on the camera head bracket.

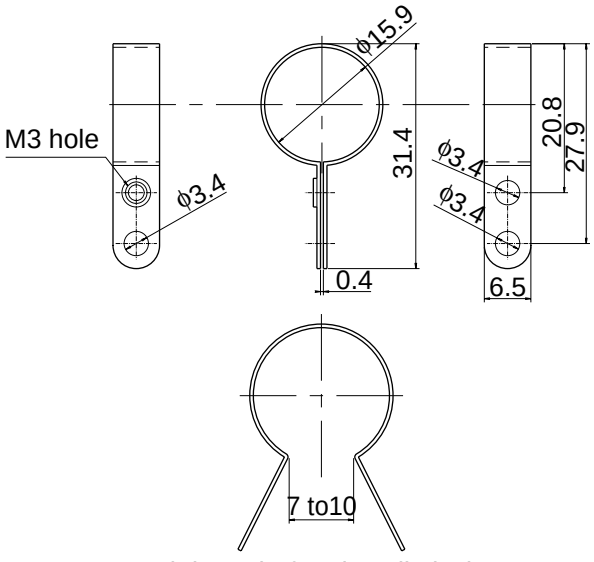
Front view **Side view**



Note: The camera head bracket supplied with the camera is for simple installations and is not vibration-damping. To meet specific needs, the user may have to make a specialized bracket.

• External dimensions of the camera head bracket

(Unit: mm)



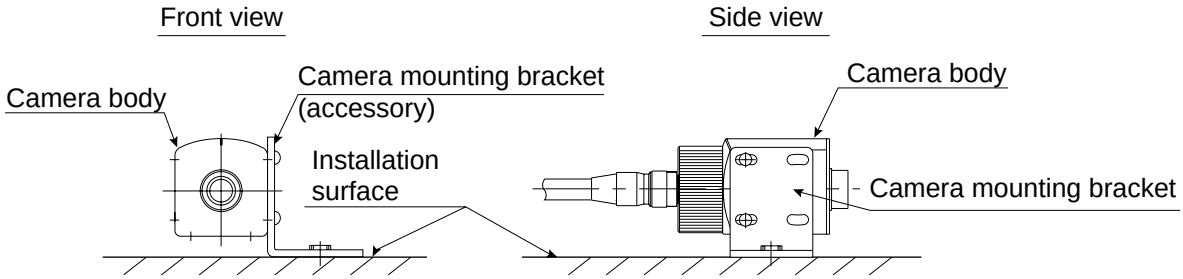
(Shape before installation)

(3) Installation of the camera body

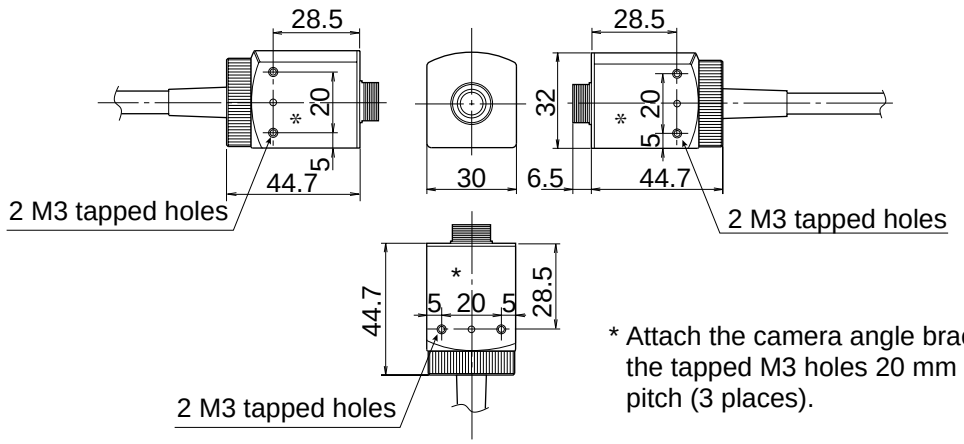
① Attach the camera mounting bracket (comes with the IV-S30C2 to the three M3 tapped holes (spacing: 20 mm) on the camera body using the M3×6 installation screws that come with the IV-S30C2.

② Secure the camera mounting bracket on the installation surface using a 3.2mm long, 20 mm difference screw or a 1/4-20 UNC screw hole.

[Installation example]

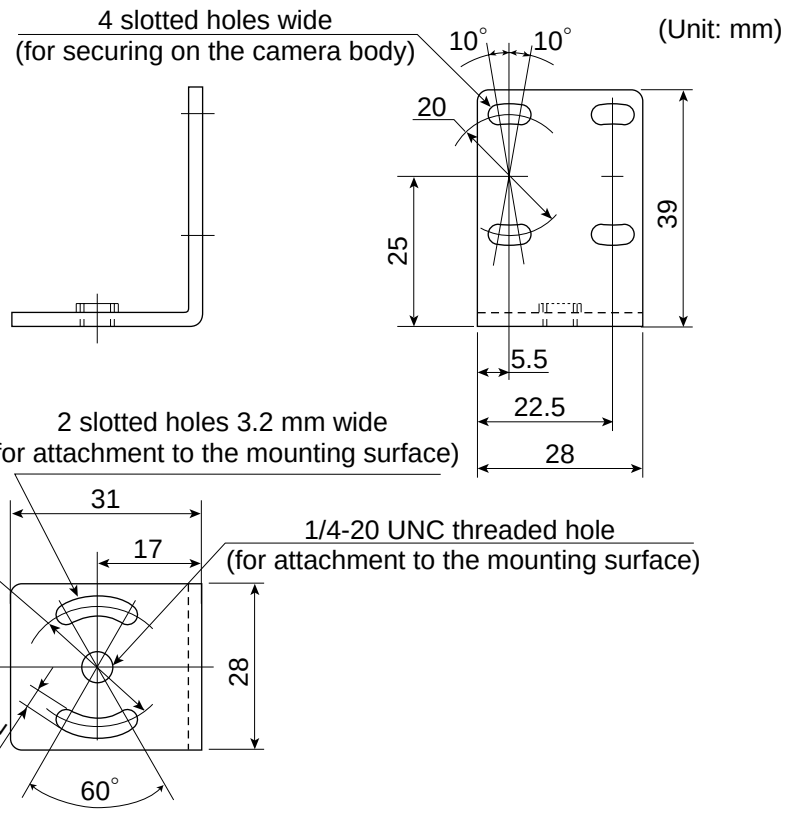


- External dimensions of the camera (IV-S30C2) (Unit: mm)



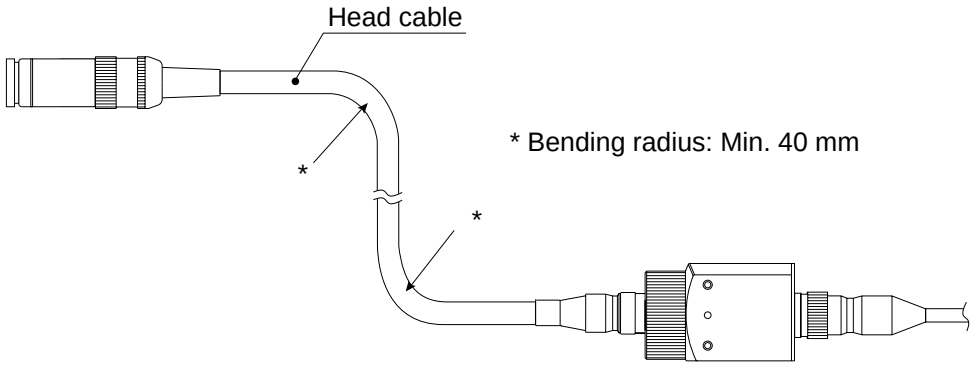
* Attach the camera angle bracket to one of the tapped M3 holes 20 mm mounting pitch (3 places).

- External dimensions of camera angle bracket



Note

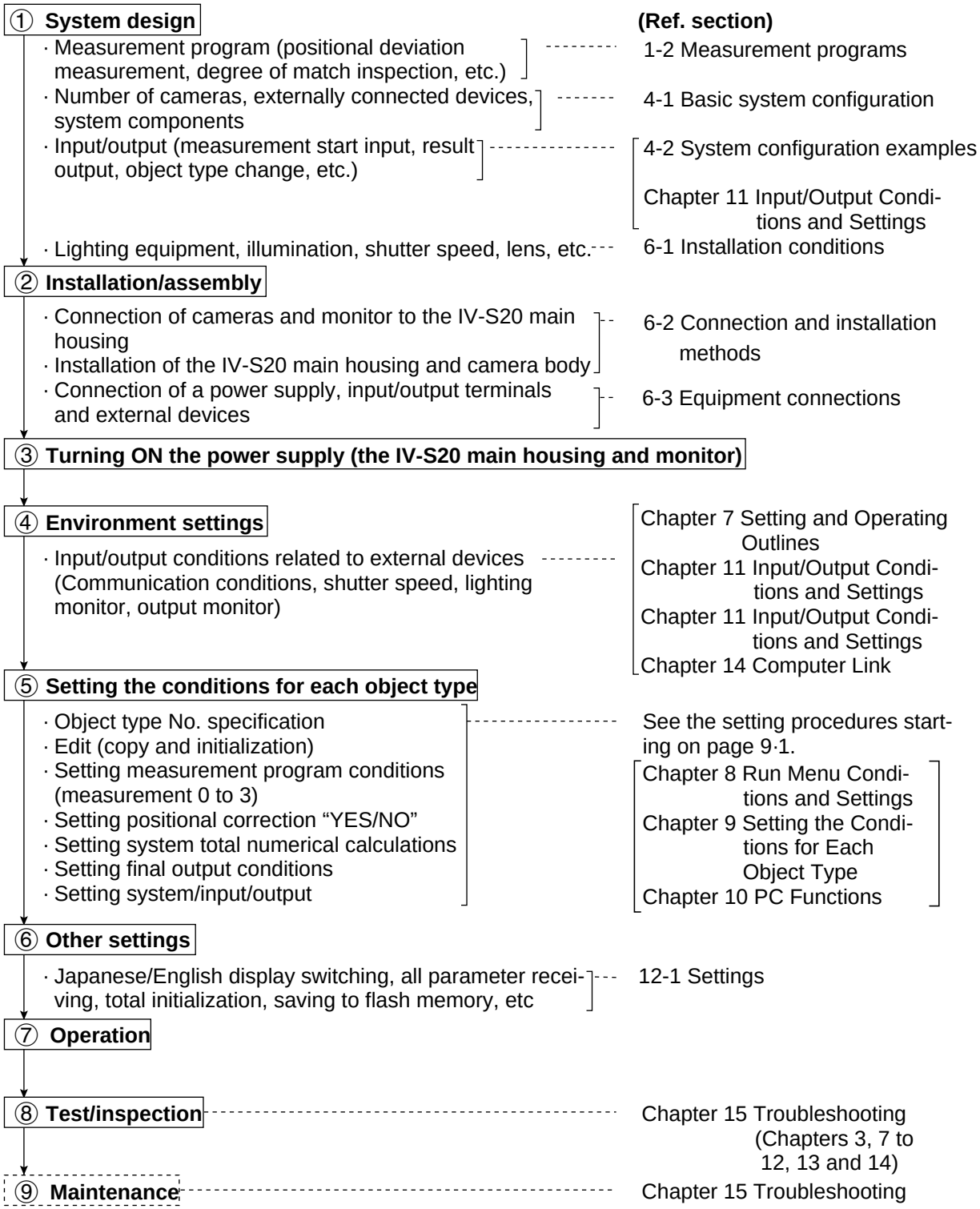
- When the camera head cable is bent, its bending radius should be larger than 40 mm.
  If the camera cable will be bent repeatedly during operation, design the cable layout so that the bending radius is 75 mm or more and use components that can be flexed up to 2 million times.



Chapter 7: Setting and Operating Outlines

7-1 Setting and operating procedures

The setting and operating procedures are outlined below.

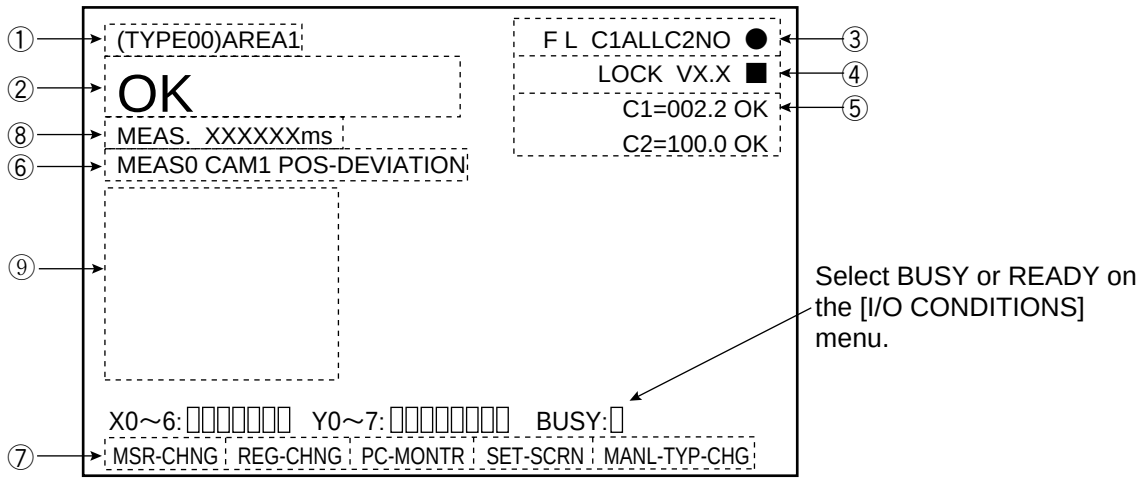


7-2 Screen specifications

[1] Operation (run) screen

Supply power to the IV-S20 main housing, and the MAIN OPS MENU (startup screen) will be displayed on the monitor.

- Before applying the power, make sure that the power cable, monitor cable, camera cables, and remote key pad have been connected to the IV-S20 main housing.



7

① Object type No. (00 to 15) and the name assigned by the user for each object type

② Display of the results of the programmable output (auxiliary relay C116)
If C116 has not been set, the results of C112 are output. (See page 10·7)

Display	Description
OK	"OK" is displayed when all of the individual evaluation results are acceptable.
NG	"NG" is displayed if any single evaluation result is unacceptable.
(Error message)	An error code and the measurement number that caused the error are displayed on the upper line. The error message is displayed on the lower line.

③ FL C1 ALL C2NO ●
- Operation status display: ● flashing = running, ○ flashing = CCD trigger sampling
- Output monitor status
  Camera 1 (C1)/camera 2 (C2) = All/upper/middle/lower/none
- Image brightness: H = Original brightness of captured image
  L = Brightness reduced to half that in the captured image
- Image display mode: F = Freeze mode N = No camera input

④ LOCK VX.X ■
- Flashes during communications
- System program version number
- Run menu lock ("LOCK" is not displayed while the screen is unlocked.)

⑤ C1=002.2 OK
- Average density during measurement, and judgment (OK/NG)
- Camera No. (C1 = camera 1, C2 = camera 2)

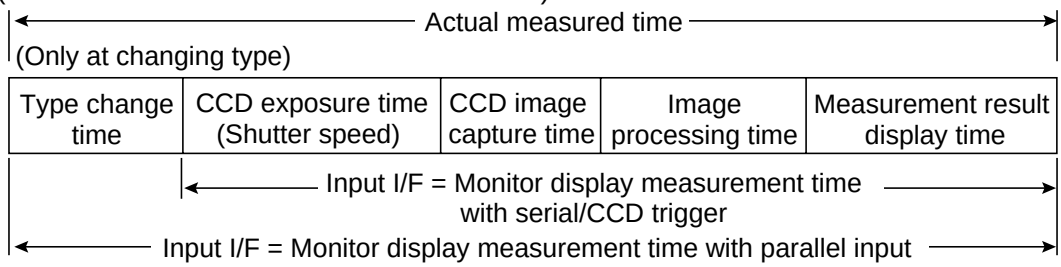
· This item is displayed when the illuminance monitor MONITOR LIGHT LVL on the [OBJECT TYPE I/O] menu has been set to "YES." (See page. 9·115.)

⑥ Measurement No. (0 to 3), camera No. (1 or 2) and measurement program name

⑦ Menu bar

Menu bar	Description
MSR-CHNG (measure-ment change	The display of evaluation results can be cycled through in the order of the measurement numbers using the up and down keys. (Measurement 0 camera 1 →Measurement 0 camera 2 → Measurement 1 → Measurement 2 → Measurement 3)
REG-CHNG (registration change)	The display of the measurement results/numerical calculation results can be cycled through in the order of the registration numbers in the measurement program using the up and down keys.
PC-MONTR (PC monitor)	The PC monitor screen is displayed by pressing the SET key. → See section 10-5 “PC monitor screen.” (X input, Y input, auxiliary relay, timer/counter, final numerical calculation result)
SET-SCRN (setting screen)	Press the SET key, and the screen will change to the next [SYSTEM SETUP] menu. · When the screen is returned from the [SYSTEM SETUP] menu to the MAIN OPS MENU, if CAPTURE AN IMAGE has been set to “NO,” the image will not be cleared.
MANL-TYP -CHG (manual type change)	The object type number (00 to 15) can be changed using the up and dow keys. · The object type number can be changed manually by setting the OBJ. NO. MANL MODE item to “YES.” (See page 8·9) · Every time the object type is changed, the image will be cleared. (However, the image will not be cleared when CAPTURE AN IMAGE has been set to “NO.”)

⑧ The screen shows the measuring time determined by the following time (from measurement start to measurement end).



To decrease the measuring time:

1. Increase the shutter speed (page 9·117),
2. Change the CCD image capture mode (CAPTURE AN IMAGE) to PARTIAL-IMAGE (see page 8·3), and
3. Set the result displays (MESSAGE DISPLAY and PATTERN DISPLAY) to “NO” (see page 8·4 and 8·5).

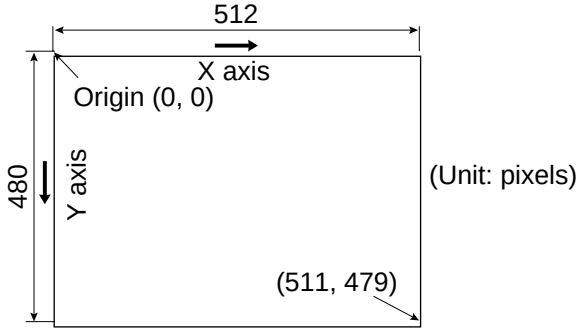
⑨ Display the measured results for each mesurement program

· The IV-S20 can store the setting conditions*. “Measured result screen” and “Image brightness: H/L” on the MAIN OPS MENU (operation screen) will be latched, even after reapplying the power.

* To store the data, select ⑨ SAVE IN FLASH MEM, or ⑩ OPERATIONS, on the [SYSTEM SETUP] menu.

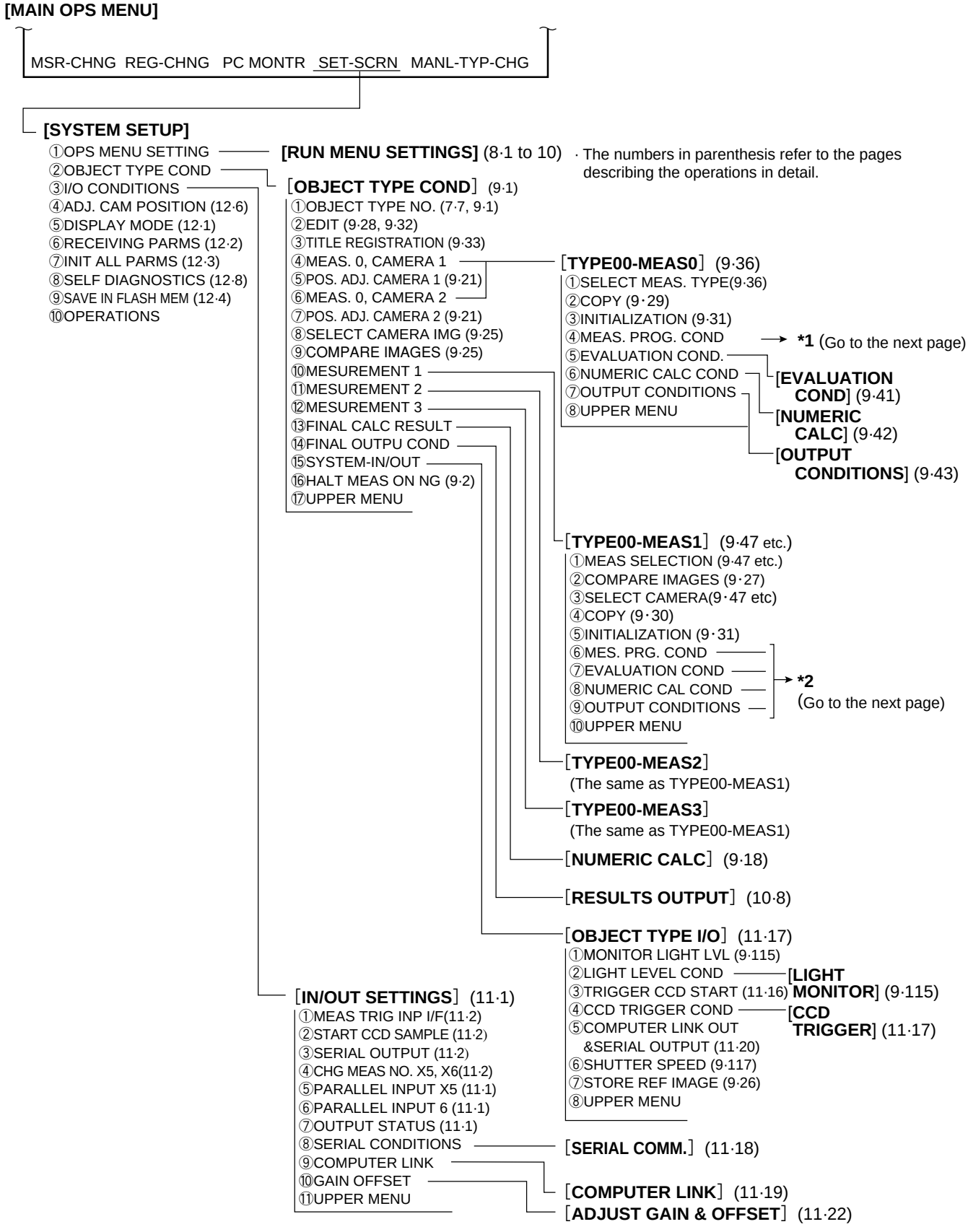
[Image display area]

The size of the area (in pixels) where the image is displayed on the monitor is 512 (horizontal) × 480 (vertical).

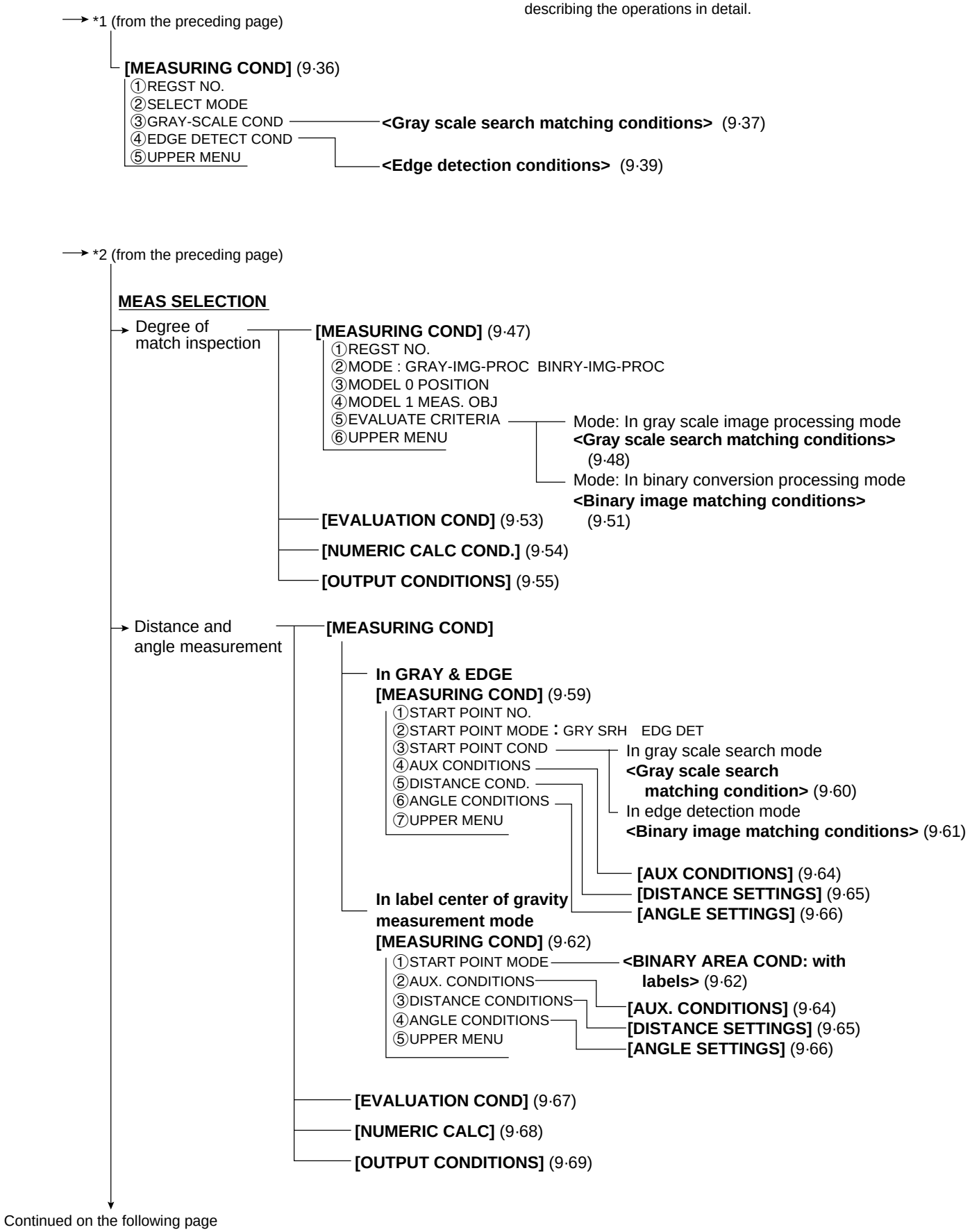


[2] Menu configuration

On the MAIN OPS MENU, move the cursor to SET-SCRN item on the menu bar at the bottom of the screen with the right and left keys, and press the SET key. Then, the [SYSTEM SETUP] menu will be displayed. Select an item, and the corresponding sub-menu will be displayed.



· The numbers in parenthesis refer to the pages describing the operations in detail.

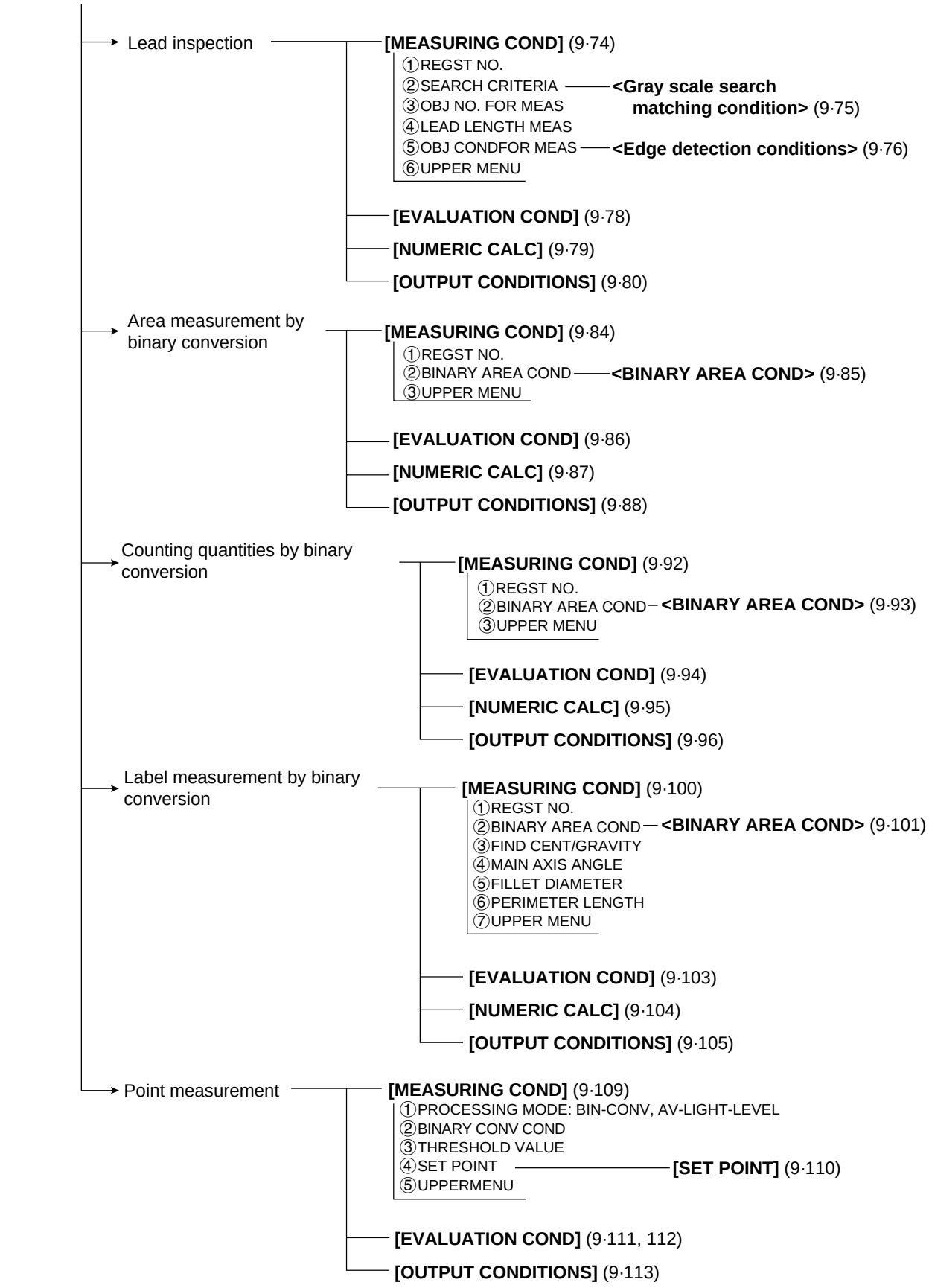


Continued on the following page

7

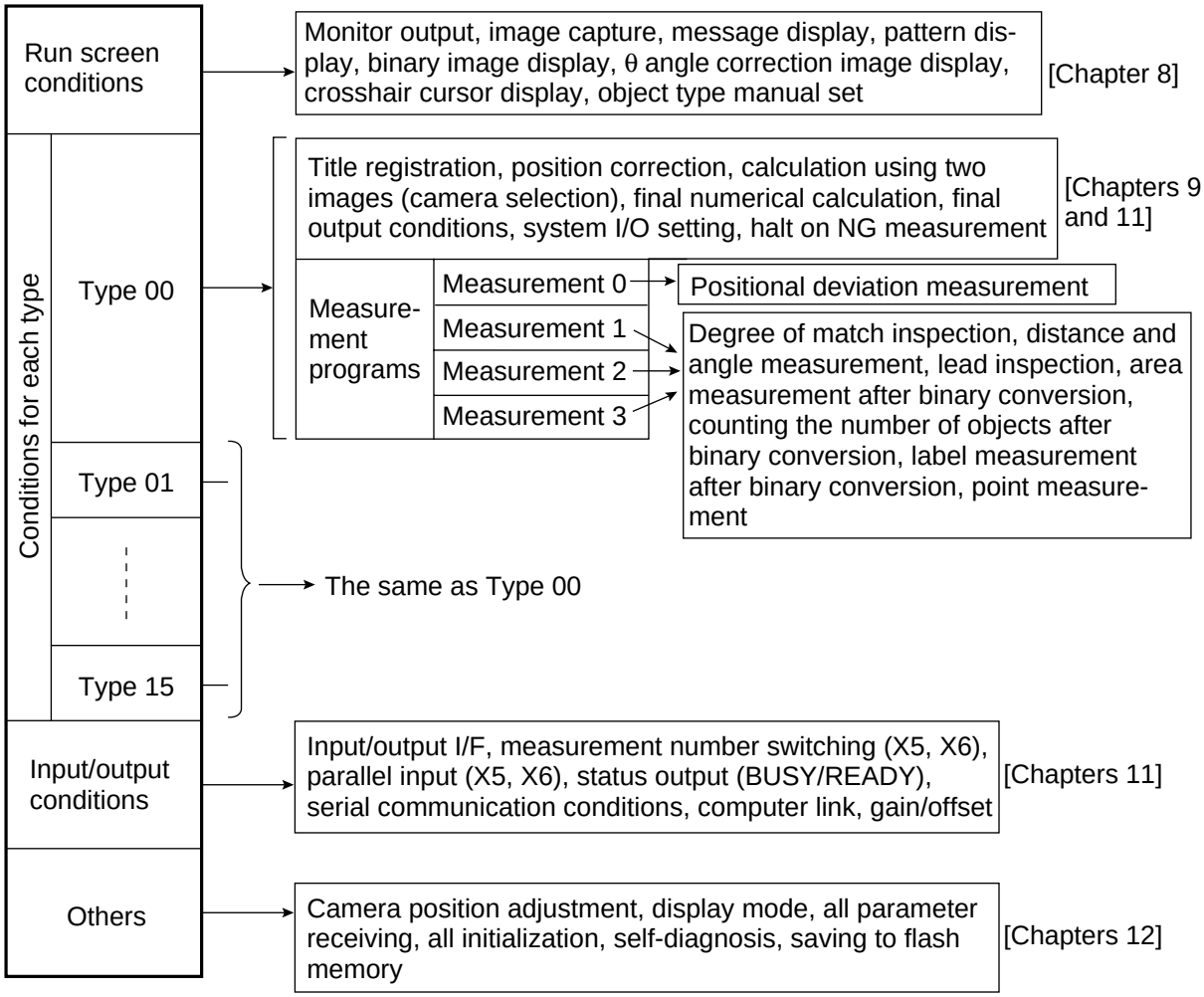
From the preceding page

· The numbers in parenthesis refer to the pages describing the operations in detail.



[3] Set condition configuration

The chapters to refer to are shown in square brackets.



[4] Image display

(1) Image display modes

There are two image display modes, i.e. through (moving images) and freeze (still image).

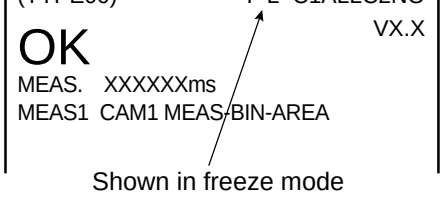
Display mode	Description
Through	· A single image taken by a camera is displayed. · This mode is used for adjusting the camera focus, adjusting an image, and moving a workpiece during testing.
Freeze	· When a measurement trigger is input, and an image is captured, the still image is displayed. · This mode is used for setting measurement conditions, while looking at the still image, and for performing settings on the MAIN OPS MENU.

The operation (run) screen is only displayed in the FREEZE MODE, and the "ADJUST GAIN & OFFSET" screen is only displayed in the through mode.

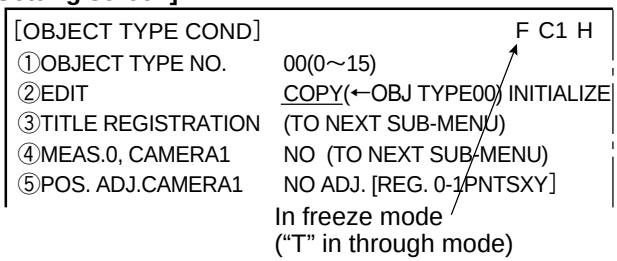
- Status display

At the upper right of the screen, "T" is displayed in the through mode, and "F" is displayed in the freeze mode. (On the MAIN OPS MENU only, the word FREEZE is displayed.)

[Run screen]



[Setting screen]



Notes

- **To register a reference image for gray scale searches, and to test evaluation conditions**
  If these operations are started in the through mode, the message CHANGE TO FREEZE MODE will be displayed. Before starting these operations, change to the image F (freeze display mode.)
- **Displaying binary images**
  In the through mode, the image captured when the freeze mode is invoked while be displayed after binary conversion.

(2) Adjustment of image brightness

The image brightness can be adjusted on any setting screen (other than the run screen) output on the monitor.

- Purpose

This function is used when the image is so bright that the characters and pattern display are difficult to see.

- Status display

The brightness level, "H" or "L," is displayed in the upper right corner of the screen.

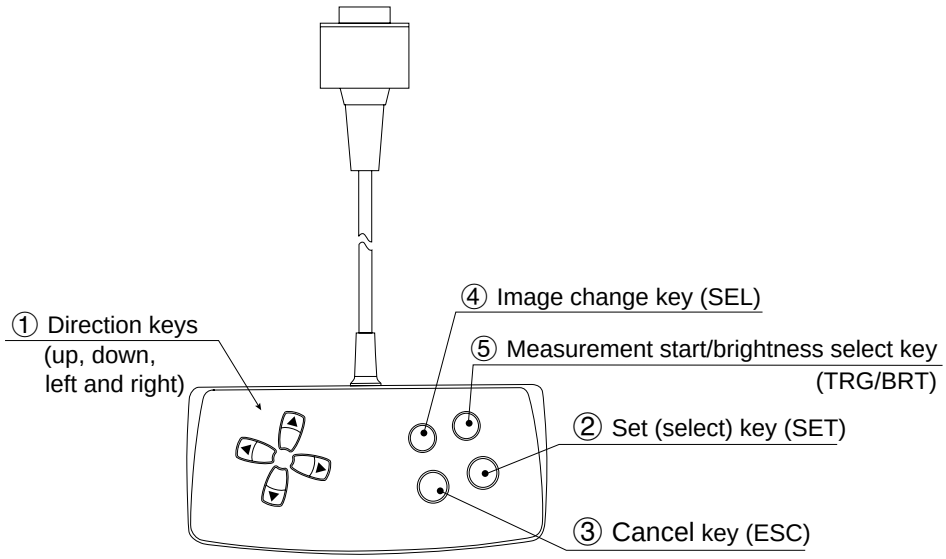
Level display	Description
H	The image captured by the camera is displayed at the original brightness of the image.
L	The image captured by the camera is displayed at half the brightness of the original.

- Examples of brightness displays

(At H level)

(At L level)

7-3 Remote key pad specifications

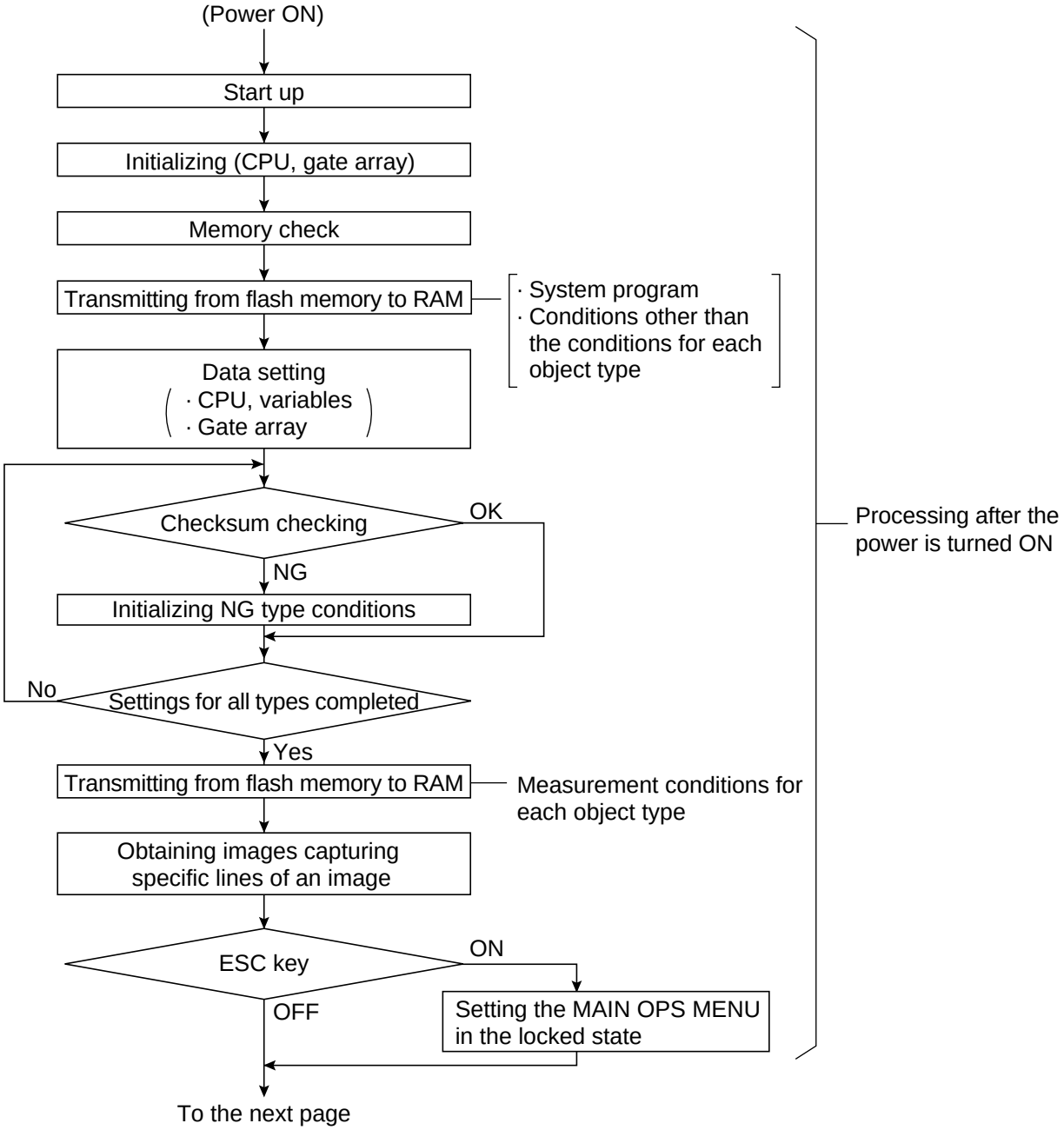


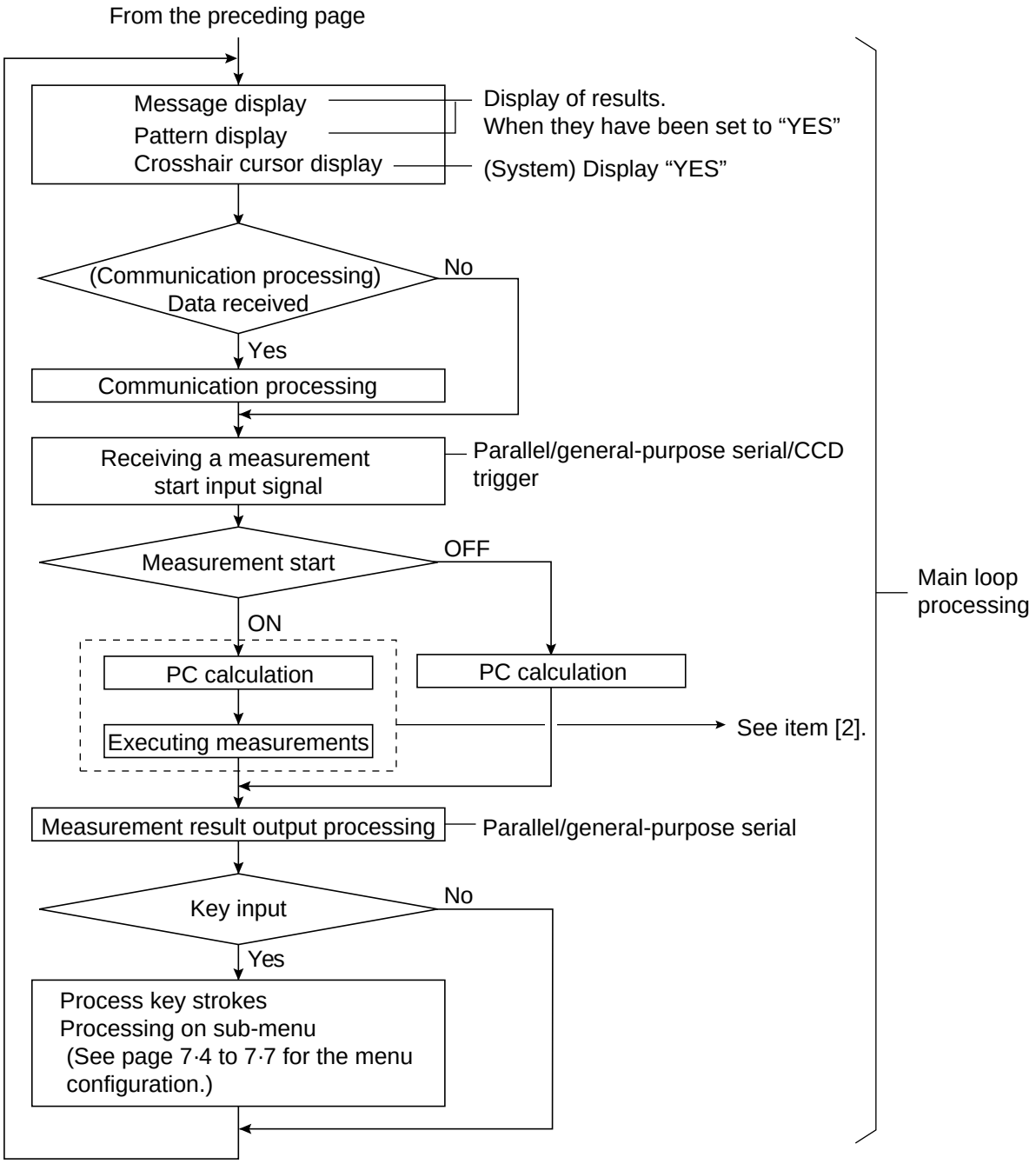
	Key name	Function	Description
①	Direction keys (up, down, left and right) *	Selecting an item on a menu screen	Select an item with the up, down, left and right keys.
		Setting a window	Set each coordinate.
		Setting a value	· Select a digit or an item with the left and right keys, and then specify a value with the up and down keys. · Specify a value with the up, down, right and left keys.
②	Set (select) key (SET)	Determine a highlighted item	———
		Determine the setting value	
③	Cancel key (ESC)	Returning a setting to its original state before being changed	———
		Returning to the previous menu	
④	Image change key (SEL)	Switching the image mode between the through mode and freeze mode	Switch the image mode between through and freeze on a setting screen. (See the preceding page.) When the mode is switched from through to freeze, a new image is captured. **Note:** The run screen is only displayed in the freeze mode, and the "ADJUST GAIN & OFFSET" screen is only displayed in the through mode.
⑤	Measurement start/brightness select key (TRG/BRT)	Start measurement input	Press this key on the run screen, and a new measurement is triggered.
		Switching the brightness level (H and L)	Change the displayed image brightness. (See the preceding page.) · Use this key when the image is so bright that characters are difficult to see. · The brightness can be changed on any screen other than the run screen.

* The direction keys have an auto-repeat function (holding them down is the same as pressing them repeatedly).

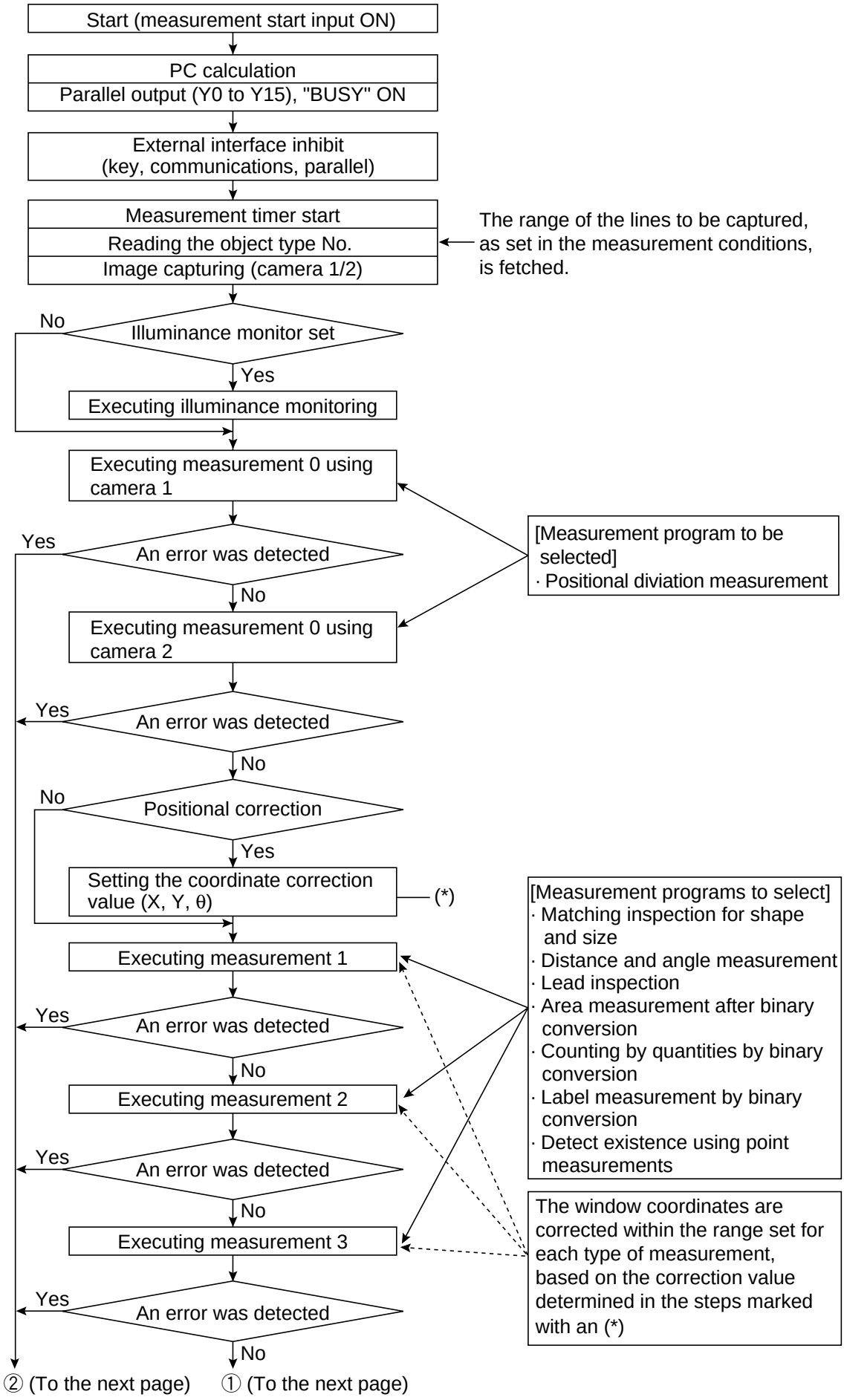
7-4 Operation flow

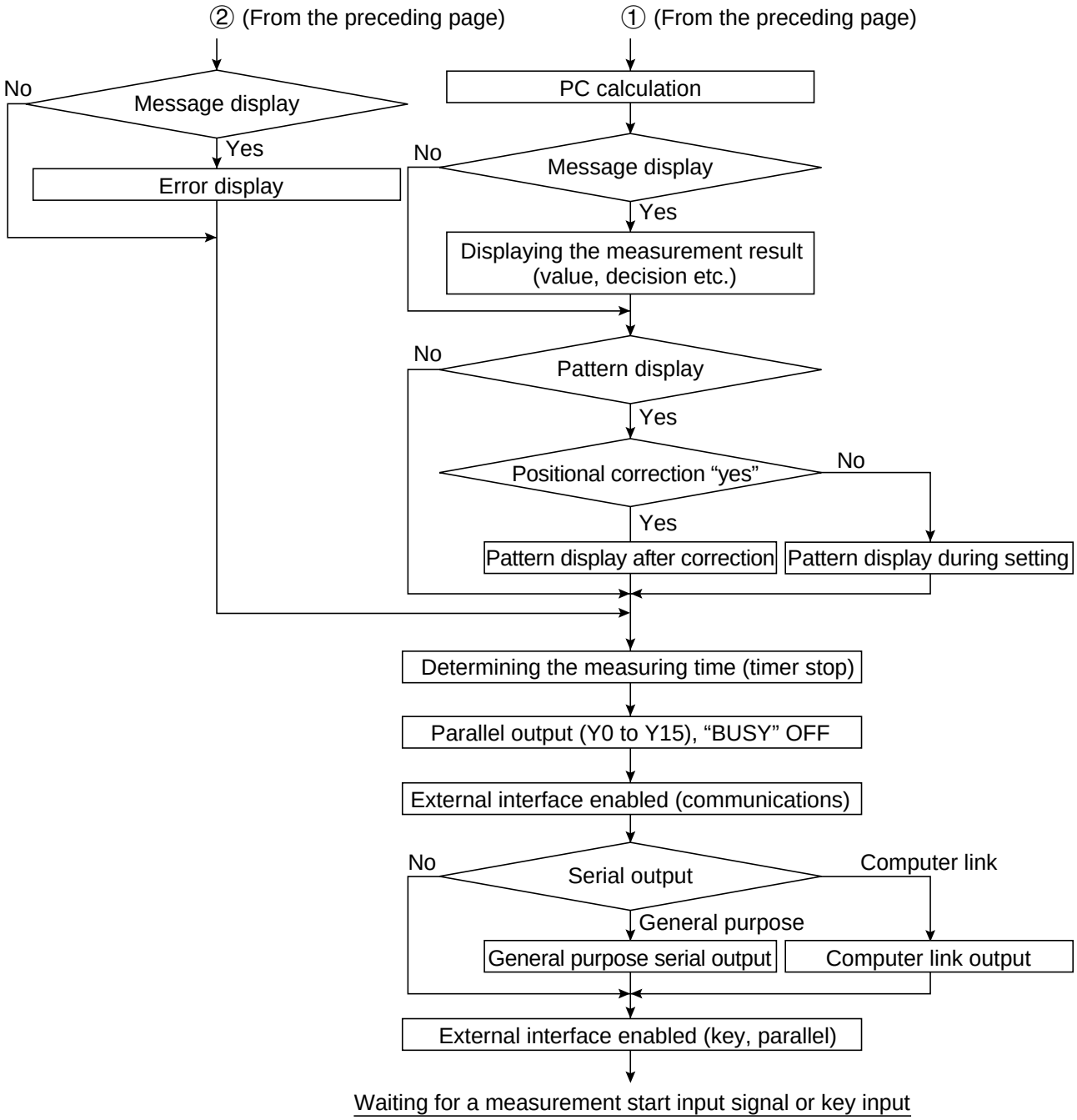
[1] Processing after power is turned ON and main loop processing




From the preceding page
Message display
Pattern display
Crosshair cursor display
Display of results.
When they have been set to “YES”
(System) Display “YES”
(Communication processing)
Data received
No
Yes
Communication processing
Receiving a measurement
start input signal
Parallel/general-purpose serial/CCD
trigger
Measurement start
OFF
ON
PC calculation
Executing measurements
PC calculation
See item [2].
Measurement result output processing
Parallel/general-purpose serial
Key input
No
Yes
Process key strokes
Processing on sub-menu
(See page 7·4 to 7·7 for the menu
configuration.)
Main loop
processing

[2] Operation flow after a measurement start input signal is given



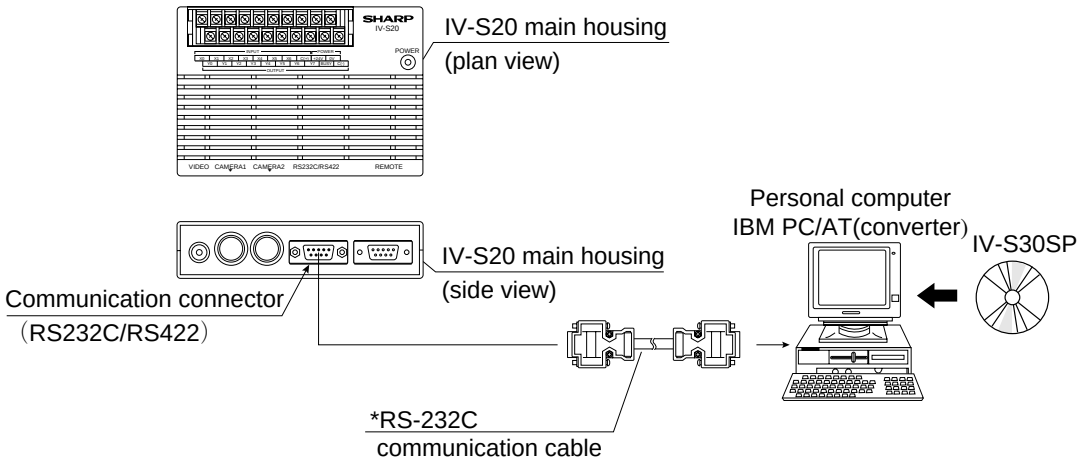


- If HALT MEAS ON NG (halt operation on NG measurement) has been set to "YES" (page 9-2), measurement will be interrupted at any point in the process if an NG measurement occurs the same as when an error occurs.

7-5 When using the IV-S30SP

The IV-S30SP is support software used to design the IV-S20/S30 system configuration. It will run on Windows 95,98, or NT 4.0 computers. You can easily set the various measuring conditions for the IV-S20 using your personal computer. It also facilitates the setting, uploading, and downloading the IV-S20 parameters, saves the displayed image and messages, and can test the commands, upgrade the software.

It can create and point documents such as the set of parameters, using the tools common of the Window environment.



* An RS-232C communication cable is an accessory that comes with the IV-S30SP.
  - Cable length ----- 1.5m
  - Connector -------- 9 pin D-sub male (IV-S20 side) + 9 pin D-sub female (personal computer side)

The IV-S30SP software can be used on any personal computer that has the operating environment described below :

Item	Specifications
Personal computer	IBM PC/AT (compatible machine))
CPU	Pentium 90MHz or more (Pentium 133MHz or more is recommended)
Operating system	Microsoft Windows 95/98 Japanese version Microsoft Windows NT4.0 Japanese version
Memory	At least 32M-bytes RAM memory (48M-bytes or more is recommended)
Hardware diskette	Vacant area of 30M bytes
Monitor	SVGA or better monitor (resolution: 800 x 600 pixels, 256 colors minimum.)
CD-ROM drive	1 set
RS-232C port	1 port or more
Mouse	Microsoft Mouse or equivalent pointing device
Printer	A printer compatible with the Window95, 98, or NT environment.
USB port	1 port is recommended (supporting USB port only with Windows98)

- Windows is a registered trade mark of the Microsoft Corporation, USA.
- Pentium is a registered trade mark of the Intel Corporation, USA.

For details about the IV-S30SP, see the IV-S30SP instruction manual.

Chapter 8: Run Menu Conditions and Settings

[1] Output monitor

When two cameras have been connected to IV-S20, you can switch back and forth between the image from the cameras on one monitor. Also, the monitor screen can be divided into two parts to display the two images simultaneously.

- Purpose of the setting

To set the conditions in which an image captured during measurement will be displayed on the run menu.

- Output monitor switching

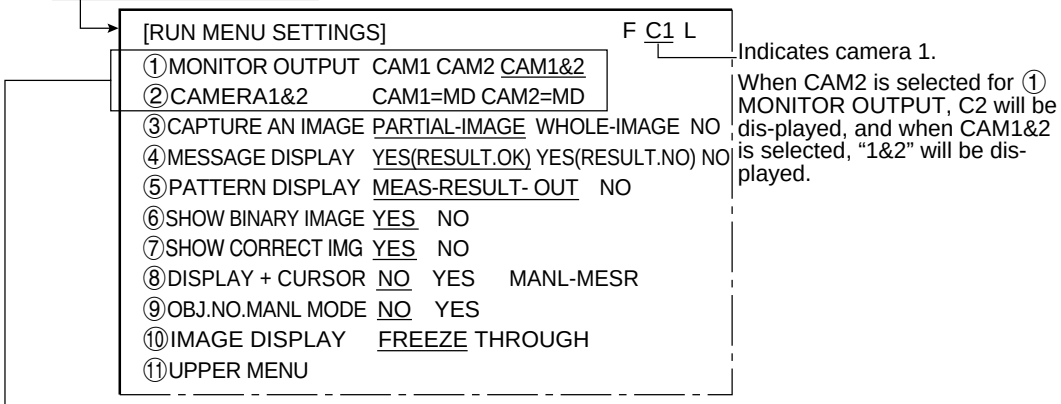
The monitor can be switched by two methods, i.e. key pressing or parallel input.

(1) Output monitor switching by key presses

To specify a monitor, select the ① MONITOR OUTPUT and ② CAMERA1&2 options you want on the [RUN MENU SETTINGS] menu.

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key

⇨ On the [SYSTEM SETUP] menu, move the cursor to item ① OPS MENU SETTING and press the SET key.



· Item ② will be displayed if CAM1&2 has been selected in item ①.

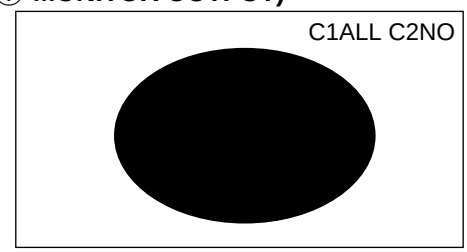
MAIN OPS MENU condition	Description of setting (selection)
① MONITOR OUTPUT	Select the camera whose image will be displayed on the screen. · If CAM1&2 is selected, the picture taken by camera 1 will be displayed on the upper half of the screen, and the picture taken by camera 2 will be displayed on the lower half of the screen.
② CAMERA1&2	Each images taken by cameras 1 and 2 is divided into three parts, i.e. the upper, middle and lower parts. Select the part you want displayed on the screen. (When CAM1&2 has been specified in ① MONITOR OUTPUT.)

[Operation procedure]

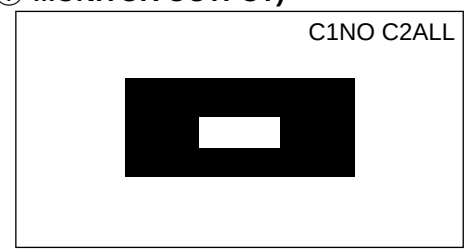
1. On the [RUN MENU SETTINGS] menu (shown above), move the cursor to item ① MONITOR OUTPUT with up and down keys, and press the SET key.
2. Move the cursor to CAM1, CAM2, or CAM1&2 with the left and right keys, and press the SET key. (If CAM1&2 is specified, continue with steps 3 and 4.)
3. Move the cursor to ② CAME1&2, with the up and down keys, and press the SET key.
4. Select CAM1 or CAM2 with the left and right keys, the select UP, MD or LO for each camera with the up and down keys, and press the SET key.

[Display examples on the MAIN OPS MENU]

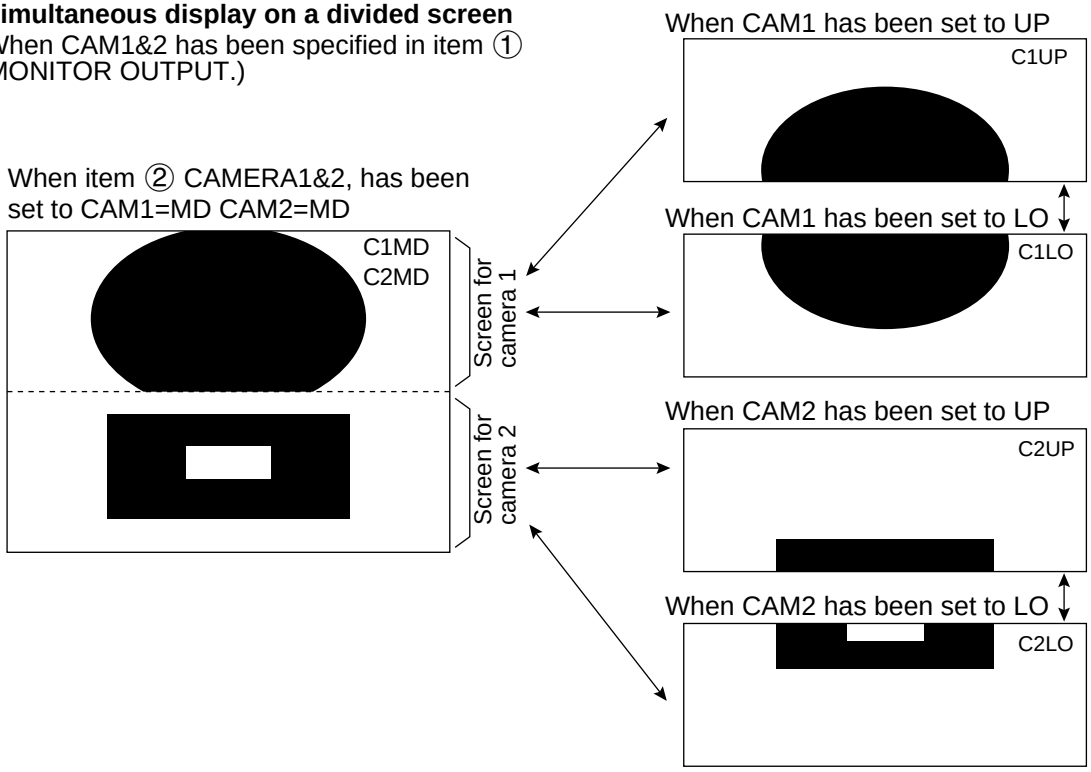
· Camera 1 on the whole screen (When CAM1 has been specified in item ① MONITOR OUTPUT)



· Camera 2 on the whole screen (When CAM2 has been specified in item ① MONITOR OUTPUT)



· Simultaneous display on a divided screen
(When CAM1&2 has been specified in item ① MONITOR OUTPUT.)



(2) Output monitor switching by parallel input

On the [MAIN OPS MENU], move the cursor to SET-SCRN item, and press the SET key.
⇒ Move the cursor to ③ I/O CONDITIONS (input/output conditions) on the [SYSTEM SETUP] menu, and press the SET key.

```
[IN/OUT SETTINGS]
①MEAS TRIG INP I/F   PARALLEL  SERIAL  CCD-TRG

③SERIAL OUTPUT      NO   PC-LINK   SERIAL
  (INPUT-PARALLEL)
④CHG MEAS NO.X5,X6 NO   YES
⑤PARALLEL INPUT X5  EXT-INP.  REG-REF-IMG(MSR0)
⑥PARALLEL INPUT X6  EXT-INP.  CHG-IMG-OUT-CAM  CAM-MEAS
⑦OUTPUT STATUS      BUSY   READY
⑧SERIAL CONDITIONS(TO NEXT SUB-MENU)
⑨COMPUTER LINK      (TO NEXT SUB-MENU)
⑩GAIN-OFFSET        (TO NEXT SUB-MENU)
⑪UPPER MENU
```

· Item ② is displayed when CCD-TRG. (CCD trigger) has been specified in item ①.
· Set PARALLEL INPUT X6 to CHG-IMG-OUT-CAM.
· Every time the signal X6 is turned ON from OFF, camera display will be switched.

Camera 1 on the whole screen → Camera 2 on the whole screen → Cameras 1 and 2 on a divided screen

Note: You can change the display part of the image from the CAM1 & 2 to the UP, MD or LO by key input or by using a general-purpose serial interface command.

· An the example of the display on the MAIN OPS MENU is the same as that shown in Item (1) above “Output monitor switching by key input.”

[2] Image capture

In item ③ CAPTURE AN IMAGE, on the [RUN MENU SETTINGS] menu, specify the range of lines which will be captured during operation.

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to ① OPS MENU SETTING and press the SET key.

```
[RUN MENU SETTINGS]
①MONITOR OUTPUT  CAM1 CAM2 CAM1&2
②CAMERA1&2       CAM1=MD CAM2=MD
③CAPTURE AN IMAGE PARTIAL-IMAGE WHOLE-IMAGE NO
④MESSAGE DISPLAY  YES(RESULT.OK) YES(RESULT.NO) NO
⑤PATTERN DISPLAY  MEAS-RESULT- OUT  NO
⑥SHOW BINARY IMAGE YES  NO
⑦SHOW CORRECT IMG YES  NO
⑧DISPLAY + CURSOR NO  YES  MANL-MESR
⑨OBJ.NO.MANL MODE NO  YES
⑩IMAGE DISPLAY    FREEZE THROUGH
⑪UPPER MENU
```

③ CAPTURE AN IMAGE	Description
PARTIAL-IMAGE (partial image)	· An image of the specified lines, required for inspection or measurement, will be captured. · The processing time is shorter than in the WHOLE-IMAGE mode.
WHOLE-IMAGE (whole image)	· A whole image will be captured, irrespective of the window settings for inspection or measurement. · This mode is used to monitor portions of an image outside the window set up for inspection or measurement.
NO (no image)	· No image will be captured during operation. Measurements will be carried out with an image being displayed. · This mode only used to carry out measurements on an image transmitted from a personal computer to the IV-S20.

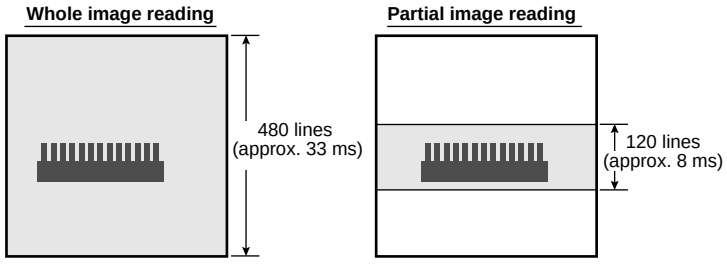
[Operation procedure]

1. On the [RUN MENU SETTINGS] menu (shown above), move the cursor to item ③ CAPTURE AN IMAGE with the up and down keys, and press the SET key.
2. Move the cursor to PARTIAL-IMAGE, WHOLE-IMAGE or NO with the left and right keys, and press the SET key.

[Example of a comparison of the capture times]

If the number of lines required has been set to 120:

When PARTIAL-IMAGE is specified: Approx. 8 ms
When WHOLE-IMAGE is specified: Approx. 33 ms (regardless of the number of lines)



[3] Message display

Select "YES" or "NO" to display messages on the MAIN OPS MENU.

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to item ① OPS MENU SETTING and press the SET key.

```
[RUN MENU SETTINGS]
①MONITOR OUTPUT  CAM1 CAM2 CAM1&2
②CAMERA1&2       CAM1=MD CAM2=MD
③CAPTURE AN IMAGE PARTIAL-IMAGE  WHOLE-IMAGE  NO
④MESSAGE DISPLAY  YES(RESULT.OK) YES(RESULT.NO) NO
⑤PATTERN DISPLAY  MEAS-RESULT- OUT   NO
⑥SHOW BINARY IMAGE YES   NO
⑦SHOW CORRECT IMG YES   NO
⑧DISPLAY + CURSOR  NO   YES     MANL-MESR
⑨OBJ.NO.MANL MODE  NO   YES
⑩IMAGE DISPLAY     FREEZE THROUGH
⑪UPPER MENU
```

④ MESSAGE DISPLAY	Description
YES (RESULT.OK)	All data will be displayed.
YES (RESULT.NO)	Data other than the numerical result will not be displayed.
NO	No messages will be displayed.

Setting to "NO" reduces the processing time.

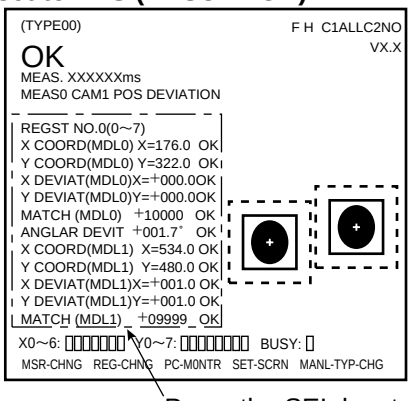
YES (RESULT.OK) > YES (RESULT.NO) < NO

[Operation procedure]

1. On the [RUN MENU SETTINGS] menu, move the cursor to item ④ MESSAGE DISPLAY with the up and down keys, and press the SET key.
2. Move the cursor to YES (RESULT.OK), YES (RESULT.NO) or NO with the left and right keys, and press the SET key.

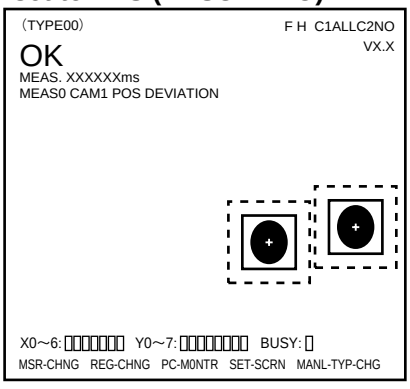
[Display examples]

· When the display mode has been set to YES (RESULT.OK)

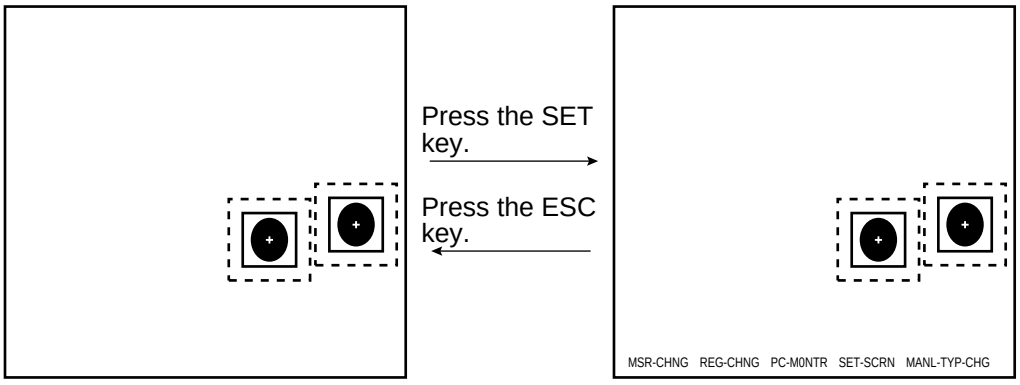


Press the SEL key to delete.

· When the display mode has been set to YES (RESULT.NO)



· When the display mode has been set to NO



The menu bar will be displayed.

[4] Pattern display

Select MEAS-RESULT-OUT or NO, to determine whether to display (windows and other marking) over an image displayed on the MAIN OPS MENU.

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to item ① OPS MENU SETTING and press the SET key.

```
[RUN MENU SETTINGS]
①MONITOR OUTPUT  CAM1 CAM2 CAM1&2
②CAMERA1&2       CAM1=MD CAM2=MD
③CAPTURE AN IMAGE PARTIAL-IMAGE  WHOLE-IMAGE  NO
④MESSAGE DISPLAY  YES(RESULT.OK) YES(RESULT.NO) NO
⑤PATTERN DISPLAY  MEAS-RESULT- OUT   NO
⑥SHOW BINARY IMAGE YES   NO
⑦SHOW CORRECT IMG YES   NO
⑧DISPLAY + CURSOR  NO   YES    MANL-MESR
⑨OBJ.NO.MANL MODE  NO   YES
⑩IMAGE DISPLAY     FREEZE THROUGH
⑪UPPER MENU
```

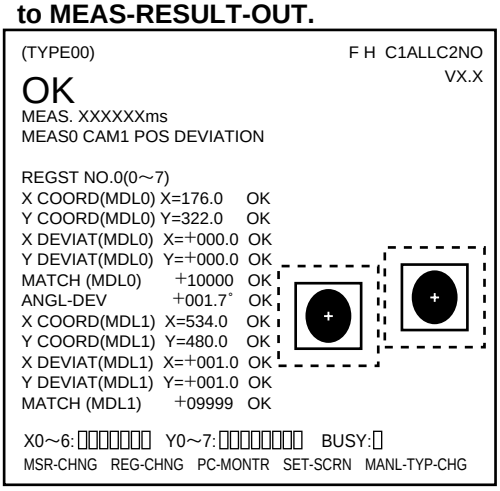
⑤ PATTERN DISPLAY	Description
MEAS-RESULT -OUT	When correction registration has been set to YES in items ⑥ and ⑦ on the [OBJECT TYPE COND] menu, the pattern display will be corrected on the MAIN OPS MENU. Note: When the monitor camera mode has been set to the 2-screen divided display mode (cameras 1 and 2), the patterns will not be displayed even if MEAS-RESULT-OUT is specified.
NO	Patterns will not be displayed on the [MAIN OPS MENU.]

[Operation procedure]

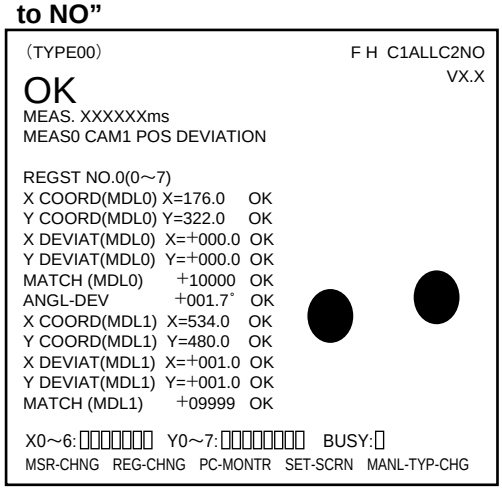
1. On the [RUN MENU SETTINGS] menu, move the cursor to item ⑤ PATTERN DISPLAY, with the up and down keys, and press the SET key.
2. Move the cursor to MEAS-RESULT-OUT or NO with the right and left keys, and press the SET key.

[Display examples]

· When the display mode has been set to MEAS-RESULT-OUT.



· When the display mode has been set to NO"



[5] Binary image display

Select "YES" or "NO" to display a binary image on the MAIN OPS MENU.

On the [MAIN OPS MENU,] move the cursor to SET-SCRN, and press the SET key.
⇨ On the [SYSTEM SETUP] menu, move the cursor to item ① OPS MENU SETTING and press the SET key.

```
[RUN MENU SETTINGS]
①MONITOR OUTPUT  CAM1 CAM2 CAM1&2
②CAMERA1&2       CAM1=MD CAM2=MD
③CAPTURE AN IMAGE PARTIAL-IMAGE  WHOLE-IMAGE  NO
④MESSAGE DISPLAY  YES(RESULT.OK) YES(RESULT.NO) NO
⑤PATTERN DISPLAY  MEAS-RESULT- OUT   NO
⑥SHOW BINARY IMAGE YES  NO
⑦SHOW CORRECT IMG YES  NO
⑧DISPLAY + CURSOR  NO  YES    MANL-MESR
⑨OBJ.NO.MANL MODE NO  YES
⑩IMAGE DISPLAY    FREEZE THROUGH
⑪UPPER MENU
```

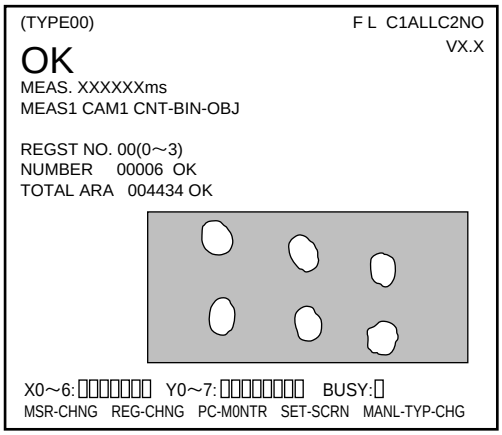
⑥ SHOW BINARY IMAGE	Description
YES	A binary image will be displayed on the MAIN OPS MENU. Note: When the monitor camera mode has been set to the 2-screen divided display mode (cameras 1 and 2), the binary image will not be displayed even if "YES" is selected.
NO	A binary image will not be displayed on the MAIN OPS MENU.

[Operation procedure]

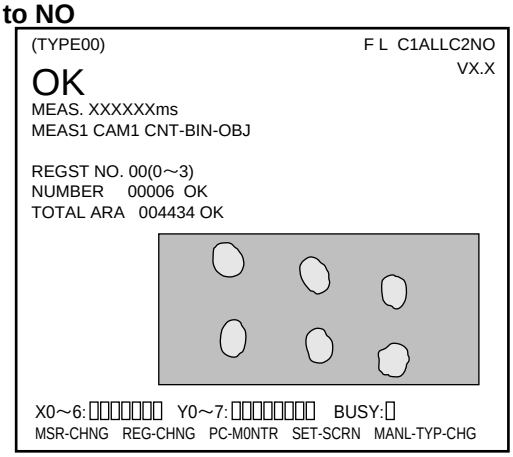
1. On the [RUN MENU SETTINGS] menu, move the cursor to item ⑥ SHOW BINARY IMAGE with the up and down keys, and press the SET key.
2. Move the cursor to YES or NO with the left and right keys, and press the SET key.

[Display examples]

· When the display mode has been set to YES



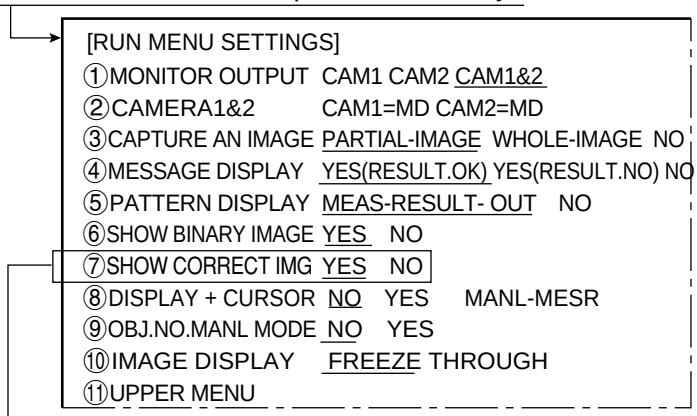
· When the display mode has been set to NO



[6] θ angle correction image display

Select "YES" or "NO" to display a θ angle corrected image on the [MAIN OPS MENU.]

On the [MAIN OPS MENU,] move the cursor to SET-SCRN item, and press the SET key.
⇨ On the [SYSTEM SETUP] menu item, move the cursor to item ①,
OPS MENU SETTING and press the SET key.

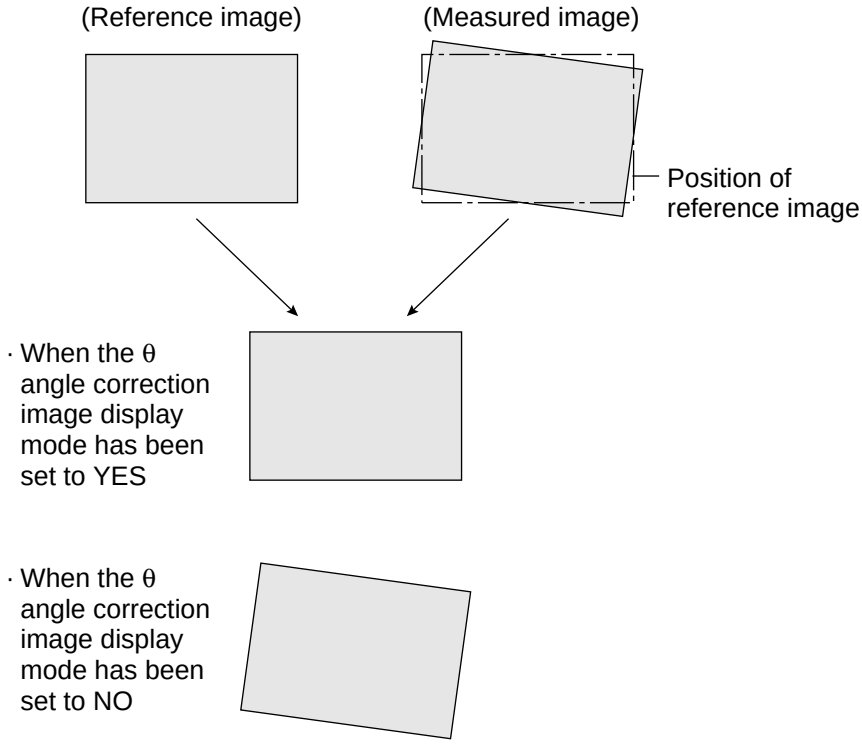


⑦SHOW CORRECT IMG	Description
YES	A θ angle corrected image will be displayed on the MAIN OPS MENU.
NO	A θ angle corrected image will not be displayed on the MAIN OPS MENU.

[Operation procedure]

1. On the [RUN MENU SETTINGS] menu, move the cursor to item ⑦ SHOW CORRECT IMG, with the up and down keys, and press the SET key.
2. Move the cursor to YES or NO with the left and right keys, and press the SET key.

[Display examples]



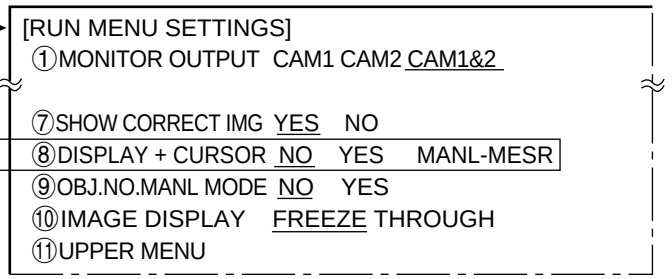
See “Positional correction” (page 9·20) for details about θ angle correction.

[7] Crosshair cursor display

A crosshair cursor can be displayed at any point on the MAIN OPS MENU item and used to manually position a workpiece.

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to item ① OPS MENU SETTING and press the SET key.



⑧ DISPLAY +CURSOR	Description
YES	A crosshair cursor can be displayed at any point on the MAIN OPS MENU. - The initial coordinates of the crosshair cursor position are (255, 240).
NO	A crosshair cursor will not be displayed on the MAIN OPS MENU.
MANL-MESR	The distance, X coordinate distance, and Y coordinate distance of the two points that were manually designated on the MAIN OPS MENU can be measured.

8

[Operation procedure]

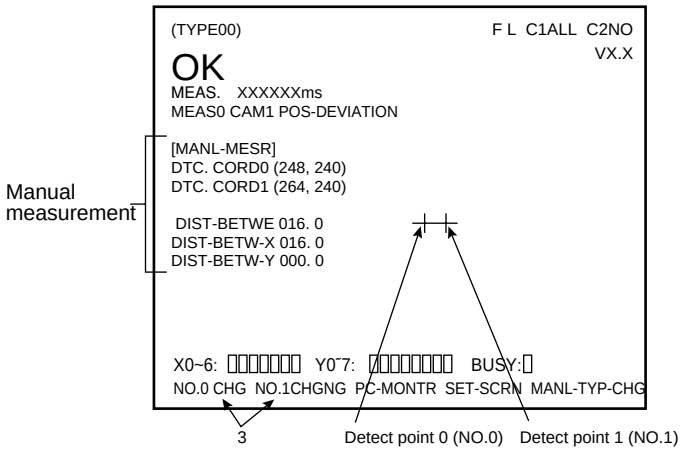
1. On the [RUN MENU SETTINGS] menu, move the cursor to item ⑧ DISPLAY + CURSOR, with the up and down keys, and press the SET key.
2. Move the cursor to YES or NO with the left and right keys, and press the SET key.
   When the cursor has been set to YES, the crosshair cursor can be moved with the direction keys. After defining the position, press the SET key.

● **When "YES" is selected**

1. Move the crosshair cursor using the up/down and left/right keys.
2. When the position is correct, press the SET key.

● **When MANL-MESR**

1. Return to the MAIN OPS MENU
2. Display [MANL-MESR] using the SEL key.

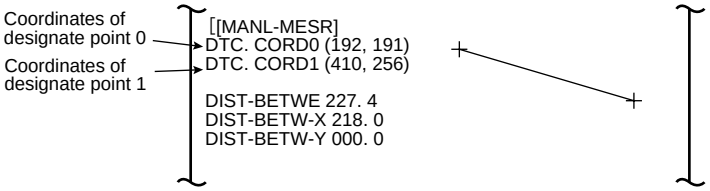


- Automatically enter the initial values

When measurement 1 is a distance and angle measurement, a degree of match inspection, or a lead inspection, the points for register numbers 0 and 1 are set automatically to the initial values for inspection points 0 and 1.

Output point for register 0
→ Detect point 0 for manual measurement
Output point for register 1
→ Detect point 1 for manual measurement

3. Select NO.0 CHG using the left and right keys
   - When NO.0 CHG is selected, you can move designated point 0. (When you select NO.1 CHG, you can move designated point 1.
4. Move designated point 0 using the up/down and left/right keys. When it reaches the desired position, press SEL to confirm the position.
5. Designate point 1 by repeating steps 2 to 4 above.
   ⇨ Now the distance between designated points 0 and 1, designated manually above, and X coordinate distance, and Y coordinate distance can be displayed.



[8] Manually setting the object type

On the [MAIN OPS MENU], the object type (00 to 15) can be changed manually (using the remote key pad).

[RUN MENU SETTINGS]
①MONITOR OUTPUT CAM1 CAM2 CAM1&2
②CAMERA1&2 CAM1=MD CAM2=MD
③CAPTURE AN IMAGE PARTIAL-IMAGE WHOLE-IMAGE NO
④MESSAGE DISPLAY YES(RESULT.OK) YES(RESULT.NO) NO
⑤PATTERN DISPLAY MEAS-RESULT- OUT NO
⑥SHOW BINARY IMAGE YES NO
⑦SHOW CORRECT IMG YES NO
⑧DISPLAY + CURSOR NO YES MANL-MESR
⑨OBJ.NO.MANL MODE NO YES
⑩IMAGE DISPLAY FREEZE THROUGH
⑪UPPER MENU

⑨ OBJ. NO. MANL MODE	Description
YES	The type can be manually changed on the MAIN OPS MENU. Note: If OBJ. NO. MANL MODE is set to YES, the type cannot be changed with an external interface (parallel I/O or general purpose serial IF).
NO	The type cannot be manually changed on the MAIN OPS MENU.

[Operation procedure]

1. On the [RUN MENU SETTINGS] menu, move the cursor to item ⑨ OBJ. NO. MANL MODE with the up and down keys, and press the SET key.
2. Move the cursor to YES or NO with the left and right keys, and press the SET key.

[Changing the object type on the MAIN OPS MENU]

1. Move the cursor to MANL-TYPE-CHG with the left and right keys.
2. Change the object type number (displayed in the uppermost area) with the up and down keys.

[9] Image display

Select the desired measurement image status (FREEZE or THROUGH) on the MAIN OPS MENU.

```
[RUN MENU SETTINGS]
 ①MONITOR OUTPUT  CAM1 CAM2 CAM1&2
 ②CAMERA1&2       CAM1=MD CAM2=MD
 ③CAPTURE AN IMAGE PARTIAL-IMAGE  WHOLE-IMAGE  NO
 ④MESSAGE DISPLAY  YES(RESULT.OK) YES(RESULT.NO) NO
 ⑤PATTERN DISPLAY  MEAS-RESULT- OUT   NO
 ⑥SHOW BINARY IMAGE YES   NO
 ⑦SHOW CORRECT IMG YES   NO
 ⑧DISPLAY + CURSOR  NO   YES    MANL-MESR
 ⑨OBJ.NO.MANL MODE  NO   YES
 ⑩IMAGE DISPLAY    FREEZE THROUGH
 ⑪UPPER MENU
```

⑩IMAGE DISPLAY	Contents
FREEZE	Measurements can be made on a frozen image.
THROUGH	Measurements can be made on a frozen image.

[Operation procedure]

1. On the [RUN MENU SETTINGS] menu, move the cursor to item ⑩IMAGE DISPLAY with the up and down keys, and press the SET key.
2. Move the cursor to FREEZE or THROUGH with the left and right keys, and press the SET key.

[10] Main operations menu lock

To prevent accidental changes to conditions you have set, the MAIN OPS MENU can be locked so that the screen cannot be changed to SET-SCRN. The operation is carried out on the [POWER ON SETTINGS] menu.

[Display procedure]

Follow the procedure described below when turning ON the power to the IV-S20 main housing, and the [POWER ON SETTINGS] menu will be displayed on the monitor.

1. Turn ON the power to the IV-S20 main housing, while holding down the ESC key.
2. Keep pressing the ESC key down for approx. 3 sec., after turning ON the power and the menu will be displayed.

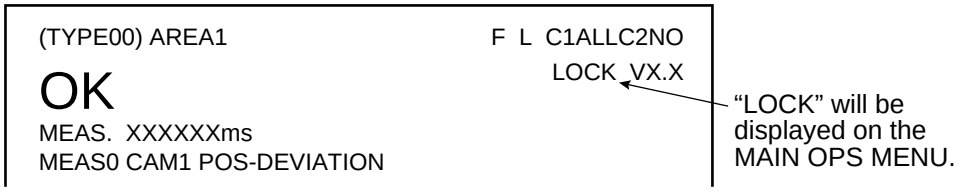
```
[POWER ON SETTINGS]
 ①MAIN OPS MENU      UNLOCK  LOCK
 ②OPERATION
```

① MAIN OPS MENU	Description
UNLOCK	All of the operating conditions for the IV-S20 can be changed.
LOCK	The MAIN OPS MENU is locked and no change can be made.

[Operation procedure]

1. On the [POWER ON SETTINGS] menu, move the cursor to item ① MAIN OPS MENU with the up and down keys, and press the SET key.
2. Move the cursor to UNLOCK or LOCK with the left and right keys, and press the SET key.
3. Move the cursor to item ② OPERATION with the up and down keys, and press the SET key. Press the SET key once more.
   ⇨ The screan returns to the MAIN OPS MENU.

[Display when the MAIN OPS MENU is locked]



Chapter 9 : Setting the Conditions for Each Object Type

9-1 Outline

The measuring conditions for each object type are set on the [OBJECT TYPE COND] (conditions for object type) menu.

[Settings screen]

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key

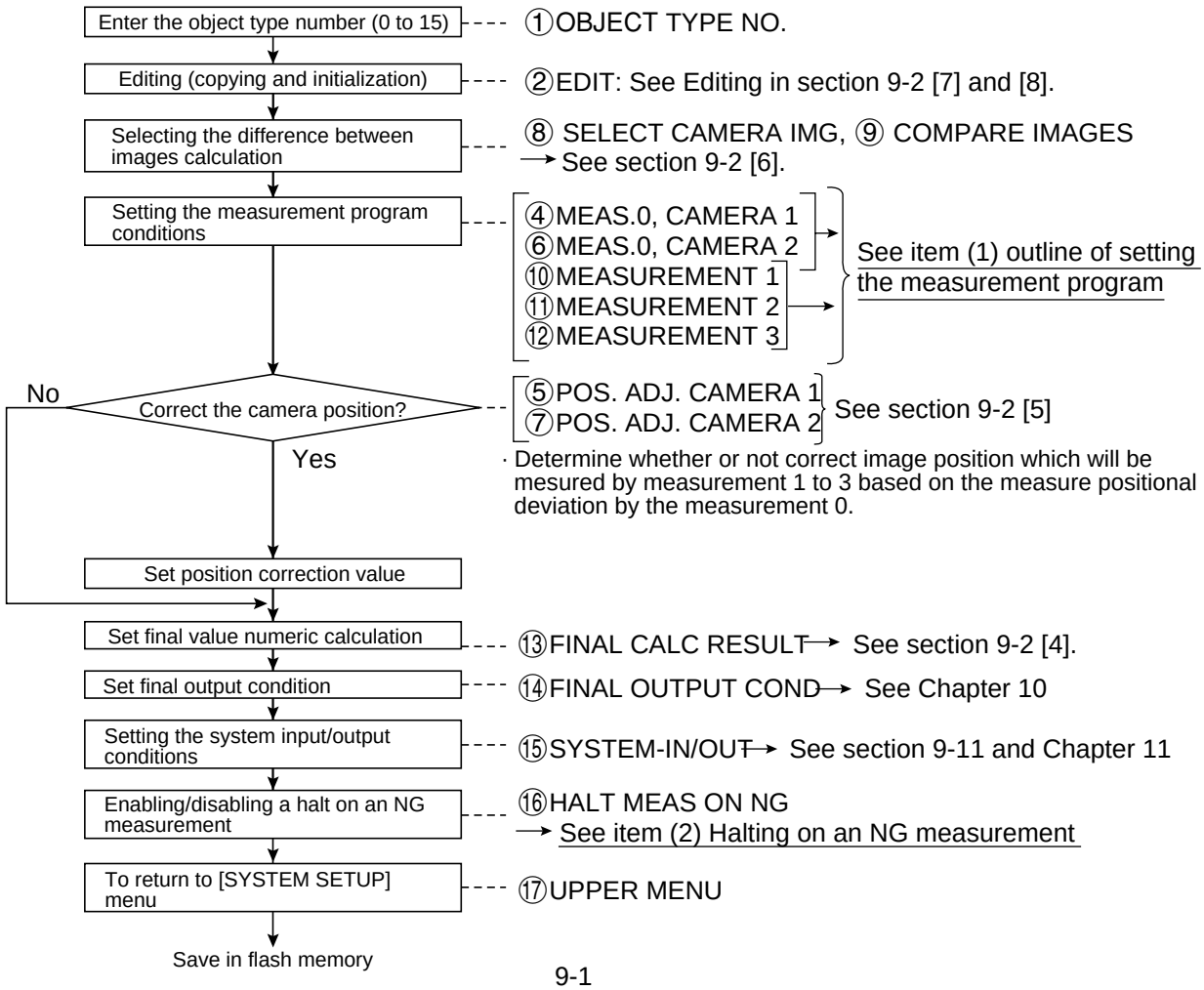
⇨ On the [SYSTEM SETUP] menu, move the cursor to item ② OBJECT TYPE COND and press the SET key.

[OBJECT TYPE COND]	
①OBJECT TYPE NO.	00(0~15)
②EDIT	COPY(←OBJ TYPE00) INITIALIZE
③TITLE REGISTRATION	(TO NEXT SUB-MENU)
④MEAS.0, CAMERA1	NO (TO NEXT SUB-MENU)
⑤POS. ADJ.CAMERA1	NO ADJ. [REG. 0-1PNTSXY]
⑥MEAS.0, CAMERA2	NO (TO NEXT SUB-MENU)
⑦POS. ADJ.CAMERA2	NO ADJ. [REG. 0-1PNTSXY]
⑧SELECT CAMERA IMG	NO CAM1 CAM1 CAM1&2
⑨COMPARE IMAGES	NO SUB.I1—T1 DIFF.ABS | I1—T1 |
⑩MEASUREMENT 1	NO (TO NEXT SUB-MENU)
⑪MEASUREMENT 2	NO (TO NEXT SUB-MENU)
⑫MEASUREMENT 3	NO (TO NEXT SUB-MENU)
⑬FINAL CALC RESULT	(TO NEXT SUB-MENU)
⑭FINAL OUTPUT COND	(TO NEXT SUB-MENU)
⑮SYSTEM-IN/OUT	(TO NEXT SUB-MENU)
⑯HALT MEAS ON NG	NO YES
⑰UPPER MENU	

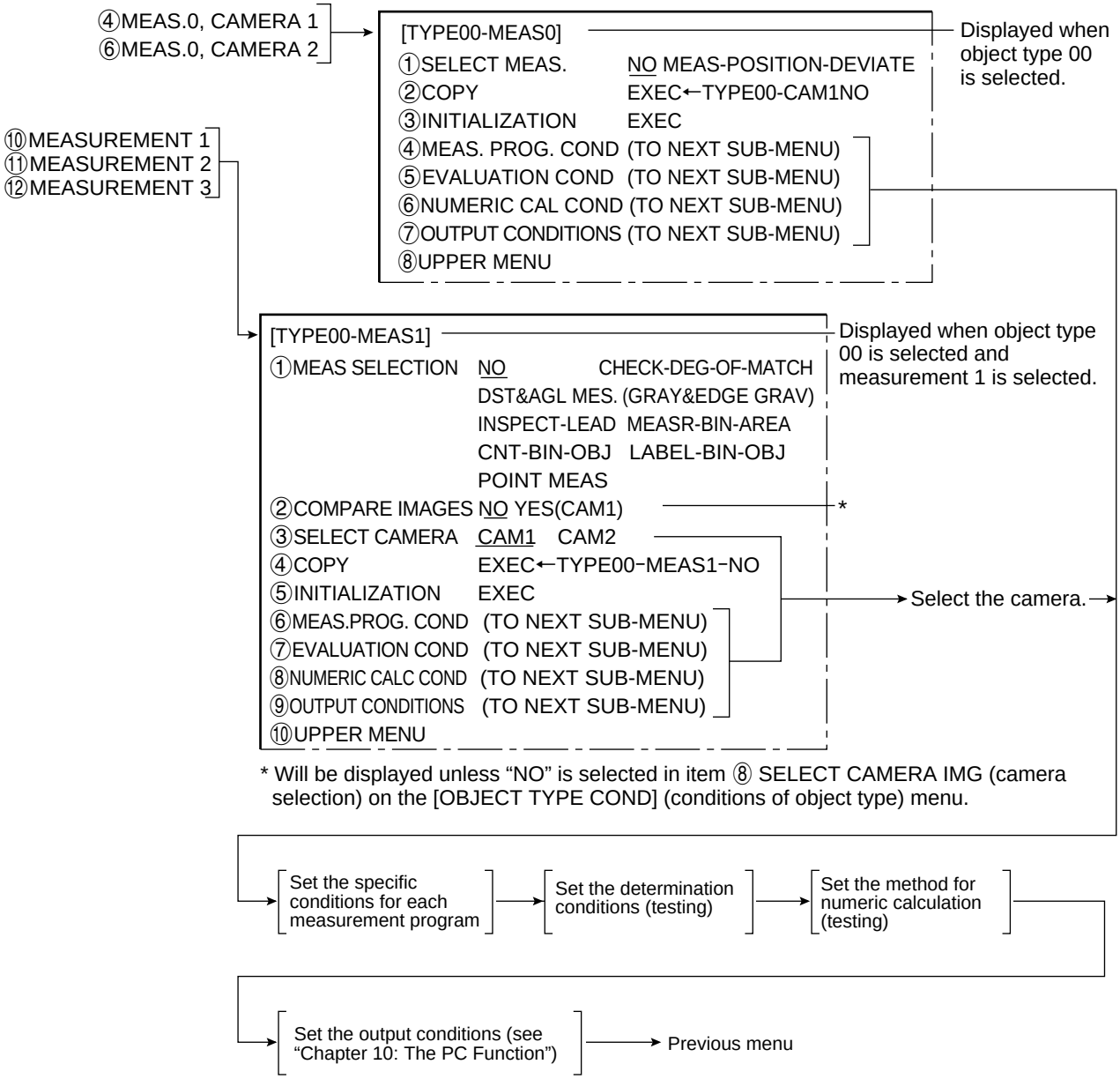
· Unless item ⑧ is set to "NO," then item ⑨ will also be displayed.

