SHARP®

Version 2.0
Produced in July 2002

Compact image sensor camera

IV-S30

User's Manual (Function and Operation)

< Controller >
-IV-S31M
-IV-S32M
-IV-S33M

Thank you for purchasing the SHARP IV-S30 compact image sensor camera (IV-S33M controller). Read this introductory 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.
In addition to this manual, there are two other IV-S30 manuals as follows. Read them in conjunction with this manual.

IV-S30 (IV-S31M/S32M/S33M) ———— User's Manual (Introduction and Hardware)
IV-S30 (IV-S31M/S32M/S33M) ———— User's Manual (Function and Operation: **This manual**)

Manual type	Major subjects	How to use
IV-S30 (IV-S31M/S32M/S33M) User's Manual (Introduction & Hardware)	- Outline of the IV-S30 (features and functions) - Description of the hardware - Startup method - Operation using the simplified menus - General performance specifications.	- Become acquainted with the IV-S30 - Learn how to install the IV-S30 and wire it up - Learn how to execute positioning and existence inspections with simple setting operations.
IV-S30 (IV-S31M/S32M/S33M) User's manual (Function and Operation)	- Detailed explanations of all the measurement functions. - Operation using the standard menus. - Details of inputting and outputting data and communications with other devices. - Troubleshooting	- Learn how to specify measurement /inspection conditions, good or NG judgment conditions, etc. - Learn how to connect a programmable controller or personal computer. - Learn what to do if a problem occurs.

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 service agents.
- Copying all or part of this booklet is prohibited.
- The contents of this manual may be revised or modified for improvement without prior notice.

Software version

[1] Software version of IV-S33M

This manual describes the IV-S31M/S32M using software version V2.02.
The upgrade details (functions added to version V1.15) for the IV-S31M/S32M software (system program) are as follows.

■ Newly added functions in software version V2.02 (compared with V1.15)

Item	Added function	Reference page
NG image (IV-S32M only)	NG image display function added. Therefore, the "①DISP NG IMAGE" line (display NG images) on the [OBJECT TYPE SYS.] menu is deleted.	1-21,1-22
	Added "NG-IMG-INIT" (initialize NG images) on the "④INITIALIZATION" line of the [SYSTEM COND] menu.	2-15 (1-22)
CCD trigger	Added "YES (GRAY SRC)" on the "①TRIG CCD START " line of the [OBJECT TYPE I/O] menu.	17-17
Measurement program	Added "MULTI-POSI" and "MULTI MATCHES" for use as the measurement programs.	Chapter12, Chapter13
Light level inspection	Added the "④MATCHING (AVG-GRAYS, DIFF. ABS)" line on the [MEAS COND] menu. <Degree of match inspection, multiple degree of match inspection>	5-2,13-2
Contrast search	Added "CONTRAST SR" to the "REF IMG AREA" choices on the [Gray search] menu. <Positional deviation measurement, degree of match inspection, multiple position measurement, multiple degree of match inspection>	4-3, 5-3, 12-3, 13-3 (3-15)
Use camera setting	Added the "②SELECT CAMERA (CAM1&2, CAM1&NG-IMG)" line on the [TYPE MEAS COND] menu.	3-3
Automatic light level difference and edge width detection	Added an "AUTO. REGI" (automatic registration) choice on the [Edge detection] menu. <Positional deviation measurement, lead inspection, multiple position measurement>	4-4, 6-3, 12-4, (3-12)
Automatic threshold value setting	Added an "AUTO. REGIST" choice on the [Binary area cond] menu. <BGA/CSP inspection (IV-S32M), area measurement by binary conversion, object counting by binary conversion, object identification (labeling) by binary conversion>	7-3, 7-4, 8-3 to 8-5, 9-3 to 9-4, 10-3 to 10-4 (3-8)
Binary mask	Added "MANUAL" to the "①MASK SET" line on the [BINARY IMG MASK] menu. ⇨ Added a polygonal window setting.	3-19, 3-22
Object identification (labeling) by binary conversion	Added "MID-PNT " (middle point) to the "BINARY CHARACTER" choices on the [MEAS COND] menu.	10-2
Evaluation condition	Added "CONDITION SET" on the [EVALUATION COND] menu. <All measurement programs>	4-5, 5-4, etc.
Numerical calculation	- Added "FUNCTION (SUM, AVG, REG) " on the [NUMERIC CALC] menu. - Increased the number of digits below the decimal from 2 to 4, for the upper and lower value settings on the [NUMERIC CALC] menu. <All measurement programs>	15-2 to 15-3, 15-6 to 15-11
Reference image	Made it possible to display a reference image using the number previously registered on the [Gray search] menu. <Positional deviation measurement, degree of match inspection, multiple position deviation measurement, multiple degree of match inspection>	4-3, 5-3, 12-3, 13-3
Extension function	Added the "⑩EXTENSION FUNC. 2 (crosshair cursor display)" line on the [TYPE RUN COND].	2-12
Positional correction	Made it possible to set the correction registration in two stages ⇨ Added (0 to 1) on the "①MODE" line on the [POSITION CORRECT] menu.	3-27
Window group move	Added the "⑦MOVE ALL WINDOW" line on the [OBJECT TYPE SYS.]	3-38
Rotation angle unit	Added the "④ANGLE UNIT" line on the [MEAS COND] menu of the positional deviation measurement.	4-2, 4-7, 4-8

[2] Upgrade details

(1) IV-S33M

This manual describes the IV-S33M using software version V1.01.
The upgrade details (functions added to version V1.00) for the IV-S33M software (system program) are as follows.

■ **Newly added functions in software version V1.01 (Compared with V1.00)**

Item	Added function	Reference page
Halt on NG measurement	"NO (NG measurement display)" has been added on the "②HALT ON NG MEAS" line in the "OBJECT TYPE SYS." menu.	3-37
NG image display screen	When the MONITOR OUTPUT is set to "CAM1&2", the screen displays the camera number (Camera 1: C1, Camera 2: C2) next to the measurement display screen.	1-21
Strobe output	On the setting screen, a strobe output is now available when switching from a dynamic image to a static image. ("⑥STROBE OUT" on [I/O CONDITIONS] menu)	17-2

Differences between types of controllers

Item		IV-S31M	IV-S32M	IV-S33M	Reference page in this manual (item)
Number of object types handled		16	32	64	1-4, 1-5 (Operation screen) 17-1 ("64OBJ-CHG" on "PARALLEL INP X6" line)
Maximum number of reference images/ total number of images		300/3	600/8	600/8	4-3, 5-3, 12-3, 13-3
Gray search time*		18 ms	12 ms	9 ms	4-3, 5-3, 12-3, 13-3
Camera setting		-	-	○	2-19 to 2-22 (Camera setting, image capture mode, camera synchronization)
Split display of two camera images on the left and right sides of the screen		-	-	○	2-3 to 2-4
NG image edit function		-	○	○	1-4 to 1-6 ("NG-IMG-DSP" and "NEXT-NG" menu bars on the MAIN OPS menu screen.) 1-7, 1-17 to 1-22 (NG image display screen) 3-36 (NG image registration) 2-15 (NG image initialization)
Time setting		-	○	○	2-17 (Setting the system time)
BGA/CSP inspection		-	○	○	Chapter 7
Input terminal block	Object type be changed	X1 to X4	X1 to X5	X1 to X7	17-1 to 17-14 (Setting the input/output conditions)
	External input	X5 to X7	X6, X7	X7	
Power consumption		7W	7W	7W	---

("○": Compatible/available, "-": Not compatible/unavailable)

* The gray search times given above are true when the search area is 256 x 256 pixels, the model is 64 x 64 pixels, and the contraction value is set to 3.

A table of controller (IV-S31M/S32M/S33M) functions is shown on pages 1-28 and 1-29.

Table of Contents

Chapter 1: Setting and Operating Outline

1-1 Setting and operating procedures

The setting and operating procedures are outlined below.

① System design — **(Ref. section)**

- Measurement program (positional deviation measurement, degree of match inspection, etc.) — 1-2 Measurement programs
- Number of cameras, externally connected devices, system components — 3-1 Basic system configuration
- Input/output (start measurement input, result output, object type change, etc.) — 3-2 System configuration examples; Chapter 17 Settings the Input/Output Conditions

(* 1)

- Lighting equipment, light level, shutter speed, lens, etc. — 5-1 Installation conditions * 1

② Installation/assembly

- Cameras and monitor connections to the IV-S30 main housing
- Installation of the IV-S30 main housing and camera body
- Connection of a power supply, input/output terminals and external devices

— 5-2 to 4 Connection, installation, and wiring methods * 1

③ Turning ON the power supply (for the IV-S30 controller and monitor)

* 1 See the IV-S30 (IV-S31M/S32M/S33M) User's Manual (Introduction and Hardware).

④ Select menu

- Selection of STANDARD MENU and SIMPLIFIED MENU — 1-2 Method for selecting the menu (standard/simplified) configuration

⑤ Environment settings

- Input/output conditions related to external devices (Measurement start method, communication conditions, etc.)
- Operation conditions (Image caputuring methods, measuremat result display methods, etc.)

— Chapter 1 Setting and Operating Outline; Chapter 2 Setting the Operating and System Conditions; Chapter 17 Setting the Input/Output Conditions; Chapter 18 Communication (General Purpose Serial Interface); Chapter 19 Computer Link

⑥ Setting the conditions for each object type

- Object type No. specification
- Setting measurement program conditions (measurement 0 to 4)
- Setting system total numerical calculations
- Setting final output conditions
- Setting system and input/output conditions

— See the setting procedures starting on page 3-1.; Chapter 3 Setting Measurement Conditions; Chapter 4 to 14 Each measurement program; Chapter 15 Numerical Caluculations; Chapter 16 PC Function

(* 2)

⑦ Operation

⑧ Test/inspection — Chapter 20 Troubleshooting

⑨ Maintenance — Chapter 20 Troubleshooting

* 2 For operation methods using the simplified menus, see the "IV-S30 (IV-S31M/S32M/S33M) User's Manual (Introduction and Hardware)."

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1-2 Method for selecting the menu configuration

(1) When power is first turned ON after the machine is delivered

When power is first turned ON after the machine is delivered, the [SELECT MENU] screen will appear.

Power ON

[SELECT MENU]

```
[SELECT MENU]
①STANDARD MENU     (STD RUN-MENU)
②SIMPLIFIED MENU   (SEL EASY MENU)
```

② To select the simplified menus configuration
1. Move the cursor to the [②SIMPLIFIED MENU] item with the up and down keys, and press the SET key.
   ⇨ The [SIMPLIFIED MENU] screen will appear.

① To select the standard menus configuration
1. Move the cursor to the [①STANDARD MENU] item with the up and down keys, and press the SET key.
   ⇨ The standard mode [MAIN OPS MENU] screen will appear.

[SIMPLIFIED MENU]

```
[SIMPLIFIED MENU]
①MEAS OBJ          POSITIONING EXISTENCE
②SELECT CAMERA     CAM1 CAM1&2
③XY CORRECTION     NO YES


OPS-MENU
```

```
(TYPE00)                                   T.IMG C1 L
                                                VX.X
MEAS  0000ms  2000-08-01 10:30
MEASURE 0 CAM1 NO

X0~7 □□□□□□□□ Y0~7 □□□□□□□□  READY
CHG-MEA CHG-REG CHG-RST CHG-C1 CHG-C2 CHG-EVAL CUSTOM-MNU
OPS-CND MEA-CND SYS-CND CHG-TYPE NG-IMG-DSP NEXT-NG MANL-MEAS
```

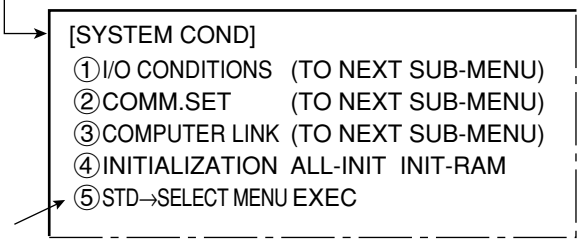
- For details about the method for using the simplified menus, see the IV-S30 User's Manual (Introduction and Hardware).

Notes

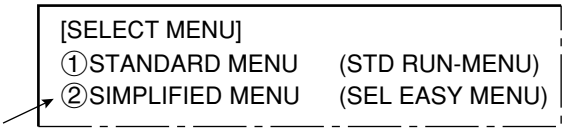
- If you have saved the configuration data in flash memory by selecting the "SAVE" item, the next time you turn ON the power, the MAIN OPS MENU you selected will be displayed automatically.

(2) Changing the screen from the standard menus to the simplified menus configuration

Move the cursor to the "SYS-CND" item on the MAIN OPS MENU screen, and press the SET key.



1. Move the cursor to the "⑤STD → SELECT MENU" item on the [SYSTEM COND] menu, and press the SET key.
2. Select the "EXEC" item, and press the SET key. The [SELECT MENU] screen will appear.



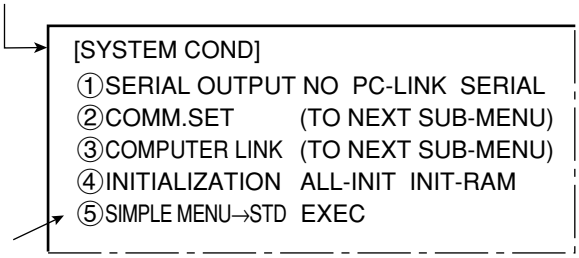
1. Move the cursor to the "②SIMPLIFIED MENU" item with the up and down keys, and press the SET key.
   ⇨ The [SIMPLIFIED MENU] screen will appear.
2. As described on the previous page, select each item that you want to specify, and press the SET key.

Notes

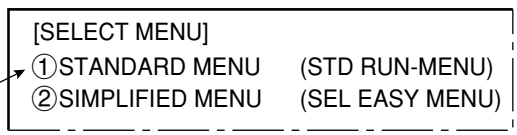
- Make sure to SAVE the system configuration data after you change from the standard menus to the simplified menus configuration. Otherwise, your selection of the simplified menus configuration will be ignored the next time you turn ON the power.
- When you change the IV-S30 configuration from the standard menus to the simplified menus, the data will be saved into the RAM.

(3) Changing from the simplified menus to the standard menus configuration

Move the cursor to the "SYS-CND" item on the MAIN OPS MENU screen, and press the SET key.



1. Move the cursor to the "⑤SIMPLE MENU → STD" item on the [SYSTEM COND] menu, and press the SET key.
2. Select the "EXEC" item, and press the SET key. The [SELECT MENU] screen will appear.



1. Move the cursor to the "①STANDARD MENU" item with the up and down keys, and press the SET key.
   ⇨ The [MAIN OPS MENU] screen with the standard menus will appear.

To select whether "POSITIONING" or "EXISTENCE" is displayed on the simplified menus, select the [② SIMPLIFIED MENU] item on the [SELECT MENU] screen, and specify each item you want to appear on the simplified menus.

Notes

- Make sure to SAVE the system configuration data after you change from the simplified menus to standard menus configuration. Otherwise, your selection of the standard menus configuration will be ignored the next time you turn ON the power.
- The items that you selected for display on the simplified menus will be saved when the screen configuration is changed to the standard menus.

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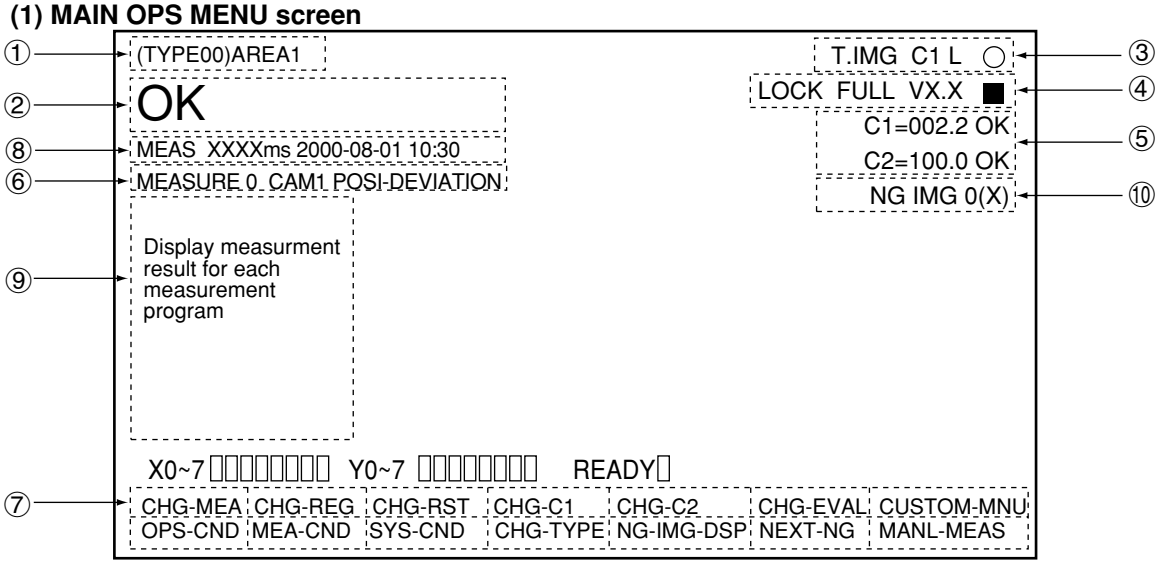
1-3 Screen specifications

[1] Operation (run) screen

After selecting the "STANDARD MENU" and save it (see page 1-2), supply power to the controller (IV-S31M/S32M/S33M), 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 controller.

(1) MAIN OPS MENU screen



① Object type No. ((IV-S33M: 00 to 63, IV-S32M: 00 to 31, IV-S31M: 00 to 15) and the name assigned by the user for each object type.

② The results of the programmable output (auxiliary relay C116) are displayed.
If C116 has not been set, the results of C112 are output. ⇨ See page 16-8

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 T C1 L ●

- Operation status display: ○ flashing = running,
- Image brightness: H = Original brightness of captured image
  L = Brightness reduced to half that in the captured image
- Output monitor status: C1 = Camera 1, C2 = Camera 2, C1/C2 = Camera 1 & 2
  NG = NG image, C1/NG = Camera 1 & NG image
- Image display mode: F = Freeze mode, T = Through mode (raw images),
  N = No camera input (To change between F and T modes, press the SEL key.)

- To display a dynamic image on the MAIN OPS MENU, set the through image function to "Yes." ⇨ See page 2-10.

④ LOCK FULL VX.X ■

- Flashes during communications
- System program version number
- Image capture modes (Fixed "FULL" for the IV-S31M/S32M): FULL = full, HALF = half, F+H = Full + half.
- Run menu is locked ("LOCK" is not displayed when the screen is unlocked.)