[Setting procedure]

Items set on the [OBJECT TYPE COND] menu.



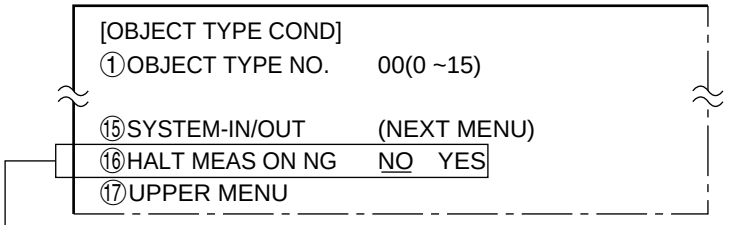
(1) Outline of setting the measurement program



* Will be displayed unless “NO” is selected in item ⑧ SELECT CAMERA IMG (camera selection) on the [OBJECT TYPE COND] (conditions of object type) menu.

(2) Halting on an NG measurement

All measurements can be halted if an NG measurement occurs whilst operating the IV-S20. This is done by selecting item ⑯ HALT MEAS ON NG on the [OBJECT TYPE COND] menu.



⑯ HALT MEAS ON NG (Halting on an NG measurement)	Description
YES	Halt all measurements if an NG evaluation occurs.
NO	Allows measurements to continue when an NG evaluation occurs.

9-2 Shared settings

[1] Window shape selection and settings

This section describes how to select and set the window shapes used for image processing (e.g. rectangular windows, horizontal or vertical line boundaries, round windows, and elliptical windows). This can be done using the up, down, left, and right setting keys on the remote key pad.

(1) A rectangular window

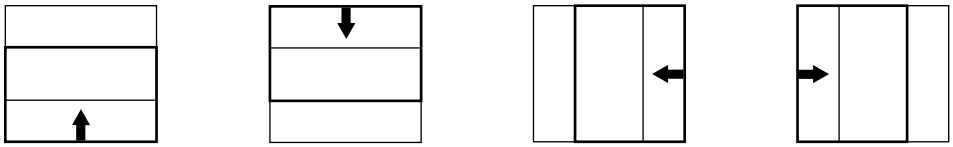
Line type	Image processing used	Measurement programs
Solid lines	Reference image gray scale search, binary image matching	Positional deviation measurement (gray scale search), degree of match inspection for shape and size, distance and angle measurement (gray scale search/locating the center of gravity), lead inspection
	Window containing a binary image	Area measurement by binary conversion, counting quantities by binary conversion, identifying objects by binary conversion
Dotted lines	Gray scale search area detection	Positional deviation measurement (gray scale search), degree of match inspection for shape and size, distance and angle measurement (gray scale search), lead inspection (criteria search).
	Edge of an area detection	Positional deviation measurement (edge), distance and angle measurement (edge).
	Binary image window mask	Distance and angle measurement (center of gravity), Area measurement by binary conversion, counting quantities by binary conversion, identifying objects by binary conversion

[How to set a rectangular window]

The following items on the settings menu can be used to define the mask: move, upper left, lower right. Shown here is an example of how to define a solid-line rectangular window.

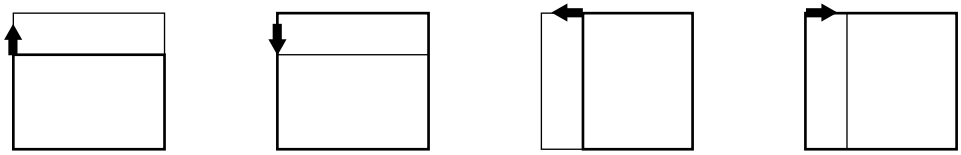
1. Moving the mask

· Up key · Down key · Left key · Right key



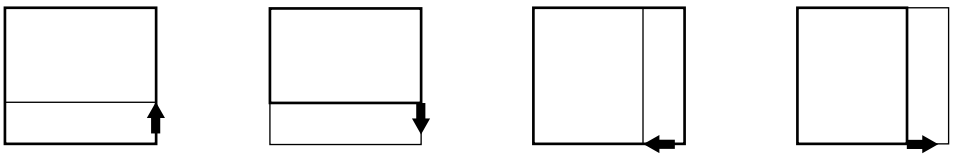
2. Specifying the upper left corner

· Up key · Down key · Left key · Right key



3. Specifying the lower right corner

· Up key · Down key · Left key · Right key



(2) Horizontal/vertical lines

Line type	Image processing used	Measurement programs
Solid lines	Gray scale search (reference image)	Positional deviation measurement (gray scale search), degree of match inspection for shape and size, distance and angle measurement (gray scale search), lead inspection (criteria search).
	Edge of an area detection	Lead inspection
Dotted lines	Gray scale search line detection	Positional deviation measurement (gray scale search), degree of match inspection for shape and size, distance and angle measurement (gray scale search), lead inspection (criteria search).

[How to set horizontal lines]

The following items on the settings menu can be used to define lines: move, starting point, ending point. Shown here is an example of how to define a solid line.

1. Move

· Up key · Down key · Left key · Right key

2. Specifying the starting point

· Left key · Right key

(The up and down keys function the same as in the move item)

3. Specifying the ending point

· Left key · Right key

(The up and down keys function the same as in the move item)

[How to set vertical lines]

1. Move

· Up key · Down key · Left key · Right key

2. Specifying the starting point

· Up key · Down key

(The left and right keys function the same as in the move item)

3. Specifying the ending point

· Up key · Down key

(The left and right keys function the same as in the move item)

(3) Circle window

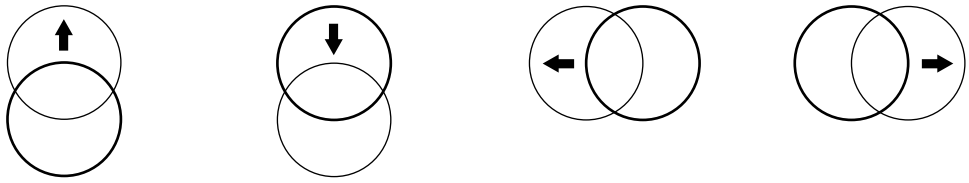
Line type	Image processing used	Measurement programs
Solid lines	Window containing a binary image	Distance and angle measurement (center of gravity), area measurement by binary conversion, counting quantities by binary conversion, identifying objects by binary conversion
Dotted lines	Binary image window mask	Distance and angle measurement (center of gravity), area measurement by binary conversion, counting quantities by binary conversion, identifying objects by binary conversion

[How to set a circle window]

The following items on the settings menu can be used to define the circle window: center, radius. Shown here is an example of how to define a solid line round window.

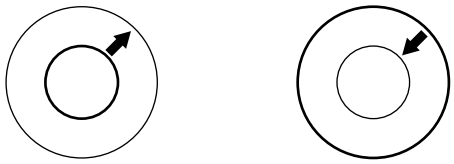
1. Specifying the center

· Up key · Down key · Left key · Right key



2. Specifying the radius

· Up/right key · Down/left key



(4) Elliptical window

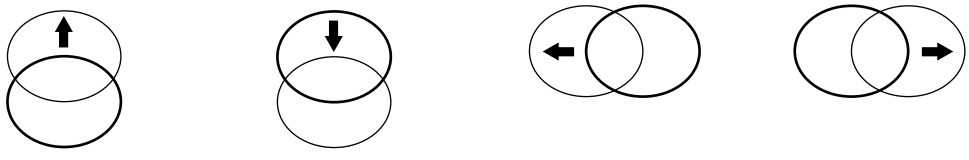
Line type	Image processing used	Measurement programs
Solid lines	Window containing a binary image	Distance and angle measurement (center of gravity), area measurement by binary conversion, counting quantities by binary conversion, identifying objects by binary conversion
Dotted lines	Binary image window mask	Distance and angle measurement (center of gravity), area measurement by binary conversion, counting quantities by binary conversion, identifying objects by binary conversion

[How to set an elliptical window]

The following items on the settings menu can be used to define the elliptical window: center, radius. Shown here is an example of how to define a solid line elliptical window.

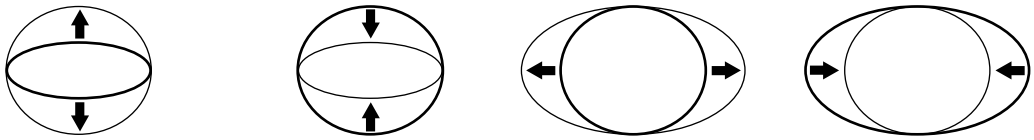
1. Specifying the center

· Up key · Down key · Left key · Right key



2. Specifying the radius

· Up key · Down key · Left key · Right key



[2] Image settings

What follows is a description of how to use the image settings to control the measuring program.

(1) Gray scale processing (pixel contraction and detection precision)

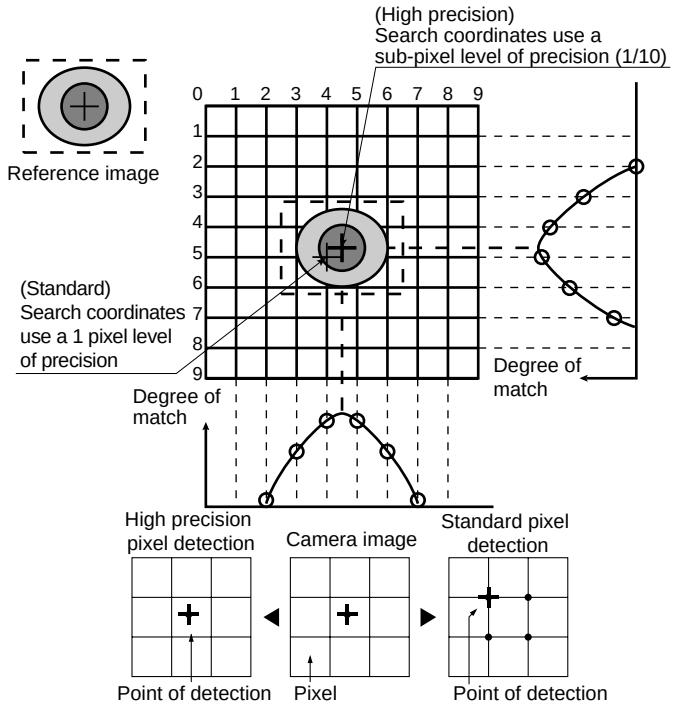
[Settings menu screen]

· Positional deviation measurement (gray scale search)
Degree of match inspection for shape and size (gray scale processing).

⑤CONTR. PIXEL (MDL 0) 1 2 3
⑩CONTR. PIXEL (MDL 1) 1 2 3
⑪DETECT ACCURACY STANDARD HI-PRC

· Distance and angle measurement (gray scale search)
Lead inspection (criteria search).

⑤CONTR. PIXEL(MDL0) 1 2 3
⑪DETECT ACCURACY STANDARD HI-PRC

Menu	Description
⑤⑩CONTR. PIXEL (pixel contraction)	· 1: Search the scanned image in groups of 2 pixels. · 2: Search the scanned image in groups of 4 pixels. · 3: Search the scanned image in groups of 8 pixels.
⑪DETECT ACCURACY (detection precision)	· STANDARD (standard): Detection precision of 1 pixel unit level · HI-PRC (High precision): Detection precision of 1/10 pixel unit level 

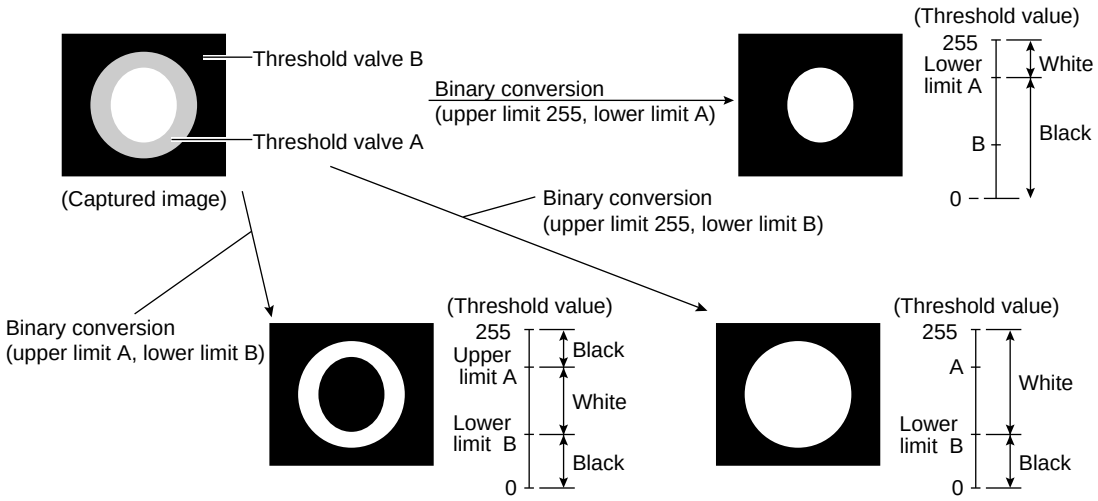
· To increase the speed of your search, you must take into account the settings listed below.
1. When using the high precision setting, a smaller image should be used.
2. Reduce the size of the scanned image.
3. After considering what the maximum out of position dimension would be, make the search area as small as possible.
4. If the size of the object is larger than 8 pixels then set the pixel contraction to 3.

[Measurement programs which are affected by these settings]

Positional deviation measurement (gray scale search: page 9-37)
Degree of match inspection for shape and size (gray scale processing: page 9-48)
Distance and angle measurement (gray scale search: page 9-60)
Lead inspection (criteria search: page 9-75)

(2) Threshold value setting

The IV-S20 treats the "areas darker than the lower limit value" or "brighter than the upper limit value" as "black." It treats that the areas between the upper limit value and lower limit value as "white." However, if the white-black reverse function is enabled, conversion to white/black will be reversed. Normally, if you want to use only one threshold value for binary conversion, set the upper limit value to "255." Then you only need to adjust the lower limit value to a threshold value that works for our application.



[Measurement programs which are affected by these settings]

Degree of match inspection for shape and size (binary conversion: page 9-51)
Distance and angle measurement (center of gravity: page 9-62)
Area measurement by binary conversion (page 9-85)
Counting quantities by binary conversion (page 9-93)
Identifying object by binary conversion (page 9-101)
Point measurement (binary images: page 9-109)

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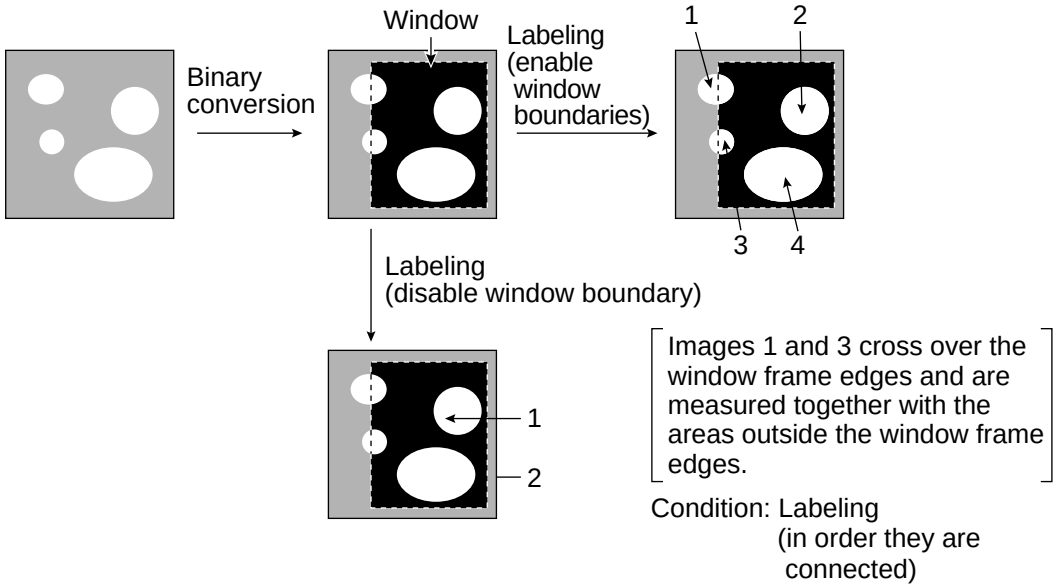
(3) Setting window boundaries (enable/disable)

This function enables and disables the labeling (object identification) of binary images located that cross over the window frame boundary.

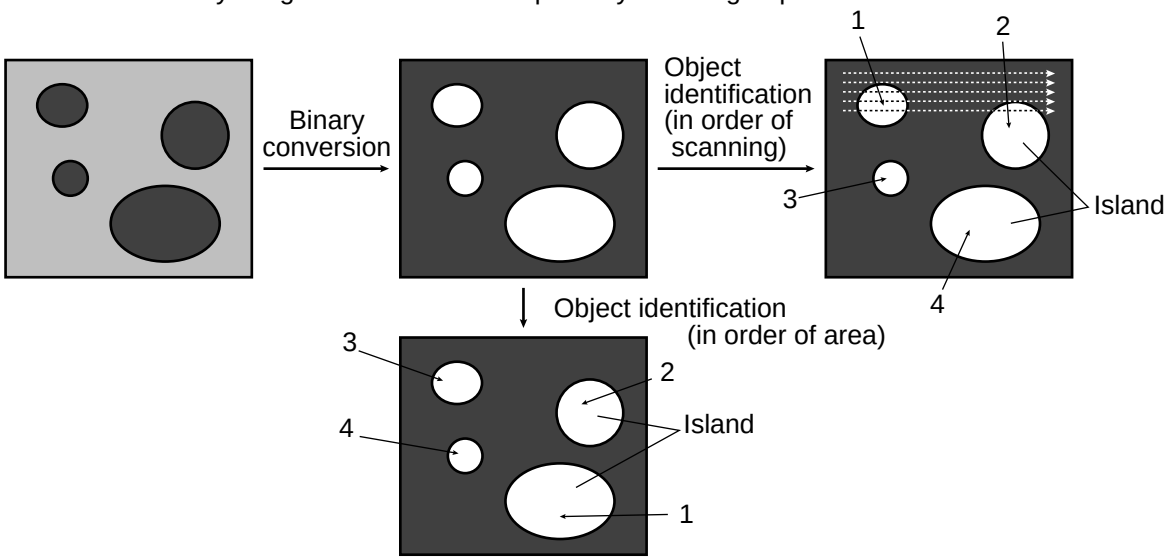


[Measurement programs which are affected by these settings]

Distance and angle measurement (center of gravity: page 9-62)
Counting quantiities by binary conversion (page 9-93)
Identifying object by binary conversion (page 9-101)

(4) Object identification and numbering function, (labeling)

Object identification and numbering (labeling) is a process for locating separate object and assigning serial numbers (labels) one at a time in a binary image. By this process, multiple objects in the same binary image can be handled separately or as a group.

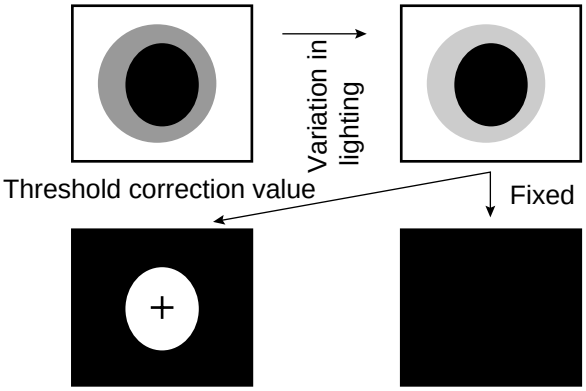


[Measurement programs which are affected by these settings]

Distance and angle measurement (center of gravity: page 9-62)
Counting quantities by binary conversion (page 9-93)
Identifying object by binary conversion (page 9-101)

(5) Binary processing (fixed/threshold value correction)

By setting THESHLD. ADJ (threshold adjustment function), the IV-S20 can cope with variations in lighting.



Note: In order to use the THESHLD.ADJ (threshold adjustment function), the monitor brightness functions must be selected to measure variations in lighting. If you don't select the monitor brightness function, a COMP. BIN: ILLM. MON. UNSET (correcting binary value: monitor illumination not selected) error will occur.

Fails to convert the image due to a variation in lighting

Threshold correction using either VAR-DIFF (enter variations in lighting as value) and VAR-RATE (enter variations in lighting as a rate) can be selected the THRSHOLD-ADJ (the threshold adjustment function).

Set (selection) item		Details of correction
Threshold value adjustment	Variation difference	Correct the threshold value by adding the previously specified threshold value to the light level variation difference. (Measured light level – reference light level) + specified threshold value
	Variation rate	Correct the threshold value by multiplying the previously threshold value to the light level variation rate. (Measured light level ÷ reference light level) x specified threshold value

[Measurement programs which are affected by these settings]

Degee of match inspection for shape and size (binary conversion: page 9-51)
Distance and angle measurement (center of gravity: page 9-62)
Area measurement by binary conversion (page 9-85)
Counting quantities by binary conversion (page 9-93)
Identifying object by binary conversion (page 9-101)
Point measurement (binary images: page 9-109)

(6) Pre-processing

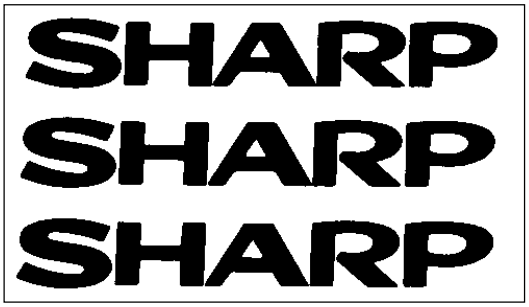
Pre-processing includes various image manipulation processes that create more readable images by removing noise and distortion in the image data. And, by extracting or emphasizing certain image features, it is easier to evaluate or identify target objects by converting the images into standard patterns.

In the IV-S20, you can select from "smoothing," "edge emphasis," and "edge extraction (whole, horizontal, vertical)" pre-processing techniques

Item	Contents
Smoothing	· Display smooth images decreasing the noise. · Use to eliminated surface flaws and unevenness in the reflected light caused by protrusions or dents.
Edge emphasis	· Display images with sharp boundaries between brighter and darker areas. · Used to stabilize and create a binary outline of obscure objects.
Edge extraction	· Display images after extracting and clarifying the boundaries between the brighter and darker areas. · Used to measure objects with low contrast. · Horizontal edge extraction: Display only the with horizontal boundaries o an object. · Vertical edge extraction: Display only the vertical boundaries of an object.

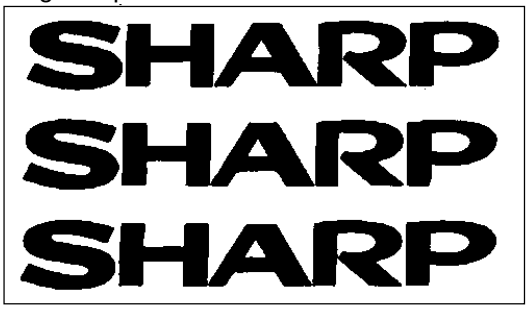
[Example of an image]

- OFF

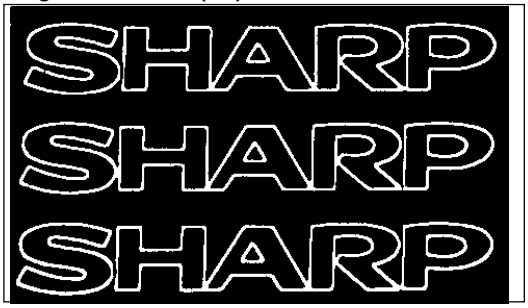


- Smoothing

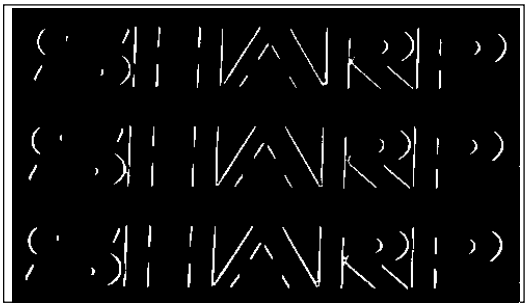
- Edge emphasis



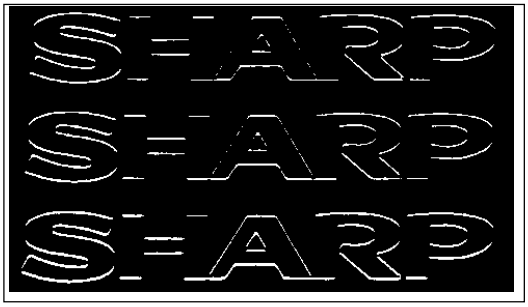
- Edge extraction (All)



- Edge extraction (horizontal)



- Edge extraction (vertical)



[Measurement programs which are affected by these settings]

Distance and angle measurement (center of gravity: page 9-62)
Area measurement by binary conversion (page 9-85)
Counting quantities by binary conversion (page 9-93)
Identifying object by binary conversion (page 9-101)

(7) The expansion/contraction method of eliminating noise in binary images

When converting an image to binary values, it is often the case that dots of noise will show up in the converted image. This noise may be eliminated during pre-processing by using the smoothing function. However, it can also be dealt with through the expansion/contraction noise elimination method.

-① Expansion

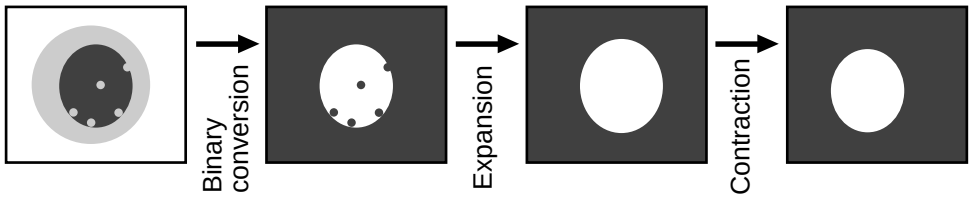
A single white dot, or small groups of white dots, in the middle of a black background can be eliminated from the image.

② Contraction

A single black dot, or small groups of black dots, in the middle of a white background can be eliminated from the image.

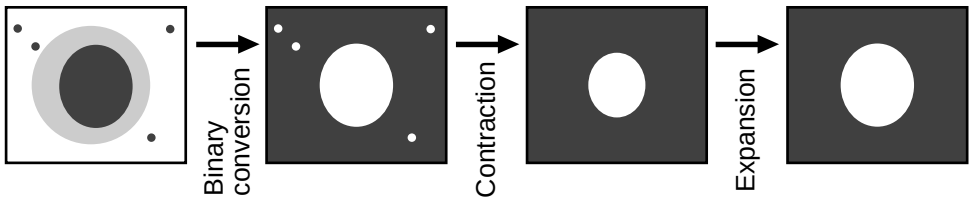
-① Expansion ➡ contraction

When isolated dots of noise are eliminated by expansion, the areas enlarged by the expansion are returned to their original size by contracting them again.



② Contraction ➡ expansion

When isolated white noise is eliminated by contraction, the areas shrunk by contraction are returned to their original size by expanding them again.



The IV-S20 has both "contraction ➡ expansion" and "expansion ➡ contraction" functions for eliminating binary noise.

- Number of times of expansion and number of times of contraction can be set independenly. When the number of contraction cycles is set to 0, and the number of expansion cycles is one or greater, then only the expansion function will be used. On the other hand, if the number of expansion cycles is set to 0 and the number of contraction cycles is one or greater, then only the contraction function will be used.

[Measurement programs which are affected by these settings]

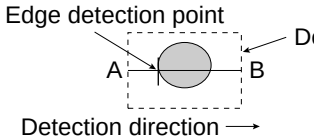
Degee of match inspection for shape and size (binary conversion: page 9-51)
Distance and angle measurement (center of gravity: page 9-62)
Area measurement by binary conversion (page 9-85)
Counting quantities by binary conversion (page 9-93)
Identifying object by binary conversion (page 9-101)

(8) Edge detection

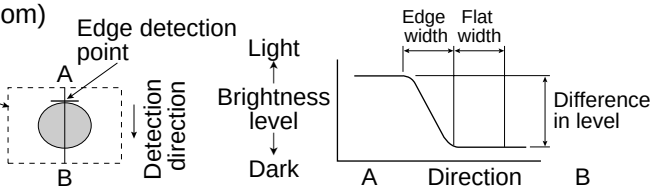
The "edge" refers to the boundaries between the brighter (white) and darker (black) parts in an image. The "edge detection" function is used to detect this boundary by processing the image.

[An example of detecting a point using the edge detection function and user specified criteria]

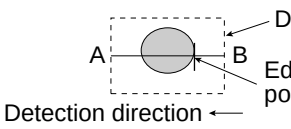
· Horizontal transition point from light to dark (moving from left to right)



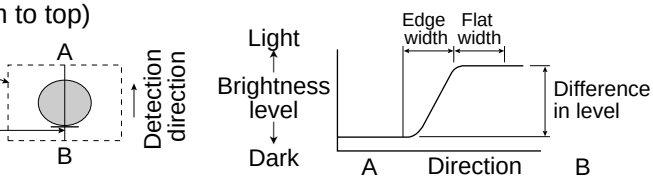
· Vertical transition point from light to dark (moving from top to bottom)



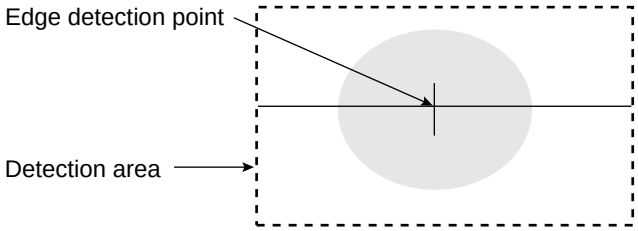
· Horizontal transition point from light to dark (moving from right to left)



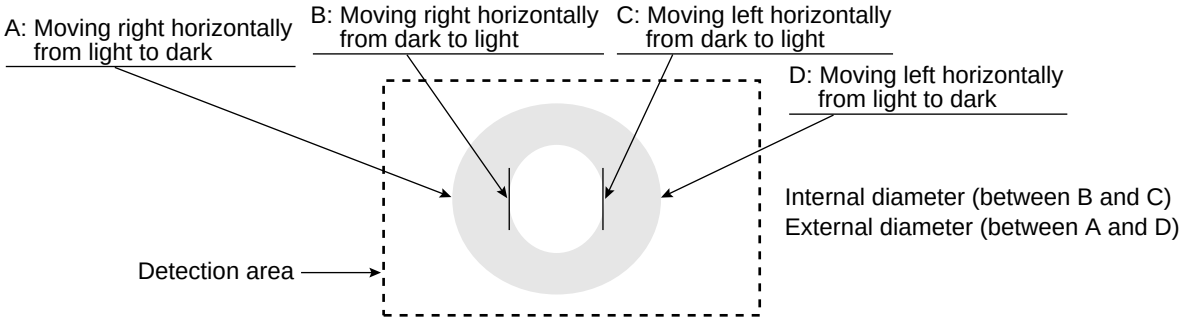
· Vertical transition point from light to dark (moving from bottom to top)



· Center (dark), horizontal (left and right)



· Edge detection of the inside and outside edges of a two circles



- The edge detection point coordinates are used as a reference point to detect an out of position condition.
- Edge detection in binary images is much quicker than in a gray scale search. However, the binary image detection process is less precise at detecting position.

[Measurement programs which are affected by these settings]

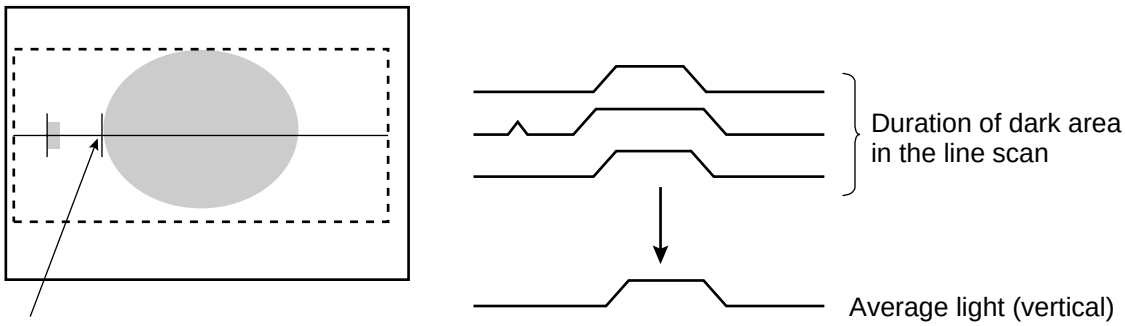
Positional deviation measurement (edge detection: page 9-39),
Distance and angle measurement (edge detection page 9-61)
Lead inspection (edge detection: page 9-76).

(9) Artifact processing

Artifact processing is a method of processing that eliminates the false detection of the edge of the target object when an artifact is in the line being scanned. This process can be used during edge detection. The real edge of the target object is detected by computing the average duration of the dark area in the scan line, which is much longer for a target object than for an artifact.

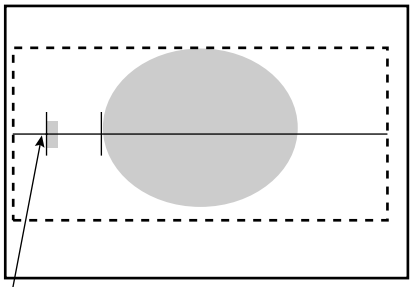
[Example of detection]

- An example of light to dark averaging (DETECT MODE:BRT➡DRK) while scanning horizontally (DETECT DIR.:HORI ➡), with artifact processing (enabled) (PRC. PROJECT: YES).



Edge detection point
(with artifact processing: enabled)

When artifact processing is disabled in the above example, the edge detection point changes.



Edge detection point (with artifact processing off)

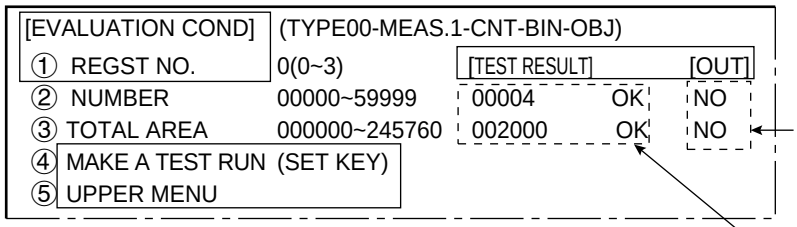
[Measurement programs which are affected by these settings]

Positional deviation measurement (edge detection: page 9-39),
Distance and angle measurement (edge detection, page 9-61)
Lead inspection (edge detection: page 9-76).

[3] Evaluation conditions

The setting details and procedures for setting the evaluation conditions are the same for all measurement programs.
In this section we explain the use of the [EVALUATION COND] (evaluation conditions) menu when counting quantities by binary conversion.

Evaluation conditions [EVALUATION COND] menu for counting quantities by binary conversion



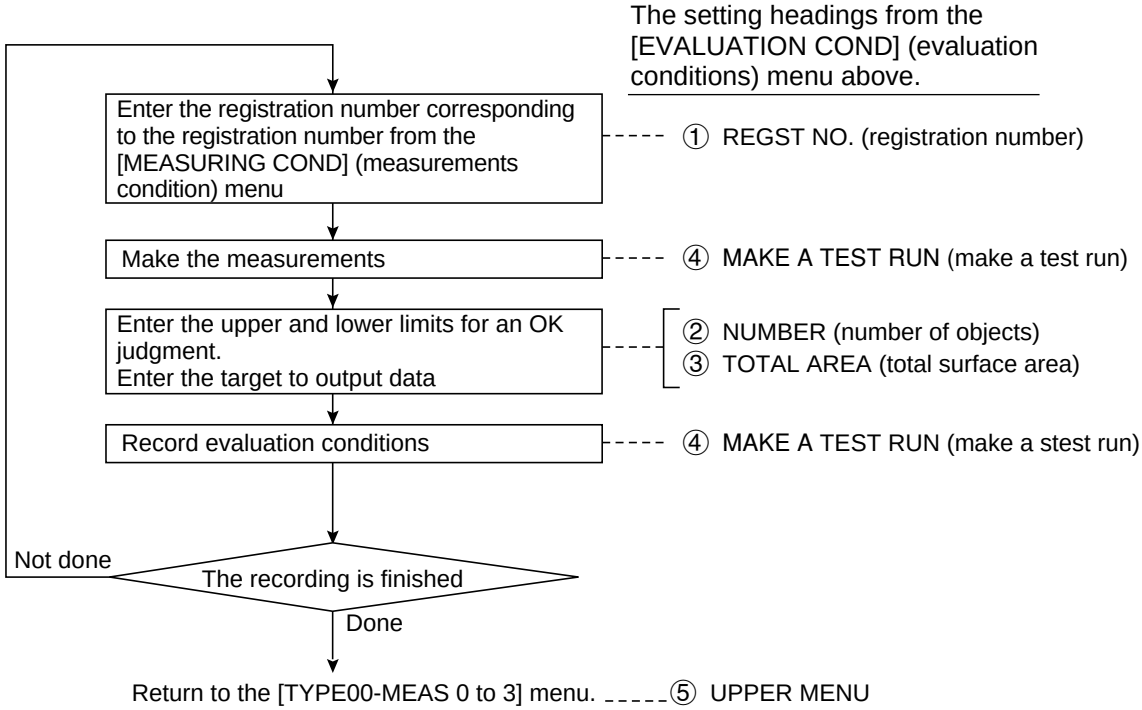
· Items in the regtangle ☐ are the same for each measuremet program.

Using the up and down keys, you can set the output to NO (no output), Y0 to 7 (output on these relays), or C000 to C127 (output on these secondary relays), in the output area of the menu.
(If the test result returns OK, then the output is turned ON. If it is NG, then it is turned OFF).

When carrying out a test using item ④, MAKE A TEST RUN, on the menu, the resulting measurement values and the evaluation (OK or NG) will be displayed.

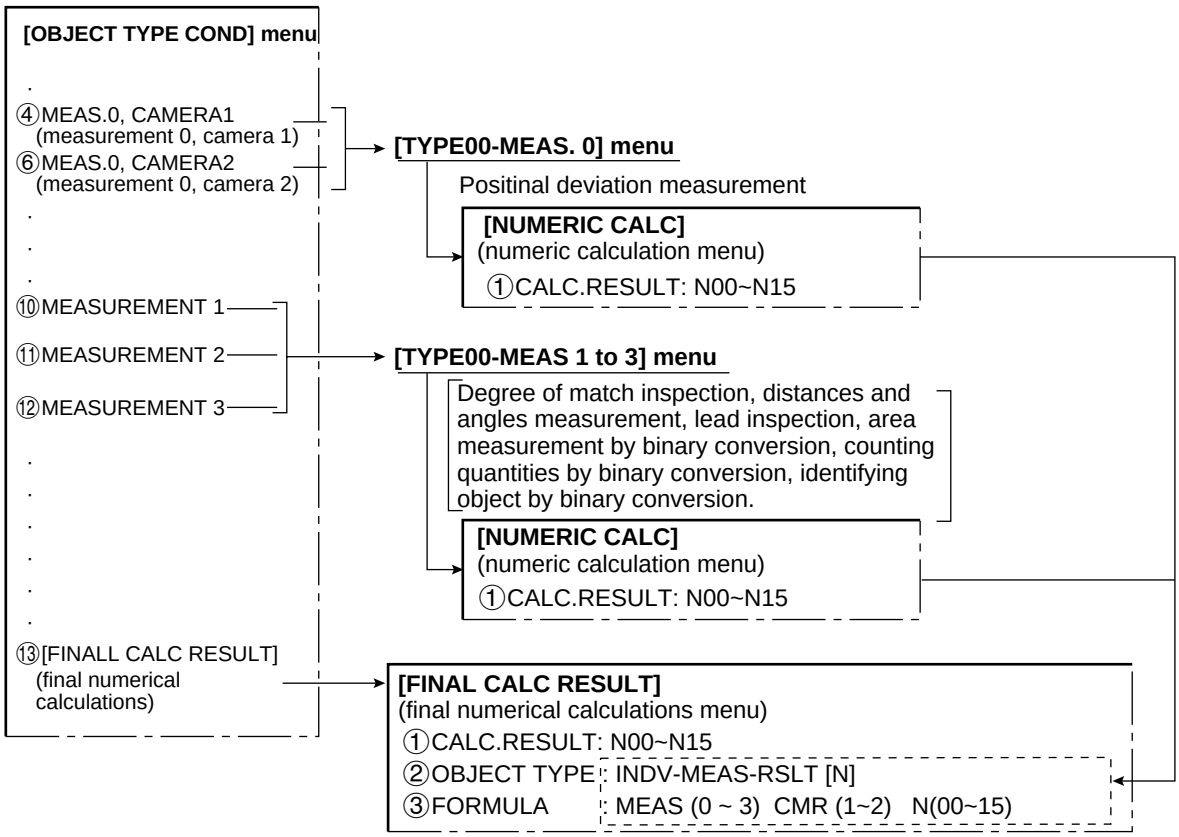
Evaluation conditions	Settings details
① REGST NO. (registration number)	Set to 0 to 3 corresponds to the registration number item ① REGT.NO (registration number) on the measurement condition menu [MEASURING COND].
② NUMBER (number of objects)	Set the range for the number of objects which will produce an OK judgment.
③ TOTAL AREA	Set the range for the total surface area which will produce an OK judgment.
④ MAKE A TEST RUN	To carry out a MAKE A TEST RUN of the evaluation conditions, push the SET key. The results will be displayed. This will also record the details of the settings.
⑤ UPPER MENU	Return to the [TYPE00-MEAS 0 to 3] menu.

[The setting procedure]



[4] Numerical calculations

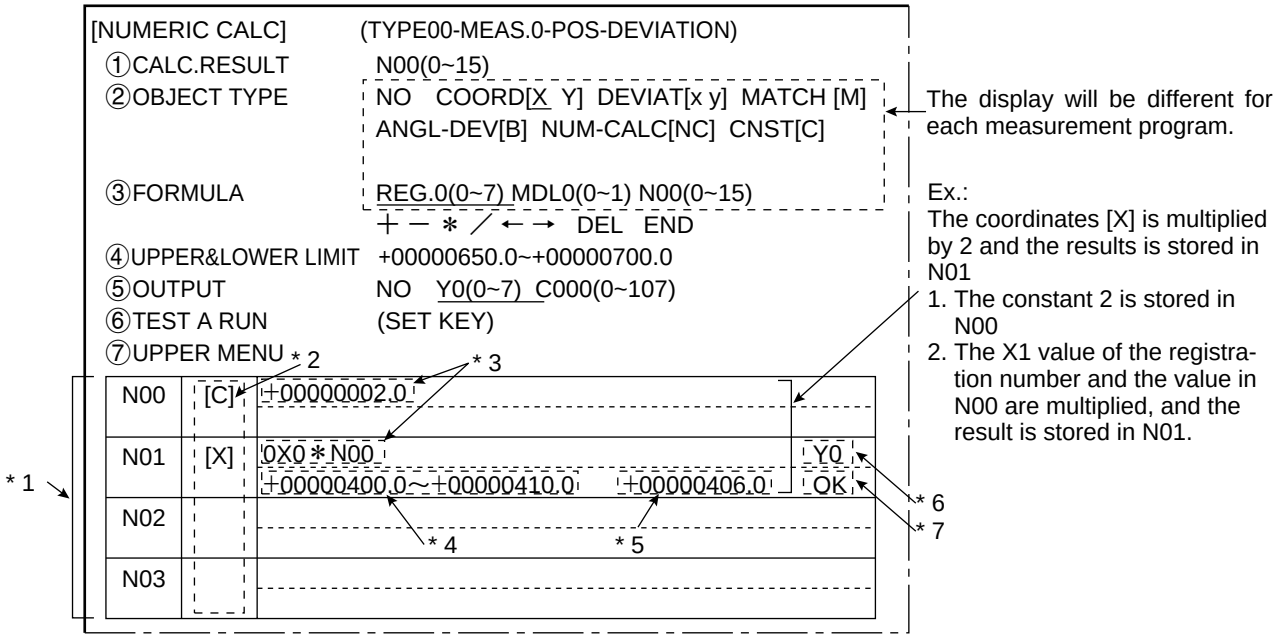
Numeric calculation fuction of the IV-S20 consisits of "numeric calculations," which is set individually for each measurement program, and "final numeric calculations," which are set according to object type. The N00 to N15 results of the calculations which are set individually for each measuring program may be used according to the ② OBJECT TYPE and ③ FORMULA (style) settings of the final numerical calculation.



(1) The individual numerical calculations for each measuring program

The setting details and procedures for numerical calculations are the same for all measurement programs with the exception of the point measurement program. In this section we explain the use of the numerical calculations menu [NUMERIC CALC] for out of position measurements.

- The [NUMERIC CALC] (numerical calculations) menu for positional deviation measurement.



The display will be different for each measurement program.

Ex.:
The coordinates [X] is multiplied by 2 and the results is stored in N01
1. The constant 2 is stored in N00
2. The X1 value of the registration number and the value in N00 are multiplied, and the result is stored in N01.

Numerical calculation	Setting details (selections)
①CALC. RESULT (calculation results)	You may set the location where the arithmetical operation results of the specified output data will be stored, from locations 00 to 15. ⇒The results will be displayed 4 as one unit at position * 1 above.
②OBJECT TYPE	Select the type of data being calculated.
③FORMULA (registation number)	A number of style settings are used. · The style type is selected using the left and right keys and the numerical values are entered using the up and down keys. ⇒The settings are displayed at N00 to N15, position * 3 above. The first line of the display will change, according to the selection made in item ②. **Item ② selections** / **The first line of the display** Coordinates X and Y, positional deviation coordinates x and y, degree of match M: Record 0 (0 to 7) Model 0 (0 to 1) N00 (0 to 15) Angular deviation B: Record 0 (0 to 7) N00 (0 to 15) Numerical calculation NC: ABS √TAN ATAN N00(0 to 15) (second line is not displayed) Constant C: +00000000.0 (second line is not displayed) Note: Please enter a smaller number for N (00 to 15) in the formula than N (00 to 15) of item ①CALC. RESULT
④UPPER&LOWER LIMIT	Enter the upper and lower limits for making a judgment. ⇒This setting will be displayed in N00 to N15, at position * 4 above.
⑤OUTPUT	Setting the output of the calculation results. The output can be set to Y0 to Y7 or C000 to C107. ⇒This setting is displayed in N00 to N15, at position * 6 above.
⑥TEST A RUN (make a test run)	Pressing the SET key will store the setting details as well as run a test. ⇒Both the numerical results of the tests and the OK or NG judgment will be displayed at position * 5 and * 7 above.
⑦UPPER MENU	Will return to the [TYPE00-MEAS0] menu.

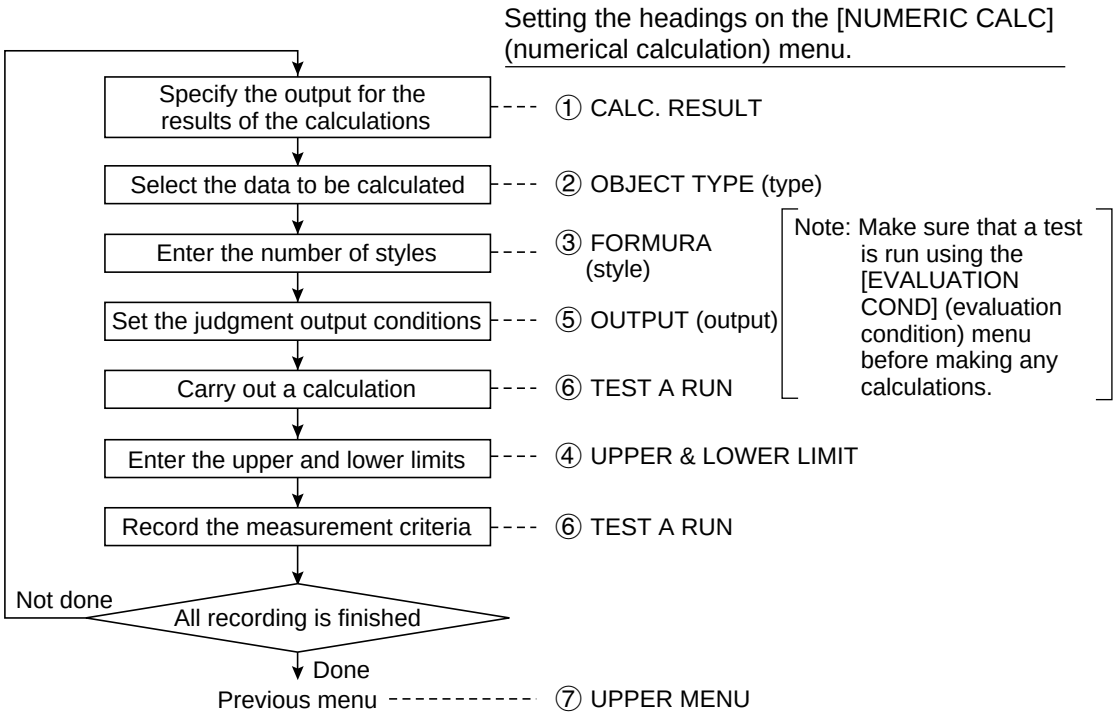
· The number of styles may be set as follows, depending on the selections made in items ② and ③.

② OBJECT TYPE	Model 0	Model 1
Coordinates X/Y	0X0 to 7X0 / 0Y0 to 7Y0	0X1 to 7X1 / 0Y1 to 7Y1
Coordinate deviation	0x0 to 7x0 / 0y0 to 7y0	0x1 to 7x1 / 0y1 to 7y1
Degree of match M	0M0 to 7M0	0M1 to 7M1
Angular deviation B	0B to 7B	
Numerical calculation NC	ABS / √ / TAN / ATAN (00 to 15)	
Constant C	-99999999.9 to +99999999.9	

The numbers from 0 to 7 in front of the characters are registration numbers.

9

[Setting procedure]



[Output error]

An error will be output if there are too many digits as well as if there is an attempt to divide by zero.

[Order of calculation]

The calculation results are produced in order, from N00 to N15.

[Parallel output based on the output conditions]

It is possible to use the parallel output for the evaluation results from the calculations by selecting the PC function in the output conditions (the general output conditions are taken from the output conditions set for each measurement program)

[Types and number of styles of entered for each measurement program]

Input types	Measurement functions			
	Positional deviation measurement	Degree of match inspection for shape and size	Distance and angle measurement	Lead inspection
Degree of match	Model 0: 0M0 to 7M0 Model 1: 0M1 to 7M1	Model 0 (positioning): 0M0 to 15M0 Model 1 (object measurement): 0M0 to 15M1	[Starting point] 00M to 15M	0M to 3M
Coordinate X	Model 0: 0X0 to 7X0 Model 1: 0X1 to 7X1	Model 0 (positioning): 0X0 to 15X0 Model 1 (object measurement): 0X0 to 15X1	[Starting point] 00X to 15X	0X to 3X
Coordinate Y	Model 0: 0Y0 to 7Y0 Model 1: 0Y1 to 7Y1	Model 0 (positioning): 0Y0 to 15Y0 Model 1 (object measurement): 0Y0 to 15Y1	[Starting point] 00Y to 15Y	0Y to 3Y
Coordinate deviation x	Model 0: 0x0 to 7x0 Model 1: 0x1 to 7x1			
Coordinate deviation y	Model 0: 0y0 to 7y0 Model 1: 0y1 to 7y1			
Angular deviation B	0B to 7B		00B to 15B	
Light level G		Model 0 (positioning): 0G0 to 15G0 Model 1 (object measurement): 0G0 to 15G1		
Auxiliary points HX			00HX to 15HX	
Auxiliary points HY			00HY to 15HY	
Number of objects K				0K0 to 0K7 …3K0 to 3K7
Distance D			00D to 15D	
Maximum distance MXD				0MXD0 to 0MXD7 …3MXD0 to 3MXD7
Minimum distance MND				0MND0 to 0MND7 …3MND0 to 3MND7
Maximum lead length MXL				0MXL0 to 0MXL7 …3MXL0 to 3MXL7
Minimum lead length MNL				0MNL0 to 0MNL7 …3MNL0 to 3MNL7
Numerical calculation N	N00 to N15	N00 to N15	N00 to N15	N00 to N15

Input types	Measurement functions		
	Area measurement by binary conversion	Counting quantities by binary conversion	Label measurement by binary conversion
Total area A	00A to 15A	0A to 3A	0A to 3A
Number of objects K		0K to 3K	0K to 3K
Area with each labeling R			0R000 to 0R127…3R000 to 3R127
Center of gravity with each labeling GX			0GX000 to 0GX127…3GX000 to 3GX127
Center of gravity with each labeling GY			0GY000 to 0GY127…3GY000 to 3GY127
Main axis angle B with each labeling			0GB000 to 0GB127…3GB000 to 3GB127
Fellet diameter with each labeling FX			0FX000 to 0FX127…3FX000 to 3FX127
Fellet diameter with each labeling FY			0FY000 to 0FY127…3FY000 to 3FY127
Circumference with each labeling CR			0CR000 to 0CR127…3CR000 to 3CR127
Numerical calculations N	N00 to N15	N00 to N15	N00 to N15

(2) Final numerical calculations

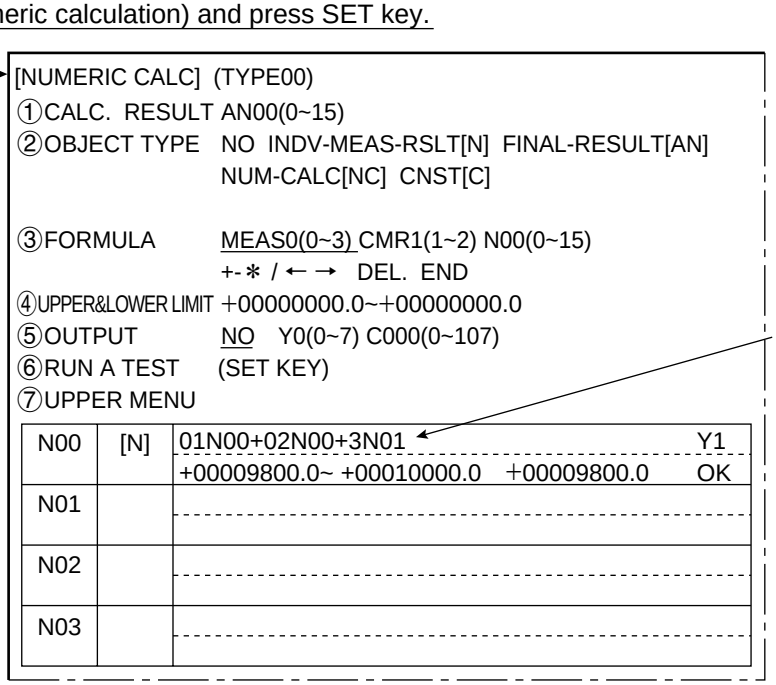
Final numerical calculations can be set at item ⑬ FINAL CALC RESULT on the conditions of object types menu [OBJECT TYPE COND].

The setting procedure, error output settings, calculation sequence and parallel output based on the output conditions are exactly the same as those used for item (1) individual numerical calculations for each measuring programs.

On the MAIN OPS MENU, move the cursor to SET-SCRN and press the SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to ②OBJECT TYPE COND (conditions of object type) and press the SET key.

⇨On the [OBJECT TYPE COND] menu, move the cursor to ⑬FINAL CALC RESULT (final numeric calculation) and press SET key.



Example:
[Results of the calculations for measurement 0, camera 1: N00] + [Results of the calculations for measurement 0, camera 2: N00] + [Results of the calculations for measurement 3: N01]

· The display areas on the screen are in the same places as those for item (1) individual numerical calculations for each measuring program.

Numerical calculation	Setting details
① CALC.RESULT	The location where the rule 4 calculation result of the specified output data is stored may be set from 00 to 15.
② OBJECT TYPE	Select the type of data being calculated.
③ FORMULA (registaration number)	A number of style settings are used. The first line will change according to the selection made in item ②. **Selection of ② / The first line of the display** Calculation results for measurements [N] / Measurement 0 (0 to 3) camera 1 (1 to 2) N00 (0 to 15) Final calculation results [AN] / AN00 (0 to 15) Numerical calculations [NC] / ABS √ TAN ATAN AN00 (0 to 15) (the second line will not be displayed) Constant [C] / +00000000.0 (the second line will not be displayed) Note: Please use a smaller number for entering numbers at AN (00 to 15) than that ① CALC. RESULT (calculations results) AN (00 to 15).
④ UPPER&LOWER LIMIT	Enter the upper and lower limits for making a decision.
⑤ OUTPUT	Setting the output of the calculation results.
⑥ RUN A TEST	Pressing the SET key will record the setting details as well as run a test.
⑦ UPPER MENU	This will return you to the [OBJECT TYPE COND] (conditions of object type)

- Based on the settings at items ② and ③, the number of styles may be entered as follows.

②OBJECT TYPE	Number of styles
INDV-MEAS-RSLT [N] (Results of the calculations for measurements)	01N00 to 01N15 (Calculation result for measurement 0, camera 1: N00 to 15) 02N00 to 02N15 (Calculation result for measurement 0, camera 2: N00 to 15) 1N00 to 1N15 (Calculation result for measurement 1: N00 to 15) 2N00 to 2N15 (Calculation result for measurement 2: N00 to 15) 3N00 to 3N15 (Calculation result for measurement 3: N00 to 15)
FINAL-RESULT [AN] (Results of final calculations)	AN00 to AN15
NUM-CALC [NC] (Numerical calculations)	ABS / √ / TAN / ATAN (00 to 15)
CNST [C] (Constant)	-99999999.9 to +99999999.9

[5] Position correction

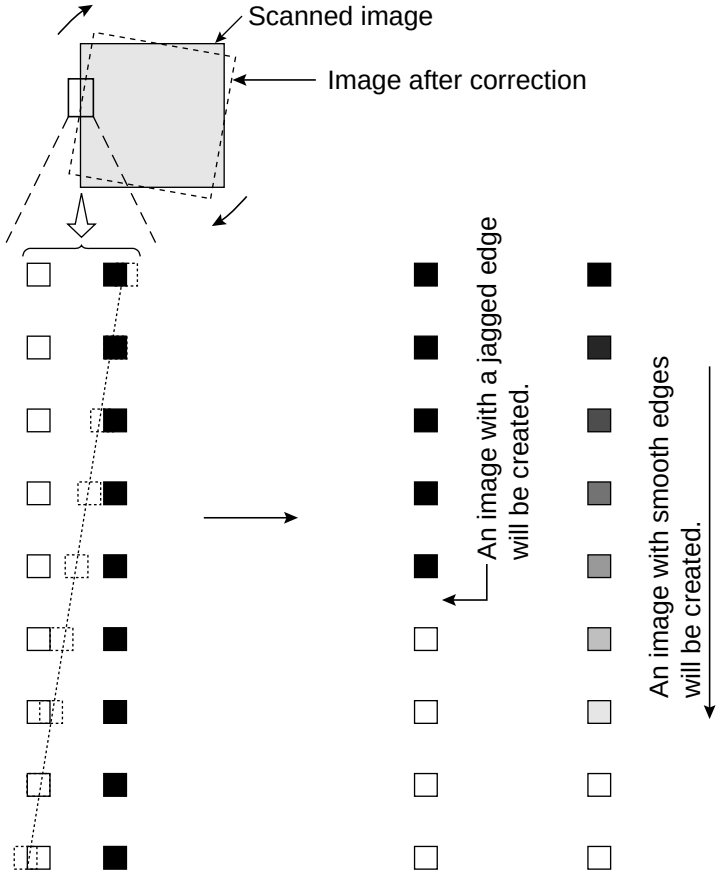
Based on the positional deviation data measurement 0 (positional deviation measurement), the correction of the image coordinates is dealt with using measurements 1 to 3.

(1) Correction details

The types of position correction available are: XY correction, angular correction (standard) and angular correction (high precision)

Type	Details
XY correction	The position is adjusted according to the amount of deviation in X and Y at the first point (model 0) detected in measurement 0. There are three correction directions: X axis correction, Y axis correction and X and Y axis correction. · X axis correction--Adjusted misalignment in the X axis · Y axis correction--Adjusted misalignment in the Y axis · X and Y axes correction--Adjusted misalignment in both the X and Y axes
Angular correction (standard)	The position is adjusted because of a detected angular deviation in rotation [2-point search/2-point edge/1-point search + 1-point edge] from measurement 0.
Angular correction (high precision)	The position is adjusted because of a detected angular deviation in rotation [2-point search/2-point edge/1-point search + 1-point edge] from measurement 0. The high precision angular correction settings allows the IV-S20 to display a very precisely corrected image. But, this selection lowers rotation processing speed.

[Example of a comparison between standard and high precision angular correction]

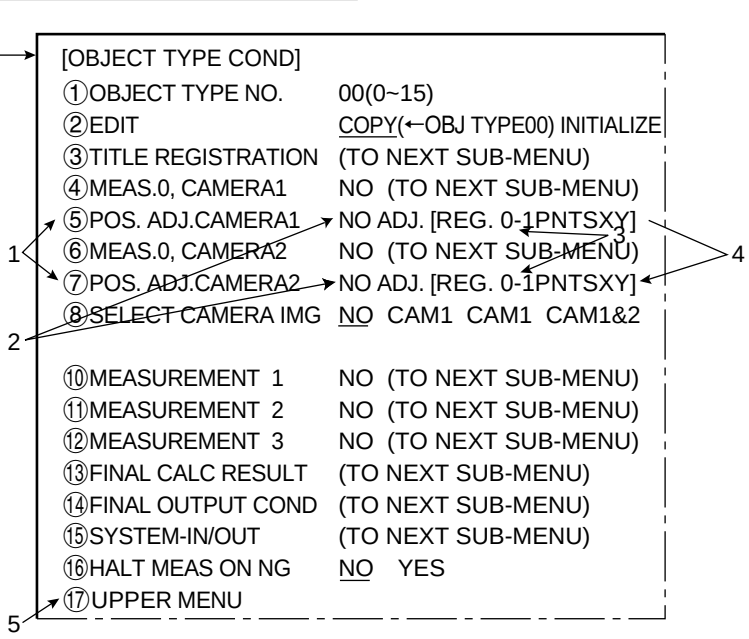


(2) Operation setting details

Setting takes place at camera (1/2) in items ⑤ and ⑥ on the [OBJECT TYPE COND] (conditions of object type) menu.

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.



[Setting procedure]

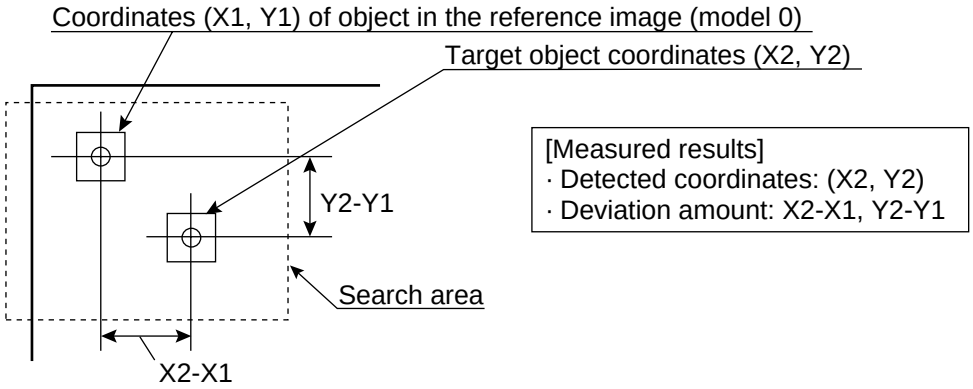
1. Select item ⑤ POS. ADJ. CAMERA 1 for camera 1, or item ⑦ POS. ADJ. CAMERA 2 for camera 2, using the up and down keys.
2. Move the cursor to [NO ADJ.] (no adjustment) using the left and right keys. Then select either X and Y correction, angular correction (standard) or angular correction (high precision), using the up and down keys.
3. Move the cursor to [REG. 0] (register 0) using the left and right keys and then select [0 to 7] using the up and down keys.
   - Registration No. 0 to 7 correspond to register No.0 to 7 [MEASURING COND] (measurement condition) menu in positional deviation measurement.
4. In the case of an X and Y correction, move the cursor to 1PNTSXY (first X and Y point) using the left and right keys and then select XY or X or Y using the up and down keys.
   - In the case of angular correction, it is unnecessary to perform step 4.
5. Press the SET key. Move the cursor to item ⑰ UPPER MENU and press the SET key.

This completes the settings for positional correction.

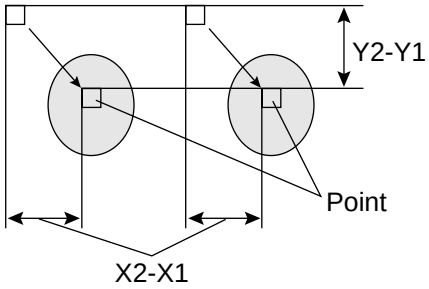
(3) Correction example

[Example of correcting the first X and Y point]

1. Amount of correction (X2-X1, Y2-Y1) specified by measurement 0 (positional deviation measurement)



2. Measuring a point using measurement 1

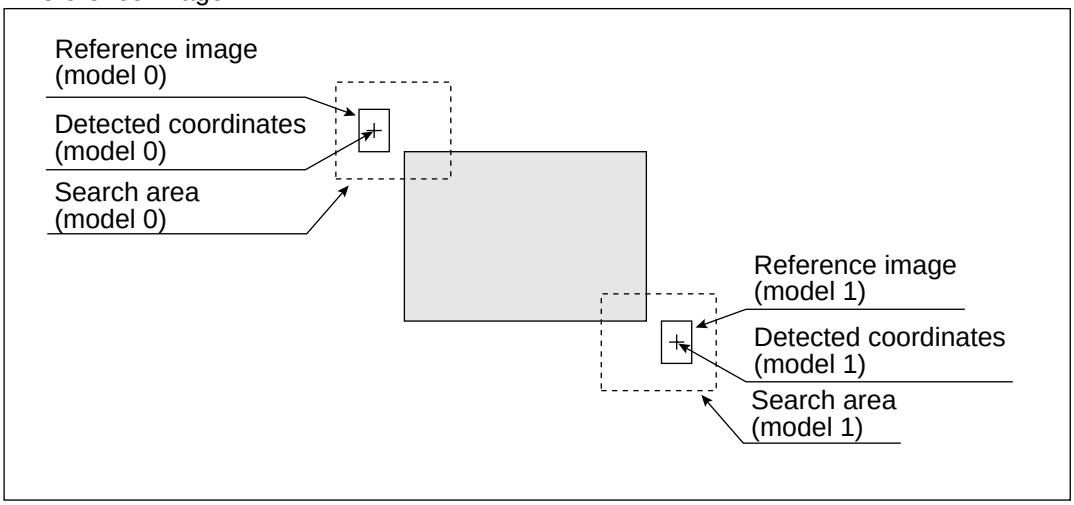


- If the first point is X, only the X position will be corrected. Likewise, if the first point is Y, only the Y position will be corrected.

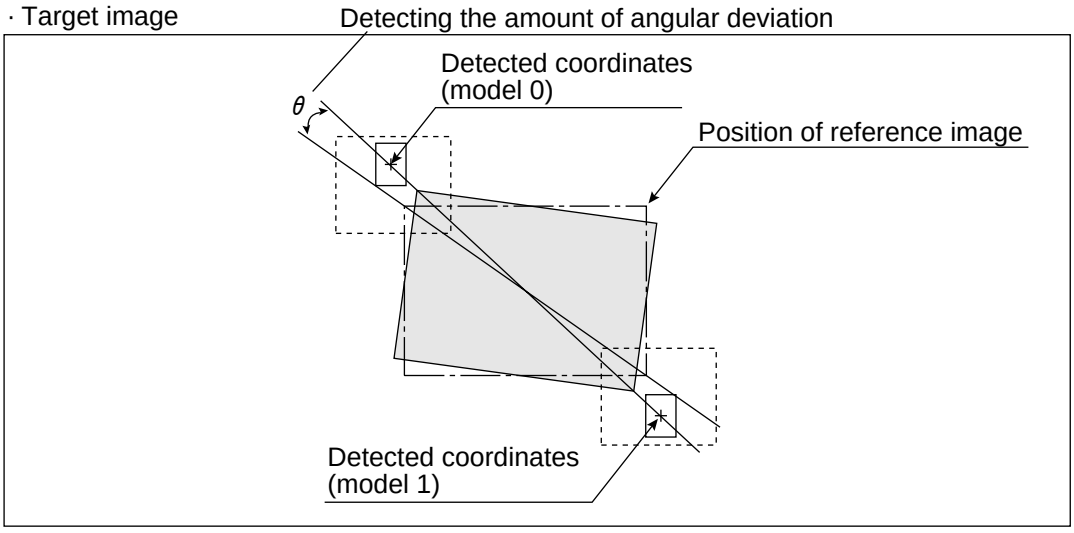
[Example of angular correction]

1. Detection of the amount of angular deviation (using measurement 0, 2 point search (positional deviation measurement).

· Reference image

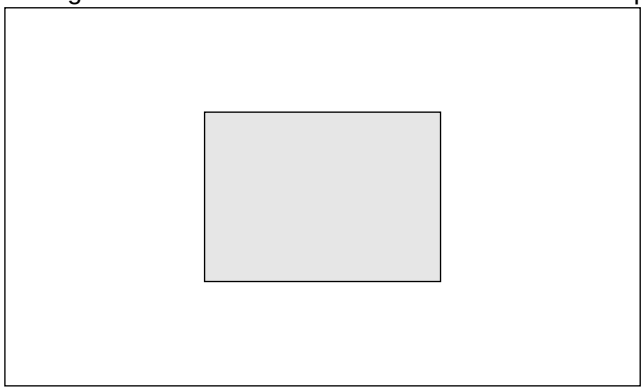


· Target image



2. Performing measurement 1 (of distance and angle measurement) on an image that has been rotated around its center by the amount of angular diviation detected in step 1.

· Image that has been rotated around its center in step 1



[6] Comparative calculations between images

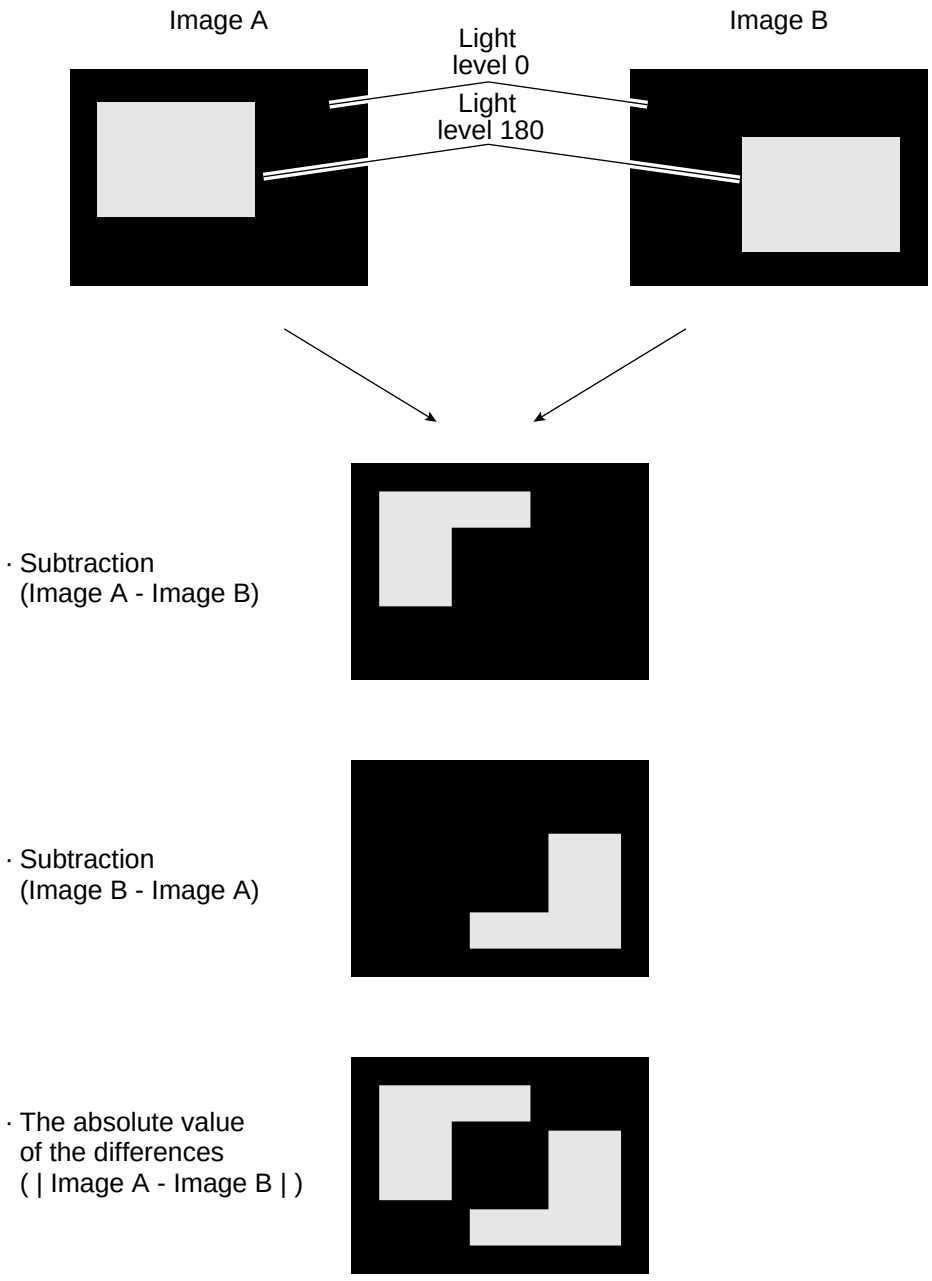
It is possible to run calculations on the differences between the images taken by camera 1 and camera 2, as well as on the differences between the current image and the already stored reference image.

(1) Type of calculation

There are two types of calculation: subtraction and the absolute value of the differences.

Subtraction	Light level in image 1 (0 to 255) - Light level in image 2 (0 to 255) ⇨ Light level after calculation However, a result less than 0 will give a result of 0.
The absolute value of the differences	| Light level in image 1 (0 to 255) - Light level in image 2 (0 to 255) | ⇨ Light level after calculation (0 to 255)

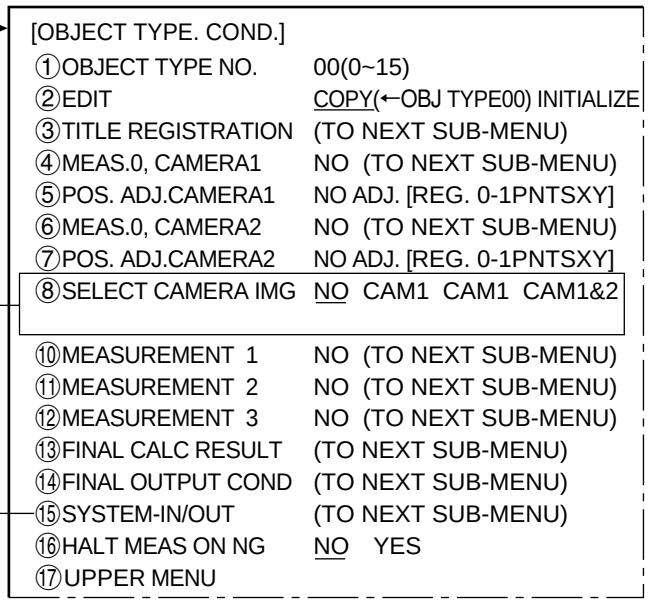
[Example of comparative calculations between images]



(2) Setting details

On the MAIN OPS MENU, move the curson to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE CND (conditions of object type) and press the SET key.



At item ⑧ SELECT CAMERA IMG (camera selection), select the NO, CAM1, CAM2, or CAM1&2 with left and right keys and press the SET key. When you have specified the camera, item ⑨ COMPARE IMAGES, will be displayed.

・The display seen when ⑧ is set to CAM1

⑧SELECT CAMERA IMG NO CAM1 CAM1 CAM1&2
⑨COMPARE IMAGES NO SUB.I1−T1 DIFF.ABS |I1−T1|

When ⑧ is set, otherwise ⑨ will be displayed as shown below in column ⑨.

The list of the settings which may be selected at item ⑨ COMPARE IMAGES, (comparative calculations between images) is as follows.

⑧ SELECT CAMERA IMG	⑨ COMPARE IMAGES (calculation between images)	Contents
NO (none)	————	Comparative calculations of differences between images will not be carried out.
CAM 1 (camera 1)	None	Comparative calculations of differences between images will not be carried out.
	Subtraction I1-T1	The reference image T1 (* 1) is subtracted from the image taken by camera 1.
	The absolute value of the difference between |I1-T1|	The absolute value of the difference is calculated between the reference image T1 (* 1) and the image taken by camera 1.
CAM 2 (camera 2)	None	Comparative calculations of differences between images will not be carried out.
	Subtraction I2-T2	The reference image T2 (* 1) is subtracted from the image taken by camera 2.
	The absolute value of the difference between |I2-T2|	The absolute value of the difference is calculated between the reference image T2 (* 1) and the image taken by camera 2.
CAM 1&2 (cameras 1 & 2)	Subtraction I1-I2	The image taken by camera 1 is subtracted from the image taken by camera 2.
	Subtraction I2-I1	The image taken by camera 2 is subtracted from the image taken by camera 1.
	The absolute value of the difference between |I2-I2|	The absolute value of the difference is calculated between the image taken by camera 1 and the image taken by camera 2.

* 1 The reference images T1 and T2 may be set in item ⑦ STZORE REF IMAGE (reference images for comparison between images), which can be found on the [OBJECT TYPE I/O] menu. (see the next page)

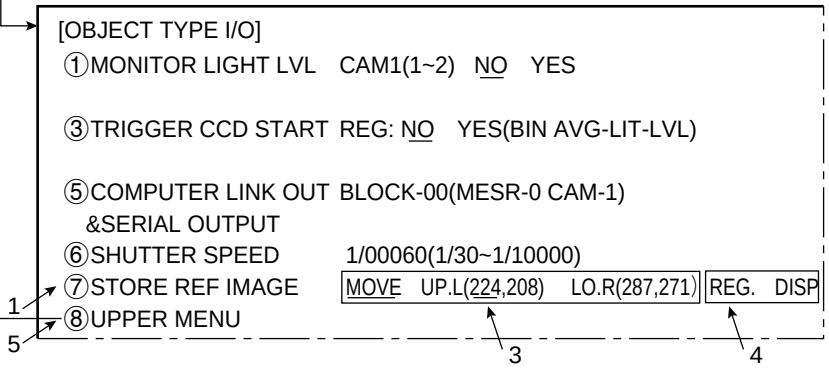
* 2 The size of the areas covered by I1 and I2 (the images taken by cameras 1 and 2) may be set in item ⑦ SET IMAGE WINDOWS (setting areas for comparison between images) which can be found in the [OBJECT TYPE I/O] menu. (see the next page)

Continued on the following page

From the previous page

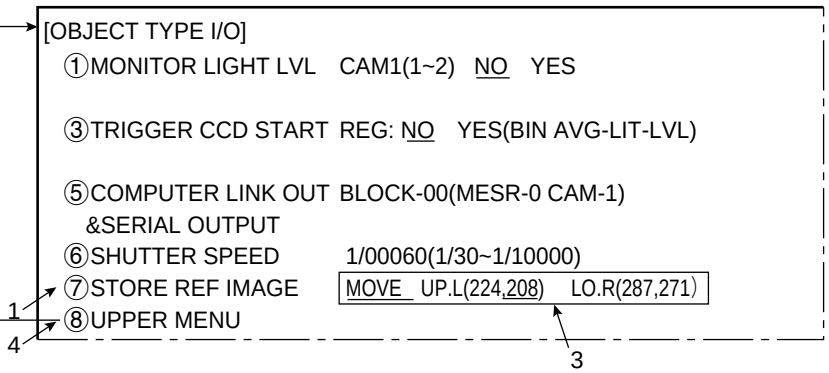
After selecting item ⑮ SYSTEM-IN/OUT, on the [OBJECT TYPE COND] (conditions of object type) menu.

When the selected camera is either CAM1 or CAM2



1. Use the up and down keys to set item ⑦ STORE REF IMAGE, (reference images for comparison between images) for comparison between images.
2. Display an image by pressing the SEL key. Then focus the lens and adjust the camera's iris to adjust the image.
   - After adjusting the image, press the SEL key to freeze the frame.
3. Creating the window for the reference image.
   - Select one of the following: MOVE, UP.L, or LO.R. Then adjust the window to suit your needs.
     Decide on the position of the window for the reference image before every operation and then press the SET key.
4. When the position of the image window has been defined, record the selection by using the left and right keys to go to REG. (register). Then press SET key.
   - Using the left and right keys, go to DISP (display) and then press SET to display the image in the bottom right hand corner of the screen. When you have finished checking your selection, press the ESC key to exit.
5. After pressing the ESC key, move the cursor to item ⑧ UPPER MENU with up and down keys, and press the SET key.
   ⇨ This will return you to the [OBJECT TYPE COND] (conditions of object type) menu.

When the selected camera is CAM 1&2

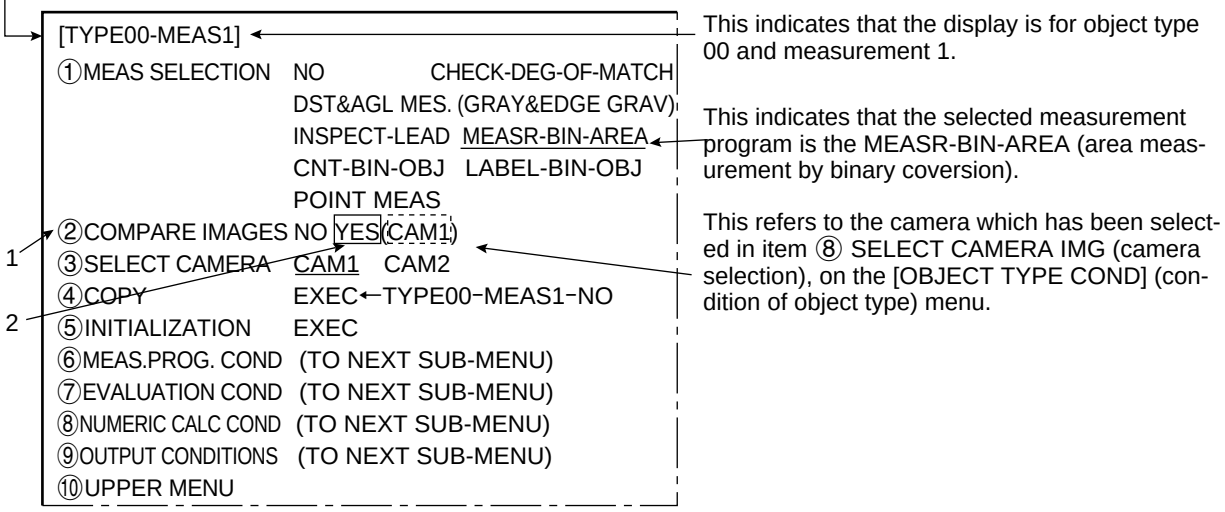


1. Use the up and down keys to set item ⑦ SET IMAGE WINDOWS (area setting) for comparison between images.
2. Display an image by pressing the SEL key. Then focus the lens and adjust the camera's iris to adjust the image.
3. Select the area of the image to be used.
   - Select one of the following: MOVE/UP.L/LO.R and then define the area.
     Define the position of the window to be used with the reference image and then press the SET key.
4. Press the ESC key, move the cursor to item ⑧ UPPER MENU with up and down keys, and press the SET key.
   ⇨ This will return you to the [OBJECT TYPE COND] (conditions of object type) menu.

Continued on the following page

From the previous page

Select item ⑩ MEASUREMENT 1, ⑪ MEASUREMENT 2 or ⑫ MEASUREMENT 3, on the [OBJECT TYPE COND] (conditions of object type) menu.



1. Using the up and down keys, select item ② COMPARE IMAGES (calculation between images).
2. Select "YES" (enable calculation) using the left and right keys.
   ⇨This will display the results of the comparative calculations between images.
   Then, item ③ SELECT CAMERA will disappear.

With this the settings concerning comparative calculations between images are complete.

9

[7] Copying (editing)

When there are many common parameters between measurement programs or object types, it is most efficient to access those existing sets of parameters in order to copy and then modify them.

- There are two types of copy functions on the IV-S20: Copying between object types and copying between measurement programs.

(1) Copying between object types

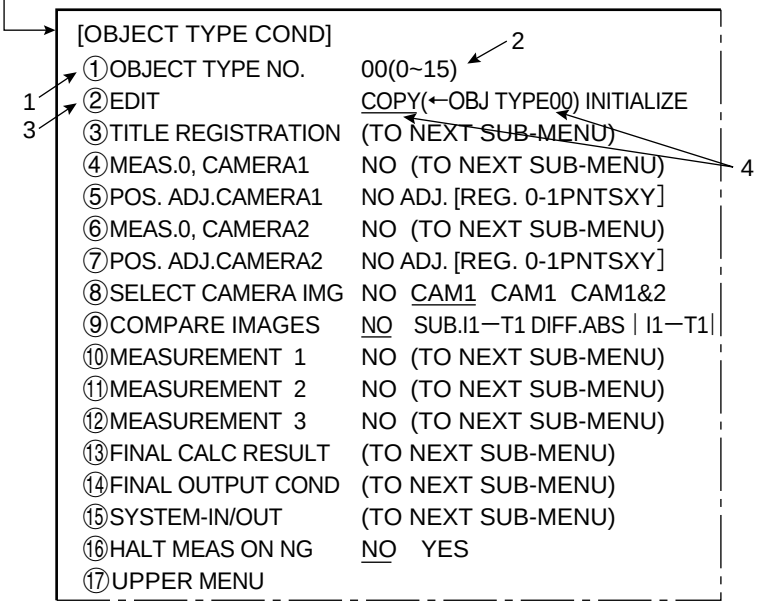
The parameters of a previously specified object type are copied into another object type, after which they can be modified.

The source of the copy		The target of the copy
The measurement conditions of the source object type. (The data is copied from flash memory)	⇨	The measurement conditions of the target object type. (The data is used to simplify setting the target object's parameters)

[Operation procedure]

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (condition of object type) and press the SET key.



· Item ⑨ COMPARE IMAGES (calculation between images) will be displayed unless item ⑧ SELECT CAMERA IMG is set to NO.

1. Select item ① OBJECT TYPE NO., using the up and down keys and press SET key.
2. Using the up and down keys, enter the object type number (00 to 15) for the target of the copy.
3. Select item ② EDIT, using the up and down keys and press SET key.
4. Move the cursor to COPY (copying) using the left and right keys and enter the object type number (00 to 15) for the source of the copy using the up and down keys. When the number has been selected, press SET key.
   - While something is being copied, the message [COPYING] will appear at the top of the screen. This message will disappear when the copying is complete.

Notes

- Do not disconnect the power while the IV-S20 is copying.
- Once data has been corrupted it will be necessary to start after initializing the setting, all over again. Unless this is done it will not be possible to restart the machine.
- The reference images used for the gray scale seach function are not copied with the operation above. Make sure reset them.

(2) Copying between measurement programs

Copying a specific measuring program's settings from on object type number to another.

The source of the copy		The target of the copy
The specific measuring program settings stored in a particular object type number. (The data is copied from flash memory)	⇨	The settings for the same measuring program in a different object type number. (The data is used to simplify setting the target object's parameters)

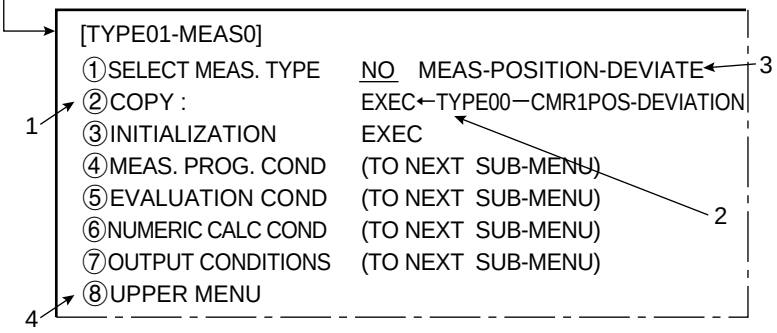
[The procedure for copying measurement program 0]

- Example: Copying the (object type number 00, measurement 0, program settings: for positional deviation measurements) into the settings for (object type number 01, measurement 0, program setting no).

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and pess the SET key.

⇨ On the [OBJECT TYPE COND] (conditions for object type) menu, set item ① OBJECT TYPE NO. (object type number) to 01 and select item ④ MEAS.0, CAMERA1.



1. Select item ② COPY using the up and down keys and press SET key.
2. Enter the object type number (00 to 15) for the source copy using the up and down keys. The name of the measurement program for this object type number will also be displayed. When the number has been entered, press the SET key.
3. Once the measurement program has been copied, the underlined entry at item ① SELECT MEAS.TYPE (select measurement) will now be MEAS-POSITION-DEVIATE (positional deviation measurement) whereas NO was previously underlined.
4. Move the cursor to item ⑧ UPPER MENU, and press SET key twice.
   ⇨ This will return you to the [OBJECT TYPE COND] menu.

Note

- When processing item ② COPY, by itself, the IV-S20 will not copy to the flash memory. To save the copied settings in flash memory go to item ⑨ SAVE IN FLASH MEM, or item ⑩ OPERATIONS, which are both found on the [SYSTEM SETUP] menu.

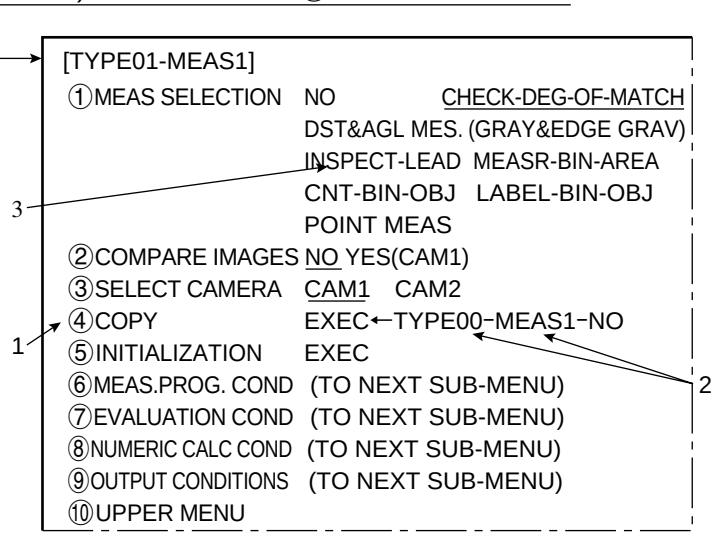
[The procedure for copying measurement programs 1 to 3]

- Example: Copying the settings from object type 00, measurement 2 (lead inspection), into object type 01, measurement 1 (degree of match inspection).

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.

⇨ On the [OBJECT TYPE COND] menu, set item ① OBJECT TYPE NO. (object type number) to 01 and select ⑩ MEASUREMENT 1.



1. Select item ④ COPY, using the up and down keys and press SET.
2. Select TYPE00 or MEAS1 with the left and right keys. Next enter the object type number (00 to 15) and the measurement program number 1 to 3 for the source of the copy, using the up and down keys (the name of the measurement program for the source of the copy will also be displayed). When the numbers have been entered, press the SET key.
   - It is possible to copy a new measurement program choice to the same object type number (i.e. specify another measurement program during the copying process). The target object type number will be the same as originally specified. The only change is the target measurement program number where the copy will be placed.
3. Once the measurement program has been copied, INSPECT-LEAD (lead inspection) will now be underlined, whereas CHECK-DEG-OF-MATCH (degree of match inspection) is previously the underlined entry at item ①.
4. Move the cursor to item ⑧ UPPER MENU, and press SET key.
   ⇨ This will return you to the [OBJECT TYPE COND] (conditions of object type) menu.

Note

- When processing item ④ COPY, by itself, the IV-S20 will not copy to the flash memory. To save the copied settings in flash memory go to item ⑨ SAVE IN FLASH MEM, or item ⑩ OPERATIONS, which are both found on the [SYSTEM SETUP] menu.

[8] Editing after initialization

When you first start to set all of the parameters, we recommend that you initialize the conditions first. The contents required to initialize are as follows.

- All of the conditions ——————————— ⇨ See 12-1 [3] Total initialization
- Measurement conditions of each measurement program ⇨ (1)
- Measurement conditions of each type number ——————— ⇨ (2)

(1) Initialize measurement conditions for each measurememt program number

The IV-S20 will always start up with the measuring program for an object type which has been specified and stored in the memory (RAM). If the measurement 0 program was specified, then a camera number will also have been specified.

- Any measurement conditions stored in flash memory will remain as they were before initialization.

[Operation procedure for measurement program 0]

- This example shows the initialization of object type 01, measurement 0, camera 1: measurement of positional deviation.

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.

⇨ On the conditions for object types menu [OBJECT TYPE COND], set item ①OBJECT TYPE NO. (object type number) to 01 and select item ④ MEAS.0, CAMERA 1

```
[TYPE00-MEAS0]
①SELECT MEAS. TYPE    NO  MEAS-POSITION-DEVIATE
②COPY :               EXEC←TYPE00−CMR1POS-DEVIATION
③INITIALIZATION       EXEC
④MEAS. PROG. COND     (TO NEXT  SUB-MENU)
⑤EVALUATION COND      (TO NEXT  SUB-MENU)
⑥NUMERIC CALC COND    (TO NEXT  SUB-MENU)
⑦OUTPUT CONDITIONS    (TO NEXT  SUB-MENU)
⑧UPPER MENU
```

1

1. Select item ③ INITIALIZATION, using the up and down keys and press the SET key.
2. When the SET key is pressed, the initialization will begin.

[Operation procedure for measurement programs 1 to 3]

- This is an example of the initialization of object type 02, measurement 1.

On the MAIN OPS MENU, move the cursor to SET-SCRN, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND and press the SET key.

⇨ On the [OBJECT TYPE COND] (conditions for object type) menu, set item ① OBJECT TYPE NO. to 02 and select ⑩ MEASUREMENT 1.

```
[TYPE00-MEAS1]
①MEAS SELECTION   NO          CHECK-DEG-OF-MATCH
                  DST&AGL MES. (GRAY&EDGE GRAV)
                  INSPECT-LEAD  MEASR-BIN-AREA
                  CNT-BIN-OBJ   LABEL-BIN-OBJ
                  POINT MEAS
②COMPARE IMAGES   NO YES(CAM1)
③SELECT CAMERA    CAM1  CAM2
④COPY             EXEC←TYPE00−MEAS1−NO
⑤INITIALIZATION   EXEC
⑥MEAS.PROG. COND  (TO NEXT SUB-MENU)
⑦EVALUATION COND  (TO NEXT SUB-MENU)
⑧NUMERIC CALC COND (TO NEXT SUB-MENU)
⑨OUTPUT CONDITIONS (TO NEXT SUB-MENU)
⑩UPPER MENU
```

1

1. Select item ⑤ INITIALIZATION (initialize), using the up and down keys and press SET key.
2. When the SET key is pressed, the initialization will begin.

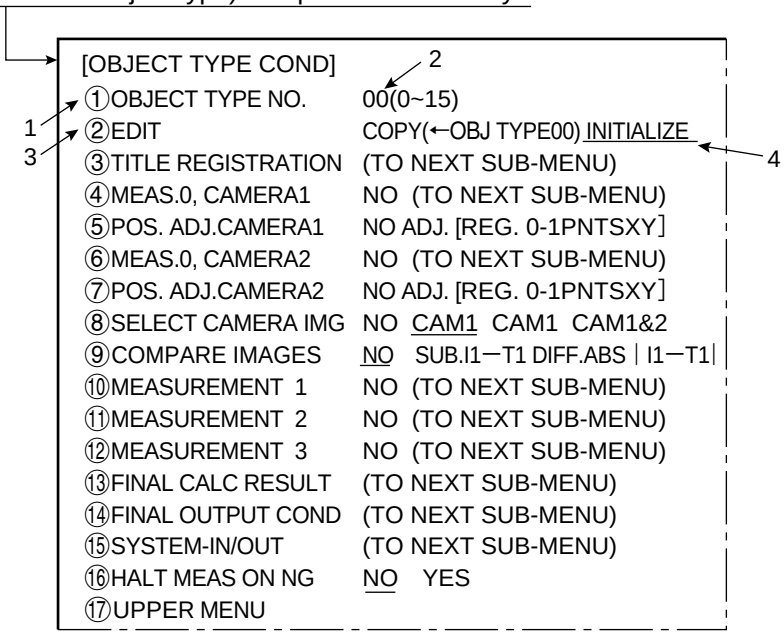
(2) Initialize measurement condition of each type

The measurement conditions for a specified object type (data for the object type you are in the process of entering) will be initialized.

[Operation procedure]

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (condition of object type) and press the SET key.



· Item ⑨ COMPARE IMAGES, will be displayed unless item ⑧ SELECT CAMERA IMG, is set to NO.

1. Select item ① OBJECT TYPE NO. (object type number) using the up and down keys and press SET key.
2. Select the object type number (00 to 15) to be initialized using the up and down keys.
3. Select item ② EDIT, using the up and down keys and press SET key.
4. Select EXEC.INIT (start initialization) using the up and down keys and press SET key.
   ⇨ While the initialization is in progress, the message "Initialization of data is in progress" will appear at the top of the screen. When the initialization is complete, this message will disappear.

Note

- Do not disconnect the power while IV-S20 is initializing.
  The set data other than currently initializing may be corrupted. Unless all of the data is initialized it will not be possible to restart the machine (i.e. partial initialization is not possible).

[9] Title registration

A title for a object type number can be entered and saved when the object type number is displayed on the screen.

[Purpose]

The title is used to make it easier to control the details of the settings for the object type.

[Title characters]

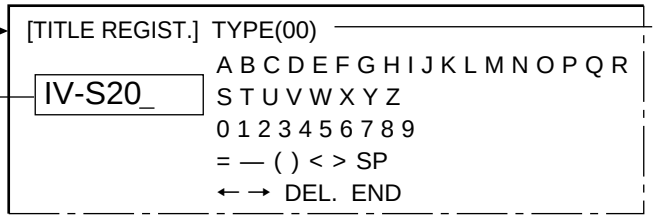
A maximum of 16 letters and symbols may be entered.

[Operation method]

On the MAIN OPS MENU, move the cursor to SET-SCRN, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.

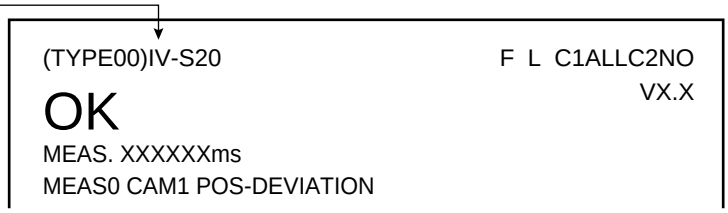
⇨ [OBJECT TYPE COND] menu, move the cursor to ③ TITLE REGISTRATION and press the SET key.



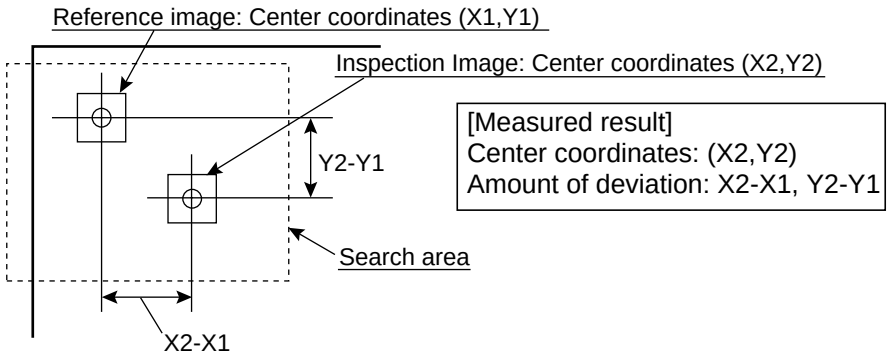
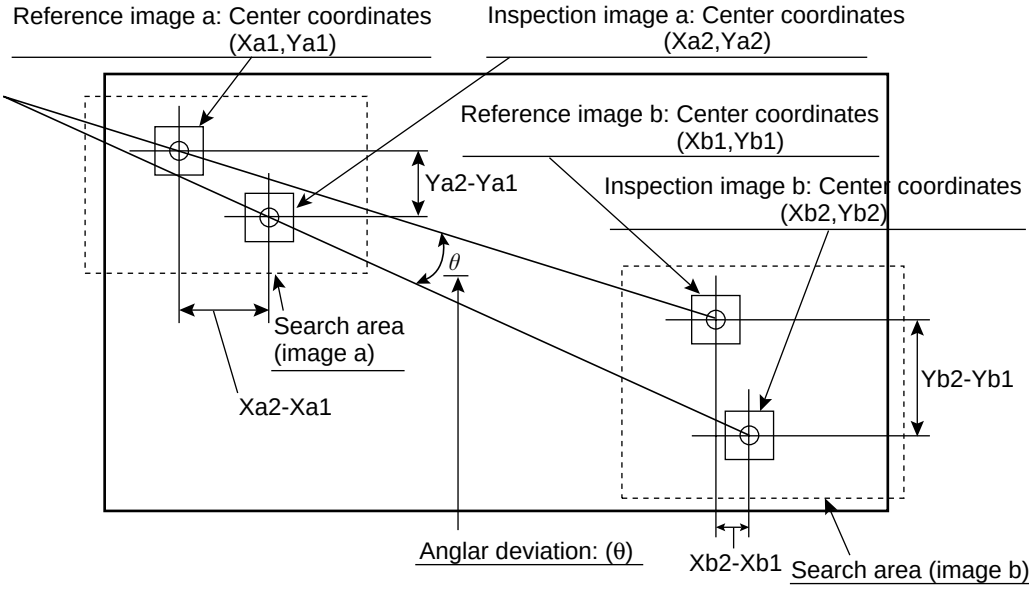
Indicates that object type 00 is selected set.

TITLE REGIST. TYPE	Setting details
A to Z	These characters and symbols are used to enter the title name.
0 to 9	
= to >	
SP (space bar)	This is used to make spaces
← →	These are used to move the cursor
DEL. (delete)	This is used to delete the character to the right of the cursor
END	This key is used to return to the [TYPE.COND.] (conditions of object type) menu.