⑤ C1= 002.2 OK

- Average light level and judgment result (OK/NG)
- Camera No. (C1 = camera 1, C2 = camera 2)

- This item is displayed when the light level monitor "MNTR LIGHT LVL" on the [OBJECT TYPE SYS.] menu has been set to "YES." ⇨ See page 3-31

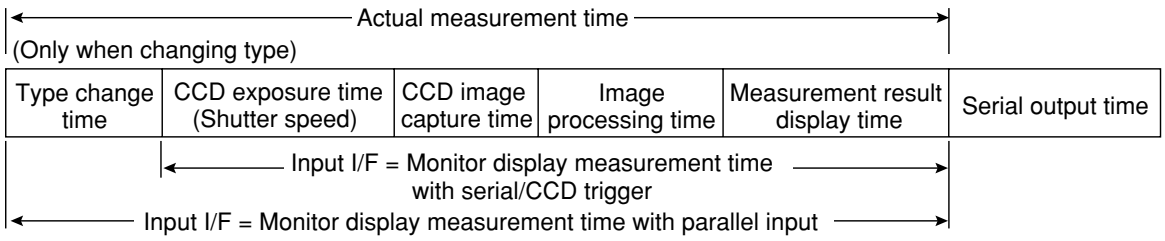
⑥ Measurement No. (0 to 4), camera No. (1 or 2) and measurement program name

⑦ Menu bar

Menu bar	Description
CHG-MEA (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. (MEASURE0 CAM1 →MEASURE0 CAM2 →MEASUREMENT1 → MEASUREMENT2 → MEASUREMENT3 →MEASUREMENT4)
CHG-REG (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.
CHG-RST	To change the display in the following sequence, press the up and down keys: "Measurement program results →distance and angle measurements →numeric calculations." - The measurement programs using the distance and angle measurements are the position deviation measurement, the degree of match measurement, object identification after binary conversion, (center of gravity) multiple position measurements, and multiple degree of match inspections.
CHG-C1	Scroll the split images from the two cameras up/down using the up and down keys. (When the screen is split above and below, the screen can be scrolled from top to bottom or bottm to top. When the screen is split left and right, the screen will scroll from left to right or right to left.) This function can be used when you select CAM1 & 2 or CAM1 & NG-IMG on the "MONITOR OUTPUT" item. (⇨ page 2-2)
CHG-C2 (change NG)	
CHG-EVAL	Move from one operation screen to another by pressing the up and down keys. "MAIN OPS MENU →EVALUATION COND CHANGE →PC MONITOR →" - Select "MAIN YES" on the "OPS MENU DISPLAY" item. (⇨ page 2-10) - For details about the methods for using the "MAIN OPS MENU," "EAVALUATION COND CHANGE," and "PC monitor" screen, see pages 16-19. - If you press the SET key while the EVALUATION COND CHANGE screen is displayed, the cursor will move to the item to change.
CUSTOM-MNU	Press the SET key to bring up the "CUSTOM MENU" (sub menu).
OPS-CND	Press the SET key to bring up the "TYPE RUN COND" (sub menu). (⇨ page 2-1 to 2-13)
MEA-CND	Press the SET key to bring up the "TYPE MEAS COND" menu (sub menu).
SYS-CND	Press the SET key to bring up the "SYSTEM COND" and "I/O CONDITIONS" menus (sub menus).
CHG-TYPE	Change the object type number (0 to 63) using the up and down keys. The number can be changed manually by setting the "MANL TYPE CHNG" item to "YES" on the "I/O CONDITIONS" menu. ⇨ page 2-14
*1 NG-IMG-DSP	Press the SET key to move to the NG image display screen. ⇨ Page 1-7, 1-21. - When the NG image is not registered, the display will not change to this screen.
NEXT-NG	Display the registered NG images and change registered number using the up and down keys.
MANL-MEAS	Move the two crosshair cursors manually to measure the distances between any two points on the X and Y axes - Select " MANL-MEAS" on the "EXTENSION FUNC. 1" item. ⇨ page 2-12

*1: These functions are displayed and can be used when an IV-S32M/S33M is being used.

⑧ The screen shows the total measurement time which is determined by the following times (from measurement start to measurement end).



In order to speed up the measuring time, 1 increase the shutter speed, 2 select partial capture of the CCD image, and 3 set NO for each of the result displays (message display, pattern display). When the IV-S33M is used, you can also 4 use a high-speed camera, and 5) select the half mode.

When the IV-S32M/S33M is used, the date and time are displayed on the screen.
[E.g.] 2000-10-01 10:30 ⇨ 10:30 October 1, 2000

1

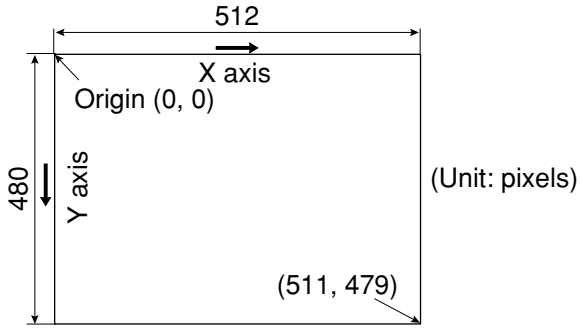
⑨ Display the measured results for each mesurement program
- If you save*2 the set conditions, "measured result screen" and "Image brightness: H/L" on the MAIN OPS MENU (operation screen), your settings will be restored whenever the power is turend ON.

*2 To save the data, enter the "SAVE" item on the [TYPE RUN COND], [TYPE MEAS COND], or [SYSTEM COND] menus.

⑩ With the IV-S32M/S33M, the NG image number and the total number of NG images registered are both displayed.
- To display these, select "YES" for the NG image registration. (Each object type) ⇨ Page 3-36
- The NG image register No. can be changed using the menu bar.

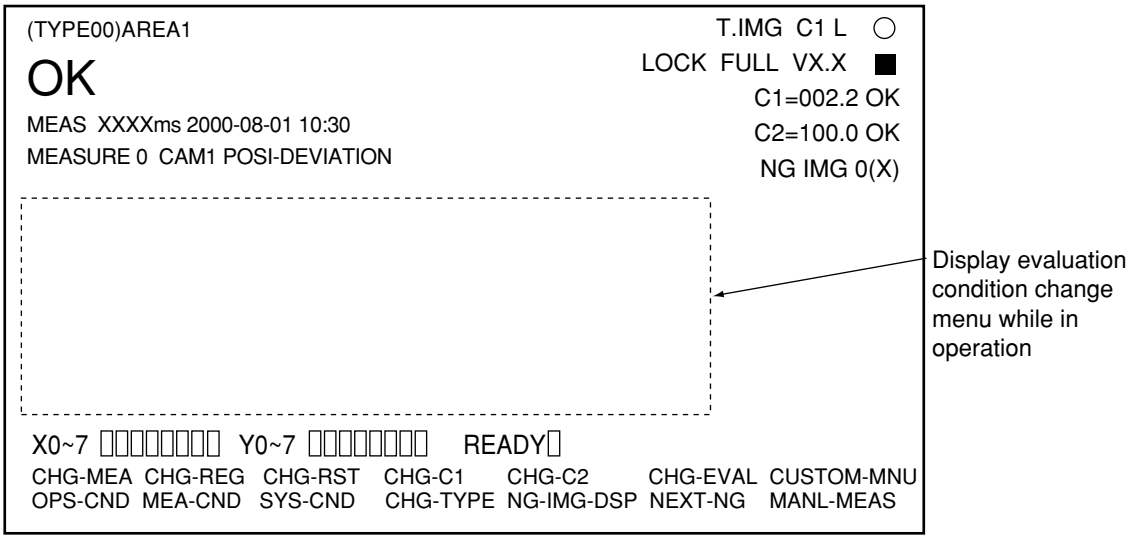
■ Image display area

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



■ Evaluation condition change screen

On the MAIN OPS MENU screen (page1-4), select the "CHG-EVAL" item on the menu bar. You can display the evaluation condition change menu by pressing the up and down keys (see the previous page).



(Screen on the IV-S33M)

- Press the SET key. The cursor will move to the area containing the phrase "evaluation condition change menu during operation." You can change the settings for the evaluation conditions.
- At this time, the screen display will look the same as the normal MAIN OPS MENU, except for the area marked "evaluation condition change menu shown during operation."

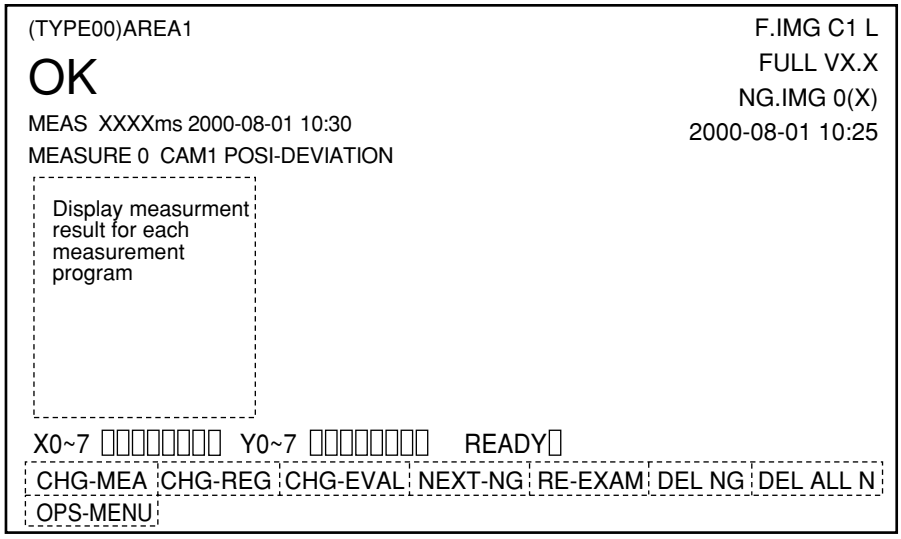
(2) NG image display screen (IV-S32M/S33M)

When the IV-S32M/S33M is used, move the cursor to the menu bar "NG-IMG-DSP" on the MAIN OPS MENU (page 1-4), and press the SET key. The screen will change to the NG image display screen. When the measuring stops, you can see the NG images already registered.

- To display the NG image while measuring, see "Displaying NG images on the MAIN OPS menu".
⇨ See 1-18.

Note: Please do the following to display NG images on the screen.

1. Before entering this screen, you must set the "①REGST NG IMG" on the [OBJECT TYPE SYS] to "YES."
2. Change the image display in the upper right of the screen to "F.IMG" (static image) by pressing the SEL key. ⇨ See 1-17.
3. NOTE WELL that while an NG image is being displayed, the IV-S30 cannot start another set of measurements.



- For details about the menu bar on the screen above. ⇨ See page 1-21.

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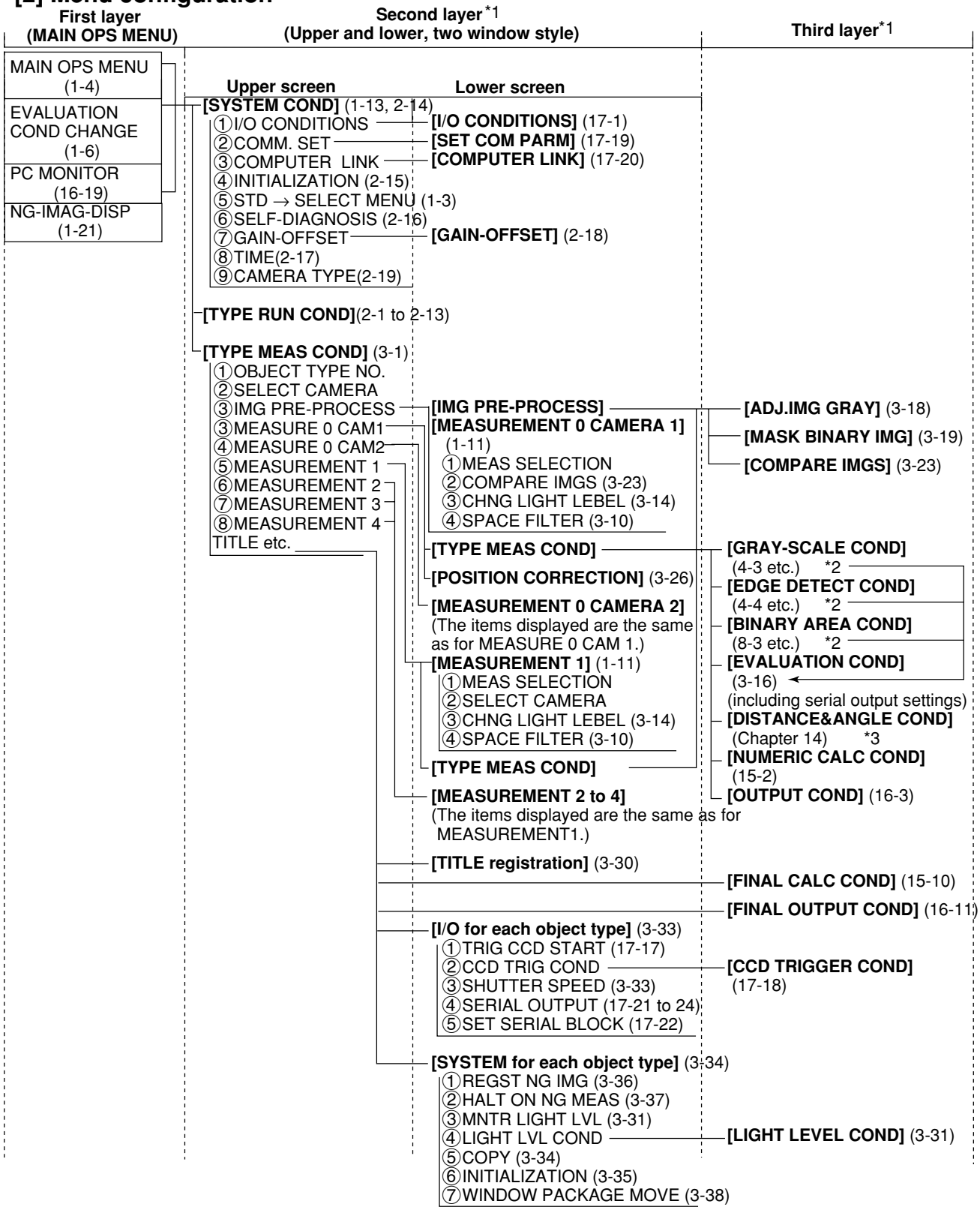
[2] Menu configuration



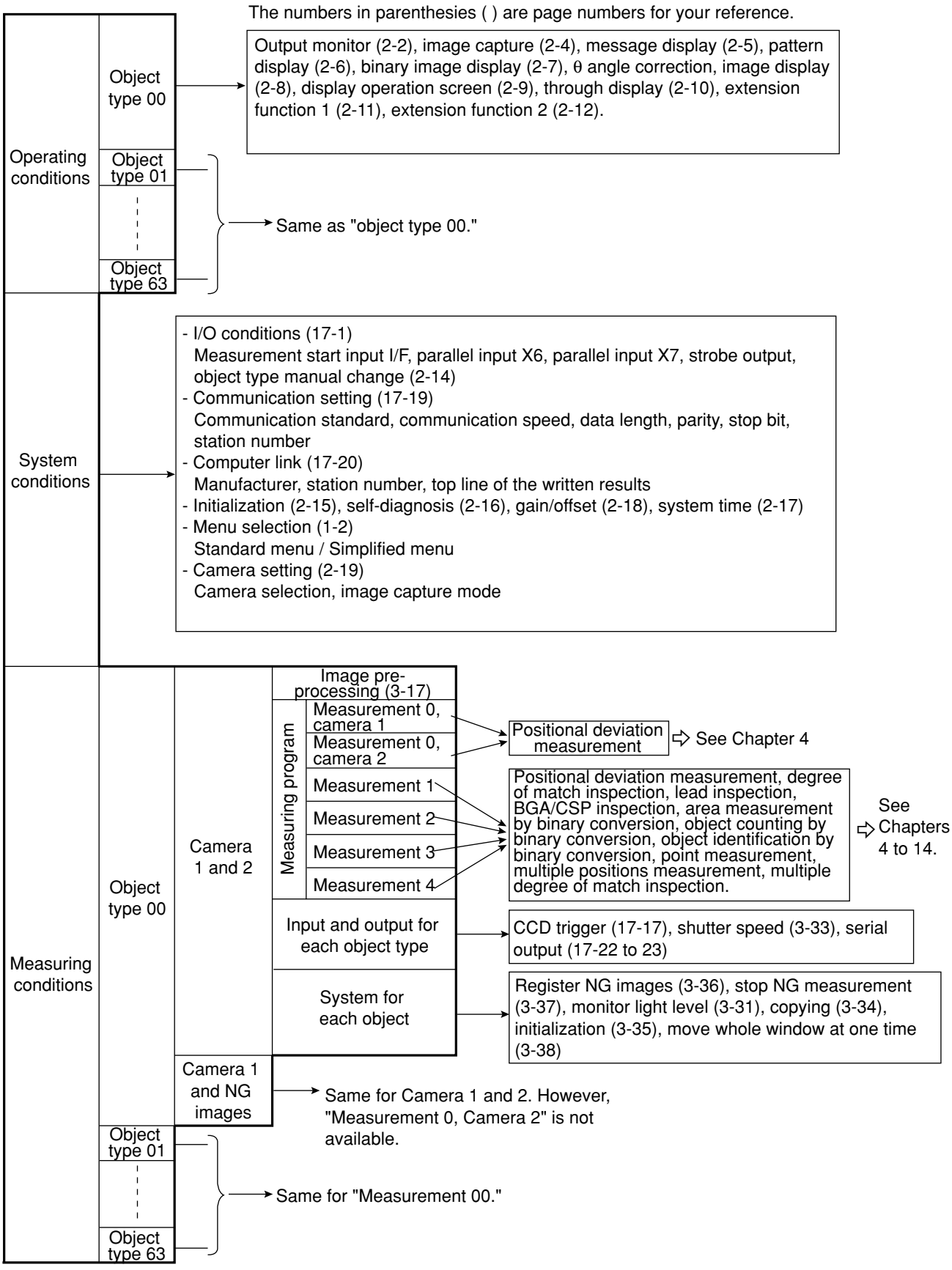
*1 You can return to the MAIN OPS MENU from any menu screen in the 2nd or 3rd layer.

*2 You can directly access the evaluation conditions from the image setting conditions, such as the gray scale search, edge inspection, and binary area conditions.

*3 The measurement programs that can execute a distance and angle measurement are as follows: Positional deviation measurement, degree of match measurement, and object identification by binary conversion (center of gravity), multiple position measurement, multiple degree of match inspection.

- The numbers shown inside parentheses are reference page numbers.
- For the details about the simplified menu configuration, see the "IV-S30 User's Manual (Introduction and Hardware)."

[3] Configuration of the setting conditions



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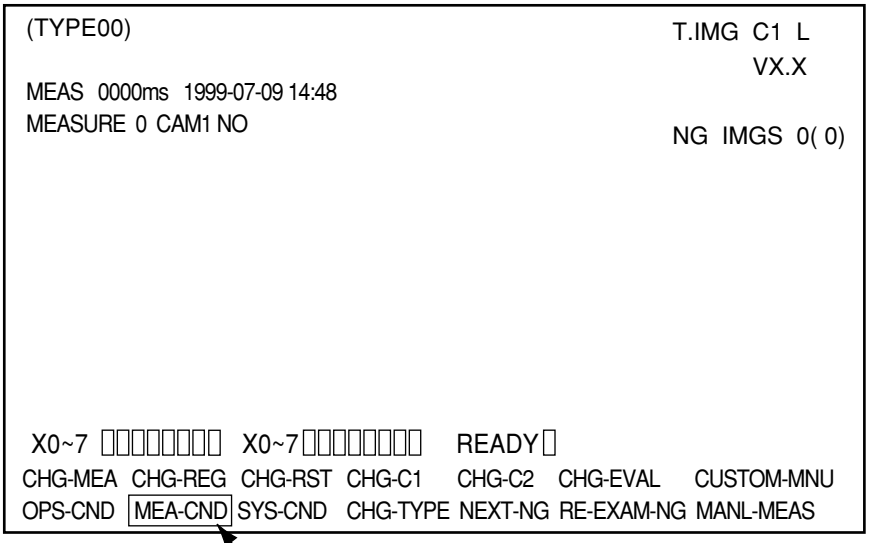
1-4 Setting the measurement programs