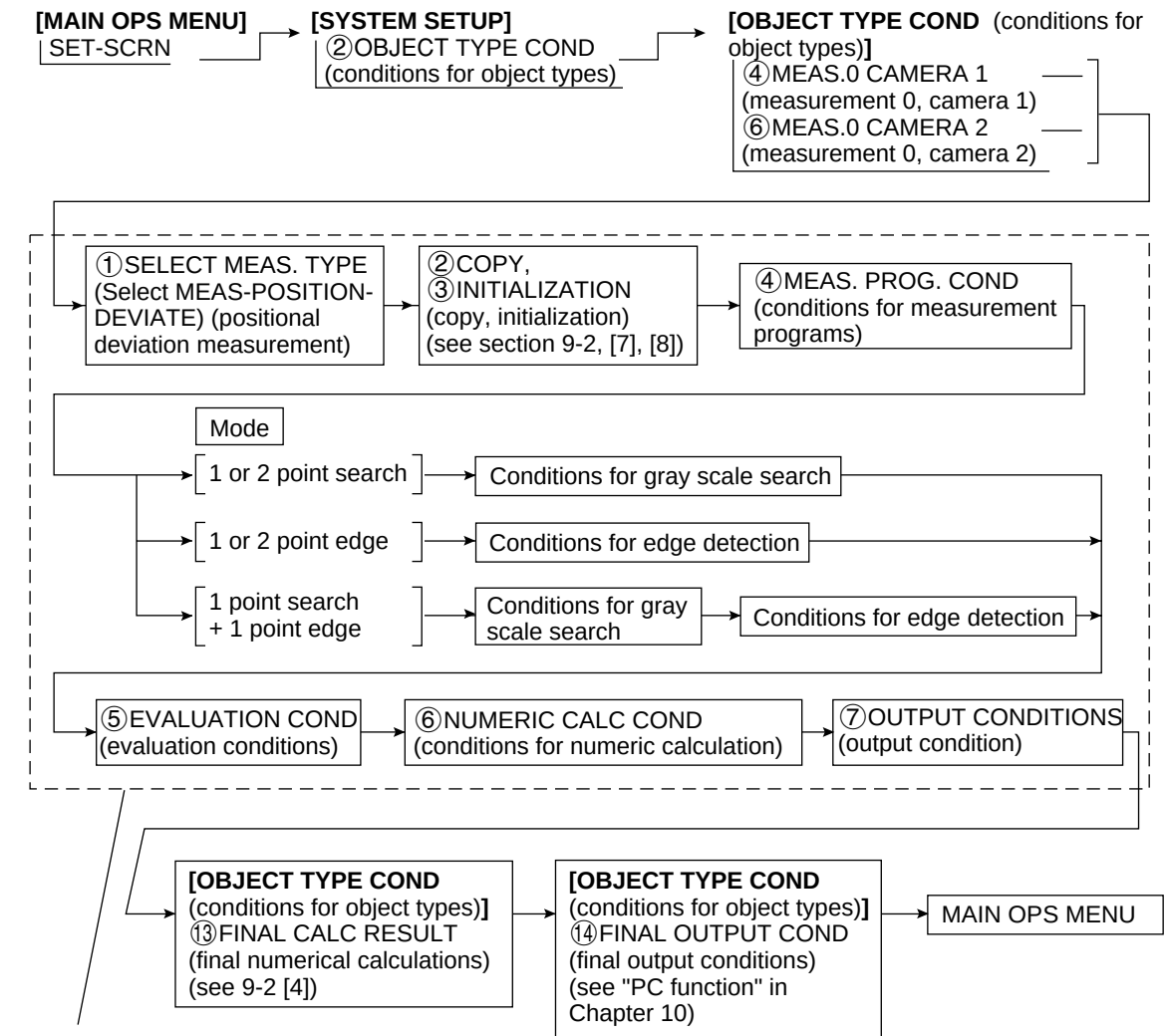
The title that has been entered will be displayed in the top left corner of the run menu screen.



9-3 Positional deviation and absolute position measurement

Purpose	The gray scale search function makes it possible to measure positional deviation as well as the absolute position. · It is also possible to detect the position of sub-pixel units with great accuracy.
Application	Used to determine the position of machine parts and substrates.
Example	[Determining the location of the positioning (the fiducial mark) mark that identifies the position of the substrate] **(1) 1 point search: Detecting the deviation in position in X and Y directions**  **(2) 2 point search: Determining positional deviation in X and Y directions as well as rotational deviation**  [Measured result] · Center coordinates of image a: (Xa2,Ya2) · Amount of deviation of image a: Xa2-Xa1, Ya2-Ya1 · Center coordinates of image b: (Xb2,Yb2) · Amount of deviation of image b: Xb2-Xb1, Yb2-Yb1 · Deviation angle: (θ) · The deviation angle (θ), determined in the 2 point search, is used to readjust the rotation of the image for measurements 1 to 3. For details about rotational adjustments, see section 9-2, item [5] Position correction.

[1] Setting sequence



9

[2] Setting details

An explanation of item ④ MEAS. PROG. COND (conditions for measurement programs) from the TYPE00-MEAS0 (object type - measurement 0) menu.

On the MAIN OPS MENU item, move the cursor to SET-SCRN item, and press the SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND and press the SET key.

⇨Select item ④ MEAS.0, CAMERA 1 (measurement 0, camera 1), or ⑥ MEAS.0, CAMERA 2 (measurement 0, camera 2), on the [OBJECT TYPE COND] (conditions for object types) menu.

```
[TYPE00-MEAS0]                                  ← Indicates that the object type 00 is selected.
①SELECT MEAS. TYPE     NO  MEAS-POSITION-DEVIATE
②COPY :                EXEC←TYPE00−CMR1DIFF.MESURE.
③INITIALIZATION        EXEC
④MEAS. PROG. COND      (TO NEXT SUB-MENU)
⑤EVALUATION COND       (TO NEXT SUB-MENU)
⑥NUMERIC CALC COND     (TO NEXT SUB-MENU)
⑦OUTPUT CONDITIONS     (TO NEXT SUB-MENU)
⑧UPPER MENU
```

· Select MEAS-POSITION-DEVIATE (measuring positional deviation) on the ① SELECT MEAS.TYPE line.

Select item ④MEAS. PROG. COND (conditions for measurement program)

```
[MEASURING COND] (TYPE00-MEAS.0-POS-DEVIATION)
①REGST NO.        0(0~7)  REG.NO  YES
②SELECT MODE      1P-SCH  2P-SCH  1P-EDGE
                  2P-EDGE 1P-SCH+1P-EDGE
③GRAY-SCALE COND (TO NEXT SUB-MENU)
④EDGE DETECT COND (TO NEXT SUB-MENU)
⑤UPPER MENU
```

· Items ② SELECT MODE, and ④ EDGE DETECT COND are displayed when item ① REGST NO. is set to YES.

Measurement conditions	Setting details
①REGST NO. (registration number)	First enter the REGST NO. (registration number) from 0 to 7, then chose YES or NO, depending on whether you wish to record that selection.
②SELECT MODE	Select a mode. · Enter a mode for each registration number. When only a gray scale search is being used: 1-point search/ 2-point search When only edge detection is being used: 1-point edge/ 2-point edge When edge detection is being used with a gray scale search: 1-point search + 1-point edge · When using edge detection, try to limit variations in the brightness at the perimeter of the workpieces by manipulating things like the lighting.
③GRAY-SCALE COND (conditions for a gray scale search)	Set the conditions for a gray scale search in the next menu.
④EDGE DETECT COND (condi-tions for edge detection)	Set the conditions for edge detection in the next menu.
⑤UPPER MENU	This will return you to the [TYPE00-MEAS0] (object type - measurement 0) menu.

When you specify a 1P-EDGE (1 point edge) or a 2P-EDGE (2 point edge) in item ② SELECT MODE, be sure to select item ④ EDGE DETECT COND (edge detection conditions).

Go to page 9·39.

When you specify a 1P-SCH (1-point search), a 2P-SCH (2-point search), or a 1P-SCH+1P-EDGE (1-point search + 1-point edge) in item ② SELECT MODE, be sure to select item select item ③ GRAY-SCALE COND (gray scale search conditions).

Continued on the following page

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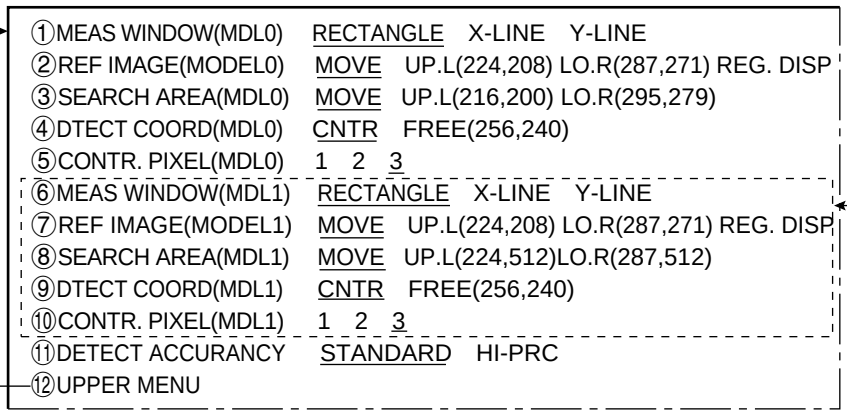
Specify a 1P-SCH (1-point search), a 2P-SCH (2-point search), or a 1P-SCH+1P-EDGE (1-point search + 1-point edge) in item ② SELECT MODE. Then select item ③ GRAY-SCALE COND (gray scale search



These items in the dotted line are only displayed when 2-point search is selected.

· You can switch between displaying all of the headings together and displaying each one separately by using the ESC key.

Menu	Setting details
①MEAS WINDOW(MDL0) (measurement window)	Select the measurement window shape for model 0.
②REF IMAGE(MODEL0) (reference images)	Record a reference image for model 0 · The upper left or lower right area of the screen specified above will change according the setting in item ① MEAS WINDOW(MDL0).
③SEARCH AREA(MDL0) (search area)	Set the search area for model 0.
④DTECT COORD(MDL0) (detection coordinates)	Set the position of the cursor inside the measurement window for model 0. · If FREE is selected, then the position of the cursor is optional.
⑤CONTR. PIXEL(MDL0) (pixel contraction)	Select number of pixel contractions for model 0. ⇨See page 9·6 gray scale processing using shared settings. · When either X-LINE (horizontal line) or Y-LINE (vertical line) are selected in item ① MEAS WINDOW(MDL0), you can select only 1 or 2 in item ⑤.
⑥MEAS WINDOW(MDL1) (measurement window)	Set these items for model 1 just the same way as item ① to ⑤ above.
⑦REF IMAGE(MODEL1) (reference images)	
⑧SEARCH AREA(MDL1)	
⑨DTECT COORD(MDL1) (detection coordinates)	
⑩CONTR. PIXEL(MDL1) (pixel contraction)	
⑪DETECT ACCURACY (accuracy of detection)	Set the level of detection precision for models 0 and 1. ⇨See page 9·6 gray scale processing in shared settings.
⑫UPPER MENU	This will return you to the menu [MEASURING COND] (measurement conditions) menu.

The setting at item ①	The display in the upper left and lower right areas of the screen.
RECTANGLE (rectangle)	Upper left, lower right.
X-LINE (horizontal line)	Starting point, end point
Y-LINE (vertical line)	

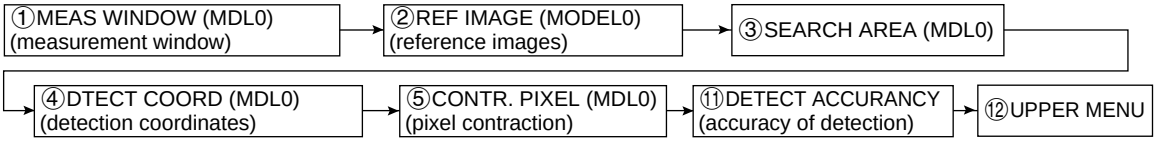
Continued on the following page

Continued from the previous page

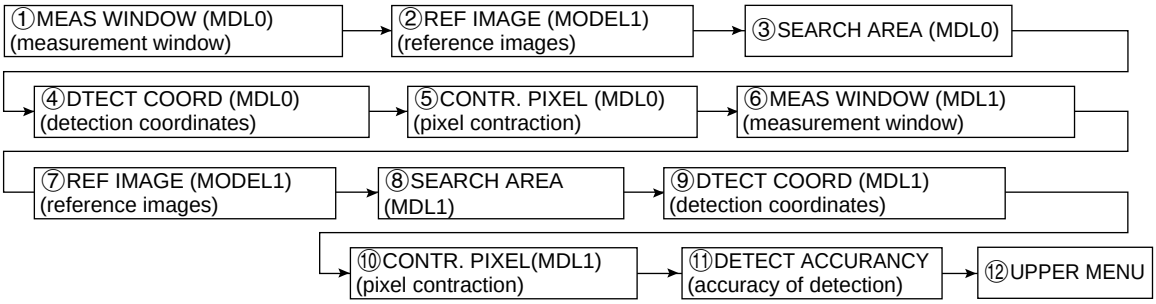
Specify a 1P-SCH (1-point search), a 2P-SCH (2-point search), or a 1P-SCH+1P-EDGE (1-point search + 1-point edge)

[The setting sequence for the gray scale search conditions]

· This is the sequence of events when a 1-point search or a 1-point search + 1-point edge is selected.



· This is the sequence of events when a 2-point search is selected.



[Information about the recording of a reference image]

In order to record a reference image it is necessary to use the freeze frame.
The specifications for the windows are as follows.

· In the case of a rectangular window

	Line type	Movement	Size	Minimum	Maximum
Reference image	Solid line	Units of 4 pixels	Units of 4 pixels	32 x 32 (pixels)	X xY (X x Y=65536 pixels)
Search area	Dotted line	Units of 4 pixels	Units of 4 pixels	32 x 32 (pixels)	512 x 480 pixels

· In the case of a horizontal line

	Line type	Movement	Length	Minimum length	Maximum length
Reference image	Solid line	In a horizontal direction: units of 4 pixels In a vertical direction: units of 1 pixel	Units of 4 pixels	8 pixels	512 pixels
Search area	Dotted line				

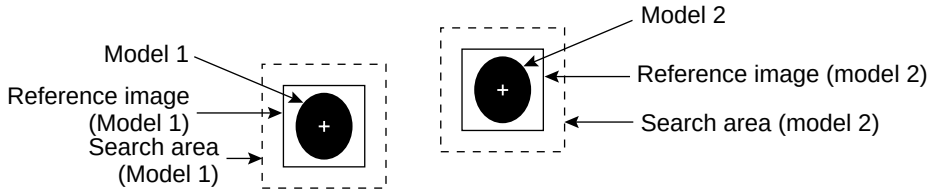
· In the case of a vertical line

	Line type	Movement	Length	Minimum length	Maximum length
Reference image	Solid line	In a horizontal direction: units of 1 pixel In a vertical direction: units of 4 pixels	Units of 4 pixels	8 pixels	480 pixels
Search area	Dotted line				

When using either a horizontal or vertical line, please bear the following in mind.
The length of the reference image must be less than that of the search area.

[An example of recording]

· This example is of a 2-point search in a rectangular measurement window.



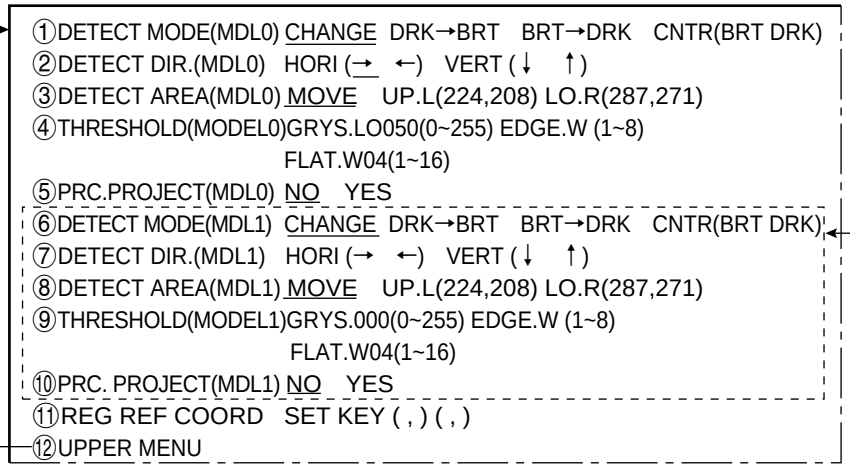
· For an example of a horizontal or vertical line measurement window, see page 9·50.

Returns you to the [MEASURING COND]

If you specified a 1P-SCH (1-point search) or a 2P-SCH (2-point search), select item ⑤ UPPER MENU. → Go to page 9·41

If you specified a 1P-SCH + 1P-EDGE (1-point search + 1-point edge), select item ④ EDGE DETECT COND (edge detection conditions). → Continued on the following page

Continued from the previous page, or from page 9·36: When you specified a 1P-EDGE (1-point edge), 2P-EDGE (2-point edge) or 1P-SCH + 1P-EDGE (1-point search + 1-point edge)



These items in the dotted line are only displayed when 2-point edge is selected.

· You can switch between displaying all of the headings together and displaying each one separately by using the ESC key.

Menu	Setting details
①DETECT MODE (MDL0) (detection mode)	Select the detection mode for model 0. (Point of change: _┌ or ┐_ , From dark to light: _┌ From light to dark: ┐_ Centering (light or dark center))
②DETECT DIR. (MDL0) (detection direction)	Select the direction in which detection will take place for model 0.
③DETECT AREA (MDL0) (area of detection)	Set up a dotted line rectangular perimeter around the search area for model 0. · In order to increase the speed of the searches, make the length of Y as small as possible.
④THRESHOLD (MODEL0) (threshold values)	Set the width of the edge (1 to 8) and the flat (1 to 16), as well as the difference in the light level (0 to 255).
⑤PRC. PROJECT (MDL0) (artifact processing)	Select whether to employ artifact processing in model 0 or not. ⇨See page 9·12, artifact processing.
⑥DETECT MODE (MDL1) (detection mode)	Set these items for model 1 just the same way as item ① to ⑤ above.
⑦DETECT DIR. (MDL1) (detection direction)	
⑧DETECT AREA (MDL1) (area of detection)	
⑨THRESHOLD (MODEL1) (threshold values)	
⑩PRC. PROJECT (MDL1) (artifact processing)	
⑪REG REF COORD (register reference coodinates)	Register a coordinate, which is used as the reference point for edge detection.
⑫UPPER MENU	This will return you to the [MEASURING COND] (measurement condition) menu.

· For more information about the settings for edge detection see page 9·11, Edge detection, in shared settings.

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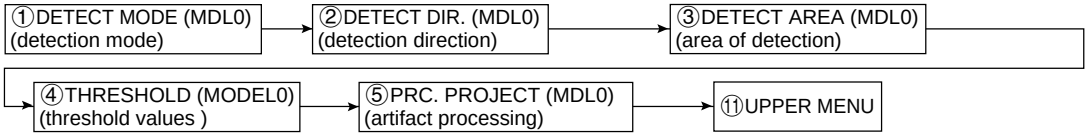
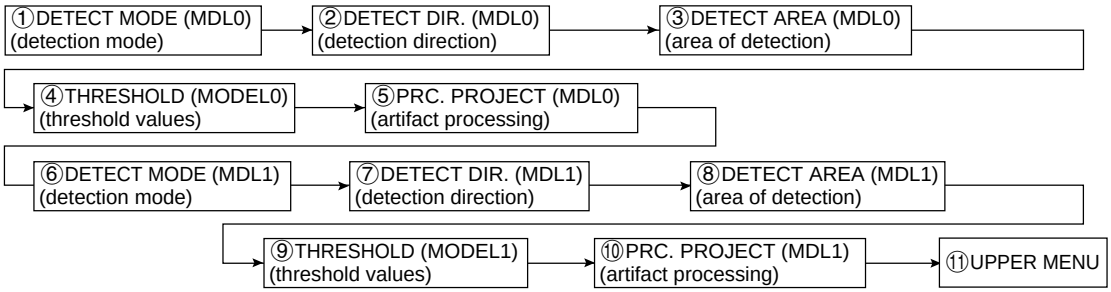
Continued from the previous page

[Procedure for setting the conditions for edge detection]

- When you specify a 1P-EDGE (1-point edge) or a 1P-SCH + 1P-EDGE (1-point search + 1-point edge).



- When a 2P-EDGE (2-point edge) has been specified.



[Information about the settings for edge detection]

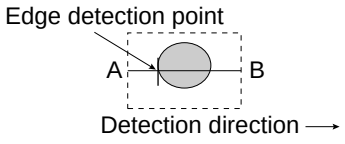
In order to record a reference image it is necessary to freeze the frame.

- Specifications for the area of detection

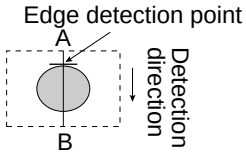
Line type	Movement	Size	Minimum	Maximum
Dotted line	Units of 1 pixel	Units of 1 pixel	0 x 0 pixels	512 x 480 pixels

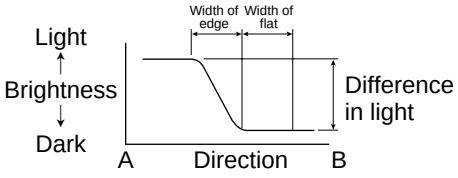
[Example of an edge detection point in detection mode, shown with different directions of detection.]

· Point of change/ from light to dark, horizontal

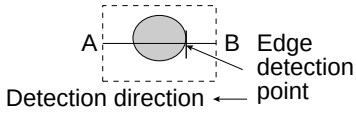


· Point of change/ from light to dark, vertical

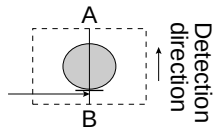


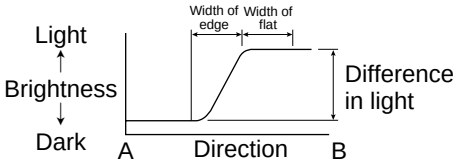


· Point of change/ from dark to light, horizontal



· Point of change/ from dark to light, vertical





- The edge detection point is used as a reference coordinates when the positional deviation is detected.
- Compared with a gray scale search, the edge detection is quicker but the position detection is less accurate.

Return to the [MEASURING COND] (measurement conditions) menu and select item ⑤ UPPER MENU.

Continued on the following page

From page 9·38: When you specify a 1P-SCH (1-point search) or a 2P-SCH (2-point search)

From the previous page: When you specify a 1P-EDGE (1-point edge), 2P-EDGE (2-point edge) or a 1P-SCH + 1P-EDGE (1-point search + 1-point edge) for the MODE.

Select item ⑤ EVALUATION COND (evaluation conditions),on the [TYPE00-MEAS0] menu.

[EVALUATION COND] (TYPE00-MEAS.0-POS-DEVIATION)

①REGST NO.	0(0~7)	[TEST RESULT]		[OUT]
②X COORD.(MDL0)	000.0~511.0	X=000.0	OK	NO
③Y COORD.(MDL0)	000.0~479.0	Y=000.0	OK	NO
④X DEVIAT(MDL0)	000.0~511.0	X=000.0	OK	NO
⑤Y DEVIAT(MDL0)	000.0~479.0	Y=000.0	OK	NO
⑥MATCH (MDL0)	−10000~+10000	+09000	OK	NO
⑦ANGULAR DEVIT	−180.0~+180.0	+010.0°	OK	NO
⑧X COORD.(MDL1)	000.0~511.0	X=000.0	OK	NO
⑨Y COORD.(MDL1)	000.0~479.0	Y=000.0	OK	NO
⑩X DEVIAT(MDL1)	000.0~511.0	X=000.0	OK	NO
⑪Y DEVIAT(MDL1)	000.0~479.0	Y=000.0	OK	NO
⑫MATCH (MDL1)	−10000~+10000	+09000	OK	NO
⑬MAKE A TEST RUN	(SET KEY)			
⑭UPPER MENU				

These displays can be set using the up and down keys. (The choices are NO, Y0 to 7, C000 to C127)

· Items ⑦ ANGULAR DEVIT, to ⑪ Y DEVIAT (MDL1), are displayed when you specify a 2P-SCH (2-point search), 2P-EDGE (2-point edge) or a 1P-SCH + 1P-EDGE (1-point search + 1-point edge).
· Item ⑥ MATCH (MDL0), is displayed when you specify a 1P-SCH (1-point search), 2P-SCH (2-point search) or a 1P-SCH + 1P-EDGE (1-point search + 1-point edge).
· Item ⑫ MATCH (MDL1), is displayed when a 2P-SCH (2-point search) is specified.

Evaluation condition	Setting details
①REGST NO. (registration number)	Enter any number from 0 to 7.
②X COORD. (MDL0) (X coordinates)	Enter the range of X* coordinates for model 0 which will produce an OK decision.
③Y COORD. (MDL0) (Y coordinates)	Enter the range of Y* coordinates for model 0 which will produce an OK decision.
④X DEVIAT (MDL0) (range of X deviation)	Enter the maximum amount of difference in the X direction in model 0 which will still produce an OK decision.
⑤Y DEVIAT (MDL0) (range of Y deviation)	Enter the maximum amount of difference in the Y direction in model 0 which will still produce an OK decision.
⑥MATCH (MDL0) (degree of match with the reference image)	Enter the percentage of pixels that must match the reference image for model 0 which will still produce an OK decision.
⑦ANGULAR DEVIT (angular deviation)	Set the amount of angular displacement for models 0 and 1 that will still produce an OK decision.
⑧X COORD. (MDL1) (X coordinates)	Set these items for model 1 just the same way as item ② to ⑥ above.
⑨Y COORD. (MDL1) (Y coordinates)	
⑪X DEVIAT (MDL1) (range of X deviation)	
⑫Y DEVIAT (MDL1) (range of Y deviation)	
⑬MATCH (MDL1) (degree of match with the reference image)	
⑭MAKE A TEST RUN	Pressing the SET key will test the evaluation condition, display the test results.
⑮UPPER MENU	This will return you to the [TYPE-MEAS0] menu.

* The X and Y coordinates come from either the point of detection in the reference image or from the point at which the edge was detected in the target image.

· Verify your settings by testing the upper and lower limits for decisions that you have set. This can be done using item ⑬ MAKE A TEST RUN (make a test run).
· For more information about evaluation condition, see section 9-2 [3] Evaluation conditions.

Return to the [TYPE00-MEAS0] and select item ⑥ NUMERIC CALC COND (conditions for numerical calculations)

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```
[NUMERIC CALC]      (TYPE00-MEAS.0-POS-DEVIATION)
 ①CALC.RESULT          N00(0~15)
 ②OBJECT TYPE          NO  COORD[X Y]  DEVIAT[x y]  MATCH [M]
                       ANGL-DEV[B]  NUM-CALC[NC]  CNST[C]

 ③FORMULA              REG.0(0~7) MDL0(0~1) N00(0~15)
                       + - ∗/ ← →  DEL  END
 ④UPPER&LOWER LIMIT    +00000650.0~+00000700.0
 ⑤OUTPUT               NO  Y0(0~7)  C000(0~107)
 ⑥TEST A RUN           (SET KEY)
 ⑦UPPER MENU
```

N00	[X]	0X0+0X1	Y0
		+00000650.0~+00000700.0 +00000660.0	OK
N01	[M]	N00∗0M1	Y1
		+00065000.0~+00070000.0 +00064000.0	NG
N02			
N03			

Numerical calculation	Setting details
①CALC.RESULT (calculation result)	Set the recording and display of the results from arithmetical operation for specified output data at any value from 00 to 15.
②OBJECT TYPE (type)	Select the type of data being calculated.
③FORMULA	A number of formula settings are used. The first line will change according to the selection made in item ②. **Selection of ② / The first line of the display** The coordinates [XY], the deviation coordinates [xy], and the degree of match with the reference image. [M] / Record 0 (0 to 7) Model (0 to 1) N00 (0 to 15) Angular deviation [B] / Record 0 (0 to 7) N00 (0 to 15) Numerical calculations [NC] / ABS √ TAN ATAN N00 (0 to 15) (the second line will not be displayed) Constant [C] / +00000000.0 (the second line will not be displayed) Note: Please use a smaller number for the number of formulas at N (00 to 15) than that used for ① CALC. RESULT N (00 to 15).
④UPPER&LOWER LIMIT	Set the upper and lower limits for decisions.
⑤OUTPUT	Set the output conditions for the results of calculations.
⑥TEST A RUN (make a test run)	Pressing the SET key will record the setting details as well as run a test.
⑦UPPER MENU	Returns you to the [TYPE00-MEAS0] menu.

· The number of formulas which can be set are dictated by the selections made in items ② and ③ as follows.

②OBJECT TYPE	Model 0	Model 1
Coordinates X/Y	0X0 to 7X0/0Y0 to 7Y0	0X1 to 7X1/0Y1 to 7Y1
Coordinate deviation x/y	0x0 to 7x0/0y0 to 7y0	0x1 to 7x1/0y1 to 7y1
Degree of match M	0M0 to 7M0	0M0 to 7M0
Angular deviation B	0B to 7B	
Numerical calculation NC	ABS/√/TAN/ATAN (00 to 15)	
Constant C	-99999999.9 to +99999999.9	

The numbers ranging from 0 to 7 in front of the characters are registration numbers.

· For more information on numerical calculations see section 9-2 [4] Numerical calculations.

Note: You must run a test using item ⑥ TEST A RUN, before making any calculations.

Return to the [TYPE00-MEAS0] menu and select item ⑦ OUTPUT CONDITIONS (output condition).

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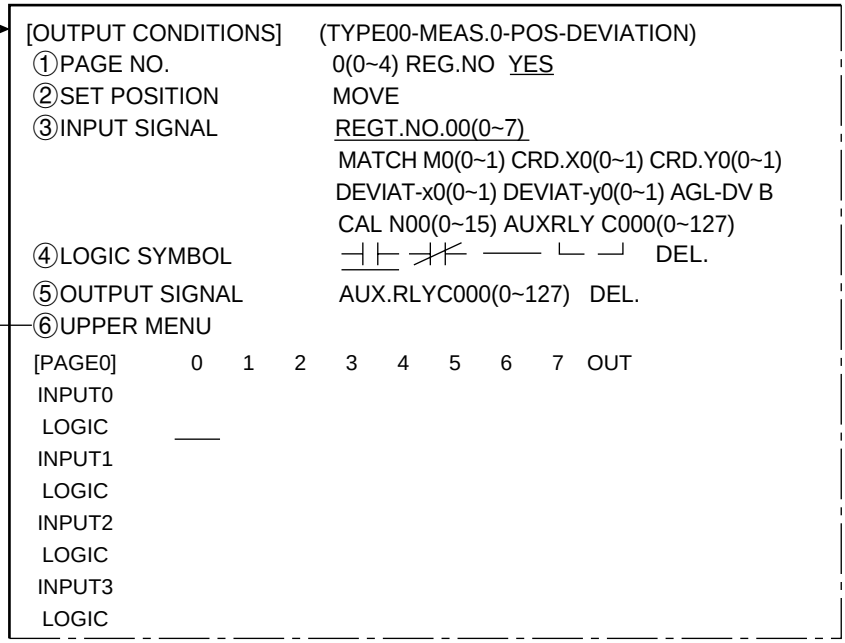

· The input signals which may be set depend on the selection made at item ③ as follows.

③INPUT SIGNAL	Model 0	Model 1
Degree of match M	0M0 to 7M0	0M1 to 7M1
Coordinates X/Y	0X0 to 7X0/0Y0 to 7Y0	0X1 to 7X1/0Y1 to 7Y1
Coordinate deviation x/y	0x0 to 7x0/0y0 to 7y0	0x1 to 7x1/0y1 to 7y1
Angular deviation B	0B to 7B	
Calculation N	N00 to N15	
Auxiliary relay C	C000 to C127	

The numbers ranging from 0 to 7 in front of the characters are registration numbers.

· For more information on output conditions, see the “PC Function” in Chapter 10.

Return to the MAIN OPS MENU

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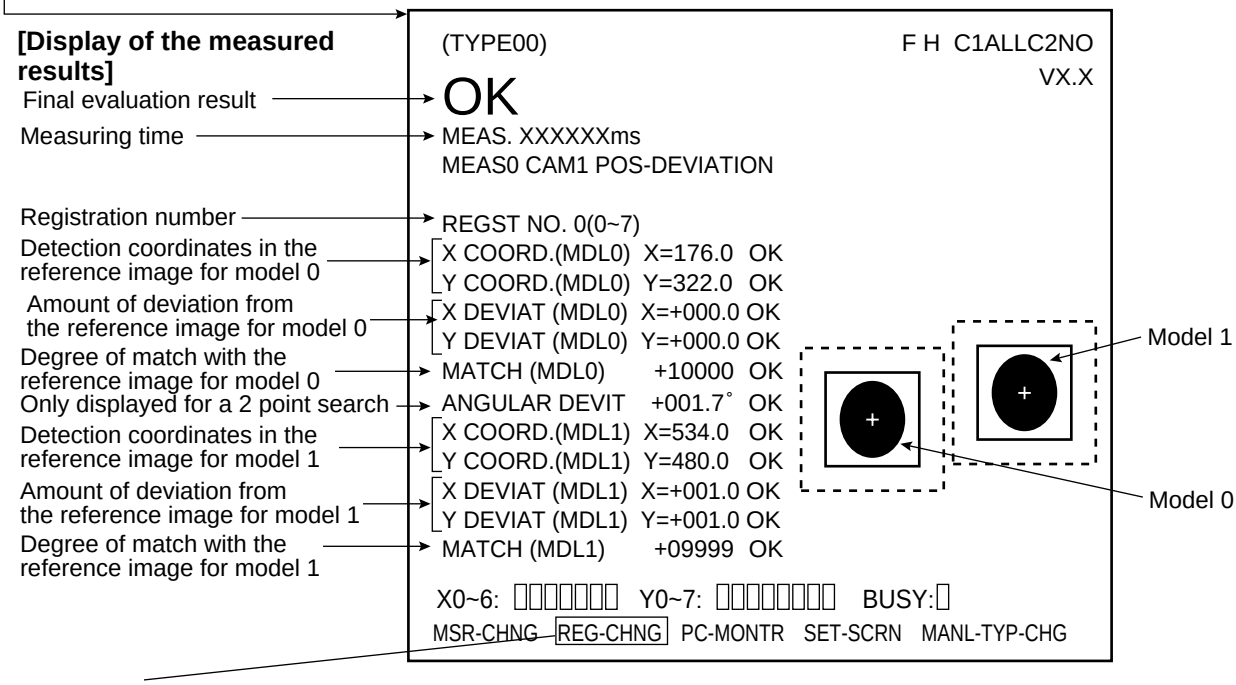
Pressing the TRG/BRT key will display the results of a positional deviation measurement for the new image that you have recorded.
Shown below is the display when a 2 point search has been specified.

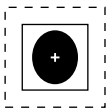
[Display of the measured results]



- By moving the cursor to REG-CHNG (change registration), and pressing the up key, it is possible to see the measurement results for different registration numbers and numerical calculations. This is done by scrolling through them in this order: registration numbers 0→1→2→3…7. These are followed by the results of the numerical calculations N00 to N15. The measurements screen also has this feature. Pressing the down key in these situations will scroll back through the results in the opposite order.
- Unregistered numbers will be skipped.
- When there are no recorded numbers (other than those currently on display) or if no measurement has actually been carried out, then it will not be possible to scroll through the data.
- The displays for other modes are as follows.

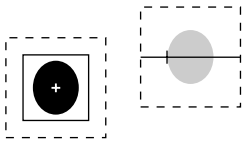
(1-point search)

REGST NO. 0(0~7)
X COORD.(MDL0) X=176.0 OK
Y COORD.(MDL0) Y=322.0 OK
X DEVIAT (MDL0) X=+000.0 OK
Y DEVIAT (MDL0) Y=+000.0 OK
MATCH (MDL0) +10000 OK



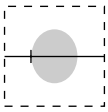
(1-point search + 1-point edge)

REGST NO. 0(0~7)
X COORD.(MDL0) X=176.0 OK
Y COORD.(MDL0) Y=322.0 OK
X DEVIAT (MDL0) X=+000.0 OK
Y DEVIAT (MDL0) Y=+000.0 OK
MATCH (MDL0) +10000 OK
ANGULAR DEVIT +001.7˚ OK
X COORD.(MDL1) X=534.0 OK
Y COORD.(MDL1) Y=480.0 OK
X DEVIAT (MDL1) X=+001.0 OK
Y DEVIAT (MDL1) Y=+001.0 OK



(1-point edge)

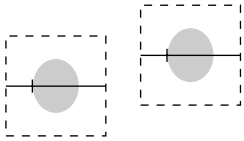
REGST NO. 0(0~7)
X COORD.(MDL0) X=176.0 OK
Y COORD.(MDL0) Y=322.0 OK
X DEVIAT (MDL0) X=+000.0 OK
Y DEVIAT (MDL0) Y=+000.0 OK



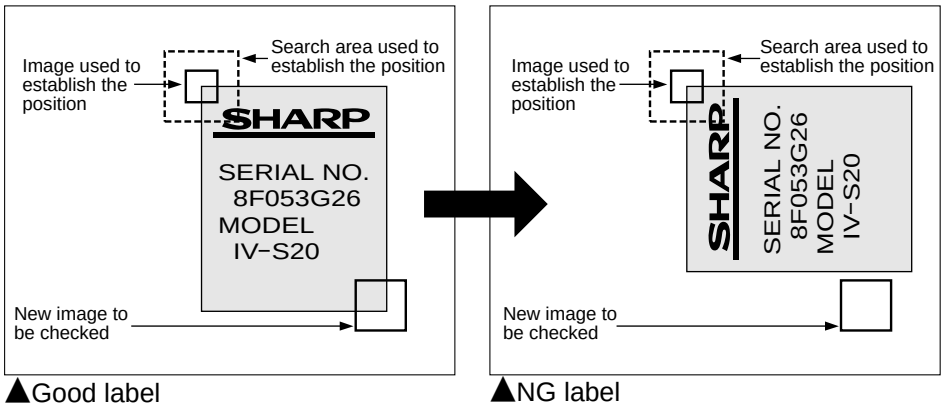
(2-point edge)

REGST NO. 0(0~7)
X COORD.(MDL0) X=176.0 OK
Y COORD.(MDL0) Y=322.0 OK
X DEVIAT (MDL0) X=+000.0 OK
Y DEVIAT (MDL0) Y=+000.0 OK

ANGULAR DEVIT +001.7˚ OK
X COORD.(MDL1) X=534.0 OK
Y COORD.(MDL1) Y=480.0 OK
X DEVIAT (MDL1) X=+001.0 OK
Y DEVIAT (MDL1) Y=+001.0 OK

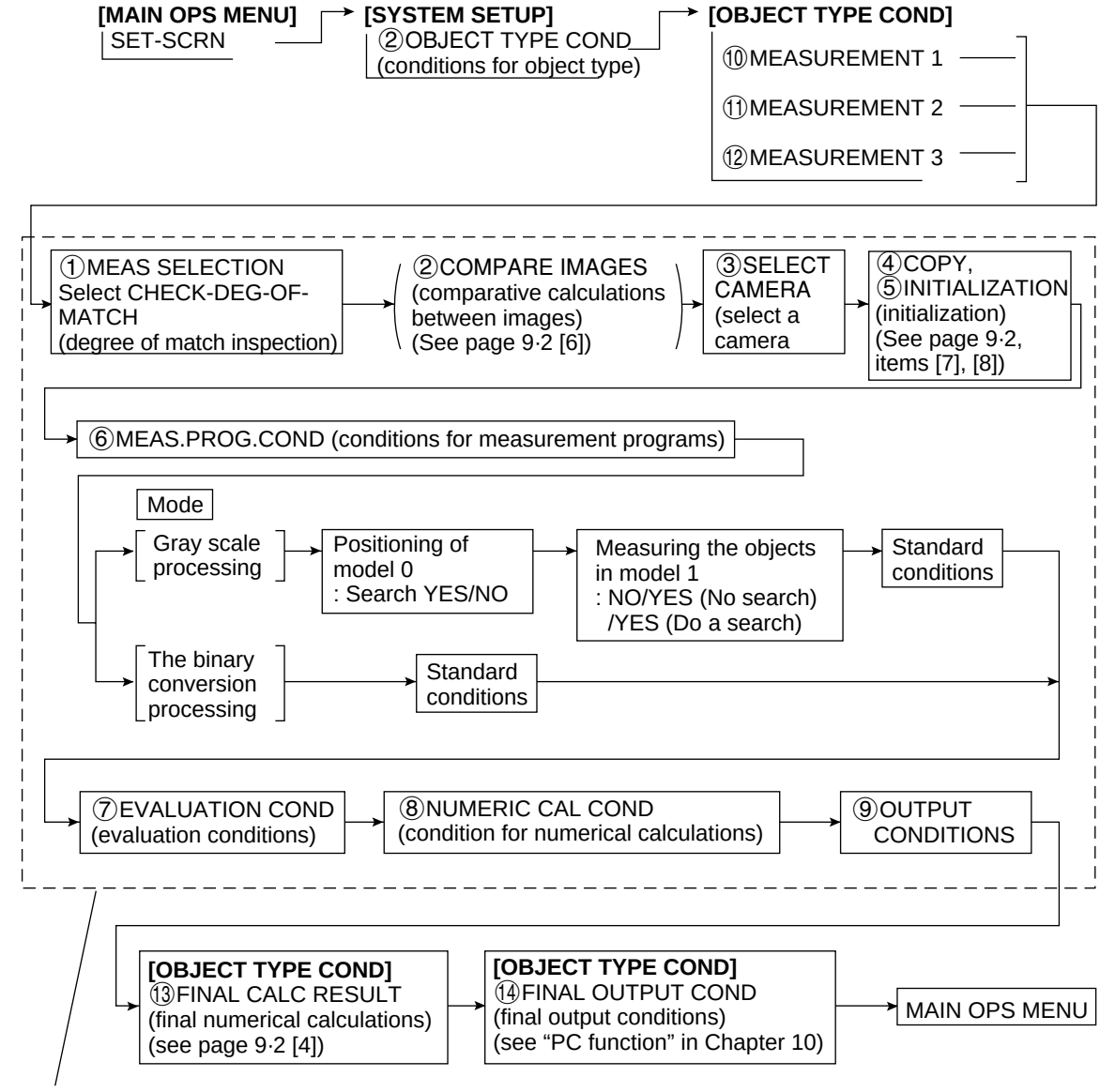


9-4 Degree of match inspection for shape and size

Purpose	The comparison requires the use of the gray scale search function for measuring the new image against the reference image. By identifying the differences between images, decisions can be made about the new image being tested. (The acceptance of the workpiece (in the image being tested) is based its level of similarity to the reference image.) It is also possible to make matching decisions about images which have undergone binary conversion.
Applica-tions	Checking the positional deviation of labels, checking for the wrong part or other foreign objects mixing in with the desired parts, checking for sufficiently high precision in the mounting of electrical components on PC boards, checking for misprints, check for missing electrical parts such as terminals, and simple inspection of lettering.
Example	**[Checking for label misalignment]**  ▲Good label ▲NG label **· Checking sequence** ① Conduct a gray scale search of the image used to establish the position. ② Using the image coordinates obtained in step ①, first, adjust the position of the new image and then begin the matching process. ③ If the level of match between the images is too low, then a "label NG" decision will result.

9

[1] Setting sequence



These settings are found in the [TYPE00-MEAS1 to 3] menu.

[2] Setting details

An explanation of item ⑥ MEAS. PROG. COND (conditions for measurement programs) from the [TYPE00-MEAS1 to 3] (object type measurement).

On the MAIN OPS MENU move the cursor to SET-SCRN item, and press SET key.

⇨On the [SYSTEM SETUP] menu item, move the cursor to ② OBJECT TYPE COND (condition of object type) and press the SET key.

⇨Select item ⑩ MEASUREMENT 1, ⑪ MEASUREMENT 2, or ⑫ MEASUREMENT 3 on the [OBJECT TYPE COND] (conditions for object types) menu.

```
[TYPE00-MEAS1]
①MEAS SELECTION   NO            CHECK-DEG-OF-MATCH
                  DST&AGL MES. (GRAY&EDGE GRAV)
                  INSPECT-LEAD  MEASR-BIN-AREA
                  CNT-BIN-OBJ   LABEL-BIN-OBJ
                  POINT MEAS
②COMPARE IMAGES NO YES(CAM1)
③SELECT CAMERA   CAM1   CAM2
④COPY            EXEC←TYPE00−MEAS1−NO
⑤INITIALIZATION  EXEC
⑥MEAS.PROG. COND  (TO NEXT SUB-MENU)
⑦EVALUATION COND  (TO NEXT SUB-MENU)
⑧NUMERIC CALC COND (TO NEXT SUB-MENU)
⑨OUTPUT CONDITIONS (TO NEXT SUB-MENU)
⑩UPPER MENU
```

This is how the line looks when the object type is set to 00 and the selected measurement is 1.

- To select the CHECK-DEG-OF-MATCH (degree of match with the reference image), go to item ① MEAS SELECTION.
- Item ② COMPARE IMAGES will be displayed unless NO is selected in item ⑧ SELECT CAMERA IMG (select camera one of two images), which is in the [OBJECT TYPE COND] menu.

Select item ⑥ MEAS. PROG. COND (condition for measurement programs).

```
[MEASURING COND]  (TYPE00-MEAS.1-DEG OF MATCH)
①REGST NO.        00(0~15) REG.NO   YES
②MODE             GRAY-IMG-PROC BINRY-IMG-PROC
③MODEL0 POSITION  NO-SEARCH   SEARCH
④MODEL 1 MEAS. OBJ NO YES(NO-SEARCH) YES(SEARCH)
⑤EVALUATE CRITERIA (TO NEXT SUB-MENU)
⑥UPPER MENU
```

The display will look like this when item ② MODE, is set to GRAY-IMG-PROC (gray scale processing)

```
[MEASURING COND]  (TYPE00-MEAS.1-DEG OF MATCH)
①REGST NO.        00(0~15) REG.NO   YES
②MODE             GRAY-IMG-PROC BINRY-IMG-PROC


⑤EVALUATE CRITERIA (TO NEXT SUB-MENU)
⑥UPPER MENU
```

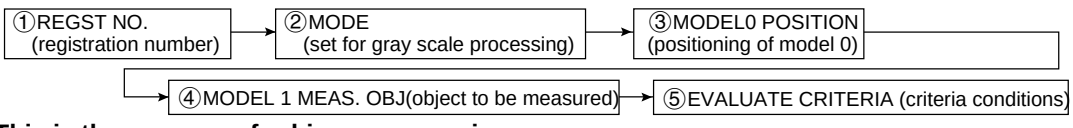
The display will look like this when item ② MODE, is set to BINRY-IMG-PROC (binary processing)

- Items ② to ⑤ will be displayed if item ① REGST NO. (registration) is set to YES. However, if BINRY-IMG-PROC (binary processing) is selected in item ②, then items ③ and ④ will not be displayed (and so can not be set).

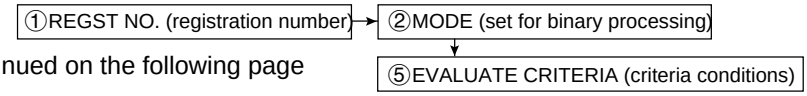
Measurement conditions	Setting details
①REGST NO. (registration number)	First select the REGST NO. (registration number) from 0 to 15, then chose YES or NO, depending on whether you wish to record that selection.
②MODE	Select either GRAY-IMG-PROC(gray scale processing) or BINRY-IMG-PROC (binary processing).
③MODEL 0 POSITION (positioning)	When the GRAY-IMG-PROC((gray scale processing) mode has been selected, then NO-SEARCH or SEARCH (search) must be selected for the MODEL 0 POSITION (positioning of model 0).
④MODEL 1 MEAS. OBJ (object to be measured)	When the GRAY-IMG-PROC (gray scale processing) mode has been selected, then NO, YES (NO-SEARCH) or YES (SEARCH) (existance/non existance of an object, search/do not search) must be selected for the MODEL 1 MEAS. OBJ (object to be measured in model 1).
⑤EVALUATE CRITERIA (criteria condition)	Criteria conditions are set in the next menu.
⑥UPPER MENU	This will return you to [TYPE00.MEAS1 to 3].

[Settings sequence]

- This is the sequence for gray scale processing



- This is the sequence for binary processing



Continued on the following page

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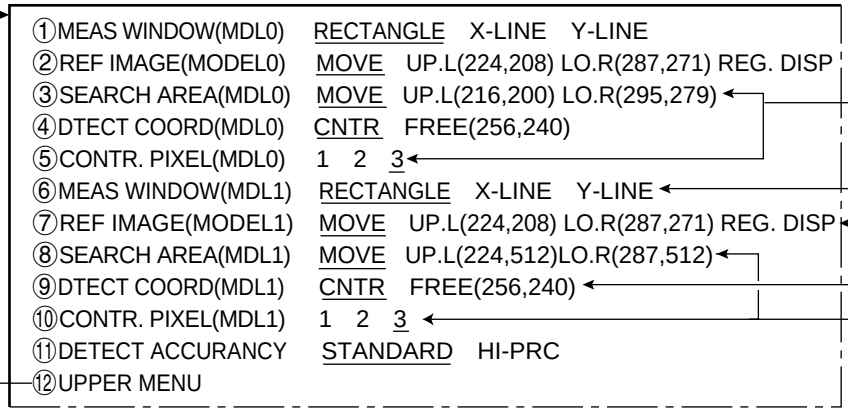
Continued from the previous page.

Select item ⑤ EVALUATE CRITERIA (criteria conditions)

This is how the display looks when the GRAY-IMG-PROC (gray scale processing) mode is selected.

To see how the display looks when the BINRY-IMG-PROC (binary processing) mode is selected.

Go to page 9·51.



· You can switch between displaying all of the headings together and displaying each one separately, using the ESC key.

Menu	Setting details
①MEAS WINDOW(MDL0) (measurement window)	Select the measurement window shape for model 0 (positioning).
②REF IMAGE(MODEL0) (reference images)	Record a reference image for model 0 · The upper left or lower right area of the screen specified above will change according the setting in item ①.
③SEARCH AREA(MDL0) (search area)	If model 0 is set to SEARCH (search), then enter the search area.
④DTECT COORD(MDL0) (detection coordinates)	Set the position of the cursor inside the measurement window for model 0. · If FREE is selected, then the position of cursor is optional.
⑤CONTR. PIXEL(MDL0) (pixel contraction)	If model 0 is set to SEARCH (search yes), then enter the pixel contraction level. ⇨See (page 9·6) gray scale processing, in shared settings. · When either X-LINE (horizontal line) or Y-LINE(vertical line) are selected in item ①, you can select only 1 or 2 in item ⑤.
⑥MEAS WINDOW(MDL1) (measurement window)	The settings for these are the same for model 1 as they are for model 0, numbers ① to ⑤.
⑦REF IMAGE(MODEL1) (reference image)	
⑧SEARCH AREA(MDL1) (search area)	
⑨DTECT COORD(MDL1) (detection coordinates)	
⑩CONTR. PIXEL(MDL1) (pixel contraction)	
⑪DETECT ACCURANCY (accuracy of detection)	Set the level of detection precision for models 0 and 1. ⇨See page 9·6 “Gray scale processing” in shared settings.
⑫UPPER MENU	This will return you to the [MEASURING COND] (measurement conditions) menu.

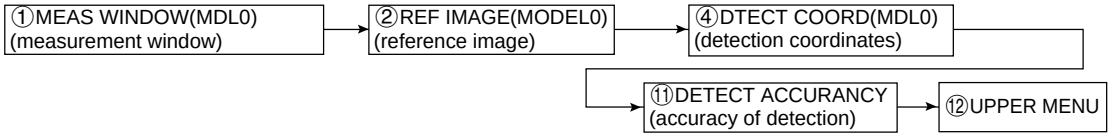
The selection at item ①	The display in the upper left, lower right areas of the screen.
RECTANGLE(rectangle)	Upper left, lower right.
X-LINE (horizontal line)	Starting point, end point
Y-LINE (vertical line)	

Continued on the following page

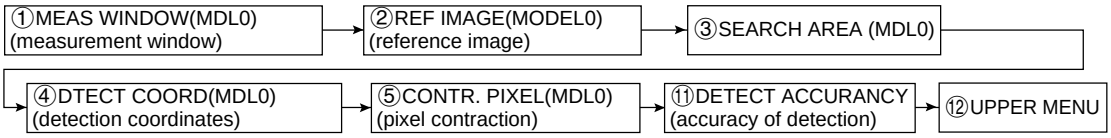
Continued from the previous page: When the GRAY-IMG-PROC (gray scale processing mode) is selected.

[The setting sequence for criteria condition]

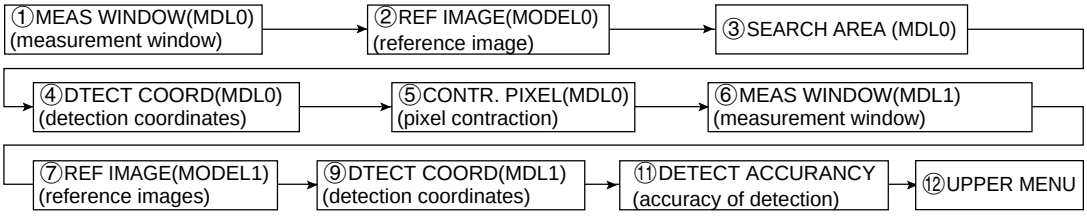
- This is the sequence to follow when model 0 (positioning) is set to NO-SEARCH (do not search) and model 1 (object to be measured) is set to NO



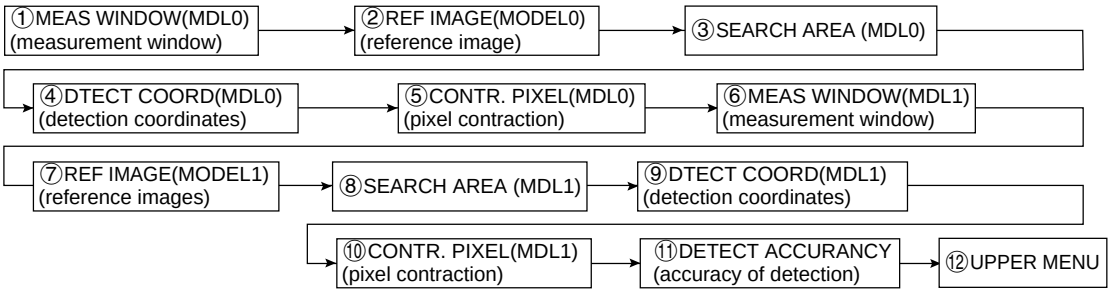
- This is the sequence to follow when model 0 (positioning) is set to SEARCH (search) and model 1 (object to be measured) is set to NO



· This is the sequence to follow when model 0 (positioning) is set to SEARCH (search) and model 1 (object to be measured) is set to YES (NO-SEARCH) (do not search)



- This is the sequence to follow when model 0 (positioning) is set to SEARCH (search) and model 1 (object to be measured) is set to YES (SEARCH) (do not search)



[Information about the recording of a reference image]

In order to record a reference image it is necessary to use the freeze frame.
The specifications for the windows are as follows.

- In the case of a rectangular window

	Line type	Movement	Size	Minimum	Maximum
Reference image	Solid line	Units of 4 pixels	Units of 4 pixels	32 X 32 (pixels)	X X Y (X X Y=65536 pixels)
Search area	Dotted line	Units of 4 pixels	Units of 4 pixels	32 X 32 (pixels)	512 X 480 pixels

· In the case of a horizontal line

	Line type	Movement	Length	Minimum length	Maximum length
Reference image	Solid line	In a horizontal direction: units of 4 pixels In a vertical direction: units of 1 pixel	Units of 4 pixels	8 pixels	512 pixels
Search area	Dotted line				

- In the case of a vertical line

	Line type	Movement	Length	Minimum length	Maximum length
Reference image	Solid line	In a horizontal direction: units of 1 pixel In a vertical direction: units of 4 pixels	Units of 4 pixels	8 pixels	480 pixels
Search area	Dotted line				

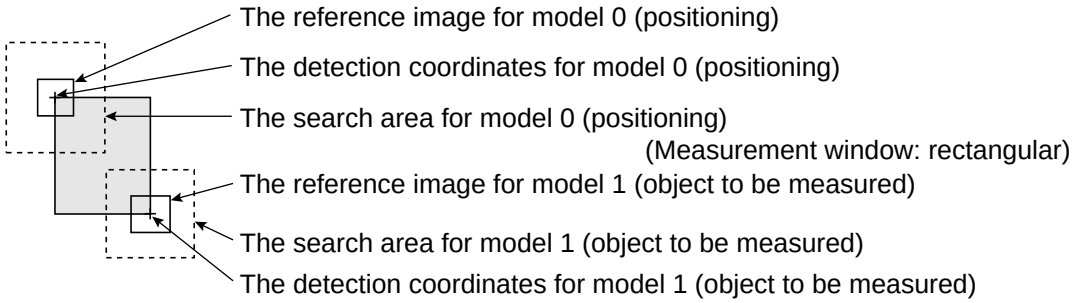
When using either a horizontal or a vertical line, please bear the following in mind.
The length of the reference image must be less than that of the search area.

Continued on the following page

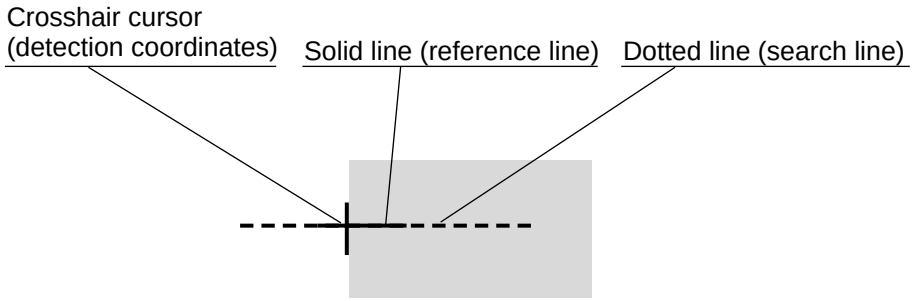
Continued from the previous page: When the GRAY-IMG-PROC (gray scale processing mode) is selected.

[Example of recording]

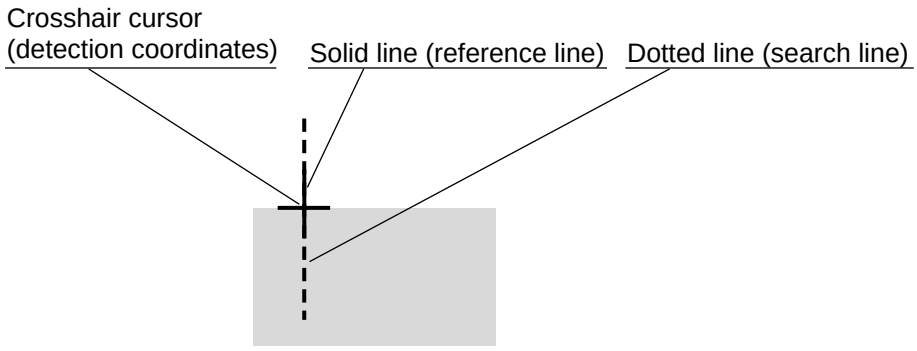
- This example shows a recorded image when model 0 (positioning) is set to SEARCH (search) and model 1 (object to be measured) is set to YES (SEARCH) (do not search)



- Example of a horizontal line measurement window (SEARCH)



- Example of a vertical line measurement window (SEARCH)



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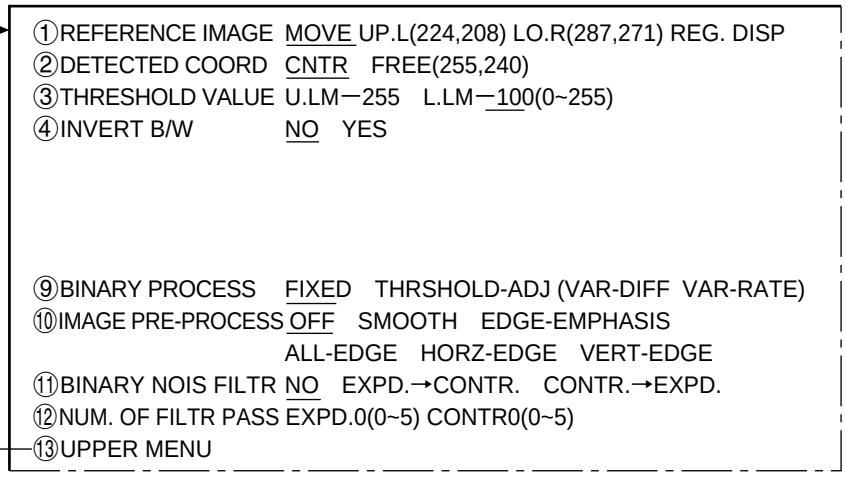
Return to the [MEASURING COND] (measurement condition) menu and select item ⑥ UPPER MENU.

Go to page 9·53

Continued from page 9·48: When the BINRY-IMG-PROC (binary processing mode) is selected.



· You can switch between displaying all of the headings together and displaying each one separately using the ESC key.

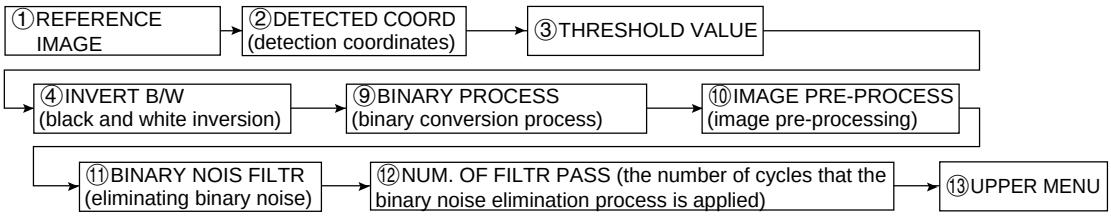
Menu	Setting details
①REFERENCE IMAGE	Record a reference image.
②DETECTED COORD (detection coordinates)	Set the position of the cursor inside the measurement window. · If FREE is selected, then position of cursor is optional.
③THRESHOLD VALUE	Set the upper and lower limits for binary conversion within the range of 0 to 255. ⇨See page 9·7 “Setting threshold values”, in “Shared settings”
④INVERT B/W (black and white inversion)	Set the inversion of black and white in the image to YES or NO. · Selecting NO means that the white area is measured after the image has been converted to binary values. · Selecting YES means that the black area will be measured after the image has been converted to binary values.
⑨BINARY PROCESS (the binary conversion process)	Select either fixed or threshold value correction as the binary conversion processing method. (VAR-DIFF or VAR-RATE).⇨See page 9·8 “Methods for binary conversion” in “Shared settings”
⑩IMAGE PRE-PROCESS (image pre-processing)	Select a method for pre-processing the image data. ⇨See page 9·9, “Pre-processing” in “Shared settings”
⑪BINARY NOIS FILTR (eliminating binary noise)	Select a method for eliminating binary noise. ⇨See page 9·10, “Methods for eliminating noise from binary images, expansion/contraction” and, “Eliminating binary noise”, in “Shared settings”
⑫NUM. OF FILTR PASS (the number of binary noise elimination processing)	Separately set the number of cycles that the expansion and contraction binary noise elimination processes will be repeated (0 to 5).
⑬UPPER MENU	This will return you to the [MEASURING COND] (measurement condition) menu.

Continued on the following page

Continued from the previous page: When the BINRY-IMG-PROC (binary processing mode) is selected.

[Setting sequence for reference criteria]

- This is the sequence to follow when model 1 (object to be measured) is set to NO

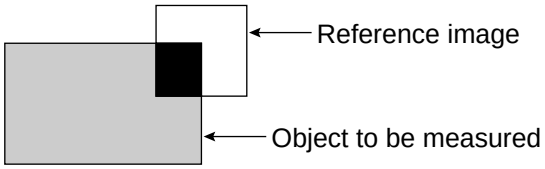


[Information about the recording of a reference image]

In order to record a reference image it is necessary to use the freeze frame.
The specifications for a rectangular window are as follows.

	Line type	Movement	Size	Minimum	Maximum
Reference image	Solid line	Units of 4 pixels	Units of 4 pixels	32 X 32 (pixels)	X X Y (X X Y=65536 pixels)

[Example of recording]



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Return to the [MEASURING COND] (measurement condition) menu and select item ⑥UPPER MENU.

Continued on the follwing page

Continued from page 9·50: When the GRAY-IMG-PROC (gray scale processing mode) is selected.

Continued from the previous page: When the binary processing mode is selected.

Select item ⑦ EVALUATION COND (evaluation conditions), from the [TYPE00-MEAS1 to 3] menu

```
[EVALUATION COND]   (TYPE00-MEAS.1-DEG OF MATCH)
 ①REGST NO.        0(0~15)            [TEST RESULT]      [OUT]
 ②MATCH (MDL0)     -10000~+10000      +09000     OK      NO
 ③X COORD.(MDL0)   000.0~511.0        X=000.0    OK      NO
 ④Y COORD.(MDL0)   000.0~479.0        Y=000.0    OK      NO
 ⑤LIGT LVL(MDL0)   000.0~255.0        116.0      OK      NO
 ⑥MATCH (MDL1)     -10000~+10000      +09000     OK      NO
 ⑦X COORD.(MDL1)   000.0~511.0        X=000.0    OK      NO
 ⑧Y COORD.(MDL1)   000.0~479.0        Y=000.0    OK      NO
 ⑨LIGT LVL(MDL1)   000.0~255.0        100.0      OK      NO
 ⑬MAKE A TEST RUN (SET KEY)
 ⑭UPPER MENU
```

These displays can be set using the up and down keys. (The choices are NO, Y0 to 7, C000 to C127)

This is how the display looks when the GRAY-IMG-PROC (gray scale search mode) is selected and MODEL1 MEAS. OBJ (model 1 object to be measured) is set to YES.

· You can switch between displaying all of the headings together and displaying each one separately using the ESC key.

Evaluation condition	Setting details
①REGST NO.(registration number)	Enter any number from 0 to 15.
②MATCH (MDL0) (degree of match with the reference image)	Set the percentage of match with the reference image for model 0 that will still produce an OK decision.
③X COORD.(MDL0) (X coordinates)	Set the range of X(*) coordinates for model 0 that will produce an OK decision.
④Y COORD.(MDL0) (Y coordinates)	Set the range of Y(*) coordinates for model 0 that will produce an OK decision.
⑤LIGT LVL (MDL0) (light level)	Set these items for model 1 just the same way as item ② to ⑤ above.
⑥MATCH (MDL1) (degree of match with the reference image)	
⑦X COORD.(MDL1) (X coordinates)	
⑧Y COORD.(MDL1) (Y coordinates)	
⑨LIGT LVL (MDL1) (light level)	
⑩MAKE A TEST RUN	Pressing the SET key will test the evaluation condition, display the test results.
⑪UPPER MENU	This will return you to the [MEASURING COND] (measurement condition).

* The X and Y coordinates come from either the point of detection in the reference image.

· Check your selection by testing the upper and lower limits for the evaluations that you have set. This can be done using item ⑩ MAKE A TEST RUN.
· For more information about evaluation conditions see (section 9·2 [3] Evaluaation conditions).

Return to the [TYPE00-MEAS1 to 3] and select item ⑧ NUMERIC CALC COND (conditions for numerical calculations)

Continued on the following page

From the previous page

[NUMERIC CALC] (TYPE00-MEAS.1-DEG OF MATCH)
①CALC. RESULT N00(0~15)
②OBJECT TYPE NO MATCH [M] CORD[X Y] LEVL[G]
NUM-CALC[NC] CNST[C]

③FORMULA REG.00(0~15) MDL0(0~1) N00(0~15)
+ - ∗/ ← → DEL END
④UPPER&LOWER LIMIT +00000000.0~ +00000000.0
⑤OUTPUT NO Y0(0~7) C000(0~107)
⑥RUN A TEST (SET KEY)
⑦UPPER MENU

N00	[M]	00M0	Y0
		+00009800.0~ +00010000.0 +00009800.0	OK
N01			
N02			
N03			

Numerical calculation	Setting details
①CALC.RESULT (calculation result)	Set the specified output data for recording and displaying the results of arithmetical operation to any value from 00 to 15.
②OBJECT TYPE(type)	Select the type of data being calculated.
③FORMULA	A number of formula settings are used. The first line will change according to the selection made in item ②. **Selection of ② / The first line of the display** Coordinates [XY], the degree of match with the reference image [M] and the level of light [G]. → Record 00 (0 to 15) model (0 to 1) N00 (0 to 15) Numerical calculations [NC] → ABS √ TAN ATAN N00 (0 to 15) (the second line will not be displayed) Constant [C] → +00000000.0 (the second line will not be displayed) Note: Please use a smaller number for the number of formulas at N (00 to 15) than that used for ① CALC. RESULT N (00 to 15).
④UPPER&LOWER LIMIT	Set the upper and lower limits for decisions.
⑤OUTPUT	Set the output conditions for the results of calculations.
⑥RUN A TEST (make a test run)	Pressing the SET key will record the setting details as well as run a test.
⑦UPPER MENU	Returns you to the [TYPE00-MEAS1 to 3] menu.

· The number of formulas which can be set are dictated by the selections made in items ② and ③ as follows.

② OBJECT TYPE	Model 0	Model 1
Coordinates X/Y	00X0 to 15X0/00Y0 to 15Y0	00X1 to 15X1/00Y1 to 15Y1
Degree of match M	00M0 to 15M0	00M1 to 15M1
Light level G	00G0 to 15G0	00G1 to 15G1
Numerical calculation NC	ABS/√/TAN/ATAN (00 to 15)	
Constant C	-99999999.9 to +99999999.9	

The numbers ranging from 00 to 15 in front of the characters are registration numbers.

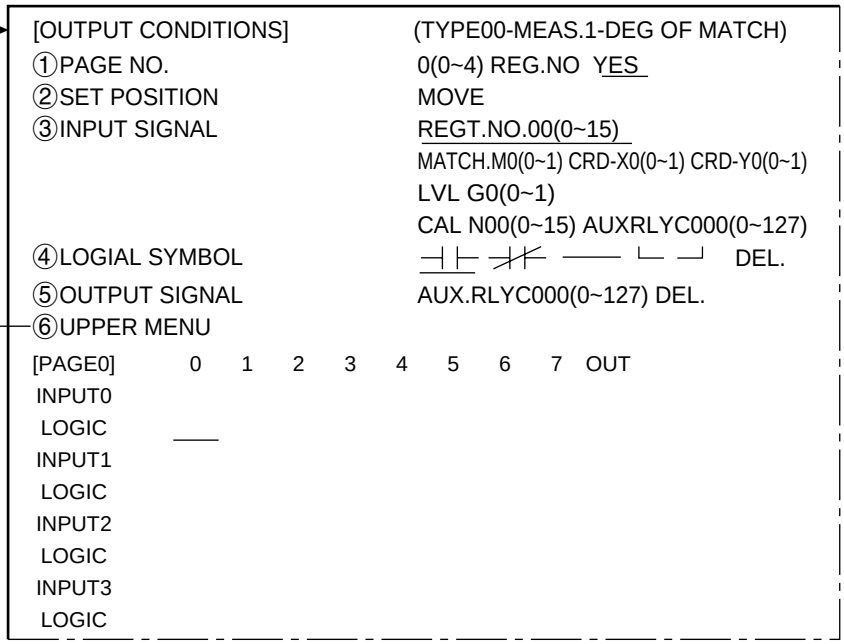
· For more information on numerical calculations see (section 9-2 [4] Numerical calculations).

Note: You must run a test using item ⑥ RUN A TEST before making any calculations.

Return to the [TYPE00-MEAS1 to 3] and select item ⑨ OUTPUT CONDITIONS (output condition).

Continued on the follwing page

Continued from the previous page



· The input signals which may be set depend on the selection made at item ③ as follows.

③INPUT SIGNAL	Model 0	Model 1
Degree of match M	00M0 to 15M0	00M1 to 15M1
Coordinates X/Y	00X0 to 15X0/00Y0 to 15Y0	00X1 to 15X1/00Y1 to 15Y1
Light level G	00G to 15G	00G to 15G
Calculation N	N00 to N15	
Auxiliary relay C	C000 to C127	

The numbers ranging from 00 to 15 in front of the characters are registration numbers.

· For more information on output conditions see “the PC Function”, in Chapter 10.

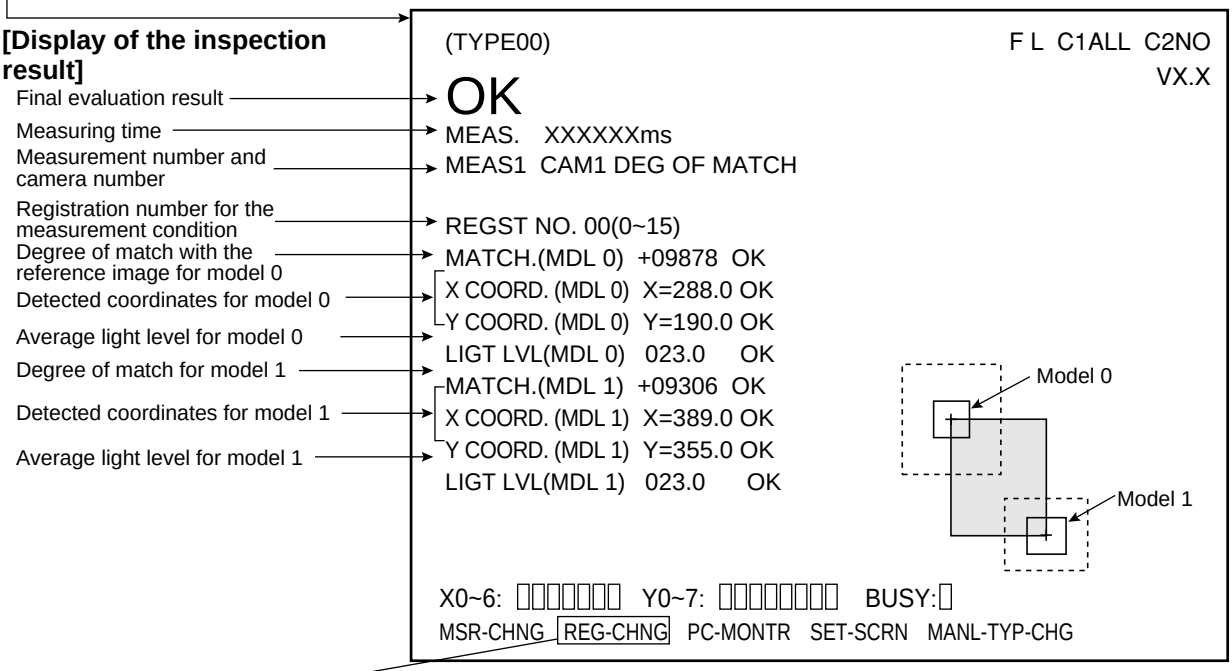
Return to the MAIN OPS MENU

Continued on the following page

Continued form the previous page

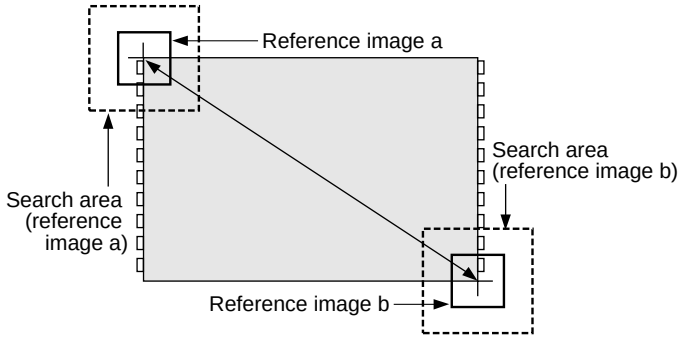
Pressing the TRG/BRT key will run a check by starting a manual measurement.
Shown below is an example of how the display will look when the gray scale search mode has been selected and both models 0 and 1 have been set to (Search YES).

[Display of the inspection result]



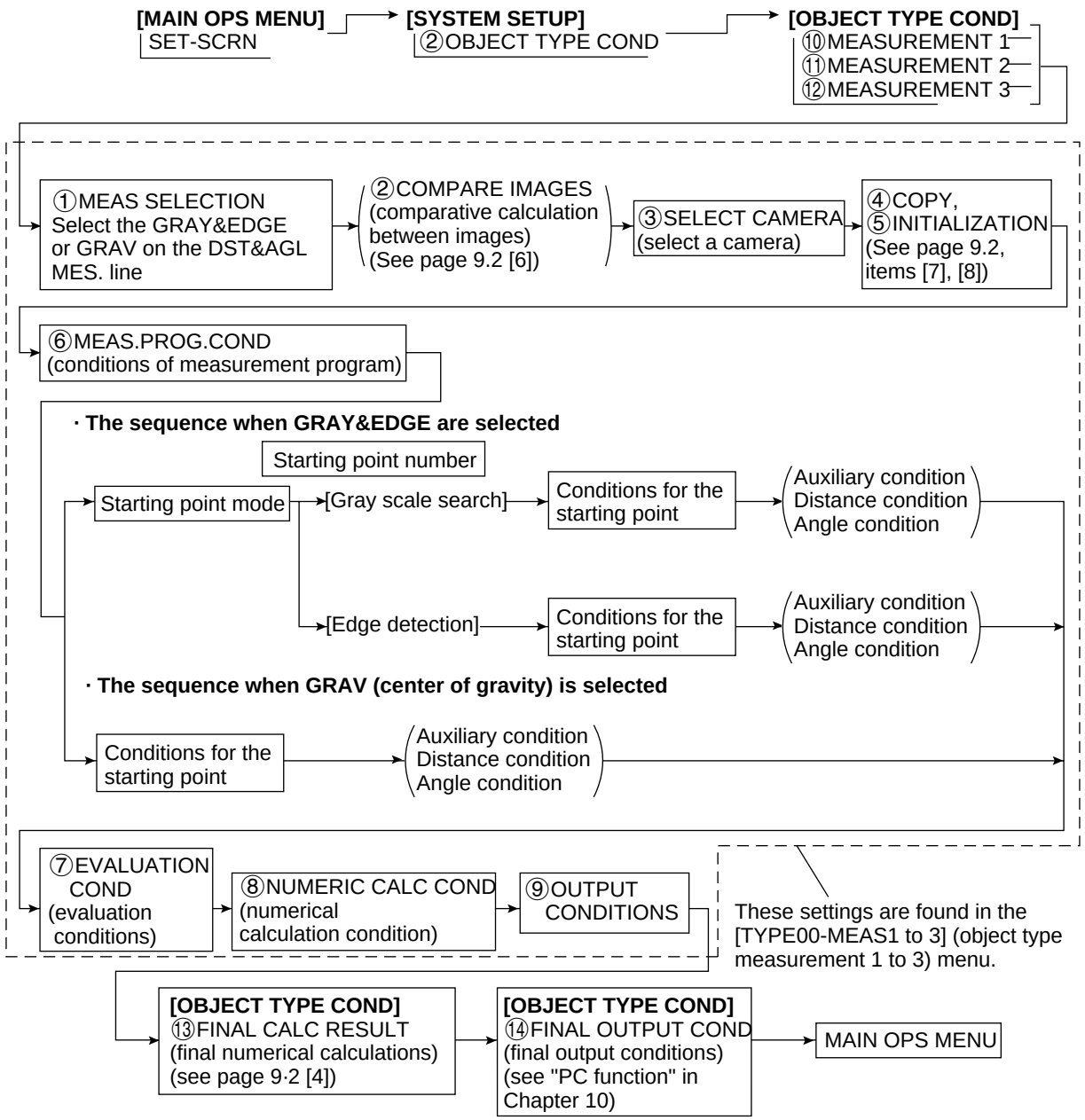
- By moving the cursor to REG-CHNG (change registration) and pressing the up key, you can see the measurement results for different registration numbers and numerical calculations. This is done by scrolling through them in the following order: Registration numbers 00→01→02,…,15,00…. These are followed by the results of the numerical calculations N00 to N15. The measurements screen also has this feature. Pressing the down key in these situations will scroll back through the results in the opposite order.
- Unregistered numbers will be skipped.
- When there are no recorded numbers (other than those currently on display) or if no measurement has actually been carried out, then it will not be possible to switch back and forth between data.

9-5 Distance and angle measurement

Purpose	The distance and angle of the centers of detected points can be measured by the center detection function and the edge detection function in a gray scale search and the center of grevity detection function, which is a part of the labeling process.
Applications	Measurement for mounting electronic components
Example	**[Measuring an IC package]**  Reference images a and b are recorded when the crosshair cursor is placed on the edge of the IC package. **· Measuring sequence** ① Obtain the center points of images a and b by running a 2 point gray scale search. ② Determine the distance between the two center points.

· For details about measuring the distance, X coordinate distance, and Y coordinate distance of two manually designated points, see the MANL-MESR (manual measurement) section for the crosshair cursor display (page 8·8).

[1] Setting sequence



[2] Setting details

An explanation of item ⑥ MEAS.PROG.COND (conditions for measurement programs) from the [TYPE00-MEAS1 to 3] menu.

On the MAIN OPS MENU, move the cursor to SET-SCRN, and press SET key.

⇨On the [SYSTEM SETUP], move the cursor to item ② OBJECT TYPE COND and press SET key.

⇨Select item ⑩ MEASUREMENT 1, ⑪MEASUREMENT 2 or ⑫ MEASUREMENT 3 on the [OBJECT TYPE COND] (conditions for object types) menu.

[TYPE00-MEAS1]

①MEAS SELECTION NO CHECK-DEG-OF-MATCH
DST&AGL MES. (GRAY&EDGE GRAV)
INSPECT-LEAD MEASR-BIN-AREA
CNT-BIN-OBJ LABEL-BIN-OBJ
POINT MEAS
②COMPARE IMAGES NO YES(CAM1)
③SELECT CAMERA CAM1 CAM2
④COPY EXEC←TYPE00−MEAS1−NO
⑤INITIALIZATION EXEC
⑥MEAS.PROG. COND (TO NEXT SUB-MENU)
⑦EVALUATION COND (TO NEXT SUB-MENU)
⑧NUMERIC CALC COND (TO NEXT SUB-MENU)
⑨OUTPUT CONDITIONS (TO NEXT SUB-MENU)
⑩UPPER MENU

This is how the line looks when the object type is set to 00 and the selected measurement is 1.

· Set the DST&AGL MES. (measurement of distance and angle) which can be found under item ① MEAS SELECTION (select measurements) to either GRAY&EDGE (gray scale search and edge detection) or GRAV. (center of gravity).
· Item ② COMPARE IMAGES (calculation between images) will be displayed unless NO is selected in item ⑧ NUMERIC CALC COND(camera selection) which is in the [OBJECT TYPE COND] menu.

Select item ⑥ MEAS.PROG.COND (conditions for measurement programs).

This is how the display looks when GRAY&EDGE are selected

[MEASURING COND] (TYPE00-MEAS.1-DST&ANGL.MEAS)
①START POINT NO 00(0~15) REG.NO YES
②START POINT MODE GRAY-SEARCH EDGE-DETECT
③START POINT COND (TO NEXT SUB-MENU)
④AUX.CONDITIONS (TO NEXT SUB-MENU)
⑤DISTANCE COND (TO NEXT SUB-MENU)
⑥ANGLE CONDITIONS (TO NEXT SUB-MENU)
⑦UPPER MENU

If item ① START POINT NO is set to YES (enable registration), then items ② to ⑥ will be displayed.

Measurement conditions	Setting details
①START POINT NO	Set the starting point number to any number from 0 to 15 and then set REG. (registration) to YES, to save your selection.
②START POINT MODE (starting point mode)	Select either GRAY-SEARCH (gray scale search) or EDGE DETECT (edge detection) as the starting point mode.
③START POINT COND (start point condition)	These are set in the next menu.
④AUX.CONDITIONS (auxiliary condition)	
⑤DISTANCE COND (distance condition)	
⑥ANGLE CONDITIONS (angular condition)	
⑦UPPER MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

Select item ③ START POINT COND (conditions for the starting point)

Select the GRAY-SEARCH (gray scale search) for starting point mode

Continued on the following page

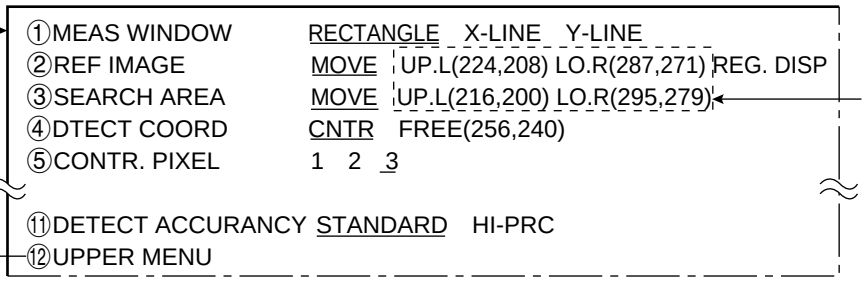
Select the EDGE DETECT (edge detection) for starting point mode

Go to page 9·61

When the GRAV (center of gravity) is selected

Go to page 9·6

From the previous page: When the GRAY-SEARCH (gray scale search) starting point mode is selected as the START POINT COND (starting point condition).



This is how the display looks when the ①MEASURE WINDOW (measurement window) is a RECTANGLE (rectangle).

· You can switch between displaying all the headings together and displaying each one separately using the ESC key.

Menu	Setting details
①MEASURE WINDOW (measurement window)	Select the shape of the measurement window.
②REFERENCE IMAGE	Record a reference image and then set the search area. · If X-LINE (horizontal line) or Y-LINE (vertical line) are selected, then the UP.L (upper left) and LO.R (lower right) choices in the screen above will be ST-PNT (starting point) and E-PNT (end point).
③SEARCH AREA	
④DETECTED COORD (detection coordinates)	Set the position of the cursor inside the measurement window. · If FREE is selected, then the cursor may be positioned as desired.
⑤CONTRACT PIXELS (pixel contraction)	Set the number of pixel contractions. ⇨See page 9·6 gray scale processing using shared settings. · When either a X-LINE (horizontal) or a Y-LINE (vertical) are selected in item ①, the choices here will be 1 or 2.
⑪DETECT ACCURANCY (artifact processing)	Select the level of precision used for detection. ⇨See page 9·6 gray scale processing using shared setting.
⑫UPPER MENU	This will return you to the [MEASURING COND] menu.

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[The setting sequence of the starting point conditions in a gray scale search.]

①MEASURE WINDOW → ②REFFERENCE IMAGE → ③SEARCH AREA → ④DETECTED COORD → ⑤CONTRACT PIXELS → ⑪DETECT ACCURANCY → ⑫UPPER MENU

[Information about the recording of a reference image]

In order to record a reference image it is necessary to freeze the frame.
The specifications for the windows are as follows.

· In the case of a rectangular window

	Line type	Movement	Size	Minimum	Maximum
Reference image	Solid line	Units of 4 pixels	Units of 4 pixels	32×32 (pixels)	X × Y (X × Y=65536 pixels)
Search area	Dotted line	Units of 4 pixels	Units of 4 pixels	32×32 (pixels)	512 × 480 pixels

· In the case of a horizontal line

	Line type	Movement	Length	Minimum length	Maximum length
Reference image	Solid line	In a horizontal direction: units of 4 pixels In a vertical direction: units of 1 pixel	Units of 4 pixels	8 pixels	512 pixels
Search area	Dotted line				

· In the case of a vertical line

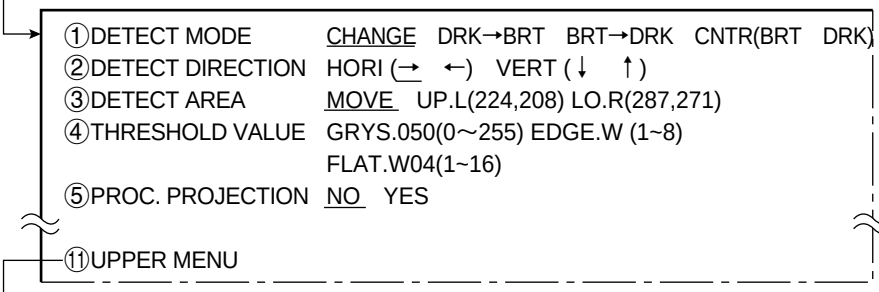
	Line type	Movement	Length	Minimum length	Maximum length
Reference image	Solid line	In a horizontal direction: units of 1 pixel In a vertical direction: units of 4 pixels	Units of 4 pixels	8 pixels	480 pixels
Search area	Dotted line				

When either a horizontal or a vertical line is selected please bear the following in mind.
The reference image must be shorter than the search area.

Return to the [MEASURING COND] (measurement condition) menu and select item ④ AUX.CONDITIONS (auxiliary condition).

Go to page 9·64

Continued from page 9·59: When the EDGE-DETECT (edge detection) starting point mode is selected as the START POINT COND (starting point conditions).

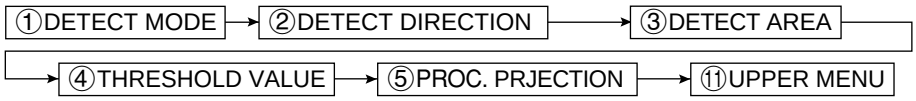


· You can switch between displaying all the headings together and displaying each one separately using the ESC key.

Menu	Setting details
①DETECT MODE (detection mode)	Select the detection mode. (Change point _┌ or ┐_ ; Dark to light ; _┌, Light to dark ; ┐_, Center (light or dark center))
②DETECT DIRECTION (detection direction)	Select the detection direction.
③DETECT AREA (area of detection)	Draw a dotted-line rectangle around the search area. · In order to enhance detection performance, make dimension Y as short as possible.
④THRESHOLD VALUE (threshold values)	Set the width of the edge (1 to 8) and the flat (1 to 16) as well as the difference in the light level (0 to 255).
⑤PROC. PROJECTION (artifact processing)	Select whether to employ artifact processing or not. ⇨For more information about artifact processing see page 9·12, “Artifact processing” using shared settings.
⑪UPPER MENU	This will return you to the [MEASURING COND] menu.

· For more information about the setting for edge detection see page 9·11, “Edge detection”, in shared settings.

[Setting sequence of the starting point conditions of edge detection]



[Information about setting the starting point conditions of edge detection]

In order to record a reference image it is necessary to freeze the frame.

· Specifications for the area of detection.

Line type	Movement	Size	Minimum	Maximum
Dotted line	Units of 1 pixel	Units of 1 pixel	0×0 pixels	512×480 pixels

Return to the [MEASURING COND] (measurement conditions) menu and select item ④ AUX.CONDITIONS (auxiliary condition).

Go to page 9·64

Continued from page 9·59: Setting the DST & AGL MES. (measurement of distance and angle) for GRAV. (center of gravity operations).