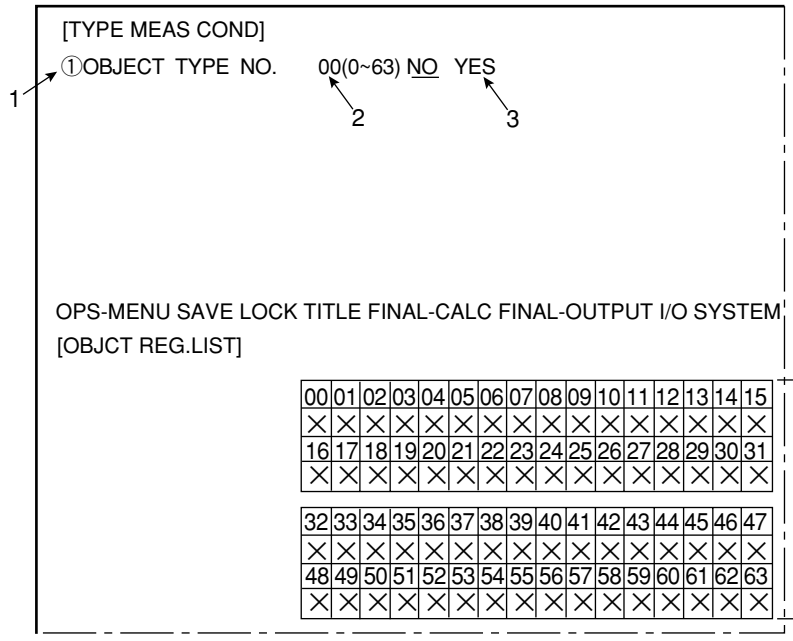
To execute a specific measurement program (positional deviation measurement, degree of match inspection, etc.), select MEASUREMENT 0 to 4 on the "TYPE MEAS COND" menu.

- MEASUREMENT 0 only allows you to measure positional deviation.
- For details about the settings for each measurement program, see Chapters 4 to 14.
- Specify the conditions for distance and angle measurement in the positional deviation measurement, the degree of match inspection, object identification by binary conversion (MEAS GRAV CENTR: YES), multiple position measurement, and for multiple degree of match inspection.

■ **MAIN OPS MENU screen** (See page 1-4.)



Move the cursor to the "MEA-CND" item using the left and right keys, and press the SET key.



1. Move the cursor to item ① using the left and right keys.
2. Select the object type No. (0 to 63) that you want using the up and down keys.*
3. Move the cursor to "YES" using the left and right keys.
   ⇨ Items ② to ⑧ shown on the next page will be displayed.

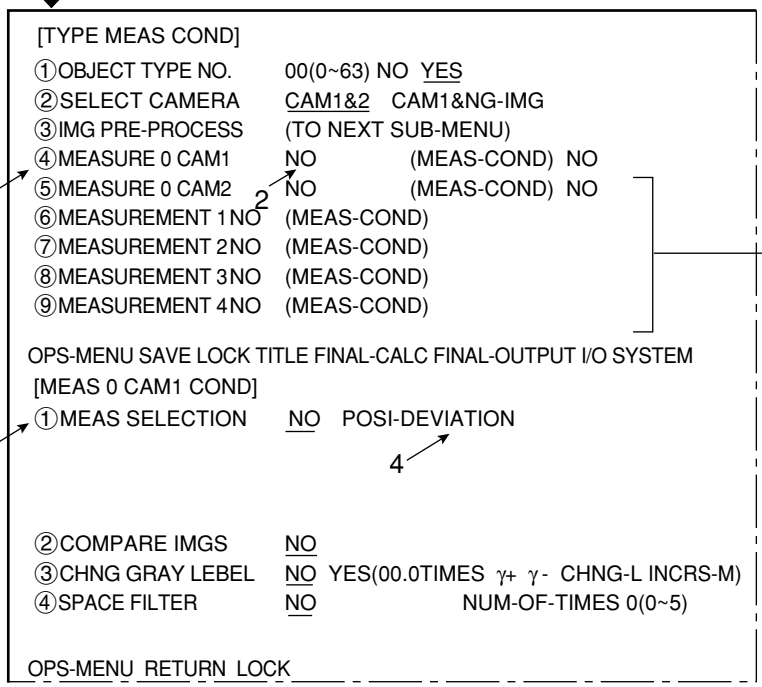
*Object type No.
[IV-S33M: 00 to 63
IV-S32M: 00 to 31
IV-S31M: 00 to 15]

← A "X" mark will change to "O" when a corresponding object type is registered from No. (*).

To the next page

From the previous page

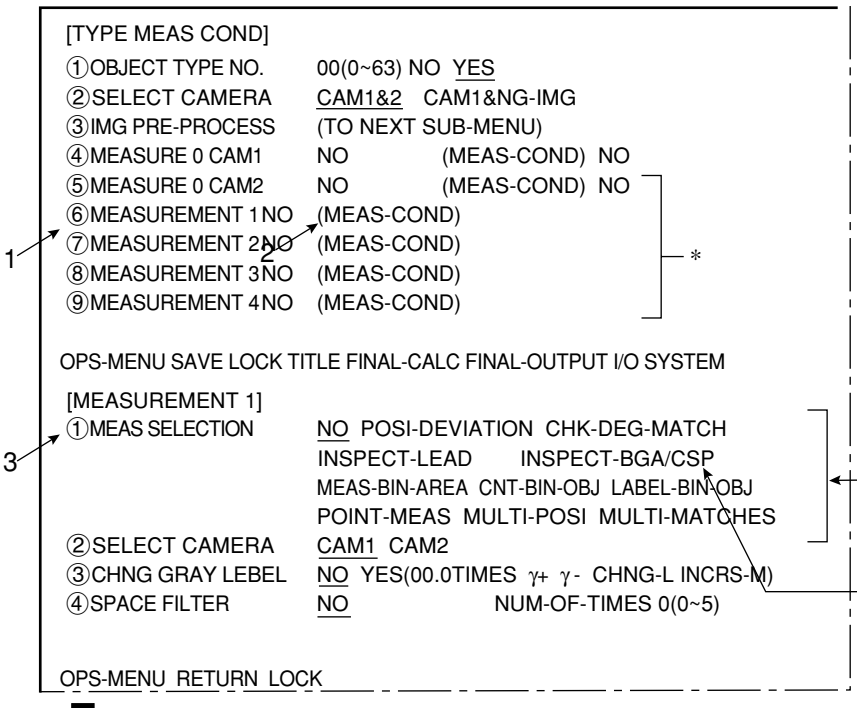
When you want to specify MEASUREMENT 0 (CAM1/2)
- The only measurement program available in this mode is "POSI-DEVIATION"



1. Select item ④ or ⑤ using the up and down keys.
2. Select "NO" using the left and right keys.
3. Select item ① on the lower half of the screen, and press the SET key.
4. Select the "POS-DEVIATION" item using the left and right keys, and press the SET key.
   ⇨ "NO" in item ④ or ⑤ will change to "POS-DEVIATION."

* (Two positions marked) When "CAM1&NG-IMG" is selected for "② SELECT CAMERA," the display will be different.
⇨ See page 3-3.

When you want to choose any of MEASUREMENT 1 to 4.
- You can select from 10 measurement programs.



1. Select item ⑥, ⑦, ⑧, or ⑨ using the up and down keys.
2. Select "NO" using the left and right keys.
3. Select item ① on the lower half of the screen, and press the SET key.
4. Select the measurement program that you want to use using the left and right keys, and press the SET key.
   ⇨ The "NO" in item ⑥, ⑦, ⑧, or ⑨ will change to the measurement program that you have set.

Displayed when the IV-S32M/S33M is used.

To chapter 4 to 14

1

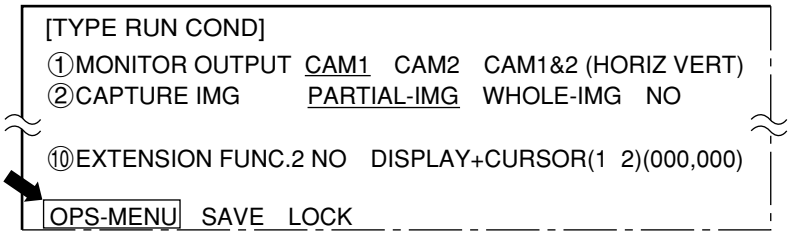
1-5 Common operations for each menu

[1] Operations to return to the MAIN OPS MENU

You can let the screen return to the MAIN OPS MENU at one operation from any menu screen.

■ Menu display

[TYPE RUN COND] menu



■ Operation details

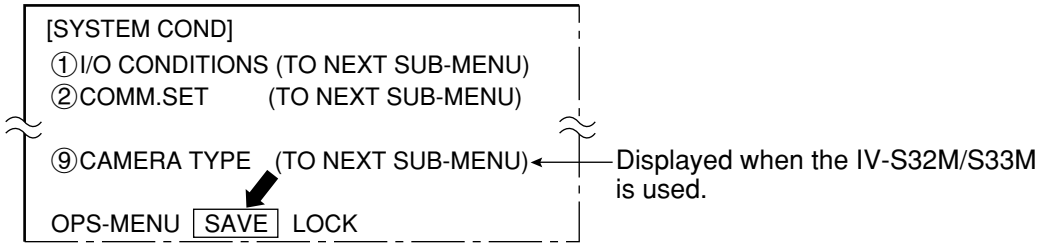
Move the cursor to the "OPS-MENU" item using the up/down and left/right keys. Then press the SET key. The screen will return to the "MAIN OPS MENU."

[2] Saving data

All of the data such as measurement and evaluation conditions entered on the "TYPE RUN COND," "TYPE MEAS COND," and "SYSTEM COND" menus, can be saved into the IV-S30 flash memory.

■ Operation procedure

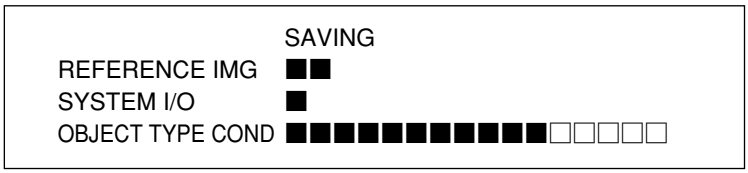
[SYSTEM COND] menu



1. On each menu screen, move the cursor to "SAVE" using the up/down and left/right keys, and press the SET key.
   ⇨ The following message will be displayed on the lower part of the screen.

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

2. Press the SET key.
   ⇨ The IV-S30 will start saving the data and the progress will be displayed on the bottom of the screen.



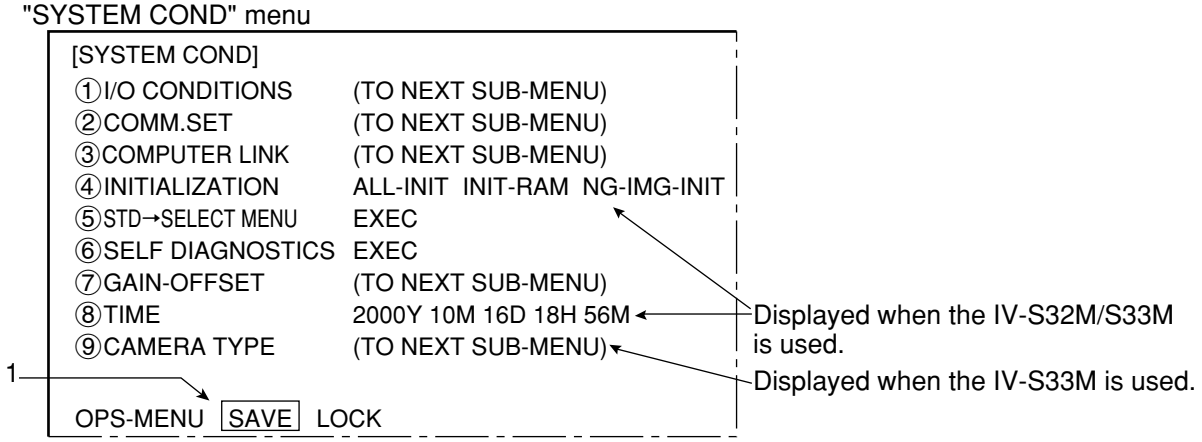
When the data has been saved in the IV-S30 flash memory, the display will change from "SAVING" to "COMPLETE SAVE."

[3] Lock the menu display

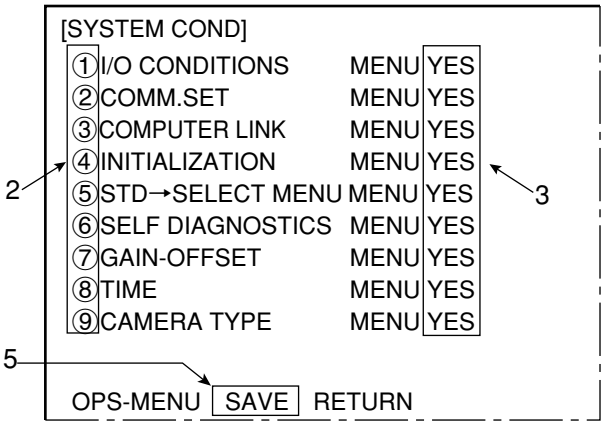
You can select whether or not to display menus on each of the menu screen.
Select the "LOCK" item on each menu screen to change the settings.

■ Operating procedure

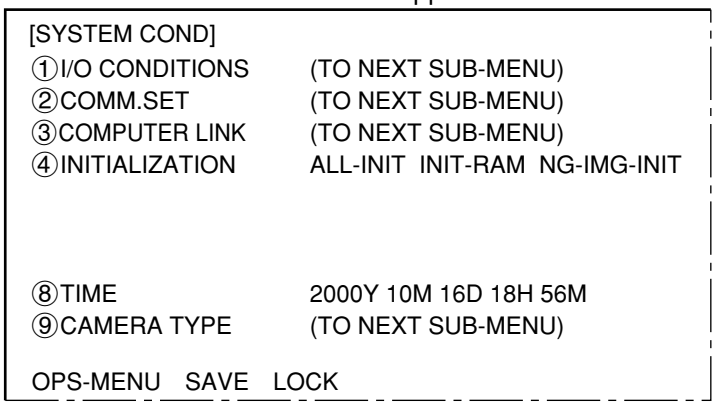
"SYSTEM COND" menu



1. Move the cursor to "LOCK" using the up/down and left/right keys, and press the SET key.
   ⇨ The screen for selecting whether or not to display each of the menus will appear.



2. Move the cursor to the item that you want to change using the up and down keys, and press the SET key.
3. Select "YES" or "NO" using the up and down keys.
4. Repeat the steps 2 and 3 to change other menus.
5. Select the "RETURN" item using the up/down and left/right keys, and press the SET key.
   ⇨ Items that are set to "NO" will not appear on the screen.



- The screen on the left will be shown when "NO" is selected for menus ⑤ to ⑦ on the menu display setting screen.

1

1-6 Power ON setting menu

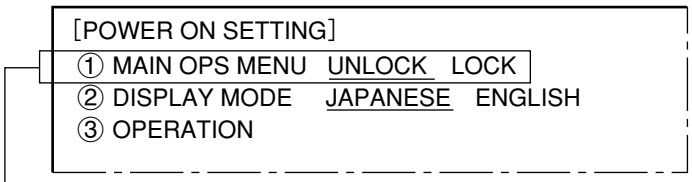
[1] Operations menu lock

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 can only be carried out on the [POWER ON SETTING] menu.

■ Display procedure

Follow the procedure described below when turning ON the power to the controller (IV-S31M/S32M/S33M) , and the [POWER ON SETTING] menu will be displayed on the monitor.

1. Turn ON the power to the IV-S30 controller, while holding down the ESC key.
2. Keep pressing the ESC key down for approx. 9 sec., after turning ON the power and the menu will be displayed.

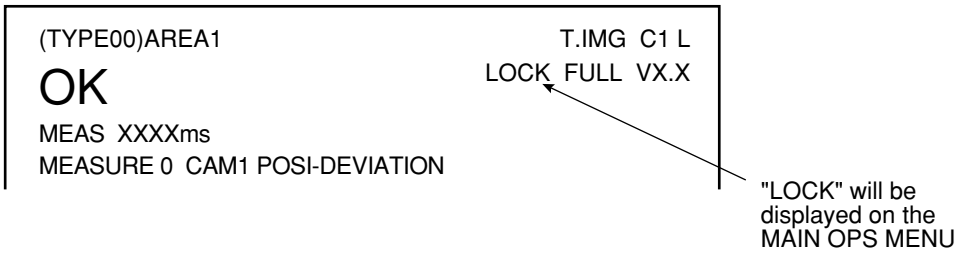


① MAIN OPS MENU	Description
UNLOCK	All of the operating conditions for the IV-S30 can be changed.
LOCK	The MAIN OPS MENU is locked and no change can be made.

■ Operation procedure

1. On the [POWER ON SETTING] menu, move the cursor to item ①MAIN 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 ③OPERATION with the up and down keys, and press the SET key. Press the SET key once more.
   ⇨ The IV-S30 saves the settings in the flash memory and the screen will return to the SELECT MENU.

■ Display when the MAIN OPS MENU is locked



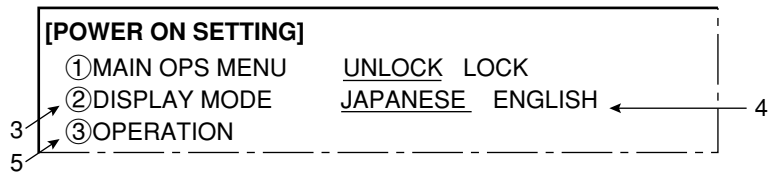
[2] Change the Japanese or English display mode

Change disply between Japanese and English. Use the [POWER ON SETTING] menu for the selection.

■ Display procedure

Follow the procedure described below when turning ON the power to the controller(IV-S31M/S32M/S33M), and the [POWER ON SETTING] menu will be displayed on the monitor.

1. Turn ON the power to the controller, while holding down the ESC key.
2. Keep pressing the ESC key down for approx. 9 sec., and the following menu will be displayed.

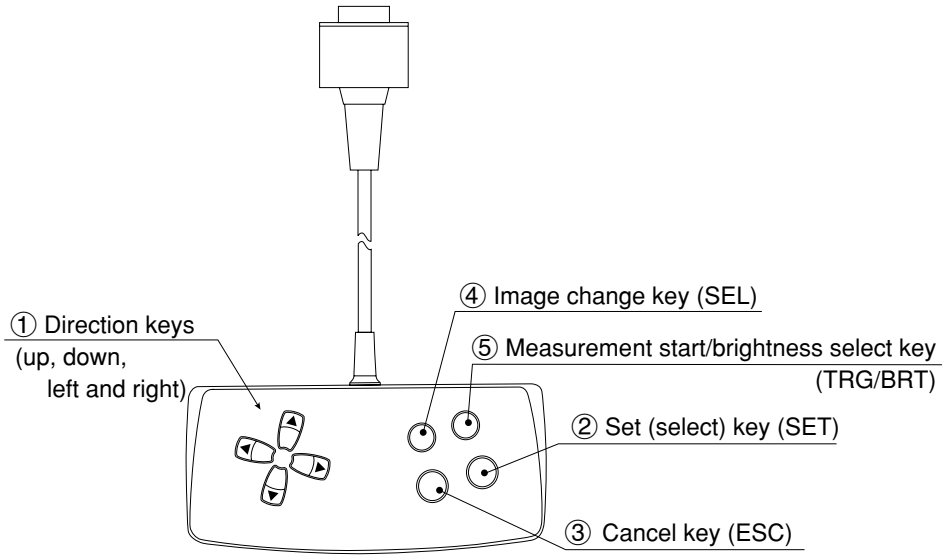


■ Operating procedure

3. Move the cursor to item "②DISPLAY MODE" (display mode) with the up and down keys, and press the SET key.
4. Move the cursor to "JAPANESE" or "ENGLISH" with the left and right keys.
5. Move the cursor to "③OPERATION" using up and down keys and press the SET key. Then, again press the SET key.
   ⇨ The screen will change to MAIN OPS MENU.