```
[MEASURING COND] (TYPE00-MEAS.1-DST&ANGL MEAS)
 ①START POINT COND        (TO NEXT SUB-MENU)
 ②AUX.CONDITIONS          (TO NEXT SUB-MENU)
 ③DISTANCE CONDITIONS     (TO NEXT SUB-MENU)
 ④ANGLE CONDITIONS        (TO NEXT SUB-MENU)
 ⑤UPPER MENU
```

Select item ① START POINT COND (starting point conditions)

```
①MEAS WINDOW TYPE  RECTANGLE  CIRCLE  ELLIPSE
②MEAS WINDOW POSIT MOVE  UP.L(224,208) LO.R(287,271)
③MASK WINDOW TYPE  NO  RECTANGLE  CIRCLE  ELLIPSE
④MASK WINDOW POSIT MOVE  UP.L(224,208) LO.R(287,271)
⑤THRESHOLD VALUE   U.LM−255  L.LM−100(0~255)
⑥INVERT B/W        NO  YES
⑦BINARY PROCESS    FIXED  THRSHOLD-ADJ (VAR-DIFF  VAR-RATE)
⑧BOUNDARY PROCESS  VALD  INVLD
⑨LABEL ORDER       SACN-ORDER  SIZE-ORDER
⑩IMAGE PRE-PROCESS OFF  SMOOTH  EDGE-EMPHASIS
                   ALL-EDGE  HORZ-EDGE  VERT-EDGE
⑪BINARY NOIS FILTR NO  EXP.→CONTR.  CONTR.→EXP.
⑫NUM. OF FILTR PASS EXPD.0(0~5) CONTR0(0~5)
⑬AREA FILTER       000000PIXEL LOWER LIMIT
⑭UPPER MENU
```

This is how the display looks when item ① MEAS WINDOW TYPE is set to RECTANGLE.

This is how the display looks when item ③ MASK WINDOW TYPE, is set to RECTANGLE.

· Item ④ will be displayed unless item ③ is set to NO.

Menu	Setting details
①MEAS WINDOW TYPE (measurement window)	Select measurement window type: RECTANGLE (rectangular), CIRCLE (circular) or ELLIPSE (elliptical).
②MEAS WINDOW POSIT (measurement window position)	Set the size and position of the window in units of 1 pixel. · If circle or ellipse is selected in item ①, then the two variables you must set are the center and diameter.
③MASK WINDOW TYPE	Decide whether a mask window will be employed and if so which type (rectangular, round or elliptical). · A mask window exists inside the boundary of the measurement window and screens out those parts of the image which are not needed for the measurement process.
④MASK WINDOW POSIT (mask window position)	Set the size and position of the mask window (which is drawn with a dotted line) using units of 1 pixel. · If a circle or an ellipse is selected in item ①, then the two variables you must set are the center and diameter. · The mask window can be set exceeding the measurement window.
⑤THRESHOLD VALUE	Set the upper and lower limits for binary conversion, within the range of 0 to 255. ⇨See page 9·7, Setting threshold values, in shared settings.
⑥INVERT B/W (black and white inversion)	Set the inversion of black and white in the image to YES or NO. · NO means the white area will be measured after the image has been converted to binary values. · YES means the black area will be measured after the image has been converted to binary values.
⑦BINARY PROCESS (binary conversion process)	Select either fixed or threshold value correction as the binary conversion processing method. (VAR-DIFF or VAR-RATE).⇨See methods for binary conversion in shared settings on page 9·8.
⑧BOUNDARY PROCESS (boundary processing)	Enable or disable boundary processing. ⇨See setting the window boundary in shared settings on page 9·7.
⑨LABEL ORDER	Select the labeling order. ⇨See labeling order in shared settings on page 9·8.
⑩IMAGE PRE-PROCESS	Select a method for pre-processing image data. ⇨See pre-processing in shared settings on page 9·9.

Continued on the following page

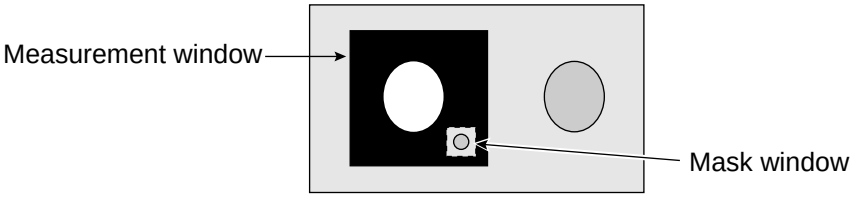
Continued from the previous page: Setting the DST &AGL MES. (measurement of distance and angle) for GRAV.(center of gravity operations).

⑪BINARY NOIS FILTR (eliminating binary noise)	Select a method for eliminating binary noise. ⇨See methods for eliminating noise from binary images, expansion/contraction and eliminating binary noise in shared settings on page 9·10.
⑫NUM. OF FILTR PASS (number of noise elimination cycles)	Set the number of times that the elimination of binary noise process is carried out (0 to 5). Set separately for expansion and contraction cycles.
⑬AREA FILTER	After object identification, the area filter is a function used to identify small islands whose area is less than a specified amount. It eliminates them from the object which is being measured. · Set the maximum number of pixels. Areas with fewer pixels will be ignored. Enter any number from 0 to 245760.
⑭UPPER MENU	This will return you to the [MEASURING COND] menu.

[Information about the window settings]

- In order to set a window it is necessary to freeze the frame.
- First freeze the frame. Then operate the camera normally. Finally, freeze the frame again. The first frozen image that was taken will be converted to binary values and this will be the final binary image.
  The second frozen image that was taken may also be converted to a binary image by repeating steps ① to ⑬ above.

[Example of recording]



- The binary image will be the contents of the measurement window, after the portion excluded by the mask window has been removed.

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Return to the [MEASURING COND] (measurement condition) menu and select item ② AUX CONDITIONS (auxiliary condition).

Continued on the next page

Continued from pages 9-60, 9-61 and 9-63: GRAY & EDGE, GRAV.

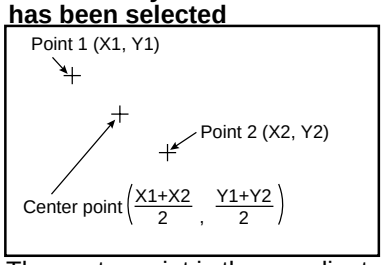
```
[AUX. CONDITIONS]  (TYPE00-MEAS.1-DST&ANGL MEAS)
 ①AUX.NO.          00(0~15)
 ②AUX.TYPE         NO MID-PNT PERIMETR C-GRAV LEG INTRSCT-PT
 ③POINT NO.1 :     ST-PNT00   AUX.NO
 ④POINT NO.2 :     ST-PNT00   AUX.NO
 ⑤POINT NO.3 :     ST-PNT00   AUX.NO
 ⑥UPPER MENU
```

Those settings already established for auxiliary points may also be used as measurement conditions.

- Items ③ and ④ will be displayed unless NO is selected in item ②.
- If either PERIMETR (center of circle) or C-GRAV (center of gravity) is selected in item ②, then item ⑤ will be displayed.

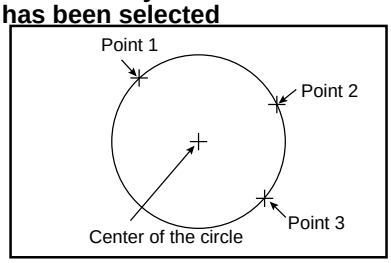
Auxiliary conditions	Setting details
①AUX.NO. (auxiliary number)	Set this to any number from 0 to 15.
②AUX. TYPE (auxiliary type)	Select from NO (none), MID-PNT (set 2 points), PERIMETR (set 3 points), C-GRAV (set 3 points), LEG (set 2 points), or INTRSCT-PT (set 2 points).
③POINT NO.1	If the starting point number (either the starting point number or the label number) is entered for points 1 to 3 (points 1 and 2 when MID-PNT, LEG, or INTRSCT-PT is selected) then the type of auxiliary that was selected in ② will be displayed next to each point.
④POINT NO.2	
⑤POINT NO.3	
⑥UPPER MENU	This will return you to the [MEASURING COND] menu.

The auxiliary when MID-PNT has been selected



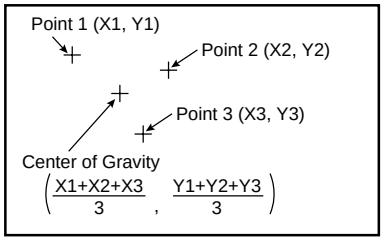
The center point is the coordinate half way between points 1 and 2.

The auxiliary when PERIMETR has been selected



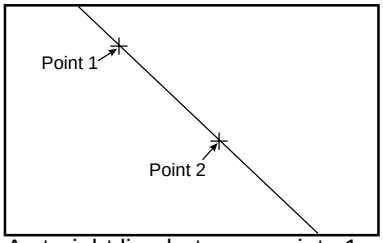
The center of the circle is the central coordinate of three points positioned on the circumference of the circle.

The auxiliary when C-GRAV has been selected



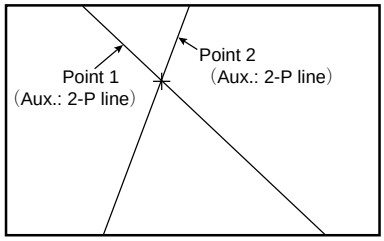
The center of gravity between points 1 to 3 is calculated as the mean of the three

The auxiliary when LEG has been selected



A straight line between points 1 and 2.

The auxiliary when INTRSCT-PT has been selected



Crosspoint of the two lines that were specified in "AUX.TYPE: LEG."

Return to the [MEASURING COND] (measurement conditions) menu and select item ⑤ DISTANCE COND (distance conditions) if the GRAY&EDGE is selected, and select item ③ DISTANCE CONDITIONS (distance conditions) if the GRAV (center of gravity) mode is selected.

Continued on the following page

Continued from the previous page: GRAY&EDGE, GRAV.

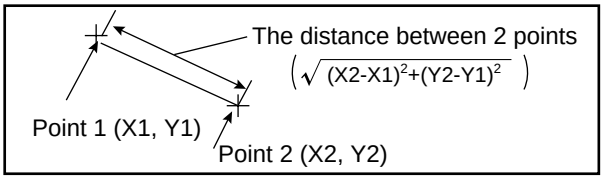
[DISTANCE SETTINGS] (TYPE00-MEAS.1-DST&ANGL MEAS)
①DISTANCE NUMBER 00(0~15)
②DISTANCE TYPE NO DIST-BETW-2PT DIST-BETW-X DIST-BETW-Y
③POINT NO.1 : ST-PNT00 AUX.NO
④POINT NO.2 : ST-PNT00 AUX.NO
⑤UPPER MENU

If auxiliary point settings have been made in the [AUX.CONDITIONS] (auxiliary condition) menu, then they may be used for the measurement conditions here.

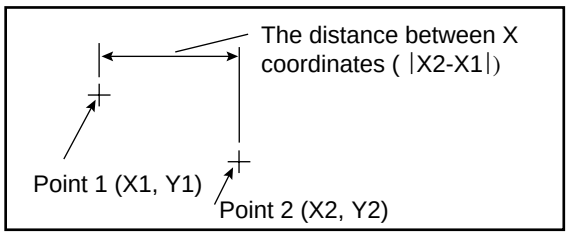
- Items ③ and ④ will be displayed if except NO is selected in item ②.

Distance settings	Setting details
①DISTANCE NUMBER (distance selection)	Set this to any number from 0 to 15.
②DISTANCE TYPE	Set the distance type to be the distance between two points, distance between X coordinates, or distance between Y coordinates.
③POINT NO.1	Enter the number (either the starting point number) or the auxiliary number for the starting point of the measurement distance between two points, that was specified in item ②.
④POINT NO.2	
⑤UPPER MENU	This will return you to the [MEASURING COND] menu.

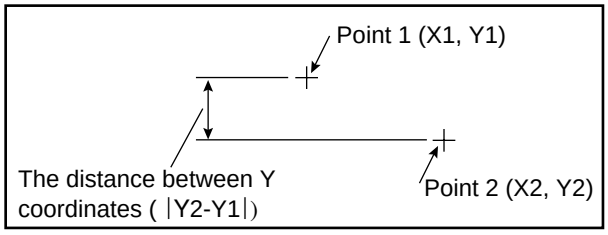
The distance type when distance between two points has been selected



The distance type when distance between X coordinates has been selected



The distance type when distance between Y coordinates has been selected



Return to the [MEASURING COND] (measurement conditions) menu and select item ⑥ ANGLE CONDITIONS if the GRAY&EDGE is selected, and select item ④ ANGLE CONDITIONS if the GRAV (center of gravity) mode is selected.

Continued on the following page

Continued from the previous page: GRAY&EDGE, GRAV.

[ANGLE SETTINGS] (TYPE00-MEAS.1-DST&ANGL MEAS)

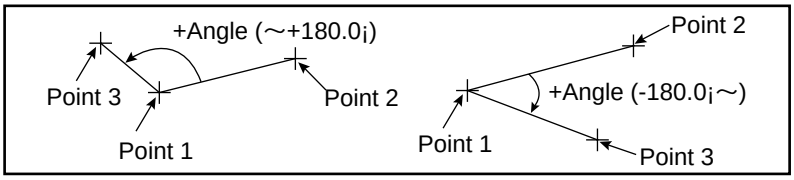
①ANGLE NO.	00(0~15)	
②ANGLE TYPE	NO 3PT-ANGL 2PT-ANGL(HORI VERT)	
③POINT NO.1 :	ST-PNT00	AUX.NO
④POINT NO.2 :	ST-PNT00	AUX.NO
⑤POINT NO.3 :	ST-PNT00	AUX.NO
⑥UPPER MENU		

If auxiliary point settings have been made in the [AUX.CONDITIONS] (auxiliary condition) menu, then they may be used for the measurement

Items ③ and ④ will be displayed unless NO is selected in item ②.
If 3PT-ANGL (3 point angle) is selected in item ②, then item ⑤ will be displayed.

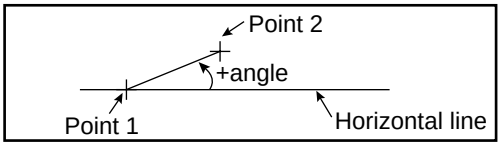
Angle settings	Setting details
①ANGLE NO.	Set the angle number to any number from 0 to 15
②ANGLE TYPE	Select either a 3-point angle (3 points of data are required) or a 2-point angle (horizontal and vertical).
③POINT NO.1	Enter the starting point number for the angle type to be measured, as specified in item ②.
④POINT NO.2	
⑤POINT NO.3	
⑥UPPER MENU	This will return you to the [MEASURING COND] menu.

Angle: When a 3 point angle is specified



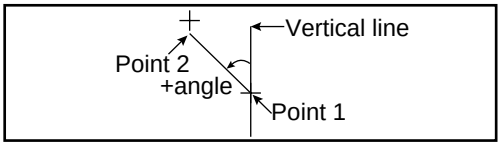
Point 1 is the point of intersection of the two lines. Relative to the line between points 1 and 2, the line between points 1 and 3 will be said to be at a positive angle if the angle is measured in a counterclockwise direction, and it will be at a negative angle if it is measured in a clockwise direction.

Angle: When a 2-point (horizontal) angle is specified



Relative to the horizontal line, the line from point 2 that intersects point 1 will be said to at a positive angle if the angle is measured in a counterclockwise direction and at a negative angle if it is measured in a clockwise direction.

Angle: When a 2-point (vertical) angle is specified

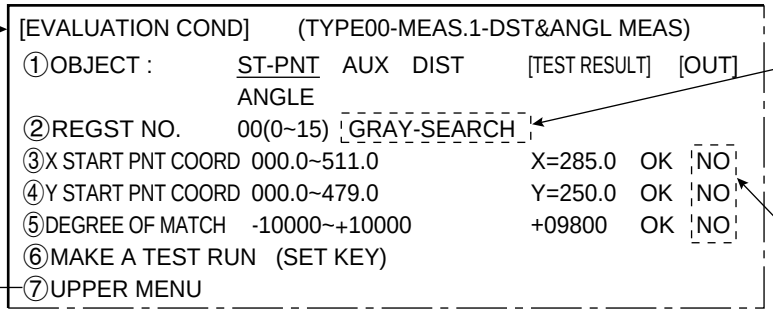


Relative to the vertical line, the line from point 2 that intersects point 1 will be said to at a positive angle if the angle is measured in a counterclockwise direction and at a negative angle if it is measured in a clockwise direction.

Return to the [MEASURING COND] (measurement conditions) menu and select item ⑦ UPPER MENU

Continued on the following page

Continued from the previous page: GRAY&EDGE, GRAV.

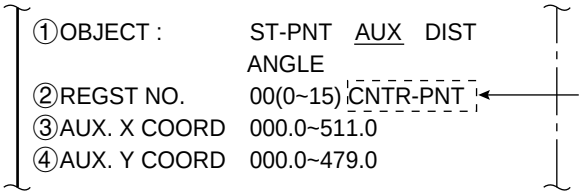


Alternatively, EDGE DETECT (tip of the edge) or GRAVITY (label center of gravity) may also be displayed here.

Use the up and down keys to select NO, Y0 to 7, or C000 to C127.

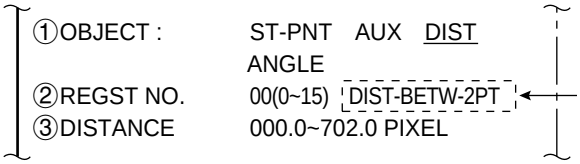
Evaluation conditions	Setting details
①OBJECT	Select the object for evaluation.
②REGST NO. (registration number)	Set this at any number from 0 to 15.
③ ④ ⑤	Enter the ranges that will produce an OK decision. The titles of items 3 to 5 will change, according to the settings in item ①. The example above shows the display when ①OBJECT: ST-PNT (starting point) has been selected. See below for the displays when other object settings are selected.
⑥MAKE A TEST RUN	Pressing the SET key will test the evaluation condition, display the test results.
⑦UPPER MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

①OBJECT: When AUX (auxiliary) is selected



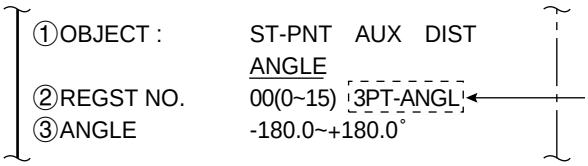
PERIMRTER (center of a circle), C-GRAV (center of gravity), LEG (lines on two points), INTRSCT-PT (crosspint over two lines) or NO (disabled) may also be displayed here.

①OBJECT: When DIST (distance) is selected



DIST-BETW-X, DIST -BETW-Y, NO may also be displayed here.

①OBJECT: When ANGLE is selected



2PT-ANGL(HORI) (2 point horizontal), 2PT-ANGL(VERT) (2 point vertical) or NO (disabled) may also be displayed here.

- Check your selection by testing the upper and lower limits for the evaluation that you have set. This can be done using item ⑥ MAKE A TEST RUN.
- For more information about evaluation conditions see section 9-2 [3] Evaluation conditions .

Return to the [TYPE00-MEAS1 to 3] and select item ⑧ NUMERIC CAL COND (numeric calculation condition).

Continued on the following page

Continued from the previous page: GRAY&EDGE, GRAV.

[NUMERIC CALC] (TYPE00-MEAS.1-DST&ANGL MEAS)
①CALC.RESULT N00(0~15)
②OBJECT TYPE NO MATCH[M] CORD[X Y] AUX[HX HY]
DIST[D] ANGL[B] NUM-CALC[NC] CNST[C]

③FORMULA REG.00(0~15) N00(0~15)
+ - */ ← → DEL. END
④UPPER&LOWER LIMIT +00000000.0~ +00000000.0
⑤OUTPUT NO Y0(0~7) C000(0~107)
⑥RUN A TEST (SET KEY)
⑦UPPER MENU

N00	[D]	00D	Y0
		+00000350.0~ +00000355.0 +00000352.0	OK
N01			
N02			
N03			

Numerical calculation	Setting details
①CALC.RESULT (calculation result)	Set the recording and display the results from arithmetical operation for specified output data at any value from 00 to 15.
②OBJECT TYPE (type)	Select the type of data being calculated.
③FORMULA	A number of formula settings are used. The first line will change according to the selection made in item ②.

Selection of ②	The first line of the display
The degree of match with the reference image [M] coordinates [XY], auxiliary [HX, HY], distance [D] and angle [B].	Record 00 (0 to 15) N00 (0 to 15)
Numerical calculations [NC]	ABS √ TAN ATAN N0 (0 to 15) (the second line will not be displayed)
Constant [C]	+00000000.0 (the second line will not be displayed)

Note: Please use a smaller number for the number of formulas at N (00 to 15) than that used for ① CALC. RESULT N (00 to 15).

④UPPER&LOWER LIMIT (upper and lower limits)	Set the upper and lower limits for decisions.
⑤OUTPUT	Set the output conditions for the results of calculations.
⑥RUN A TEST (make a test run)	Pressing the SET key will record the setting details as well as run a test.
⑦UPPER MENU	Returns you to the [TYPE00-MEAS1 to 3] menu.

- The number of formulas which can be set are dictated by the selections made in items ② and ③ as follows.

②OBJECT TYPE	Number of formulas
Degree of match [M]	00M to 15M
Coordinates [X][Y]	00X to 15X/00Y to 15Y
Auxiliary [HX/HY]	00HX to 15Hx/00HY to 15HY
Distance [D]	00D to 15D
Angle [B]	00B to 15B
Numerical calculation [NC]	ABS/√/TAN/ATAN (00 to 15)
Constant [C]	-99999999.9 to +99999999.9

The numbers ranging from 00 to 15 in front of the characters are registration numbers.

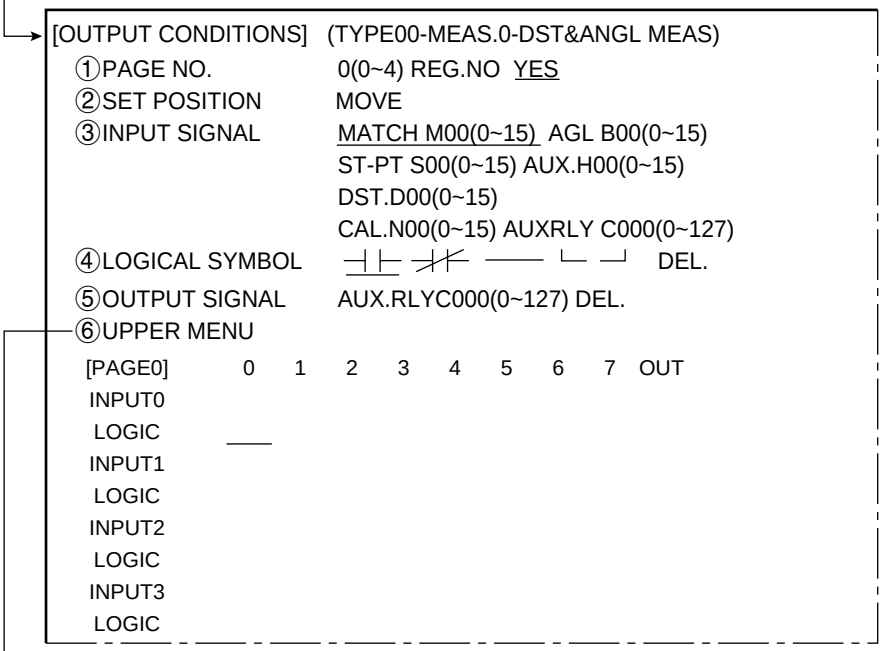
- For more information on numerical calculations see section 9-2 [4] Numerical calculations .

Note: You must run a test using item ⑥ RUN A TEST before making any calculations.

Return to the [TYPE00-MEAS1 to 3] and select item ⑨ OUTPUT CONDITIONS (output condition)

Continued on the following page

Continued from the previous page: GRAY&EDGE, GRAV.



- The input signals which may be set depend on the selection made at item ③ as follows.

Selection of ③	Input signals
Degree of match M	00M to 15M
Angle B	00B to 15B
Starting point S	00S to 15S
Auxiliary point H	00H to 15H
Distance D	00D to 15D
Calculation N	N00 to N15
Secondary relay C	C000 to C127

The numbers ranging from 00 to 15 in front of the characters are registration numbers.

- For more information on output conditions see the PC Function in Chapter 10.

Return to the MAIN OPS MENU

Continued on the following page

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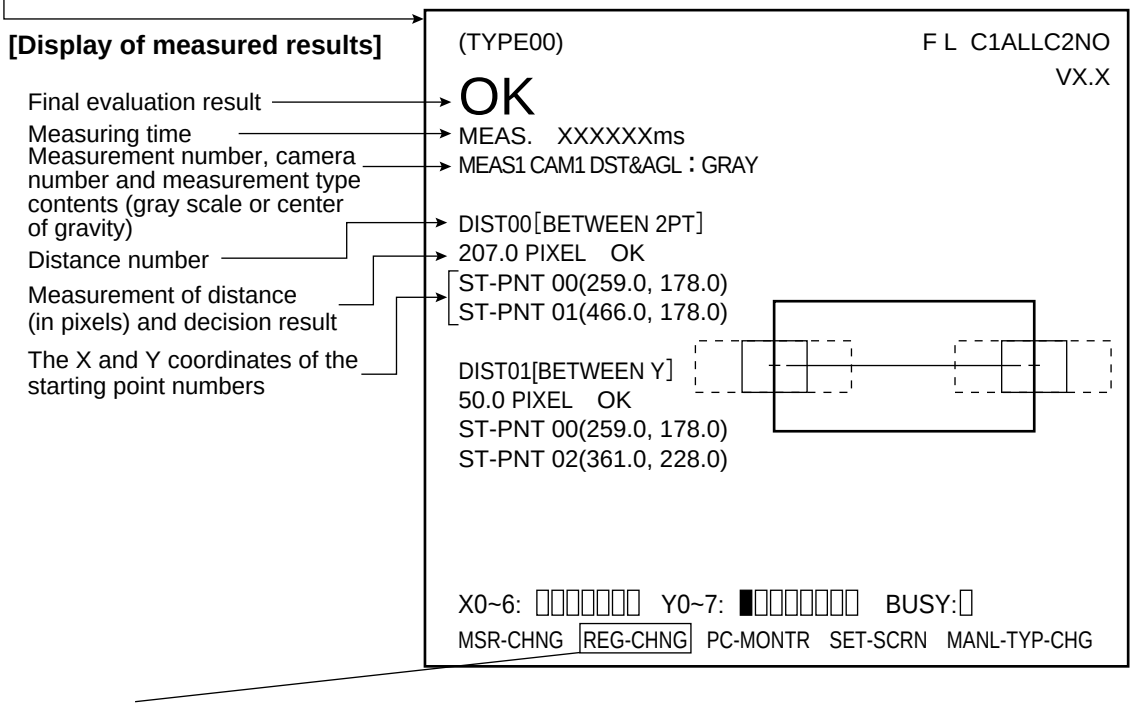
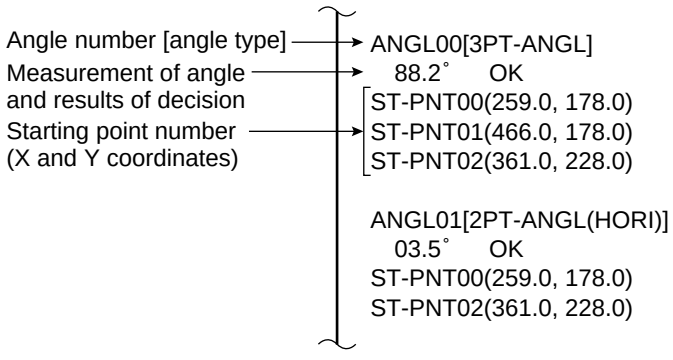
Pressing the TRG/BRT key will run a measurement of distance and angle after manually measuring the starting point.
Below is an example of the results display for a distance measurement.

[Display of measured results]

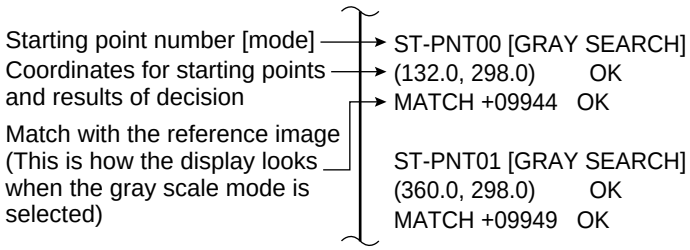


- By moving the cursor to REG-CHNG (change registration) and pressing the up key, it is possible to see the measurement results corresponding to other types of data which may be scrolled through in this order: distance number (00 to 15), angle number (00 to 15), starting point number (00 to 15), auxiliary point number (00 to 15) and then returning again to distance number (which is the type of data currently on the display in the illustration above). Pressing the down key in these situations will scroll backwards in the opposite order.
- Unregistered numbers will be skipped.
- When there are no recorded numbers (other than those currently on display), or if no measurement has actually been carried out, then it will not be possible to switch back and forth between data.
- The following are some examples of other displays.

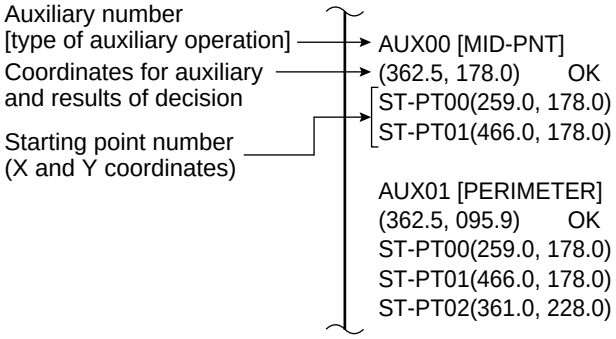
Example of the display of angle results



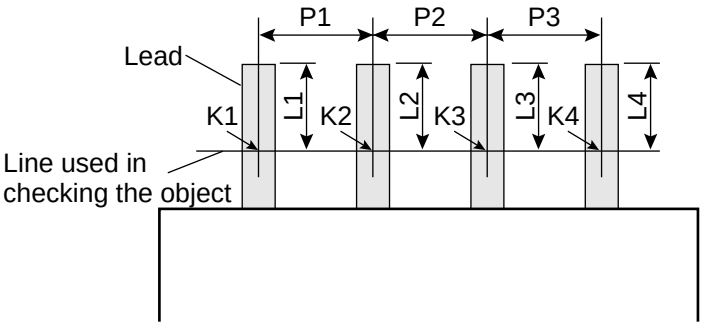
Example of the display of starting point results



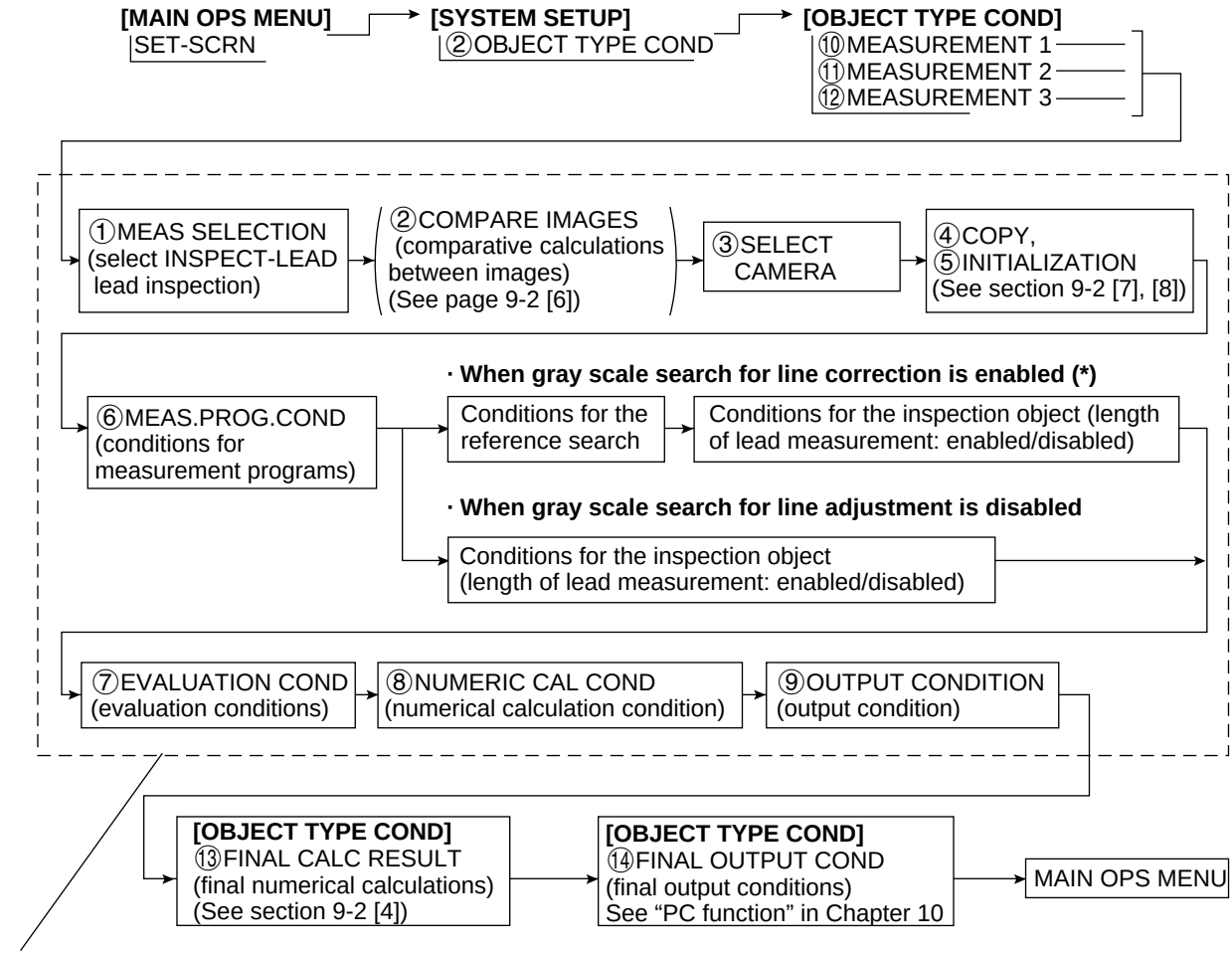
Example of the display of auxiliary results



9-6 Lead inspection

Purpose	Based on positional information obtained from the gray scale search function, inspect the condition of IC leads and connector pins. (No. of detected lead pins : Max. 128 pieces)
Application	Checks IC leads and packages for connectors.
Example	**[Check the alignment of things like IC leads and packages for connectors.]**  **[Lead inspection]** · P1 to P3: The distance between the center of 2 adjacent leads · K1 to K4: The center points of leads · L1 to L4: Length of lead · Number of leads · A lead with inadequate position **· Checking sequence** ① Determine the center points (K1 to K4) of those leads which are in a line to inspect. ② Check for any bending of leads that may have occurred by comparing the shortest and longest P measurements with variations in those measurements within the reference image. ③ Check the length of the leads, which is measured based the direction specified before, by comparing the shortest and longest L measurements against those within the reference image.

[1] Setting sequence



These settings are found in the [TYPE00-MEAS1 to 3] (object type measurement 1 to 3) menu.

* Gray scale search for line correction/enabled means that the position of the line will be adjusted according to positional deviation detected in a gray scale search.

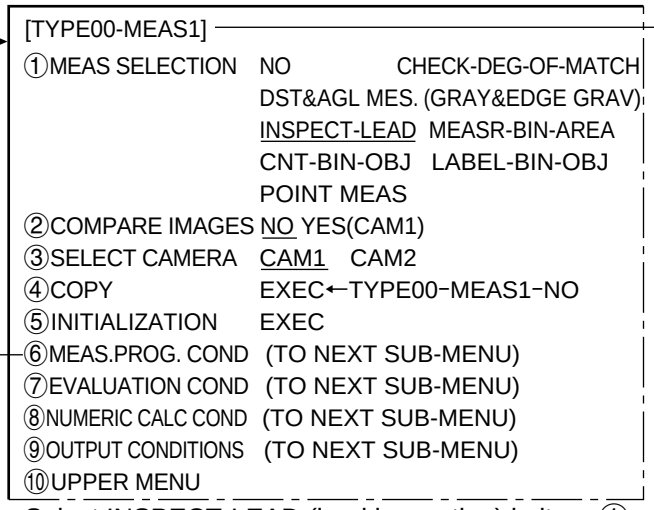
[2] Setting details

An explanation of item ⑥ MEAS.PROG.COND (condition for measurement programs) from the [TYPE-MEAS1 to 3] menu.

On the MAIN OPS MENU, move the cursor to SET-SCRN, and press SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of objrct type) and press SET key.

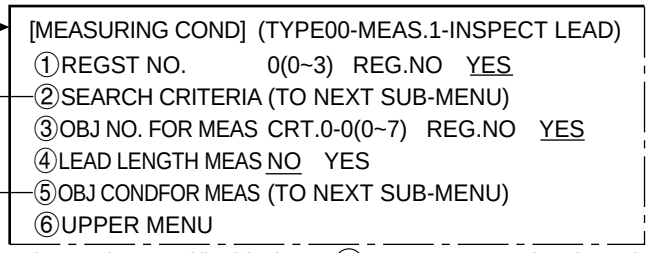
⇨Select item ⑩ MEASUREMENT 1 ⑪ MEASUREMENT 2, or ⑫ MEASUREMENT 3 on the [OBJECT TYPE COND] menu.



This is how the line looks when the object type is set to 00 and the selected measurement is 1.

- Select INSPECT-LEAD (lead inspection) in item ①.
- Item ② will be displayed unless NO is selected in item ⑧ SELECT CAMERA IMG (camera selection) which is in the [OBJECT TYPE COND] menu.

Select item ⑥ MEAS.PROG.COND (conditions for measurement programs).



- If YES is specified in item ① REGST NO. (registration number), then item ② will be displayed.
- If YES is specified in item ③ OBJ NO. FOR MEAS (object number), then items ④ and ⑤ will be displayed.

Measurement conditions	Setting details
①REGST NO. (registration number)	Enter number 0 to 3, and select NO or YES (disable/enable) of registration - If you want to enable the gray scale search for line correction, select YES in this line.
②SEARCH CRITERIA (criteria search conditions)	Set gray scale match, which will be reference search conditions, in the next menu - This setting is enabled when YES is selected in item ① above.
③OBJ NO.FOR MEAS (ID number for object to be measured)	Enter number 0 to 7 correspond to the object to be measured, and select NO or YES (enable/disable) registration. - If you enter 0 for CRT. (criteria number), it will correspond to registration number (0 to 3) entered in item ① above.
④LEAD LENGTH MEAS (lead length measurement)	Choice of NO/YES (disable/enable) lead length measurement.
⑤OBJ CONDFOR MEAS (conditions for object to be measured)	Set edge detection, which will be conditions for object to be measured, in the next menu. - This setting is enabled when YES is selected in item ③ above.
⑥UPPER MENU	This will return you to [TYPE00-MEAS1 to 3] menu.

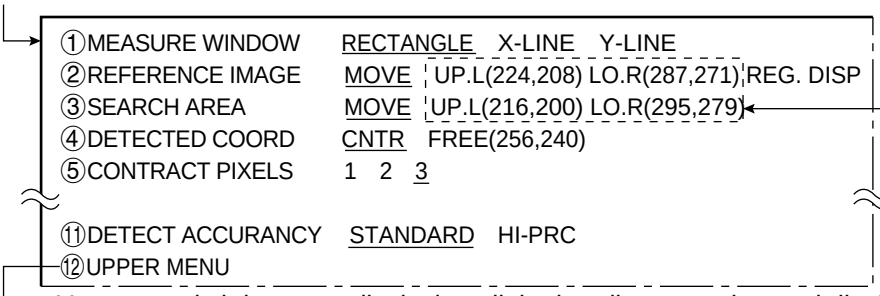
If you disabled the gray scale search for line correction, select item ⑤ OBJ CONDFOR MEAS (conditions for object to be measured).

Go to page 9-76

If you enabled to gray scale search for line correction, select item ② SEARCH CRITERIA (conditions for criteria search).

Continued on the following page

From the previous page: When gray scale search for line correction is enabled, then select the ② SEARCH CRITERIA (conditions for criteria search).



· You can switch between displaying all the headings together and displaying each one separately using the ESC key.

Menu	Setting details
①MEASURE WINDOW (measurement window)	Select the shape of the measurement window.
②REFFERENCE IMAGE	Record a reference image and then set the search area. · If X-LINE (horizontal line) or Y-LINE (vertical line) is selected, then the UP.L (upper left) LO.R (lower right) choices in the screen above will be ST-PNT (starting point) and E-PNT (end point).
③SEARCH AREA	
④DETECTED COORD (detection coordinates)	Set the position of the cursor inside the measurement window. · If FREE is selected, then the cursor may be positioned as desired.
⑤CONTRACT PIXELS (pixel contraction)	Set the number of pixel contractions. ⇨See page 9·6 gray scale processing, using shared settings. · When either a X-LINE (horizontal)or a Y-LINE (vertical) line are selected in item ①, the choices here will be 1 or 2.
⑪DETECT ACCURACY (detection accuracy)	Select the level of precision used for detection. ⇨See page 9·6 gray scale processing, using shared settings.
⑫UPPER MENU	This will return you to the [MEASURING COND] menu.

[The setting sequence of the starting point criteria in a gray scale search.]

①MEASURE WINDOW → ②REFERENCE IMAGE → ③SEARCH AREA → ④DETECTED COORD → ⑤CONTRACT PIXELS → ⑪DETECT ACCURACY → ⑫UPPER MENU

[Information about the recording of a reference image]

In order to record a reference image it is necessary to freeze the frame.
The specifications for the windows are as follows.

· In the case of a rectangular window

	Line type	Movement	Size	Minimum	Maximum
Reference image	Solid line	Units of 4 pixels	Units of 4 pixels	32×32 (pixels)	XXY (XXY=65536 pixels)
Search area	Dotted line	Units of 4 pixels	Units of 4 pixels	32×32 (pixels)	512×480 pixels

· In the case of a horizontal line

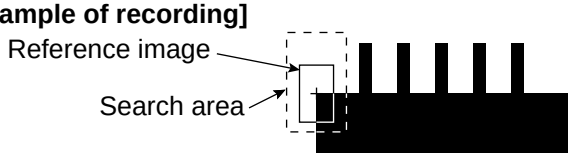
	Line type	Movement	Length	Minimum length	Maximum length
Reference image	Solid line	In a horizontal direction: units of 4 pixels In a vertical direction: units of 1 pixel	Units of 4 pixels	8 pixels	512 pixels
Search area	Dotted line				

· In the case of a vertical line

	Line type	Movement	Length	Minimum length	Maximum length
Reference image	Solid line	In a horizontal direction: units of 1 pixel In a vertical direction: units of 4 pixels	Units of 4 pixels	8 pixels	480 pixels
Search area	Dotted line				

When either a horizontal or a vertical line is selected please bear the following in mind.
The reference image must be shorter than the search area.

[Example of recording]



· The measurement window is set to BOX (rectangular).

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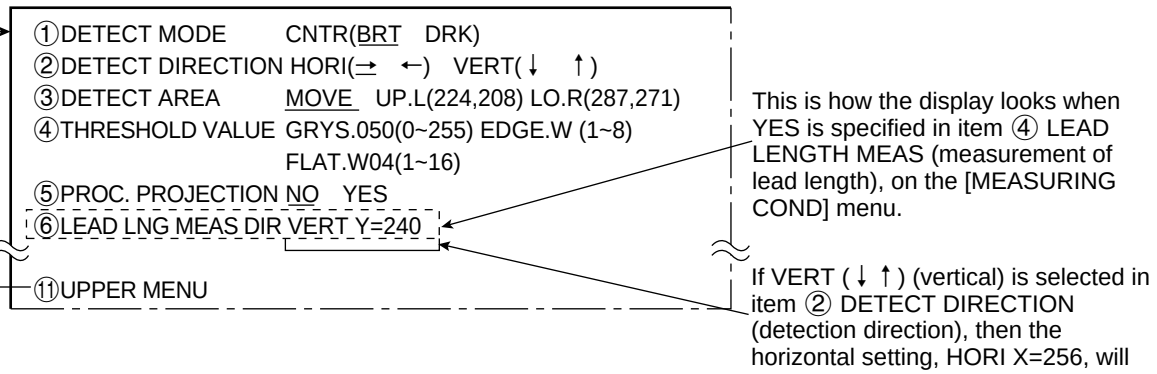
Return to the [MEASURING COND] menu and select item ⑤ OBJ CONDFOR MEAS (conditions for objects to be measured)

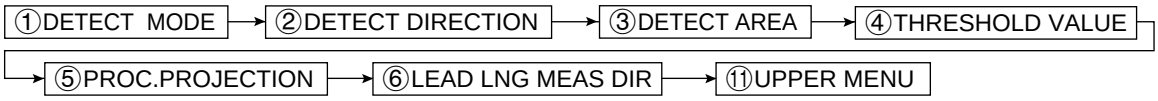
Continued from page 9·74: Select OBJ CONDFOR MEAS (conditions for objects to be measured).



· You can switch between displaying all of the headings together and displaying each one separately using the ESC key.

Menu	Setting details
①DETECT MODE (detection mode)	Set the detection mode to BRT or DRK (center bright or center dark).
②DETECT DIRECTION (detection direction)	Select the detection direction.
③DETECT AREA (area of detection)	Draw a dotted-line rectangle around the search area. In order to enhance detection performance, make the Y dimension as short as possible.
④THRESHOLD VALUE (threshold values)	Set the width of the edge (1 to 8) and the flat (1 to 16), as well as the difference in the light level (0 to 255).
⑤PROC.PROJECTION (artifact processing)	Select whether to employ artifact processing or not. ⇨For more information about artifact processing see page 9·12 "Artifact processing", using shared settings.
⑥LEAD LNG MEAS DIR (direction of lead length measurement)	When the measurement of lead length item is set to YES, set the direction in which the measurement will take place.
⑪UPPER MENU	This will return you to the [MEASURING COND] menu.

[Setting sequence of the conditions for objects to be measured of edge detection.]



[Information about setting the conditions for objects to be measured]

In order to record a reference image it is necessary to freeze the frame.

· Specifications for the area of detection.

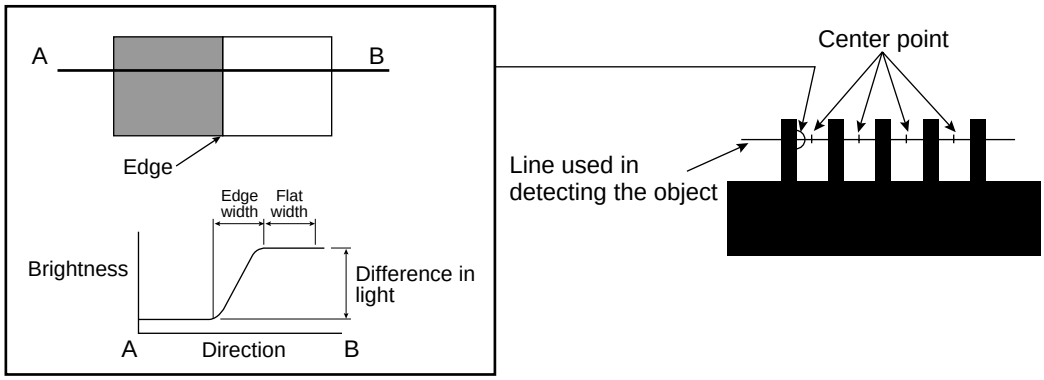
Line type	Movement	Size	Minimum	Maximum
Dotted line	Units of 1 pixel	Units of 1 pixel	0×0 pixels	512×480 pixels

Continued on the following page

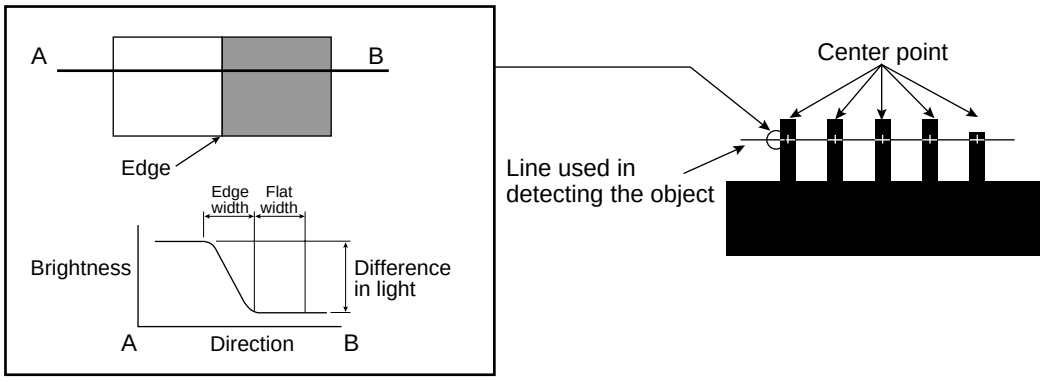
Continued from the previous page

[Examples of settings]

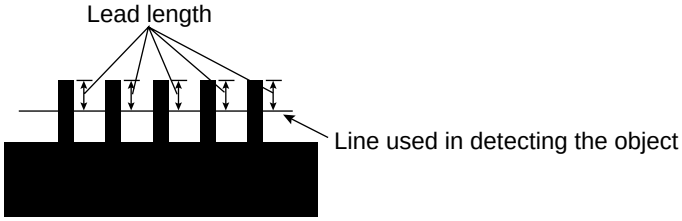
Example when ① DETECT MODE (detection mode) is set to CNTR (BRT) (center bright) or and ② DETECT DIRECTION (detection direction) is set to HORI (horizontal).



Example when ① DETECT MODE (detection mode) is set to CNTR (DRK) (center dark) and ②DETECT DIRECTION (detection direction) is set to HORI (horizontal).



Example when ⑥ LEAD LNG MEAS DIR (measurement direction of lead length) is set to VERT (vertical) and ② DETECT DIRECTION (detection direction) is set to VERT (↑) (vertical).



- If the position of the line used in to detect the object is out of position relative to the reference point, then it is adjusted accordingly.
- If this correction is unnecessary, then set ① REGST NO. (registration number) to REG.NO (disable registration) which is in the [MEASURING COND] (measurement condition) menu. (see page 9-74).

Return to the [MEASURING COND] menu and select ⑥ UPPER MENU.

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Select item ⑦ EVALUATION COND (evaluation conditions) on the [TYPE00-MEAS1 to 3] menu

[EVALUATION COND] (TYPE00-MEAS.1-INSPECT LEAD)

		[TEST RESULT]		[OUT]
①REGST NO.	0(0~3)			
②X COORD	000.0～=˜511.0	000.0	OK	NO
③Y COORD	000.0~479.0	000.0	OK	NO
④MATCH	-10000~+10000	+10000	OK	NO
⑤MEAS OBJ	CRT.0-0(0~7)			
⑥NUMBER	000~128	003	OK	NO
⑦DISTANCE	000.0~702.0	050.0	OK	NO
		048.0		
⑧L.LNGTH	000.0~702.0	100.0	OK	NO
		097.0		

⑨MAKE A TEST RUN (SET KEY)

⑩UPPER MENU

These displays can be set using the up and down keys. (The choices are NO, Y0 to 7, C000 to C127)

Maximum distance

Minimum distance

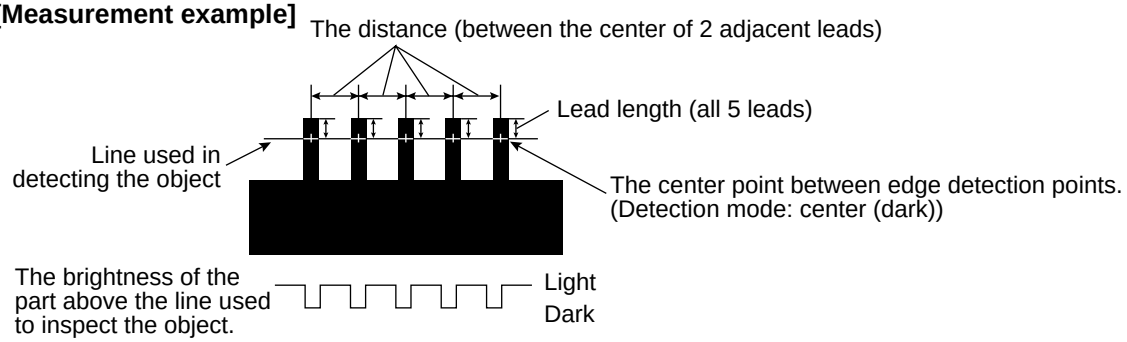
Items ② to ④ and ⑥ to ⑧ will not be displayed if the setting at items ① and ⑤ is REG.NO (disable registration) on the [MEASURING COND] (mesurement condition) menu.

Evaluation conditions	Setting details
①REGST NO. (registration number)	Enter 0 to 3. · Corresponds to the registration number entered in item ① REGST NO. (registration number) in the [MEASURING COND] menu.
②X COORD (X coordinates)	Set the range that will produce an OK evaluation for the X and Y coordinates in the reference image. These coordinates are set in the SEARCH CRITERIA (reference search conditions) item on the [MEASURING COND] menu.
③Y COORD (Y coordinates)	
④MATCH (degree of match with the reference Image)	Set the range that will produce an OK evaluation for the degree of match with the reference image.
⑤MEAS OBJ (measurement object)	Enter the measurement object number for the object being evaluated. · Corresponds to the ③ OBJ NO. FOR MEAS (measurement object number) on the [MEASURING COND] menu.
⑥NUMBER (number of objects)	Set the number of objects (from 0 to 128) that can exist between the edge detection points and still produce an OK evaluation.
⑦DISTANCE (distance between edge centers)	Set the range of distances (from 0 to 702.0) between edge detection points that will produce an OK evaluation. · The longest and shortest distances will be displayed in the test results.
⑧L.LNGTH (lead length)	Set the range of lead lengths (from 0 to 702.0) that will produce an OK evaluation. · The longest and shortest distances will be displayed in the test results.
⑨MAKE A TEST RUN	Pressing the SET key will record the settings details as well as run a test.
⑩PRIOR MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

· Check your selection by testing the upper and lower limits for the evaluations that you have set. This can be done using item ⑨ MAKE A TEST RUN.

· For more information about evaluation conditions, see section 9-2 [3] Evaluation conditions.

[Measurement example]



Even if only one measurement of the distance between the center points of 2 adjacent leads (as shown above) falls outside the range of the upper and lower limits specified, it will result in an NG evaluation.

Return to the [TYPE00-MEAS1 to 3] menu and select item ⑧ NUMERIC CALC COND (numerical calculation conditions).

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[NUMERIC CALC] (TYPE00-MEAS.1-INSPECT LEAD)
①CALC. RESULT N00(0~15)
②OBJECT TYPE NO MATCH[M] CORD[X Y] QTY[K]
MAX.DIST[MXD] MIN.DIST[MND]
MAX-L.LENG[MXL] MIN-L.LENG[MNL]
NUM-CALC[NC] CNST[C]
③FORMULA REG.0(0~3) MES-OBJ.0(0~7) N00(0~15)
+ - * / ← → DEL. END
④UPPER&LOWER LIMIT +00000000.0~ +00000000.0
⑤OUTPUT NO Y0(0~7) C000(0~107)
⑥RUN A TEST (SET KEY)
⑦UPPER MENU

N00	[MXD]	0MXD0	Y0
		+00000050.0~ +00000052.0 +00000051.0	OK
N01			
N02			
N03			

Numerical calculation	Setting details
①CALC.RESULT (calculation result)	Set the recording and display the results from arithmetical operation for specified output data at any value from 00 to 15.
②OBJECT TYPE	Select the type of data being calculated.
③FORMULA	A number of formula settings are used. The first line will change according to the selection made in item ②. **Selection of ② / The first line of the display** The degree of match with the reference image [M] coordinates [XY] / Record 0 (0 to 3) N0 (0 to 15) Number of objects [K], maximum distance [MXD], minimum distance [MND], maximum lead length [MXL] and minimum lead length [MNL] / Record 0 (0 to 3) Object to be measured 0 (0 to 7) N0 (0 to 15) Numerical calculations [NC] / ABS √ TAN ATAN N00 (0 to 15) (the second line will not be displayed) Constant [C] / +00000000.0 (the second line will not be displayed) Note: Please use a smaller number for the number of formulas at N (00 to 15) than that used for ① CALC. RESULT N (00 to 15).
④UPPER&LOWER.LIMIT	Set the upper and lower limits for decisions.
⑤OUTPUT	Set the output conditions for the results of calculations.
⑥RUN A TEST (make a test run)	Pressing the SET key will record the settings details as well as run a test.
⑦UPPER MENU	Returns you to the [TYPE00-MEAS1 to 3] menu.

· The number of formulas which can be set are dictated by the selections made in items ② and ③ as follows.

②FORMULA	Number of formulas
Degree of match [M]/ Coordinates [X]/[Y]	0M to 3M/0X to 3X/0Y to 3Y
Number of objects [K]/maximum distance [MXD]/minimum distance [MND]	0K0 to 3K7/0MXD0 to 3MXD7/ 0MND0 to 3MND7
Maximum lead length [MXL]/minimum lead length [MNL]	0MXL0~3MXL7/0MNL0~3MNL7
Numerical calculation [NC]	ABS/√/TAN/ATAN (00 to 15)
Constant [C]	-99999999.9 to +99999999.9

The numbers ranging from 0 to 3 in front of the characters are registration numbers. The numbers ranging from 0 to 7 after the characters are numbers for the object to be measured.

· For more information on numerical calculations see section 9-2 [4] Numerical calculations.

Note: You must run a test using item ⑥ RUN A TEST before making any calculations.

Return to the [TYPE00-MEAS1 to 3] and select item ⑨ OUTPUT CONDITIONS

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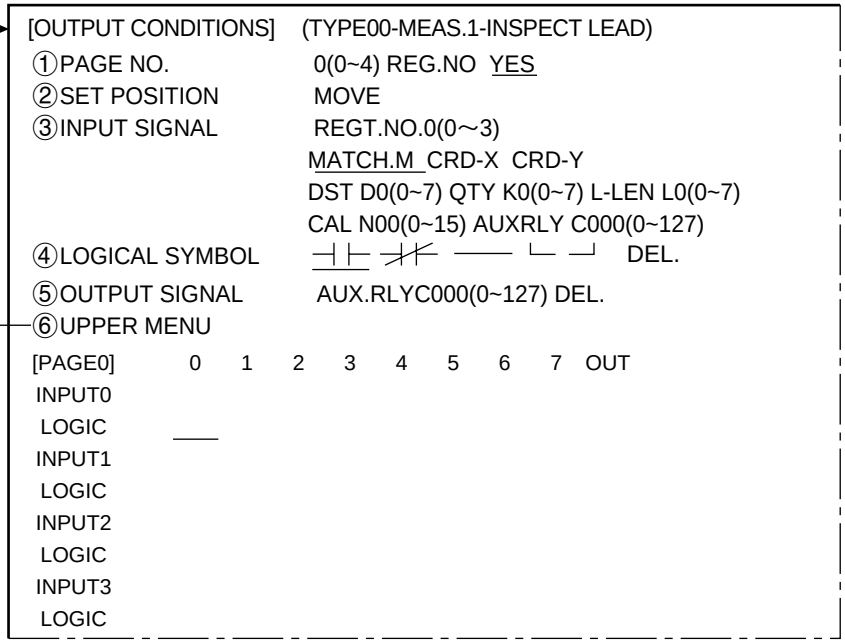

· The input signals which may be set depend on the selection at item ③ as follows.

Selection of ③	Input signals
Degree of match M	0M to 3M
Coordinate X	0X to 3X
Coordinate Y	0Y to 3Y
Distance D	0D0 to 3C7
Number of objects K	0K0 to 3K7
Lead length L	0L0 to 3L7
Calculation N	N00 to N15
Secondary relay C	C000 to C12

The numbers ranging from 0 to 3 in front of the characters are registration numbers.
The numbers ranging from 0 to 7 after the characters are numbers for the object to be mesured.

· For more information on output conditions see the "PC Function," in Chapter 10.

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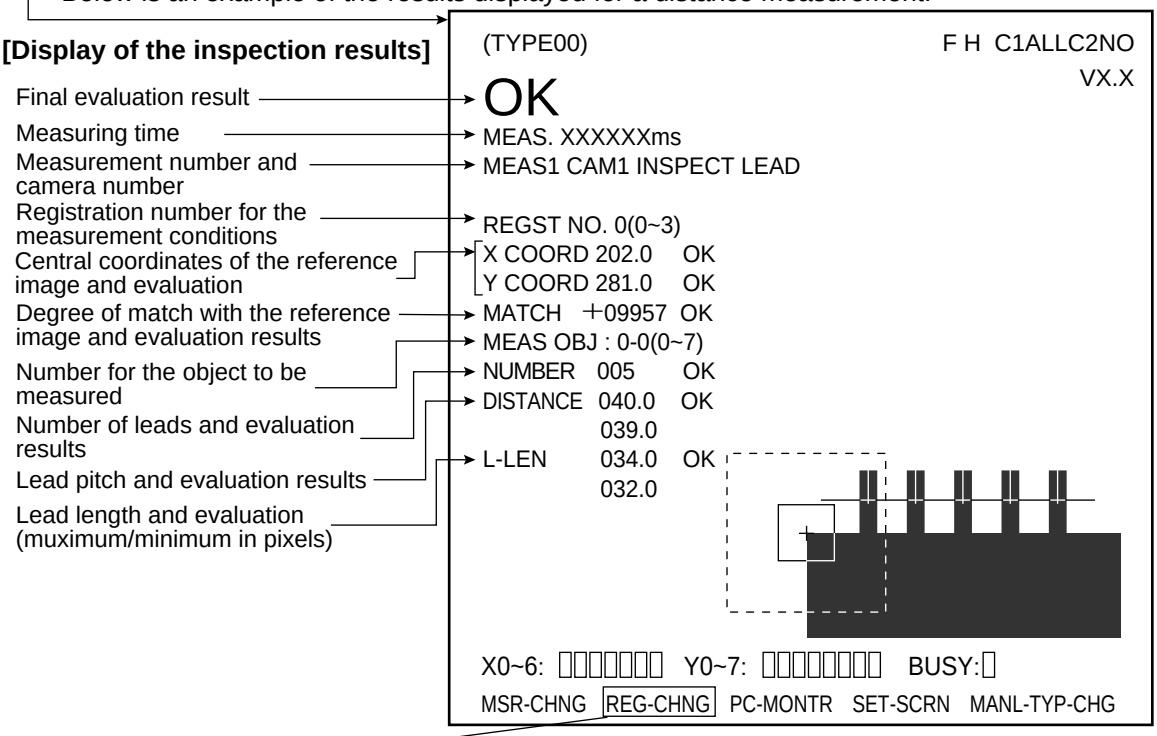
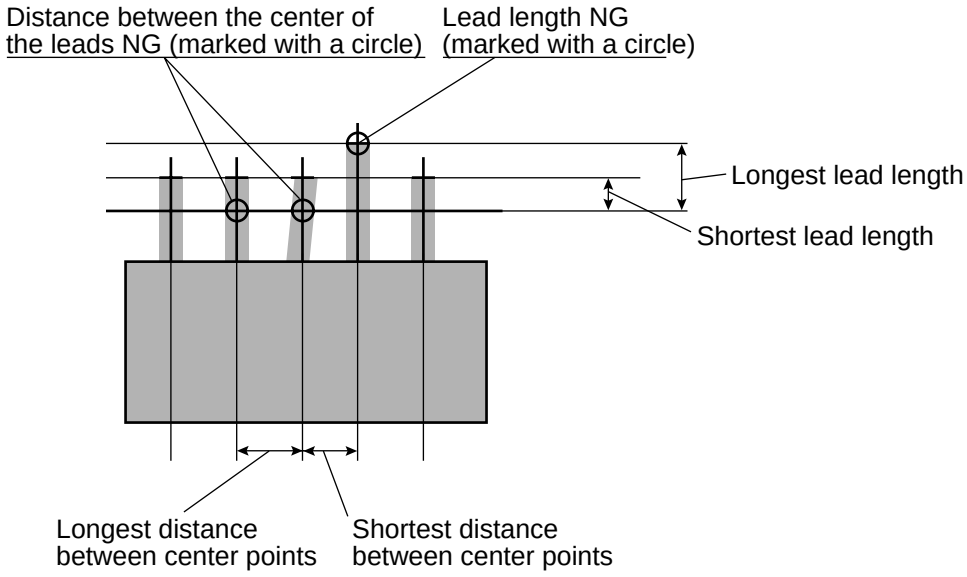
Pressing the TRG/BRT key will measure the distance and angle after manually measuring the starting point.
Below is an example of the results displayed for a distance measurement.

[Display of the inspection results]

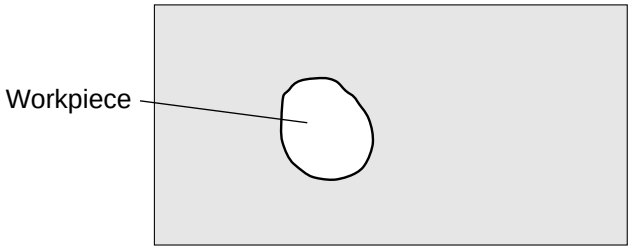


- By moving the cursor to REG-CHNG (change registration) and pressing the up key, you can see the inspection results corresponding to the registration number (the first number) and the number of the object to be measured (the second number), then the results of the numerical calculations. All of these may be scrolled through in this order: 0 (0-0→0-7) 1 (1-0→1-7) 2 (2-0→2-7) 3(3-0→3-7) N00 to N15. 0-0 is the number on display in the above illustration. Pressing the down key in these situations will scroll backwards through the results.
- Unregistered numbers will be skipped.
- When there are no recorded numbers (other than those currently on the display), or if no measurement has actually been carried out, then it will not be possible to switch back and forth between data.
- When a distance or a lead length results in an NG evaluation, the point in the image will be marked with a circle.

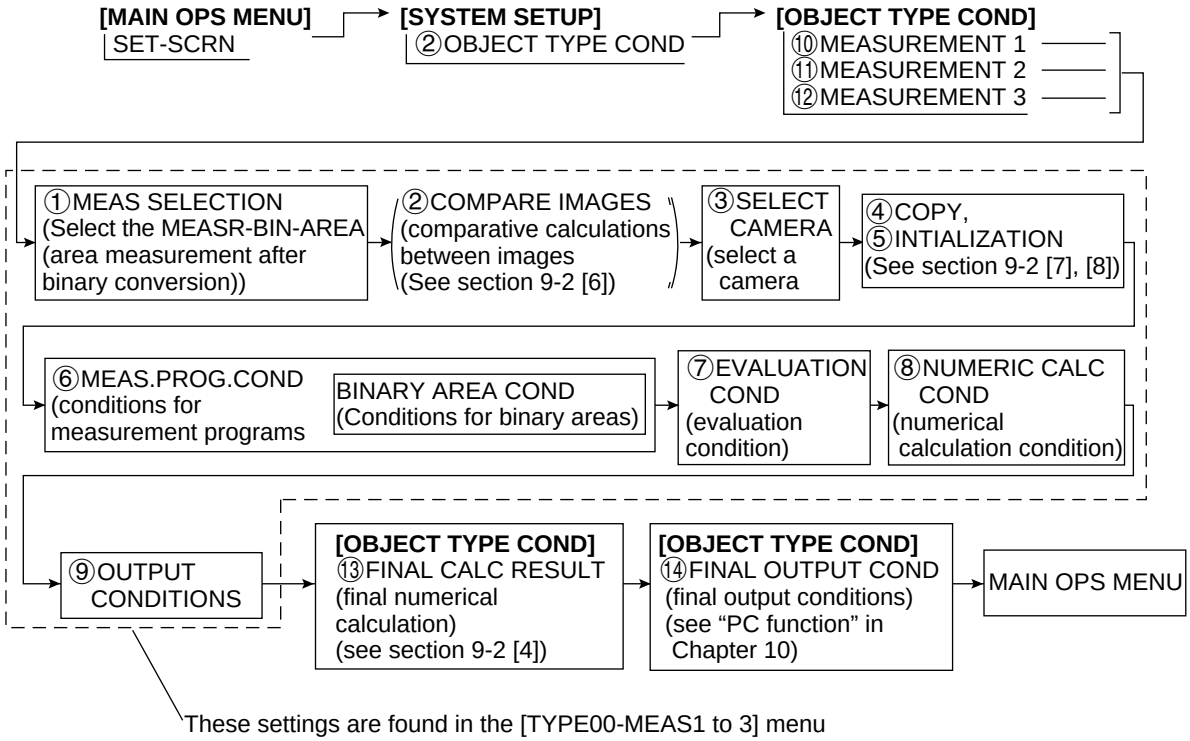
Example of the display:



9-7 Area measurement by binary conversion

Purpose	This function is used to determine the existence and or size of a workpiece when the workpiece is in one place or when it has a fixed measurement position. - This function measures the area of the white field after the image has been converted to binary values (i.e. black and white).
Application	Checking for correctly inserted ball bearings, preventing foreign objects from becoming mixed in with parts being processed, distinguishing between different types of waterproof lids, checking the existence of labels on packages, checking the printing on electric cables, checking for adequate coatings of grease and checking the existence of frozen foods.
Example	 **[Measured result]** - The area of the workpiece **- Checking sequence** Taking an image → Convert it to binary → Measure (area)

[1] Setting sequence



[2] Setting details

An explanation of item ⑥ MEAS.PROG.COND (conditions for measurement programs) in the [TYPE00-MEAS1 to 3] menu.

⇨On the [SYSTEM SETUP menu] move the cursor to ② OBJECT TYPE COND (conditions of object type and press the SET key.

⇨Go to item ⑩ MEASUREMENT 1, item ⑪ MEASUREMENT 2 or, item ⑫ MEASUREMENT 3 on the [OBJECT TYPE COND] menu and press the SET key.

```
[TYPE00-MEAS1]
①MEAS SELECTION   NO            CHECK-DEG-OF-MATCH
                  DST&AGL MES. (GRAY&EDGE GRAV)
                  INSPECT-LEAD  MEASR-BIN-AREA
                  CNT-BIN-OBJ   LABEL-BIN-OBJ
                  POINT MEAS
②COMPARE IMAGES   NO YES(CAM1)
③SELECT CAMERA    CAM1   CAM2
④COPY             EXEC←TYPE00−MEAS1−NO
⑤INITIALIZATION   EXEC
⑥MEAS.PROG. COND  (TO NEXT SUB-MENU)
⑦EVALUATION COND  (TO NEXT SUB-MENU)
⑧NUMERIC CALC COND (TO NEXT SUB-MENU)
⑨OUTPUT CONDITIONS (TO NEXT SUB-MENU)
⑩UPPER MENU
```

This is how the line looks when the object type is set to 00 and the selected measurement is 1.

- In item ①, select MEASR-BIN-AREA (measure the area of binary images).
- Item ② will be displayed unless NO is selected in item ⑧ SELECT CAMERA IMG (camera selection) which is in the [OBJECT TYPE COND] menu.

Select item ⑥ MEAS.PROG.COND (conditions for measurement programs).

```
[MEASURING COND]  (TYPE00-MEAS.1-MEAS-BIN-AREA)
 ①REGST NO.          00(0~15)  REG.NO   YES
 ②BINARY AREA COND (TO NEXT SUB-MENU)
 ③UPPER MENU
```

- If YES is specified in item ① REGST NO. (registration number), then item ② will be displayed.

Measurement conditions	Setting details
①REGST NO. (registration number)	Set this to any number from 0 to 15 and select NO or YES to store it.
②BINARY AREA COND (conditions for binary areas)	The condition for binary areas are set on the next menu.
③UPPER MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

Select item ② BINARY AREA COND (conditions for binary areas).

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```
①MEAS WINDOW TYPE RECTANGLE  CIRCLE  ELLIPSE
②MEAS WINDOW POSIT MOVE  UP.L(224,208) LO.R(287,271)
③MASK WINDOW TYPE NO  RECTANGLE  CIRCLE  ELLIPSE
④MASK WINDOW POSIT MOVE  UP.L(224,208) LO.R(287,271)
⑤THRESHOLD VALUE U.LM−255  L.LM−100(0~255)
⑥INVERT B/W       NO  YES
⑦BINARY PROCESS   FIXED  THRSHOLD-ADJ (VAR-DIFF  VAR-RATE)
⑧IMAGE PRE-PROCESS OFF  SMOOTH  EDGE-EMPHASIS
                   ALL-EDGE  HORZ-EDGE  VERT-EDGE
⑨BINARY NOIS FILTR NO  EXP.→CONTR.  CONTR.→EXP.
⑩NUM. OF FILTR PASS EXPD.0(0~5) CONTR0(0~5)
⑪UPPER MENU
```

This is how the display looks when item ① MEAS WINDOW TYPE (measuring window) is set to RECTANGLE.

This is how the display looks when item ③ MASK WINDOW TYPE (shape of mask window) is set to RECTANGLE.

· Item ④ will be displayed unless item ③ is set to NO.

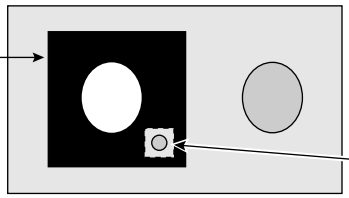
Menu	Setting details
①MEAS WINDOW TYPE (measuring window)	Select the measuring window type: RECTANGLE (rectangular), CIRCLE (circular) or ELLPSE (elliptical).
②MEAS WINDOW POSIT	Set the size and position of the window in units of 1 pixel. · If a circle or ellipse is selected in item ①, then the two variables you need to set are the center and diameter.
③MASK WINDOW TYPE	Decide whether a mask window will be employed and if so which type (rectangular/round or elliptical). · A mask window exists inside the boundary of the measurement window and screens out those parts of the image which are not needed in the measurement process.
④MASK WINOW POSIT (mask window position)	Set the size and position of the mask window (which is drown with a dotted line) using units of 1 pixel. · If a circle or ellipse is selected in item ①, then the two variables you need to set are the center and diameter. · The mask window can be set exceeding the measurement window.
⑤THRESHOLD VALUE	Set the upper and lower limits for binary conversion within the range of 0 to 255. ⇨See “threshold setting” in shared settings on page 9·7.
⑥INVERT B/W (black and white inversion)	Select whether to invert the black and white in the image: YES or NO. · NO means the white area will be measured after the image has been converted to binary values. · YES means the black area will be measured after the image has been converted to binary values.
⑦BINARY PROCESS (binary conversion)	Select either fixed or threshold value correction as the binary conversion processing method. ⇨See methods for binary conversion in shared settings on page 9·8.
⑧IMAGE-PRE-PROCESS (image pre-processing)	Select a method for pre-processing image data. ⇨See pre-processing in shared settings on page 9·9.
⑨BINARY NOIS FILTR (eliminating binary noise)	Select a method for eliminating binary noise. ⇨See methods for eliminating noise from binary images, expansion/contraction and eliminating binary noise in shared settings on page 9·10.
⑩NUM.OF FILTR PASS (The number of noise elimination cycles)	Set the number of cycles that the binary noise elimination process will be carried out (0 to 5). Set number of times for expansion and contraction, separately.
⑪UPPER MENU	This will return you to the [MEASURING COND] menu.

[Information about the window settings]

· In order to set a window it is necessary to freeze the frame.

· First freeze the frame. Then operate the camera normally. Finally, freeze the frame again. The first frozen image that was taken will be converted to binary values and this will be the final binary image.
The second frozen image that was taken may also be converted to a binary image by repeating steps ① to ⑩ above

[Example of recording]



· The binary image will be the contents of the measurement window, after the portion excluded by the mask window has been removed.

Return to the [MEASURING COND] menu and select item ③ UPPER MENU.

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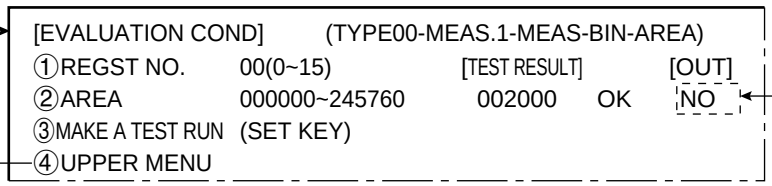
Select item ⑦ EVALUATION COND (evaluation condition) on the [TYPE00-MEAS 1 to 3] menu.



These displays can be set using the up and down keys. (The choices are NO, Y0 to 7, C000 to C127)

Items ② and ③ will be displayed if the REGST NO. (registration number) is set to YES on the [MEASURING COND] menu.

Evaluation conditions	Setting details
①REGST NO. (registration number)	Select any number from 0 to 15.
②AREA	Set the range for the area that will produce an OK evaluation.
③MAKE A TEST RUN	Pressing the SET key will test the evaluation condition, display the test results.
④PRIOR MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

· Check your selection by testing the upper and lower limits for evaluations that you have set. This can be done using item ③ MAKE A TEST RUN.
· For more information about evaluation conditions, see section 9-2 [3] Evaluation condition.

Return to the [TYPE00-MEAS1 to 3] menu and select item ⑧ NUMERIC CALC COND (numerical calculation conditions).

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[NUMERIC CALC] (TYPE00-MEAS.1-MEAS-BIN-AREA)
①CALC.RESULT N00(0~15)
②OBJECT TYPE NO T-AREA[A] NUM-CALC[NC] CNST[C]

③FORMULA REG.00(0~15) N00(0~15)
+ - */ ← → DEL. END
④UPPER&LOWER LIMIT +00000000.0~ +00000000.0
⑤OUTPUT NO Y0(0~7) C000(0~107)
⑥RUN A TEST (SET KEY)
⑦UPPER MENU

N00	[A]	00A	Y0
		+00009000.0~+00010000.0 +00009500.0	OK
N01			
N02			
N03			

Numerical calculation	Setting details
①CALC.RESULT (calculation result)	See the recording and display the results from arithmetical operation for specified output data at any value from 00 to 15.
②OBJECT TYPE	Select the type of data being calculated.
③FORMULA	A number of formula settings are used. The first line will change according to the selection made in item ②. **Selection of ② / The first line of the display** Total area A / Record 00 (0 to 15) N00 (0 to 15) Numerical calculations [NC] / ABS √ TAN ATAN N0 (0 to 15) (the second line will not be displayed) Constant [C] / +00000000.0 (the second line will not be displayed) Note: Please use a smaller number for the number of formulas at N (00 to 15) than that used for ① CALC. RESULT N (00 to 15).
④UPPER&LOWER LIMIT	Set the upper and lower limits for decisions.
⑤OUTPUT	Set the evaluation output for the results of the calculations.
⑥RUN A TEST (make a test run)	Pressing the SET key will record the settings details as well as run a test.
⑦UPPER MENU	Returns you to the [TYPE00-MEAS1 to 3] menu.

· The number of formulas which can be set are dictated by the selections made in items ② and ③ as follows.

②KIND (type)	Number of formulas
Total area [A]	00A to 15A
Numerical calculation [NC]	ABS/√/TAN/ATAN (00 to 15)
Constant [C]	-99999999.9 to +99999999.9

The numbers ranging from 00 to 15 in front of the characters are registration numbers.
· For more information on numerical calculations see section 9-2 [4] Numerical calculations.
Note: You must run a test using item ⑥ RUN A TEST, before making any calculations.

Return to the [TYPE00-MEAS1 to 3] menu and select item ⑨ OUTPUT CONDITIONS.

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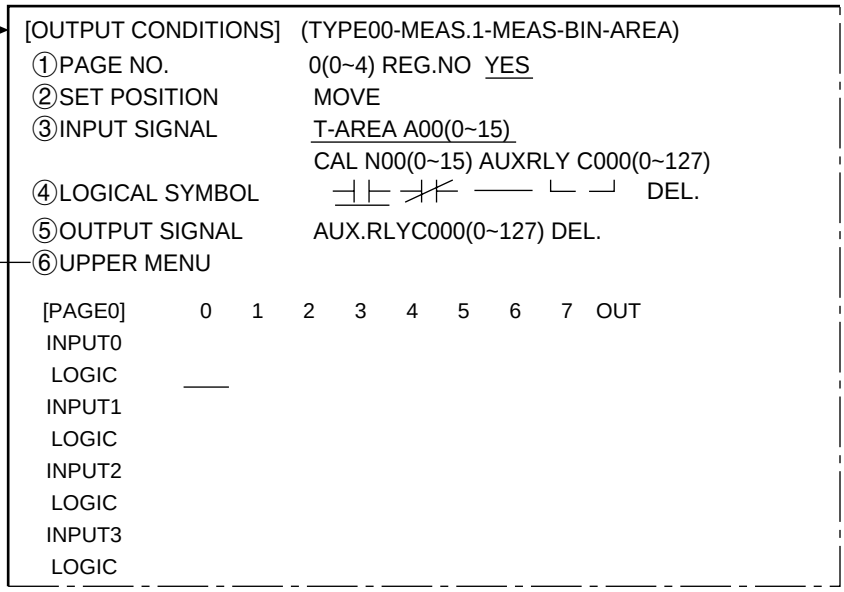

· The input signals which may be set depend on the selection made at item ③ as follows.

Selection of ③	Input signals
Total area A	00A to 15A
Calculation N	N00 to N15
Secondary relay C	C000 to C127

The numbers ranging from 00 to 15 in front of A are registration numbers.

· For more information on output condition, see the PC Function, in Chapter 10.

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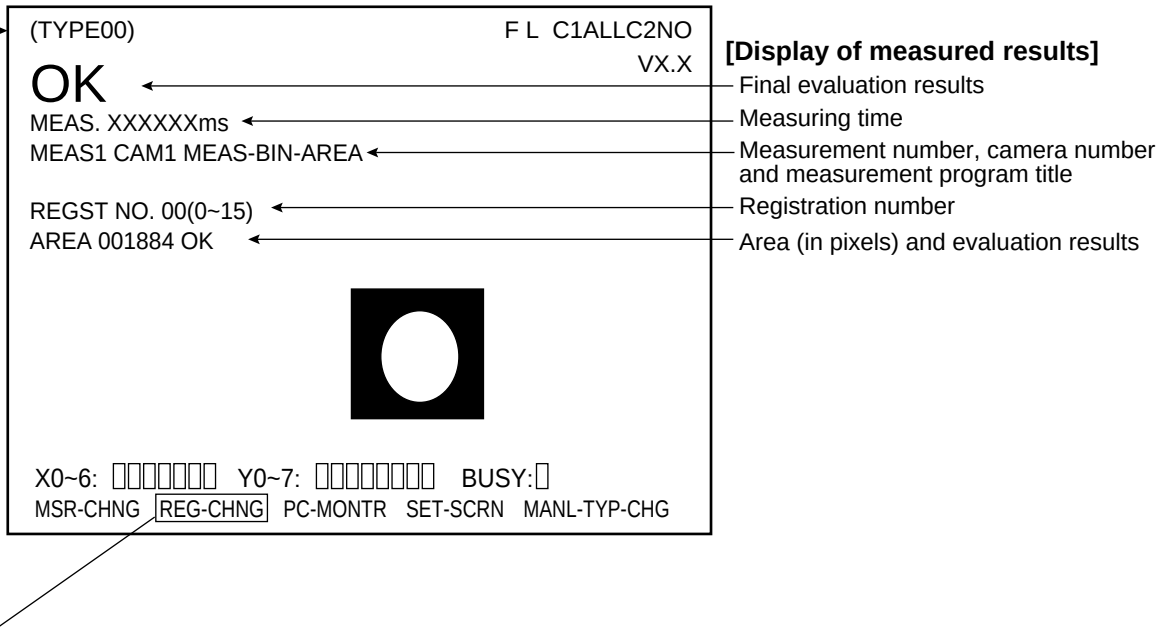
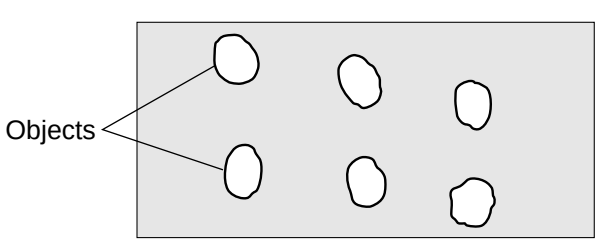
Pressing the TRG/BRT key will display the size of the area inside the measurement window, in pixels.



· By moving the cursor to REG-CHNG (change registration) and pressing the up key, you can see the measurement results for different registration numbers and numerical calculations. This is done by scrolling through them in this order: registration numbers (00+0 15), numerical calculation result (N00+0 N15), and then returns to registration numbers. The measurements screen also has this feature.
· Unregistered numbers will be skipped.
· When there are no recorded numbers, other than those currently on display, or if no measurement has actually been carried out, then it will not be possible to switch back and forth between data.

9-8 Counting quantities by binary conversion

Purpose	Checks the number of objects (max. 3000 pcs.) when there is more than one object in an image. Measurement of the object's position is optional. · When the specified pixel field has been converted to a binary image, the white areas are measured or identified as separate objects and counted.
Application	Counting the number of food products or parts.
Example	 **[Measurement result]** · Number of objects/total area **· Inspection sequence** Capture an image → Convert it to a binary image → Measure the number of objects/total area

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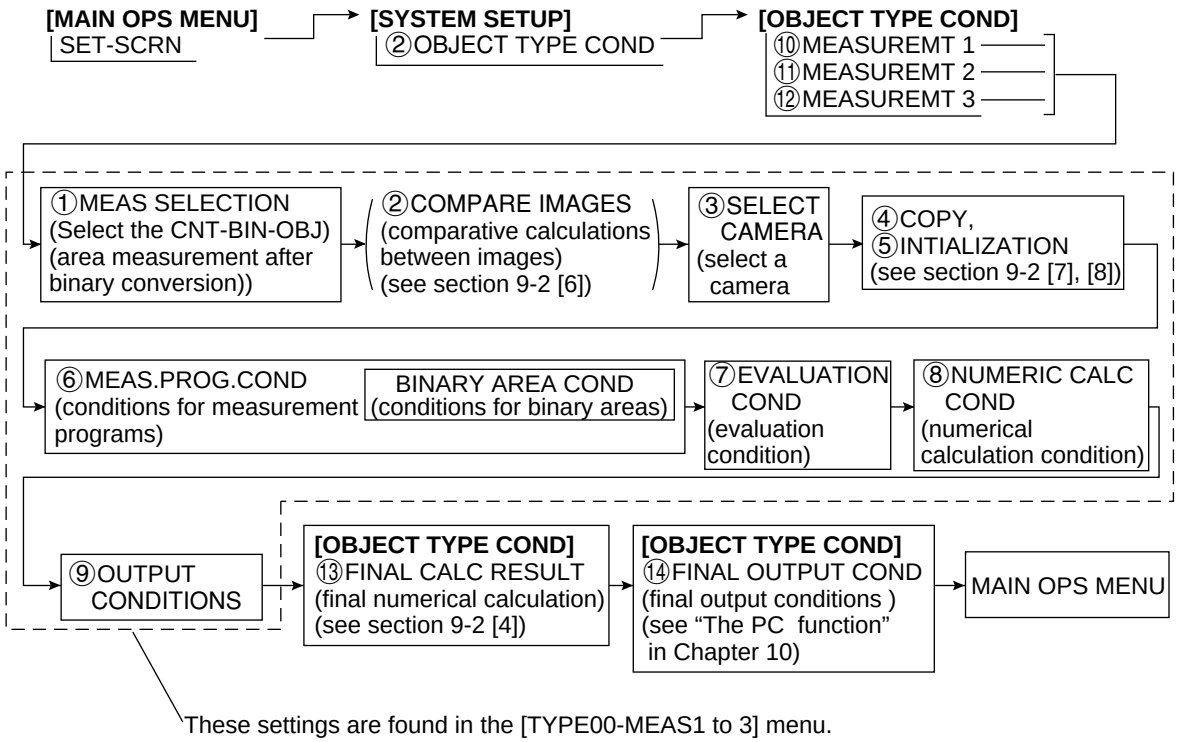
[1] Setting sequence



9

[2] Setting details

An explanation of ⑥ MEAS.PROG.COND (conditions for measurement programs) from the [TYPE00-MEAS1 to 3] (object type measurement) menu.

On the MAIN OPS MENU, move the cursor to SET-SCRN, and press SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.

⇨Select item ⑩ MEASUREMENT 1, ⑪ MEASUREMENT 2 or, ⑫ MEASUREMENT 3 on the [OBJET TYPE COND] menu .

[TYPE00-MEAS1]

①MEAS SELECTION	NO CHECK-DEG-OF-MATCH DST&AGL MES. (GRAY&EDGE GRAV) INSPECT-LEAD MEASR-BIN-AREA CNT-BIN-OBJ LABEL-BIN-OBJ POINT MEAS
②COMPARE IMAGES	NO YES(CAM1)
③SELECT CAMERA	CAM1 CAM2
④COPY	EXEC←TYPE00—MEAS1—NO
⑤INITIALIZATION	EXEC
⑥MEAS.PROG. COND	(TO NEXT SUB-MENU)
⑦EVALUATION COND	(TO NEXT SUB-MENU)
⑧NUMERIC CALC COND	(TO NEXT SUB-MENU)
⑨OUTPUT CONDITIONS	(TO NEXT SUB-MENU)
⑩UPPER MENU	

This is how the line looks when the object type is set to 00 and the selected measurement is 1.

- In item ①, select CNT-BIN-OBJ (measure the area of binary images).
- Item ② will be displayed unless NO is selected in item ⑧ SELECT CAMERA IMG (camera selection) which is in the [OBJECT TYPE COND] menu.

Select item ⑥ MEAS.PROG.COND (conditions for measurement programs).

[MEASURING COND] (TYPE00-MEAS.1-CNT-BIN-OBJ)

①REGST NO.	00(0~3) REG.NO YES
②BINARY AREA COND	(TO NEXT SUB-MENU)
③UPPER MENU	

- If YES is specified in item ① REGST NO. (registration number), then item ② will be displayed.

Measurement conditions	Setting details
①REGST NO. (registration number)	Set this to any number from 0 to 3 and select NO or YES to store it.
②BINARY AREA COND (conditions for binary areas)	The conditions for binary areas are set on the next menu.
③UPPER MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

Select item ② BINARY AREA COND (conditions for binary areas).

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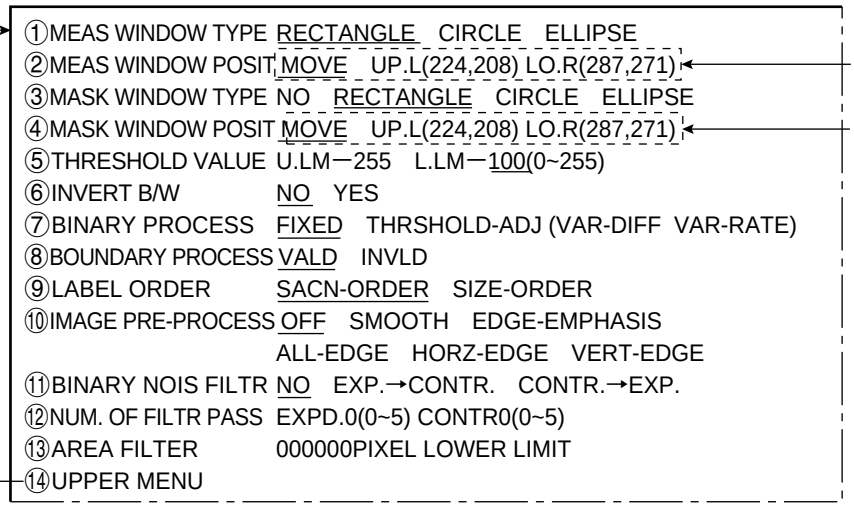

· Item ④ will be displayed unless item ③ is set to NO.

Menu	Setting details
①MEAS WINDOW TYPE (measurement window)	Select a measurement window type: RECTANGLE, CIRCLE or ELLIPSE.
②MEAS WINDOW POSIT	Set the size and position of the window, in units of 1 pixel. · If a circle or ellipse is selected in item ①, then the two variables you must set are the center and the diameter.
③MASK WINDOW TYPE	Decide whether a mask window will be employed and if so which type (a rectangle, circle or ellipse). · A mask window exists inside the boundary of the measurement window and screens out those parts of the image which are not needed for the measurement process.
④MASK WINDOW POSIT (mask window position)	Set the size and position of the mask window (which is drawn with a dotted line), using units of 1 pixel. · If a circle or ellipse is selected in item ①, then the two variables you must set are the center and the diameter. · It is possible to set the heading so that the mask window is actually bigger than the measurement window.
⑤THRESHOLD VALUE	Set the upper and lower limits for binary conversion within the range of 0 to 255. ⇨See setting threshold values in shared settings on page 9·7.
⑥INVERT B/W (black and white Inversion)	Select whether to invert the black and white in the image: YES or NO. · NO means the white area will be measured after the image has been converted to binary values. · YES means the black area will be measured after the image has been converted to binary values.
⑦BINARY PROCESS	Select either fixed or threshold value correction as the binary conversion processing method. (VAR-DIFF or VAR-RATE). ⇨See methods for binary conversion in shared settings on page 9·8.
⑧BOUDARY PROCESS (boundary processing)	Enable or disable boundary processing. ⇨See setting the window boundary in shared settings on page 9·7. · When this function is disabled, if a workpiece contacts with the window, this workpiece is not measured.
⑨LABEL ORDER	Select the order for labeling objects. ⇨See order of labeling in shared settings on page 9·8.
⑩IMAGE PRE-PROCESS	Select a method for pre-processing image data. ⇨See pre-processing in shared settings on page 9·9.
⑪BINARY NOIS FILTR (eliminating binary noise)	Select a method for eliminating binary noise. ⇨See methods for eliminating noise from binary images, expansion/contraction and eliminating binary noise in shared settings on page 9·10.
⑫NUM.OF FILTR PASS (the number of noise elimination cycles)	Set the number of cycles that the binary noise elimination process will be carried out (0 to 5). Set number of times for expansion and contraction, separately.
⑬AREA FILTER	After object identification and labeling, the area filter is a function used to identify small islands whose area is less than a specified amount. It eliminates them from the object which is being measured. Set the maximum number of pixels. Enter any number from 0 to 245760. · To enter number, select ⑬ AERA FILTER using up and down keys, and press the SET key twice. Select a required digit using the left and right keys, and select the required figure using the up and down keys.
⑭UPPER MENU	This will return you to the [MEASURING COND] menu.

Continued on the following page

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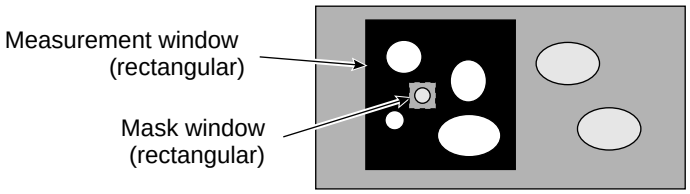
[Information about the window settings]

· In order to set a window it is necessary to freeze the frame.
· First freeze the frame. Then operate the camera normally. Finally, freeze the frame again. The first frozen image that was taken will be converted to binary values and this will be the final binary image.
The second frozen image that was taken may also be converted to a binary image by repeating steps ① to ⑬ above.

[Example of recording]



· The binary image will be the contents of the measurement window, after the portion excluded by the mask window has been removed.

Return to the [MEASURING COND] menu and select item ③ UPPER MENU.

Select item ⑦ EVALUATION COND (evaluation condition) on the [TYPE00-MEAS1 to 3] menu.

[EVALUATION COND] (TYPE00-MEAS.1-CNT-BIN-OBJ)

		[TEST RESULT]		[OUT]
①REGST NO.	0(0~3)			
②NUMBER	0000~3000	00004	OK	NO
③TOTAL AREA	000000~245760	002000	OK	NO
④MAKE A TEST RUN	(SET KEY)			
⑤UPPER MENU				

These displays can be set using the up and down keys. (The choices are NO, Y0 to 7, C000 to C127).

· Items ② to ④ will be displayed if REGST NO. (registration number) is set to YES on the [MEASURING COND] (mesurement condition) menu.

Evaluation conditions	Setting details
①REGST NO. (registration number)	Enter any number from 0 to 3.
②NUMBER (number of objects)	Set the range for the number of objects that will produce an OK evaluation.
③TOTAL AREA	Set the range for the total area that will produce an OK evaluation.
④MAKE A TEST RUN	Pressing the SET key will test the evaluation conditions, display the test results.
⑤UPPER MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

· Check your selection by testing the upper and lower limits for evaluations that you have set. This can be done using item ④ MAKE A TEST RUN.
· For more information about evaluation conditions see section 9-2 [3] Evaluation conditions.

Return to the [TYPE00-MEAS1 to 3] menu and select item ⑧ NUMERIC CALC COND (numerical calculation conditions).

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[NUMERIC CALC] (TYPE00-MEAS.1-CNT-BIN-OBJ)
①CALC.RESULT N00(0~15)
②OBJECT TYPE NO T-AREA[A] QTY[K] NUM-CALC[NC] CNST[C]

③FORMULA REG.00(0~15) N00(0~15)
+ - */ ← → DEL. END
④UPPER&LOWER LIMIT +00000000.0~+00000000.0
⑤OUTPUT NO Y0(0~7) C000(0~107)
⑥RUN A TEST (SET KEY)
⑦UPPER MENU

N00	[A]	00A	Y0
		+00009000.0~ +00010000.0 +00009500.0	OK
N01			
N02			
N03			

Numerical calculation	Setting details
①CALC.RESULT (calculation result)	See the recording and display the results from arithmetical operation for specified output data at any value from 00 to 15.
②OBJECT TYPE (type)	Select the type of data being calculated.
③FORMULA	A number of formula settings are used. The first line will change according to the selection made in item ②.
④UPPER&LOWER LIMIT	Set the upper and lower limits for decisions.
⑤OUTPUT	Set the evaluation output for the results of the calculations.
⑥RUN A TEST RUN (make a test run)	Pressing the SET key will record the settings details as well as run a test.
⑦UPPER MENU	Returns you to the [TYPE00-MEAS1 to 3] menu.

Selection of ②	The first line of the display
Total area [A]	Record 00 (0 to 15) N00 (0 to 15)
Number of objects [K]	
Numerical calculations [NC]	ABS √ TAN ATAN N00 (0 to 15) (the second line will not be displayed)
Constant [C]	+00000000.0 (the second line will not be displayed)

Note: Please use a smaller number for the number of formulas at N (00 to 15) than that used for ① CALC.RESULT N (00 to 15).

· The number of formulas which can be set are dictated by the selections made in items ② and ③ as follows.

②OBJECT TYPE	Number of formulas
Total area [A]	00A to 15A
Numerical calculation [NC]	ABS/√/TAN/ATAN (00 to 15)
Constant [C]	-99999999.9 to +99999999.9

The numbers ranging from 00 to 15 in front of the characters are registration numbers.
· For more information on numerical calculations see section 9-2 [4] Numerical calculations.
Note: You must run a test using item ⑥ RUN A TEST before making any calculations.

Return to the [TYPE00-MEAS1 to 3] menu and select item ⑨ OUTPUT CONDITIONS.

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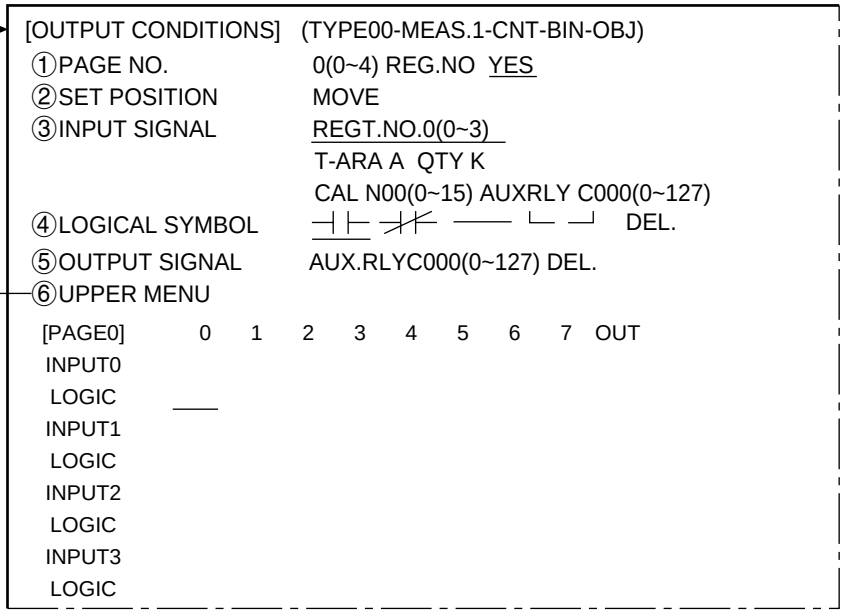

· If item ① PAGE NO. (registration number) is set to YES, then items ② to ⑤ will be displayed.
· The input signals which may be set depend on the selection made in item ③ as follows.

Selection of ③	Input signals
Total area A	0A to 3A
Number of objects K	0K to 3K
Calculation N	N00 to N15
Secondary relay C	C000 to C127

The numbers ranging from 0 to 3 in front of the characters are registration numbers.

· For more information on output conditions, see the “PC Function,” in Chapter 10.

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Return to the MAIN OPS MENU

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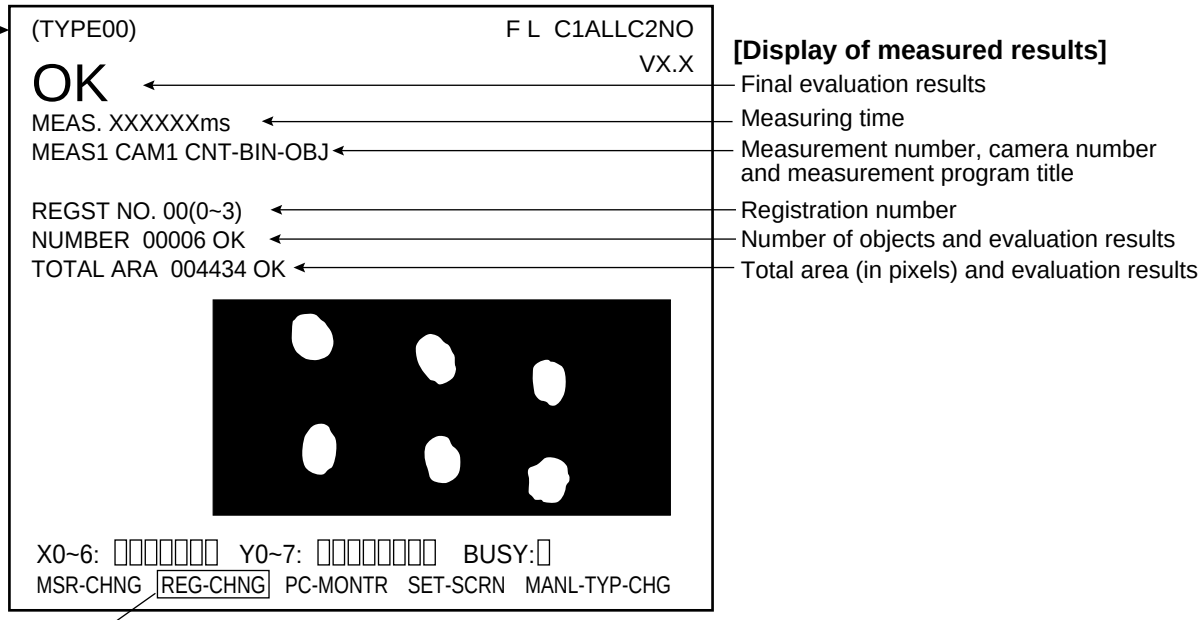
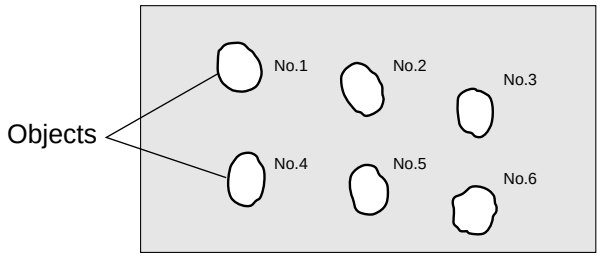
Pressing the TRG/BRT key will display the total area (in pixels) and the number of objects inside the measurement window.

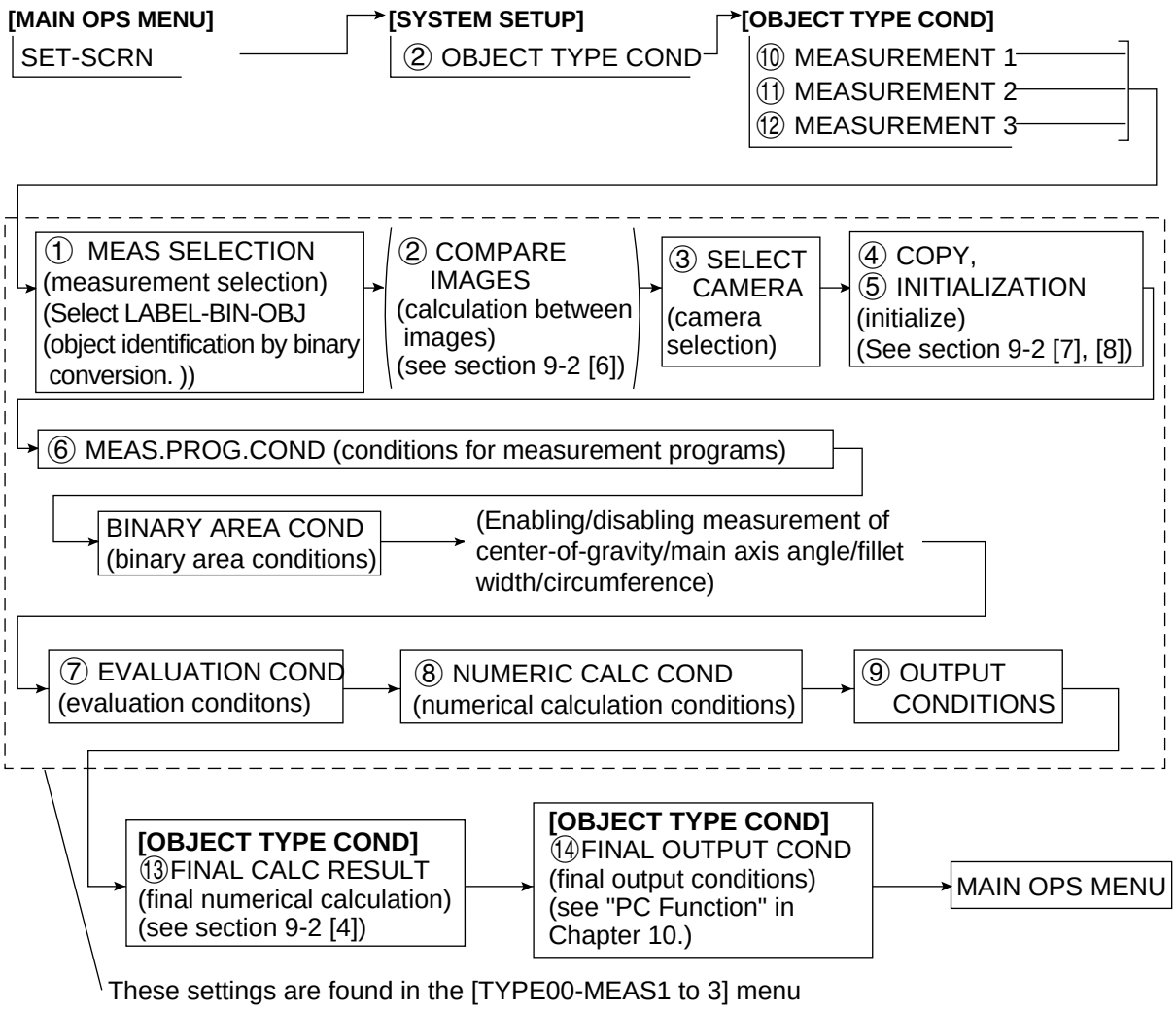


· By moving the cursor to REG-CHNG (change registration) item and pressing the up key, you can see the measurement results for different registration numbers and numerical calculations. This is done by scrolling through them in this order: registration numbers (0 to 3), numerical calculation results (N00 to ON15), and then returns to registration number. The measurements screen also has this feature.
· Unregistered numbers will be skipped.
· When there are no recorded numbers (other than those currently on display) or if no measurement

9-9 Object identification (labeling) by binary conversion

Purpose	When there are several objects and the measuring position is arbitrary, the presence or absence of objects and the size of the objects can be determined. · The specified pixel area is converted to a binary image. The number of objects, total size of the white area (the objects) and the area, center of gravity, main axis angle, fillet diameter, and circumference of each white area can be measured.
Application	Counting the number of food products or parts, measuring the sloped angle or center of gravity of parts, and measuring the size of food products
Example	**[Measurement of 6 objects]**  **[Measured results]** · Object identification (labeling and numbering), number of objects present, total area · Area, center of gravity, main axis angle, fillet diameter, and circumference of each object (No.1 - No.6). **· Inspection sequence** Image capture → Convert it to a binary image → Object identification (labeling and numbering) → Measure the area, center of gravity, main axis angle, fillet diameter, and circumference

[1] Setting sequence



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[2] Setting details

An explanation of the ⑥ MEAS.PROG.COND (conditions for measurement programs) from the [TYPE00-MEAS1 to 3] (object type measurement) menu.

On the MAIN OPS MENU, move the cursor to SET-SCRN, and press SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.

⇨ Select item ⑩ MEASUREMENT 1, ⑪ MEASUREMENT 2 or ⑫ MEASUREMENT 3 on the [OBJECT TYPE COND] menu .

```
[TYPE00-MEAS1]
①MEAS SELECTION   NO              CHECK-DEG-OF-MATCH
                  DST&AGL MES. (GRAY&EDGE GRAV)
                  INSPECT-LEAD  MEASR-BIN-AREA
                  CNT-BIN-OBJ   LABEL-BIN-OBJ
                  POINT MEAS
②COMPARE IMAGES  NO YES(CAM1)
③SELECT CAMERA   CAM1  CAM2
④COPY            EXEC←TYPE00−MEAS1−NO
⑤INITIALIZATION  EXEC
⑥MEAS.PROG. COND (TO NEXT SUB-MENU)
⑦EVALUATION COND (TO NEXT SUB-MENU)
⑧NUMERIC CALC COND (TO NEXT SUB-MENU)
⑨OUTPUT CONDITIONS (TO NEXT SUB-MENU)
⑩UPPER MENU
```

This is how the line looks when the object type is set to 00 and the selected measurement is 1.

- Select LABEL-BIN-OBJ (object identification by binary conversion) in item ①.
- Item ② will be displayed unless NO is selected in item ⑧ SELECT CAMERA IMG (camera selection) which is in the [OBJECT TYPE COND] (conditions of object type) menu.

Select item ⑥ MEAS.PROG.COND (conditions for measurement programs).

```
[MEASURING COND]  (TYPE00-MEAS.1-LABEL-BIN-OBJ)
①REGST NO.          00(0~3)  REG.NO   YES
②BINARY AREA COND (TO NEXT SUB-MENU)
③FIND CENT/GRAVITY NO   YES
④MAIN AXIS ANGLE   NO   YES
⑤FILLET DIAMETER   NO   YES
⑥PERIMETER LENGTH  NO   YES
⑦UPPER MENU
```

- If YES was specified in item ① REGST NO. (registration number), then items ② to 6 will be displayed.

Mesurement conditions	Setting details
① REGST NO. (registration number)	Set this to any number from 0 to 3 and select NO or YES to store it.
② BINARY AREA COND (condition for binary areas)	The conditions for binary areas are set on the next menu.
③ FIND CENT/GRAVITY (center of gravity measurement)	Select YES/NO for each of the measurements. ⇨ See page 9Æ102.
④ MAIN AXIS ANGLE	
⑤ FILLET DIAMETER (fillet width)	
⑥ PERIMETER LENGTH (circumference)	
⑦ UPPER MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

Select item ② BINARY AREA COND (conditions for binary areas).

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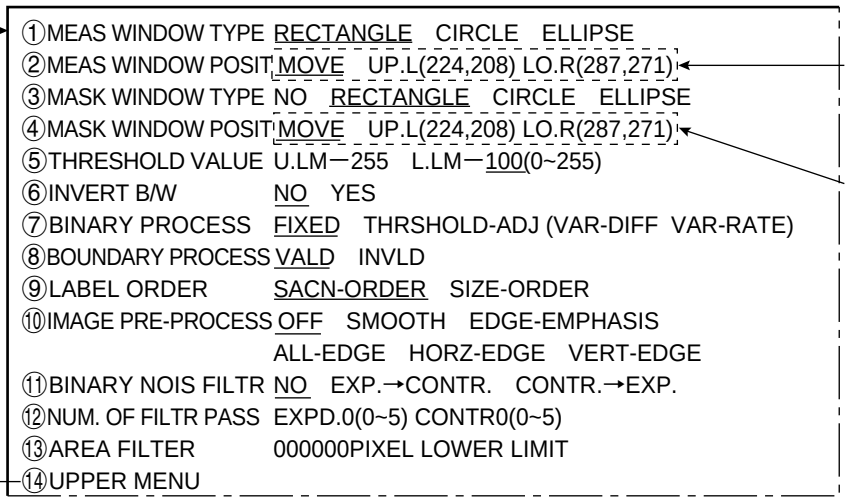

· Item ④ will be displayed unless item ③ is set to "NO."

Menu	Setting details
① MEAS WINDOW TYPE (measurement window)	Select the measurement window type: RECTANGLE (rectangular), CIRCLE (circular) or ELLIPSE (ellipse).
② MEAS WINDOW POSIT (position of measuring window)	Set the size and position of the window in units of 1 pixel. · If a circle or ellipse is selected in item ①, then the two variables you need to set are center and diameter.
③ MASK WINDOW TYPE	Decide whether a mask window will be employed and if so which type (rectangular, round or elliptical). · A mask window exists inside the boundary of the measurement window and screens out those parts of the image which are not needed in the measurement process.
④ MASK WINDOW POSIT (mask window position)	Set the size and position of the mask window (which is framed with a dotted line) in units of 1 pixel. · If a circle or ellipse was selected in item ①, then the two variables you need to set are center and diameter. · It is possible to enter dimensions that make the mask window bigger than the measurement window.
⑤ THRESHOLD VALUE	Set the upper and lower limits for binary conversion within the range of 0 to 255. ⇨ See setting threshold values in shared settings on page 9·7
⑥ INVERT B/W (black and white inversion)	Select whether to invert the black and white in the image: YES or NO. · NO means the white area will be measured after the image has been converted to binary values. · YES means the black area will be measured after the image has been converted to binary values.
⑦ BINARY PROCESS (binary conversion)	Select either fixed or threshold value correction as the binary conversion processing method. (VAR-DIFF or VAR-RATE). ⇨ See methods for binary conversion in shared settings on page 9·8.
⑧ BOUDARY PROCESS (boundary processing)	Enable or disable boundary processing. ⇨ See setting the window boundary in shared settings on page 9·7. · When disabled, a workpiece contacting the window will not be measured.
⑨ LABEL ORDER	Select the order for labeling objects. ⇨ See order of labeling in shared settings on page 9·8.
⑩ IMAGE PRE-PROCESS (image pre-processing)	Select a method for pre-processing image data. See pre-processing in shared settings on page 9·9.
⑪ BINARY NOIS FILTR (eliminating binary noise)	Select a method for eliminating binary noise. ⇨ See methods for eliminating noise from binary images, expansion/contraction and eliminating binary noise in shared settings on page 9·10.
⑫ NUM. OF FILTR PASS (the number of noise elimination cycles)	Set the number of cycles that the binary noise elimination process will be carried out (0 to 5). Enter number of times for expansion and contraction, separately.
⑬ AREA FILTER	After the labeling, the area filter is a function used to identify small islands whose area is less than a specified amount. It eliminates them from the object which is being measured. Set the maximum number of pixels. Enter any number from 0 to 245760. · To enter number, select ⑬ AREA FILTER using up and down keys, and press the SET key twice. Select a required digit using the left and right keys, and select the required figure using the up and down keys.
⑭ UPPER MENU	This will return you to the [MEASURING COND] menu.

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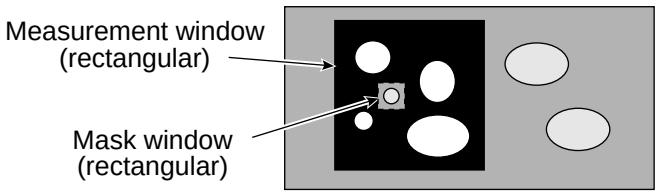
[Window settings]

· In order to set a window it is necessary to freeze the image.
· First freeze the image. Then operate the camera normally. Finally, freeze the image again. The first frozen image that was taken will be converted to binary values and this will be the final binary image. The second frozen image that was taken may also be converted to a binary image by repeating steps ① to ⑬ above.

[Example of recording an image]

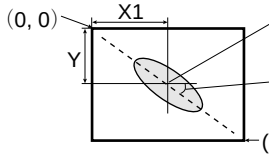


·The binary image will be the contents of the measurement window, after the portion excluded by the mask window has been removed.

[MEASURING COND] (TYPE00-MEAS.1-LABEL-BIN-OBJ)
①REGST NO. 00(0~3) REG.NO YES
②BINARY AREA COND (TO NEXT SUB-MENU)
③FIND CENT/GRAVITY NO YES
④MAIN AXIS ANGLE NO YES
⑤FILLET DIAMETER NO YES
⑥PERIMETER LENGTH NO YES
⑦UPPER MENU

· Set measurement items ③ to ⑥ to NO or YES, as desired.

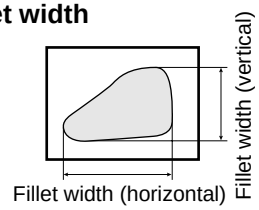
Center of gravity, main axis angle



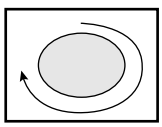
Center of gravity (X1, Y1)
· Calculated from the area and the position of each object.
· (X1, Y1)=(Σx/N, Σy/N) N: Area

Main axis angle
· Angle between the longitudinal and horizontal directions with the center of gravity treated as the base.

Fillet width



Peripheral



The number of pixels in the boundary line of an object (Inclination: √2 times)

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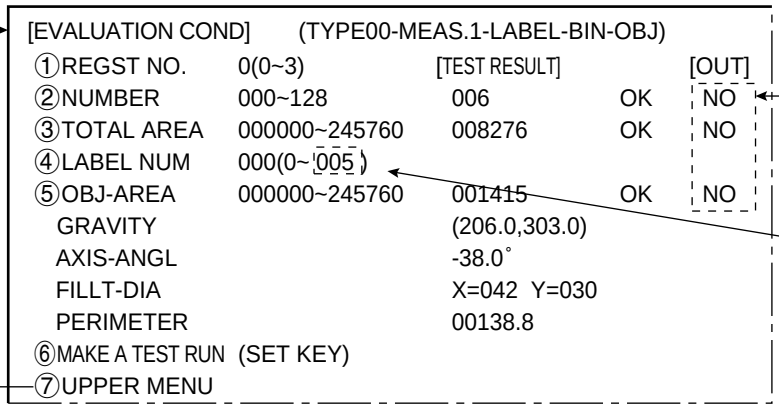
Select item ⑦ EVALUATION COND (evaluation condition) on the [TYPE00-MEAS1 to 3] menu.



· Items ② to ⑥ will be displayed if REGST NO. (registration number) is set to YES on the [MEASURING COND] (measurement conditions) menu.

Evaluation conditions	Setting details
① REGST NO. (registration number)	Enter a number from 0 to 3.
② NUMBER (number of objects)	Set the range for the number of objects that will produce an OK evaluation.
③ TOTAL AREA (total surface area)	Set the range for the total area that will produce an OK evaluation.
④ LABEL NUM	After performing a MAKE A TEST RUN at item ⑥, and a label number is entered, the results displayed in item ⑤ will change.
⑤ OBJ-AREA	Enter the maximum label size (area) that will produce an OK result. · The center of gravity/main axis angle/fillet width/perimeter will be displayed when measurement is set to YES on the [MEASURING COND] menu.
⑥ MAKE A TEST RUN	Pressing the SET key will test the evaluation conditions, display the test results.
⑦ UPPER MENU	This will return you to the [TYPE00 to MEAS1 to 3] menu.

· Set the maximum number of objects/total area/area per label after checking the test results from item ⑥ MAKE A TEST RUN.
· For more information about evaluation conditions, see section 9-2 [3] Evaluation conditions.

Return to the [TYPE00-MEAS1 to 3] (object type measurement) menu and select item ⑧ NUMERIC CALC COND (numerical calculation conditions).

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[NUMERIC CALC] (TYPE00-MEAS.1-LABEL-BIN-OBJ)
①CALC.RESULT N00(0~15)
②OBJECT TYPE NO T-AREA[A] QTY[K] OBJ-AREA[R]
OBJ-GRAVTY[GX GY] OBJ-ANGLE[B]
OBJ-FILLET[FX FY] OBJ-PERIMETR[CR]
NUM-CALC[NC] CNST[C]
③FORMULA REG.0(0~3) LABL000(0~127) N00(0~15)
+ - ∗/ ← → DEL. END
④UPPER&LOWER LIMIT+00000000.0～+00000000.0
⑤OUTPUT NO Y0(0~7) C000(0~107)
⑥RUN A TEST (SET KEY)
⑦UPPER MENU

N00	[R]	0R000	Y0
		+00001950.0~ +00002050.0 +00002000.0	OK
N01			
N02			
N03			

Numerical calculation	Setting details
① CALC.RESULT (calculation result)	See the recording and display the results from arithmetical operation for specified data at any value from 00 to 15.
② OBJECT TYPE (type)	Select the type of data being calculated.
③ FORMULA	A number of formula settings are used. The first line will change according to the selection made in item ②. **Selection of ② / The first line of the display** Total area [A], number of objects [K] — Registration 0 (0 to 3), N00 (0 to 15) Area by label [R] Center of gravity by label [GX, GY] Main axis angle of label [B] Fillet width by label [FX, FY] Circumference by label [CR] — Registration 0 (0 to 3), Label 000 (0 to 127), N00 (0 to 15) Numerical calculation [NC] — ABS √ TAN ATAN N00 (0 to 15) (The second line is not be displayed.) Constant [C] — +00000000.0 (The second line is not be displayed.) Note: Please use a smaller number for the number of formulas at N (00 to 15) than that used for ① CALC. RESULT N (00 to 15).
④ UPPER&LOWER LIMIT	Set the upper and lower limits for decisions.
⑤ OUTPUT	Set the evaluation output for the results of the calculations.
⑥ RUN A TEST (make a test run)	Pressing the SET key will record the settings details as well as run a test.
⑦ UPPER MENU	Returns you to the [TYPE00-MEAS1 to 3] menu.

· The number of formulas which can be set are dictated by the selections made in items ② and ③ as follows.

② Type	Mathematical expression
Total area [A] / number of objects [K]	0A to 3A/0K to 3K
Area per label [R], Center of gravity by label [GX]/[GY]	0R000 to 3R127, 0GX000 to 3GX127/0GY000 to 3GY127
Main axis angle of each label [B], Fillet width of each label [FX]/[FY]	0B000 to 3B127, 0FX000 to 0FX127/0FY000 to 0FY127
Perimeter of each label [CR]	0CR000 to 3CR127
Numerical calculation [NC]	ABS/√/TAN/ATAN (00 to 15)
Constant [C]	−99999999.9 to +99999999.9

The numbers ranging from 0 to 3 in front of the characters are registration numbers.

· For more information on numerical calculations see section 9-2 [4] Numerical calculations.
Note: You must run a test using item ⑥ RUN A TEST, before making any calculations.

Return to the [TYPE00-MEAS1 to 3] menu and select item ⑨ OUTPUT CONDITIONS.

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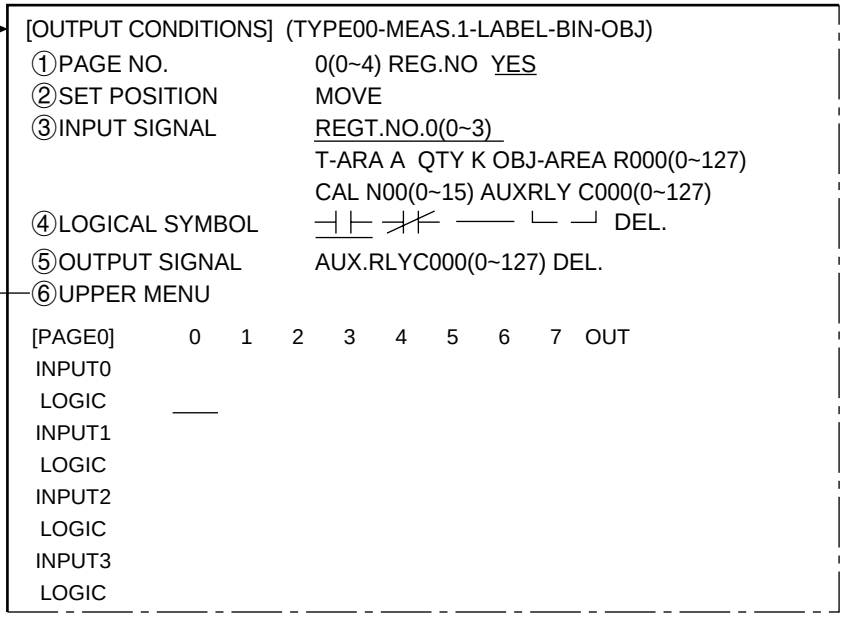

· If item ① PAGE NO. (register number) is set to YES, then items ② to ⑤ will be displayed.

· The input signals which may be set depend on the selection made in item ③ as follows.

Selection of ③	Input signals
Total area A	0A to 3A
Number of objects K	0K to 3K
Area by label R	0R000 to 3R127
Calculation N	N00 to N15
Auxiliary relay C	C000 to C127

The numbers ranging from 0 to 3 in front of the characters are registration numbers.

· For more information on output conditions , see the “PC Function” in Chapter 10.

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Return to the MAIN OPS MENU.

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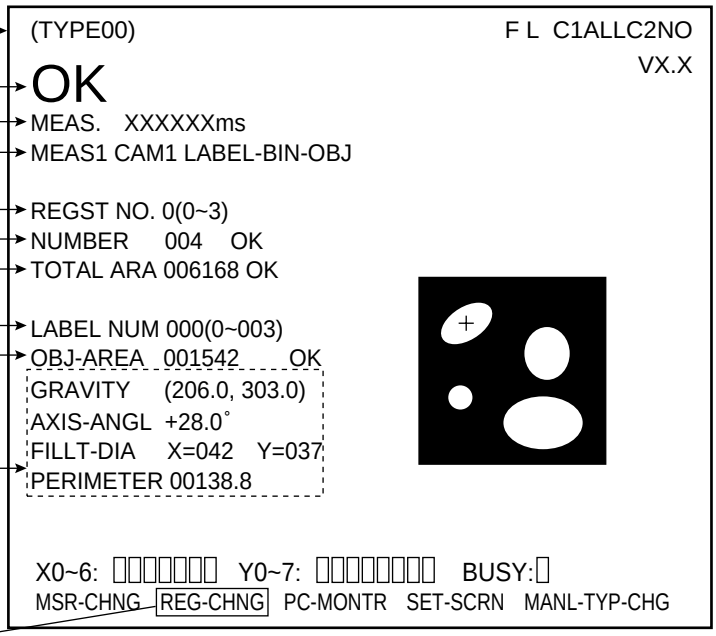
When the TRG/BRT key is pressed, the labeling measurements are performed manually.

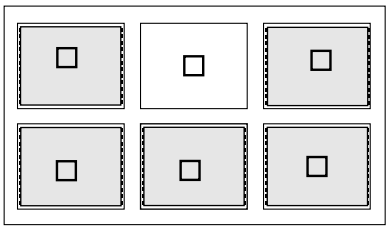
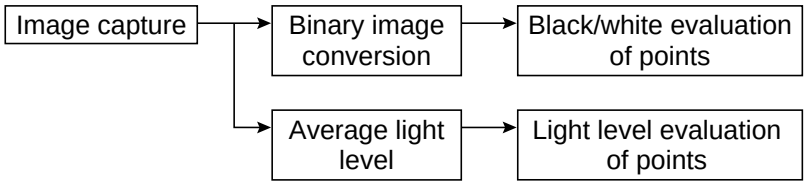
[Display of measured results]

Final evaluation results
Measuring time
Measurement number, camera number, measurement program name
Registration number
Number of labels and evaluation result
Total area (in pixels) and evaluation results
Label number
Area (in pixels) of the label number being displayed and the evaluation result
Center of gravity, main axis angle, fillet width, and perimeter of the label number being displayed (Measurements set to YES are displayed in the [MEASURE] (measurement condition) menu.)



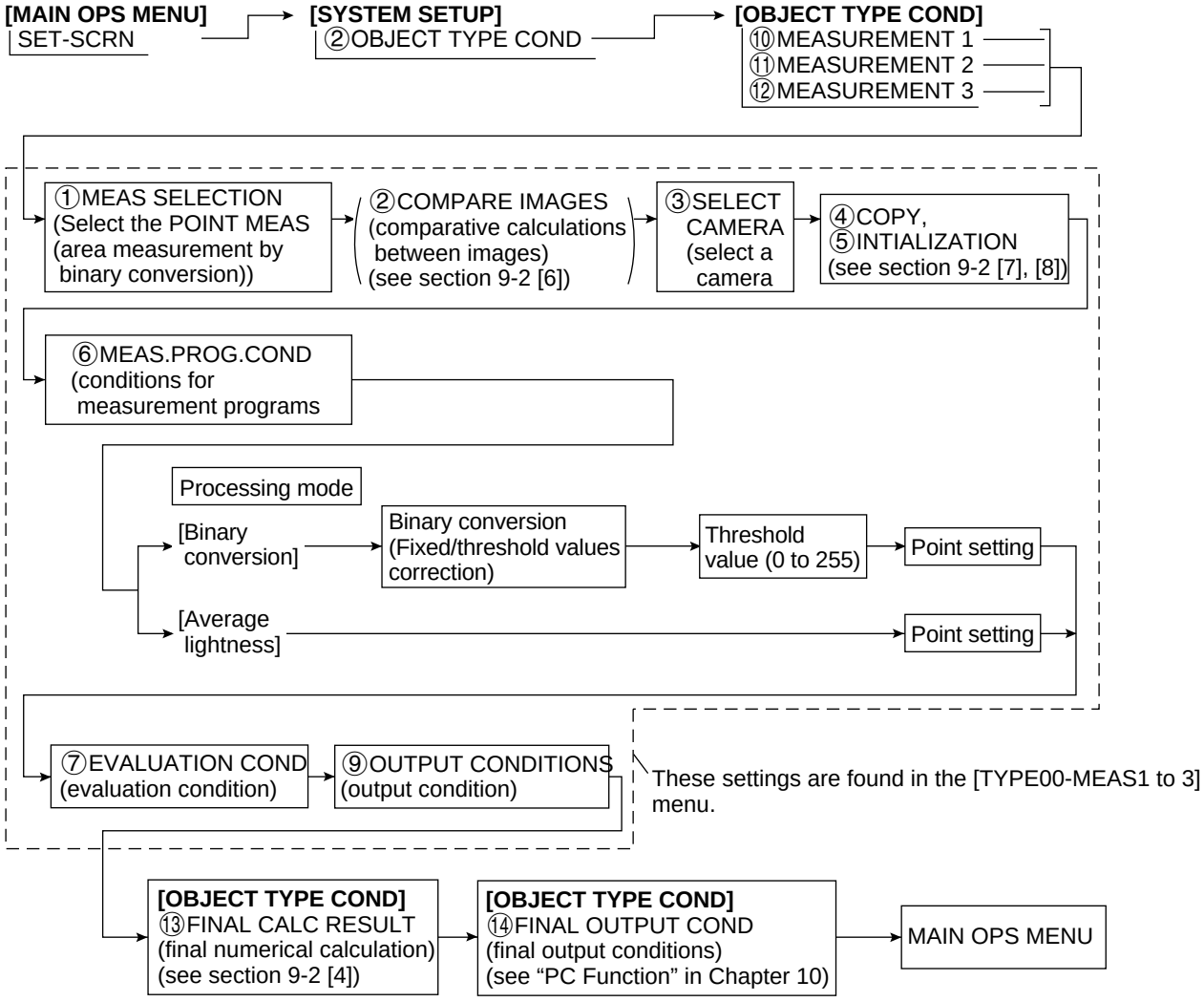
- By moving the cursor to REG-CHNG (change registration) and pressing the up key, you can see the measurement results for different registration numbers, labels and numerical calculations. They are displayed as follows: Registration number 0 (label numbers 0 → 127) → ... → registration number 3 (label numbers 0 → 127) → results of numerical calculations (N00 to N15) → registration number 0 → ... When the down key is pressed, the display can scroll through the data in reverse order. The measurements screen also has this feature.
- Unregistered numbers will be skipped.
- When there are no recorded numbers, (other than those currently on display,) or if no measurement has actually been carried out, then it will not be possible to switch back and forth between data.

9-10 Existence inspection by point measurement

Purpose	The presence or absence of target objects is examined. · A simple black or white evaluation is made in the specified pixel area of binary images. · The light level in the specified pixel area is averaged, and a decision is made whether or not it is within the specified lightness range in gray scale images.
Applications	Checking the presence or absence of packed parts, inspecting the working condition of LEDs or fluorescent character display tubes, and sorting household electric appliances
Example	**[Inspection at 6 points]**  Number of points (max.) : 128 points at average light levels 256 points in binary images Point size: 2 m x 2n pixels (m, n = 1 to 16) **· Inspection sequence** 

9

[1] Setting sequence



[2] Setting details

An explanation of the ⑥ MEAS.PROG.COND (conditions for each measurement program), from the [TYPE00-MEAS1 to 3] menu.

On the MAIN OPS MENU, move the cursor to SET-SCRN, and press SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) ane press SET key.

⇨Select to item ⑩ MEASUREMENT 1, ⑪ MEASUREMENT 2 or item ⑫ MEASUREMENT 3 on the [OBJECT TYPE COND] menu.

```
[TYPE00-MEAS1]
①MEAS SELECTION   NO              CHECK-DEG-OF-MATCH
                  DST&AGL MES. (GRAY&EDGE GRAV)
                  INSPECT-LEAD  MEASR-BIN-AREA
                  CNT-BIN-OBJ   LABEL-BIN-OBJ
                  POINT MEAS
②COMPARE IMAGES   NO YES(CAM1)
③SELECT CAMERA    CAM1   CAM2
④COPY             EXEC←TYPE00−MEAS1−NO
⑤INITIALIZATION   EXEC
⑥MEAS.PROG. COND  (TO NEXT SUB-MENU)
⑦EVALUATION COND  (TO NEXT SUB-MENU)
⑧NUMERIC CALC COND (TO NEXT SUB-MENU)
⑨OUTPUT CONDITIONS (TO NEXT SUB-MENU)
⑩UPPER MENU
```

This is how the line looks when the object type is set to 00 and the selected measurement is 1.

- Select POINT MEAS (point measurement) in item ① MEAS SELECTION.
- Item ② will be displayed unless NO is selected in item ⑧ SELECT CAMERA IMG which is in the [OBJECT TYPE COND] menu.

Select item ⑥ MEAS.PROG.COND (conditions for measurement programs).

```
[MEASURING COND]  (TYPE00-MEAS.1-POINT MEAS)
① PROCESSING MODE  BIN-CONV AV-LIGHT-LEVEL
② BINARY CONV COND  FIXED THRSHOLD-ADJ (VAR-DIFF VAR-RATE)
③ THRESHOLD VALUE  U.LM-255 L.LM-100(0～255)
④ SET POINT        (TO NEXT SUB-MENU)
⑤ UPPER MENU
```

When item ① PROCESSING MODE is set to BIN-CONV. (binary conversion)

```
[MEASURING COND]  (TYPE00-MEAS.1-POINT MEAS)
① PROCESSING MODE BIN-CONV AV-LIGHT-LEVEL

④ SET POINT        (TO NEXT SUB-MENU)
⑤ UPPER MENU
```

When item ① PROCESSING MODEis set to AV-LIGHT-LEVEL (average light level)

Measurement conditions	Setting details
① PROCESSING MODE	Select the processing mode, BIN-CONV. (binary) or AV-LIGHT-LEVEL (averabe light level).
② BINARY CONV COND (processing binary images)	**- When the BIN-CONV (binary) processing mode is selected.** Select either fixed or threshold value correction as the binary conversion processing method. (VAR-DIFF or VAR-RATE). ⇨ See page 9Æ8 Binary processing in shared settings.
③ THRESHOLD VALUE	**- When the BIN-CONV (binary) processing mode is selected.** Set the threshold values (upper and lower limits) within the range of 0 to 255. ⇨ See page 9Æ7 Threshold value setting in shared settings.
④ SET POINT (point setting)	Set a point on the next menu.
⑤ UPPER MENU	This will return you to the [TYPE00 to MEAS1 to 3] menu.

Select item ④ SET POINT (point setting).

Continued on the following page

Continued from the previous page

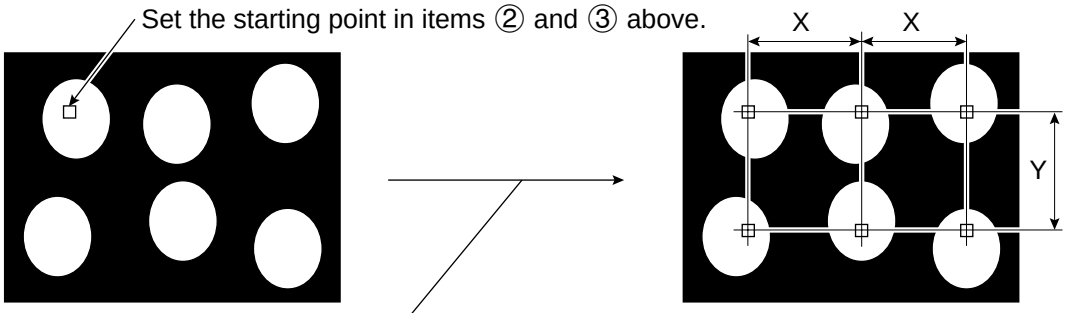
① POINT SIZE : Y-08×X-08(2 to 32)
② STO PNT POSITIONS 000(0 to 255)REG.NO YES
③ START POINT POS MOVE(,)
④ BLOCK LAYOUT 001×001
⑤ BLOCK SPACING Y-004 X-004
⑥ STORE BLOCK COND EXEC
⑦ DELETE BLOCK COND EXEC
⑧ UPPER MENU

This value will be 127 when AV-LIGHT-LEVEL (average light level) is selected for the processing mode.

· You can switch between displaying all of the headings together and displaying each one separately using the ESC key.

Menu	Setting details
① POINT SIZE	Set the size of the point (vertical and horizontal), within the range of 2 to 32, in units of 2 pixels.
② STO POSITIONS	Set points individually, and select NO/YES to store each. · There are a maximum of 256 point registration locations (0 to 255) for the BIN-CONV (binary) mode and 128 point registration locations (0 to 127) for the AV-LIGHT-LEVEL (average light level) mode. · The point identifying a block of pixels is the starting point.
③ START POINT POS	Set the starting point position. · A group of pixels used as a point are treated as a single pixel. · The point identifying a block is the starting point.
④ BLOCK LAYOUT	Set the number of vertical objects times the number of horizontal objects that will be registered as a block.
⑤ BLOCK SPACING	Set the vertical and horizontal intervals for points in the objects that will be registered as a block, in unit of 1 pixel. (Min. 0 pixel.)
⑥ STORE BLOCK COND	Store the settings as a block.
⑦ DELETE BLOCK COND	Delete all of the registered points in a block.
⑧ PRIOR MENU	Returns you to the [MEASURING COND] (measurement condition) menu.

[Example of a block registration]



(Binary image)

Enter 002 (vertical) × 003 (horizontal) in item ④ BLOCK LAYOUT, and enter the vertital (Y) and horizontal (X) intervals in item ⑤ BLOCK SPACING. Then select item ⑥ STORE BLOCK COND to store the settings for the block.

Return to the [MEASURING COND] (measurement condition) menu, and select item ⑤ UPPER MENU

Item ⑦ EVALUATION COND (evaluation condition) in the [TYPE00 to MEAS1 to 3] menu.

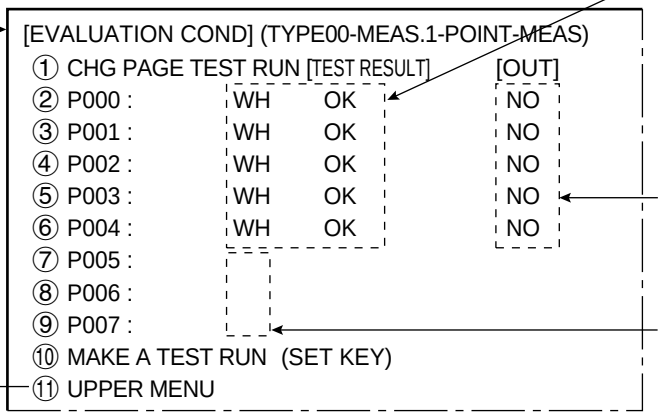
When BIN-CONV (binary) is selected as the processing mode.

When AV-LIGHT-LEVEL (average light level) is selected as the processing mode.

Continued on the following page

Go to page 9·112

Continued from the previous page (when BIN-CONV (binary conversion) was selected for the processing mode)



OK/NG judgment
White: Will be OK if a majority of the objects to be measured is seen as white.
Black: Will be OK if a majority of the objects to be measured is seen as black.
Example: When the object to be measured is an 8 x 8 area (64 pixels) and white was selected for an OK judgement, if the amount of white in the area is 33 pixels or more, a judgment of OK will be produced.

These displays can be set using the up and down keys.
(The choices are NO, Y0 to 7, C000 to C127)

Not displayed for point numbers which have not been previously registered on the point setting menu.

Evaluation conditions	Setting details
① CHG PAGE (page change)	Point numbers ② to ⑨ can be displayed as groups of 8 objects, using the up and down keys.Pressing the SET key will test the evaluation conditions, display the test results.
② P . . ⑨ P	The white or black judgment condition assigned to point numbers 0 to 255 is set using the up and down keys. · The numbers of the selected points will flash. · No color is displayed for unregistered point numbers.
⑩ MAKE A TEST RUN	Pressing the SET key will test the evaluation conditions, display the test results.
⑪ UPPER MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

· Assign an OK measurement value of white or black after checking the test results (OK/NG) from the item ⑩ MAKE A TEST RUN.

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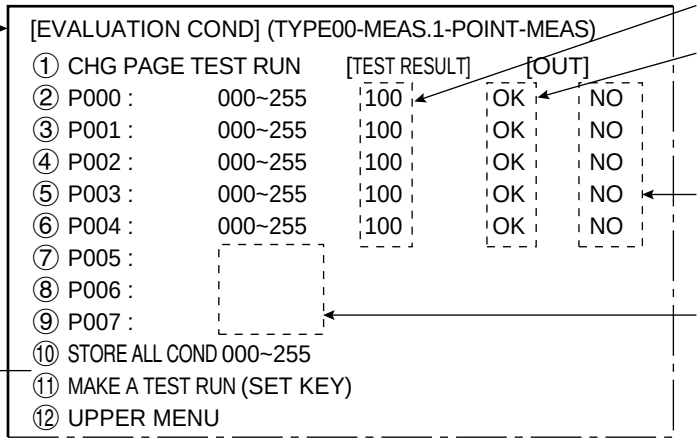
Return to the [TYPE00-MEAS1 to 3] menu, and select item ⑨ OUTPUT CONDITIONS.

Go to page 9·113

From page 9-110: When AV-LIGHT-LEVEL (average light level) is selected for the processing mode.



Evaluation condition	Setting details
① CHG PAGE (page change)	Point numbers ② to ⑨ can be displayed as groups of 8 objects, using the up and down keys. Pressing the SET key will test the evaluation conditions, display the test. results.
② P - - ⑨ P	Set the range of the average light level for all point numbers from 0 to 127. - The numbers of the selected point will flash. - No light level is displayed for unregistered point numbers.
⑩ STORE ALL COND	The light level is collectively averaged for all of the point numbers that have been registered.
⑪ MAKE A TEST RUN	Pressing the SET key will test the evaluation conditions, display the test results.
⑫ UPPER MENU	This will return you to the [TYPE00-MEAS1 to 3] menu.

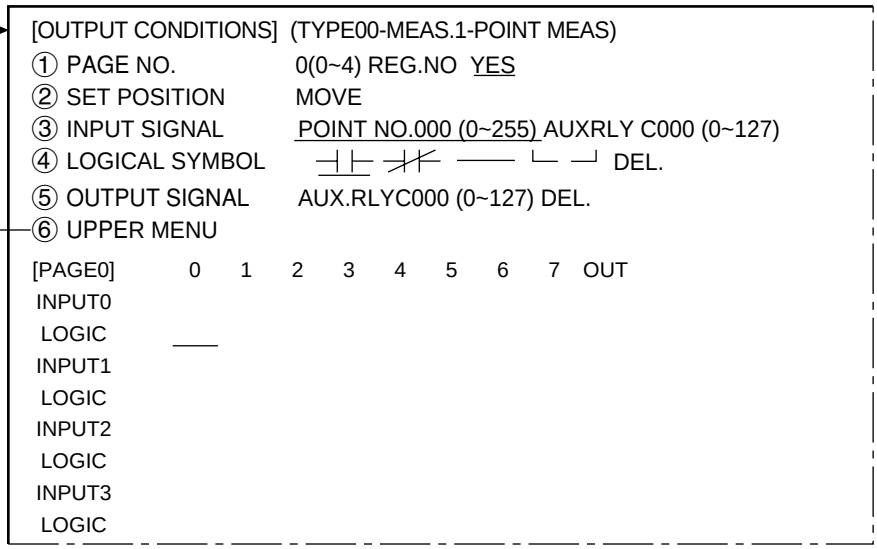
- Set the measurement value (range of the average light level) that will produce a result of OK in item ⑪ MAKE A TEST RUN.

Return to the [TYPE00-MEAS1 to 3] menu, and select item ⑨ OUTPUT CONDITIONS.

Continued on the following page

From page 9·111: When BIN-CONV (binary) was selected for the processing mode.

Continued from the previous page: When AV-LIGHT-LEVEL (average light level) is selected for the processing mode.



· Items ② to ⑤ will be displayed when item ① is set to YES.
· The input signals which maybe set depend on the selection made in item ③ as follows:

Selection of item ③	Input signals
Point number	P000 to P255 *
Auxiliary rely	C000 to C127

* When AV-LIGHT-LEVEL (average light level) is selected for the processing mode, the setting range is P000 to P127.

· For more information on output conditions, see the “PC Function” in Chapter 10.

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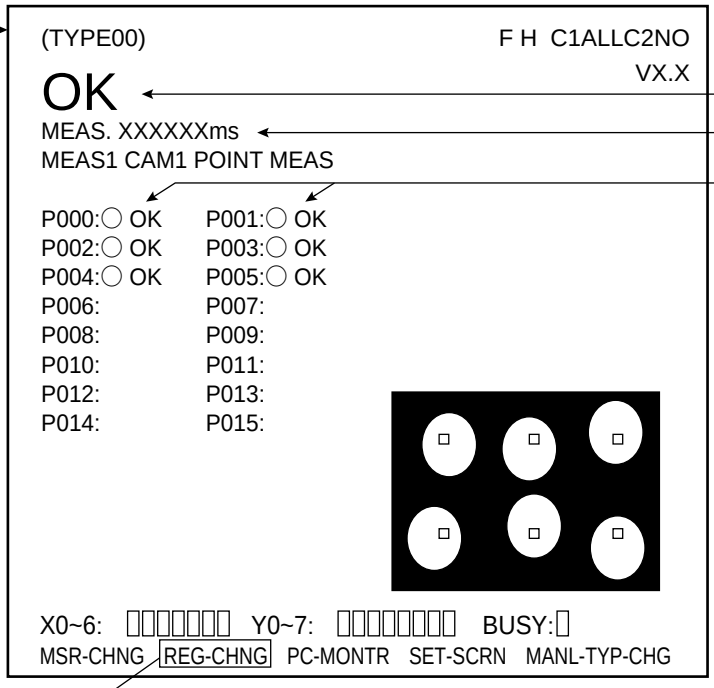
Returns to the MAIN OPS MENU.

Continued on the following page

Form the preceding page

When the TRG/BRT key is pressed, manual measurement will start, and the points will be measured. The following is how the display of the results will look when BIN (binary) was selected for the processeing mode.



[Display of the measured results]

- Final evaluation result
- Measuring time
- Evaluation of the correct black or white color detected at registered points

Object to be measured \ Evaluation condition (OK)	White	Black
White (display ○)	OK	NG
Black (display ●)	NG	OK

· When the cursor is moved to the REG-CHNG (change register) item and the up or down key is pressed, the point number display will show groups of 16 objects at a time.
Up key: Next set of numbers, Down key: Previous set of numbers

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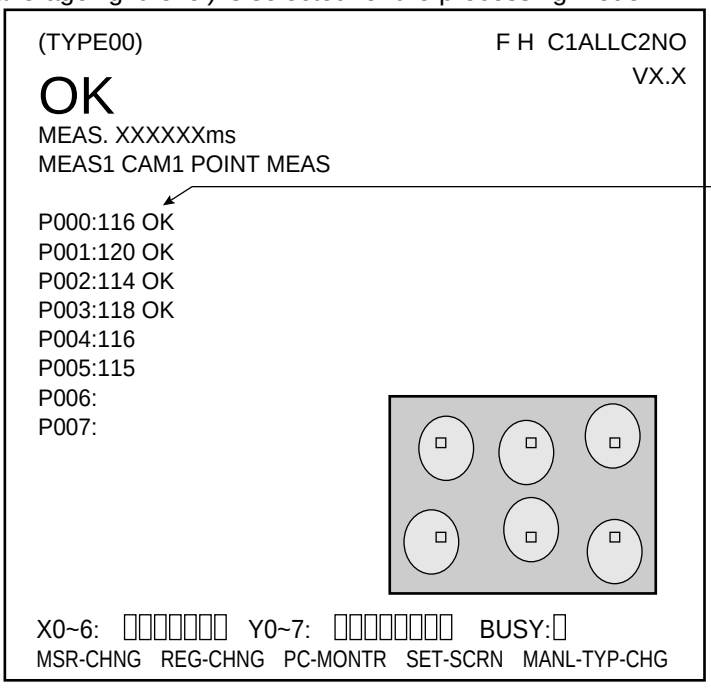
· The following is an example of how the results are displayed when AV-LIGHT-LEVEL (average light level) is selected for the processing mode.



[Display of the measured results]

- Average light level of registered points and the OK/NG evaluation of each

9-11 System settings

[1] Illuminance (light level) monitor

(1) Purpose

1. Allows the system to monitor changes the lighting of the environment

If the light level exceeds the preset lighting range, it will be regarded as a change in the environment and "Light level over range" will be displayed on the MAIN OPS MENU.

2. Automatic adjustment of the threshold values used for binary conversions can follow changes in the lighting environment.

The threshold value is modified from the user's setting due to changes in the actual brightness measured in the environment.

(2) Applications

Used when the level of illumination changed due to changes in voltage or when the influence of sunlight in the workplace cannot be ignored.

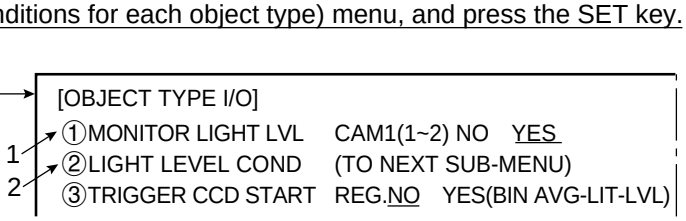
(3) Setting procedure

The following procedure describes how to handle the settings in the [OBJECT TYPE I/O] menu and in the [MONITOR LIGHT LVL] (check light level) menu.

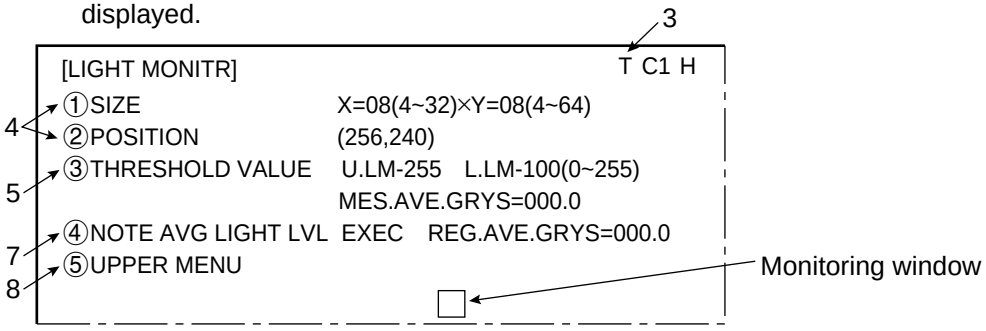
On the MAIN OPS MENU, move the cursor to SET-SCRN, and press the SET key

⇨ On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.

⇨ Move the cursor to item ⑮ SYSTEM-IN/OUT on the [OBJECT TYPE COND] menu (conditions for each object type) menu, and press the SET key.



1. Select ① MONITOR LIGHT LVL (check light level) using the up and down keys, and press the SET key.
   - After selecting the camera number (1 or 2) using the up and down keys, select YES using the left and right keys. Then press the SET key.
2. Select item ② LIGHT LEVEL COND. (conditions for checking light level) using the up and down keys, and press the SET key.
   ⇨ The [LIGHT MONITR] (check light level) menu and the monitoring window will be displayed.



3. Press the SEL key to enter the through image mode.
   ⇨ T (through) will be displayed in the upper right corner of the screen.
4. Select item ① SIZE, and item ② POSITION, using the up and down keys, and press the SET key. Then, set the size and position of the monitoring window using the direction keys.
   - The monitoring window should be placed in a location with medium brightness, which does not contain any objects to be measured.
   - The monitor window is a rectangle 4 to 32 pixels tall and 4 to 64 pixels wide (se in multiples of 4 pixels). The monitor window can be moved one pixel at a time.
   - The average light level in the monitoring window is displayed on MES.AVE.GRYS (average measured light level) in item ③.

[When monitoring changes in the lighting environment] ... If not, go to item 6.

5. Select item ③ THRESHOLD VALUE, using the up and down keys, and press the SET key.
   - Select the upper and lower limits using the left and right keys, and set the light level range (0 to 255) using the up and down keys. Then, press the SET key.
   ⇨ When the average light level in the monitoring window is out of the preset light level range, OVR ILLM. RANGE (light level over range) will be displayed on the MAIN OPS MENU.

[When the threshold value for binary conversion is automatically modified to take into account changes in the lighting environment] .... If not, go to item 8.

6. Press the SEL key to enter freeze frame the image.
   ⇨ F (freeze) will be displayed in the upper right corner of the screen.
   - Before reading and storing the next average light level sample, it is necessary to enter the freeze frame.
7. Select item ④ NOTE AVG LIGHT LVL (average light level registration), using the up and down keys, and press the SET key. When the SET key is pressed again, the REG. AVE. GRYS (average light level) will be registered.
   - This average light level is required when threshold value correction is selected in the binary conversion method.
   ⇨ If the average light level has not been registered, you will see error 22: BIN MON. LIGHT LVL NOT SET (the light level check function has not been enabled).
   - The registered light level is the reference value used when threshold values are modified.
   - If the current screen is not a frozen image, CHANGE TO FREEZE MODE (change to freeze) will be displayed.
8. Select item ⑤ UPPER MENU, using the up and down keys, and press the SET key.
   - Press the SET key again to store the parameter settings in the IV-S20 flash memory.

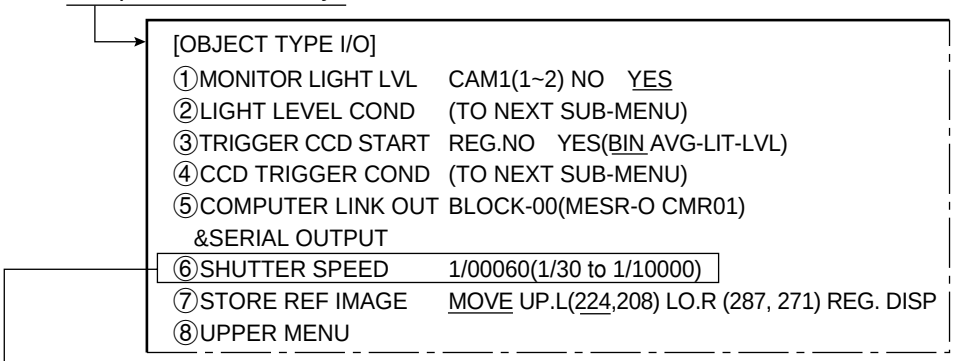
After the measurement monitoring function is turned ON and images have been captured, the lighting monitoring function set above will be active.

[2] Shutter speed

On the MAIN OPS MENU, move the cursor to SET-SCRN, and press the SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to ② OBJECT TYPE COND (conditions of object type) and press the SET key.

⇨Move the cursor to item ⑮ SYSTEM-IN/OUT, on the [OBJECT TYPE COND] menu, and press the SET key.



The shutter speed can be set arbitrarily in the range of 1/30 to 1/10,000 of a second (Initial value: 1/60, Unit: second).

[Setting procedure]

1. Select item ⑥ SHUTTER SPEED, using the up and down keys, and press the SET key.
2. Move the cursor to the digit you want to set, using the left and right keys.

   1/00060
   This will move the cursor to the left and right.
3. Set the value using the up and down keys.
4. Repeat steps 2 and 3 to set each digit.
   After setting all of the digits, press the SET key.

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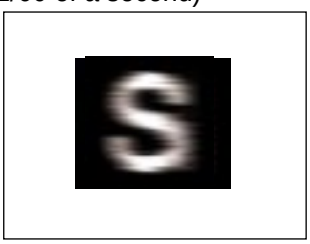
- Since the same shutter speed can be used for all of the object types.
- Since the shutter speed can be set continuously in the range of 1/30 to 1/10,000 of a second, very fine adjustment is possible.
- If you want to measure moving objects and increase the image processing speed, set the shutter speed to around 1/1000 or 1/2000 seconds. However, if you use a faster shutter speed than you need, very bright lights will be necessary, and bright lighting is not economical.
- For details about the relationship between the brightness of objects (objects to be measured) and the shutter speed, see section "6-1 [2] Illumination and shutter speed."

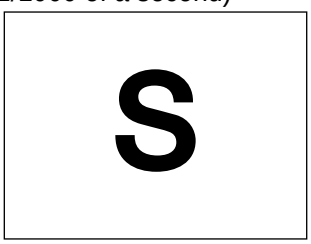
[Example]

· When the shutter speed is slow (1/60 of a second)



The object is blurred across the screen.

· When the shutter speed is fast (1/1000 of a second)



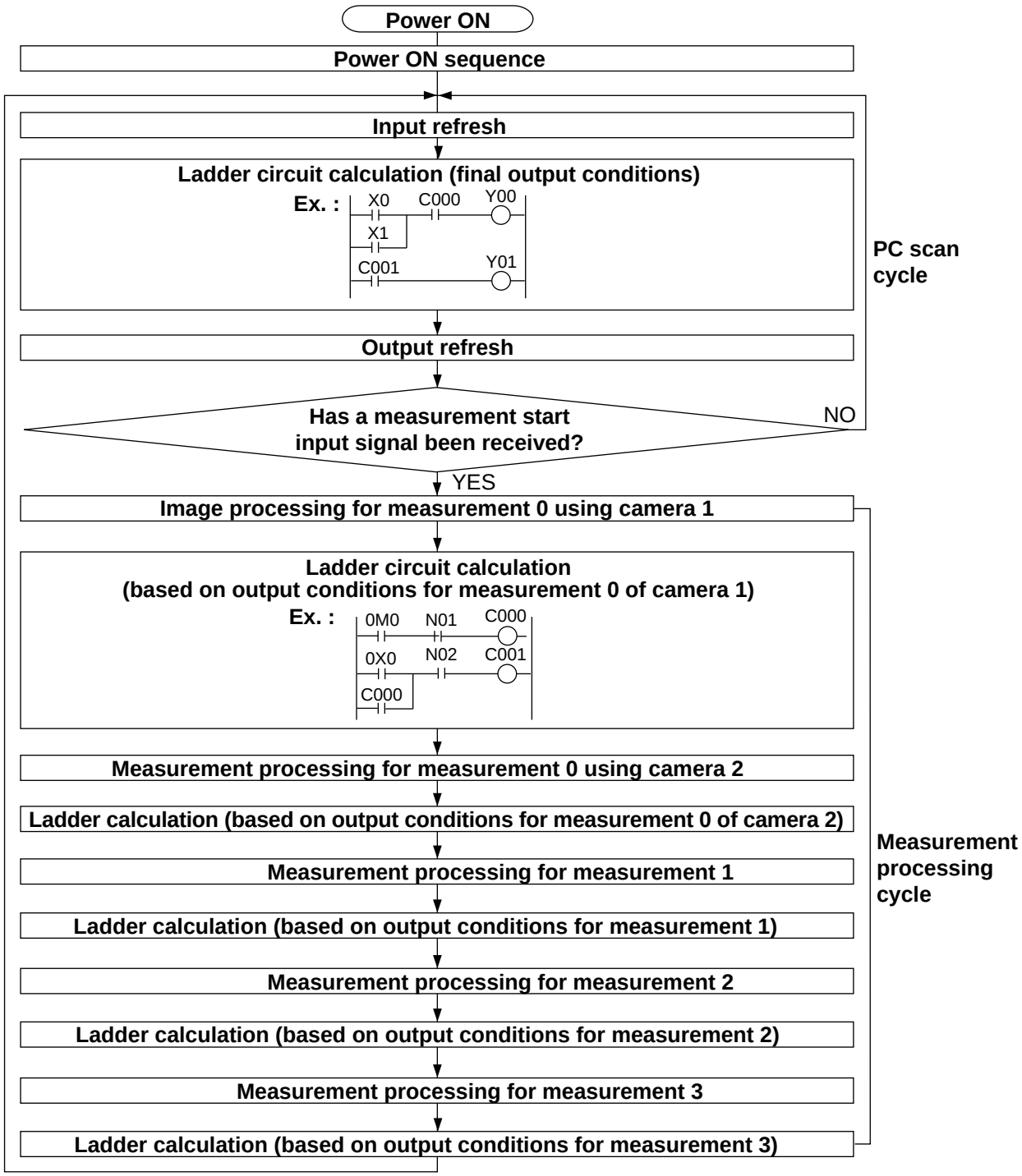
The object is frozen on the screen.

Chapter 10: PC Function

The PC function is designed to create a ladder circuit program based on the data (coordinates, distance, degree of match, and results of numerical calculations) obtained from the measurements and calculations made by the IV-S20. Then it outputs the results of the calculations performed by the circuit.
Use of the PC function enables the IV-S20 to output measurement results to an external equipment such as a lamp by itself, without the need for an external PC.

10-1 Operation cycle

The operation cycle of the IV-S20 is outlined below. This flowchart contains only the operations related to the PC function, and does not show communications with external devices.



[1] Power ON sequence

The parallel output terminals (Y0 to Y7) are reset, and the data memories (input relays, output relays, auxiliary relays, timer and counter) are cleared.

[2] PC scan cycle

In the PC scan cycle, the following three operations (1) to (3) are repeated cyclically.

(1) Input refresh

The ON/OFF data from the parallel input terminals (X0 to X6) is written into the data memory (input relays).

(2) Ladder circuit calculation (final output conditions)

The calculations are executed by the ladder circuit program which contains the data from input relays, output relays, auxiliary relays (incl. output which are obtained by the ladder circuit program calculation in the measurement processing cycle), timer and counter.

(3) Output refresh

The ON/OFF data of the output relays, obtained in calculation (2), is output to the parallel output terminals (Y0 to Y7).

- The processing time for the three steps described above is called "1PC scan time," and ranges from 0.3 to 3.0 ms, depending on the settings.

[3] Measurement processing cycle

When the measurement start input signal is given, the measurement processing is carried out, and the calculations of the ladder circuit program for measurements 0 to 3 are executed.

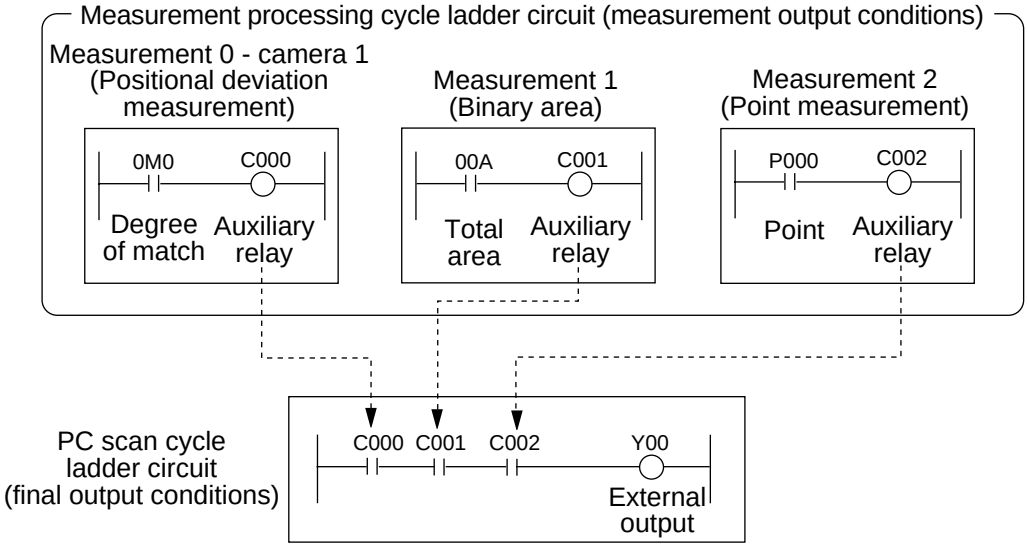
(1) Measurement processing (measurement 0 to 3)

- The coordinates, distance, and degree of match are determined by the measurement programs. If the numerical calculation conditions have been set, calculations will be executed.
- Each measurement obtained is judged to be OK or NG, based on the criteria entered by the user. If it is OK, 1 (ON) will be used as the input condition for the following calculation on the ladder circuit, and if it is NG, 0 (OFF) will be used.

(2) Ladder circuit calculation (based on output conditions for measurements 0 to 3)

- The values obtained from the measurement processing are used as the input conditions for the ladder circuit. Calculations will be executed by a ladder circuit. The output relays are the auxiliary relays that will be used for calculation by the ladder circuit in the PC scan cycle.

■ The relationship between the ladder circuit in the measurement processing cycle and the ladder circuit in the PC scan cycle



Notes

- 128 auxiliary relays, C000 to C127, can be set. However, identical auxiliary relay numbers cannot be used for measurement 0 using camera 1, and measurement 0 using camera 2, or for measurement 1, measurement 2 and measurement 3.
- The auxiliary relays C110 to C127 are special relays. The special relays are used on the PC scan cycle ladder circuit. Do not use them for the measurement processing cycle ladder circuit.

10-2 Ladder circuit program creation

[1] Procedure for creating measurement output condition and a ladder circuit

A separate ladder circuit can be created for positional deviation measurement, degree of match inspection, distance/angle measurement, lead inspection, area measurement by binary conversion, object counting by binary conversion, label measurement by binary conversion, and point measurement.

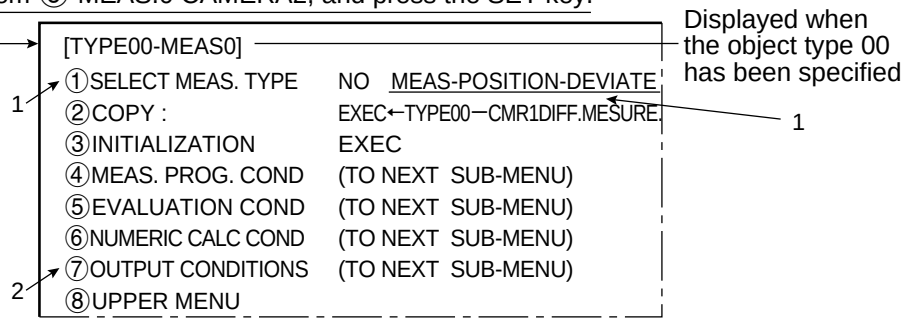
The procedure for creating a ladder circuit for positional deviation measurement is given below. A ladder circuit can be created the same way for other measurement just change the input contact point setting.

(1) Operation to invoke the [OUTPUT CONDITIONS] menu (for positional deviation measurement)

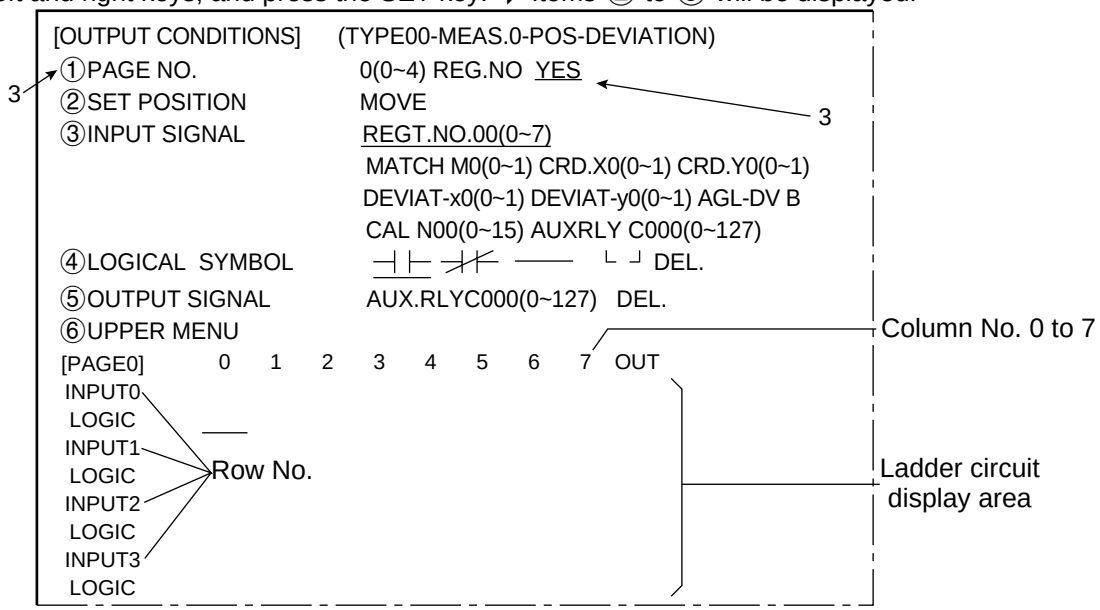
On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to item ② OBJECT TYPE COND (condition of object type), and press the SET key.

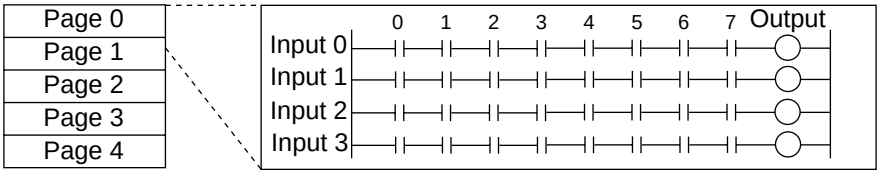
⇨ On the [OBJECT TYPE COND] menu, move the cursor to item ④ MEAS.0 CAMERA1, or item ⑥ MEAS.0 CAMERA2, and press the SET key.



1. Move the cursor to item ① SELECT MEAS. TYPE with the up and down keys, and press the SET key. Then, move the cursor to MEAS-POSITION DEVIATE. with the left and right keys, and press the SET key.
2. Move the cursor to item ⑦ OUTPUT CONDITIONS with the up and down keys, and press the SET key. ⇨ The [OUTPUT CONDITIONS] menu will be displayed.
3. After moving the cursor to item ① PAGE NO. with the up and down keys and after pressing the SET key, specify page number 0 with the up and down keys. Set the REG. item to YES with the left and right keys, and press the SET key. ⇨ Items ② to ⑤ will be displayed.



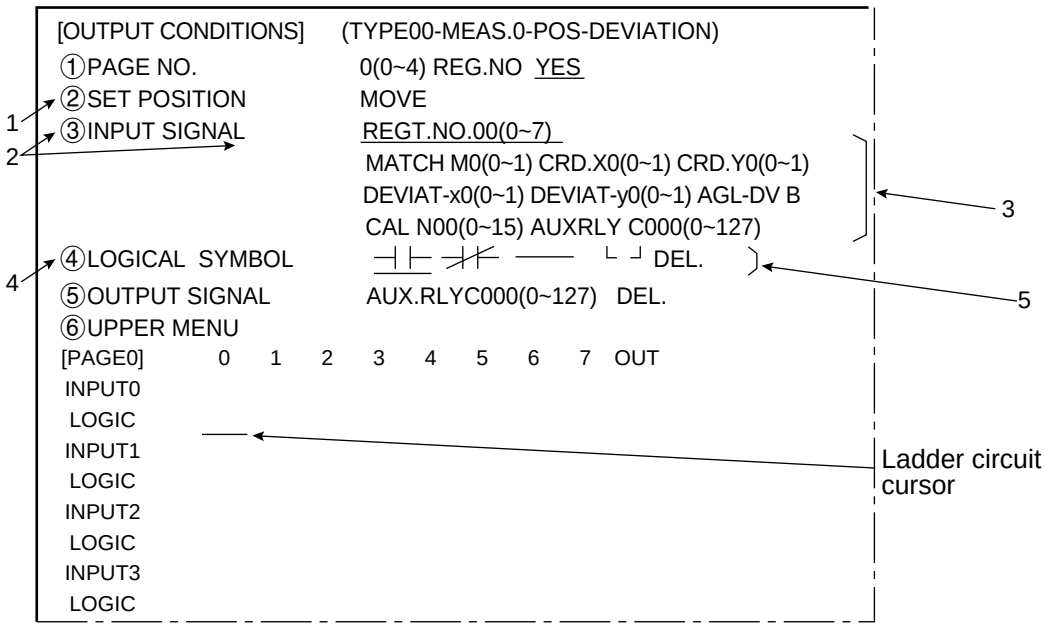
A ladder circuit program can be created on each page from 0 to 4 consisting of 4 rows, each of which has 8 terminals and 1 output relay. Therefore, a ladder circuit can be created that consists of 20 rows in all (one row contains 8 terminals and 1 output relay). Calculations will be carried out in the order of the page numbers 0, 1, 2, 3 and 4.



Continued on the following page

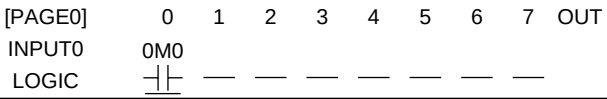
From the preceding page

(2) Ladder circuit creation 1 (setting input signals)



1. Move the cursor to item ② SET POSITION with the up and down keys, and press the SET key.
   - The ladder circuit cursor can be moved with the up, down, left and right keys. Move the cursor to a position where an input terminal will be placed, and press the SET key.
2. Move the cursor to item ③ INPUT SIGNAL with the up and down keys, and press the SET key.
   - In the case of the positional deviation measurement, degree of match inspection, lead inspection, object counting by binary conversion or label measurement by binary conversion, first move the cursor to REGT.NO. (register number) with the left and right keys, and select a number with the up and down keys. This registration number should be the same registration number specified on the [EVALUATION COND] menu.
     - Positional deviation measurement: 0 to 7 Degree of match inspection: 0 to 15
     - Lead inspection: 0 to 3 Object counting by binary conversion: 0 to 3
     - Label measurement by binary conversion: 0 to 3
3. After moving the cursor to the kind of input signal you want with the left and right keys, select a number with the up and down keys. Then press the ESC key. (See page 10-6 for the kinds of input signals available for each measurement program, and see page 10-7 for details about the auxiliary relays.)
4. Move the cursor to item ④ LOGICAL SYMBOL with the up and down keys, and press the SET key.
5. Move the cursor to the logic symbol to be used for the input signal selected in step 3, and press the SET key.
   ⇨ The logic symbols and the input signals will be displayed as a ladder circuit.

Display example:

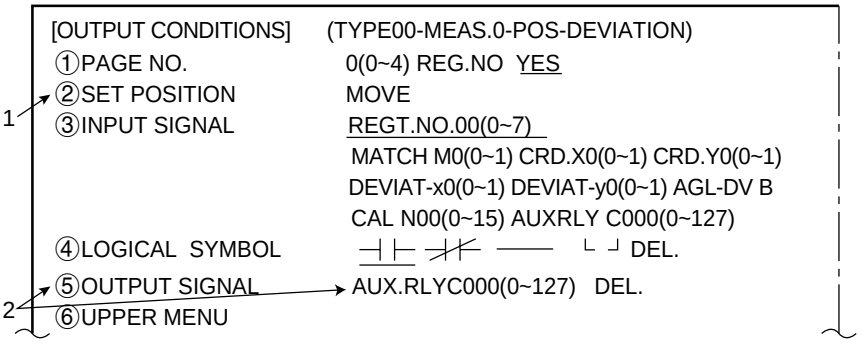


Logic symbol	Function
⊣ ⊢	a contact on a series circuit (ON, when the evaluation result is OK)
⊣/⊢	b contact on a series circuit (OFF, when the evaluation result is OK)
—	Deletes a contact on the cursor. (Contacts after the deleted contact will not be brought forward.) Note: This symbol cannot be used on the first row.
└	Used to create an OR circuit.
┘	Used to create an OR circuit
Deletion	Deletes the contact on the cursor. (Contacts after the deleted contact will be brought forward.) When a contact exists only on the first row, if the contact is deleted, also the output relay will be deleted.

Continued on the following page

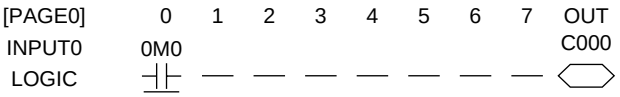
From the preceding page

(3) Ladder circuit creation 2 (setting output signals)



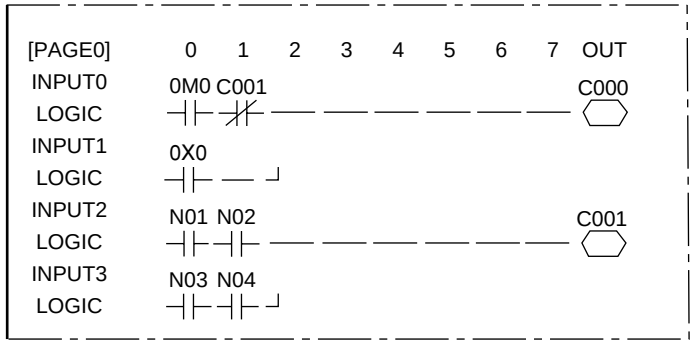
1. Move the cursor to item ② SET POSITION and press the SET key.
   - Move the cursor to a row where a ladder circuit output signal will be placed with the up and down keys, and press the SET key.
     An output signal can only be placed on rows where input signals have already been placed.
2. Set the cursor to item ⑤ OUTPUT SIGNAL with the up and down keys, and press the SET key.
   - Select an output auxiliary relay number (see page 10-7) with the up and down keys, and press the SET key.
     ⇨ The output symbol and auxiliary relay number will be displayed on the row specified in step 1.

Display example:

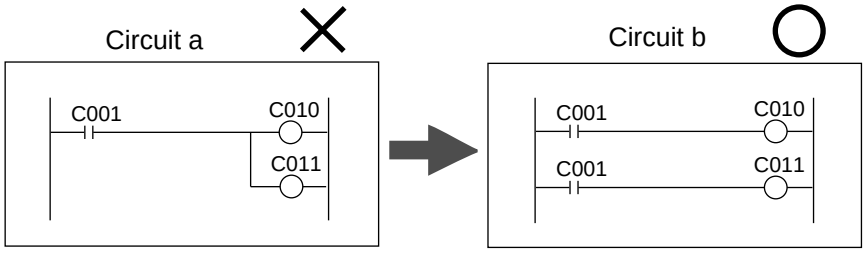


(4) Create a ladder circuit for the page numbers registered in step (1), repeating the operations in steps (2) and (3)

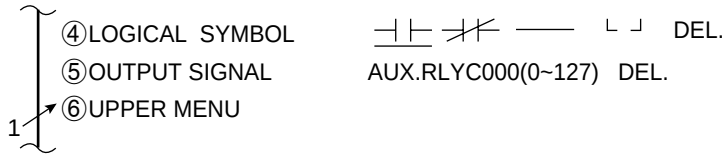
Creation example:



Note: Output relays cannot be used in series on a ladder circuit. Change circuit a to circuit b.



(5) Storing the circuit in the IV-S20 memory (RAM)



1. Move the cursor to item ⑥ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [TYPE-MEAS] menu, and the ladder circuit creation process will be finished.

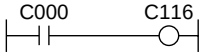
[Kinds of input signals in each measurement program]

Kind of input	Measurement function			
	Positional deviation measurement	Matching inspection for shape and size	Distance and angle measurement	Lead inspection
Degree of match	Model 0: 0M0 to 7M0 Model 1: 0M1 to 7M1	Model 0 (positioning): 00M0 to 15M0 Model 1 (measuring object): 00M1 to 15M1	[Start point] 00M to 15M	0M to 3M
Coordinate X	Model 0: 0X0 to 7X0 Model 1: 0X1 to 7X1	Model 0 (positioning): 00X0 to 15X0 Model 1 (measuring object): 00X1 to 15X1		0X to 3X
Coordinate Y	Model 0: 0Y0 to 7Y0 Model 1: 0Y1 to 7Y1	Model 0 (positioning): 00Y0 to 15Y0 Model 1 (measuring object): 00Y1 to 15Y1		0Y to 3Y
Coordinate deviation x	Model 0: 0x0 to 7x0 Model 1: 0x1 to 7x1			
Coordinate deviation y	Model 0: 0y0 to 7y0 Model 1: 0y1 to 7y1			
Angle (deviation) B	0B to 7B		00B to 15B	
Light level G		Model 0 (positioning): 00G0 to 15G0 Model 1 (measuring object): 00G1 to 15G1		
Start point coordinates S			00S to 63S	
Auxiliary point coordinates H			00H to 15H	
Distance D			00D to 15D	0D0 to 0D7… 3D0 to 3D7
Quantity K				0K0 to 0K7… 3K0 to 3K7
Lead length L				0L0 to 0L7… 3L0 to 3L7
Numerical calculation N	N00 to N15	N00 to N15	N00 to N15	N00 to N15
Auxiliary relay	C000 to C127			

Kind of input	Measurement function			
	Area measurement by binary conversion	Counting quantities by binary conversion	Label measurement by binary conversion	Point measure-ment
Total area A	00A to 15A	0A to 3A	0A to 3A	
Quantity K		0K to 3K	0K to 3K	
Area of each label R			0R000 to 0R127 …3R000 to 3R127	
Point P				P000 to P255
Numerical calculation N	N00 to N15	N00 to N15	N00 to N15	N00 to N15
Auxiliary relay	C000 to C127			

[Auxiliary relay C000 to C127]

The functions of the auxiliary relays (C000 to C127), which can be used for input and output signals, are explained below.

Relay No. (relay name)	Function	
	Use for input signals	Use for output signals
C000 to C109 (internal calculation)	· Relays for internal calculation · For the final output conditions, relays also used for output in the measurement processing cycle can be used.	
C110, C111	Reserved area (Do not use these relays.)	
C112 (Final evaluation result)	· Turned ON when all of the evaluation items have been judged OK, and turned OFF if any single item has been judged NG. · If C116 is not used, OK/NG will be displayed on the MAIN OPS MENU which correspons to ON/OFF of C112. * · If an error occurs (C118 is turned ON),C112 will be turned OFF (NG).	———
C113 (Continuous measurement start input)	———	· When C113 is ON, continuous measurements will be executed. (Ex) When X0 is ON,continuous measurements will be executed. 
C114 (CCD trigger status output)	Output the CCD trigger status to C114, regardless of the Yes/No setting for the start of the measurement. · When “binary conversion” is specified, if the white area is 50% or more of the image, C114 will be turned ON, and if it is less than 50 %, C114 will be turned OFF. · When the “average light level” is specified, C114 will be turned ON when the image is within the specified level range, and turned OFF when it is out of the range.	———
C115	· The same signal as the BUSY/READY signal is output internally.	———
C116 (programmable output)	———	· If an output signal is passed to C116, the display of the OK/NG result on the MAIN OPS MENU will depend on the ON/OFF state of C116. (Ex.)“OK” is displayed on the MAIN OPS MENU when C000 is ON, and “NG” when the C000 is OFF.  · If C116 relay is not used, the display of the OK/NG result will depend on of the final evaluation result (C112). *
C117 (Illuminance monitor error)	· Turned OFF when the illumination exceeds the upper or lower warning level of the illuminance monitor set on the [MONITOR LIGHT LVL] menu (page 9·115). Warning light levels can be set for each of the cameras 1 and 2 separately. This relay is turned OFF when either one of them exceeds the upper or lower level.	———
C118 (measurement operation error)	· Turned ON when a measurement processing error occurs.(However, except the end code 34/35/36/3E. ⇨ See page 15·4.)	
C119 (measurement termination)	· Turned ON upon termination of measurement processing, and turned OFF when a measurement start input signal is given.	
C120 to C127 (counter reset)	· Do not use these relays for input signals.	· They are turned ON to reset counters CN0 to CN7. C120 to C127 correspond to CN0 to CN7. Create a circuit for sending an output signal to one of these relays on the row following a row that contains a counter instruction. (Counter instruction ⇒ See page 10·12.)

* OK/NG displayed on the MAIN OPS MENU ⇨ See page 7·2.)

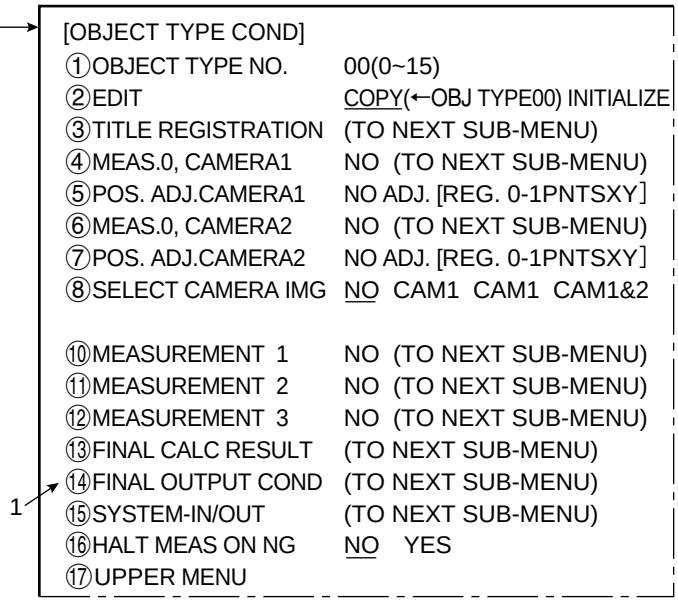
[2] Procedure for creating the final output conditions in a ladder circuit

A ladder circuit can be created for each object type (0 to 15) using the following procedure.

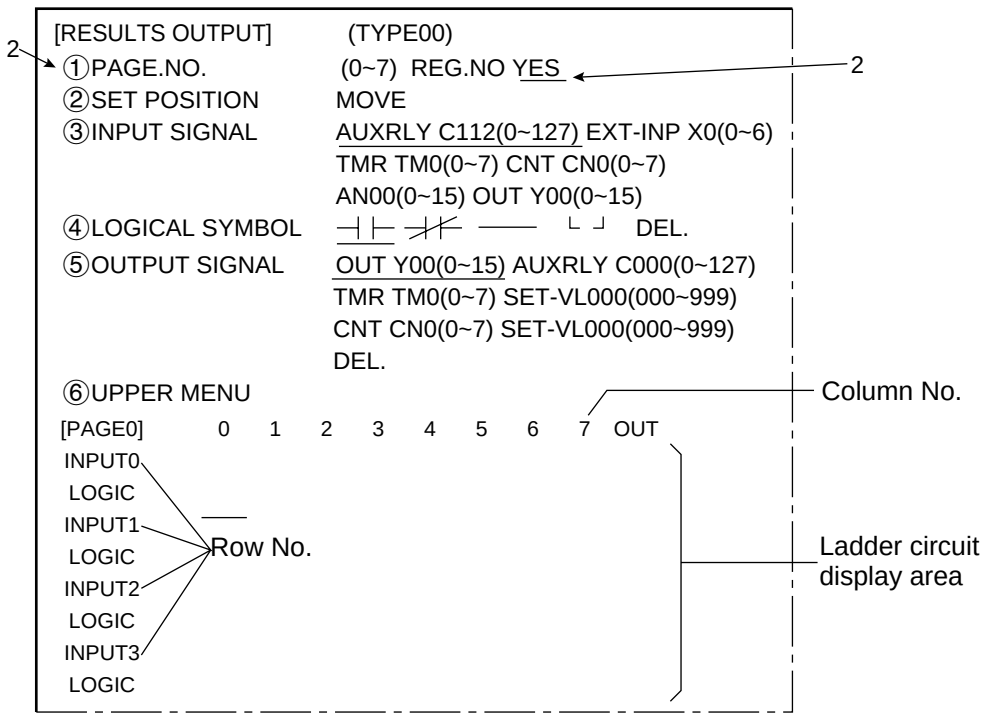
(1) Operation to invoke the [FINAL OUTPUT COND.] menu

On the MAIN OPS MENU, move the cursor to SET-SCRN item, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to item ② OBJECT TYPE COND and press the SET key.



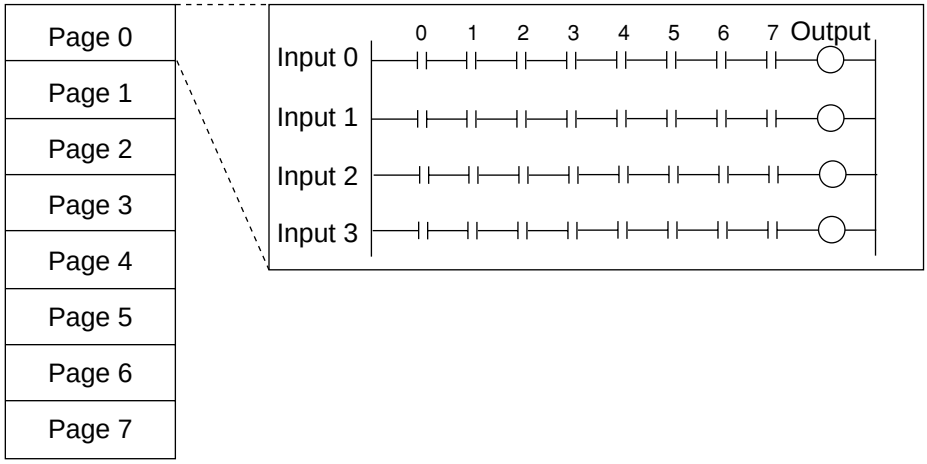
1. Move the cursor to item ⑭ FINAL OUTPUT COND with the up and down keys, and press the SET key.
   ⇨ The [RESULTS OUTPUT] menu will be displayed.
2. After moving the cursor to item ① PAGE NO. (register number) with the up and down keys, and pressing the SET key, specify page number "0" with the up and down keys, set the REG. (register) item to YES with the left and right keys, and press the SET key. ⇨ Items ② to ⑤ will be displayed.



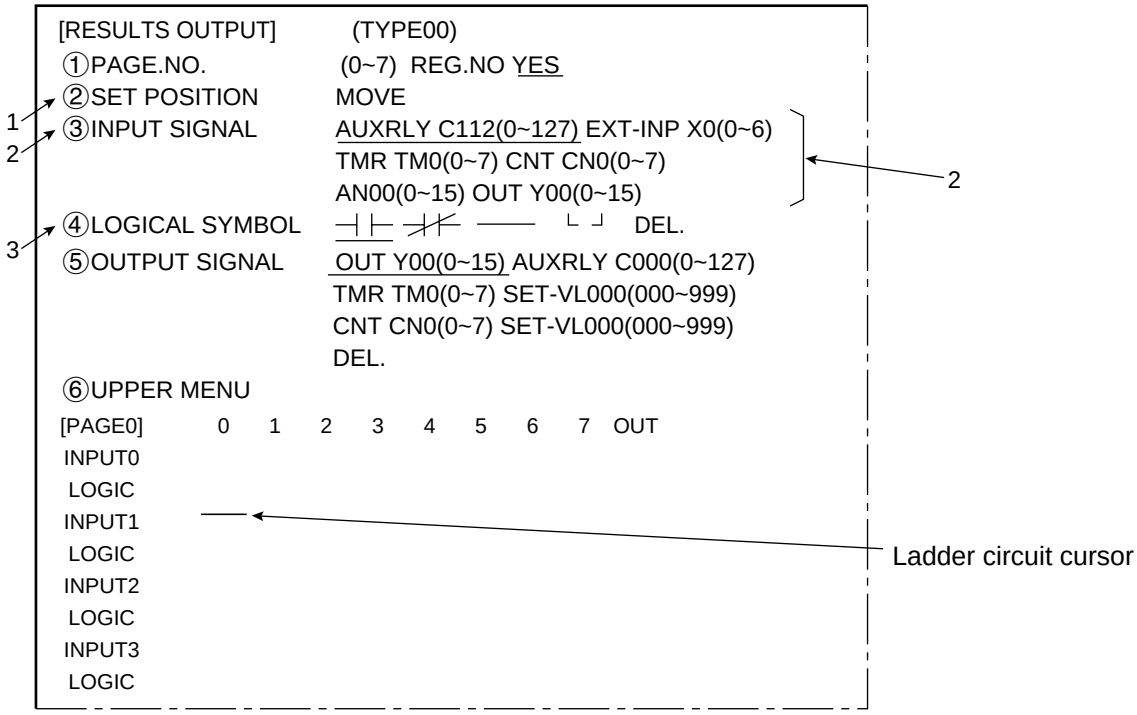
Continued on the following page

From the preceding page

A ladder circuit can be created on each page from 0 to 7 consisting of 4 rows, each of which has 8 terminals and 1 output relay. Therefore, a ladder circuit can be created that consist of 32 rows in all (one row contains 8 terminals and 1 output relay).
Calculations will be carried out in the order of the page numbers 0, 1, 2, 3, 4, 5, 6 and 7.



(2) Ladder circuit creation 1 (setting input signals)



1. Move the cursor to item ② SET POSITION with the up and down keys, and press the SET key.
   - The ladder circuit cursor can be moved with the up, down, left and right keys. Move the cursor to the position where you want to place an input terminal, and press the SET key.
2. Move the cursor to item ③ INPUT SIGNAL with the up and down keys, and press the SET key.
   - Set the kind of input signal and its number.
   - After moving the cursor to the kind of input signal you want, select a number with the up and down keys, and press the ESC key.

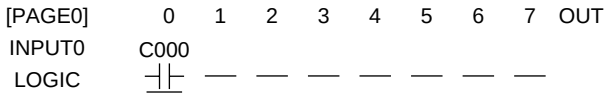
Continued on the following page

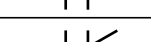
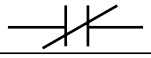
From the preceding page

Kind of input signal	Data memory No.	Function
External input terminals	X0 to X6	The external input terminals X0 to X6 can be assigned.
Timer terminals	TM0 to TM7	When any of the timer instructions TM0 to TM7 causes a time-out, the corresponding terminal is turned ON. When a timer instruction input is switched OFF, the terminal is turned OFF.
Counter terminals	CN0 to CN7	When any of the counter instructions CN0 to CN7 counts out, the corresponding terminal is turned ON. When any of the counter reset relays C120 to C127 for the respective counters is turned ON, the corresponding terminal is turned OFF.
Final calculation result terminals	AN0 to AN15	When the final numerical calculation results AN0 to AN15 are OK, these terminals are turned ON. If any of the results are NG, they are turned OFF. (See item 9-2 [4] for details about the final numerical calculation.)
Output terminals	Y0 to Y15	They can be used as auxiliary relays for the external output terminals Y0 to Y15.

· See page 10-7 for details about the auxiliary relays C000 to C127.

3. Move the cursor to item ④ LOGICAL SYMBOL with the up and down keys, and press the SET key.
4. Move the cursor to the logic symbol to be used for the input signal selected in step 3, and press the SET key.
   ⇨ The logic symbols and the input signals will be displayed as a ladder circuit.
   Display example:



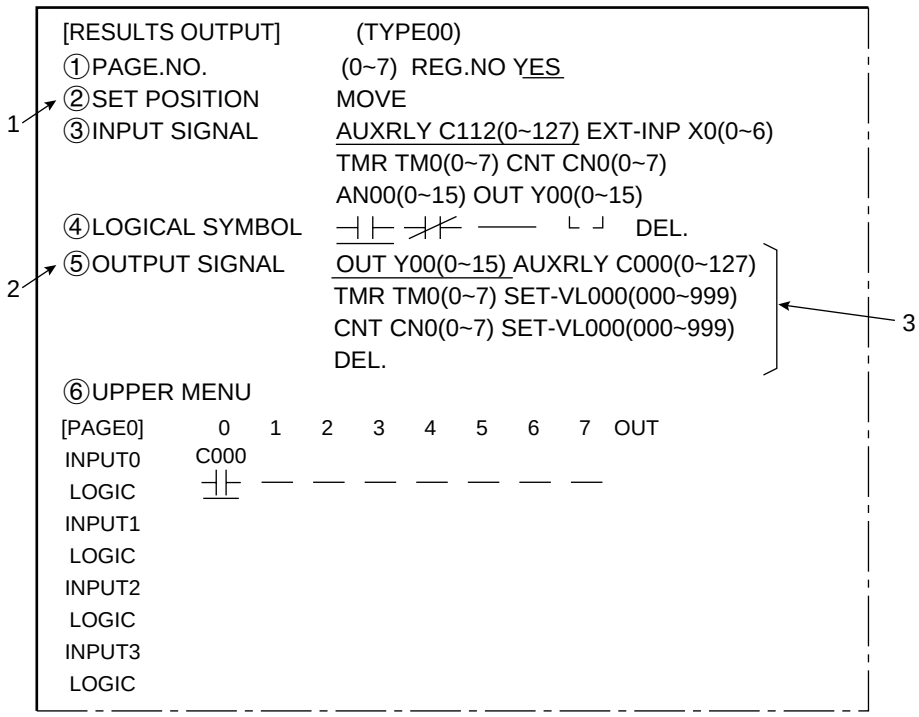
Logic symbol	Function
	a contact on a series circuit (ON, when the evaluation result is OK)
	b contact on a series circuit (OFF, when the evaluation result is OK)
	Deletes the contact on the cursor. (Contacts after the deleted contact will not be brought forward.) Note: This symbol cannot be used on the first row.
	Used to create an OR circuit.
	Used to create an OR circuit
Deletion	Deletes the contact on the cursor. (Contacts after the deleted contact will be brought forward.) When a contact exists only on the first row, if the contact is deleted, also the output relay will also be deleted.

10

Continued on the following page

From the preceding page

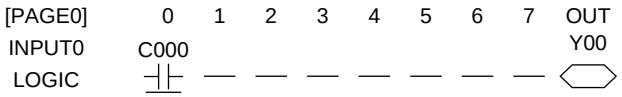
(3) Ladder circuit 2 (setting output signals)



1. Move the cursor to item ② SET POSITION with the up and down keys, and press the SET key.
   - Move the cursor to the row where a ladder circuit output relay will be placed, and press the SET key. An output relay can only be placed only on rows where input signals have already been placed.
2. Move the cursor to item ⑤ OUTPUT SIGNAL with the up and down keys, and press the SET key.
3. Select the kind of output signal and the number (set value). After moving the cursor to the desired output signal with the left and right keys, select a number (set value) with the up and down keys, and press the SET key.

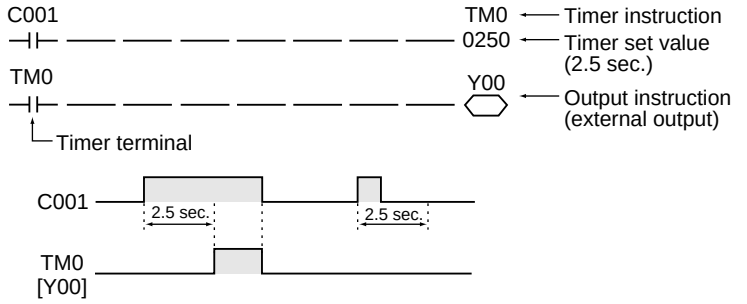
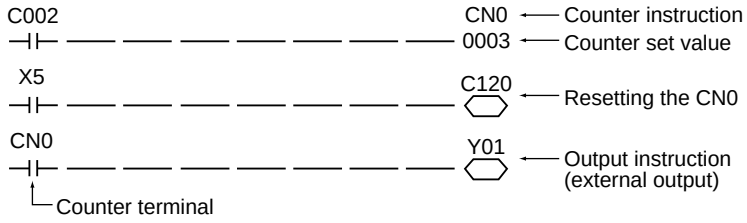
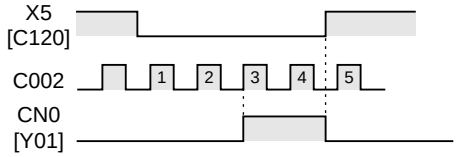
   ⇨ The output symbol and signal will be displayed on the row specified in step 1.

   Display example:



Continued on the following page

From the preceding page

Kind of output signal	Data memory No.	Function
External output instructions	Y0 to Y7	Output to the parallel I/F, general purpose serial I/F and computer link
	Y8 to Y15	Output to the general purpose serial I/F or computer link
Timer instructions	TM0 to TM7	A timer terminal will be turned ON for a set amount of time (set value 000 to 999, unit 10 ms) after the timer instruction is input. (Decrementing type) When the timer instruction input is turned OFF, the timer terminal will be turned OFF. **[Ex.]** 
Counter instructions	CN0 to CN7	While the counter reset relay is OFF, if a counter instruction input is cycled from OFF to ON, the number of times you set (set value 000 to 999), the counter terminal will be turned ON. (Decrementing type) When the counter reset relay is turned ON, the counter terminal is turned OFF. Create a circuit to turn the counter reset relay ON and OFF on the row following a row that containing a counter instruction. **[Ex.]**  
Deletion		The output relay on the row where the cursor is located will be deleted.

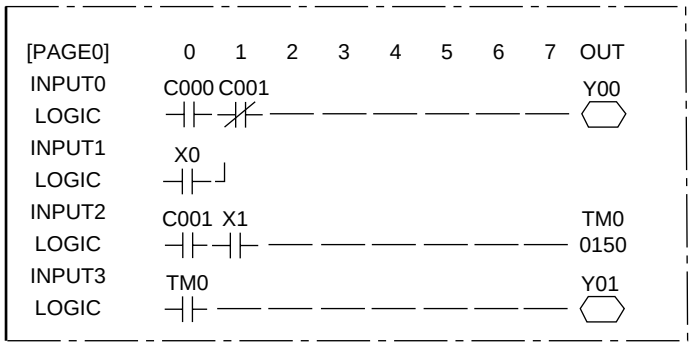
· See page 10-7 for details about the auxiliary relays C000 to C127.

Continued on the following page

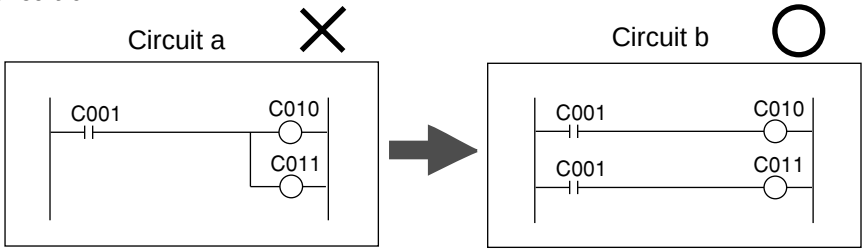
From the preceding page

(4) Create a ladder circuit for the page numbers registered in s.tep (1) repeating the operations given in steps (2) and (3).

Creation example:



Note: Output relays cannot be used in series on a ladder circuit. Change circuit a to circuit b.



(5) Storing the circuit in the IV-S20 memory (RAM)

④LOGICAL SYMBOL ⊣⊢ ⊣/⊢ —— └ ┘ DEL.

⑤OUTPUT SIGNAL OUT Y00(0~15) AUXRLY C000(0~127)
TMR TM0(0~7) SET-VL000(000~999)
CNT CN0(0~7) SET-VL000(000~999)
DEL.

1 ⑥UPPER MENU

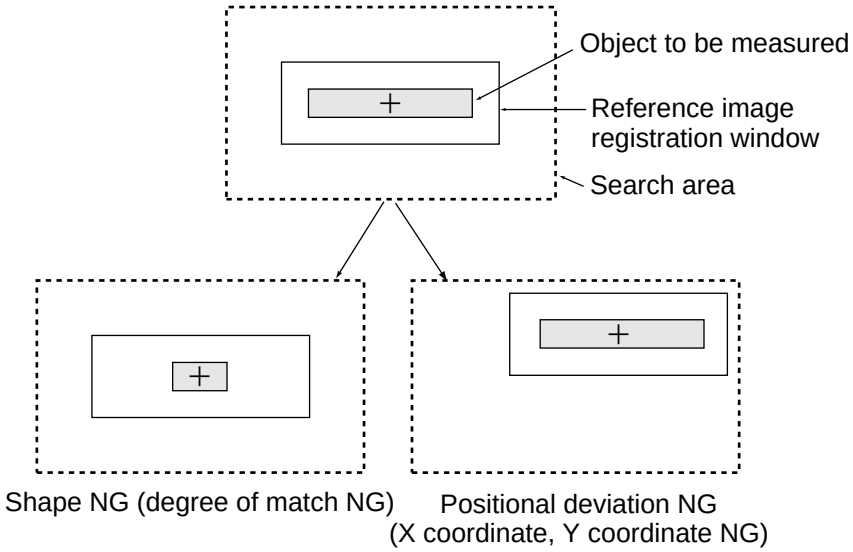
1. Move the cursor to item ⑥ UPPER MENU with the up and down keys, and press the SET key.
   ⇨ The screen will return to the [OBJECT TYPE COND] menu, and the ladder circuit creation process will be finished.

10-3 Program examples (shape and positional deviation inspection)

Outline

The positional deviation measurement (one point search) in measurement 0 allows the degree of match and coordinates to be measured, and the result, OK or NG, is output.

Reference image (registration No.0)



Criteria (acceptable range)

Coordinate (model 0-X): 200.0 to 250.0

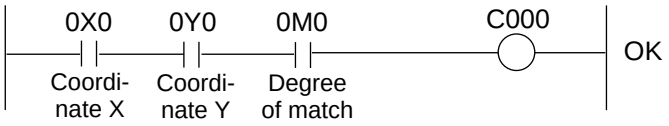
Coordinate (model 0-Y): 150.0 to 200.0

Degree of match (model 0): +09500 to +10000

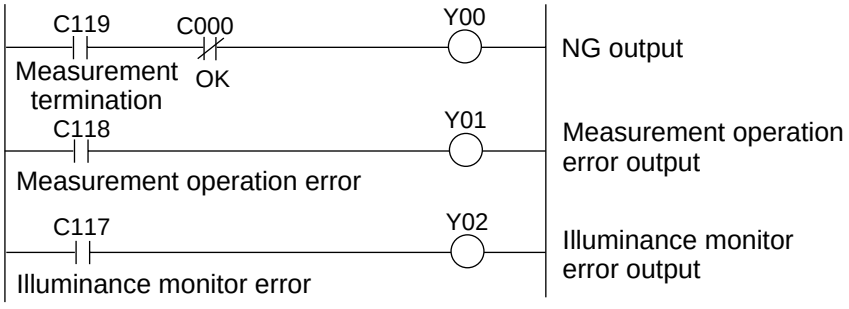
10

Output conditions ladder circuit for measurement 0 using camera 1

When the X coordinate, Y coordinate and degree of match are within acceptable ranges, the auxiliary relay C000 is turned ON.

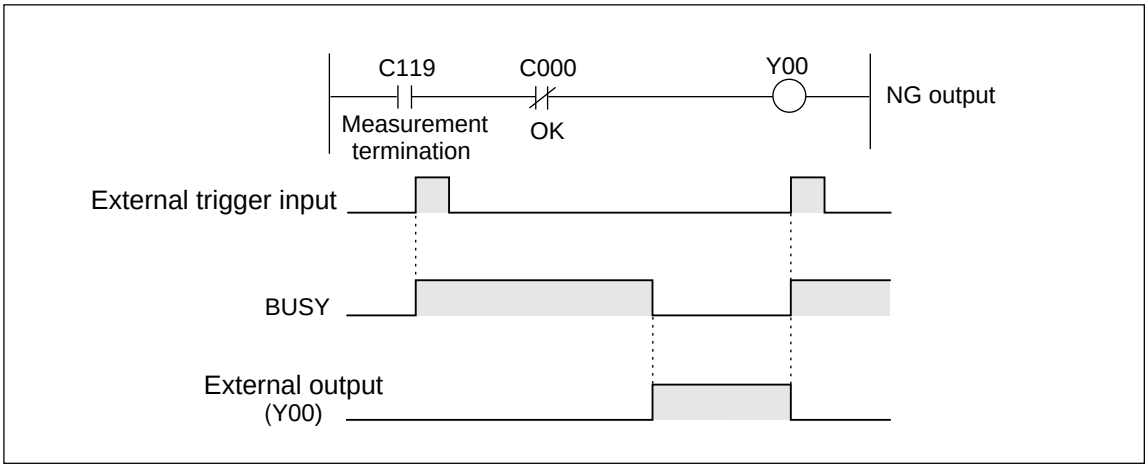


Final output conditions ladder circuit

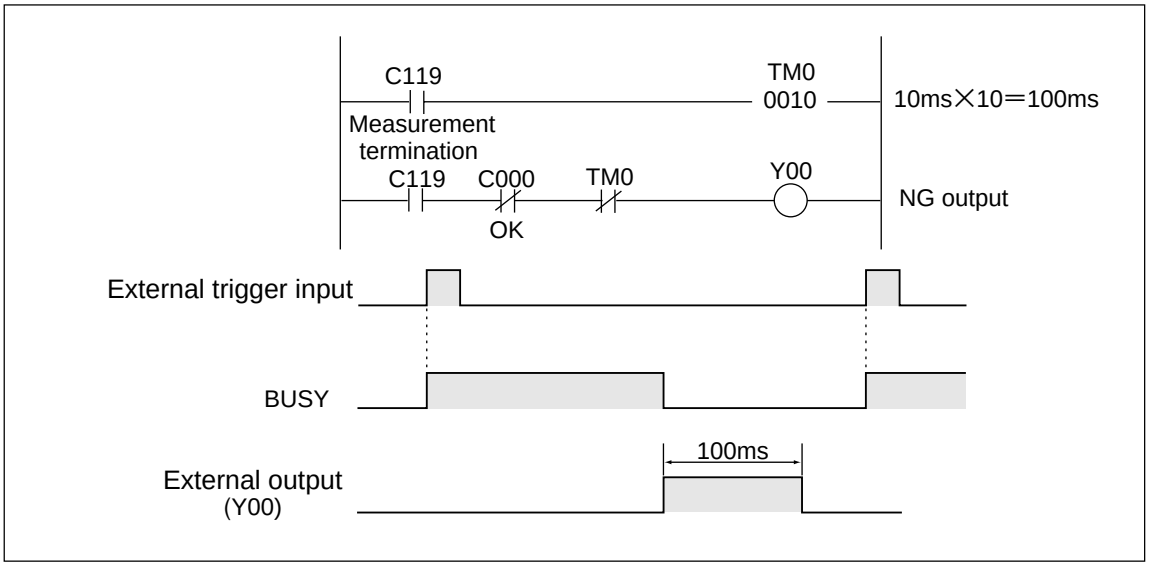


10-4 Examples of a final output conditions ladder circuit

(1) Circuit for keeping the external output ON until the next external trigger is received

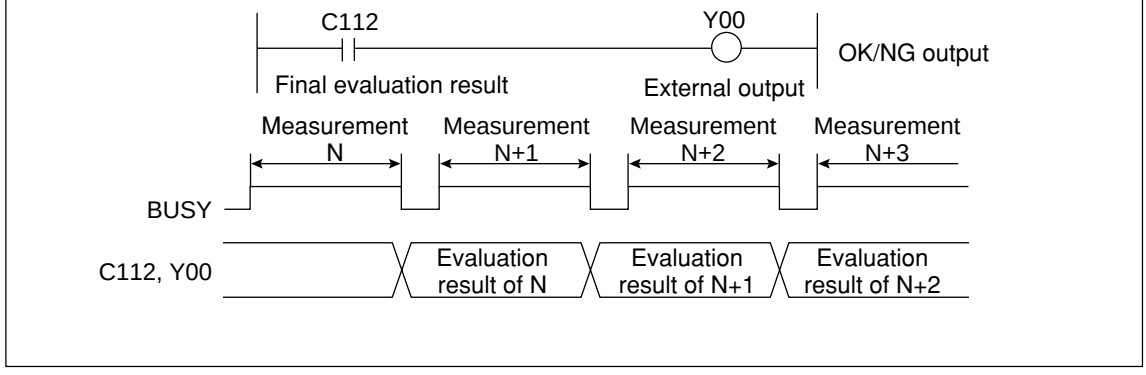


(2) Circuit for controlling the ON time of the external output using the timer



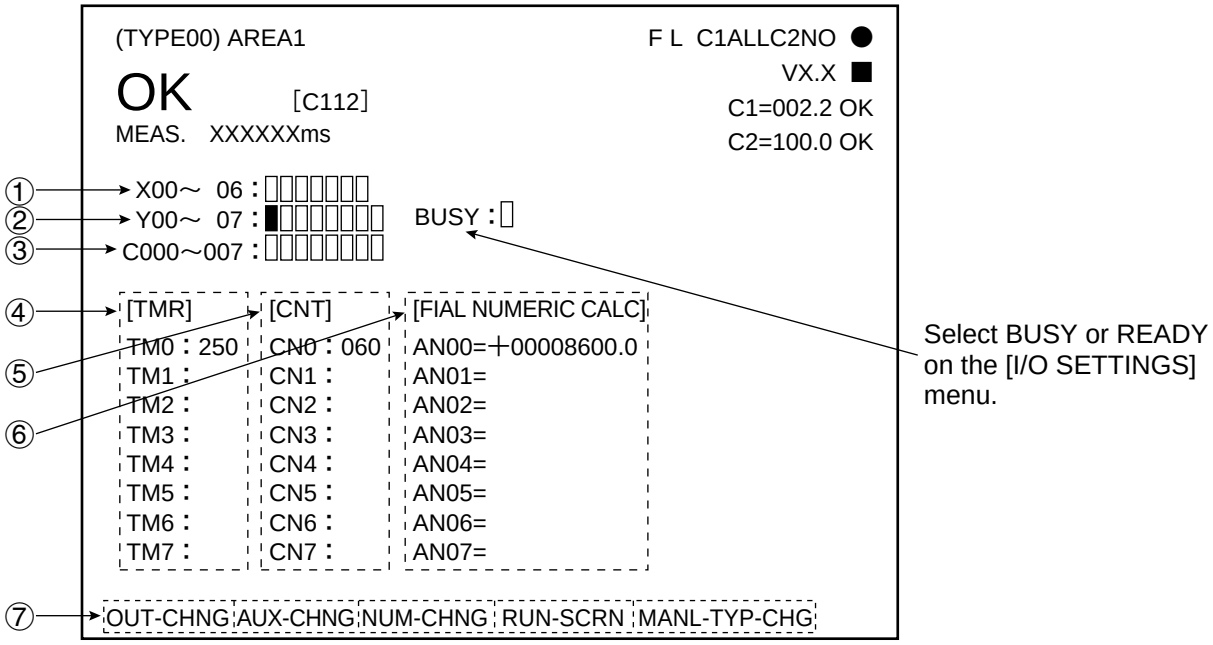
(3) Pipeline control

If the interval between triggers is too close to the total measuring time on a non-stop conveyor line, the time allowed for outputting the measurement result is reduced, and the external device will not receive the measurement results.
In this case, a pipeline control type of circuit should be created, so that the external device can receive the measurement results in the next cycle.



10-5 PC monitor screen

On the MAIN OPS MENU, move the cursor to PC-MONTR item, on the menu bar at the bottom of the screen, and press the SET key. Then, the PC monitor screen will be displayed.