1

1-7 Remote key pad and 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 the 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 the setting screen. (See the preceding page.) When the mode is switched from through to freeze, a new image is captured. Note: The "Gain/offset adjustment" screen is only displayed in the through mode.
⑤	Measurement start/brightness select key (TRG/BRT)	Start measurement input	Press this key on the MAIN OPS MENU, and a new measurement is triggered.
		Switching the brightness level (between H and L)	Change the displayed image brightness. - 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

1-8 Register and display NG images

NG image refers to any image that the controller has determined to be unacceptable after making the measurements.

- NG images are registered in the controller's memory. By replaying the NG images, you can review the points with problems.

This section describes how to register, display, and initialize NG images. Depending on type of the controller you are using, some settings are not available.

Item			IV-S31M	IV-S32M	IV-S33M	Reference page
Register NG images			×	○	○	1-17
NG images display	MAIN OPS menu screen	Display when an NG image occurs	○*	○*	○	1-18 to 1-20
		Display history	×	○*	○	1-20
	NG image display screen		×	○	○	1-21 to 1-22
Initialize NG images			×	○	○	1-22

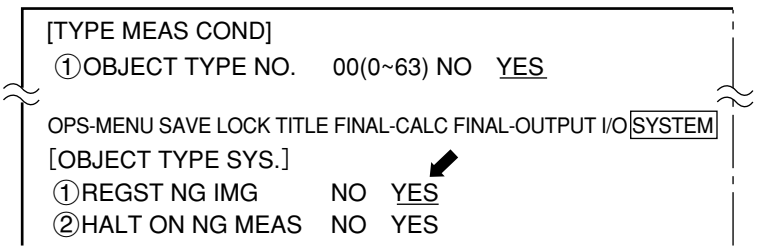
* The left and right split screen display is not available using the monitor output.

[1] How to register NG images (IV-S32M/S33M)

When the IV-S32M/S33M is used, select "YES" for NG image registration. NG images will be registered in the controller's memory as they occur.

To make this setting, select 1, "REGST NG-IMG" on the [OBJECT TYPE SYS.] menu.

⇨ See page 3-36.



- Up to 128 NG images can be registered at one time (the NG image numbers are 0 to 127). When 128 NG images are registered, the oldest NG image will be deleted and replaced by the 129th NG image. (All of numbers assigned to the NG images will de decremented by one.)
  The actual total number of NG images that can be registered may less than the 128, depending on the size of the images registered.
  [Limitation] The total number of NG images sizes can only occupy a maximum 8, full-size screens (1,966,080 pixels: 512 x 480 x 8). The maximum screen size is 512 x 480 pixels.
  Example: When the NG image size is 256 x 240 pixels, the controller can register up to 32 images. (256 x 240 x 32 = 1,966,080)

1

[2] How to display NG images

NG images can be displayed on the MAIN OPS MENU and on the NG image display screen (IV-S32M/S33M).

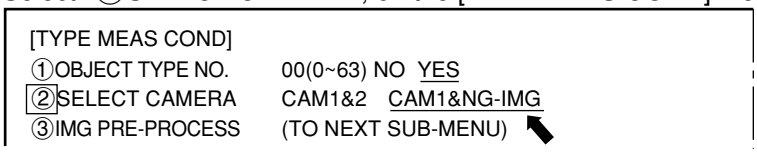
(1) Displaying NG images on the MAIN OPS menu

An NG image (the latest or any previous NG image) recorded with camera 1 can be displayed on the monitor while conducting measurements from the MAIN OPS MENU.

- This function only refreshes the NG image if another NG is captured. The screen is not refreshed with normal image measurement results. Thus, this method is useful for an operation that has a short cycle time and needs to process another workpiece soon after saving the NG image.
- When the measuring is stopped, NG images can also be displayed on the NG image display screen.
⇨ See page 1-21.

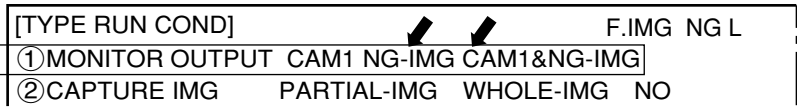
The setting procedures are as follows:

1. Select "CAM1&NG-IMG" from the monitor output.
   Select "②SELECT CAMERA", on the [TYPE MEAS COND] menu. ⇨ See page 3-3



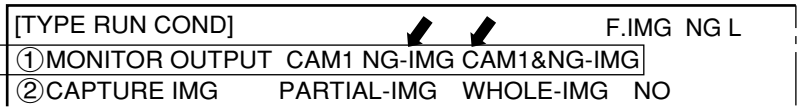
2. Set the monitor output to "NG-IMG" or "CAM1&NG-IMG."
   Select 1, "MONITOR OUTPUT" on the [TYPE RUN COND] menu. ⇨ See page 2-3.

● **When the IV-S33M is used**



①MONITOR OUTPUT	Description
CAM1	Display the camera 1 image on the whole screen.
NG-IMG	Display the NG image on the whole screen.
CAM1&NG-IMG	Display the camera 1 image on upper half, and the NG image on lower half.

● **When the IV-S32M/S33M is used**

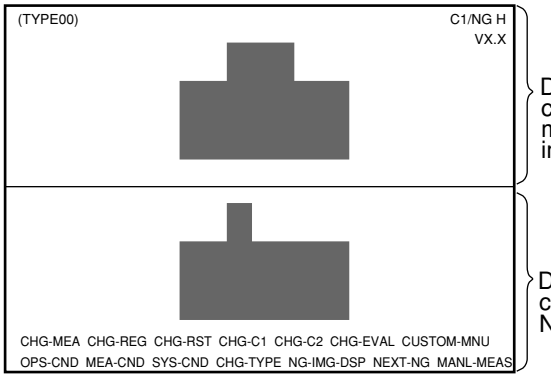


①MONITOR OUTPUT	Description
CAM1	Display the camera 1 image on the whole screen.
NG-IMG	Display the NG image on the whole screen.
CAM1&NG-IMG	Display the camera 1 image on upper half, and the NG image on lower half.

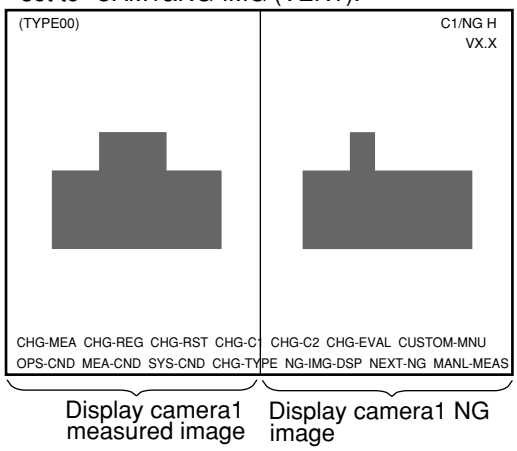
3. Return to the MAIN OPS MENU (page 1-4) and start making measurements.
   Shown below are examples of the NG image display.

● When the IV-S33M is used

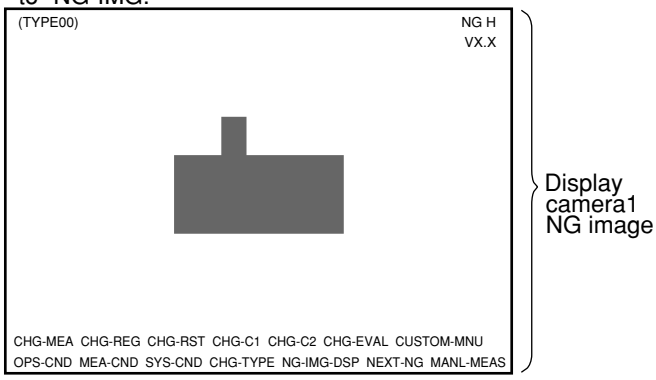
- Display example when the monitor output is set to "CAM1&NG-IMG (HORIZ)."



- Display example when the monitor output is set to "CAM1&NG-IMG (VERT)."

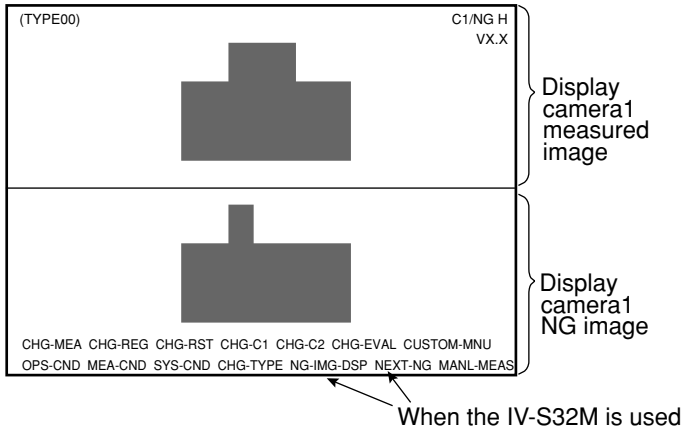


- Display example when the monitor output is set to "NG-IMG."

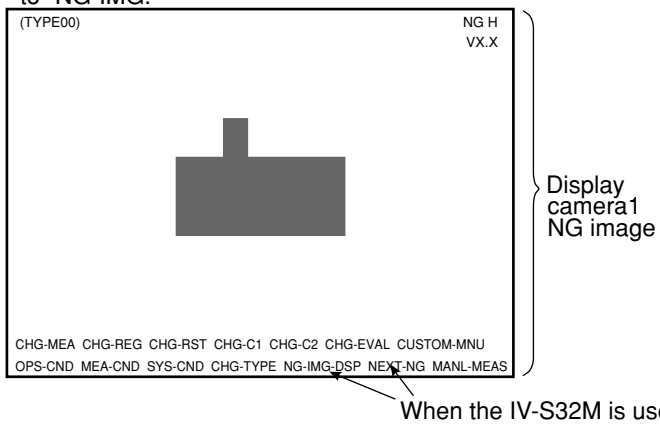


● When the IV-S31M/32M is used

- Display example when the monitor output is set to "CAM1&NG-IMG."