① The ON (■) or OFF (□) status of the input relays (X00 to X06) is displayed.
② The ON (■) or OFF (□) status of the output relays (Y00 to Y15) is displayed.
③ The ON (■) or OFF (□) status of the auxiliary relays (C000 to C127) is displayed.
④ The current timer value is displayed.
⑤ The current counter value is displayed.
⑥ The results (AN00 to AN15) of the final numerical calculations are displayed.
⑦ Menu bar

Menu bar	Description
OUT-CHNG	Change the output relay address (Y00 to Y15) with the up and down keys (in units of 8 points).
AUX-CHNG	Change the auxiliary relay address (C000 to C127) with the up and down keys (in units of 8 points).
NUM-CHNG	Change the final numerical calculation address (AN00 to AN15) with the up and down keys (in units of 8 points).
RUN-SCRN	Press the SET key to return to the MAIN OPS MENU.
MANL-TYP-CHG	Manually change the object type number (00 to 15) with the up and down keys. · The object type number can be changed by setting the OBJ. NO. MANL MODE item to YES. (See page 8·9.) · The image will be cleared every time the object type is changed. (However, when the CAPTURE AN IMAGE item has been set to “NO,” the image will not be cleared.)

The other data displayed is the same as on the MAIN OPS MENU. (See page 7·2.)

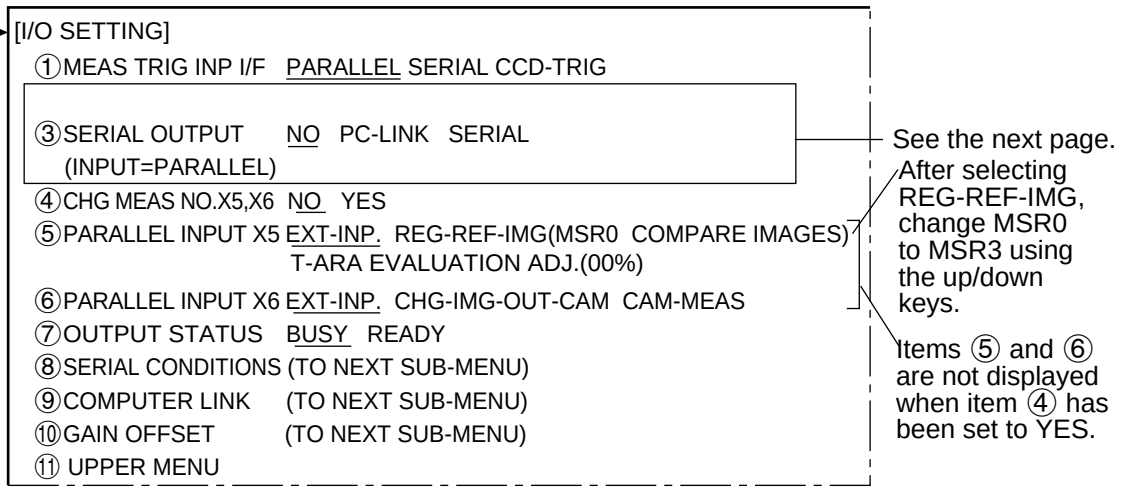
Chapter 11: Setting the Input/Output Conditions

11-1 Outline

This chapter explains the input/output settings on the IV-S20. The conditions are set on the [IN/OUT CND.] menu.

On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.

⇨On the [SYSTEM SETUP] menu, move the cursor to item ③ I/O CONDITIONS and press the SET key.

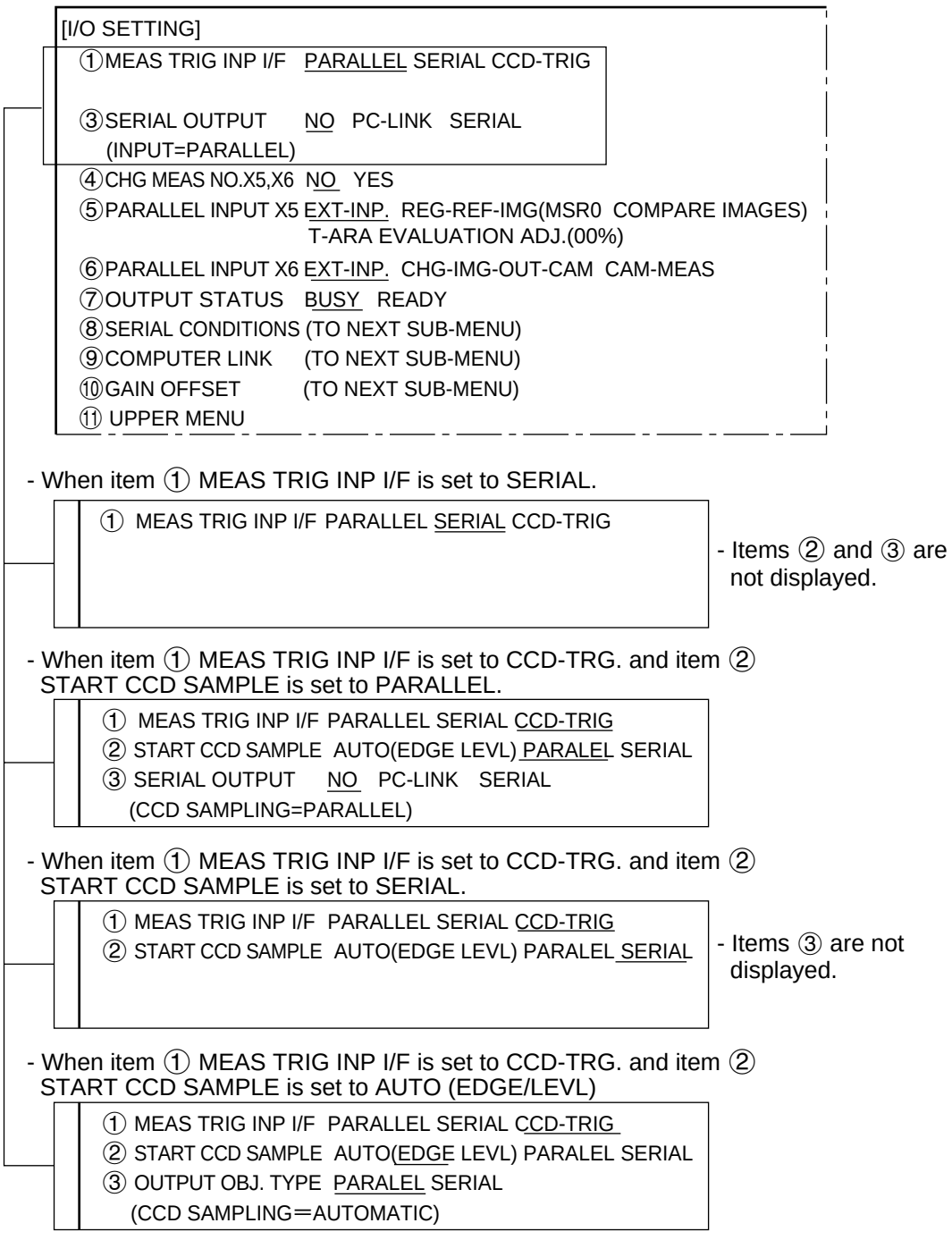


Input/output condition	Setting details
① MEAS TRIG INP I/F (measurement start input)	Select an input interface for starting the measurement on the IV-S20.
② ③	The display of item ② and ③ depends on the setting in item ① MEAS TRIG INP I/F. ⇨ See Item (1) on the next page.
④ CHG MEAS NO. X5, X6 (Measurement No. switching X5 and X6)	Turn ON or OFF the input terminals (INPUT) X5 and X6 to specify the measurement number. ⇨ See item (2) on the next page.
⑤ PARALLEL INPUT X5* (Parallel input X5)	Select the type of input terminal (INPUT) X5. **External input**: The PC function uses the terminal as an external input signal. (See Chapter 10.) **Register reference image – Measurement 0 to 3**: When X5 is switched from OFF to ON on the [MAIN OPS MENU], the reference image (registration number only) for the specified measurement program (camera 1/2) will be stored in the IV-S20 flash memory. **Register reference image – Calculation between images**: When the parallel input X5 on the OBJECT TYPE COND screen is ON, the reference image, that previously registered for calculation between images, is stored in the IV-S20 flash memory. (Calculation between images => See page 9-24 to 9-27.) **Correction of final area judgement**: - When the parallel input X5 on the OBJECT TYPE COND screen is ON, and if the IV-S20 measurements are any of the followings; the upper and lower limits of the final area judgment conditions will be corrected automatically at the specified ratio. (Correction ratio range: 0 to 50%) - Correction compatible measurements: Binary area measurement, counting number of objects after binary conversion, and object identification (labeling) after binary conversion.
⑥ PARALLEL INPUT X6* (Parallel input X6)	Select the type of input terminal (INPUT) X6. **External input**: The PC function uses the terminal as an external input signal. (See Chapter 10.) **Image output camera switching**: The monitor setting on the [MAIN OPS MENU] is switched. (See item [1] Output monitor in Chapter 8.) **Camera measurement**: Runs only the measurement program for the assigned camera No. (When X6 is OFF, camera 1, when X6 is ON, camera 2 is selected)

* Items ⑤ and ⑥ can be selected when ④ CHG MEAS NO. X5, X6 is set to NO.

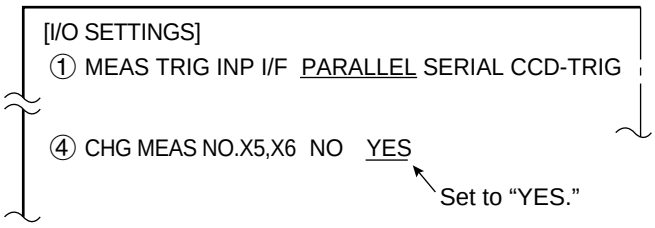
Input/output condition	Setting details
⑦ OUTPUT STATUS (Status output)	Select the IV-S20 output status => See page 6-15, 7-2, and 10-16.
⑧ SERIAL CONDITIONS (Serial communication conditions)	Set the conditions on the next menu when item ① MEAS TRIG INP I/F has been set to SERIAL. (general purpose serial), and when item ③ SERIAL OUTPUT (serial output) has been set to SERIAL or PC-LINK.
⑨ COMPUTER LINK (Computer link)	Set the conditions on the next menu when item ③ SERIAL OUT has been set to PC-LINK.
⑩ GAIN OFFSET (Gain/offset)	See section 11-7 Gain/offset adjustment.
⑪ UPPER MENU	The screen will return to the [SYSTEM SETUP] menu.

(1) The display of items ②and ③depends on the specification in item ①MEAS TRIG INP I/F



(2) Measurement number switching terminals X5 and X6

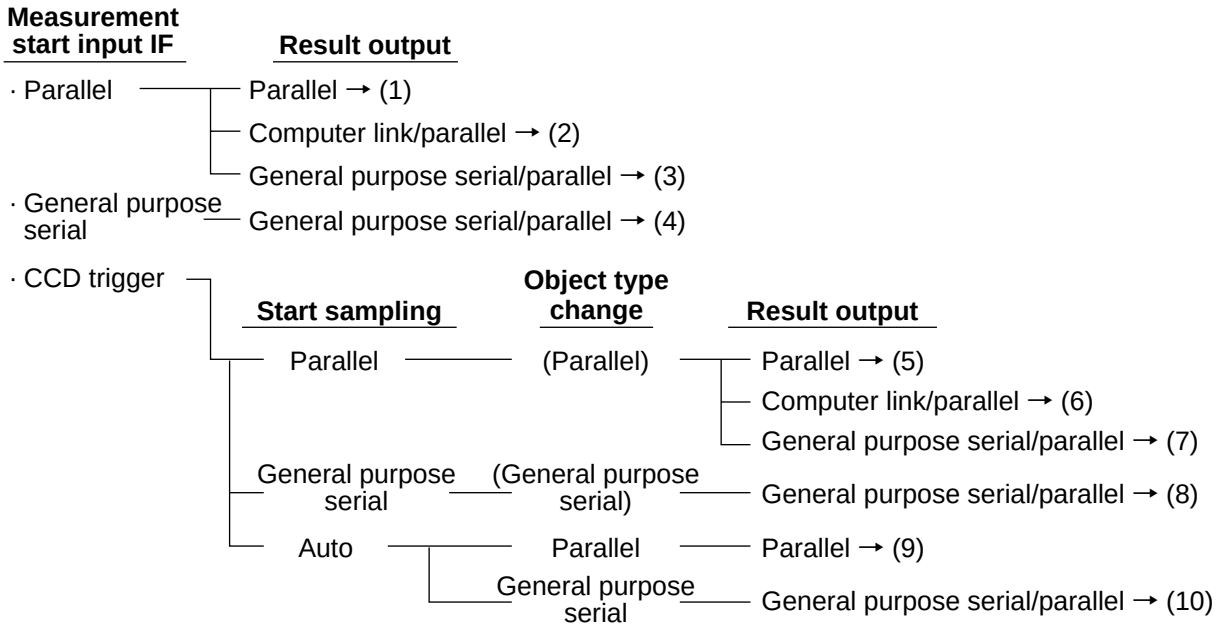
If item ④ CHG MEAS NO. X5, X6 on the [I/O SETTINGS] menu has been set to "YES," the measurement program numbers (in combination with measurement number 0) can be specified from the following 4 combinations by turning ON or OFF the input terminals (INPUT) X5 and X6.



Measurement program	X6	X5
Measurement 0	OFF	OFF
Measurement 0 & 1	OFF	ON
Measurement 0 & 2	ON	OFF
Measurement 0 & 3	ON	ON

11-2 Measurement start input and result output settings

The combinations of various settings for item ① MEAS TRIG INP I/F, item ② START CCD SAMPLE, and item ③ SERIAL OUTPUT (OUTPUT OBJ. TYPE) on the [I/O SETTINGS] menu (page 11-1) are explained below.



The time required to change object types is calculated differently according to the type of measurement start input I/O, as follows:

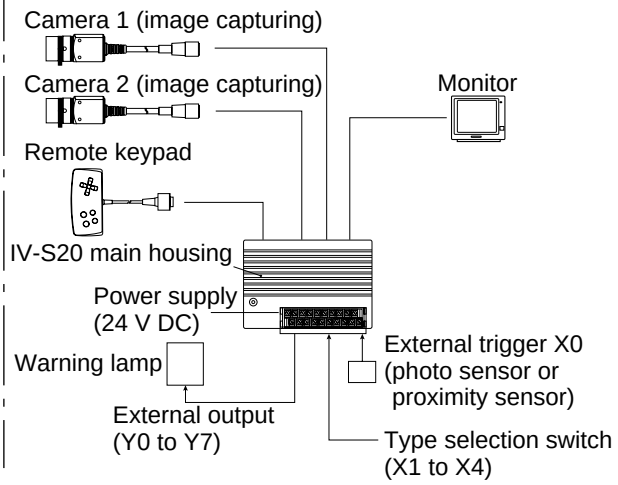
Measurement start input I/F	Time to change object type
Parallel I/O	Included in the measurement execution time
General-purpose serial	Not included in the measurement execution time
CCD trigger	Not included in the measurement execution time

(1) Measurement start input = parallel, object type change = parallel, result output = parallel

· Setting order ① (→ ③)

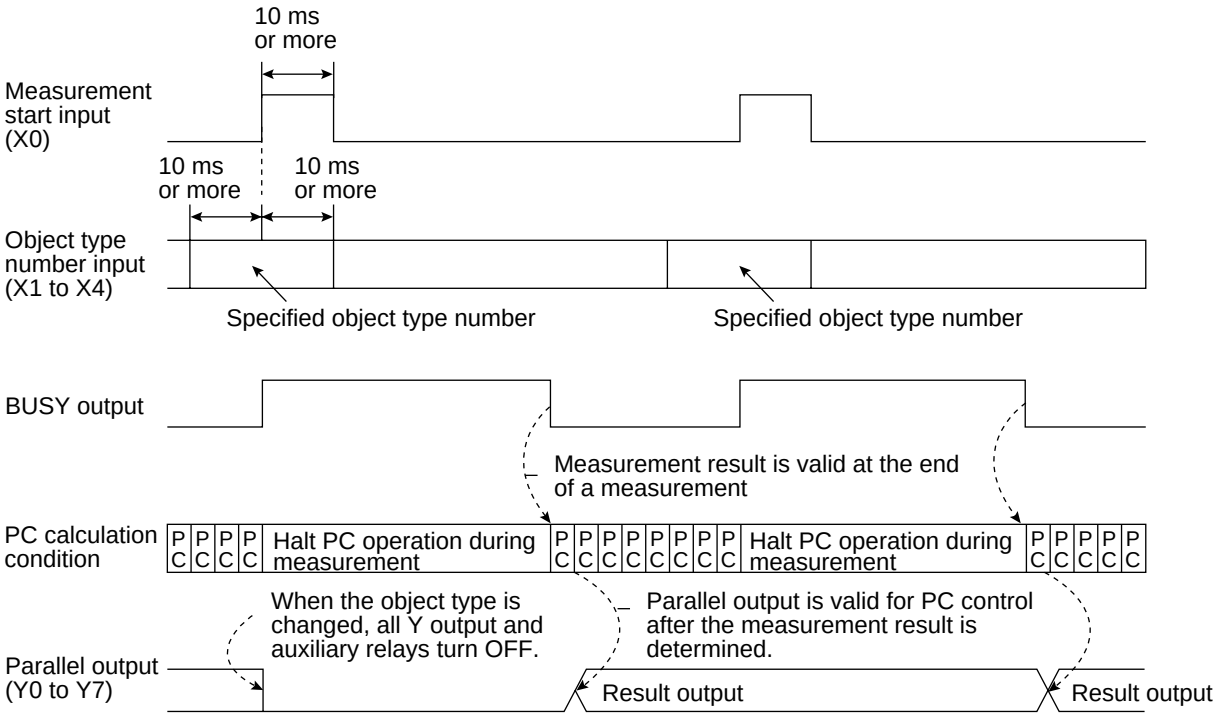
[I/O SETTINGS]
① MEAS TRIG INP I/F PARALLEL SERIAL CCD-TRIG
③ SERIAL OUTPUT NO PC-LINK SERIAL
(INPUT=PARALLEL)

· Configuration example



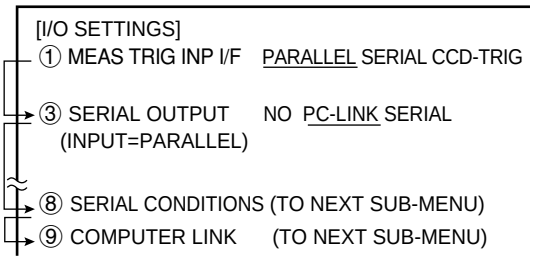
- The conditions for outputting the results to the output signals Y0 to Y7 are set by the PC function. (See Chapter 10 "PC Function.")

- Time chart

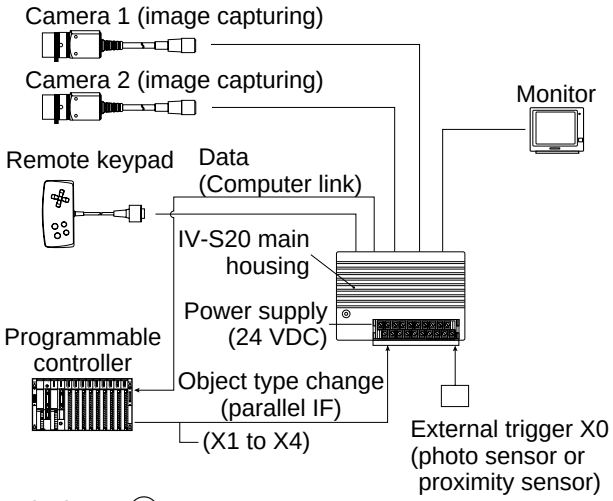


(2) Measurement start input = parallel, object type change = parallel, result output = computer link/parallel

· Setting order ① → ③ → ⑧ → ⑨

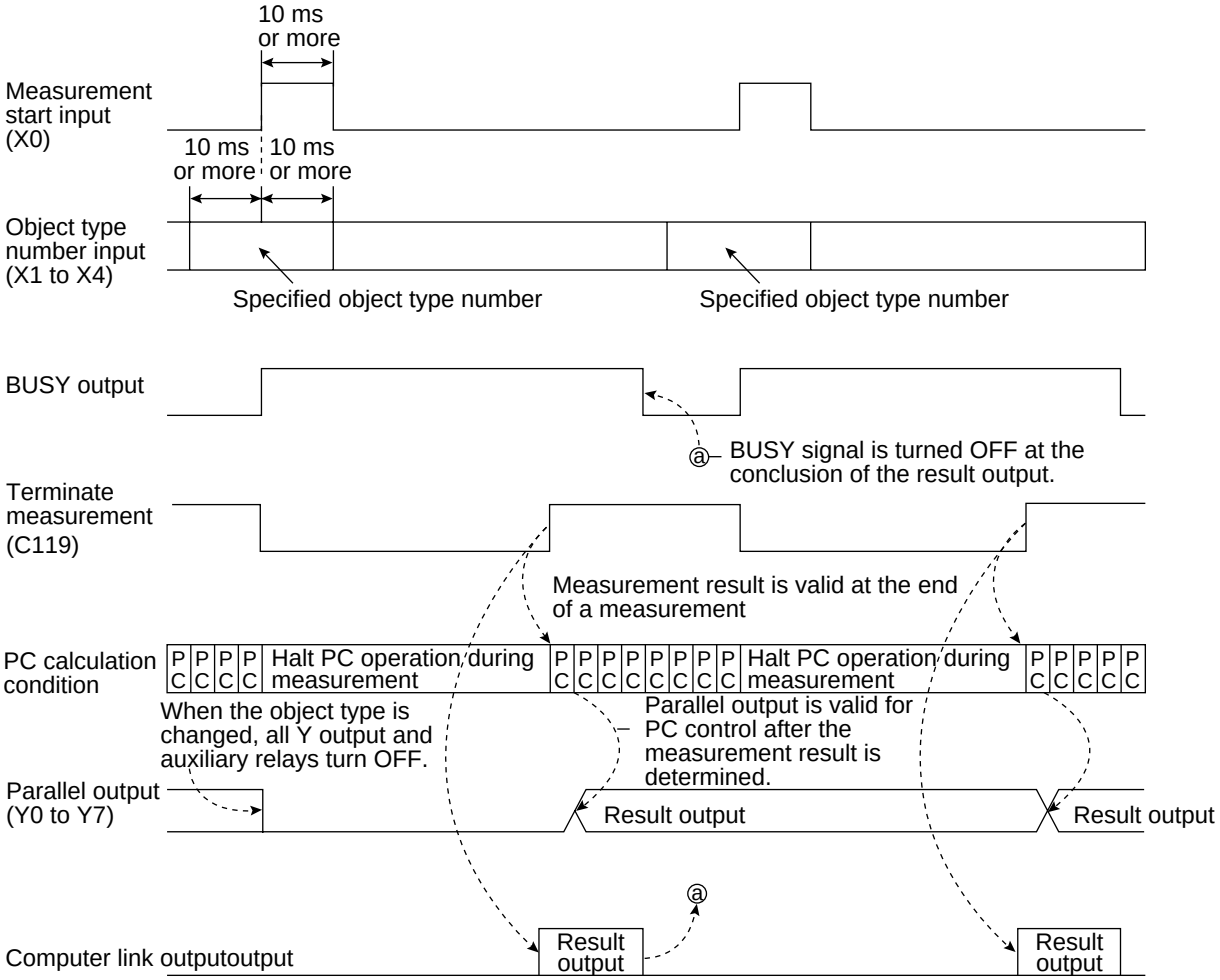


· Configuration example



- The data in a specified block No., set in item ⑤COMPUTER LINK OUT & SERIAL OUTPUT on the [OBJECT TYPE I/O] menu, will be output through the computer link. (See page 11-20.)

- Time chart



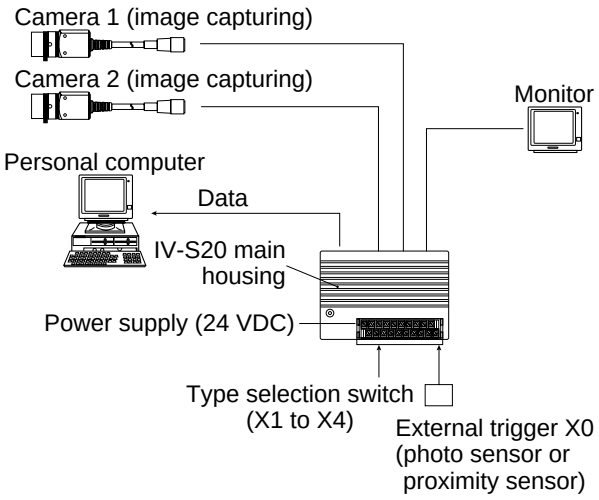
* When a Sharp PC is used, a write enable command (EWR) is transmitted from the IV-S20 to the PC in the following cases.
- When the power is applied to the IV-S20
- When a write mode nonconformity error (code $10_{(H)}$) occurs after a result write command (WRG) is transmitted (when the power is disconnected from the PC)
- When the output method is changed from the serial interface to the computer link

(3) Measurement start input = parallel, object type change = parallel, result output = general purpose serial/parallel

· Setting order ① → ③ → ⑧

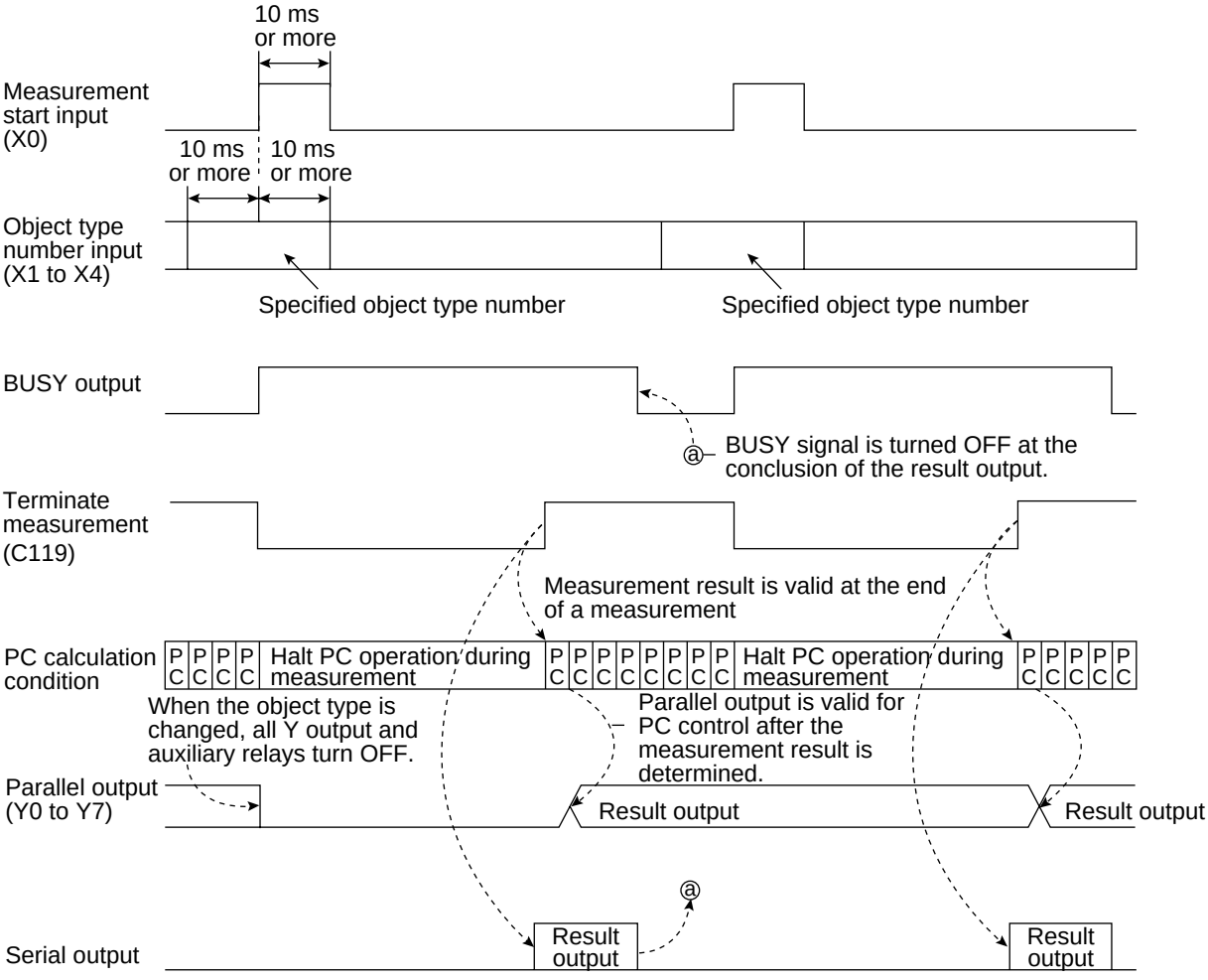
[I/O SETTINGS]
① MEAS TRIG INP I/F PARALLEL SERIAL CCD-TRIG
③ SERIAL OUTPUT NO PC-LINK SERIAL
(INPUT=PARALLEL)
⑧ SERIAL CONDITIONS (TO NEXT SUB-MENU)

· Configuration example



- The data in a block No., set in item ⑤ COMPUTER LINK OUT & SERIAL OUTPUT on the [OBJECT TYPE I/O] menu, will be output from the IV-S20 to the personal computer. (See page 11-20.)

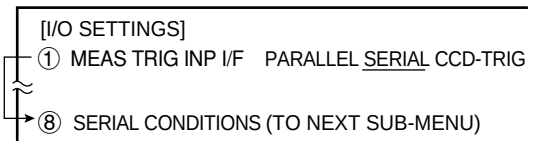
- Time chart



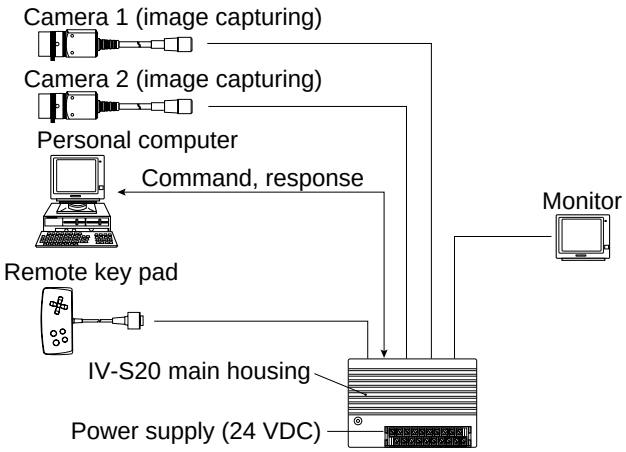
Note - Result output: The data to be sent to the personal computer will be response of general-purpose serial command (code $11_{(H)}$).

(4) Measurement start input = general-purpose serial, object type change = general-purpose serial, result output = general-purpose serial/parallel

· Setting order ① → ⑧

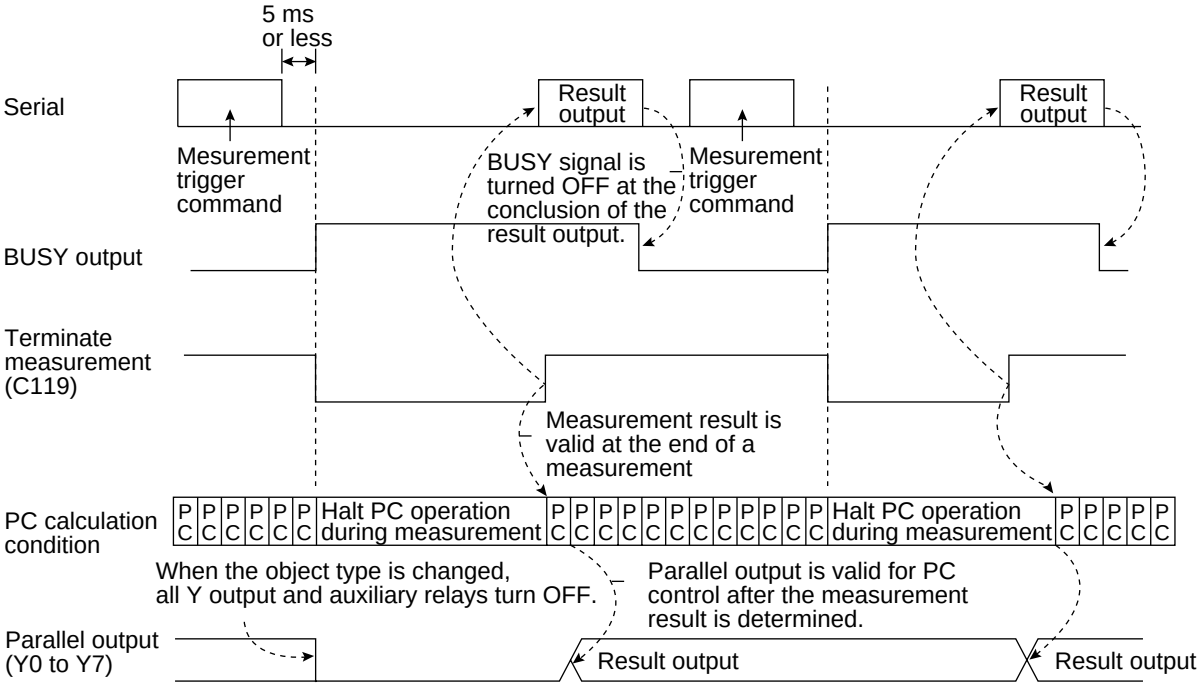


· Configuration example



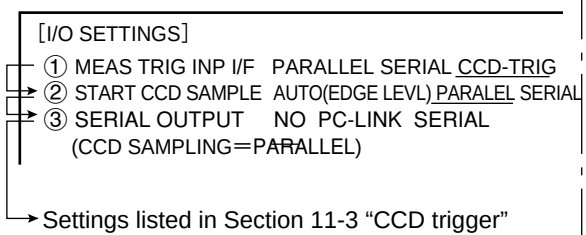
- See pages 13-6 and 13-7 for details about the measurement execution commands (codes 10, 11, 12 and $13_{(H)}$).

- Time chart

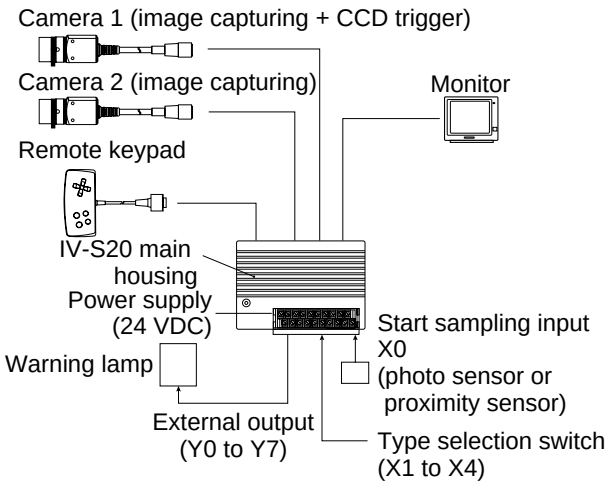


(5) Measurement start input = CCD trigger, start sampling = parallel, object type change = parallel, result output = parallel

· Setting order ① → ② (→ ③)



· Configuration example



Note 1: When the settings listed in section 11-3 "CCD trigger" have not been made, a CCD TRIGGER NOT SET. (error 34) will occur.

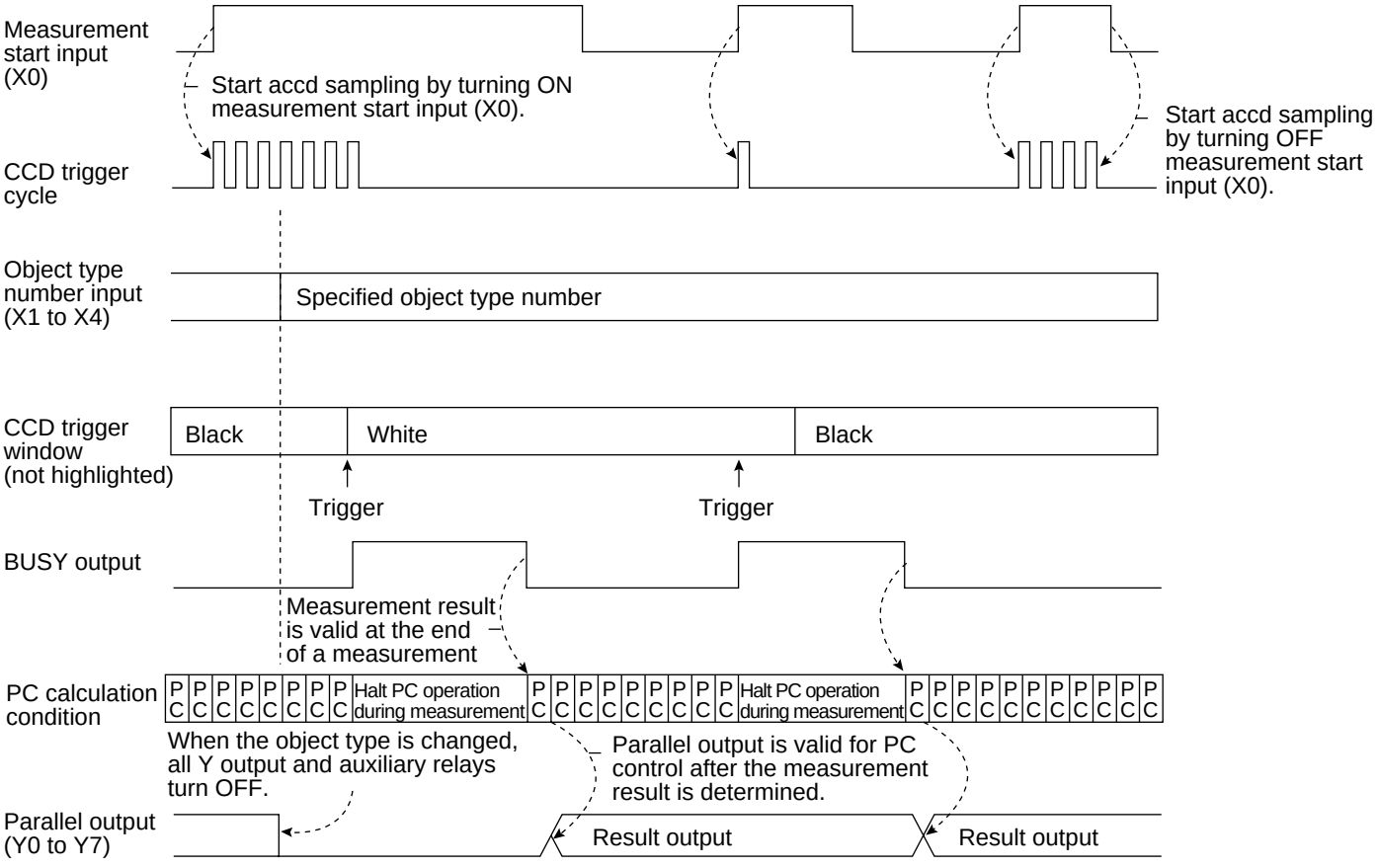
Note 2: Start sampling input (X0)

1. Sampling will be performed while this terminal is ON. When it is turned OFF, the sampling will stop.

   During sampling, ○ will flash in the upper right corner of the MAIN OPS MENU.

2. After the measurement is terminated, the sampling will be restarted when the X0 terminal is changed from OFF to ON.

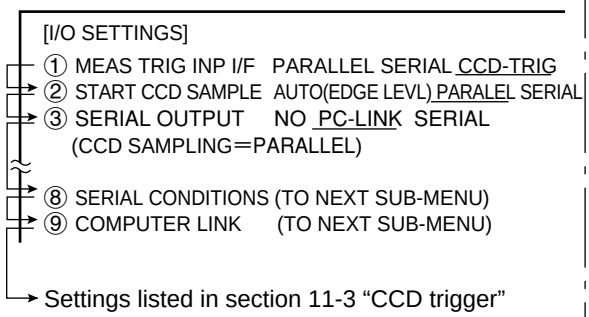
· Time chart



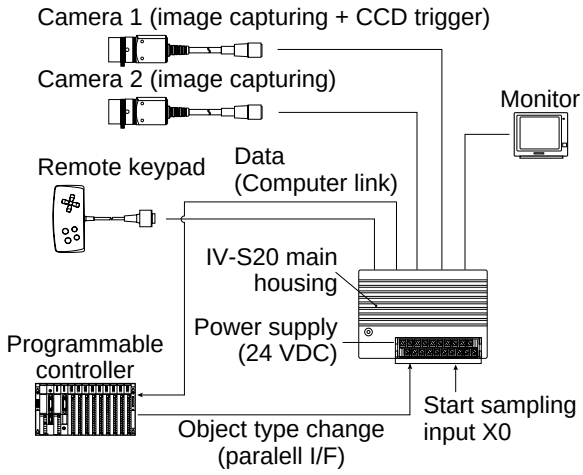
(6) Measurement start input = CCD trigger, start sampling = parallel, object type change = parallel, result output = computer link/parallel

When the start sampling input (X0) is turned ON, the CCD trigger is enabled. (Sampling starts)

· Setting order ① → ② → ③ → ⑧ → ⑨



· Configuration example



Note 1: When the settings listed in section 11-3 "CCD trigger" have not been made, a CCD TRIGGER NOT SET. (error 34) will occur.

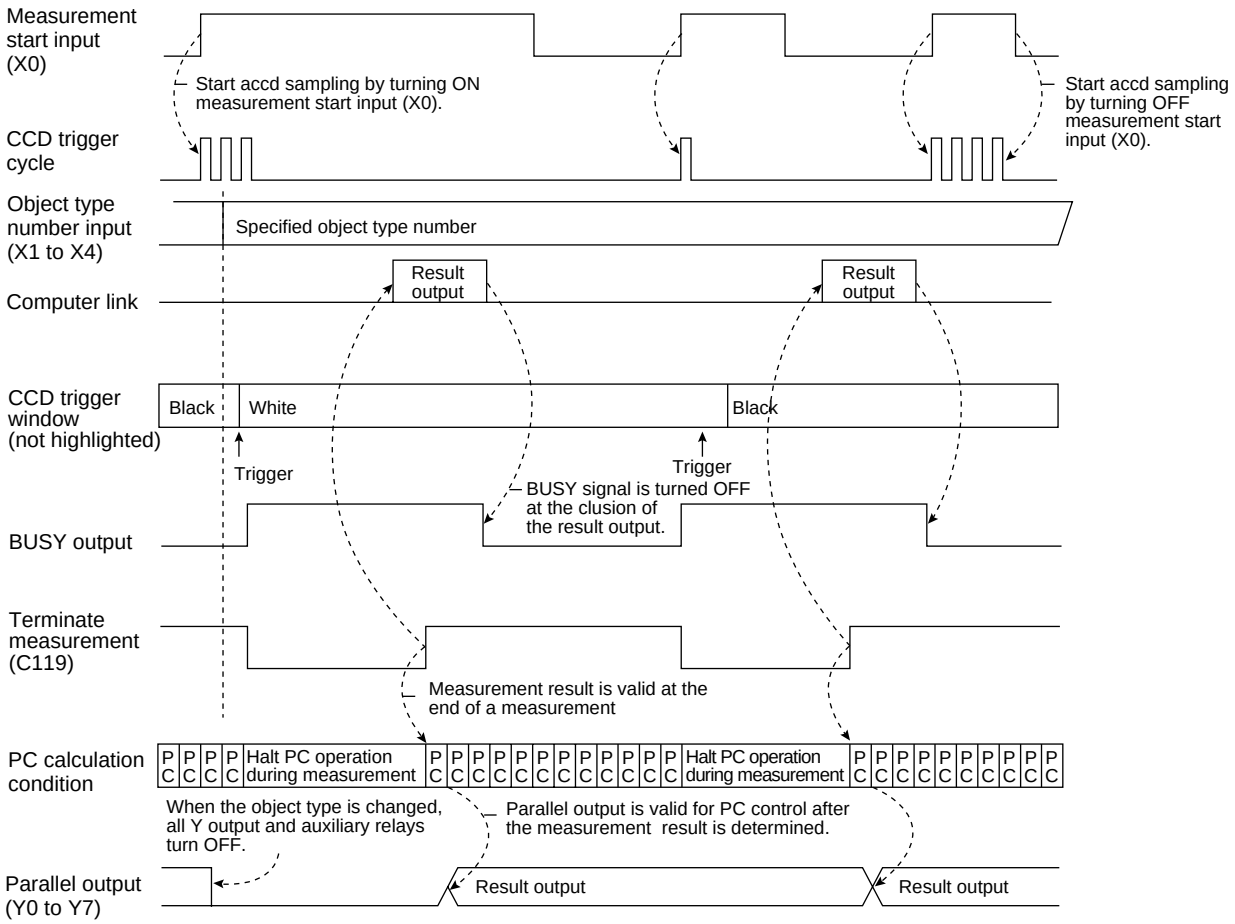
Note 2: Start sampling input (X0)

1. Sampling will be performed while this input terminal is ON. When it is turned OFF, the sampling will stop.

   During sampling, ○will flash in the upper right corner of the MAIN OPS MENU.

2. After the measurement is terminated, the sampling will be restarted when the X0 terminal is changed from OFF to ON.

· Time chart

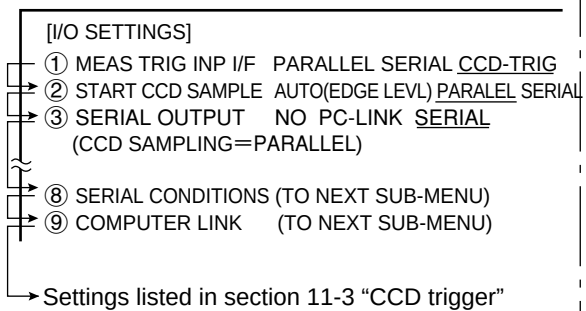


When a Sharp PC is used, a write enable command (EWR) is transmitted from the IV-S20 to the PC in the following cases.
- When the power is applied to the IV-S20
- When a write mode nonconformity error (code $10_{(H)}$) occurs after a result write command (WRG) is transmitted (when the power is disconnected from the PC)
- When the output method is changed from the serial interface to the computer link

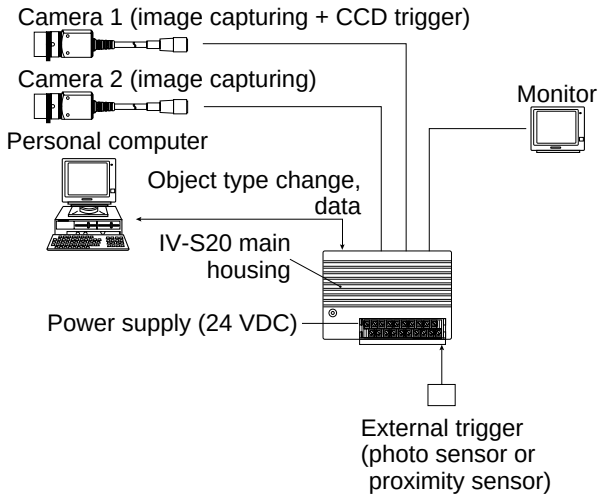
(7) Measurement start input = CCD trigger, start sampling = parallel, object type change = parallel, result output = general purpose serial/parallel

When the start sampling input (X0) is turned ON, the CCD trigger is enabled. (Sampling starts)

· Setting order ① → ② → ③ → ⑧ → ⑨



· Configuration example

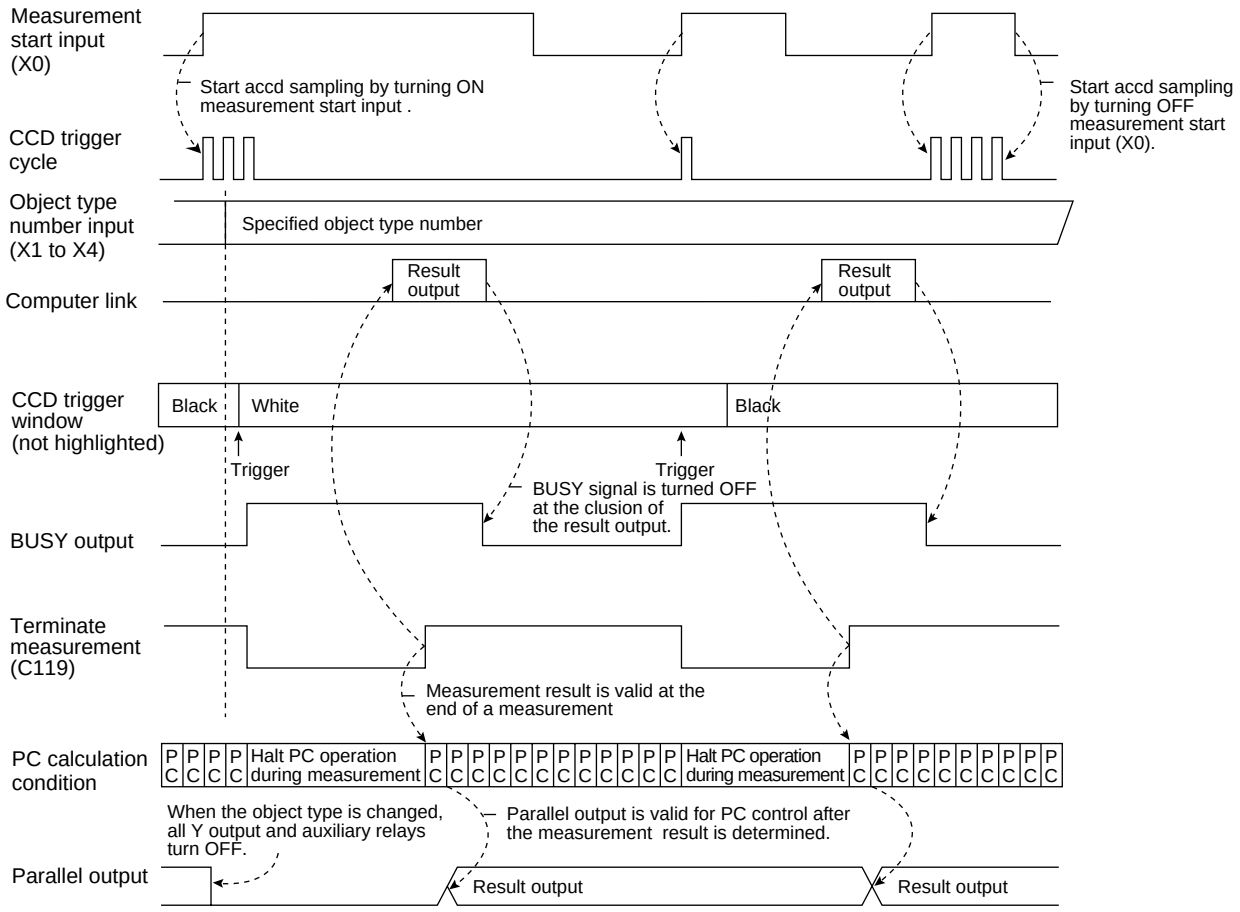


Note 1: When the settings listed in section 11-3 "CCD trigger" have not been made, a CCD TRIGGER NOT SET. (error 34) will occur.

Note 2: Start sampling input (X0)

1. Sampling will be performed while this input terminal is ON. When it is turned OFF, the sampling will stop.
   During sampling, ◯ will flash in the upper right corner of the MAIN OPS MENU.
2. After the measurement is terminated, sampling will be restarted when the X0 terminal is changed from OFF to ON.

- Time chart

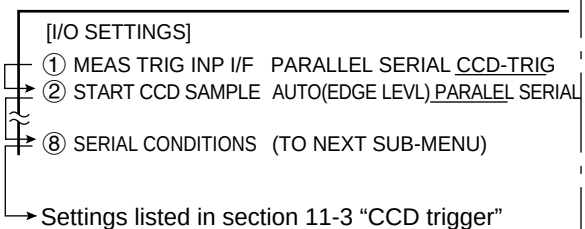


Note: Result output: The data in the block No., set in item ⑤ COMPUTER LINK OUT & SERIAL OUTPUT on the [OBJECT TYPE I/O] menu, will be transmitted to the personal computer. (See page 11-20.)

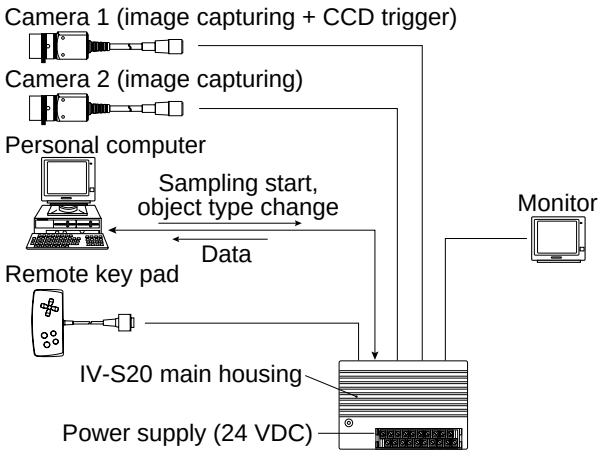
(8) Measurement start input = CCD trigger, start sampling, object type change = general purpose serial, result output = general purpose serial/parallel

The CCD trigger is enabled after a measurement execution command is entered.

· Setting order ① → ② → ⑧



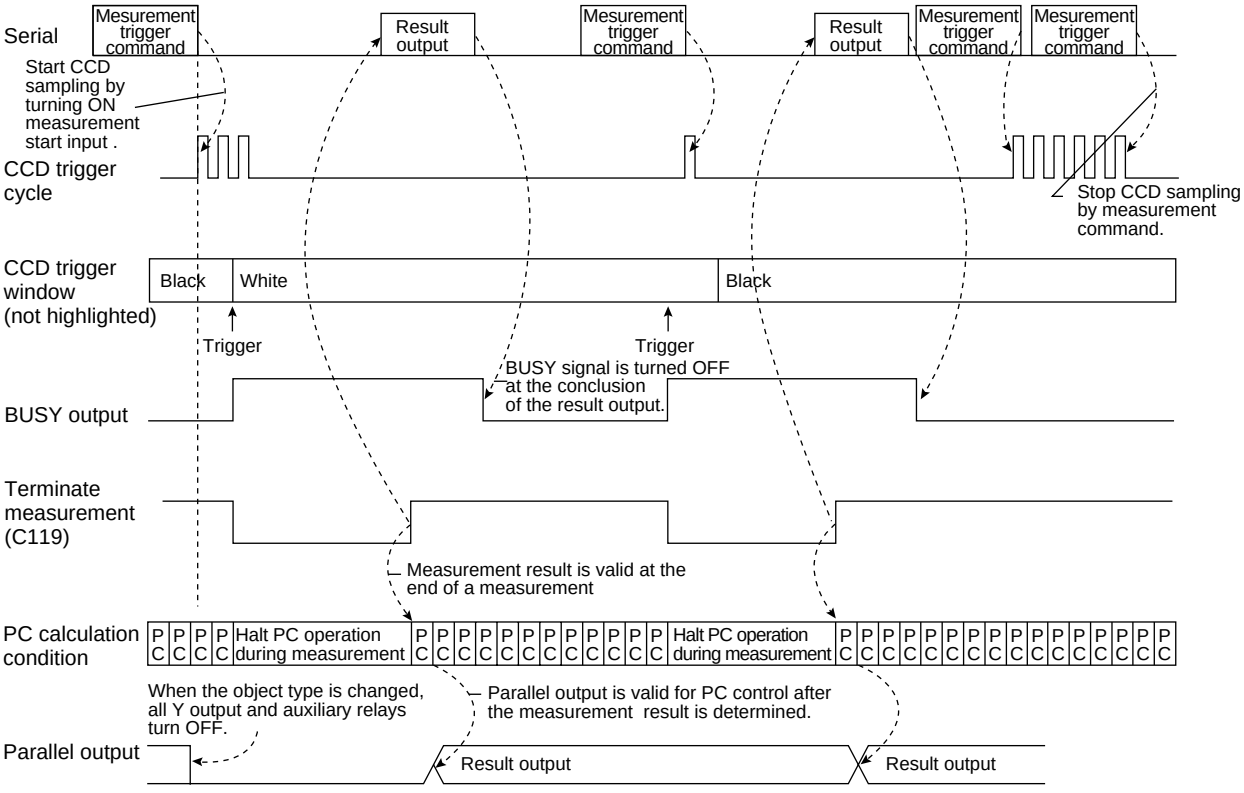
· Configuration example



- See pages 13-9 and 13-10 for details about the measurement execution commands (codes 18, 19, 1A and $1B_{(H)}$).
- When one of the measurement execution commands (codes 18, 19, 1A and $1B_{(H)}$) is normally received during sampling, the sampling will stop.

Note: When the settings listed in section 11-3 "CCD trigger" have not been made, a CCD TRIGGER NOT SET. (error 34) will occur.

· Time chart



Note: Result output: The data in the block No., set in item ⑤ COMPUTER LINK OUT &SERIAL OUTPUT on the [OBJECT TYPE I/O] menu, will be transmitted to the personal computer. (See page 11-20.)

(9) Measurement start input = CCD trigger, start sampling = auto, object type change, result output = parallel

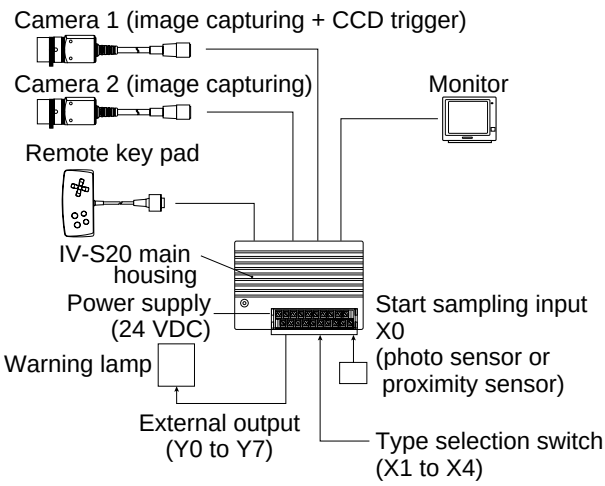
· Setting order ① → ② (→ ③)

[I/O SETTINGS]
① MEAS TRIG INP I/F PARALLEL SERIAL CCD-TRIG
② START CCD SAMPLE AUTO (EDGE LEVL) PARALEL SERIAL
③ OUTPUT OBJ. TYPE PARALLEL SERIAL
(CCD SAMPLING=AUTOMATIC)

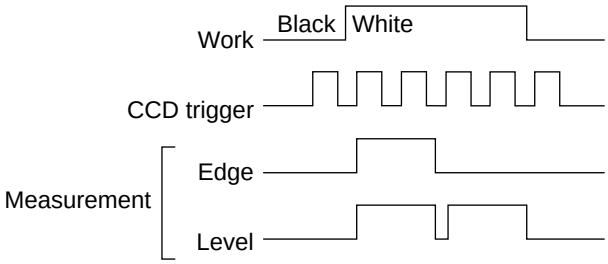
Select one of the following.

→ Settings listed in section 11-3 "CCD trigger"

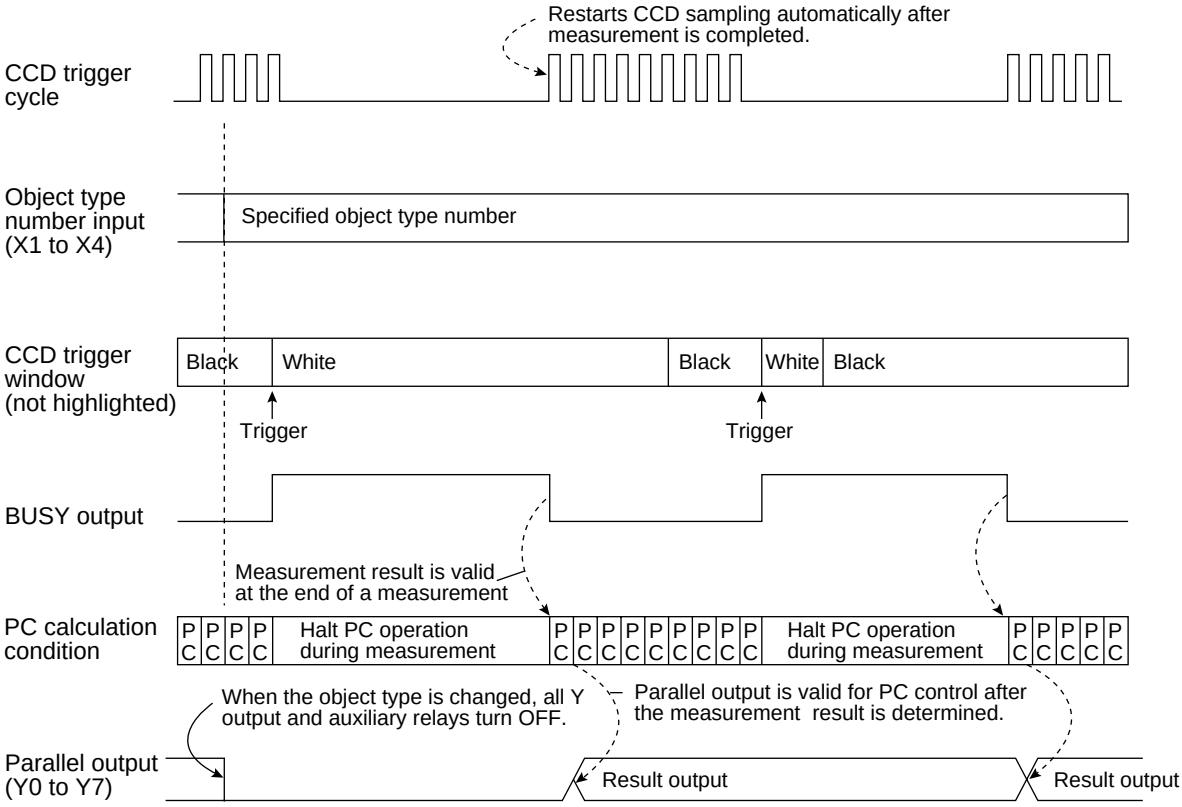
· Configuration example



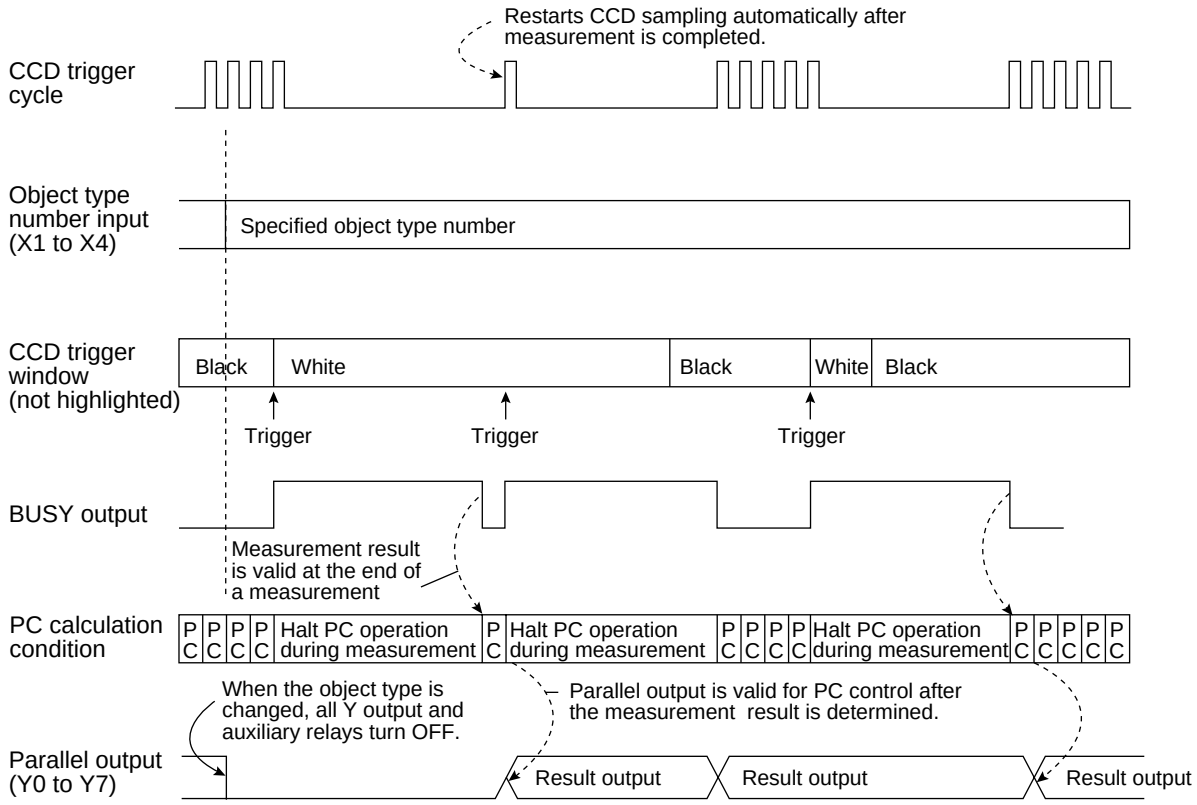
Measurement is started when the CCD trigger level is ON.
Measurement is started when a CCD trigger signal is received.



- Time chart (when auto mode (edge) is selected for as the CCD sampling start)



- Time chart (when auto mode (level) is selected for as the CCD sampling start)



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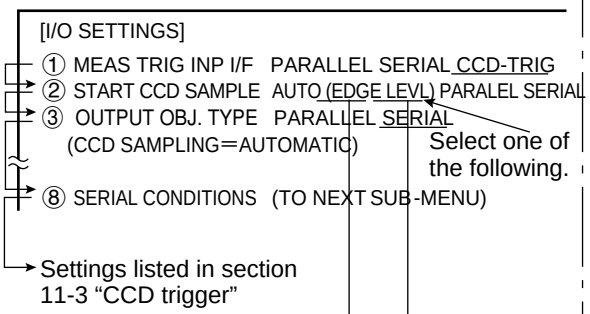
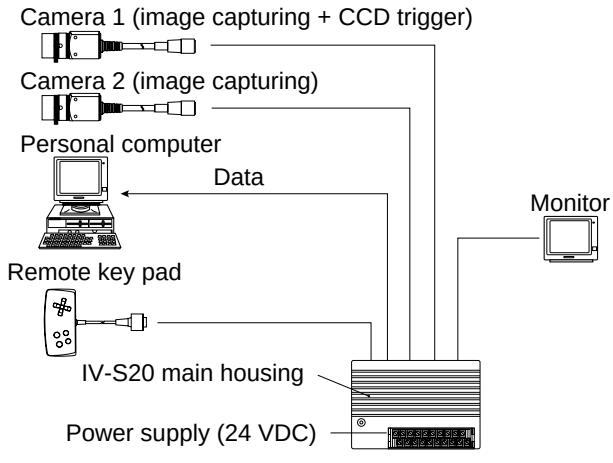
(10) Measurement start input = CCD trigger, start sampling = auto, object type change = general purpose serial, result output = general purpose serial/parallel

The general purpose serial command (code $55_{(H)}$) is used to change the object type.

· Setting order ① → ② → ③ → ⑧

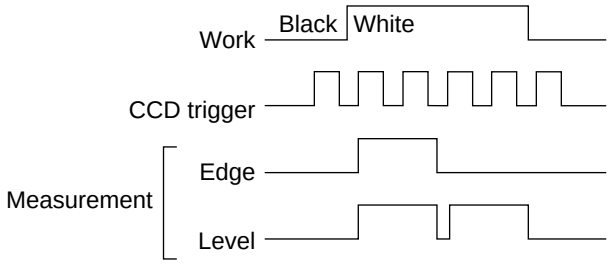


· Configuration example

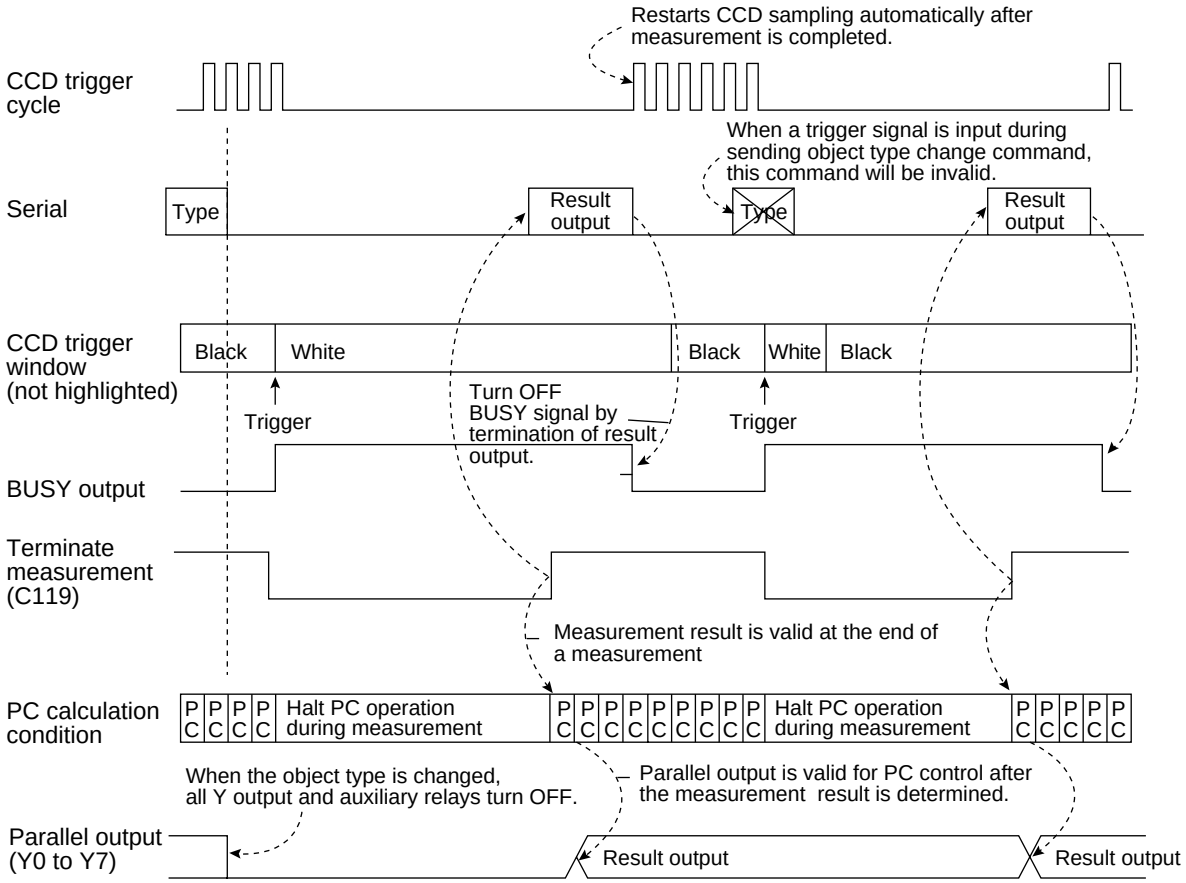


Measurement is started when the CCD trigger level is ON.

Measurement is started when a CCD trigger signal is received.

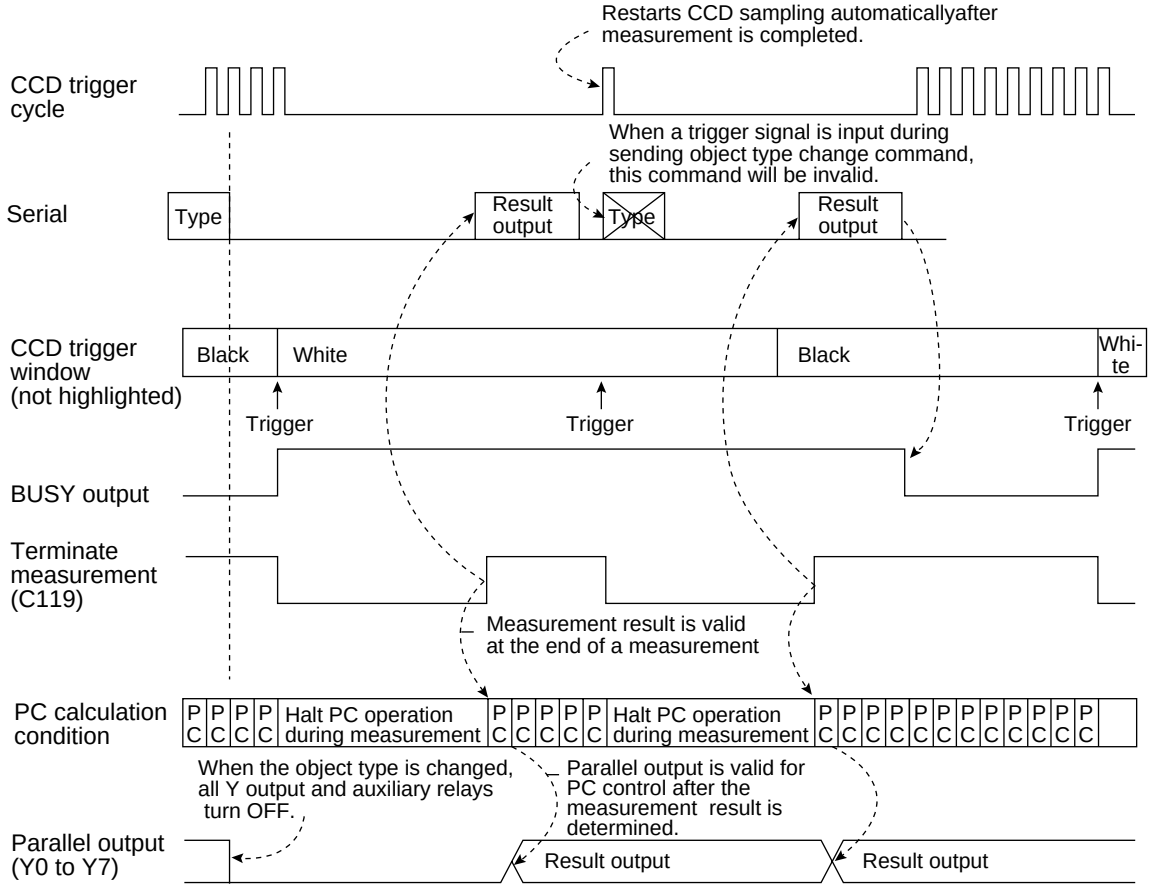


- Time chart (when auto mode (edge) is selected for as the CCD sampling start)



Note: Result output; The data in the block No., set in item ⑤ COMPUTER LINK OUT &SERIAL OUTPUT on the [OBJECT TYPE I/O] menu, will be transmitted to the personal computer. (See page 11-20.)

- Time chart (when auto mode (level) is selected for as the CCD sampling start)



11-3 CCD trigger

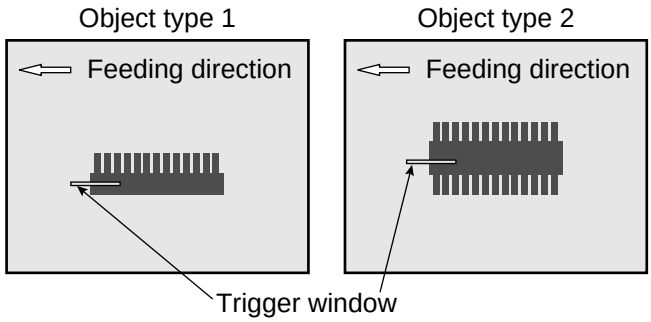
(1) Outline

This function samples a specified part (trigger window) of an image captured by the CCD camera at a high rate, and starts the measurement when the sampled image changes. Therefore, moving objects can be measured without requiring an external trigger, such as a photo sensor.
To use this function, set the input/output the CCD trigger on the [I/O SETTINGS] menu (pages 11-1 to 11-16), and set item ③ TRIGGER CCD START and item ④ CCD TRIGGER COND on the [OBJECT TYPE I/O] menu. ⇨ See Item (2).

- There are two methods for starting the measurement when there is a change in a sampled image, i.e. a binary method and an average light level method.

Binary method	When a sampled binary image changes (the white area exceeds 50%), the measurement is started. · A change in a binary image means a change in a binary image from black (background) to white (workpiece) or from white (background) to black (workpiece).
Average light level method	When the average light level of a sampled image enters a specified range, the measurement is started.

- The trigger window can be set in any position for each object type.
  In the past, the position of an external sensor had to be adjusted every time the object type was changed. However, since this function eliminates the necessity of physical position adjustments, the changeover time can be reduced.



- The internal CCD trigger can be used with camera 1. (It cannot be used with camera 2.)
- An image that can be used to set the sample window conditions is obtained when the display mode is switched from the through mode to the freeze mode.

(2) Setting procedure

On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to item ② OBJECT TYPE COND and press the SET key.

⇨ On the [OBJECT TYPE COND] menu, move the cursor to item ⑮ SYSTEM-IN/OUT and press the SET key.

```
[OBJECT TYPE I/O]
①MONITOR LIGHT LVL    CAM1(1~2) NO   YES
②LIGHT LEVEL COND     (TO NEXT SUB-MENU)
③TRIGGER CCD START    REG.NO   YES(BIN AVG-LIT-LVL)
④CCD TRIGGER COND     (TO NEXT SUB-MENU)
⑤COMPUTER LINK OUT    BLOCK-00(MESR-0 CMR01)
  &SERIAL OUTPUT
⑥SHUTTER SPEED        1/00060(1/30~1/10000)
⑦STORE REF IMAGE      MOVE UP.L(224,208) LO.R (287, 271) REG. DISP
⑧UPPER MENU
```

1
2

1. Move the cursor to item ③ TRIGGER CCD START with the up and down keys, and press the SET key.
   - Move the cursor to BIN or AVG-LIT-LVL with the left and right keys, and press the SET key.

2. Move the cursor to item ④ CCD TRIGGER COND with the up and down keys, and press the SET key.
   ⇨ The [CCD TRIGGERING] menu and a CCD trigger window will be displayed. The items displayed will vary according to the setting in item ③ TRIGGER CCD START.

· When the binary method has been selected

```
[CCD TRIGGERING]
① SIZE              X=08(4~32)×Y=08(4~64)
② POSITION          (256,240)
③ THRESHOLD VALUE U.LM—255 L.LM—100(0~255)
④ INVERT B/W        NO  YES
⑤ UPPER MENU
```

· When the average light level method has been selected

```
[CCD TRIGGERING]
① SIZE              X=08(4~32)×Y=08(4~64)
② POSITION          (256,240)
③ THRESHOLD VALUE U.LM—255 L.LM—100(0~255)
                    MES.AVE.GRYS=000.0
⑤ UPPER MENU
```

3. Press the SEL key to change the image display mode from the through mode to the freeze mode, and capture an image.
4. Move the cursor to item ① SIZE with the up and down keys, and press the SET key.
   - Set the CCD trigger window size.
   - Select the height or width field with the left and right keys, set the height or width (pixel count) with the up and down keys, and press the SET key.
     The window size (height, width) must be 4 to 32 and 4 to 64 respectively.
   - The smaller the window size, the shorter the CCD trigger sampling cycle.
     When the shutter speed is 1/4000 sec. and the window size is 8 x 8 pixels, the sampling cycle is approx. 4 ms.
5. Move the cursor to item ② POSITION with the up and down keys, and press the SET key.
   - Set the position of the CCD trigger window.
   - After determining the position with the direction keys, press the SET key.
6. Move the cursor to item ③ THRESHOLD VALUE with the up and down keys, and press the SET key.
   - Set the threshold values for the CCD trigger window.
   - Select the upper or lower limit field with the left and right keys, set the threshold value (0 to 255) with the up and down keys, and press the SET key.
7. When the binary method has been selected, move the cursor to item ④ INVERT B/W with the up and down keys, and press the SET key.
   - Select "YES" or "NO" with the left and right keys, and press the SET key.
     When "NO" is selected, the CCD trigger will trip when an image changes from black to white.
     When "YES" is selected, the CCD trigger will trip when an image changes from white to black.
8. Move the cursor to item ⑤ UPPER MENU and press the SET key.
   - Press the SET key again to store the settings in the IV-S20 flash memory.

11-4 Setting for serial communications

When “SERIAL” (general purpose serial) has been specified in item ① MEAS TRIG INP I/F on the [I/O SETTINGS] menu (page 11·1), and when “SERIAL” or “PC-LINK” has been specified in item ③ SERIAL OUTPUT the serial communication conditions must be set on the [SERIAL COMM.] menu.

· Set the items to match the communication conditions of the other device.

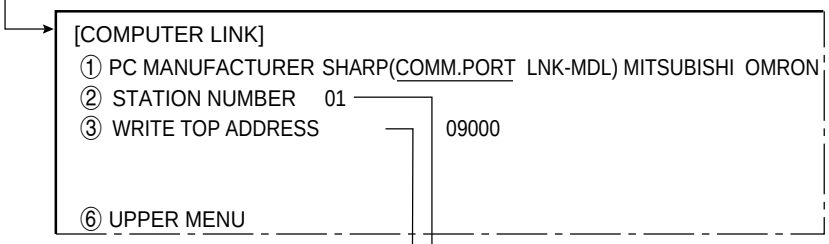
On the [I/O SETTINGS] menu, move the cursor to item ⑧ SERIAL CONDITIONS and press the SET key.

```
[SERIAL COMM.]
① COMM. STANDARD   RS232C RS422: (4-W) RS422: (2-W)
② BAUD RATE(kbps)   9.6  19.2  38.4  57.6  115.2  4.8
③ NO. OF DATA BITS  7BITS  8BITS
④ PARITY CHECK      EVEN  ODD  NO
⑤ NO. OF STOP BITS  1BITS  2BITS
⑥ TERMINATOR        CR  CR+LF
⑦ UPPER MENU
```

11-5 Computer link

When PC-LINK has been specified in item ③ SERIAL OUTPUT on the [I/O SETTINGS] menu (page 11-1), the computer link conditions must be set on the [COMPUTER LINK] menu.

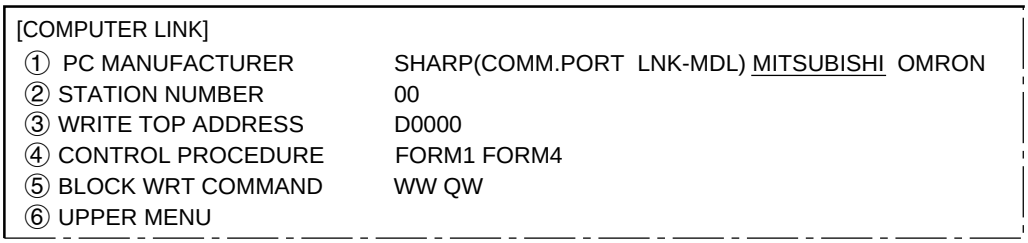
On the [I/O SETTINGS] menu, move the cursor to item ⑨ COMPUTER LINK and press the SET key.



Item	Setting range
Station No.	· Sharp: 00 to 37(8) * · Mitsubishi: 00 to 31 · OMRON: 00 to 31
Write address (max. 512 bytes)	· Sharp: 09000 to 99776 · Mitsubishi: D0000 to D9999 · OMRON: DM0000 to DM9999

* In this book, octal notation is indicated by adding(8)

♦When MITSUBISHI is selected in ① on the [COMPUTER LINK] menu



Menu	Setting details
④ CONTROL PROCEDURE	Select either FORM 1 or 4 for the control procedure. FORM 1: No line terminator FORM 4: With line terminators: “CR” + “LF” · In version 2.01, only “FORM 1” was available.
⑤ BLOCK WRT COMMAND	Select either WW or QW for the block write command. WW: Data writing address range: D0000 to D1023 QW: Data writing address range: D000000 to D008191 · In version 2.01, only “WW” was available.

If SHARP or OMRON is selected, items ④ and ⑤ will not be displayed.

- See Chapter 14 "Computer Link" for applicable models made by these manufacturers.

Note 1: Use an even address as the write start address.

Note 2: When 512 bytes are used for a write register on a Sharp model, select a write start address from the following addresses.

09000, 19000, 29000, 39000, 49000, 59000, 69000, 79000, 89000 , 99000

11-6 Output block assignment (Computer link output and general purpose serial output)

When measurement is controlled by a computer link or a communication interface (general purpose serial IF: * 1), in addition to other block 0, blocks can be specified whose measurement data will be output from the IV-S20 to a programmable controller or a personal computer.

* 1 In the case of a communication interface (general purpose serial IF), output blocks can be specified only when the measurement is started by a CCD trigger or a parallel IF signal and the results are set by a general purpose serial IF signal. (See page 13-2.)

Enter item ⑤ COMPUTER LINK OUT & SERIAL OUTPUT on the [OBJECT TYPE I/O] menu to specify selection. (see the next page.)

[1] Data in specified blocks

(1) In the case of a computer link

Data in the specified blocks will be output after the data (block 0) from measurement numbers 0 to 3 is output by the write register of the PC. (See page 14-3.)

[Write register map]

	Sharp	Mitsubishi		OMRON		Description
Result top write address (* 2) →	09000	D0000	L	DM0000	L	Termination code
	09001		H		H	Appended information
	⋮	⋮		⋮		⋮
	⋮	⋮	L	⋮	L	Output data from measurement No. 3 (block 0)
	⋮		H		H	⋮
	⋮	⋮		⋮		⋮
Result top write address + 512 bytes (* 2) →	⋮	⋮	L	⋮	L	Data in a specified block
	⋮		H		H	⋮
	⋮	⋮		⋮		⋮

* 2 Set the result top write address in item ③ WRITE TOP ADDRESS on the [COMPUTER LINK] menu. (See the preceding page.)

* 3 The top address to which the data in the specified blocks will be written is obtained by adding 512 bytes to the result top write address.

- Setting examples for various manufacturers

	Sharp		Mitsubishi	OMRON
Result top write address	09000	09300	D0000	DM0000
Top address of data in specified blocks	19000	19300	D0256	DM0256

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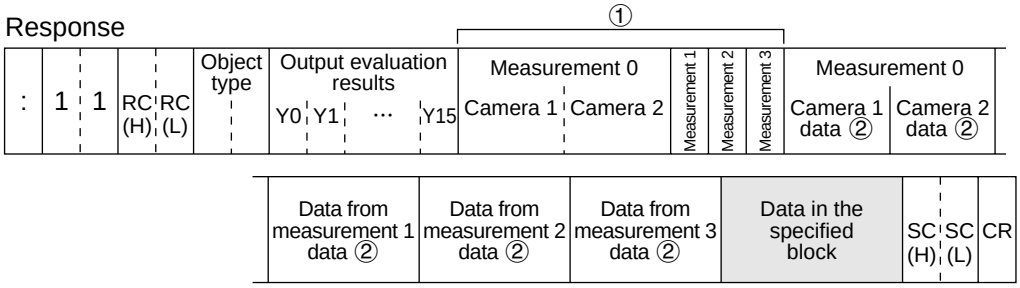
(2) When the measurement is started by a CCD trigger or a parallel I/F signal and the results are output by a general purpose serial I/F signal

When the IV-S20 responds, data in a specified block is output after the output data (block 0) from the measurement No. 0 to 3, in response to the measurement run command 2 (processing code $11_{(H)}$).

■ Response



- See page 13·5 for details about ① and ②.

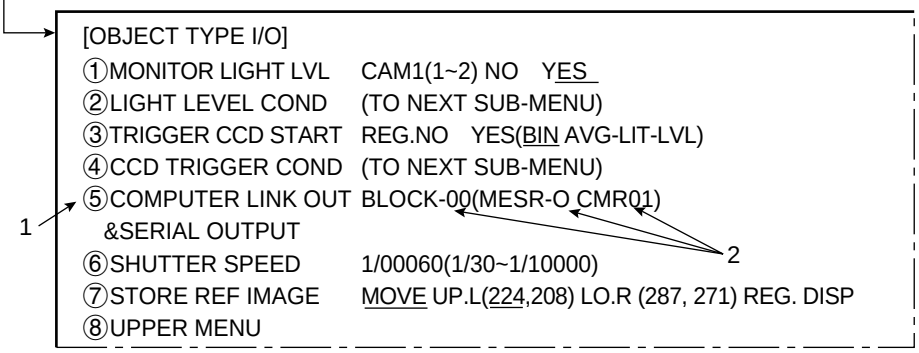
Note: The response returned by the measurement run command 2 (processing code $11_{(H)}$) will not contain the specified block.

[2] Setting (operating) procedure

On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to item ② OBJECT TYPE COND and press the SET key.

⇨ On the [OBJECT TYPE COND] menu, move the cursor to item ⑮ SYSTEM IN/OUT and press the SET key.



1. Move the cursor to item ⑤ COMPUTER LINK OUT & SERIAL OUTPUT with the up and down keys, and press the SET key.
2. Enter the program No., camera No. and block No. of the measurement data to be output, using the left, right, up and down keys.
   - Specify a block number to be returned in addition to block 0 (00).
     If block 00 is specified, data from block 00 will not be returned a second time.
3. After the settings are complete, press the SET key.

11-7 Gain/offset adjustment

The gain and offset of the IV-S20 can only be adjusted by our service engineers. Users must not try to change them.

The data which can be adjusted is shown below for reference purpose only.

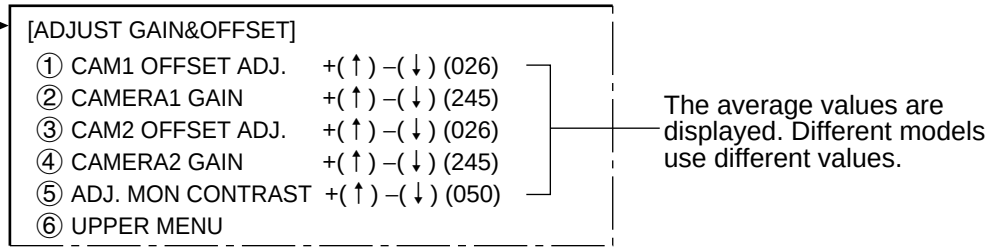
Generally, an image from the CCD camera can be optimized by adjusting the optical system, such as the lens iris. To make fine adjustments, the IV-S20 is equipped with functions to adjust the offset and gain of image signals from cameras 1 and 2 and the contrast on an external monitor screen.

- The gain and offset are adjusted by checking the display on the screen.
- The screen is kept in the through mode.

On the [MAIN OPS MENU], move the cursor to SET-SCRN and press the SET key.

⇨ On the [SYSTEM SETUP] menu, move the cursor to item ③ I/O CONDITIONS and press the SET key.

⇨ On the [I/O SETTINGS] menu, move the cursor to item ⑩ GAIN OFFSET and press the SET key.



Gain and offset adjustment	Details of adjustment (selection)
① CAM1 OFFSET ADJ.	The offset for camera 1 is adjusted with the up and down keys. · The complete signal level is shifted leaving the amplitude of the image signals from the CCD camera unchanged. As the offset value is increased, the whole screen will becomes more white.
② CAMERA1 GAIN	The gain for camera 1 is adjusted with the up and down keys. · The amplitude of the image signals from the CCD camera is changed. As the gain value is reduced, the screen will become lighter, and as the gain value is increased, the screen will become darker.
③ CAM2 OFFSET ADJ.	The offset for camera 2 is adjusted with the up and down keys. · The adjustment procedure is the same as that in Item ①.
④ CAMERA2 GAIN	The gain for camera 2 is adjusted with the up and down keys. · The adjustment procedure is the same as that in Item ②.
⑤ ADJ. MON CONTRAST	The monitor contrast is adjusted with the up and down keys. · The intensity of image signals sent to the monitor is adjusted. As the contrast value is increased, the contrast on the screen will become stronger.
⑥ UPPER MENU	The screen will return to the [I/O SETTINGS] menu.

Chapter 12: Other Settings and Operations ([SYSTEM SET UP] menu)

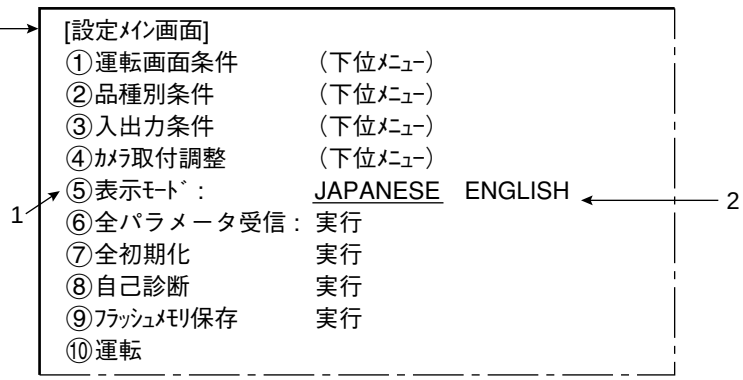
12-1 Settings

[1] Change the Japanese or English display mode

The language used on the screen scan be set to Japanese or English.

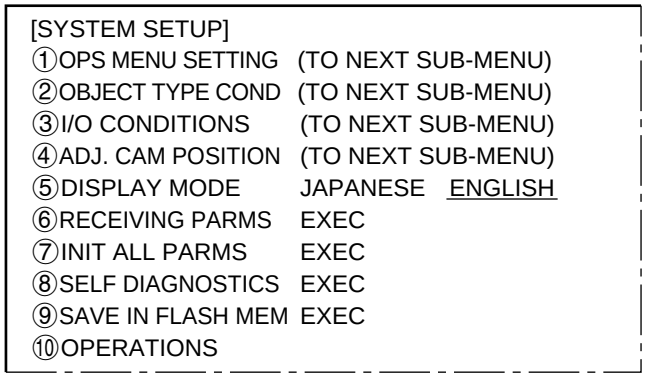
[Operating procedure]

On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.



1. Move the cursor to item ⑤ DISPLAY MODE (display mode) with the up and down keys, and press the SET key.
2. Move the cursor to JAPANESE or ENGLISH with the left and right keys.
3. When you change to another menu, it will be displayed in the selected language.

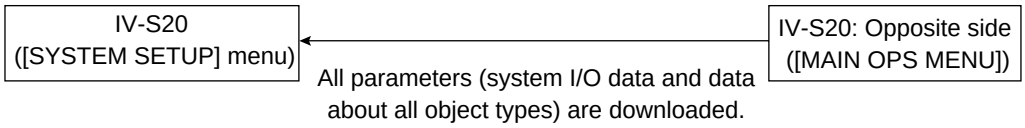
[Display example]



[SYSTEM SETUP] menu shown above in the English mode.

[2] Download all parameters

The IV-S20 can download a complete set of parameters (system I/O data and data about all object types) from an identical IV-S20.



(1) Connections

Connections between IV-S20s are shown below.

Communication connectors on the IV-S20 (RS232C/RS422: 9-pin D-sub)

Pin NO.	Signal name	Function
Connector shield	FG	Frame ground
2	RD	Received data
3	SD	Transmitted data
5	SG	Signal ground

1	FL1	Memory protection 1
6	FL2	Memory protection 2

Communication connectors on the IV-S20 (RS232C/RS422: 9-pin D-sub)

Pin NO.	Signal name	Function
Connector shield	FG	Frame ground
2	RD	Received data
3	SD	Transmitted data
5	SG	Signal ground

1	FL1	Memory protection 1
6	FL2	Memory protection 2

* (RS-232C)

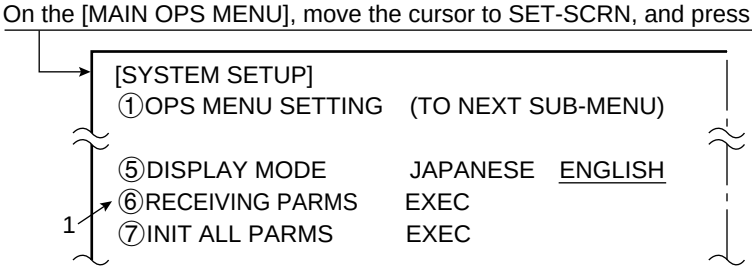
* The maximum length of the communication cable depends on the communication speed.

Communication speed (k bps)	Cable length
9.6, 19.2	15 m max.
38.4, 57.6, 115.2	2 to 3 m

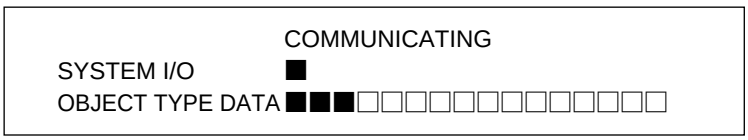
* Conduct a communication test before using the moduleto transfer data.

(2) Operating procedure

On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.



1. Move the cursor to item ⑥ RECEIVING PARMS (receive all parameters) with the up and down keys, and press the SET key.
   ⇨ Communication with the connected IV-S20 will be started, and the progress of communication will be displayed on the bottom of the screen.



After all of the parameters have been downloaded from the connected IV-S20, the message COMMUNICATING (sending data) will change to COMM COMPLETE (complete sending data).

Note: Perform the operation above with the [MAIN OPS MENU] displayed on the target IV-S20.

[3] Total initialization

When you newly set conditions, it is recommended that you first initialize the settings. The following conditions should be initialized.

- All conditions → This section
- Measurement conditions for each measurement program number
- Measurement conditions for each object type number

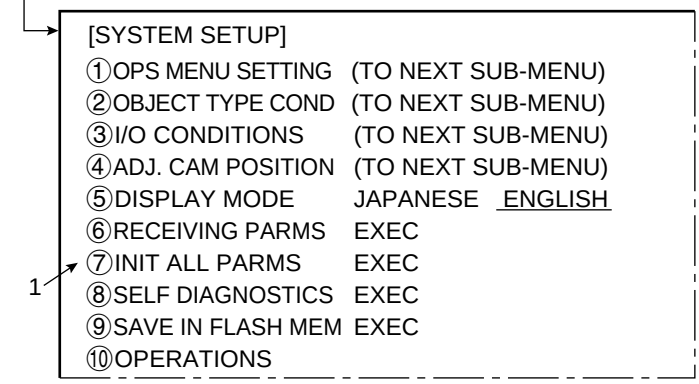
→ See Item [8], "Initialization (edit)," in section 9-2.

The total initialization function initializes all of the conditions for each object type (all object types), input/output conditions, camera position adjustment, and display mode.

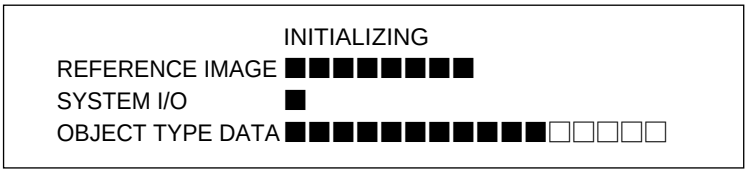
- The data stored in the flash memory and the data in the monitor display memory (RAM) are initialized (returned to their initial state).

[Operating procedure]

On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.



1. Move the cursor to item ⑦ INIT ALL PARMS (initialize all parameters) with the up and down keys, and press the SET key.
2. Press the SET key again. (Press the ESC key to abort initialization.)
   ⇨Initialization will start, and the progress of the initialization will be displayed on the bottom of the screen.



When initialization is complete, the message "INITIALIZING" (initializing) will change to "INIT COMPLETE" (complete initialization).

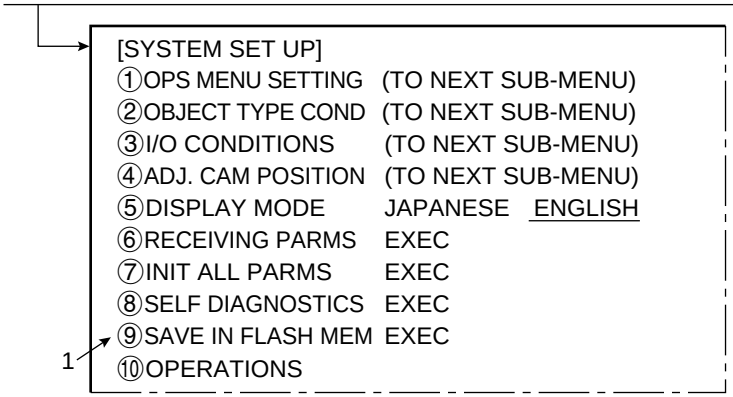
[4] Saving to flash memory

All the data entered on the [SYSTEM SETUP] menu and sub-menus (OPS MENU SETTING, OBJECT TYPE COND, I/O CONDITIONS, and ADJ.CAM POSITION menus) are saved in the IV-S20 flash memory.

- If the power is disconnected from the IV-S20 main housing, or if the object type number is changed before the data is saved in the flash memory, the data will be deleted.

[Operating procedure]

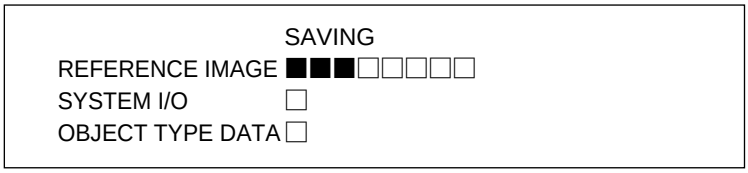
On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.



1. Move the cursor to item ⑨ SAVE IN FLASH MEM. (save data in flash memeory) with the up and down keys, and press the SET key.
   ⇨ The following message will be displayed on the upper part of the screen.

DATA SAVE? (Do you want to save data?) (YES=[SET]/NO=[ESC])

2. Press the SET key.
   ⇨ The data saving will start, and the progress will be displayed on the bottom of the screen.



When the data has been saved in the IV-S20 flash memmory, the display will change from "SAVING" (saving) to "SAVING COMPLETE" (complete saving).

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Note:

- If the ESC key is pressed, the set data entered will not be saved in the IV-S20 flash memory. In this case, if the power to the IV-S20 main housing is turned OFF, or if the object type No. is changed, the data will be deleted.

- The set data you have entered can be saved in the IV-S20 flash memory by moving the cursor to item ⑩ OPERATIONS on the [SYSTEM SETUP] menu and pressing the SET key.

12-2 Maintenance

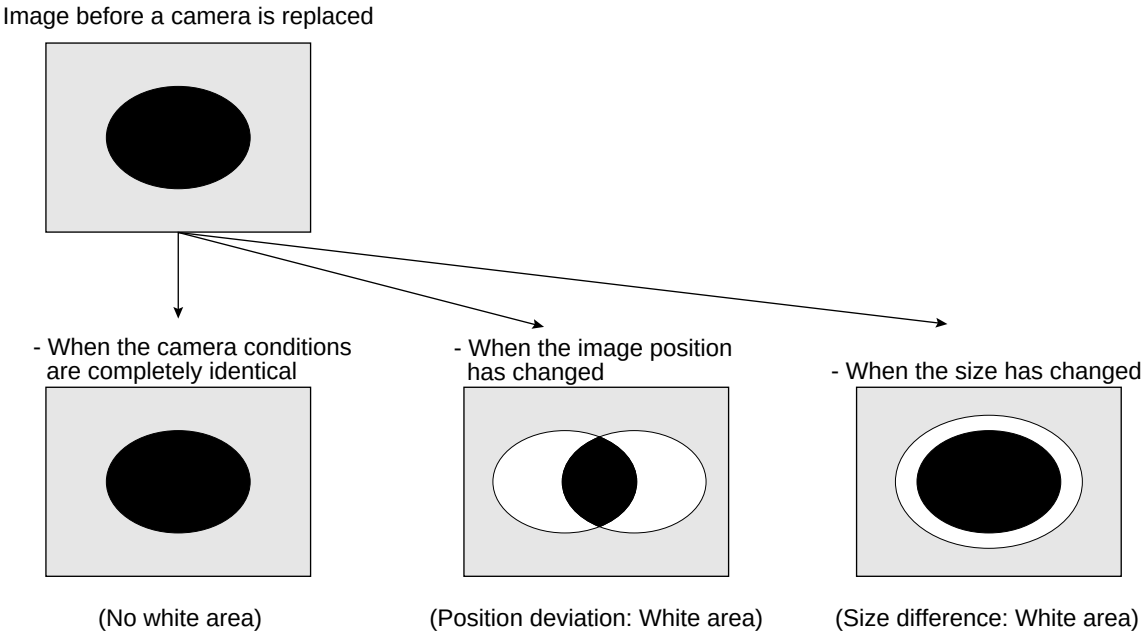
[1] Camera position adjustment

This function facilitates adjustment of the camera position and direction with respect to the object being measured and the lens aperture when a camera is replaced or when a camera is dislocated. By using this function, you will need not to adjust the settings for the measurement conditions, such as the window position, one by one.

(1) Adjusting method

Differences in size, position or brightness between two binary images, before and after a camera is replaced or a camera is dislocated, will be displayed as a white image.
When the adjustment is complete, the image is displayed as black.

[Display examples]



To make a fine adjustment, the camera position can be adjusted by comparing the fillet diameters, centers of gravity, and average light levels before and after a camera is replaced or a camera is dislocated.

(2) Adjustment items and methods

Method \ Item	Size	Position	Brightness
Differential image	○	○	○
Fillet diameter	○		
Center of gravity		○	
Average light level			○

○: Adjustable

(3) Operating procedure

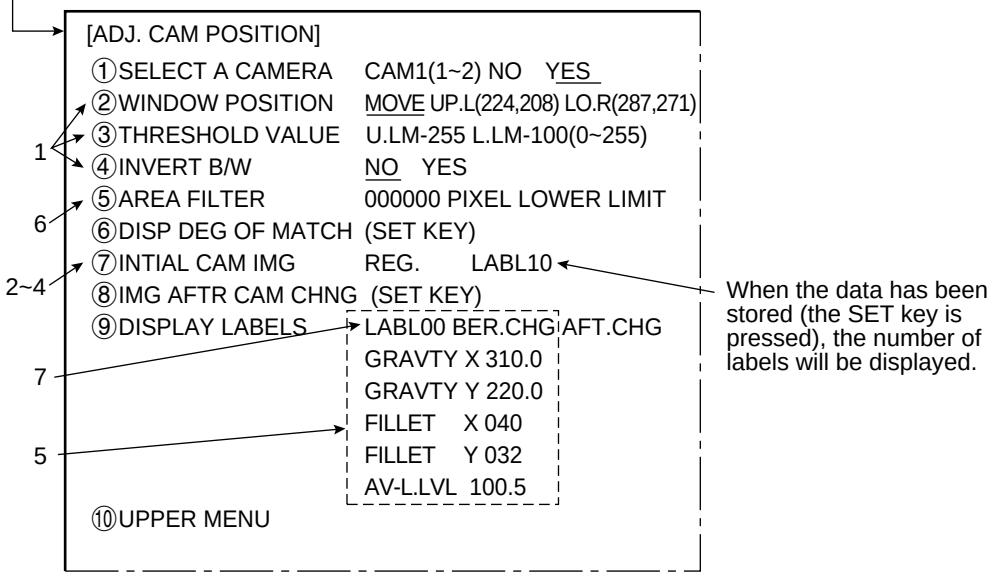
On the [ADJ. CAM POSITION] (camera position adjustment) menu, store the data needed for later adjustment (before a camera is replaced or dislocated), and then adjust the camera position (after the camera is replaced or dislocated).

Storing the data needed for adjustment (before a camera is replaced or dislocated)

On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.

⇨ On the [SYSTEM SET UP] menu, move the cursor to item ④ ADJ. CAM POSITION (camera position adjustment) and press the SET key.

⇨On the [ADJ. CAM POSITION] menu, set item ①SELECT A CAMERA to YES.



1. Set the image conditions for adjustment before replacement (window position and threshold value after binary conversion).
   - Set these conditions in items ②,③ and ④ on the [ADJ. CAM POSITION] (camera position adjustment) menu. (Set the conditions in the freeze display mode.)
2. Store a binary image for rough adjustment.
3. Store the characteristic parameters (center of gravity and fillet diameter) of a binary image for dimensional and positional adjustment.
4. Store the average light level for brightness adjustment.

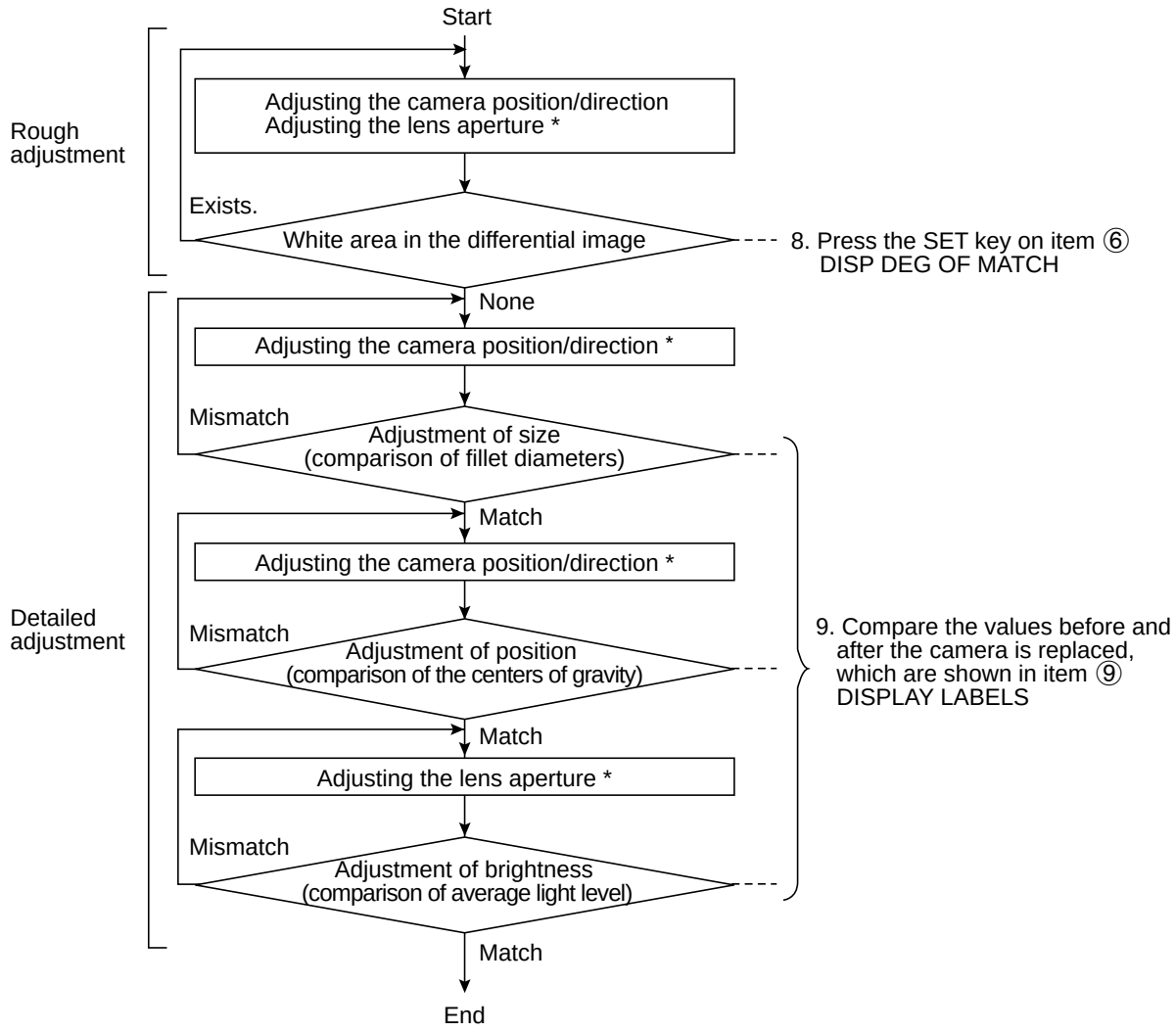
Store all of the conditions by going to item ⑦ on the [ADJ. CAM POSITION] menu. (Store them in the freeze display mode.)

5. You can check the stored values for center of gravity, fillet diameter and average light level in item ⑨.
6. If the number of labels exceeds the maximum number of labels which can be stored 32, use an area filter.
7. You can check the centers of gravity, fillet diameters and average light levels of each label from No. 1 up to the maximum number, using the up and down keys.

Go to the next page

From the preceding page

Adjusting the camera position (after the camera is replaced or dislocated)



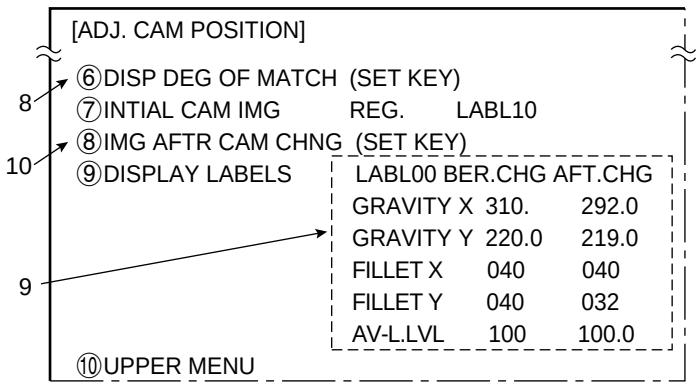
* Adjust these parameters using the following procedure.

Enter the through display mode

Adjust each parameter (adjust the camera and lens).

Enter the freeze display mode.

10. Store the image after replacing the camera by pressing the SET key in item ⑧ IMG AFTR CAM CHNG on the [ADJ. CAM POSITION] menu.



[2] Self-diagnosis

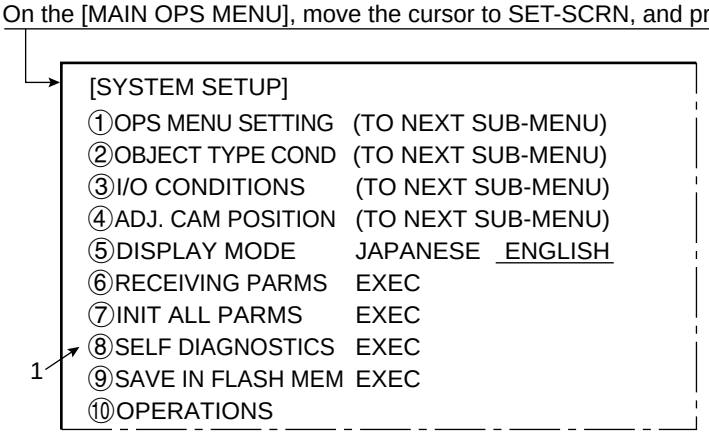
The IV-S20 can check all of its own hardware, to ensure that it is operating normally.

(1) Diagnostic items and methods

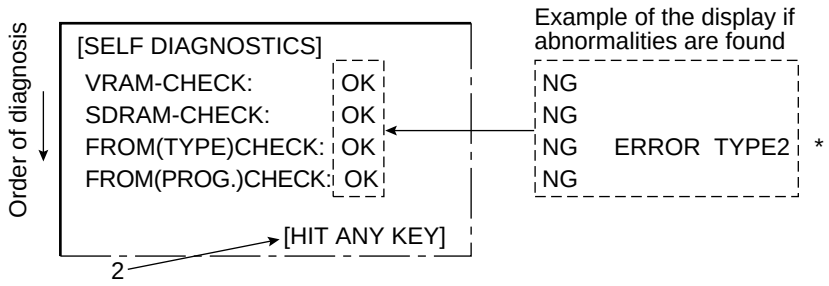
Item	Object	Method
Memory	VRAM	Read after write
	SDRAM	
Measurement conditions	Flash memory	Checksum
System program		

(2) Operating procedure

On the [MAIN OPS MENU], move the cursor to SET-SCRN, and press the SET key.



1. Move the cursor to item ⑧ SELF DIAGNOSTICS with the up and down keys, and press the SET key.
   ⇨ The [SELF DIAGNOSITICS] menu will be displayed, and each item will be checked. If the result of each diagnosis is normal, "OK" will be displayed. If the result is abnormal, "NG" will be displayed. If any abnormality occurs, consult our service center.



* In the FROM(TYPE)CHECK (object type check), the conditions are checked in the order of the object type numbers (00 ➡ 01➡ ... ➡15). If an abnormality is found, the corresponding object type number will be displayed, and the next FROM(PROG.)CHECK (program check) will be started without checking the conditions of the remaining object types.

2. Press any key on the remote key pad, and the screen will return to the [SYSTEM SETUP] menu.

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Chapter 13: Communication (General Purpose Serial Interface)

The IV-S20 can communicate with a personal computer that transmits commands and receives responses to measurement execution commands.

13-1 List of processing functions

The following functions can be used for communication between the IV-S20 and a personal computer (using the general-purpose serial interface).

Processing function				Processing code	Description	Ref. page
Measurement execution	*1	Measurement execution function 1 (evaluation result)		10	Executes a measurement for a specified object type, and outputs the evaluation result.	13-6
		Measurement execution function 2 (evaluation result + measurement data, fixed)		11	Executes a measurement for a specified object type, and outputs the evaluation result and the measurement data in block 0.	
		Measurement execution function 3 (evaluation result + measurement numerical data)		12	Executes measurement for a specified object type, and outputs the evaluation result and measurement data from a specified block.	13-7
		Measurement execution function 4 (evaluation result + logical result and calculation result)		13	Executes a measurement for a specified object type, and outputs the evaluation result, logical result and calculation result.	
	*2	Measurement execution function 5 (evaluation result)		18	Executes a measurement for a specified object type, and outputs the evaluation result.	13-8
		Measurement execution function 6 (evaluation result + measurement data, fixed)		19	Executes a measurement for a specified object type, and outputs the evaluation result and measurement data in block 0.	
		Measurement execution function 7 (evaluation result + measurement numerical data)		1A	Executes a measurement for a specified object type, and outputs the evaluation result and measurement data from a specified block.	
		Measurement execution function 8 (evaluation result + logical result and calculation result)		1B	Executes a measurement for a specified object type, and outputs the evaluation result, logical result and calculation result.	13-9
Result reading	Measurement data		Reading 1	21	Reads the results of the last measurement (measurement data from block 0).	
			Reading 2	22	Reads the result of the last measurement (evaluation result and measurement data from a specified block).	13-10
			Reading 3	23	Reads the result (logical result and calculation result) of the last evaluation.	
	Illumination reading			28	Reads the amount of illumination measured by the lighting monitor function, and the evaluation result.	
	Corrected light level reading			29	Reads the corrected light level measured by the lighting monitor function, evaluation result and preset reference density.	13-11
Setting operation screen	Operation lock status		Read	50	Read lock/unlock condition of the operation screen	13-12
			Set	51	Set lock/unlock for the operation screen	
	Object type number		Read	54	Read object type number to measure.	
			Assign	55	Used to assign an object type using the general-purpose serial I/O.	
	Output image camera		Read	58	Read camera number set for output.	
			Set	59	Set camera number for output.	

Processing function			Processing code	Description	Ref. page
Initialization*4	Initialize all parameters		60	Set all set condition to initial values (including I/O settings, and system setting area).	13-13
	Initialize measurement conditions		61	Set measurement conditions of the assigned objec type to initial values.	
	Initialize reference image		62	Clear reference image data.	
	Initialize I/O conditions		63	Set I/O conditions to inital values (including I/O settings, and system setting area).	
	Initialize system		64	Set the system conditions to the initial values.	
Self diagnostic			68	Check hardware error.	
Manual measurement coordinates		Reading	70	Read out the coordinates for manual measurement (detection point 0 and 1)	13-14
		Setting	71	Assign the coordinates for manual measurement (detection point 0 and 1)	

*1 Measurement execution functions 1 to 4 can be executed when the MEAS TRIG INP I/F (measurement start input I/F) is the SERIAL (general-purpose serial interface). However, with the measurement execution 2, If the measurement start input I/F has been set to CCD-TRIG (CCD trigger (camera 1)) or PARALLEL (parallel), the IV-S20 only processes responses.

*2 Measurement execution functions 5 to 8 can be executed when the MEAS TRIG INP I/F (measurement start input I/F) has been set to the CCD-TRIG (CCD trigger (camera 1)) and is controlled by sampled start instructions.

*3 When you want to change the object type using processing code (10 to 13, 18 to 1B), object type change time is included in the measurement excecution time display on the monitor.

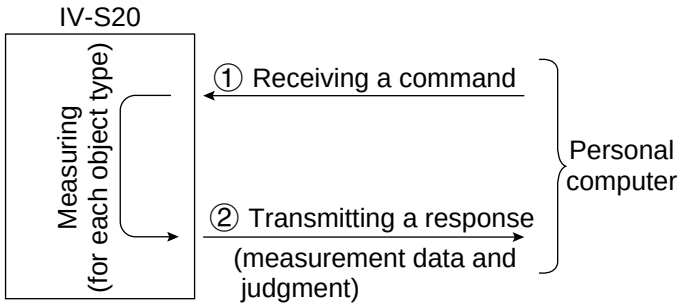
*4 Initialize both the stored data and the currently monitored data.

13-2 Data flow

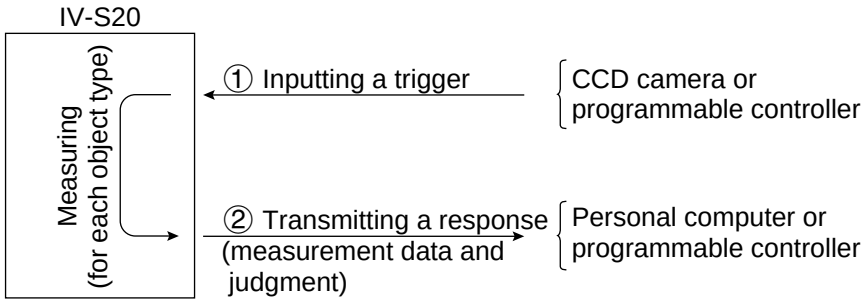
The data flow between the IV-S20 and a personal computer is shown below.

[1] When the measurement execution processing code is 10, 11, 12 or 13

(1) Data flow when the measurement is started and the output of the results are controlled by a general-purpose serial I/F signal

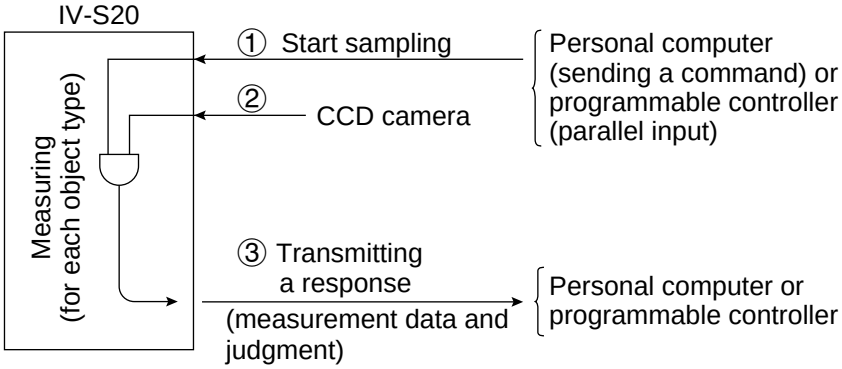


(2) Data flow when the measurement is started by a CCD trigger or a parallel I/F signal and the output of the evaluation results are controlled by a general purpose serial I/F signal



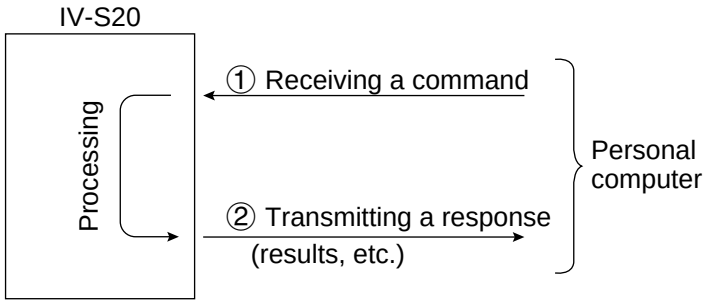
- A response block can be specified in the settings on the [OBJECT TYPE I/O] menu. (See page 11·21.)

[2] When the measurement execution processing code is 18, 19, 1A or 1B



[3] Processing other than measurement execution processing

Any processing can be executed, irrespective of the input/output settings (measurement start input and result output)



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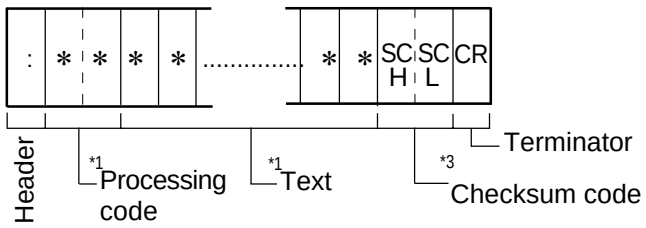
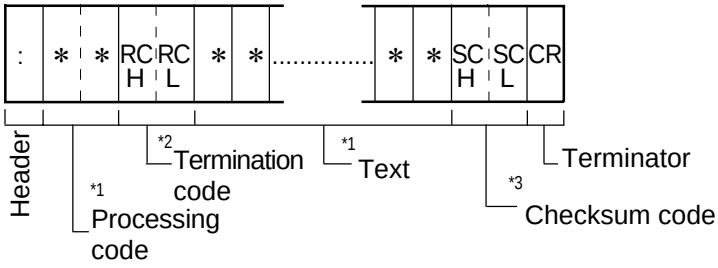
13-3 Communication format

The communication formats of the commands and responses between the IV-S20 and a personal computer are outlined below.

■ Command



■ Response



*1 Processing code and text
- They depend on the contents of communication. (See pages 13-1 and 13-6 and after.)
- On abnormal termination, no text is provided.

*2 Termination code
The termination code is a 2-digit hexadecimal number.
- When an output is sent through the general purpose serial I/F, $00_{(H)}$ is sent on normal termination.
- On abnormal termination, a code other than $00_{(H)}$ is sent. (See page 15-3.)

*3 Checksum code (SC_H and SC_L)
To improve the reliability of the transmitted data, in addition to a parity check, error detection by a checksum is used for error detection.
When the IV-S20 does not need to complete a checksum for error detection, use an @ (at sign: ASCII code $40_{(H)}$) in each of the checksum codes SC_H and SC_L included in the command.

[Error detection using a checksum]
The ASCII code for each data byte, from the processing code to the end of text (prior to the checksum code), is added. The final value is compared to the checksum code which is treated the same way. If the two values are identical, the command is considered to be valid. I/F they are not identical, an error has occurred during transmission.

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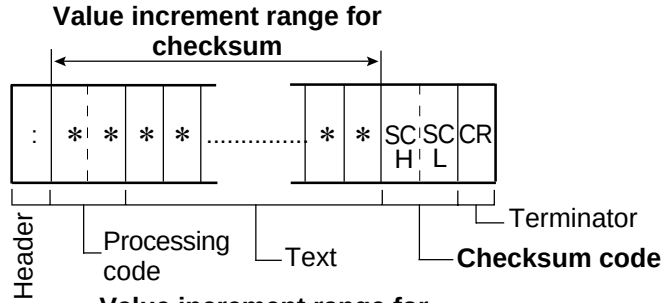
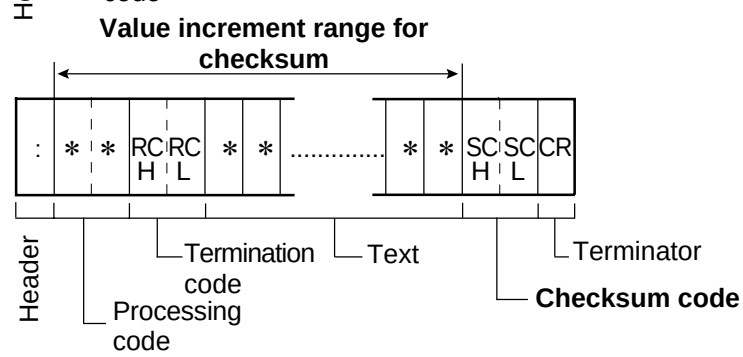
■ Command



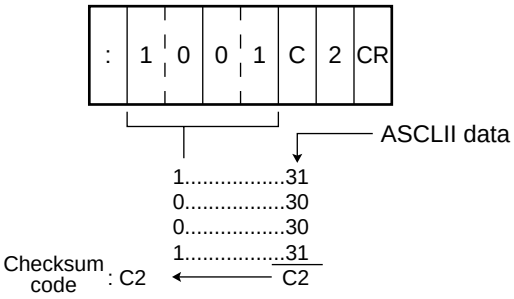
■ Response



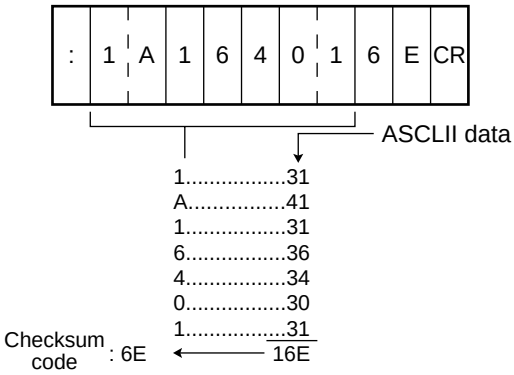
[Method for creating a checksum code]

The ASCII code for each byte of data, from the processing code to the end of text (prior to the checksum code) is added together. The lower 1 byte of this sum is divided into the upper 4 bits and the low-order 4 bits. The hex character (0 to F) is converted to the ASCII code for that character and sent as one byte. Thus the checksum code consists of two bytes.

Ex. 1 Command for the measurement execution function 1 (code $10_{(H)}$)



Ex. 2 Command for the measurement execution function 7 (code $1A_{(H)}$)



Note

· This manual uses the following notation to represent addresses and set values.

Octal numberI	(8)	Ex. $377_{(8)}$
Decimal number	None	Ex. 255
Hexadecimal number	(H)	Ex. $FF_{(H)}$

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13-4 Processing functions

[1] Measurement execution functions

(1) Measurement execution function 1 (evaluation result): code $10_{(H)}$

The measurement for a specified object type is executed, and the data obtained is compared with the criteria. Then the evaluation result (OK/NG) is output.

■ Command

:	1	0	Object type	SC (H)	SC (L)	CR

Note: When the measurement start input signal is other than tha general-purpose serial I/F signal, a command is not required.

■ Response

:	1	0	SC (H)	SC (L)	Object type	Output evaluation result Y0	Y1	···	Y15	SC (H)	SC (L)	CR

- Object type ➡ Object type for which the measurement was executed: 00 to 15
- Output evaluation result (Y0 to Y15) ➡ 0: NG or unspecified, 1: OK

(2) Measurement execution function 2 (evaluation result + measurement data, fixed): code $11_{(H)}$

The measurement for the specified object type is executed, and evaluation result (OK/NG) and the measurement data in block 0 from each measurement program are output. See pages 13-15 to 13-25 for details about the measurement data blocks.

When the measurement start input signal is other than the general purpose serial I/F signal, a fixed response to the code $11_{(H)}$ is returned.

■ Command

:	1	1	Object type	SC (H)	SC (L)	CR

■ Response

:	1	2	RC (H)	RC (L)	Object type	Output evaluation result Y0	Y1	···	Y15	① Measurement 0 Camera 1	Measurement 0 Camera 2	Measurement 1	Measurement 2	Measurement 3	Measurement 0 Camera 1 data ②	Measurement 0 Camera 2 data ②

Data on measurement 1 ②	Data on measurement 2 ②	Data on measurement 3 ②	SC (H)	SC (L)	CR

- Object type ➡ Object type for which the measurement was executed: 00 to 15
- Output evaluation result (Y0 to Y15) ➡ 0: NG or unspecified, 1: OK
- ① ➡ Measurement programs 0 to 3

  Measurement 0 ..... [0 = none, 1 = positional deviation/absolute position measurement] (camera 1 and camera 2)

  Measurement 1 to 3 ... [0 = none, 2 = shape and size comparison, 3 = distance/angle measurement (gray/edge), 4 = distance/angle measurement (center of gravity), 5 = lead inspection, 6 = area measurement after binary conversion, 7 = object counting after binary conversion, 8 = label measurement after binary conversion, 9 = existence detection with a point measurement]

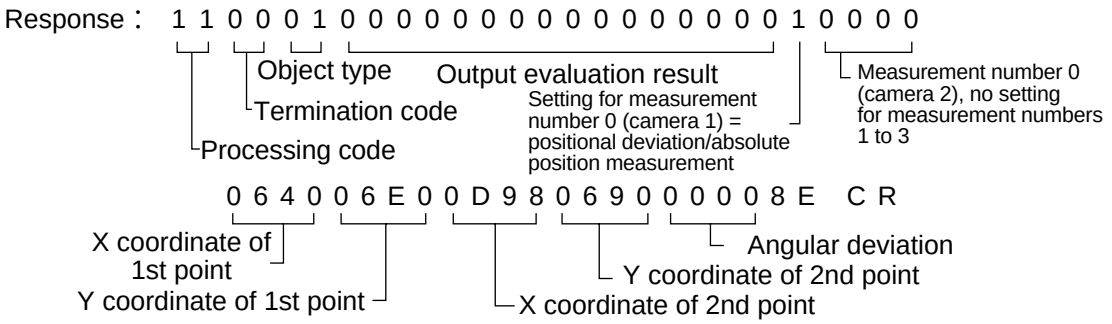
- ② ➡ Measurement data

  The measurement programs vary in terms of the data they produce. Only the data in block 0 of each measurement program is output. If the registration for a measurement program has been set to "NO," there is no data for that measurement, and the data from the next measurement number is brought forward.

  [Ex.] An example of the measurement 0 of object type 01 (camera 1: positional deviation/ absolute position measurement) is given below.

  Command: 1 1 0 1 C 3 CR

  - 1 1: Processing code
  - 0 1: Object type



The coordinates of the 1st and 2nd points are determined as follows, based on the values contained in the response, and the angular deviation is 0°.

	Values (hexadecimal) in response		Pixel coordinates (decimal)	
	X coordinate	Y coordinate	X coordinate	Y coordinate
Coordinates of 1st point	640	6E0	160.0	176.0
Coordinates of 2nd point	D98	690	348.0	168.0

(3) Measurement execution function 3 (evaluation result + measurement numerical data): code $12_{(H)}$

The measurement for a specified object type is executed, and the evaluation result (OK/NG) of each measurement function and data in a specified measurement block are output. See pages 13-15 to 13-25 for details about the measurement data blocks.

■ Command

:	1	2	Object type	Measure-ment	Block	SC (H)	SC (L)	CR

· Objeact type ➡ Object type for which the measurement was executed: 00 to 15
· Measurement ➡ Number of the measurement whose numerical data will be output: 0 to 3
· Block ➡ Specified block from which the data of a specified measurement function will be output (except block 50).

■ Response

:	1	2	RC (H)	RC (L)	Object type	Output evaluation result Y0 Y1 ··· Y15	Specified block data	SC (H)	SC (L)	CR

· Output evaluation result (Y0 to Y15) ➡ 0: NG or unspecified, 1: OK
· Specified block data ➡ Numerical data in a specified block (up to 512 bytes)

(4) Measurement execution function 4 (evaluation result + logical result and calculation result): code $13_{(H)}$

The measurement for a specified object type is executed. Among the measurement results, the evaluation results (OK/NG) of output (Y0 to 15) and the ON/OFF state of the auxiliary relays (C0 to 127) are output. Among the results of the numerical calculations for each measure- ment, the evaluation results and the calculation results of calculations N0 to N15 are output.

■ Command

:	1	3	Object type	Measure-ment	SC (H)	SC (L)	CR

· Object type ➡ Object type for which the measurement was executed: 00 to 15
· Measurement ➡ Number of the measurement whose numerical data will be output: 0 to 3
· ① ➡ The same as on the preceding page

■ Response

:	1	3	RC (H)	RC (L)	Object type	Output evaluation result Y0 Y1 ··· Y15	Measure-ment 0 Camera 1	Measure-ment 0 Camera 2	Measure-ment 1	Measure-ment 2	Measure-ment 3	Auxiliary relay C0 ···· C127	Data ② of the measurement No. specified by the command	SC (H)	SC (L)	CR

· Output evaluation result (Y0 to Y15) ➡ 0: NG or unspecified, 1: OK
· Auxiliary relay (C0 to C127)➡ 00: OFF, 01: ON
· Data ② for the measurement No. specified by the command (evaluation result and calculation result of the numerical calculation)

[When measurement No. 0 is specified]

Camera 1				Camera 2			
Calculation N0		··· Calculation N15		Calculation N0		··· Calculation N15	
Judgment (2-digit)	Result (8-digit)	Judgment (2-digit)	Result (8-digit)	Judgment (2-digit)	Result (8-digit)	Judgment (2-digit)	Result (8-digit)

[When measurement No. 1, 2 or 3 is specified]

Calculation N0		··· Calculation N15	
Judgment (2-digit)	Result (8-digit)	Judgment (2-digit)	Result (8-digit)

Judgment (2-digit) ➡ 00: NG, 01: OK
Result (8-digit): Hexadecimal number
(Data "0" is entered for unregistered calculation numbers from N0 to N15.)

(5) Measurement execution functions 5, 6, 7 and 8: codes $18_{(H)}$, $19_{(H)}$, $1A_{(H)}$ and $1B_{(H)}$

The measurement execution functions 5 to 8 can be processed when the measurement is started by a CCD trigger (camera 1) and is controlled by start sampled instructions. The contents of the commands and responses are the same as those for the measurement run functions 1 to 4, except for the processing code.

1. Measurement execution function 5 (evaluation result): code $18_{(H)}$

The measurement for a specified object type is executed, and the data obtained is compared with the criteria, and the evaluation result (OK/NG) is output.

■ Command

:	1	8	Object type	SC (H)	SC (L)	CR

■ Response

:	1	8	RC (H)	RC (L)	Object type	Output evaluation result Y0	Y1	···	Y15	SC (H)	SC (L)	CR

- The contents of the command and response are the same as those for the measurement execution function 1 (code $10_{(H)}$).

2. Measurement execution function 6 (evaluation result + measurement data, fixed): code $19_{(H)}$

The measurement for a specified object type is executed, and the evaluation result (OK/NG) and measurement data obtained from each measurement function are output.

■ Command

:	1	9	Object type	SC (H)	SC (L)	CR

■ Response

:	1	9	SC (H)	SC (L)	Object type	Output evaluation result Y0	Y1	···	Y15	① Measure-ment 0 Camera 1	Camera 2	Measure-ment 1	Measure-ment 2	Measure-ment 3	Measurement 0 Camera 1 data ②	Camera 2 data ②

Data on measure-ment 1 ②	Data on measure-ment 2 ②	Data on measure-ment 3 ②	SC (H)	SC (L)	CR

- The contents of the command and response are the same as those for the measurement execution function 2 (code $11_{(H)}$).

3. Measurement execution function 7 (evaluation result + measurement numerical data): code $1A_{(H)}$

The measurement for a specified object type is executed, and the evaluation result (OK/NG) of each measurement function and the data from a specified measurement block are output.

■ Command

:	1	A	Object type	Measure-ment	Block	SC (H)	SC (L)	CR

■ Response

:	1	A	RC (H)	RC (L)	Object type	Output evaluation result Y0	Y1	···	Y15	Specified block data	SC (H)	SC (L)	CR

- The contents of the command and response are the same as those for the measurement execution function 3 (code $12_{(H)}$).

4. Measurement execution function 8 (evaluation result + logical result and calculation result): code $1B_{(H)}$
The measurement for a specified object type is executed, and the evaluation result from the measurement results, the logical results and the calculation results of each measurement are output.

■ Command

:	1	B	Object type		Measure-ment	SC (H)	SC (L)	CR

■ Response

											①												
:	1	B	RC (H)	RC (L)	Object type		Output evaluation result Y0	Y1	…	Y15	Measure-ment 0 Camera 1	Camera 2	Measure-ment 1	Measure-ment 2	Measure-ment 3	Auxiliary relay C0	….		C127	Data ② of the measurement No. specified by the command	SC (H)	SC (L)	CR

- The contents of the command and response are the same as those for the measurement execution function 4 (code $13_{(H)}$).

[2] Result reading

Data from the last measurement is read. (No instruction is sent to execute an operation.)
See pages 13-15 to 13-25 for details about the measurement data blocks.

(1) Measurement data reading function 1 (fixed measurement data): code $21_{(H)}$

The final evaluation result, based on the results of the last measurement, and the data in block 0, which comes from the measurement functions specified for measurement numbers 0 to 3, are output.

■ Command

:	2	1	SC (H)	SC (L)	CR

■ Response

											①					
:	2	1	RC (H)	RC (L)	Object type		Output evaluation result Y0	Y1	…	Y15	Measure-ment 0 Camera 1	Camera 2	Measure-ment 1	Measure-ment 2	Measure-ment 3	Measurement 0 Camera 1 data ② / Camera 2 data ②

Data on measure-ment 1 ②	Data on measure-ment 2 ②	Data on measure-ment 3 ②	SC (H)	SC (L)	CR

- Object type ➡ Object type for which the measurement was executed: 00 to 15
- Output evaluation result (Y0 to Y15) ➡0: NG or unspecified, 1: OK
- ① ➡ Measurement functions 0 to 3
  Measurement function 0 .... [0 = none, 1 = positional deviation/absolute position measurement]
  Measurement functions 1 to 3 ... [0 = none, 2 = shape and size comparison, 3 = distance/angle measurement (gray/edge), 4 = distance/angle measurement (center of gravity), 5 = lead inspection, 6 = area measurement after binary conversion, 7 = object counting after binary conversion, 8 = label measurement after binary conversion, 9 = existence detection with a point measurement]
- ② ➡ Measurement data
  The measurement functions vary in terms of the data they produce. Only the data in block 0 is output from the complete output data produced by each measurement function.

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(2) Measurement data reading function 2 (measurement numerical data): code $22_{(H)}$

The data last output and block data from a specified measurement function are output.

■ Command

:	2	2	Measure-ment	Block	SC (H)	SC (L)	CR

■ Response

:	2	2	RC (H)	RC (L)	Object type	Output evaluation result Y0 Y1 ··· Y15	Specified block data	SC (H)	SC (L)	CR

- Measurement ➡ Number of the measurement whose numerical data will be output: 0 to 3
- Block ➡ Specified block from which the data from a specified measurement function will be output
- Object type ➡ Object type for which the measurement was executed: 00 to 15
- Output evaluation result (Y0 to Y15) ➡ 0: NG or unspecified, 1: OK
- Specified block data ➡ Numerical data in a specified block (up to 512 bytes)

(3) Measurement data reading function 3 (evaluation result + logical result and calculation result): code $23_{(H)}$

The most recent final evaluation result, and the logical result and final calculation result of each measurement are read.

■ Command

:	2	3	Object type	SC (H)	SC (L)	CR

■ Response

:	2	3	RC (H)	RC (L)	Object type	Output evaluation result Y0 Y1 ··· Y15	① Measure-ment 0 Camera 1	Camera 2	Measure-ment 1	Measure-ment 2	Measure-ment 3	Measurement 0 Camera 1 data ②	Camera 2 data ②

Data on measure-ment 1 ②	Data on measure-ment 2 ②	Data on measure-ment 3 ②	SC (H)	SC (L)	CR

- Measurement ➡ Number of the measurement whose numerical data will be output: 0 to 3
- Object type ➡ Object type for which the measurement was executed: 00 to 15
- Output evaluation result (Y0 to Y15) ➡ 0: NG or unspecified, 1: OK
- ② ➡ Logical result, calculation evaluation, calculation result
  These data are output in the order of the measurement function numbers: 0 to 3.

(4) Illuminance level reading: code $28_{(H)}$

The illuminance level measured by the illuminance monitor function and the evaluation result are read.

■ Command

:	2	8	Camera No.	SC (H)	SC (L)	CR

■ Response

:	2	8	RC (H)	RC (L)	Object type	Result	Illuminance 10^2 10^1 10^0 10^{-1}	SC (H)	SC (L)	CR

- Camera No. ➡ 1: camera 1, 2: camera 2
- Object type ➡ Object type for which the measurement was executed: 00 to 15
- Result ➡ 0: NG, 1: OK
- Illuminance ➡ 0 to 255.0

(5) Corrected light level reading: code $29_{(H)}$

The corrected light level measured by the illuminance monitor function, the evaluation result and preset reference light level are read.

■ Command

:	2	9	Camera No.	SC (H)	SC (L)	CR

- Camera No. ➡ 1: camera 1, 2: camera 2

■ Response

:	2	9	RC (H)	RC (L)	Object type	Result	±	10^2	10^1	10^0	10^{-1}	10^2	10^1	10^0	10^{-1}	SC (H)	SC (L)	CR
							Corrected light level					Reference light level						

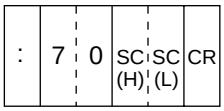
- Object type ➡ Object type for which the measurement was executed: 00 to 15
- Result ➡ 0: NG, 1: OK
- Corrected light level ➡ Corrected light level (±0 to 255.0)
- Reference light level ➡ Light level used as the criterion (0 to 255.0)

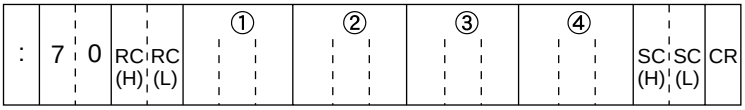
[3] Setting, initialization, self-diagnosis, and manual measurement coordinate of the operation screen

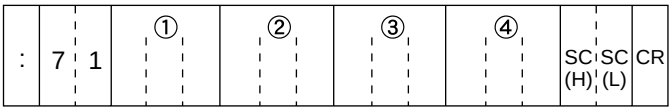
Shown below are only the instructions and responses of these processing functions.

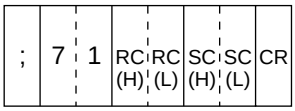
Process function		Process code	Communication format
Setting operation screen	Read operation screen lock	50	■ Command : 5 0 SC(H) SC(L) CR ■ Response : 5 0 RC(H) RC(L) ① SC(H) SC(L) CR ①➡Lock operation screen [0: Lock 1: Unlock]
	Set operation screen lock status	51	■ Command : 5 1 ① SC(H) SC(L) CR ①➡Lock operation screen [0: Lock 1: Unlock] ■ Response : 5 1 RC(H) RC(L) SC(H) SC(L) CR
	Read object type number	54	■ Command : 5 4 SC(H) SC(L) CR ■ Response : 5 4 RC(H) RC(L) Object type SC(H) SC(L) CR
	Assign object type number	55	■ Command : 5 5 Object type SC(H) SC(L) CR ■ Response : 5 5 RC(H) RC(L) SC(H) SC(L) CR
	Read out image camera condition	58	■ Command : 5 8 SC(H) SC(L) CR ■ Response : 5 8 RC(H) RC(L) ① ② SC(H) SC(L) CR ①➡Camera 1 ②➡Camera 2 [0: No 1: All 2: Upper 3: Middle 4: Lower]
	Set output image camera condition	59	■ Command : 5 9 ① ② SC(H) SC(L) CR ①➡Camera 1 ②➡Camera 2 [0: No 1: All 2: Upper 3: Middle 4: Lower] ■ Response : 5 9 RC(H) RC(L) SC(H) SC(L) CR

Process function		Process code	Communication format
Setting operation screen	Initialize all parameters	60	■ Command : 6 0 SC(H) SC(L) CR ■ Response : 6 0 RC(H) RC(L) SC(H) SC(L) CR
	Initialize measurement conditions	61	■ Command : 6 1 Object type SC(H) SC(L) CR ■ Response : 6 1 RC(H) RC(L) Object type SC(H) SC(L) CR
	Initialize reference image	62	■ Command : 6 2 SC(H) SC(L) CR ■ Response : 6 2 RC(H) RC(L) SC(H) SC(L) CR
	Initialize I/O conditions	63	■ Command : 6 3 Object type SC(H) SC(L) CR ■ Response : 6 3 RC(H) RC(L) SC(H) SC(L) CR
	Initialize system	64	■ Command : 6 4 Object type SC(H) SC(L) CR ■ Response : 6 4 RC(H) RC(L) SC(H) SC(L) CR
	Self diagnositc	68	■ Command : 6 8 SC(H) SC(L) CR ■ Response : 6 8 RC(H) RC(L) SC(H) SC(L) CR

<table>
<tr><th colspan="2">Process function</th><th>Process code</th><th>Communication format</th></tr>
<tr><td rowspan="2">Manually measured points</td><td>Reading</td><td>70</td><td>■Command
 

■Response
 

① → X coordinate (000 to 511) for detect point 0
② → Y coordinate (000 to 479) for detect point 0
③ → X coordinate (000 to 511) for detect point 1
④ → Y coordinate (000 to 479) for detect point 1</td></tr>
<tr><td>Assignment</td><td>71</td><td>■Command
 

① → X coordinate (000 to 511) for detect point 0
② → Y coordinate (000 to 479) for detect point 0
③ → X coordinate (000 to 511) for detect point 1
④ → Y coordinate (000 to 479) for detect point 1
■Response
 
</td></tr>
</table>

- The coordinates for detect points 0 and 1 correspond to the detect coordinates 0 and 1 used in manual measurements. => See page 8-8.

13-5 Measurement data blocks

[1] Number of blocks

The measurement functions vary in the number of measurement data blocks they use.

Measurement function	Blocks	
Positional deviation/absolute position measurement	0, 1	
Size and shape comparison	0, 1	
Distance/angle measurement	0, 1, 2	
Lead inspection	0, 1	
Area measurement by binary conversion	0	
Counting quantities by binary conversion	0	
Object identification (labeling) by binary conversion	0, 1, 10 to 13, 20 to 23, 30 to 33, 40 to 43, 60 to 77	
Existance detection by point measuremet	Binary conversion———0	Average light level———0, 1
Final numerical calculation result	50,51	

[2] Contents of the measurement result block (for each measurement function)

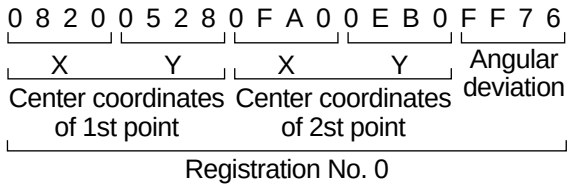
(1) Positional deviation/absolute position measurement

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
0	Registration No. 0	1st point (center coordinates)	X	None	4	1
			Y	None	4	1
		2nd point (center coordinates)	X	None	4	1
			Y	None	4	1
		Angular deviation		Provided *	4	1
	Registration No. 1 to 7	The registration No. 1 to 7 contain the same data as the registration No. 0.				

* When a sign is provided, if the highest-order bit of the data is on (1), a "-" minus sign is used, and if the bit is off (0), a "+" pulus sign is used. The value (decimal) is expressed two's complement notation. (A two's complement number is obtained by inverting the 0s and 1s in a binary number and adding 1.)

Note: If a registration number has not been used yet, the data for the next registered number will be brought forward.

[Example of the data in block 0: Only registration No. 0]



- These data are in hexadecimal. They are converted to the actual decimal measurements as shown below.

		Data (hexadecimal)	Decimal number	Measurement result (value)
Center coordinates of 1st point	X	820	2080	208.0
	Y	528	1320	132.0
Center coordinates of 2nd point	X	FA0	4000	400.0
	Y	EB0	3760	376.0
Angular deviation		FF76	−138	−13.8

*

Block	Item				Sign (+/-)	No. of digits	Decimal point (digit)	Data example	
								Hexa-decimal	Measure-ment result
1	Registration No. 0	Mode			None	2	None	02	2-point search
		Evaluation: Angular deviation			None	2	None	01	OK
		Evaluation: Degree of match	1st point		None	2	None	01	OK
			2nd point		None	2	None	01	OK
		Evaluation: X coordinate	1st point		None	2	None	01	OK
			2nd point		None	2	None	01	OK
		Evaluation: Y coordinate	1st point		None	2	None	01	OK
			2nd point		None	4	None	01	OK
		Degree of match	1st point		Provided	4	None	1B18	6936
			2nd point		Provided	8	None	0D55	3413
		Reserved area			—	8	—	00000000	—
		Evaluation: Deviation	1st point	X	None	2	None	01	OK
				Y	None	2	None	01	OK
			2nd point	X	None	2	None	01	OK
				Y	None	2	None	01	OK
		Deviation	1st point	X	Provided	4	1	0122	29.0
				Y	Provided	4	1	0052	13.0
			2nd point	X	Provided	4	1	FCEA	-78.9
				Y	Provided	4	1	0370	88.0
	Registration No. 1 to 7	Registration No. 1 to 7 contain the same data as the registration No. 0.						___	

* The values shown in the data example column have been converted the same way as wad done in example of the data in block 0.

Note: If a registration number has not been used yet, the data for the next registered number will be brought forward.

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(2) Degree of match inspection for shape and size

Block	Item		Sign (+/-)	No. of digits	Decimal point (digit)
0	Registration No. 0	Degree of match (positioning)	Provided	4	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.			

Block	Item				Sign (+/-)	No. of digits	Decimal point (digit)
1	Registration No. 0	Degree of match of measured object			Provided	4	None
		Position coordinates (positioning)		X	None	4	1
				Y	None	4	1
		Position coordinates (measuring object)		X	None	4	1
				Y	None	4	1
		Evaluation: Degree of match	Positioning		None	2	None
			Measured object		None	2	None
		Evaluation: Position coordinates	Position-ing	X	None	2	None
				Y	None	2	None
			Measured object	X	None	2	None
				Y	None	2	None
		Evaluation: Light level	Positioning		None	2	None
			Measured object		None	2	None
		Light level	Positioning		None	4	None
			Measured object		None	4	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.					

(3) Distance and angle measurement

Block	Item		Sign (+/-)	No. of digits	Decimal point (digit)
0	Registration No. 0	Size measurement: Distance	None	8	1
		Size measurement: Angle	Provided	4	1
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.			

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
1	Registration No. 0	Measurement start point	X	None	4	1
			Y	None	4	1
	Registration No. 1 to 63	Registration No. 1 to 63 contain the same data as the registration No. 0.				

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
2	Evaluation: Distance	Registration No. 0		None	2	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Evaluation: Angle	Registration No. 0		None	2	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Evaluation: Start point	Registration No. 0		None	2	None
		Registration No. 1 to 63		Registration No. 1 to 63 contain the same data as the registration No. 0.		
	Evaluation: Auxiliary point	Registration No. 0		None	2	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Auxiliary point	Registration No. 0	X coordinate	None	4	1
			Y coordinate	None	4	1
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Evaluation: Degree of match	Registration No. 0		None	2	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Degree of match	Registration No. 0		Provided	4	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Number of labels			None	2	None

(4) Lead inspection

Block	Item			No. of digits
0	Reference No. 0	Line No. 0	Quantity at center point	2
		Line No. 1 to 7	Line No. 1 to 7 contain the same data as line No. 0.	
	Reference No. 1 to 3	Reference No. 1 to 3 contain the same data as reference No. 0.		

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
1	Reference No. 0	Line No. 0	Evaluation: Quantity	None	2	None
			Evaluation: Distance	None	2	None
			Distance: Shortest	None	4	1
			Distance: Longest	None	4	1
			The lead number with an NG distance	None	2	None
			Number of leads with NG distance	None	2	None
			Evaluation: Lead length	None	2	None
			Lead length: Shortest	None	4	1
			Lead length: Longest	None	4	1
			The lead number with an NG length	None	2	None
			Number of leads with NG length	None	2	None
		Line No. 1 to 7	Line No. 1 to 7 contain the same data as line No. 0.			
		Evaluation: Reference	X coordinate	None	2	None
			Y coordinate	None	2	None
		Reference detection coordinates	X coordinate	None	4	1
			Y coordinate	None	4	1
		Evaluation: Degree of match		None	2	None
		Degree of match		Provided	4	None
		Reserved area (for the 2nd point)		—	20	—
	Reference No. 1 to 3	Reference Nos. 1 to 3 contain the same data as reference No. 0.				

(5) Area measurement by binary conversion

Block	Item		No. of digits
0	Registration No. 0	Area	8
		Evaluation: Area	2
	Registration No. 1 to 15	Registration Nos. 1 to 15 contain the same data as the registration No. 0.	

(6) Counting quantities by binary conversion

Block	Item		No. of digits
0	Registration No. 0	No. of labels	4
		Evaluation: Number of labels	2
		Evaluation: Total area	2
		Total area	8
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.	

(7) Object identification by binary conversion

Block	Item			No. of digits	Decimal point (digit)
0 *	Registration No. 0	Dummy data (*)		2	None
		No. of labels		2	
		Evaluation: No. of labels		2	
		Evaluation: Total area		2	
		Total area		8	
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.			
1	Registration No. 0	Evaluation: Label area	Label 0	2	None
			Lavel 1	2	
			to	to	
			Lavel 127	2	
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.			

Continued on the following page.

* An item comparison table of block 0 is shown on page 13-22. This is in the general purpose serial I/F used for the object identification by binary conversion in each software version.

Block	Item				No. of digits	Decimal point (digit)
10	Registration No. 0	Label 0	Label unit area		8	None
			Window label center of gravity	X	4	1
				Y	4	1
			Window label main axis angle		4	1
			Window label fillet diamete	X	4	None
				Y	4	None
			Window label circumference		8	1
		Label 1 to 31	Labels 1 to 127 contain the same data as label 0.			
11	0	32 to 63				
12	0	64 to 95				
13	0	96 to 127				
20	Registration No. 1	0 to 31	Labels 0 to 127 contain the same data as label 0 in block 10.			
21	1	32 to 63				
22	1	64 to 95				
23	1	96 to 127				
30	Registration No. 2	Label 0 to 31	Labels 0 to 127 contain the same data as label 0 in block 10.			
31	2	32 to 63				
32	2	64 to 95				
33	2	96 to 127				
40	Registration No. 3	Label 0 to 31	Labels 0 to 127 contain the same data as label 0 in block 10.			
41	3	32 to 63				
42	3	64 to 95				
43	3	96 to 127				
60	Label unit area in registration No. 0		Label 0		8	None
			to		to	
			Label 127		8	
61	Label unit area in registration No. 1		Label 0 to 127		Each label contains the same as block 60.	
62	Label unit area in registration No. 2		Label 0 to 127			
63	Label unit area in registration No. 3		Label 0 to 127			
64	Center of gravity in registration No. 0		Label 0	X	4	1
				Y	4	1
			to		to	to
			Label 127	X	4	1
				Y	4	1
65	Center of gravity in registration No. 1		Label 0 to 127		Each label contains the same as block 64.	
66	Center of gravity in registration No. 2		Label 0 to 127			
67	Center of gravity in registration No. 3		Label 0 to 127			

Continued on the following page.

Block	Item			No. of digits	Decimal point (digit)
68	Main axis angle in registration No. 0	Label 0		4	1
		to		to	to
		Label 127		4	1
	Main axis angle in registration No. 1	Label 0		4	1
		to		to	to
		Label 127		4	1
69	Main axis angle in registration No. 2	Label 0		4	1
		to		to	to
		Label 127		4	1
	Main axis angle in registration No. 3	Label 0		4	1
		to		to	to
		Label 127		4	1
70	Fillet diameter in registration No. 0	Label 0	X	4	None
			Y	4	
		to		to	
		Label 127	X	4	
			Y	4	
71	Fillet diameter in registration No. 1	Label 0 to 127		Each label contains the same as block 70.	
72	Fillet diameter in registration No. 2	Label 0 to 127			
73	Fillet diameter in registration No. 3	Label 0 to 127			
74	Circumference in registration No. 0	Label 0		8	1
		to		to	to
		Label 127		8	1
75	Circumference in registration No. 1	Label 0 to 127		Each label contains the same as block 74.	
76	Circumference in registration No. 2	Label 0 to 127			
77	Circumference in registration No. 3	Label 0 to 127			

Reference

[Item comparison table of block 0 in each software version]

Shown below is an item comparison table of the block 0 for each software version, which is the general-purpose serial I/F used for object identification by binary conversion.

Software version		Ver. 2.01 or earlier	Ver. 2.02	Ver. 2.03 to Ver. 2.09
Contents of block No. 0	Registration No. 0	No. of labels	Dummy data (00)	Dummy data (No. of labels)
		Evaluation: No. of labels	No. of labels	No. of labels
		Dummy data (00)	Evaluation: No. of labels	Evaluation: No. of labels
		Evaluation: Total area	Evaluation: Total area	Evaluation: Total area
		Total area	Total area	Total area
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.		

(8) Point measurement

1. In the binary mode

Block	Item		No. of digits
0	Point No. 0 to 7	Evaluation: Point	2
		White/black information	2
	Point No. 8 to 15	Evaluation: Point	2
		White/black information	2
	Point No. 16 to 23	Evaluation: Point	2
		White/black information	2
	. .	. .	. .
	Point No. 248 to 255	Evaluation: Point	2
		White/black information	2

Note: If a point number has not been used yet, the data for the next registered number will be brought forward.

[Data example: Only point No. 1 to 8]

E D F A

Judg- ment | White/ black information

	Data	Contents
Judgment (OK/NG)	E D (H)	E: 1 1 1 0 — D: 1 1 0 1 Point No. — P8 P7 P6 P5 P4 P3 P2 P1 Judgment — OK OK OK NG OK OK NG OK 0: NG, 1: OK
White/black information	F A (H)	F: 1 1 1 1 — A: 1 0 1 0 Point No. — P8 P7 P6 P5 P4 P3 P2 P1 White/black — White White White White White Black White Black 0: black, 1: white

2. In the average light level mode

Block	Item		No. of digits
0	Point No. 0 to 7	Evaluation: Point	2
	Point No. 8 to 15	Evaluation: Point	2
	Point No. 16 to 23	Evaluation: Point	2
	. .	. .	. .
	Point No. 120 to 127	Evaluation: Point	2
1	Point No. 0	Average light level	4
	Point No. 1	Average light level	4
	. .	. .	. .
	Point No. 127	Average light level	4

Note: If a point number has not been used yet, the data for the next registered number will be brought forward.

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(9) Final numeric calculation result

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
50	Auxiliary relay	C000		None	2 [00: OFF 01:ON]	None
		C001				
		:				
		C127				
	Results of numerical calculations (measurement 0, camera 1)	N00	Evaluation *	None	2	None
			Result	Providied	8	Provided
		N01	Evaluation *	None	2	None
			Result	Providied	8	Provided
		:	:	:	:	:
		N15	Evaluation *	None	2	None
			Result	Providied	8	Provided
	Results of numerical calculations (measurement 0, camera 2)	N00 to N15	N00 to N15 contain the same data as those in the item measurement 0, camera 1.			
	Results of numerical calculations (measurement 1)	N00 to N15	N00 to N15 contain the same data as those in the item measurement 0, camera 1.			
	Results of numerical calculations (measurement 2)	N00 to N15	N00 to N15 contain the same data as those in the item measurement 0, camera 1.			
	Results of numerical calculations (measurement 3)	N00 to N15	N00 to N15 contain the same data as those in the item measurement 0, camera 1.			
	Results of final numerical calculations	AN00 to AN15	AN00 to AN15 contain the same data as those in the item measurement 0, camera 1.			

*Evaluation result values are expressed as 0 (NG), 1 (OK), or 2 (no evaluation).

Note 1: All items will be output regardless of whether the registration is YES or NO.

Note 2: The data in block 50 are not output using measurement 3 (code 12_H). They are output using measurement 4 (code 13_H).

=> See page 13-7.

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
51	Results of numerical calculations (measurement 0, camera 1)	N00	Evaluation*	None	2	None
			Result	Provided	8	Provided
		N01	Evaluation*	None	2	None
			Result	Provided	8	Provided
		⋮	⋮	⋮	⋮	⋮
		N15	Evaluation*	None	2	None
			Result	Provided	8	Provided
	Results of numerical calculations (measurement 0, camera 2)	N00 to N15	N00 to N15 contain the same data as those in the item measurement 0, camera 1.			
	Results of numerical calculations (measurement 1)	N00 to N15	N00 to N15 contain the same data as those in the item measurement 0, camera 1.			
	Results of numerical calculations (measurement 2)	N00 to N15	N00 to N15 contain the same data as those in the item measurement 0, camera 1.			
	Results of numerical calculations (measurement 3)	N00 to N15	N00 to N15 contain the same data as those in the item measurement 0, camera 1.			
	Results of the final numerical calculations	AN00 to AN15	AN00 to AN15 contain the same data as those in the N00 to N15 of item measurement 0, camera 1.			

* Evaluation result values are expressed as 0 (NG), 1 (OK), or 2 (no evaluation).

Note: Blank items are omitted and the remaining lines are moved up.

Chapter 14: Computer Link

A programmable controller (hereafter referred to as a PC) can be connected to the IV-S20, so that the computer link can be used to have the IV-S20 execute measurements.

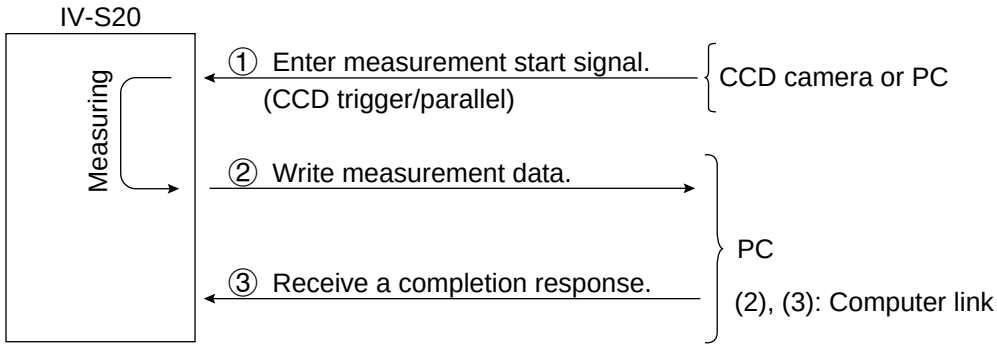
14-1 Compatible models

The IV-S20 is applicable with the computer links for the following models of Sharp, Mitsubishi and OMRON.

- Sharp
  - J-board
    - Host communication port in models Z-311J/312J
  - JW10
    - Communication port and MMI port in models JW-1324K/1342K/1424K/1442K/1624K/1642K
  - JW20H
    - Communication port in the JW-22CU
    - JW-21CM (link module)
  - JW30H
    - Communication port in models JW-32CUH/H1/M1
    - Communication port in models JW-33CUH/H1/H2/H3
    - JW-21CM (link module)
  - JW50H/70H/100H
    - Communication port in models JW-70CUH/100CUH
    - JW-10CM (link module)
- Mitsubishi
  - AnA, AnN (AJ71C24-Sx)
  - A1S (A1SJ71C24)
  - A0J2 (A0J72C24-S1)
- OMRON
  - C1000H (C500-LK203)
  - C200H RS-232C (C200H-LK201)
  - C200H RS-422 (C200H-LK202)
  - CV1000
    - CV CPU link port
    - CV500-LK201
  - CVM1
    - CV CPU link port
    - CV500-LK201
  - CS1W-SCU21

14-2 Data flow

Specify the CCD-TRIG (camera 1) or the PARALLEL (parallel interface). as the source of the MEAS TRIG INP I/F (measurement start input) signal. (See Chapter 11 "Input/Output Conditions Settings.")
The data flow for a measurement start input (CCD trigger/parallel) signal and an object type change command (parallel) is shown below.



The block of measurement data to be written from the IV-S20 to the PC, in step ②, can be specified on the [OBJECT TYPE I/O] menu. (See page 11-21.)

[When a Sharp PC is connected]

The IV-S20 sends write enable command (EWR) to the PC in the following cases.

- When the power is applied to the IV-S20.
- When a Sharp PC is selected.
- When a write mode nonconformity error (code $10_{(H)}$) occurs after a result write command (WRG) is transmitted (when the power is disconnected from the PC).

[When a Mitsubishi or OMRON PC is connected]

The data in items ② and ③ are divided into packets for transmission.

14-3 Register setting

Use PC register (writing: up to 512 bytes) to provide the IV-S20 with a computer link.

Setting item	Applicable range of address
Write register (up to 512 bytes)	* Sharp: 09000 to 99776 * Mitsubishi: D0000 to D9999 * OMRON: DM0000 to DM9999

Enter the write start address in item ③, WRITE TOP ADDRESS, on the [COMPUTER LINK] menu (page 11-19), under the [I/O SETTINGS] menu.

Note 1: When a Sharp PC is used, specify an even address for the write start address.

Note 2: When 512 bytes are used for the write register in a Sharp PC, use one of the following write start addresses.

09000, 19000, 29000, 39000, 49000, 59000, 69000, 79000, 89000, 99000

[Write register map]

The write register contains the following data.

Sharp	Mitsubishi		OMRON		Contents	
09000	D0000	L	DM0000	L	Termination code ($00_{(H)}$: normal termination, codes other than $00_{(H)}$abnormal termination ⇨ See page 15.3.)	
09001		H		H	Appended information (error code in an error response)	*1
09002	D0001	L	DM0001	L	Object type number (0 to 15: 00 to $0F_{(H)}$)	
09003		H		H	————	
09004	D0002	L	DM0002	L	Result output (Y0 to Y15)	*2
09005		H		H		
09006	D0003	L	DM0003	L	Measurement function 0 using camera 1	*3
09007		H		H	Measurement function 0 using camera 2	
09010	D0004	L	DM0004	L	Measurement function 1	*4
09011		H		H	Measurement function 2	
09012	D0005	L	DM0005	L	Measurement function 3	
09013		H		H	————	
09014	D0006	L	DM0006	L	Output data from measurement 0 (block 0)	*5
09015		H		H	:	
					:	
:	:	L	:	L	Output data from measurement 1 (block 0)	
:		H		H	:	
					:	
:	:	L	:	L	Output data from measurement 2 (block 0)	
:		H		H	:	
					:	
:	:	L	:	L	Output data from measurement 3 (block 0)	
:		H		H	:	
					:	
19000	D0256	L	DM0256	L	Assigned block data	*6
19001		H		H	:	
:	:		:		:	

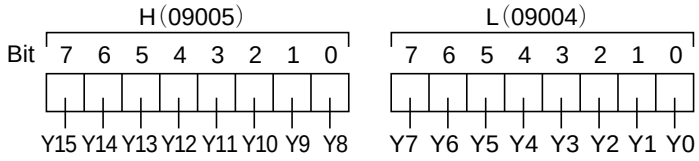
*1 to *6 ⇨ See the next page.

The register map shown above is established when the write start addresses have been set as shown below.

Manufacturer	Sharp	Mitsubishi	OMRON
Write start address	09000	D0000	DM0000

*1 When the termination code is $08_{(H)}$ (error response received error), the error code is contained in the appended information. (Example: $0A_{(H)}$ on a Sharp PC = parity error)

*2 Result output (Y0 to Y15)



*3 Measurement program for measurement 0

$00_{(H)}$ = none, $01_{(H)}$ = positional deviation/absolute position measurement

*4 Measurement programs for measurements 1 to 3

$00_{(H)}$ = none, $02_{(H)}$ = shape and size comparison, $03_{(H)}$ = distance/angle measurement (gray/edge), $04_{(H)}$ = distance/angle measurement (center of gravity), $05_{(H)}$ = lead inspection, $06_{(H)}$ = area measurement after binary conversion, $07_{(H)}$ = object counting after binary conversion, $08_{(H)}$ = label measurement after binary conversion, $09_{(H)}$ = existence detection with a point measurement

*5 Output data from measurements 0 to 3 (block 0)

The data in block 0 is output for measurement data of measurement number 0 to 3. (Max. 500 bytes).

- See pages 14-5,7 to 11-13 for details about the measurement data of block 0.
- The data (block 0) from any unselected measurement number will not be output. (Its space will be filled by the next item.)

*6 Assigned block data

When a measurement number (camera No.) or block number is specified, the IV-S20 will output its measurement data.

- For details about how to specify measurement, see pages 11-19 to 11-20.
- No data is output if block 0 (00) is specified.
- For details about the measurement data block, see pages 14-5 to 14-15.
- The top address where the specified block of data is written will be an address made by adding 512 bytes to the top address for wiring results.

	Sharp	Mitsubishi		OMRON		Contents
Result write top address →	09000	D0000	L	DM0000	L	Termination code
	09001		H		H	Appended information
	.	.		.		.
	.	.		.		.
	.	.		.		.
	:	.	L	.	L	Output data from measurement 3 (block 0)
	:	:	H	.	H	.
	.	.		.		.
	.	.		.		.
	.	.		.		.
Result write top address + 512 bytes →	19000	D0256	L	DM0256	L	Assigned block data
	19001		H		H	.
	.	.		.		.
	.	.		.		.
	.	.		.		.

14

■ Measurement data blocks

[1] Number of blocks

The measurement functions vary in the number of measurement data blocks they use.

Measurement function	Blocks	
Positional deviation/absolute position measurement	0, 1	
Size and shape comparison	0, 1	
Distance/angle measurement	0, 1, 2	
Lead inspection	0, 1	
Area measurement by binary conversion	0	
Counting quantities by binary conversion	0	
Object identification (labeling) by binary conversion	0, 1, 10 to 13, 20 to 23, 30 to 33, 40 to 43, 60 to 77	
Existance detection by point measuremet	Binary conversion———0	Average light level———0, 1
Final numerical calculation result	50,51	

[2] Contents of the measurement result block (for each measurement function)

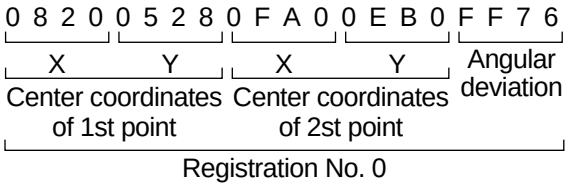
(1) Positional deviation/absolute position measurement

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
0	Registration No. 0	1st point (center coordinates)	X	None	4	1
			Y	None	4	1
		2nd point (center coordinates)	X	None	4	1
			Y	None	4	1
		Angular deviation		Provided *	4	1
	Registration No. 0 to 7	The registration No. 1 to 7 contain the same data as the registration No. 0.				

* When a sign is provided, if the highest-order bit of the data is on (1), a "-" minus sign is used, and if the bit is off (0), a "+" pulus sign is used. The value (decimal) is expressed two's complement notation. (A two's complement number is obtained by inverting the 0s and 1s in a binary number and adding 1.)

Note: If a registration number has not been used yet, the data for the next registered number will be brought forward.

[Example of the data in block 0: Only registration No. 0]



- These data are in hexadecimal. They are converted to the actual decimal measurements as shown below.

		Data (hexadecimal)	Decimal number	Measurement result (value)
Center coordinates of 1st point	X	820	2080	208.0
	Y	528	1320	132.0
Center coordinates of 2nd point	X	FA0	4000	400.0
	Y	EB0	3760	376.0
Angular deviation		FF76	–138	–13.8

*

Block	Item				Sign (+/-)	No. of digits	Decimal point (digit)	Data example	
								Hexa-decimal	Measure-ment result
1	Registration No. 0	Mode			None	2	None	02	2-point search
		Evaluation: Angular deviation			None	2	None	01	OK
		Evaluation: Degree of match	1st point		None	2	None	01	OK
			2nd point		None	2	None	01	OK
		Evaluation: X coordinate	1st point		None	2	None	01	OK
			2nd point		None	2	None	01	OK
		Evaluation: Y coordinate	1st point		None	2	None	01	OK
			2nd point		None	4	None	01	OK
		Degree of match	1st point		Provided	4	None	1B18	6936
			2nd point		Provided	8	None	0D55	3413
		Reserved area			—		—	00000000	—
		Evaluation: Deviation	1st point	X	None	2	None	01	OK
				Y	None	2	None	01	OK
			2nd point	X	None	2	None	01	OK
				Y	None	2	None	01	OK
		Deviation	1st point	X	Provided	4	1	0122	29.0
				Y	Provided	4	1	0052	13.0
			2nd point	X	Provided	4	1	FCEA	-78.9
				Y	Provided	4	1	0370	88.0
	Registration No. 1 to 7	Registration No. 1 to 7 contain the same data as the registration No. 0.						___	

* The values shown in the "data example" column have been converted the same way as wad done in "example of the data in block 0."

Note: If a registration number has not been used yet, the data for the next registered number will be brought forward.

(2) Degree of match inspection for shape and size

Block	Item		Sign (+/-)	No. of digits	Decimal point (digit)
0	Registration No. 0	Degree of match (positioning)	Provided	4	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.			

Block	Item				Sign (+/-)	No. of digits	Decimal point (digit)
1	Registration No. 0	Degree of match of measured object			Provided	4	None
		Position coordinates (positioning)		X	None	4	1
				Y	None	4	1
		Position coordinates (measuring object)		X	None	4	1
				Y	None	4	1
		Evaluation: Degree of match	Positioning		None	2	None
			Measured object		None	2	None
		Evaluation: Position coordinates	Positioning	X	None	2	None
				Y	None	2	None
			Measured object	X	None	2	None
				Y	None	2	None
		Evaluation: Light level	Positioning		None	2	None
			Measured object		None	2	None
		Light level	Positioning		None	2	None
			Measured object		None	2	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.					

(3) Distance and angle measurement

Block	Item		Sign (+/-)	No. of digits	Decimal point (digit)
0	Registration No. 0	Size measurement: Distance	None	8	1
		Size measurement: Angle	Provided	4	1
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.			

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
1	Registration No. 0	Measurement start point	X	None	4	1
			Y	None	4	1
	Registration No. 1 to 63	Registration No. 1 to 63 contain the same data as the registration No. 0.				

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
2	Evaluation: Distance*	Registration No. 0		None	2	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Evaluation: Angle*	Registration No. 0		None	2	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Evaluation: Start point*	Registration No. 0		None	2	None
		Registration No. 1 to 63		Registration No. 1 to 63 contain the same data as the registration No. 0.		
	Evaluation: Auxiliary point*	Registration No. 0		None	2	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Auxiliary point	Registration No. 0	X coordinate	None	4	1
			Y coordinate	None	4	1
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Evaluation: Degree of match*	Registration No. 0		None	2	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Degree of match	Registration No. 0		Provided	4	None
		Registration No. 1 to 15		Registration No. 1 to 15 contain the same data as the registration No. 0.		
	Number of labels			None	2	None
	Dummy data			-	2	-

* (5 places) : When evaluations are specified (distance, angle, start point, auxiliary point, degree of match), if the number of registered item is odd, two digits of dummy data will be inserted at the end of each item.

(4) Lead inspection

Block	Item			No. of digits
0	Reference No. 0	Line No. 0	Quantity at center point	2
			Dummy data	2
		Line No. 1 to 7	Line No.1 to 7 contain the same data as line No. 0.	
	Reference No. 1 to 3	Reference No. 1 to 3 contain the same data as reference No. 0.		

Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
1	Reference No. 0	Line No. 0	Evaluation: Quantity	None	2	None
			Evaluation: Distance	None	2	None
			Distance: Shortest	None	4	1
			Distance: Longest	None	4	1
			The lead number with an NG distance	None	2	None
			Number of leads with NG distance	None	2	None
			Evaluation: Lead length	None	2	None
			Dummy data	–	2	–
			Lead length: Shortest	None	4	1
			Lead length: Longest	None	4	1
			The lead number with an NG length	None	2	None
			Number of leads with NG length	None	2	None
		Line No. 1 to 7	Line No. 1 to 7 contain the same data as line No. 0.			
		Evaluation: Reference	X coordinate	None	2	None
			Y coordinate	None	2	None
		Reference detection coordinates	X coordinate	None	4	1
			Y coordinate	None	4	1
		Evaluation: Degree of match		None	2	None
		Dummy data		—	2	—
		Degree of match		Provided	4	None
		Reserved area (for the 2nd point)		—	20	—
	Reference No. 1 to 3	Reference No. 1 to 3 contain the same data as reference No. 0.				

(5) Area measurement by binary conversion

Block	Item		No. of digits
0	Registration No. 0	Window area	8
		Evaluation: Area	2
		Dummy data	2
	Registration No. 1 to 15	Registration Nos. 1 to 15 contain the same data as the registration No. 0.	

(6) Counting quantities by binary conversion

Block	Item		No. of digits
0	Registration No. 0	No. of labels	4
		Evaluation: Number of labels	2
		Evaluation: Total area	2
		Total area	8
	Registration No.1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.	

(7) Object identification by binary conversion

Block	Item				No. of digits	Decimal point (digit)
0	Registration No. 0	No. of labels			2	None
		Dummy data			2	
		Evaluation: No. of labels			2	
		Evaluation: Total area			2	
		Total area			8	
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.				
1	Registration No. 0	Evaluation: Label area	Label 0		2	None
			Lavel 1		2	
			to		to	
			Lavel 127		2	
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.				
10	Registration No. 0	Label 0	Label unit area		8	None
			Window label center of gravity	X	4	1
				Y	4	1
			Window label main axis angle		4	1
			Window label fillet diameter	X	4	None
				Y	4	None
			Window label circumference		8	1
		Label 1 to 31	Labels 1 to 127 contain the same data as label 0.			
11	0	32 to 63				
12	0	64 to 95				
13	0	96 to 127				
20	Registration No. **1**	0 to 31	Labels 0 to 127 contain the same data as label 0 in block 10.			
21	1	32 to 63				
22	1	64 to 95				
23	1	96 to 127				
30	Registration No. 2	Label 0 to 31	Labels 0 to 127 contain the same data as label 0 in block 10.			
31	2	32 to 63				
32	2	64 to 95				
33	2	96 to 127				
40	Registration No. 3	Label 0 to 31	Labels 0 to 127 contain the same data as label 0 in block 10.			
41	3	32 to 63				
42	3	64 to 95				
43	3	96 to 127				

Continued on the following page.

Block	Item			No. of digits	Decimal point (digit)
60	Label unit area in registration No. 0	Label 0		8	None
		to		to	
		Label 127		8	
61	Label unit area in registration No. 1	Label 0 to 127		Each label contains the same as block 60.	
62	Label unit area in registration No. 2	Label 0 to 127			
63	Label unit area in registration No. 3	Label 0 to 127			
64	Center of gravity in registration No. 0	Label 0	X	4	1
			Y	4	1
		to		to	to
		Label 127	X	4	1
			Y	4	1
65	Center of gravity in registration No. 1	Label 0 to 127		Each label contains the same as block 64.	
66	Center of gravity in registration No. 2	Label 0 to 127			
67	Center of gravity in registration No. 3	Label 0 to 127			
68	Main axis angle in registration No. 0	Label 0		4	1
		to		to	to
		Label 127		4	1
	Main axis angle in registration No. 1	Label 0		4	1
		to		to	to
		Label 127		4	1
69	Main axis angle in registration No. 2	Label 0		4	1
		to		to	to
		Label 127		4	1
	Main axis angle in registration No. 3	Label 0		4	1
		to		to	to
		Label 127		4	1
70	Fillet diameter in registration No. 0	Label 0	X	4	None
			Y	4	
		to		to	
		Label 127	X	4	
			Y	4	
71	Fillet diameter in registration No. 1	Label 0 to 127		Each label contains the same as block 70.	
72	Fillet diameter in registration No. 2	Label 0 to 127			
73	Fillet diameter in registration No. 3	Label 0 to 127			
74	Circumference in registration No. 0	Label 0		8	1
		to		to	to
		Label 127		8	1
75	Circumference in registration No. 1	Label 0 to 127		Each label contains the same as block 74.	
76	Circumference in registration No. 2	Label 0 to 127			
77	Circumference in registration No. 3	Label 0 to 127			

(8) Point measurement

1. In the binary mode

Block	Item		No. of digits
0	Point No. 0 to 7	Evaluation: Point	2
		White/black information	2
	Point No. 8 to 15	Evaluation: Point	2
		White/black information	2
	Point No. 16 to 23	Evaluation: Point	2
		White/black information	2
	. .	. .	. .
	Point No. 248 to 255	Evaluation: Point	2
		White/black information	2

Note: If a point number has not been used yet, the data for the next registered number will be brought forward.

[Data example: Only point No. 1 to 8]

E D F A
Judg- ment | White/ black information

	Data	Contents
Judgment (OK/NG)	E D (H)	E: 1 1 1 0 (P8 P7 P6 P5) D: 1 1 0 1 (P4 P3 P2 P1) Point No. — P8 P7 P6 P5 P4 P3 P2 P1 Judgment — OK OK OK NG OK OK NG OK 0: NG, 1: OK
White/black information	F A (H)	F: 1 1 1 1 (P8 P7 P6 P5) A: 1 0 1 0 (P4 P3 P2 P1) Point No. — P8 P7 P6 P5 P4 P3 P2 P1 White/black — White White White White White Black White Black 0: black, 1: white

2. In the average light level mode

Block	Item		No. of digits
0	Point No. 0 to 7	Evaluation: Point	2
		Dummy data	2
	Point No. 8 to 15	Evaluation: Point	2
		Dummy data	2
	Point No. 16 to 23	Evaluation: Point	2
		Dummy data	2
	. .	. .	. .
	Point No. 120 to 127	Evaluation: Point	2
		Dummy data	2
1	Point No. 0	Average light level	4
	Point No. 1	Average light level	4
	. .	. .	. .
	Point No. 127	Average light level	4

Note: If a point number has not been used yet, the data for the next registered number will be brought forward.

(9) Final numeric calculation result

Block	Item				Sign (+/-)	No. of digits	Decimal point (digit)
50	Auxiliary relay	C000 C001 ⋮ C127			None	2 [00: OFF 01: ON]	None
	Results of numerical calculations (measurement 0, camera 1)	N00	Evaluation*		None	2	None
			Dummy data			2	None
			Result		Provided	8	Provided
		N01	Evaluation*		None	2	None
			Dummy data			2	None
			Result		Provided	8	Provided
		⋮	⋮	⋮	⋮	⋮	⋮
		N15	Evaluation*		None	2	None
			Dummy data			2	None
			Result		Provided	8	Provided
	Results of numerical calculations (measurement 0, camera 2)	N00 to N15	N00 to N15 contain the same data as those in the item "measurement 0, camera 1."				
	Results of numerical calculations (measurement 1)	N00 to N15	N00 to N15 contain the same data as those in the item "measurement 0, camera 1."				
	Results of numerical calculations (measurement 2)	N00 to N15	N00 to N15 contain the same data as those in the item "measurement 0, camera 1."				
	Results of numerical calculations (measurement 3)	N00 to N15	N00 to N15 contain the same data as those in the item "measurement 0, camera 1."				
	Results of the final numerical calculations	AN00 to AN15	AN00 to AN15 contain the same data as those in the N00 to N15 of item "measurement 0, camera 1."				

* Evaluation result values are expressed as 0 (NG), 1 (OK), or 2 (no evaluation).

Note: All items will be output regardless of whether the registration is YES or NO.

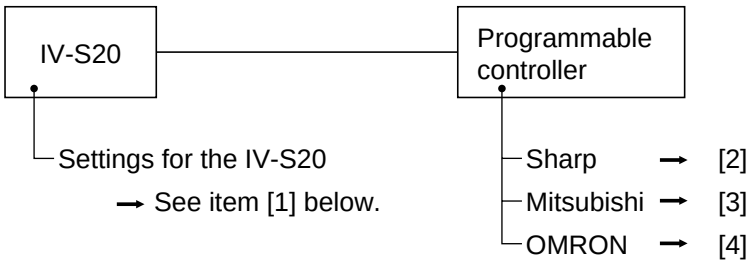
Block	Item			Sign (+/-)	No. of digits	Decimal point (digit)
51	Results of numerical calculations (measurement 0, camera 1)	N00	Evaluation*	None	2	None
			Dummy data		2	None
			Result	Provided	8	Provided
		N01	Evaluation*	None	2	None
			Dummy data		2	None
			Result	Provided	8	Provided
		⋮	⋮	⋮	⋮	⋮
		N15	Evaluation*	None	2	None
			Dummy data		2	None
			Result	Provided	8	Provided
	Results of numerical calculations (measurement 0, camera 2)	N00 to N15	N00 to N15 contain the same data as those in the item "measurement 0, camera 1."			
	Results of numerical calculations (measurement 1)	N00 to N15	N00 to N15 contain the same data as those in the item "measurement 0, camera 1."			
	Results of numerical calculations (measurement 2)	N00 to N15	N00 to N15 contain the same data as those in the item "measurement 0, camera 1."			
	Results of numerical calculations (measurement 3)	N00 to N15	N00 to N15 contain the same data as those in the item "measurement 0, camera 1."			
	Results of the final numerical calculations	AN00 to AN15	AN00 to AN15 contain the same data as those in the N00 to N15 of item "measurement 0, camera 1."			

* Evaluation result values are expressed as 0 (NG), 1 (OK), or 2 (no evaluation).

Note: Blank items are omitted and the remaining lines are moved up.

14-4 Interface

The interface between the IV-S20 and a programmable controller from each manufacturer is described below.



[1] Setting items for the IV-S20

Item	Setting details
Communication speed (k bit/sec)	115.2, 57.6, 38.4, 19.2, 9.6
Data length (bit)	7, 8
Parity	None, odd, even
Stop bit	1, 2
Error check	Checksum
Station No.	Sharp: 00 to $37_{(8)}$ Mitsubishi: 00 to 31 OMRON: 00 to 31
Write address (up to 512 bytes)	Sharp: 09000 to 99776 Mitsubishi: D000 to D9999 OMRON:DM0000 to DM9999

[2] Connection with a Sharp PC

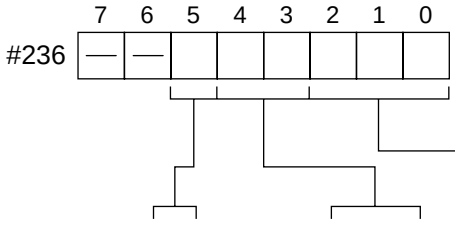
[Applicable models]

1. Control module: JW-22CU (can be used with ROM version 2.2 or later)
   JW-70CUH/100CUH, JW-32CUH/H1/M1
   JW-33CUH/H1/H2/H3
2. Basic module: JW-1324K/1342K/1424K/1442K/1624K/1642K
3. CPU board: Z-311J/312J
4. Link module: JW-21CM, JW-10CM
5. Communication board: Z-331J/332J

(1) Module setting

① When a JW-22CU or a JW-70CUH/100CUH and Z-311J/312J are used

Store the communication port conditions in system memory addresses #236 and #237.
Bits D_0 to D_5 are stored in memory address #236.



Data	D_5	Stop
7 bits, fixed	0	1 bit
	1	2 bits

D_4	D_3	Parity
0	0	None
0	1	Odd
1	0	Even

D_2	D_1	D_0	Transmission speed (k bit/sec)
0	0	1	9.6
0	0	0	19.2

#237 Station No. (001 to 037(8))

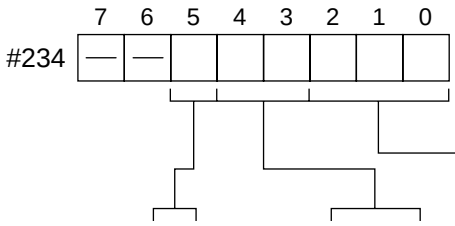
Enter the station No. for the current station.

In the initial state, addresses #236 and #237 are set to 000.

② When a JW-32CUH/H1/M1 or a JW-33CUH/H1/H2/H3 is used

1. When communication port 1 (PG/COMM1 port) is used

Store the communication conditions in system memory addresses #234 and #235. Set bits D_0 to D_5 in memory address #234. Only an RS-422 cable can be connected to the PG/COMM1 port.



Data	D_5	Stop
7 bits, fixed	0	1 bit
	1	2 bits

D_4	D_3	Parity
0	0	None
0	1	Odd
1	0	Even

D_2	D_1	D_0	Transmission speed (k bit/sec)
0	0	1	9.6
0	0	0	19.2
1	1	1	38.4 *
1	1	0	57.6 *
1	0	1	115.2 *

* Applicable only to the JW-32CUH1/M1 and JW-33CUH1/H2/H3

#235 Station No. (001 to 037(8))

Enter the station No. for the current station.

In the initial state, addresses #234 and #235 are set to 000.

2. When communication port 2 (PG/COMM2 port) is used.
Store the communication conditions in system memory addresses #222, #236 and #237. Either RS-232 or RS-422 cable can be connected to the PG/COMM2 port.

#222 Communication method for the PG/COMM2 port ($00_{(H)}$)

Set to $00_{(H)}$.

#236

7	6	5	4	3	2	1	0
—	—						

Set bits D_0 to D_5 in memory address #236.

Data
7 bits, fixed

D_5	Stop
0	1 bit
1	2 bits

D_4	D_3	Parity
0	0	None
0	1	Odd
1	0	Even

D_2	D_1	D_0	Transmission speed (k bit/sec)
0	0	1	9.6
0	0	0	19.2
1	1	1	38.4
1	1	0	57.6 *
1	0	1	115.2

* Applicable only to the JW-32CUH1/M1 and JW-33CUH1/H2/H3

#237 Station No. (001 to $037_{(8)}$)

Enter the station No. for the current station.

In the initial state, addresses #222, #236 and #237 are set to 000.

③ When a JW-1324K/1342K/1424K/1442K/1624K/1642K is used

1. When the communication port is used
Store the communication conditions in system memory addresses #234, #236 and #237.

#234 Communication mode for the communication port ($00_{(H)}$)

Set to $00_{(H)}$ (computer link).

#236

7	6	5	4	3	2	1	0
	—						

Set bits D_0 to D_5 and D_7 in memory address #236.

D_7	Data
0	7 bits
1	8 bits

D_5	Stop
0	1 bit
1	2 bits

D_4	D_3	Parity
0	0	None
0	1	Odd
1	0	Even

D_2	D_1	D_0	Transmission speed (k bit/sec)
0	0	1	9.6
0	0	0	19.2
1	1	1	38.4

#237 Station No. (001 to $037_{(8)}$)

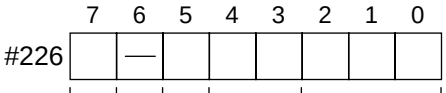
Enter the station No. for the current station.

In the initial state, addresses #234, #236 and #237 are set to 000.

2. When the MMI port is used

Store the communication conditions in system memory addresses #226 and #227. Set bits D_0 to D_5 in memory address #226.

Use of the MMI port ensures a one-to-one connection between the IV-S20 and the JW10.



D_7	Data
0	7 bits
1	8 bits

D_5	Stop
0	1 bit
1	2 bits

D_4	D_3	Parity
0	0	None
0	1	Odd
1	0	Even
1	1	Invalid

D_2	D_1	D_0	Transmission speed (k bit/sec)
0	0	1	9.6
0	0	0	19.2
1	1	1	38.4

#227 [Station No.] $(001_{(8)})$

Set to $(001_{(8)})$

In the initial state, addresses #226 and #227 are set to 000.

④ When a JW-21CM or JW-10CM is used

Set the switches (SW0 to SW4 and SW7) on the module as shown below.

Switch	Setting	Set value
SW0	Command mode	4
SW1	Station No. (upper bit)	01 to $37_{(8)}$
SW2	Station No. (lower bit)	
SW3-1	Invalid	OFF
SW3-2	4-wire system	ON
SW3-3	Invalid	OFF
SW3-4	Odd parity (OFF), even parity (ON) OFF or ON	OFF or ON
SW4	Transmission speed (k bit/sec) 0 or 1	0 or 1
SW7	With a termination resistance	ON

⑤ When a Z-331J/332J is used

Set the switches (SW0 to SW4 and SW7) on the board as shown below.

Switch	Setting	Set value
SW0	Computer link	4
SW1	Station No. (upper bit)	01 to $37_{(8)}$
SW2	Station No. (lower bit)	
SW3-1	Invalid	OFF
SW3-2	Only the 2-wire system can be used.	OFF
SW3-3	Invalid	OFF
SW3-4	Odd parity (OFF), even parity (ON)	OFF or ON
SW4	Transmission speed (k bit/sec) 19.2 (0), 9.6 (1)	0 or 1
SW7	With a termination resistance	ON

(2) Using memory

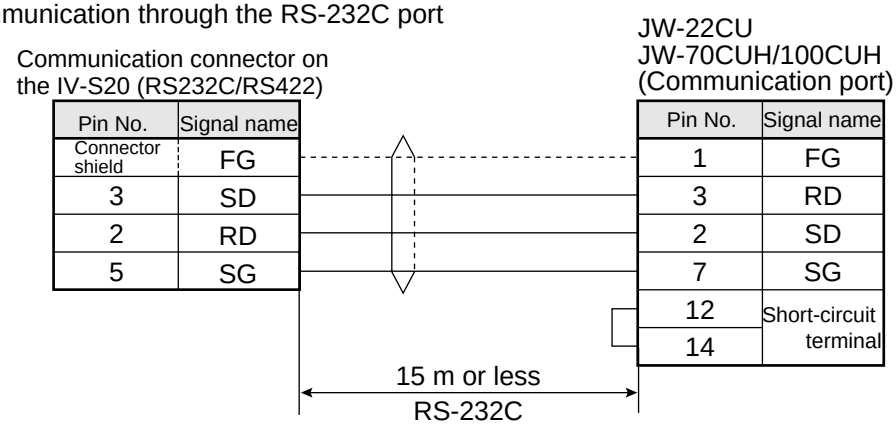
To allow the memory to be used by the IV-S20, enter a result write start address in the following range.

Memory	Range (address)
Register	09000 to 99776

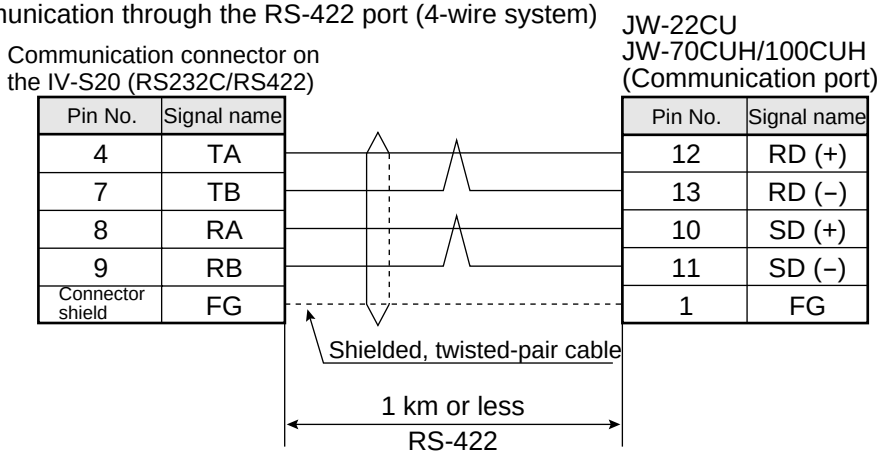
(3) Connections

① When a JW-22CU or JW-70CUH/100CUH is used

1. Communication through the RS-232C port

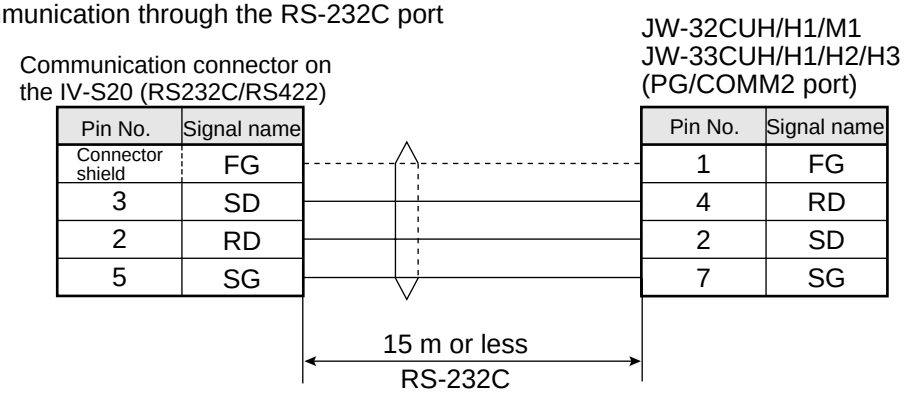


2. Communication through the RS-422 port (4-wire system)

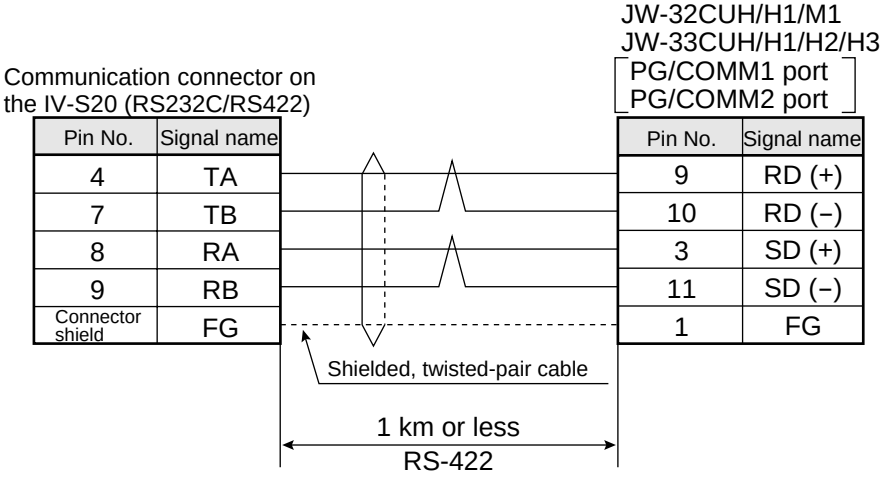


② When a JW-32CUH/H1/M1 or JW-33CUH/H1/H2/H3 is used

1. Communication through the RS-232C port



2. Communication through the RS-422 port (4-wire system)



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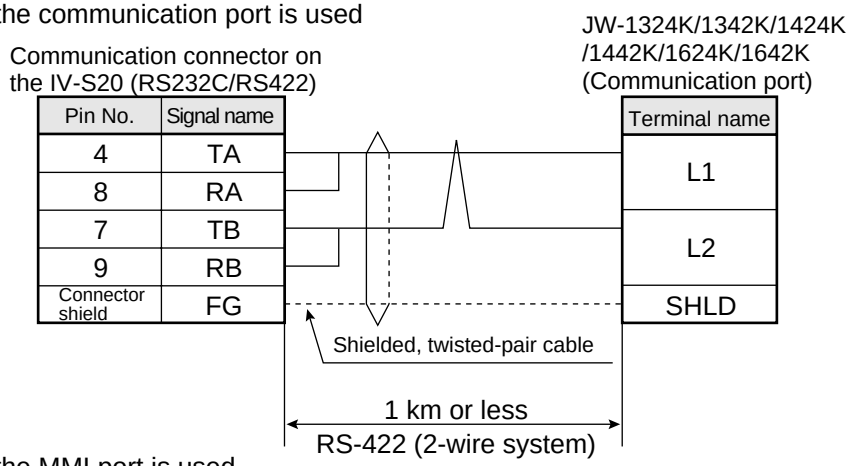
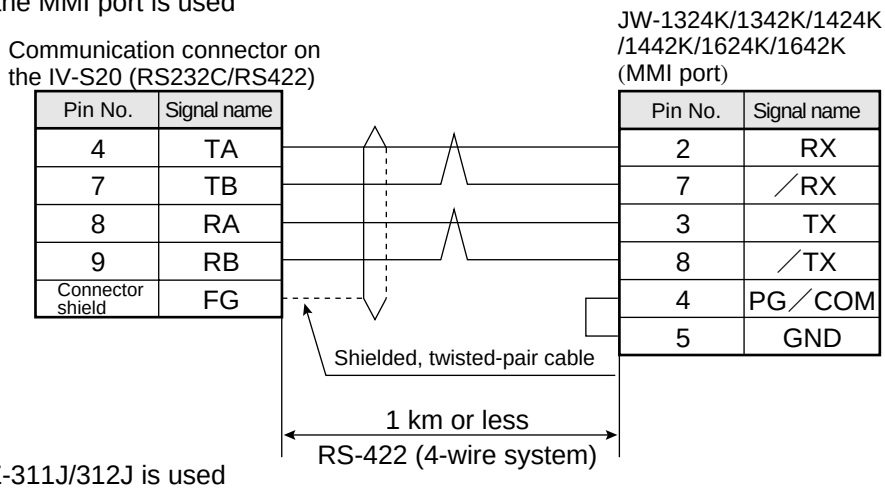
③ When a JW-1324K/1342K/1424K/1442K/1624K/1642K is used

The IV-S20 can only be connected to the RS-422 port. When the communication port is used, provide a 2-wire RS-422 system. When the MMI port is used, provide a 4-wire RS-422 system.

1. When the communication port is used

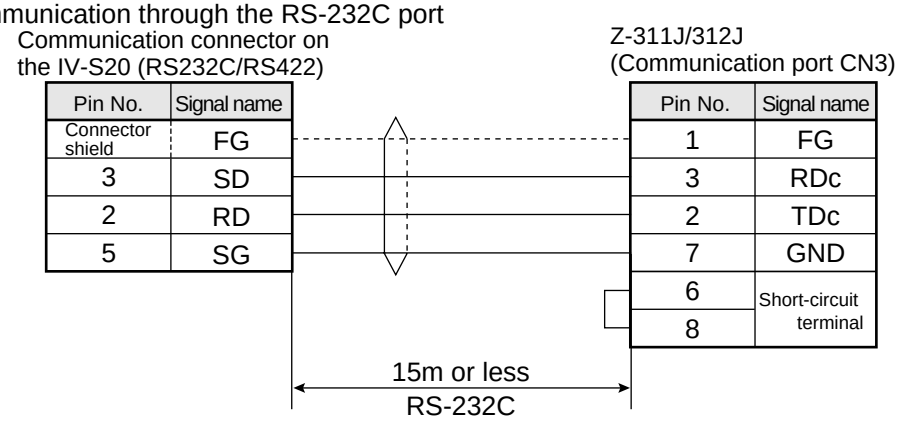


2. When the MMI port is used

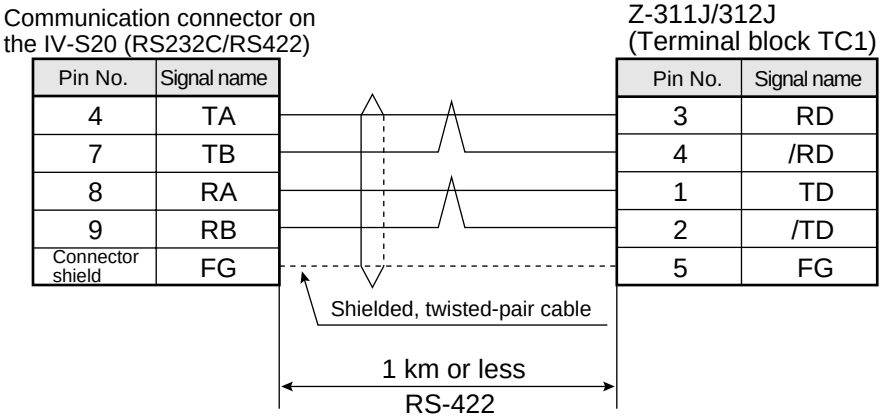


④ When a Z-311J/312J is used

1. Communication through the RS-232C port

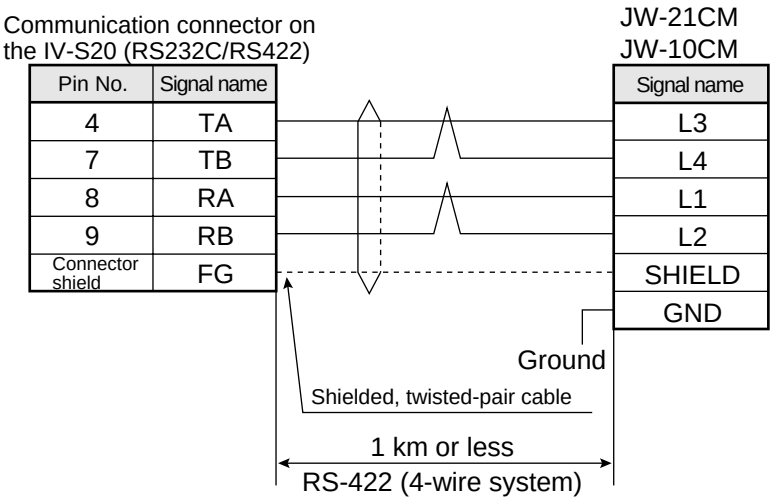


2. Communication through the RS-422 port (4-wire system)



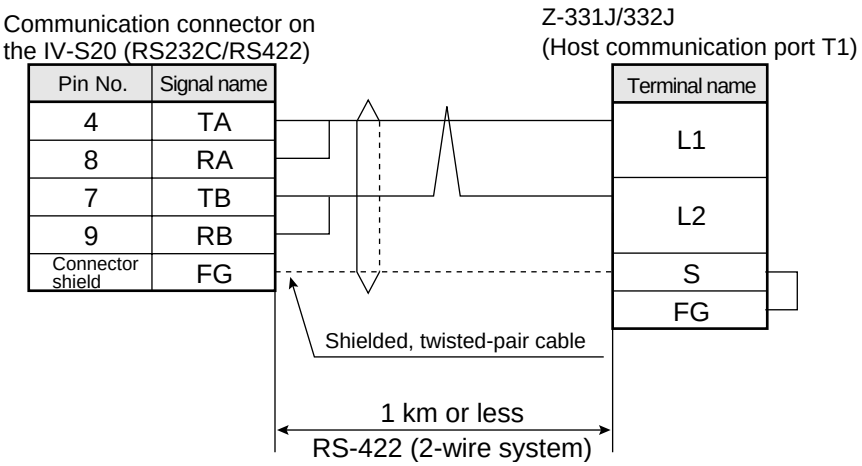
⑤ When a JW-21CM or JW-10CM is used

* Communication through the RS-422 port (4-wire system)



⑥ When a Z-331J/332J is used

* Communication through the RS-422 port (2-wire system)



[3] Connection with a Mitsubishi PC
[Applicable models]

A series computer link units

1. AJ71C24-Sx (AnA or AnN)
   In the case of the AnA, a computer link can be created if a CPU from the AnA series is used and the link module version is S6 or later.
2. A1SJ71C24(A1S)
   When the A1SJ71C24-R2 is used, the station number is fixed at 00 because it does not have a station number switch.
3. A0J72C24S1(A0J2)

(1) Module setting

① Example using an AJ71C24-Sx module

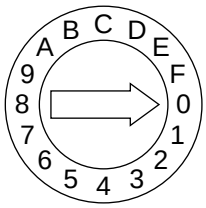
Item		Description
Transmission control procedure mode (RS-232C)		Format 1➡1
Station No.		00 to 31
Transmission speed (kbit/sec)		19.2, 9.6
Parity		None, odd, even
Transmission code	Data bit	7/8 bits (ASCII)
	Stop bit	1, 2 bits
Checksum		Executed
Writing while running		Possible

[Switch setting]

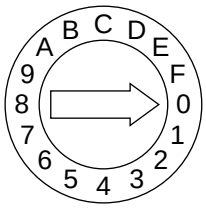
Ex.: To set as shown below:
Mode: RS-232C, Station No.: 00, Transmission speed: 19.2 K bytes/sec.
Parity: Even, Data bit: 7 bits, Stop bit: 2 bits

* 3 rotary DIP switches

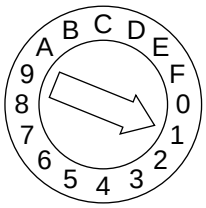
STATION No. × 10



STATION No. × 1



MODE



* DIP switches

SW11 to 13	SW14 to 24
OFF	ON

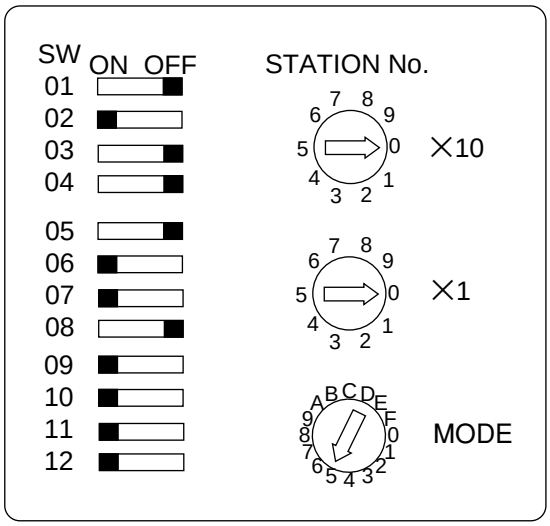
② Example using an A1SJ71UC24-R4 module

[Switch setting]

Ex.: To set as below:

Mode: RS-422, Transmission speed: 19.2 K bytes/sec.

Parity: Even, Stop bit: 2bits



(2) Using memory

To allow the memory to be used by the IV-S20, use a result write start address within the following range.

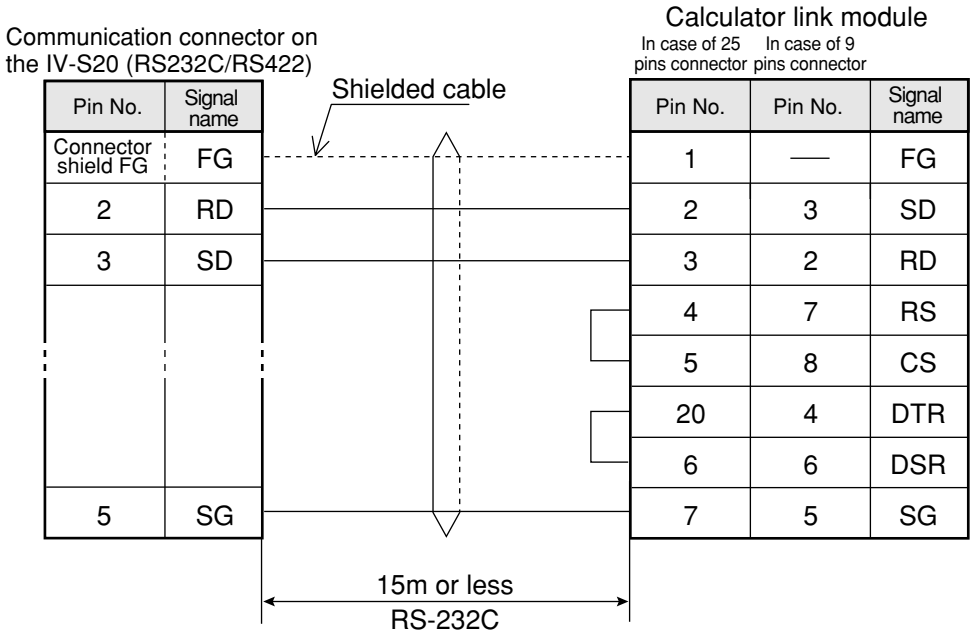
Memory	Range (address)
D (data register)	0 to 999900

Note: To write data from the IV-S20 to a Mitsubishi PC, use the WW/QW write command. The range that can be written using the write command WW/QW is D0000 to D1023/D000000 to D008191, due to the limitation of Mitsubishi PCs. The write all address can be set within the range of limitation for Mitsubishi PCs. (See page 11-19.)

(3) Connections

Shown below are the connections with a calculator link module.

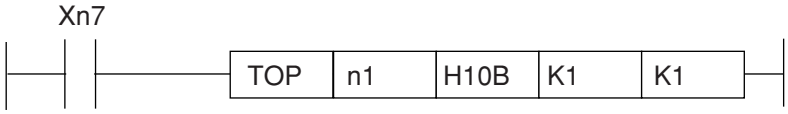
① Example of RS-232C connection



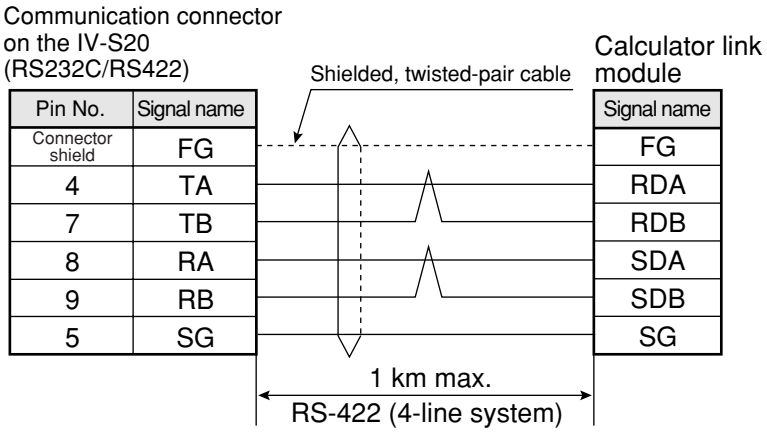
Note: Jumper the RS, CS, DR and CD lines.
Do not jumper the SG.

Remarks

- For RS-232C communications, create the sequence program shown below in order to set "**no CD terminal check**" for the CD terminal check setting. For details, see the instruction manual for Mitsubishi's calculator link module.



② Example of RS-422 communication



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[4] Connection with an OMRON PC

[Applicable models]

Host link modules

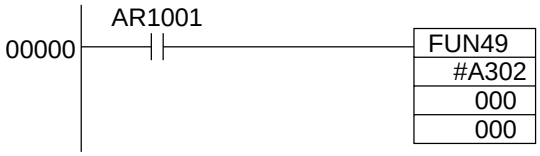
1. C500-LK203 (C1000H)
2. C200-LK201 (C200H RS-232C)
3. C200-LK202 (C200H RS-422)
4. CV CPU link port (CV1000, CVM1)
5. CV500-LK201 (CV1000, CVM1)

Remarks

- Start the OMRON PC in the monitor mode when turning ON the power. If the OMRON PC is started in any other mode, a computer link error will occur.
  The operation mode is specified using the following items for each support tool: The initial mode setting switch on the memory module, or the monitor mode rising bits of the system setting (FUN49) instruction.

Installed support tool	Memory module initial setting switch		
	OFF		ON
	The bit used to set the monitor mode in the system setting (FUN49) instruction		
	0	1 *1	
Support tools other than the programming console	Program mode	Monitor mode	Operation mode
No support tool	Operation mode	Monitor mode	Operation mode
Programming console	Programming console setting mode *2		

*1 Insert the ladder program step shown below at address 000000.



*2 When the programming console is used, set the PC to the "monitor mode using the switch.

For details, see the user's manual for the OMRON PLC module.

(1) Module setting

Item		Description
Module No.		00 to 31*
Transmission speed (k bit/sec)		19.2, 9.6
Command level		1
Parity		Odd or even
Transmission code Databit	Databit	7 (ASCII)
	Stop bit	2
1:1/1:N procedure		1:N procedure
Synchronous change-over switch		Internal synchronization
CTS change-over switch		0 V (normally ON)
5 V supply switch		OFF

* Enter the unit number of the IV-S20, as a component of CV500-LK201 system. When communication port 1 is used, the unit number is fixed at 00, and when communication port 2 is used, any number (00 to 31) can be used.

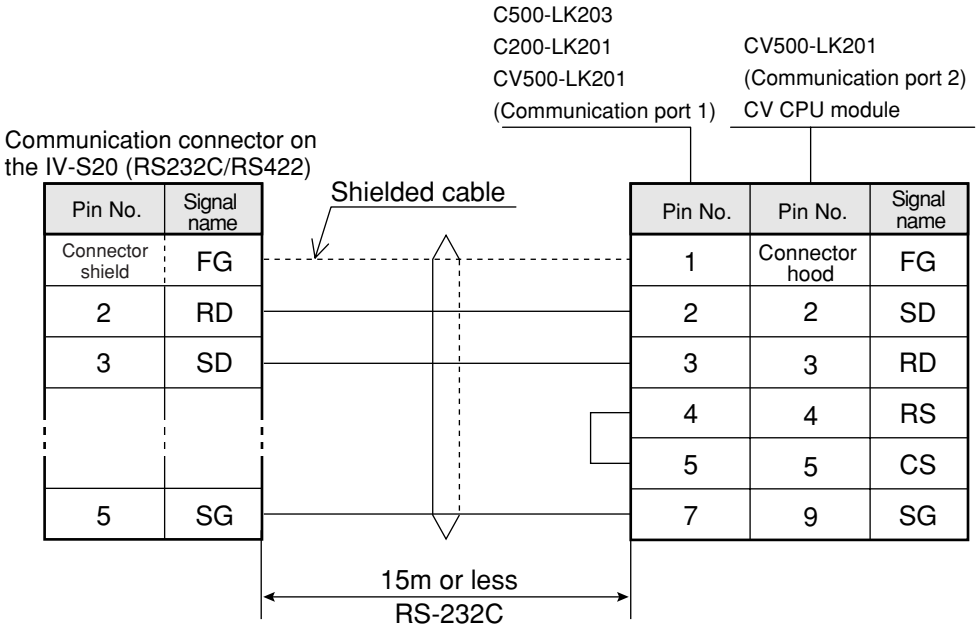
(2) Using memory

To allow the memory to be used by the IV-S20, enter a result write start address within the following setting range.

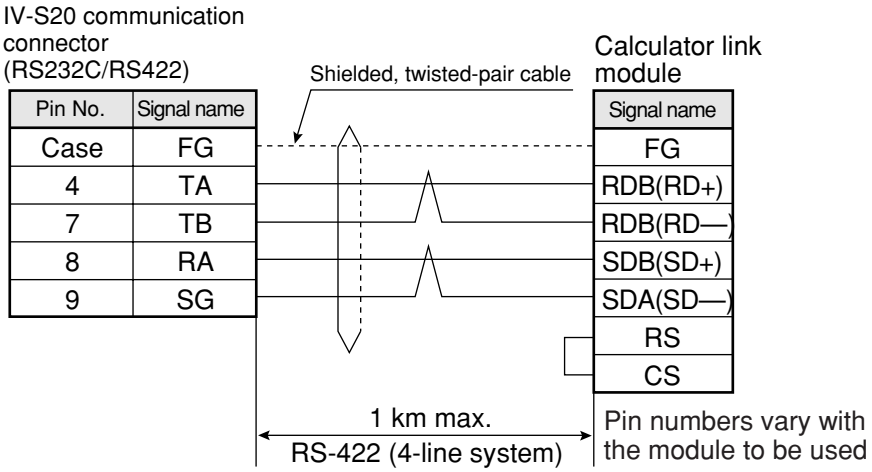
Memory	Range (address)
D (data register)	0 to 9999

(3) Connections

① Example of RS-232C communication

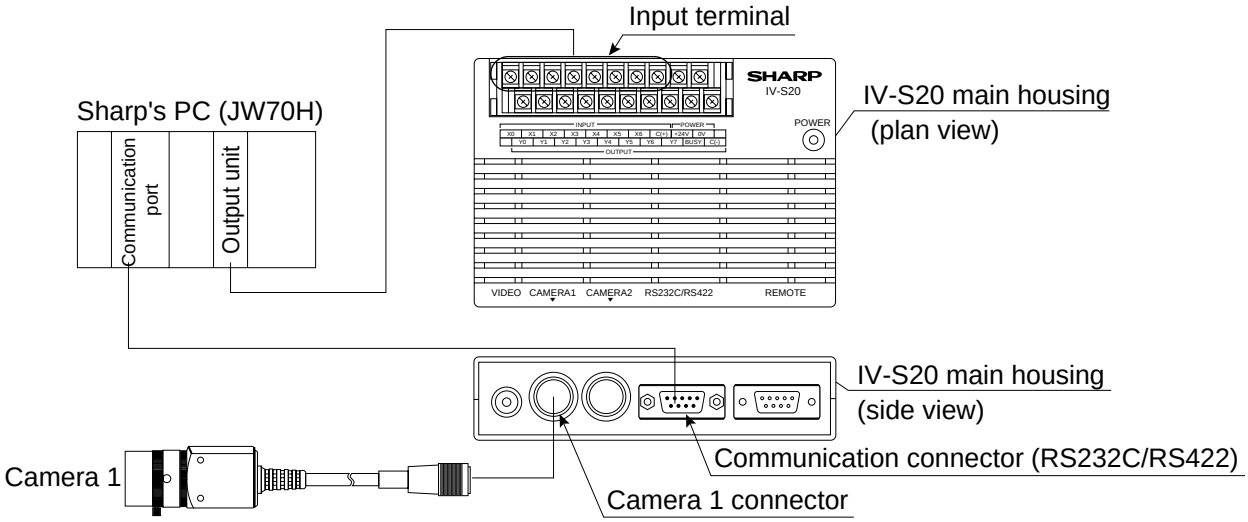


② Example of RS-422 communication



14-5 Program examples

An example of measurements using the IV-S20 and a Sharp PC (JW70H) (2-point search for positional deviation measurement) is explained below, using data flow, a flowchart and a timing chart.



(1) Data flow

Sharp PC (JW70H) IV-S20

Output relay	Description
00040	Start output

Write register	Data (H)	Description		
*1 09000	00	Termination code (normal termination)		
09001	-	———————		
09002	01	Object type No. (1)		
09003	-	———————		
09004	01	Result output Y0 to Y15 (Only Y0 is OK.)		
09005	00			
09006	01	Measurement 0 using camera 1: Positional deviation measurement		
09007	00	Measurement function of measurement 0 using camera 2 (none)		
09010	00	Measurement function of measurement 1 (none)		
09011	00	Measurement function of measurement 2 (none)		
09012	00	Measurement function of measurement3(none)		
09013	-	———————		
09014	40	X	1st point (center coordinates)	Output data from measurement 1 using camera 1(block 1)
09015	06			
09016	E0	Y		
09017	06			
09020	98	X	2nd point (center coordinates)	
09021	0D			
09022	90	Y		
09023	06			
09024	00	Angular deviation		
09025	00			

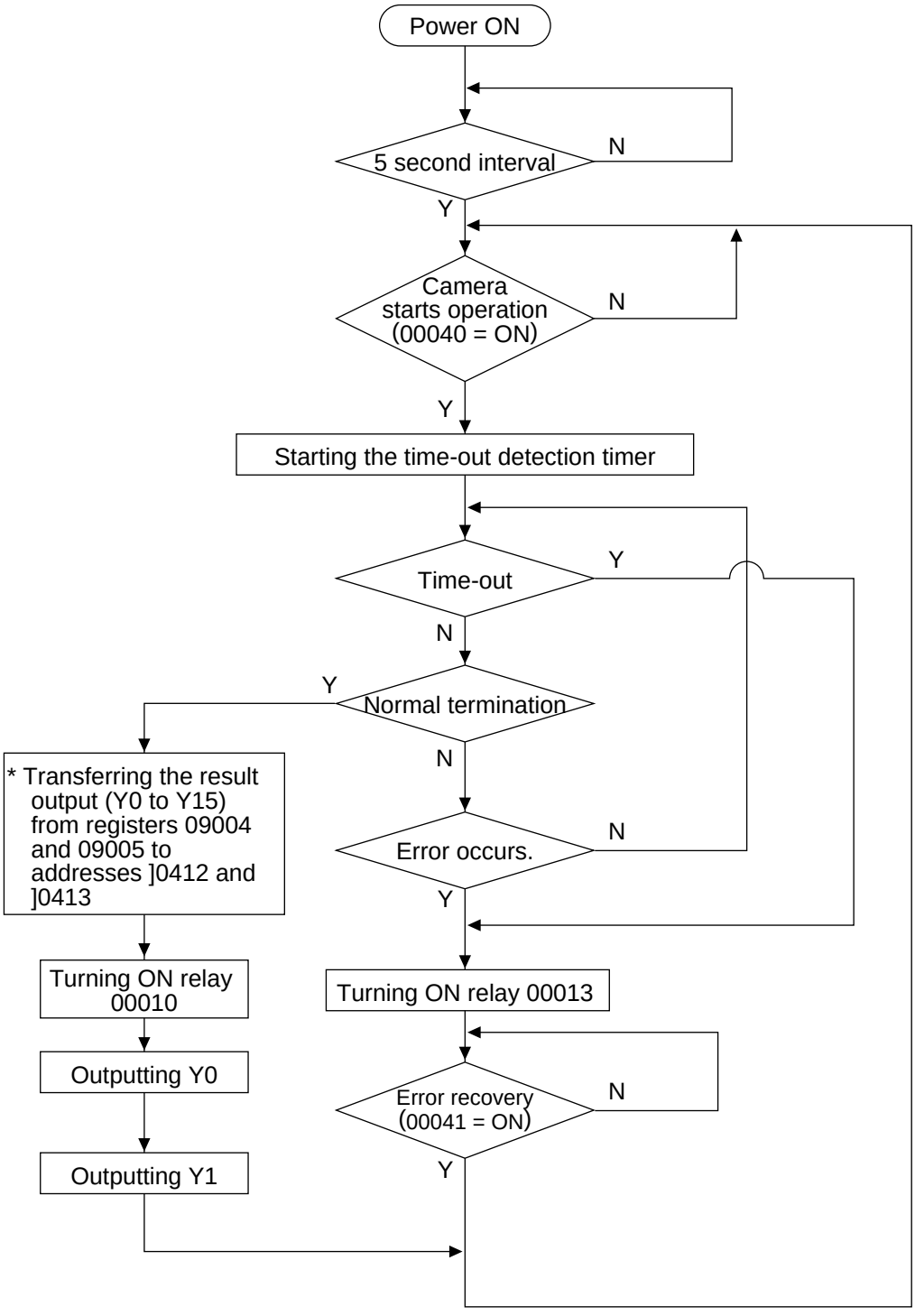
① Output a start signal.
② Write data into the register.
③ Transmit completion response.
Execution of measurement

*1 In this example, the write start address has been set to 09000.
*2 The data in registers 09014 to 09024 are the same as those shown in the example on page 13-6.

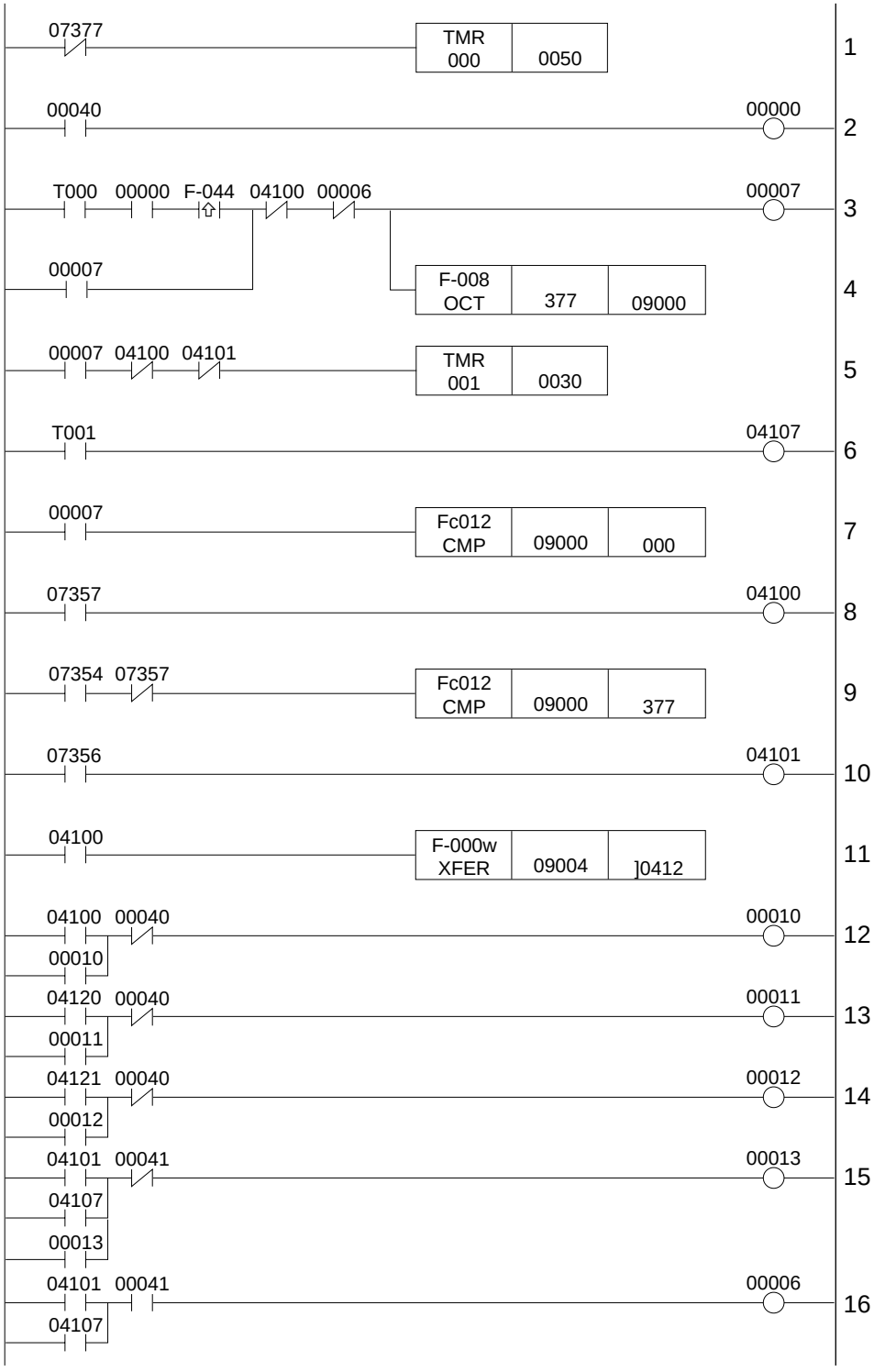
Note 1: The PC must be write enabled. A Mitsubishi or OMRON PC will operate in the same manner, but use different PC register and relay addresses.

Note 2: If the PC has not been connected to the object type input (parallel) on the IV-S20, the object type No. is set to 0. To set different types, first enter the object type numbers (parallel) using the type input terminals on the IV-S20.

(2) Flow chart


Power ON
5 second interval
N
Y
Camera starts operation (00040 = ON)
N
Y
Starting the time-out detection timer
Time-out
Y
N
Normal termination
Y
N
* Transferring the result output (Y0 to Y15) from registers 09004 and 09005 to addresses]0412 and]0413
Error occurs.
N
Y
Turning ON relay 00010
Turning ON relay 00013
Outputting Y0
Error recovery (00041 = ON)
N
Outputting Y1
Y

(3) Program

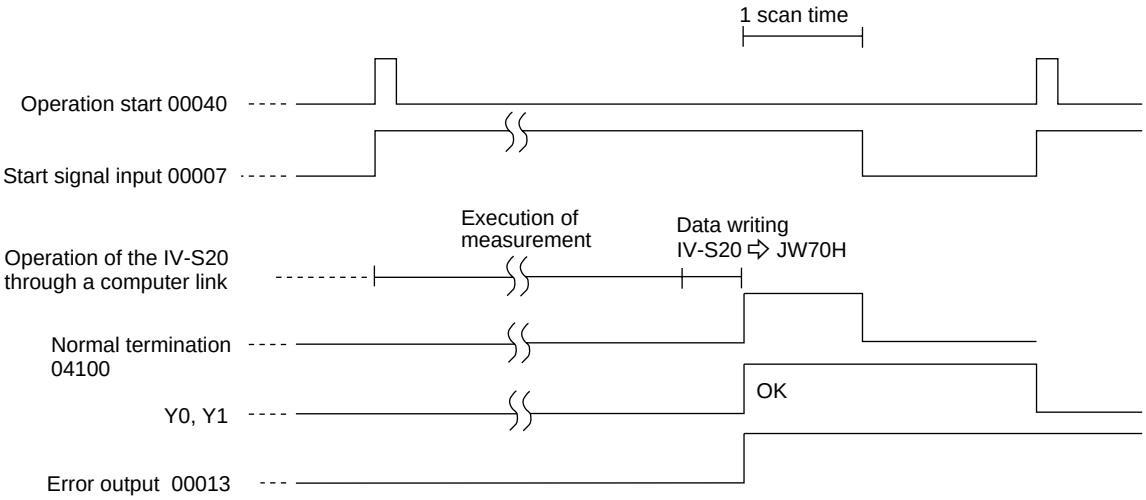

07377
TMR 000 0050
1
00040
00000
2
T000 00000 F-044 04100 00006
00007
3
00007
F-008 OCT 377 09000
4
00007 04100 04101
TMR 001 0030
5
T001
04107
6
00007
Fc012 CMP 09000 000
7
07357
04100
8
07354 07357
Fc012 CMP 09000 377
9
07356
04101
10
04100
F-000w XFER 09004]0412
11
04100 00040
00010
12
00010
04120 00040
00011
13
00011
04121 00040
00012
14
00012
04101 00041
04107
00013
15
00013
04101 00041
04107
00006
16

[Explanation of the program]

The numbers 1 to 16 below correspond to the same numbers on the preceding page.

1. Turn on the power, and wait for 5 sec. (07377 is kept ON for only 1 scan after the power is turned ON.)
2. The camera is started. (00040 enters a measurement trigger.)
3. The trigger input (00007) is self-latched when the operation start has begin (00000 = ON).
4. The termination code of the write register is cleared.
5. The time-out detection timer monitoring the computer link is started.
6. Time-out error
7. A check is made for normal termination.
8. Normal termination (09000 = $000_{(8)}$)
9. A check is made for errors.
10. Occurrence of an error (09000 = 001 to $376_{(8)}$)
11. The data in the result output relays Y0 to Y15 (16 points) on the IV-S20 is transferred from registers 09004 to 09005 to addresses]0412 and]0413.
12. A normal termination signal is output.
13. The judgment (OK/NG) of the result output relay Y0 is output.
14. The judgment (OK/NG) of the result output relay Y1 is output.
15. When a time-out or an error occurs, it is output.
16. When a time-out or an error occurs, it is reset.

(4) Timing chart



Chapter 15: Troubleshooting

Item [1] shows problems which may occur when the IV-S20 measurement system is started. If any error (the termination code is not $00_{(H)}$) occurs during image processing on the IV-S20, take the steps described in item [2].
Perform the recommended daily inspection following the maintenance procedures listed in item [3].

[1] Symptoms and checks

The following symptoms may not be malfunctions. Before asking us to repair your equipment, check the recommended parts.

Phenomenon		Checks
The power is not turned ON. (The power lamp on the IV-S20 does not light.)	1.	Make sure that the power cord has been connected properly to the DC power terminal block on the IV-S20.
	2.	Make sure that the proper supply voltage is available and has not dropped.
After the power is first turned ON, no images or characters are displayed on the monitor.	1.	Make sure that the monitor cable has been connected correctly.
	2.	Make sure that the offset and gain are adjusted properly.
After the power is first turned ON, no characters are displayed on the monitor.	1.	Make sure that the message display and pattern display modes are not set to the non-display mode. Make sure that the title field is not filled with spaces.
After the power is first turned ON, no image is displayed on the monitor, or the image on the display is abnormal.	1.	The MAIN OPS MENU is always displayed in the freeze mode. Change the mode to the through mode on the lower menu section.
	2.	Make sure that the lens iris is not closed.
	3.	Make sure that the shutter speed has not been increased.
	4.	Check the lens for contamination.
	5.	Check the CCD light receiving surface for contamination.
	6.	Make sure that the lens focus has been adjusted properly.
	7.	Make sure that the lighting equipment is providing adequate illumination.
The background is completely white (or black) even after the shutter speed is changed.	1.	Make sure that the monitor screen is not too bright or dark. (Changes in brightness cannot be sensed.) ⇨Adjust the lens aperture or the illumination of the light source.
Operations cannot be carried out using the remote key pad.	1.	Make sure that the remote key pad cable has been correctly connected to the IV-S20.
General purpose serial communications cannot be performed.	1.	Make sure that the communication cable has been correctly connected.
	2.	Make sure that each terminal of the communication cable is porperly connected.
	3.	Make sure that the communication conditions (standard, speed, and parity check) in the personal computer conform to those of the IV-S20.
	4.	Check the cable for disconnection and the connectors for contact failure.
	5.	Make sure that you waited about 5 seconds after you turned ON the power.
	6.	Make sure that the MAIN OPS MENU is displayed on the screen.

- Continued on the following page -

Phenomenon		Checks
Communications through a computer link cannot be established.	1.	Make sure that the communication cable has been correctly connected.
	2.	Make sure that the communication cable route does not run near electrically noisy devices.
	3.	Make sure that each terminal of the camera cables is properly connected.
	4.	Make sure that the communication conditions (standard, speed, and parity check) in the personal computer conform to those of the IV-S20.
	5.	Make sure that a compatible model, the station No. and result write start address have been set correctly.
	6.	Make sure that you waited about 5 seconds after you turned ON the power.
	7.	Make sure that the MAIN OPS MENU is displayed on the screen.
Measurement does not start even when a start trigger is given.	1.	Make sure that measurement can be started by using the key pad to send a trigger signal.
	2.	Make sure that the camera cables have been correctly connected.
	3.	Make sure that the device to send a trigger signal have been properly connected to the input terminals on the IV-S20 main housing.
	4.	Make sure that you waited about 5 seconds after you turned ON the power.
	5.	Make sure that the MAIN OPS MENU is displayed on the screen.
Measurement results are not output.	1.	Make sure that the camera cables have been correctly connected.
	2.	Make sure that the devices have been properly connected to the input terminals on the IV-S20 main housing.
	3.	Make sure that you waited about 5 seconds after you turned ON the power.
	4.	Make sure that the MAIN OPS MENU is displayed on the screen.
Measurement results are unstable, or NG results occur frequently.	1.	Make sure that the lighting equipment does not flicker.
	2.	Make sure that the lens has not fogged up.
	3.	Check the lens for contamination.
	4.	Make sure that the focus ring has not turned. (Make sure that the camera lock screw has been secured.)
	5.	Check whether the camera position has changed.
	6.	Make sure that the illuminance monitor window has been set to the intermediate illumination.
	7.	Make sure that the criteria have been set properly.

[2] Causes of termination codes (when an error occurs) and remedies

When an abnormal termination code (other than $00_{(H)}$) is received, take the following measures.

Termination code	(hex.)	Cause	Remedy
Communication errors	01	The specified processing code does not exist.	Check the processing code.
	02	The wrong number of data items was specified in the text.	Check the number of data items in the text.
	03	The text data is outside the acceptable range.	Check the text setting range.
	04	The results of the check sums are not identical.	- Check the checksoms. - Check the communication environment for problems such as electric noise, which may come in on the communication line.
	05	The header code (:) was not attached to the head of the communication command.	Check whether the header code was attached to the head of the communication command.
	06	An asynchronous error has occurred.	- Check the communication environment for problems such as electric noise, which may come in on the communication line.
	07	The communication command contains an improper number of data items.	Check the number of data items in the communication command.
Computer link errors	08	An error response has been returned from the programmable controller. (Communications are performed normally.)	The error code is contained in the evaluation result area, and the error code is displayed on the monitor. Take the proper measures according to the error code (different models use different codes).
	09	A time-out has occurred during communication through the computer link.	- Make sure the power supply of the programmable controller and check the connections of the cables. - Check the communication conditions and computer link settings.
	0A	Start address error (larger than the end address)	Check the address.
Hardware errors	10	SDRAM error	Replace the IV-S20 itself.
	11	Flash memory error	
	14	VRAM error has occurred.	Replace the IV-S20 itself.
	18	Flash ROM delete error	
	19	Flash ROM write error	
	1A	Flash ROM verify error	
Processing errors	20	The measurement conditions for the specified object type have not been set.	Check the abnormal setting.
	21	The setting area is larger than the screen, due to positional correction.	
	22	Correction after binary conversion: The illuminance monitor function (system) has not been set.	
	23	Correction after binary conversion: The threshold range has exceeded the specified range.	
	24	No edge detection	
	25	A reference image has not been registered.	

Termination code	(hex.)	Cause	Remedy
Processing errors	26	The number of labels exceeds the limit.	Check the abnormal setting.
	27	The image lines have not been set.	
	28	Divide by "0" (numerical calculation)	
	29	Overflow (numerical calculation)	
	2A	No numerical calculation setting	
	2B	No label (camera adjustment)	
	2C	The search area is smaller than the reference image.	
	2D	Equivalent label exceeded	
	2E	Edge center point exceeded (lead inspection)	
	30	Coordinates range exceeded (distance/angle measurement)	
	31	Same inclination (intersection of two straight lines)	
	32	Divide by "0" (center of circle, perpendicular bisector, distance between point and straight line)	
	33	Perpendicular inclination 0 (perpendicular bisector)	
	34	The CCD trigger has not been registered.	
	35	The CCD trigger is not being sampled by a serial interface signal.	
	36	The SIO trigger has not been set.	
	37	A start point has not been set. (Distance/angle measurement)	
	38	The auxiliary point conditions are not thoroughly specified. (Distance/angle measurement)	
	39	The auxiliary line conditions are not thoroughly specified. (Distance/angle measurement)	
	3A	The distance conditions are not thoroughly specified. (Distance/angle measurement)	
	3B	The angle conditions are not thoroughly specified. (Distance/angle measurement)	
	3C	Image reading/writing is impossible.	
	3D	The range of calculations using two images has exceeded the specified range.	
	3E	The reference image cannot be registered from parallel input X5.	
	3F	Exceeded the number of reference images registered	
	40	Image not captured (CCD trigger)	
	41	The reference images has not been set up yet.	
	42	The reference image edge is not registered yet.	
	43	CCD trigger disabled (through image).	
Communi-cation run errors	50	The object type cannot be changed.	
	51	No corresponding block	
	52	The output camera cannot be changed.	

[3] Maintenance

Check the equipment for the following items.

(1) Operation check

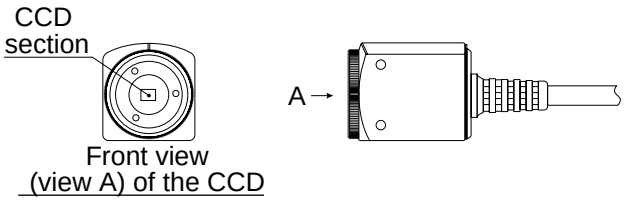
- Change the measurement number on the MAIN OPS MENU, and change the monitor screen to the freeze or through mode. Then, make sure that the image is normally displayed.

(2) Checks

- Check the illumination from the lighting equipment.
- Make sure that the monitor screen is in focus and that the aperture setting is proper.
- Check the cable insulation for breaks, and make sure that the cable connectors are not loose.
- Carefully wipe dust off the lens with a soft, dry cloth.
- If dust has landed on the CCD surfaces of this camera, wipe them with a clean cotton swab soaked in isopropyl alcohol. Move the cotton swab lightly and slowly in one direction. Change cotton swabs frequently. Do not clean more than one CCD surface with one cotton swab.

[Procedure for checking after cleaning]

① Mount the lens (mirror tube) on this camera.
② Close the lens iris all the way.
③ Point the lens toward the light source, and check the monitor screen to make sure that there are no spots on the screen. (If the iris is open even a little, then even if spots exist, they will not be visible on the monitor screen. Fine adjustments to the iris are required.)



(3) When measurement errors and/or evaluation errors occur frequently, check:

- The illumination of the lighting equipment and lamps.
- The inspection object is within the window.
- The cables for looseness or disconnection.
- The lens for dirt and dust.
- The lens focus and aperture have not changed.
- The power is being supplied normally, and
- The parameters you set have been stored.
  (If the parameters have changed, reset the parameters from the beginning.)

Reference: When a camera has been replaced, or when a camera has been dislocated, use the camera adjustment function of the IV-S20. This function facilitates adjustment of camera position and lens aperture.
(See item 12-2 [1] Adjustment of camera.)

Chapter 16: Specifications

16-1 IV-S20 main housing

[1] Image processing specifications

Item			Specifications	
Image sampling system			256 level gray scale, binary conversion, edge detection Binary conversion: With threshold value (fixed and automatic correction) function, and object identification function	
Image memory			One screen per camera	
Operation method			Using remote key pad -direction (up, down, left, and right), set, release, image change, measurement start, brightness adjustmenent-	
Window shape			Rectangle, circle, ellipse, (circle and ellipse are used for size inspection in binary image)	
No. of assignable object types			16 types maximum	
Time	CCD image capture time		33.3 ms for a full image	
	Measurement time		Gray search: 37 ms (when processing a search area of 256 x 256 pixcels and measuring an area of 64 x 64 pixels)	
Calculation between images	Image comparision		Between camera 1 image captured and the reference image Between camera 2 image captured and the reference image Between camera 1 and camera 2 images captured	
	Calculation		Absolute value of subtraction (difference)	
Image pre-processing			Edge extraction (all, horizontal, vertical), edge emphasis, smoothing	
Binary conversion			Threshold value (fixed, automatic), object identification function	
Positinal correction			Gray scale search, XY correction of edge positions, θ angle correction	
Binary noise elimination			Contraction → expansion, expansion → contraction, area filter	
Numeric calculation function			Arithmetic operation (+, -, x, /), , absolute value, TAN, ATAN	
Light monitor function			Automatic threshold adjustment in binary conversion processing	
Measurement program			**No. of windows**	**Measurement function**
M't 0	Positional deviation		8 x (no. of cameras: 2)	One point search, two points search, one point on edge, two points on edges, one point serach + one point on edge
Measurement 1, 2, 3	Degree of match inspection		16	Gray search: Two points search (yes/no) + search (yes/no) Binary matching: One point matching
	Distance, angle measurement		16 (gray scale search, edge detection)	Measure distance between two points from gray search center, edge end point, center of gravity functions (three points, horizontal, vertical) Auxiliary point: Center, gravity center of three points, center of circle, 2 point line, intersection
			1 (object identification)	
	Lead inspection		4	8 leads with gray scale search and with edge line detection
	Binary conv-ersion	Area measurement	16	Area
		Quantity count	4	Quantity (max. 3000 pieces) , total area
		Object identification	4	Total area, quantity (maximum 128 objects identified in each window), area of each object, center of gravity, spindle angle, fillet diameter, circumuference length
	Point		1	256 points (binary), 128 points (average density)
Image storage capacity			Maximum two full screens or 200 reference images	
Start measure-ment signal	Internal		CCD trigger (using CCD camera)	
	External		Trigger input (parallel I/F), general-purpose serial I/F, key pad trigger (for manual measurment)	
Output			Parallel I/F, general purpose serial I/F, computer link	
Other functions			Display measuring time, manual measurements (including manual assignment of windows), PC function, crosshair cursor, display change between Japanese and English, run screen lock function, image display change (through/freeze), gain/offset adjustment, monitor brightness adjustment	

[2] PC specifications

Item	Specifications
Input relay	7 points for parallel input (X0 to X6)
Output relay	8 points for parallel output (Y0 to Y7), 1 point for BUSY, 16 points (Y0 to Y15) for general-purpose serial I/F or computer link
Auxiliary internal relays	128 points (C0 to C127), 11 points for special area (C117 to C127)
Timers	8 points. Timer setting time; 0.01 to 9.99 sec. (count down timer)
Counters	8 points. Counter setting value; 000 to 999 (count down timer)

[3] Hardware specifications

Item		Specifications
Image input	No. of cameras	2 (maximum)
	Applicable cameras	Dedicated camera (IV-S20C1, IV-S30C1, IV-S30C2)
Image output (monitor output)	Display standard	EIA 525 lines (2 : 1 interlace)
	Image output	1.0 Vp-p
	Connector	RCA pin
Inter-face with external devices	Parallel I/F	Input : 7 points, 12/24 VDC, approx. 7 mA (24 VDC) Output : 9 points, 12/24 VDC, max. 20 mA, Tr output
	General-purpose I/F	RS-232C/RS-422 (9.6, 19.2, 38.4, 57.6, 115.2 k bits/sec.)
	Computer link	Can be connected to Sharp, OMRON, Mitsubishi computers
Power supply		Power consumption current : 250mA (24 VDC±10%) LED : When the power is ON
Termi-nal block	Input terminal (7 points)	External trigger : 1 point (fixed), type change : 4 points (fixed) Users selectable terminals : - One external input, for storing a reference image and running measurement program 1 - One external input, for storing a refernece image and running meaurement program 2 Usable as input terminal for any programmable controller
	Common for input (1 point)	(+) common
	Ouput terminal (9 points)	1 point for BUSY/READY (selectable) 8 points for user assigned logical output (Y0 to 7)
	Common for output (1 point)	(-) common
	Power supply (2 points)	24 VDC : 1 point, 0V : 1 point
Storage ambient temperature		-20 to 70 ° C
Operation ambient temperature		0 to 45 ° C
Operation ambient humidity		35 to 85%RH (non-condensing)
Operation atmospher		No corrosive gases or dust
Vibration resistance		JIS C 0911 or equivalent - Amplitude 0.15 mm (10 to 57 Hz), 9.8m/s^2 (57 to 150 Hz) No. of sweeps : 10 (1 octave/min.), three directions (X , Y ,Z)
Shock resistance		JIS C 0912 or equivalent : 147m/s^2 (each 3 times in X,Y, and Z directions)
Noise immunity		1000Vp-p 1ms width impulse (by noise simulator)
Outside dimensions (mm)		130 (W) x 92(D) x 30(H) (except protuding portions)
Weight		280 g

16-2 Camera section

[1] Camera main body: IV-S20C1

Item		Specifications
Optical system	Lens mount system	C mount
Picture taking element	System	Interline transfer system, monocrome CCD
	Reading	Full pixel, stand-alone, reading type, a partial reading of selected lines us possible
	Size	1/3 inch
	Effective no. of pixels	512 (horizontal) x 480 (vertical)
	Element shape	Square
Shutter	Shutter speed (s)	1/30 to 1/10000
	Method	Random shutter
Storage ambient temperature		-20 to 70˚ C
Operation ambient temperature		0 to 45˚ C
Operation ambient humidity		35 to 85% RH (non-condensing)
Vibration resistance		JIS C 0911 or equivalent • Amplitude 2mm (10 to 55 Hz), 147m/s^2 (55 to 150Hz)
Shock resistance		JIS C 0912 or equivalent : 980 m/s^2 (each three times in X, Y, and Z directions)
Operation atmosphere		No corrosive gases or dust
Outside dimensions (mm)		30 (W) x 32 (D) x 40 (H) (except lens and protruding portions)
Weight		240 g (not including the lens)
Camera cable		Cable length: 3 m

[2] Camera: IV-S30C1/C2

Item		Specifications	
		Standard, IV-S30C1	**Micro, IV-S30C2**
Optical system	Lens mount method	C mount	Custom ϕ17 mm mount
Picture taking element	Method	Interline transmission method, monochrome CCD	
	Reading system	Full pixel type, partial image scanning is available	
	Reading	33.3 ms *	
	Size	1/3 inch	
	No. of effective pixels	512 (horizontal) × 480 (vertical)	
	Pixel shape	Square	
Shutter	Shutter speed (s)	Settable between 1/30 and 1/10,000 for each object type	
	Method	Random shutter	
Connector		Round, 12-pin female connector	
Connection to IV-S20 main housing		- Using camera conversion cable (IV-S20HC3)	
Operation ambient temperature		0 to 45°C	
Operation ambient humidity		35 to 85% RH (non-condensing)	
Operation atmosphere		No corrosive gases or dust	
Outside dimensions (mm)	Camera body	30 (W) × 32 (H) × 40 (D)	30 (W) × 32 (H) × 50 (D)
	Head	---	ϕ17×35.6 mm
	Head cable	---	1m
Weight		50 g (not including the lens)	125 g (The head weighs approximately 12 g)
Accessories		- 1 camera angle bracket - 2 securing screws	- 1 camera angle bracket - 1 camera head bracket - 3 securing screws - 1 Instruction Manual

* Variable as per with the partial image reading specified.

[3] Camera lens: IV-S20L16

Item	Specifications
Focal distance	16 mm
Maximum f-stop	1.6
Aperture range	1.6 to 16, close
Focal range	50 mm to infinite
Filter installation dia.	M 25.5, P = 0.75, U1
Mount system	C mount
Applicable cameras	IV-S20C1, IV-S30C1, IV-S30C3 (cameras for IV-S30)

[4] Camera conversion cable: IV-S20HC3

Item	Specifications
Cable length	3 m
Cable sheath	Polyvinyl chloride
Connector	Main housing side: Round, 13-pin female connector
	Camera side: Round, 12-pin male connector
Minimum bend radius	75 mm

[5] Camera extension cable: IV-S20EC2/EC4

Item	Specifications
Cable length	2 m (IV-S20EC2), 4 m (IV-S20EC4)
Cable sheath	Polyvinyl chloride
Connector	Main housing side: Round, 13-pin female connector
	Camera side: Round, 13-pin male connector
Minimum bend radius	75 mm

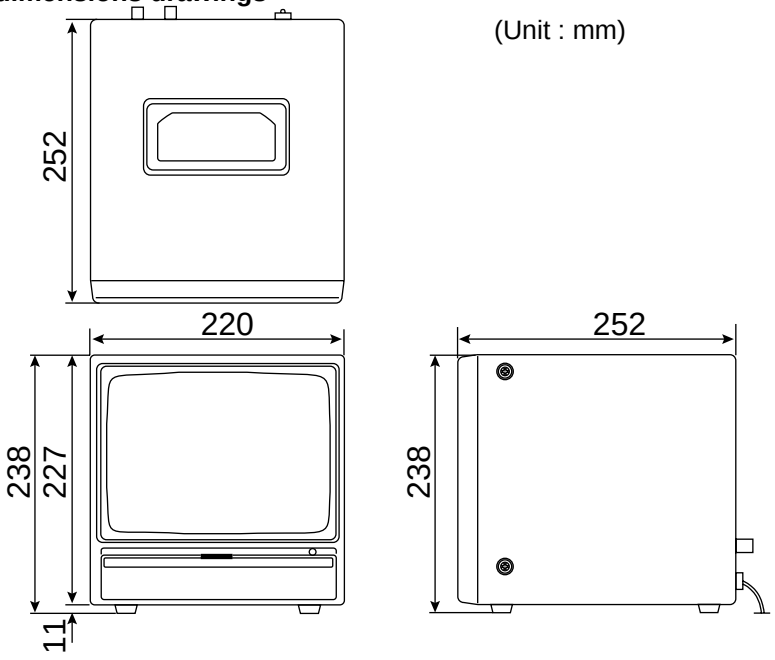
16-3 Peripheral device

[1] Monochrome monitor IV-09MT specifications

Item		Speicfications
Power input voltage		90 to 110 VAC, 50/60 Hz
Input capacity		25 VA
Signal voltage		1.0 Vp-p/75 ohms
Screen display resolution		900 scanning lines (center), 60 scanning lines (edge)
Scan method		EIA 525 lines (2:1 interlace)
Scan frequency		Horizontal : 15.75 kHz, vertical : 48 to 62 Hz
Image size		8% under scan
Linearity		Horizontal : 10% or less, vertical : max. 10%
Image input connector		BNC
Image input impedance		75 ohms/ High-Z
Video output connector		BNC
Adjustment function	Front	Brightness adjustment, contrast adjustment, vertical position adjustment, horizontal position adjustment
	Back	Focal adjustment, vertical width adjustment, horizontal linearity adjustment, sub-bright adjustment (used only by our service staff)
Storage ambient temperature		—20 to 60 °C
Operation ambient temperature		0 to 45 °C
Operation ambient humidity		35 to 85%RH (non-considering)
Atmosphere		No corrosive gases JIS C 0911 or equivalent
Vibration resistance		- Amplitude 0.15mm, (10 to 57 Hz), 9.8m/s^2 57 to 150 Hz), No. of sweeps : 10 (1 octave/min.) 3 directions (X, Y, Z)
Shock resistance		JIS C 0912 or equivalent 147m/s^2 (each 3 times in X,Y, and Z directions)
Weight		Approx. 6 kg
Dimensions (mm)		220 (W) × 238(D) × 257(H) (except protuding portions)
Dielectrical strength		AC1000V, 1 minute (between AC plug and shassis)
Insulation resistance		DC500V, 10M ohms or more (between AC plug and shassis)
Accessories		One instruction manual

■ Outlune dimensions drawings

(Unit : mm)



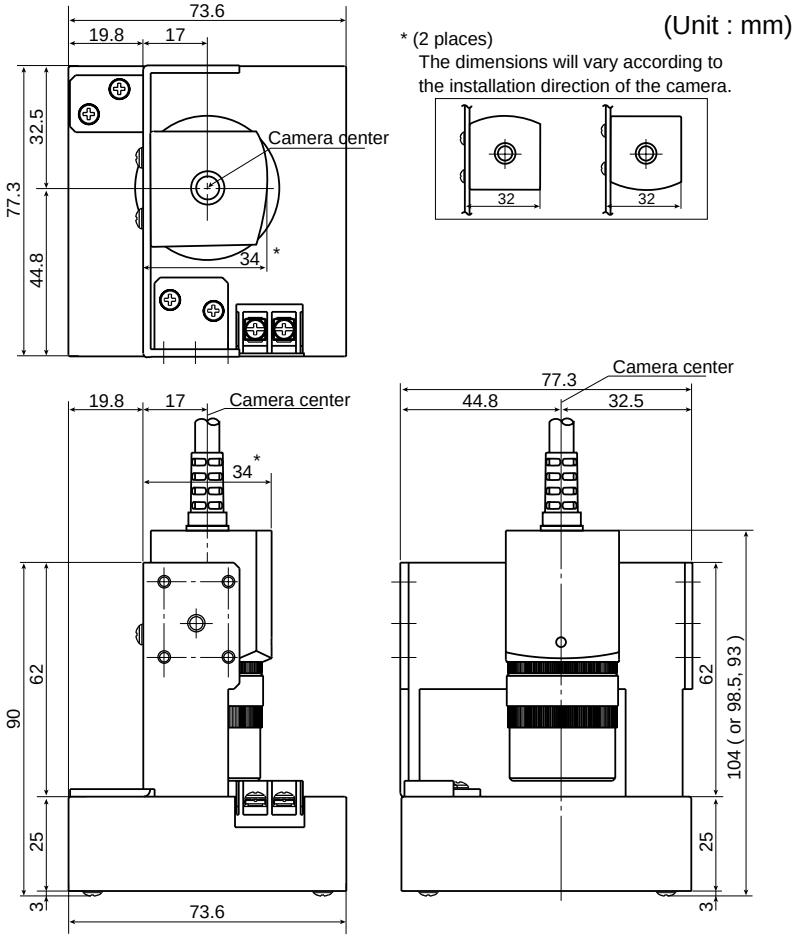
[2] LED lighting equipment IV-60LD specifications

Item	Specifications
LEDs used	36 LEDs 5mm. High brightness LEDs - Standard lighting range
Standard lighting range	Approx. 50mm × 50mm (work distance at 150mm)
Input voltage	24 VDC ±10% , 2P terminal
Current consumption	Approx. 2W
Lighting level adjustment	Semi-fixed volume
Operation ambient temperature	0 to 45 °C
Storage ambient temperature	-10 to 60 °C
Operation ambient humidity	35 to 90%RH (non-condensing)
Operation atmosphere	No corrosive gases or dust
Vibration resistance	JIS C 0911 or equivalent - Amplitude 2mm (10 to 61 Hz), 147m/s^2 (61 to 150Hz), No. of sweeps : 10 (1 octave/min.), 3 directions (X,Y,Z)
Shock resistance	JIS C 0912 or equivalent, 147m/s^2 (each 3 times in directions X, Y, and Z directions)
Outside dimensions (mm)	76.9 × 73.6 × 25.0 (except camara angle bracket)
Weight	Approx. 230g (IV-60LD body : Approx. 140g + Camera angle bracket : Approx. 90g)
Accessories	One camera angle bracket, 6 installation screws (M3 × 6mm), one instruction manual

■ Outline dimensions drawings

The dimensions shown below are when an the IV-S20 camera is attached.

(Unit : mm)



Glossary

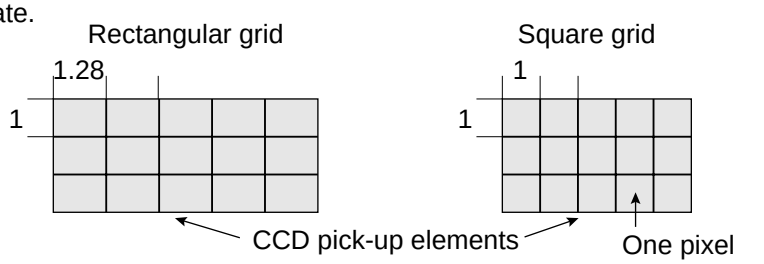
[A]

■ Area filter

A function used to eliminate an island if it area is smaller that the specified size after each of the objects in an image have been identified.

■ Arrangement of the square pixels

This refers to CCD elements whose pixels are square and arranged at the same vertical and horizontal interval.
If this type of CCD element is used, length corrections do not need to be calculated and the precision and processing time do not deteriorate.

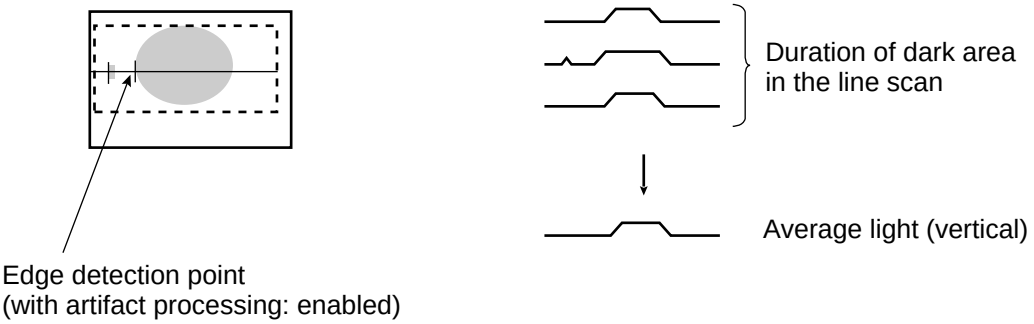


The aspect ratio is 1: 1.

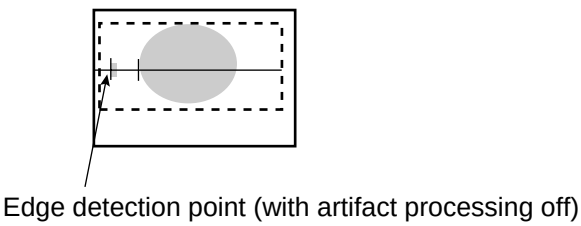
■ Artifact processing

Artifact processing is a method of processing that eliminates the false detection of the edge of the target object when an artifact is in the line being scanned. This process can be used during edge detection. The real edge of the target object is detected by computing the average duration of the dark area in the scan line, which is much longer for a target object than for an artifact.

[Example of detection]
- An example of light to dark averaging (DETECT MODE:BRT ⇨ DRK) while scanning horizontally (DE TECT DIR.:HORI ⇨), with artifact processing (enabled) (PRC. PROJECT: YES).



When artifact processing is disabled in the above example, the edge detection point changes.



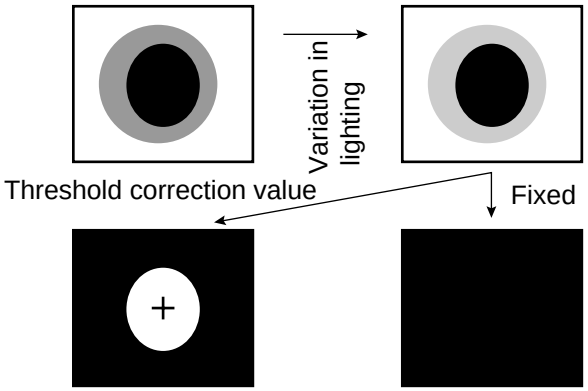
[B]

■ Binary image

Pixels in images are converted to one of two values, "1" when the pixel is lighter than the specified threshold value (level), and "0" when it is darker than the specified threshold value (level).

■ Binary processing (fixed/threshold value correction)

By setting THESHLD. ADJ (threshold adjustment function), the IV-S20 can cope with variations in lighting.



Note: In order to use the THRESHOLD-ADJ (threshold adjustment function), the monitor brightness functions must be selected to measure variations in lighting. If you don't select the monitor brightness function, a BINARY CORR.: LIGHT LVL NOT SET (correcting binary value: monitor illumination not selected) error will occur.

Fails to convert the image due to a variation in lighting

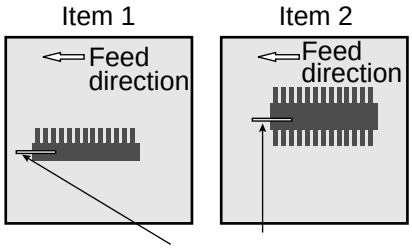
[C]

■ CCD (charge capture device)

A charge capture device (CCD) converts light into electric signals. It consists of a photo-electric converter to convert light and store it as an electric charge signal, a scanner to read the stored electric charges, and an output section to transmit the signals as a stream of data.

■ CCD trigger

The CCD trigger allows sampling a part of the CCD camera image at high speed. When the sampled image changes, the camera starts the shutter operation to capture a new image. With this build in shutter operation, an external sensor, such as a photo sensor, is not needed to trigger the shutter. A window can be created to trigger the shutter operation. The window can be set for each item on the production line so that adjustments to the position of an external sensor are no longer needed. This feature reduces the down time needed to change items on production lines.



■ Center of gravity

The "center of gravity" is the geographical center of the image. It is determined by treating the binary image to be measured as an object that has mass.

■ C mount

A system for mounting lenses on a camera body. The flange back (the distance from the reference level for mounting a lens to the focal plane surface) is defined as 17.526 mm.

■ Computer link

Programmable controllers (PC) are equipped with communication protocols. The "computer link" is used to transfer data between the PC and an external computer, or the like, using this communication protocol. The IV-S20 supports the computer link protocols used by Sharp, Omron, and Mitsubishi PCs. Therefore, the PC does not need a custom communication program in order to create a computer link with the IV-S20.

■ Contraction

⇨ See "Expansion and contraction to eliminate binary noise in the image."

[E]

■ Edge emphasis

⇨ See "Pre-processing."

■ Edge extraction

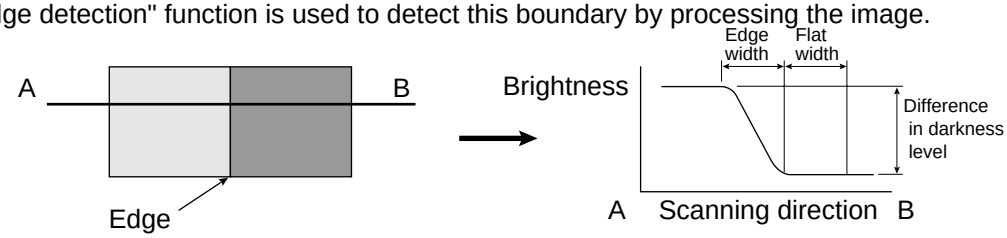
⇨ See "Pre-processing."

■ Expansion

⇨ See "Expansion and contraction to elimiate binary noise in the image."

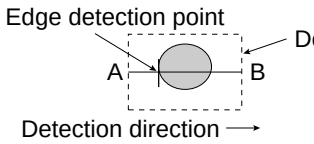
■ Edge detection

The "edge" refers to the boundaries between the brighter (white) and darker (black) parts in an image. The "edge detection" function is used to detect this boundary by processing the image.

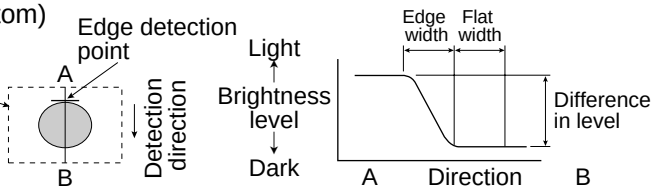


[An example of detecting a point using the edge detection function and user specified criteria]

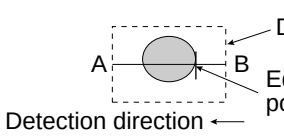
- Horizontal transition point from light to dark (moving from left to right)



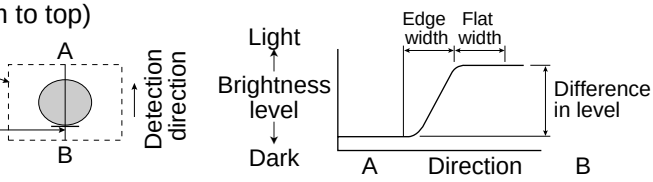
- Vertical transition point from light to dark (moving from top to bottom)



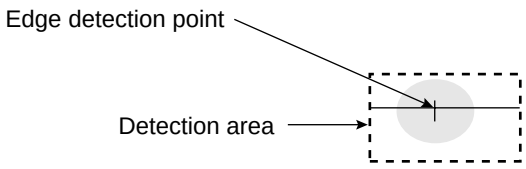
- Horizontal transition point from light to dark (moving from right to left)



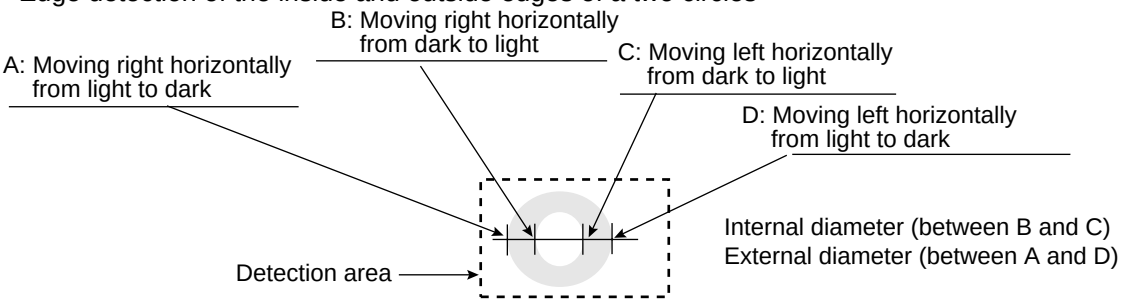
- Vertical transition point from light to dark (moving from bottom to top)



- Center (dark), horizontal (left and right)



- Edge detection of the inside and outside edges of a two circles



G

■ Expansion and contraction to eliminate binary noise in the image

When an image is converted to black and white, a number of unwanted dots may appear in the image. These noises can be eliminated during the preliminary processing. Dot control processing of binary values is used to eliminate this problem, as described below.

- ①Expansion

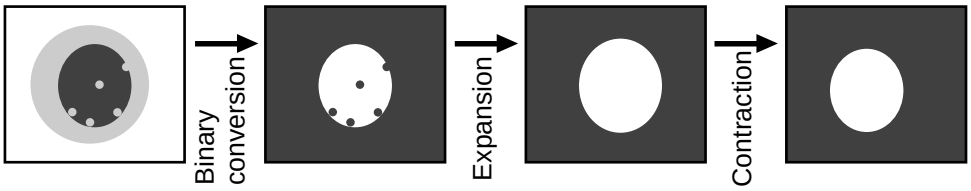
  If a white area contains a single, isolated black point, the system will interrupt the black point to white.

  ②Contraction

  If a black area contains a single, isolated white point, the system will converts the white point to black.

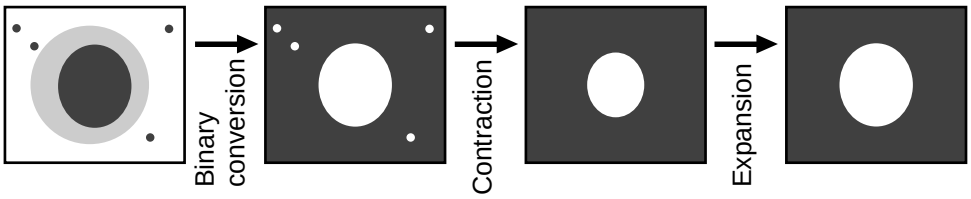
- ①Expansion ➡ contraction

  Delete isolated black points by expansion and then restore the original image size by contraction.



②Contraction ➡ expansion

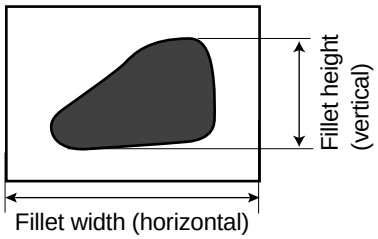
Delete isolated white points by contraction and then restore the original image size by expansion.



[F]

■ Fillet width (shading width)

Size of a hollow rectangle which closely matches to the target object in a binary image (white part). Horizontal direction: Length of a side parallel to the X axis. Vertical direction: Length of a side parallel to the Y axis.



■ Flat width

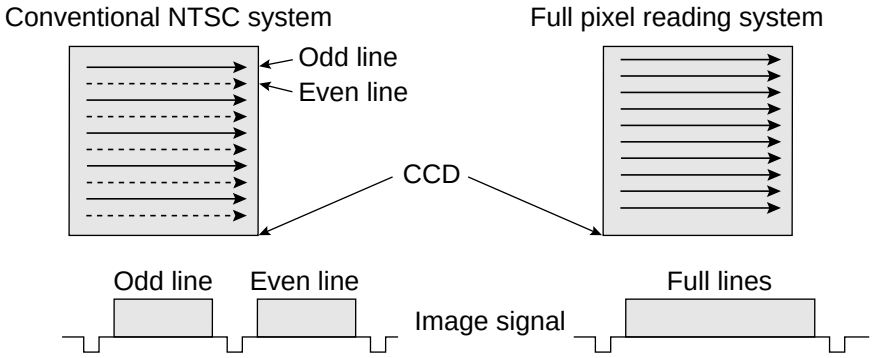
⇨ See "Edge detection."

G

■ Full pixel reading (progressive scan)

A system which reads all of pixels of image information from the CCD element one after another is referred to as "full pixel reading system." This system provides the same high resolution for moving objects as it does for static objects.

On the other hand, conventional CCDs using the NTSC scanning technique must read an object two times. First the odd lines are read and then the even lines. Therefore, NTSC system produces blurry images of moving objects. In order to solve this problem, the NTSC system can read only the odd lines. The disadvantage is that only half the resolution is available.



[G]

■ Gray scale check using the normalization correlation method

Even when the IV-S20 is looking at the same object as the object used for the reference image, the new target image and the previously stored reference image may not match completely, due to variations in the illumination conditions and the ambient light.

In order to check the resemblance between the two sets of image data, the normalization correlation method can be used.

In order to check whether or not the levels match using the normalization correlation method, the system slides the reference image one pixel at a time in the measurement objective range (measurement window), and calculates correlation value between the reference image and the target image. The position where the maximum correlation value can be obtained is treated as the position where the target image might exist, and the IV-S20 calculates resemblance level at this position.

The normalization correlation method also can be applied to binary images. However, gray scale images (images with shades of light) contain large volumes of information, compared with binary images (images with 256 levels of gray have 256 times the volume of information than in binary images). Therefore, gray-scale images offer more precision and more reliable results.

However, the larger the information volume, the larger the number of calculations that must be made for correlation values. This means that high speed processing hardware and software are required to use the normalization correlation method on the gray scale images.

■ Gray scale search (corrected gray scale search)

The "gray scale search" function is a system for detecting a point where the input image and the reference image match, after calculating the matching levels in the input image and the reference image.

[Procedures]

① Store the reference image as a gray scale image with 256 levels of gray.

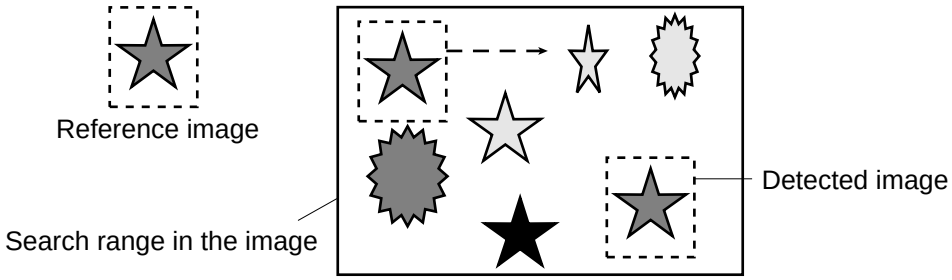
② Capture the workpiece image to be measured.

③ Move the captured image of the object so that the upper left corner of the captured image is right on top of the upper left edge of the reference image. Calculates the level of matching between the two images, based on the stored gray scale image data.

④ If the match is G, slide the reference image over one pixel width and then measure the level of matching at that position.

⑤ Repeat step ④ above for the whole workpiece image until a good match is found.

(Output)	(Application)
Maximum matching level value	Shape inspection
The center coordinates where the highest level of matching is obtained	Positional deviation measurement



■ Gray scale processing (gray image processing)

This is a process used to handle the unmodified captured image data, obtained from the CCD camera. In other words, the image data is not converted to binary values.

- This process produces more precise results than binary image processing (one pixel = one bit) by using 8 bits (one pixel = 256 gray levels) to represent each pixel in a gray scale image.

[Advantage] Theoretically, better precision and reliability can be offered because the image contains more information about the brightness of each pixel in the image.

[Disadvantage] More processing time is required because this approach must handle a large amount of data.

[H]

■ Halogen lamp

Light source with halogen gas in the bulb. When a halogen lamp is lit, the halogen gas and vaporized tungsten combine. When the filament is heated, these combined particles reattach to the tungsten, in stead of being deposited on the glass bulb, so that the original brightness of the lamp is maintained throughout its life span.

■ High frequency lighting

If a fluorescent lamp is powered by commercial electricity, it will flicker at 50 Hz or 60 Hz. Since the CCD scans images at 60 Hz, the brightness of the image may fluctuated due to the flickering of the fluorescent lamp.

By increasing frequency sued to power the fluorescent lamp (employing a high frequency light), this type interference is eliminated and a stable image can be obtained.

[I]

■ Illumination monitor alarm density setting

The "illumination (light level) monitor" is a function which automatically monitors the environmental lighting conditions when measuring objects.
If the illuminance exceeds the alarm density setting, the IV-S20 will display an alarm message.

■ Interline transfer system

The interline transfer system is an electrical charge transfer system which consists of two separate areas: the area where the light beams are converted into electrical charges by the CCD elements, and the area where the charges are transferred.

■ Island

An "island" is a separate area which is created after labeling (object identification) process the binary image.

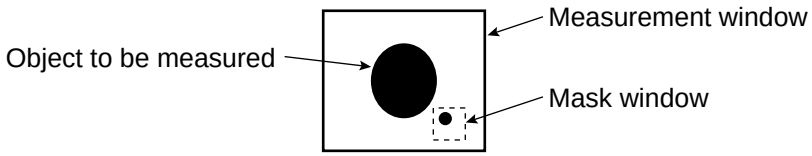
[M]

■ Main axis angle

The "center of gravity" is the geographical center of the image. It is determined by treating the binary image to be measured as an object that has mass.

■ Mask window

The image being examined may contain an area that does not need to be processed. To eliminate such an area, a mask window is used.



[N]

■ Normalization correlation

To determine whether the levels between the reference image and the input image match, the IV-S20 uses an information processing method called "normalization correlation." This is a method used to calculate relationship between two groups of data.

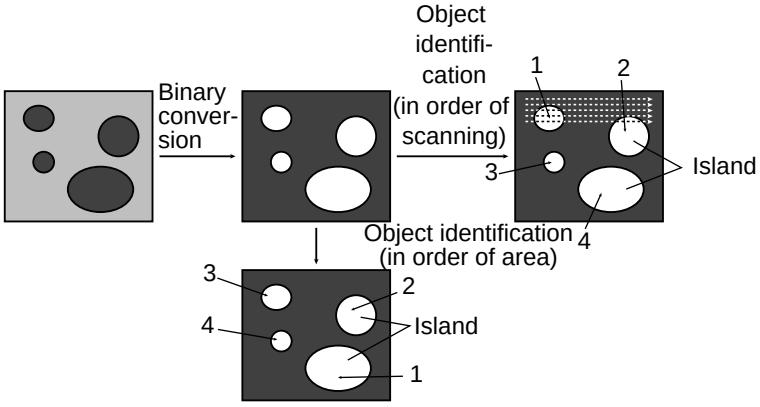
- Factors determining the correlation value
  If the densities of the two images have the same tendency (positive correlation), the two images are said to resemble each other. If the densities of the two images have opposite tendencies (negative correlation), the two images are said not to resemble each other. Therefore, areas of the reference image and the input image which resemble each other (the areas of both images are brighter, or darker) are positive, and areas which do not (the areas of one is brighter and the other is darker) are negative.
- Correlation formula = $\{ A \sqrt{B \times C} \} \times 10000$
  $A = N\sum (I \times T) - (\sum I) \times (\sum T)$: Correlation between input image and reference image
  $B = N\sum (I \times I) - (\sum I) \times (\sum I)$: Correlation between input images
  $C = N\sum (T \times T) - (\sum T) \times (\sum T)$: Correlation between reference images
  (N: Area of reference image, T: Density of reference image, I: Density of input image)

G

[O]

■ Object identification and numbering function, (labeling)

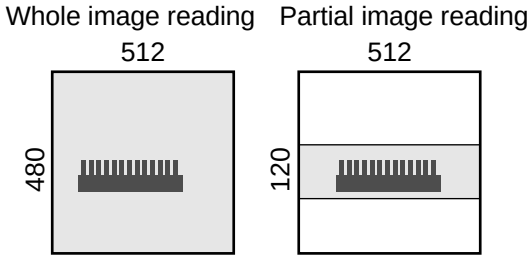
Object identification and numbering (labeling) is a process for locating separate object and assigning serial numbers (labels) one at a time in a binary image. By this process, multiple objects in the same binary image can be handled separately or as a group.



[P]

■ Partial CCD reading

The "partial CCD reading" technique reads only that part of the CCD which contains the object needed for image processing. This can shorten the data transfer time from the CCD camera to the image memory. To read the entire CCD image (480 horizontal lines) takes approximately 33 ms. With the partial reading technique (e. g.: 120 horizontal lines) can take only 25 % of the time to read the entire image.
The IV-S20 can automatically determine the width of the partial image window. You can change back and forth between reading the whole image and a partial image.



■ Pixel

On the CCD, the electrically charged elements are in close proximity, arranged in a matrix (480 lines in vertical direction, 512 rows in horizontal direction). One element is equivalent to one pixel.

■ Pre-processing

Pre-processing includes various image manipulation processes that create more readable images by removing noise and distortion in the image data. And, by extracting or emphasizing certain image features, it is easier to evaluate or identify target objects by converting the images into standard patterns.
In the IV-S20, you can select from "smoothing," "edge emphasis," and "edge extraction (whole, horizontal, vertical)" pre-processing techniques

Item	Contents
Smoothing	- Display smooth images decreasing the noise. - Use to eliminated surface flaws and unevenness in the reflected light caused by protrusions or dents.
Edge emphasis	- Display images with sharp boundaries between brighter and darker areas. - Used to stabilize and create a binary outline of obscure objects.
Edge extraction	- Display images after extracting and clarifying the boundaries between the brighter and darker areas. - Used to measure objects with low contrast. - Horizontal edge extraction: Display only the with horizontal boundaries o an object. - Vertical edge extraction: Display only the vertical boundaries of an object.

- See page 9-9 for descriptions about example for image.

■ Progressive scan

⇨ See "Full pixel reading."

[R]

■ Random shutter function

This function allows the CCD camera shutter operation to be triggered when even an object to be measured reaches a specified position in the camera's field of view.
In order to make a partial reading of the CCD image at high speed, the IV-S20 is equipped with the detection function described above with the works just like a proximity sensor to trigger the CCD. A proximate sensor can also be connected to the system.

■ Resolution

The CCD in the IV-S20 contains 512 pixels horizontally and 480 pixels vertically. If it takes a full picture, the resolution will be X/512 and Y/480.

[S]

■ Search area

A portion of the target image to be compared with the reference image, using the gray scale search function.

■ Search pixel

The relationship between detection precision and search speed, and also between pixel contraction (reduce the number of pixels in the image that must be searched) and search speed, is shown below:

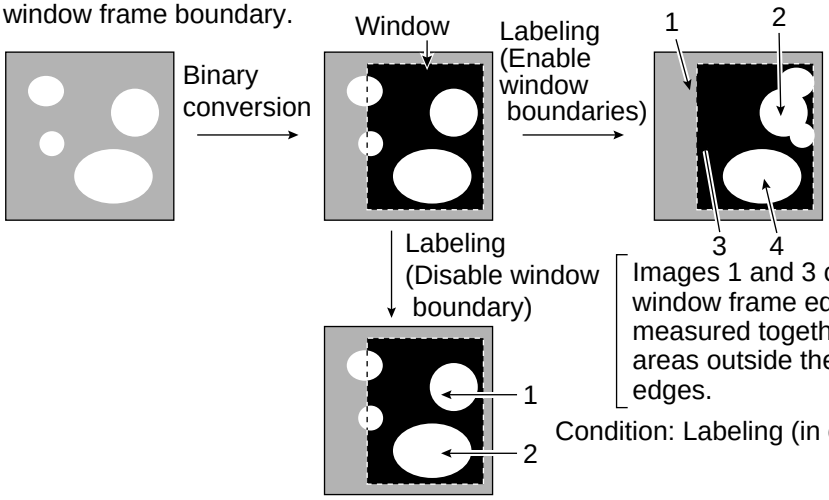
- DETECT ACCURANCY: High speed ⬅ [STANDARD-HIGH] ➡ Low speed
  (dectection precision) (standard) (high precision)

- CONTR. PIXEL: High speed ⬅ [3 - 2 - 1] ➡ Low speed
  (pixel contraction)

Search speed

■ Setting window boundaries (enable/disable)

This function enables and disables the labeling (object identification) of binary images located that cross over the window frame boundary.



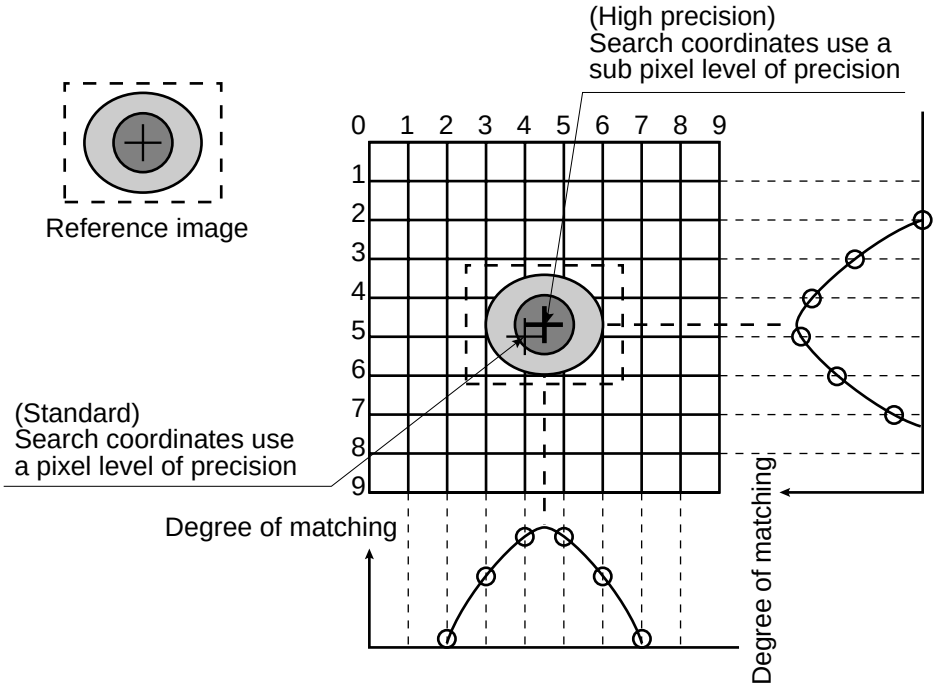
■ Smoothing

⇨ See "Pre-processing."

■ Sub pixel, pixel

Refers to the pixel precision level to be used with the gray scale search function.

- A "pixel" is one picture element (DETECT ACCURACY: STANDARD (detection precision: standard) in case of the IV-S20). "Sub pixel" refers to a unit smaller than a single pixel (DETECT ACCURACY: HIGH (detection precision: high) for 1/10 pixel in case of the IV-S20).



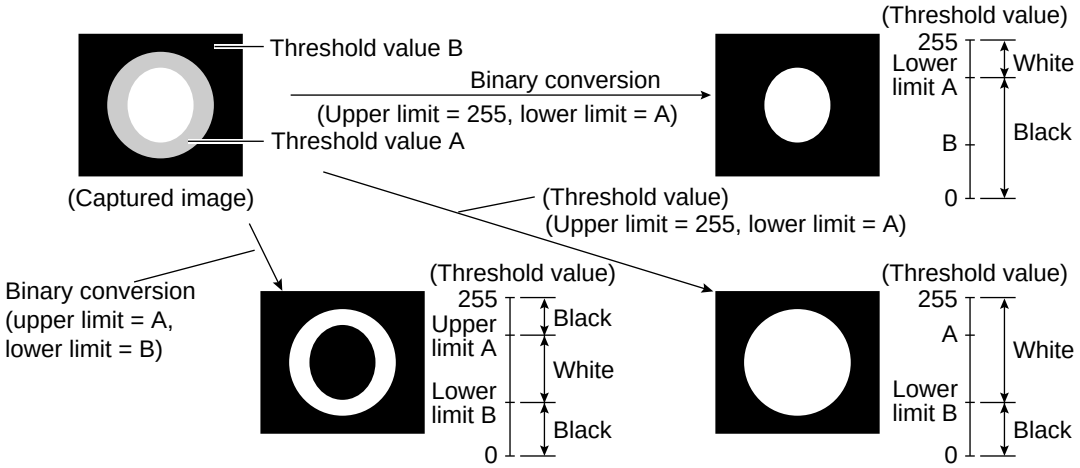
[T]

■ Threshold value

The criteria used for binary conversion of a gray scale image. If an area of the image is lighter than this threshold value, it is converted to 1. If an area of the image is darker than the threshold value, it is converted to 0.

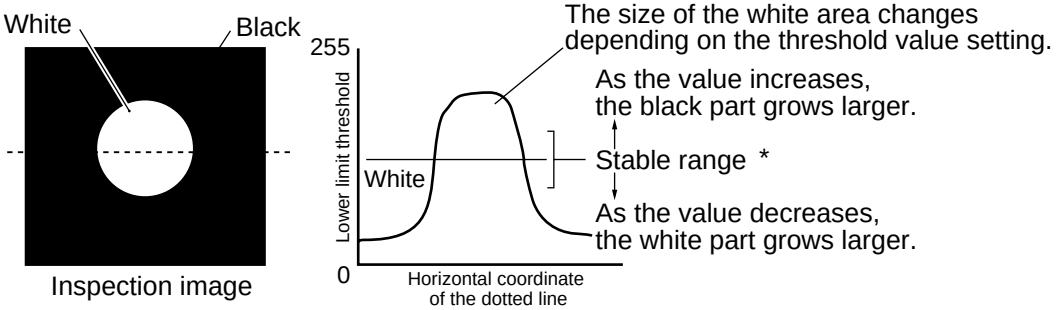
■ Threshold value setting

The IV-S20 treats the "areas darker than the lower limit value" or "brighter than the upper limit value" as "black." It treats that the areas between the upper limit value and lower limit value as "white." However, if the white-black reverse function is enabled, conversion to white/black will be reversed. Normally, if you want to use only one threshold value for binary conversion, set the upper limit value to "255." Then you only need to adjust the lower limit value to a threshold value that works for our application.



(Example for adjustment)

An example of adjustment is shown below, using a white object on a black background. When the dotted line in the window is converted to a binary image, if the lower limit is set higher, the black part in the binary image will become larger. If the lower limit is set lower, the white part will become larger. Increase and decrease the lower limit value, find the value at which the white part in the binary image starts growing and the value at which the black part starts growing. Then set the lower limit at the value halfway between these points. This will ensure reliable operation.



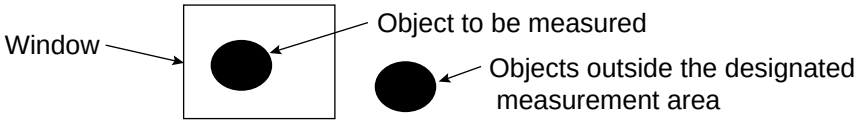
Changing the lower limit threshold value

[* If the stable range in the lower limit threshold value is less than 20, (actual measurement) measurement errors may occur.]

[W]

■ Window

The IV-S20 captures images using CCDs, which are the light sensitive elements in the camera. The IV-S20 may capture more than one target image to be measured for image processing, and it may capture images not required for measurement. In these cases, a window is used to pick out just the desired target for measurement. The area inside the window will contain the object to be measured and the areas outside the window will be ignored.



G

Appendix

Appendix 1: Support tools available on the market

Manufacturers of the support tools which can be used with the IV-S20 are listed below.

Products available from SHARP => See the next page.

(1) Lighting equipment

Supplier	Address	Postal code	Phone
Moritex Corporation	3-1-14, Jingumae, Shibuya Ku, Tokyo	150-0001	03-3401-9711
Nippon PI Co., Ltd.	1-17-1, Toranomon, Minato Ku, Tokyo	105-0001	03-3504-3321
Rawtronocs Corporation	6-1, 3 Chome, Kamifukuoka, Kamifukuoka City, Saitama	356-0004	0492-64-1391
Hayashi Watch Works Co., Ltd.	1-28-3, Kita Otsuka, Toshima Ku, Tokyo	170-0004	03-3918-5237

(2) Lens (lens-barrel)

Suplier	Address	Postal code	Phone
Seiwa Optical Corp.	12-17, 4 Chome, Yayoi Cho, Nakano Ku, Tokyo	164-0013	03-3383-6301
Asahi Precision Co., Ltd.	1-21, 1 Chome, Sirako, Wako City, Saitama	351-0101	048-466-8801
Chugai Optronics Co., Ltd.	2-15-13, Thukishima, Chuou Ku, Tokyo	104-0052	03-3536-4766
Tamron Co., Ltd.	1385, Hasunuma, Omiya City, Saitama	330-8556	048-684-9129
Canon Sales Company Inc. Optical Lens Sales Department	2-13-29, Kounan, Minato Ku, Tokyo	108-0075	03-3740-3388

(3) Optical filter

Supplier	Address	Postal code	Phone
Sakai Glass Engneering Co., Ltd.	2-3-6, Sengoku, Koutou Ku, Tokyo	135-0015	03-3647-6031

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■ Table of standard items related to the IV-S30 handled by SHARP

SHARP's article Nbr.	Moritex's article Nr.	Item name	Specifications
IV-1A0101	ML-0614	CCTV lens	C mount f = 6 mm
IV-1A0102	ML-0813	CCTV lens	C mount f = 8 mm
IV-1A0103	ML-1214	CCTV lens	C mount f = 12 mm
IV-1A0104	ML-2514	CCTV lens	C mount f = 25 mm
IV-1A0105	ML-3514	CCTV lens	C mount f = 35 mm
IV-1A0106	ML-5018	CCTV lens	C mount f = 50 mm
IV-1A0107	ML-7527	CCTV lens	C mount f = 75 mm
IV-1A0201	ML-EXR	Close up ring	A set of 7 intermediate rings
IV-1A0301	MML1-65D	Telecentric lens	C mount 1x
IV-1A0302	MML2-65D	Telecentric lens	C mount 2x
IV-1A1101	ML17-07516	CCTV lens	ϕ17 mm mount f = 7.5 mm
IV-1A1102	ML17-1520	CCTV lens	ϕ17 mm mount f = 15 mm
IV-1A1103	ML17-2431	CCTV lens	ϕ17 mm mount f = 24 mm
IV-1A1301	MML1-65D-CM1	Telecentric lens	ϕ17 mm mount 1x
IV-1A1302	MML2-65D-CM1	Telecentric lens	ϕ17 mm mount 2x
IV-2A0101	MHF-H50LR	Halogen light source	50 W
IV-2A0102	MHF-D100LR	Halogen light source	100 W
IV-2A0103	MHF-150L	Halogen light source	150 W
IV-2A0201	LM-50	Halogen lamp	12 V, 50 W
IV-2A0202	LM-100	Halogen lamp	12 V, 100 W
IV-2A0203	LM-150	Halogen lamp	12 V, 150 W (high luminous)
IV-2A0204	LM-150C	Halogen lamp	12 V, 150 W (long life)
IV-2A0301	MRG31-1500S	Ring light guide	ϕ 31 x 1500 mm
IV-2A0302	MRG48-1500S	Ring light guide	ϕ 48 x 1500 mm
IV-2A0401	MSG4-1100S	Straight light guide	ϕ 4 mm, 1100 mm
IV-2A0701	MPP60-1500S	Surface illuminating light guide	60 x 60 mm, 1500 mm
IV-2A0901	KA-03	Crystal adapter	Needed when the IV-2A0701 is used with an IV-2A0102

The items listed above are all Moritex products.

Appendix 2: Software version information

Described below are the details of the upgrade of the IV-S20 system program software.

■ Software version 2.09

Software version 2.09 does not contain any new or improved functions, not found in the software version 2.07 and 2.08.

■ Additional functions in software version 2.07 (compared with version 2.06)

Item	Added function	Reference page
Distance and angle measurement	Added "LINE-2P" and "INTERSECTION"	9-64
Serial communication	Added "4.8 kbps" communication speed	11-17

■ Additional functions in software version 2.06 (compared with version 2.04)

Item	Added function	Reference page
Parallel input X5	A reference image used for the calculation between images can also be registered.	11-1
	Automatic correction of the upper and lower limits used for the final area judgement condition.	
Manual measurement	Automatic setting of the initial value for manual measurement	8-8
General-purpose serial I/F	Added reading and specifying functions for the manual measurement coordinates (processing codes 70/71)	13-1, 13-13

■ Additional function and detalis about the improved functions on software version 2.04 (compared with version 2.02)

- Additional function

Item	Additional function	Reference page
General purpose I/F	Block 51 has just been added.	13-24
Computer link	Block 51 has just been added.	14-15
[I/O SETTINGS] menu	The CAM-MEAS has been added to the ⑥PARALLEL INPUT X6.	11-1
Distance and angle measurement	The DIST-BETW-X and DIST-BETW-Y have been added to the ② DISTANCE TYPE on the [DISTANCE SETTINGS] menu.	9-65
[RUN MENU SETTINGS] menu	The MANL-MESR have been added to the ⑧DISPLAY + CURSOR". - This is used to get the overall distance, X coordinate distance, and Y coordinate distance between two points, which are manually designated.	8-8
	The ⑩ IMAGE DISPLAY has been added. - These measurements can also be made on the through images.	8-9

- Details about the improved functions

Item	Improved functions	Reference page
Point measurement	The BLOCK SPACING for block registration has been improved. Minimum 4 pixels ➡ Minimum 0 pixel. Increase/decrease spaces in units of 4 pixels ➡ In units of 1 pixel.	9-110
Illuminance monitor	The monitoring window size and position can now be changed in units of one pixel instead of four pixels.	9-115
General purpose I/F	The number of labels is also output to a dummy label in the object identification by binary conversion operation	13-19

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■ Detalis about the improved functions in software version 2.02 (compared with version 2.01)

Item	Improved functions	Reference page
Lead inspection	Increased number of leads the can be inspected (from 64 to 128 pins max.)	9-72
Computer link	"Form 4" has been added to the control procedures, and a "QW" command has been added to the block write commands when the Mitsubishi is set.	11-18, 14-24
Binary processing	VAR-RATE (variation rate) has been added to the THRSHLD-ADJ.	9-51, 9-62 9-85, 9-93 9-101, 9-109
Communication (general-purpose serial) computer link	Blocks 60 to 77 have been added to the "Label measurement after binary conversion" operation.	13-20, 14-12
	Changed data order for the block 0 of "Label measurement after binary conversion ".	13-19, 14-11
Computer link	Changed data order for the masurement programs - Block 2 in distance and angle measurements, block 0 in lead inspection, block 0 in area measurement by binary conversion, block 0 in label measurement after binary conversion.	14-8 to 10
Parallel input X5	The reference image registration function, using input terminal X5, has been extended to make it available with camera 2.	11-1
Area measurement by binary conversion Counting quantity by binary conversion	Binary image displays are set to "Yes" and the [MAIN OPS MENU] , the measuring time is reduced. [Example of the measuring time] - Measurement conditions Capture all images, registered window number = 1 Measurement window = Rectangle, upper left coordinates (0, 0), lower right coordinates (511, 239) Mask window = Rectangle, upper left coordinates (0, 0), lower right coordinates (255, 119) ⇩ - Measuring time When the shutter speed is 1/60 sec., the measuring time is reduced from 143 ms (version 2.01) to 101 ms (version 2.02). When the shutter speed is 1/1000 sec., the measuring time is reduced from 127 ms (version 2.01) to 85 ms (version 2.02).	———
Auxiliary relay C112 Auxiliary relay C114	Changed functions of the auxiliary relays C112 (final evaluation result) and C114 (CCD trigger status output).	10-7
Change between the Japanese and English display modes	The menu display details in the English display mode have totally changed.	12-1

■ Newly added functions on software version 2.01 (compared with version 2.0)

Item	Additional function	Reference page
Operation screen	Latch the measurement results on the operation screen after resetting the power.	Description of paragraph 9 on page 7-2 to 7-3
Object type change	When the measurement start input is general-purpose serial input, the object type can be changed using the type number specification instruction (processing code 55).	11-7 and 13-1.

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■ **Detalis about the improved functions in software version 2.0 (compared with version 1.6)**

Item	Ver. 2.0	Ver. 1.6 or earlier
Gray search	High speed - Improved processing speed (from 55ms in version 1.6 to 37ms in version 2.0), when the search area is 256 × 256, a 64 × 64 model is used, and the reduction ratio is 3. - Processing speed improved approximately 60%, for the large model size.	———
	Gray search line can be used	Rectangles only
	Register a reference image from external equipment	Not available
	Detection coordinates can be set at any position	Limited to the center of the reference image
	Gray search precision level can be set independently for each reference image	Could only be set for each emasurement
Edge detection	Lines and rectangles can both be detected	Rectangles only
	Center point detection can both be detected	Not available
	Increased number of edge detection directions to 4: Horizontal (⇨, ⇦), vertical (⇩, ⇧)	Two directions： Horizontal (⇨), vertical (⇩)
	Artifact processing added	Not available
Measurement of positional deviation	Ability to assign X axis correction and Y axis correction independently for a two-point search.	Only simultaneous correction of X and Y axes.
	Rotation correction function added	Not available
Binary conversion measurement	Function to count quantities was added (up to 3000 items, including an area filter)	Up to 128 objects
	Increased number of object identification before area filter (3000 objects)	Up to 128 objects
	Ellipse window added	Only rectangle and circle
	Binary conversion pre-processing available for each window	Settable only for each measurement
Point measurement	Verification using average density is possible	Density after binary conversion only
Lead inspection	Added lead length inspection function	Lead pitch only
	Display maximum and minimum values	Average value only
	Display NG positions	No display
PC functions	Added AND STR and OR STR operation instructions	———
	Check for doubled use of the same instruction	No check
	Added list of functions used and execution monitor	No monitor
	Direct Y output and auxiliary relay for evaluation result added, also numeric value calculations.	Needed to create a ladder program.
	Added output of final evaluation result (C112) and continuous trigger relay (C113)	———
Numerical calculations	Square root, absolute value, TAN, and ATAN calculation functions are added	———
	Added final numerical calculation function	Only numerical calculation for each measurement
General-purpose serial input	Load and save displayed image	Save only
	Communication function between another IV module (for creating a clone)	Not available
Computer link	Assignable output block as well as block 0	Block 0 only

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Item	Ver. 2.0	Ver. 1.6 or earlier
Others	Added calculation functions for comparison between registered images and captured images [(balance absolute value)/(balance value)]	No calculation functions for comparison
	Added calculation function for comparison between camera 1 image and camera 2 image [(balance absolute value/(balance value)]	No calculation functions for comparison
	Windows can be set in units of one pixel (in units of 4 pixles for a gray search)	In units of 8 pixels (in units of 32 pixels for object identification)
	Introduced pop-up menus for screen display	———
	Can display binary images	Only dark and bright image
	Can display programmable OK/NG	No OK/NG display
	Displays "COMMUNICATING" (indicates that the IV-S20 is currently communicating)	No display
	Displays input terminals	No display
	Displays numerical calculation results	No display
	Measurement number selectable from X5 and X6	Not available
	Select between BUSY and READY outputs	BUSY output only
	Added evaluation using average density from CCD trigger	Area only after binary conversion
	Shutter speed can be set for each object type	One time for all types
	Shutter speed can be set continuously	Fixed value only
	Possible to test using the through image	Only available in version 1.6
	Store monitor brightness level setting in flash memory	No storing in flash memory

Note : In version 2.0, selection numbers are counted from 0 compared with version 1.6.
(except camera numbers)

	Ver. 2.0	Ver. 1.6 or earlier
Object type numbers	0 to 15	1 to 16
Measurement program numbers	Measurement 0 to 3	Measurement 1 to 4
Setting numbers for each menu (such as registration numbers, mode numbers etc.)	Start at 0	Start at 1

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