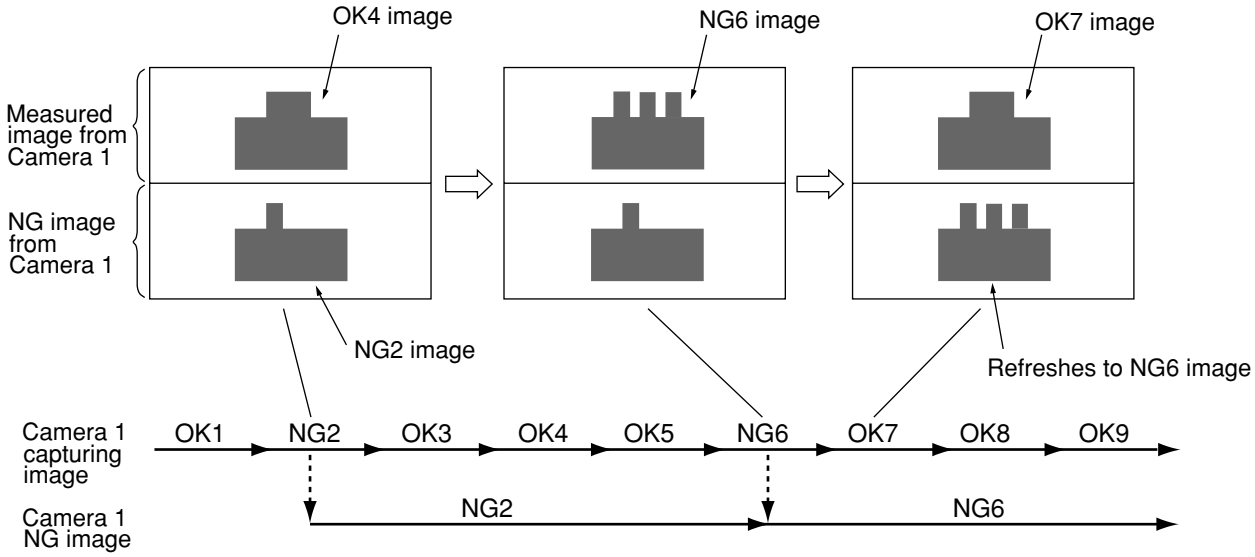
- Display example when the monitor output is set to "NG-IMG."



1

■ Display when an NG image is captured

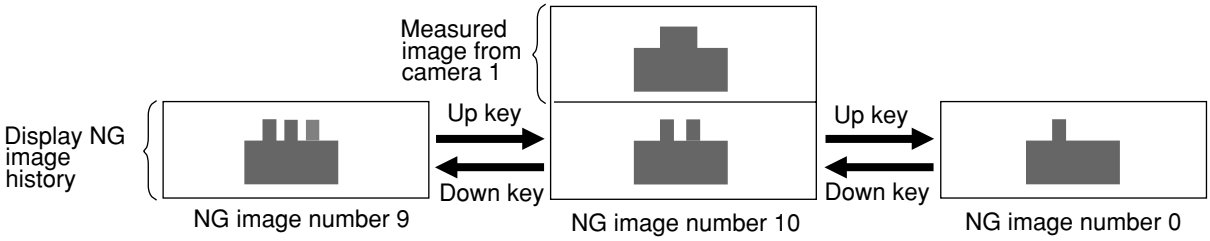
The controller automatically refreshes the NG image each time a new NG image is captured.
[An example of the split screen display (above and below)]



■ Display history of NG images (IV-S32M/S33M)

When the IV-S32M/S33M is used, move the cursor to the menu bar "NG-IMG-DISP" on the MAIN OPS MENU, using the left and right key. Press the up and down keys to display previous NG images.

[An example of scrolling the split screen display (above and below)]



- When a maximum of 10 NG images is registered.

When a new NG image is captured while displaying the history, it will be added to the history.

Note

- When "PARTIAL-IMG" is selected for image capturing (page 2-4), the NG images stored have the maximum rectangular area set in measurements 0 to 4.
- When "CAM1&NG-IMG" is selected for the monitor output, only one camera* can be used for each measurement (0 to 4) and for image pre-processing.

* The camera connected to the camera 1 connector (CAMERA 1).

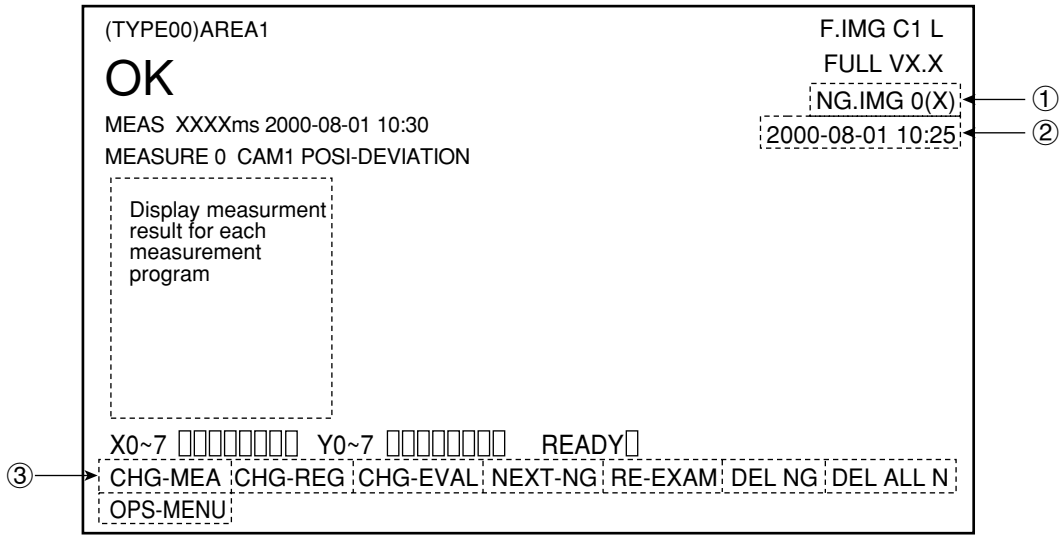
(2) Displaying images on the NG image display screen(IV-S32M/S33M)

When the IV-S32M/S33M is used, move the cursor to the menu bar "NG-IMG-DISP" on the MIN OPS MENU (page1-4) and press the SET key. The screen will change to the NG image display. When the measurement stops, the NG image will be displayed.

- To display NG images while measuring, display them on the MAIN OPS MENU. ⇨ See page 1-18.

Note: Please be aware of the following.

1. Change the image display mode in the upper right of the screen to "F.IMG" (static image) by pressing the SET key.
2. NOTE WELL that while an NG image is being displayed on the NG image display screen, you cannot measure objects.



① Display the NG image number and the number of NG images that have been registered. The NG image number can be selected by selecting "NEXT-NG" on the menu bar.

② Displays the date and time the NG image was captured.
Example: 2000-10-01 10:25 - October 1st, 2000, AM10:25.

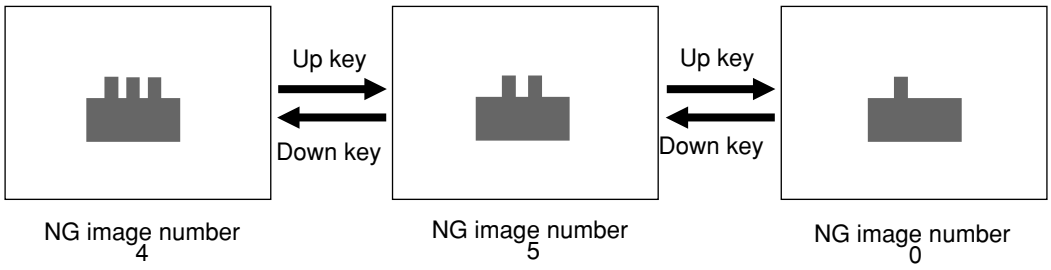
③ Menu bar

Menu bar	Details
CHG-MEA (change measurement)	Change the evaluation result display for the measurement numbers using the up and down keys. (MEASURE0 CAMERA1 → MEASURE0 CAMERA2 → MEASUREMENT1 →MEASUREMENT2 →MEASUREMENT3 → MEASUREMENT4 →)
CHG-REG (change register)	Change the measurement result display of the registered numbers in the measurement program using the up and down keys.
CHG-EVAL (change evaluation result)	Change the operation menu using the up and down keys. "Display NG image"→change evaluation conditions →Page 2-10 - The operating screen display must be set to "YES." ⇨ See page 2-10. - For information about the evaluation condition change screen, see page 1-6. - On the evaluation condition change screen, press the SET key. The cursor will move to the setting change screen.
NEXT-NG (change NG image)	Change the registered number for the NG image being displayed using the up and down keys. ⇨ See the next page.
RE-EXAM (replay)	Replay the measurements made on the NG image selected with "NEXT-NG", by pressing the SET key.
DEL NG (delete NG image)	Press the SET key. Only the NG image selected with "NEXT-NG" will be deleted.
DEL ALL N (delete all NG images)	Press the SET key. All the registered NG images will be deleted.
OPS-MENU	Press the SET key, the screen will return to the MAIN OPS MENU screen.

④ When “CAM1&2” is selected on the “④MONITOR OUTPUT” line (TYPE RUN COND menu), the camera numbers (camera 1: C1, camera 2: C2) will be displayed on the screen next to the images from those cameras.

1

■ **Display of the Change NG image operation**



- When 5 NG images are registered.

Note

- When "PARTIAL-IMG" is selected for the image capturing mode (page 2-5), the stored NG images have the maximum rectangular area set by measurements 0 to 4.

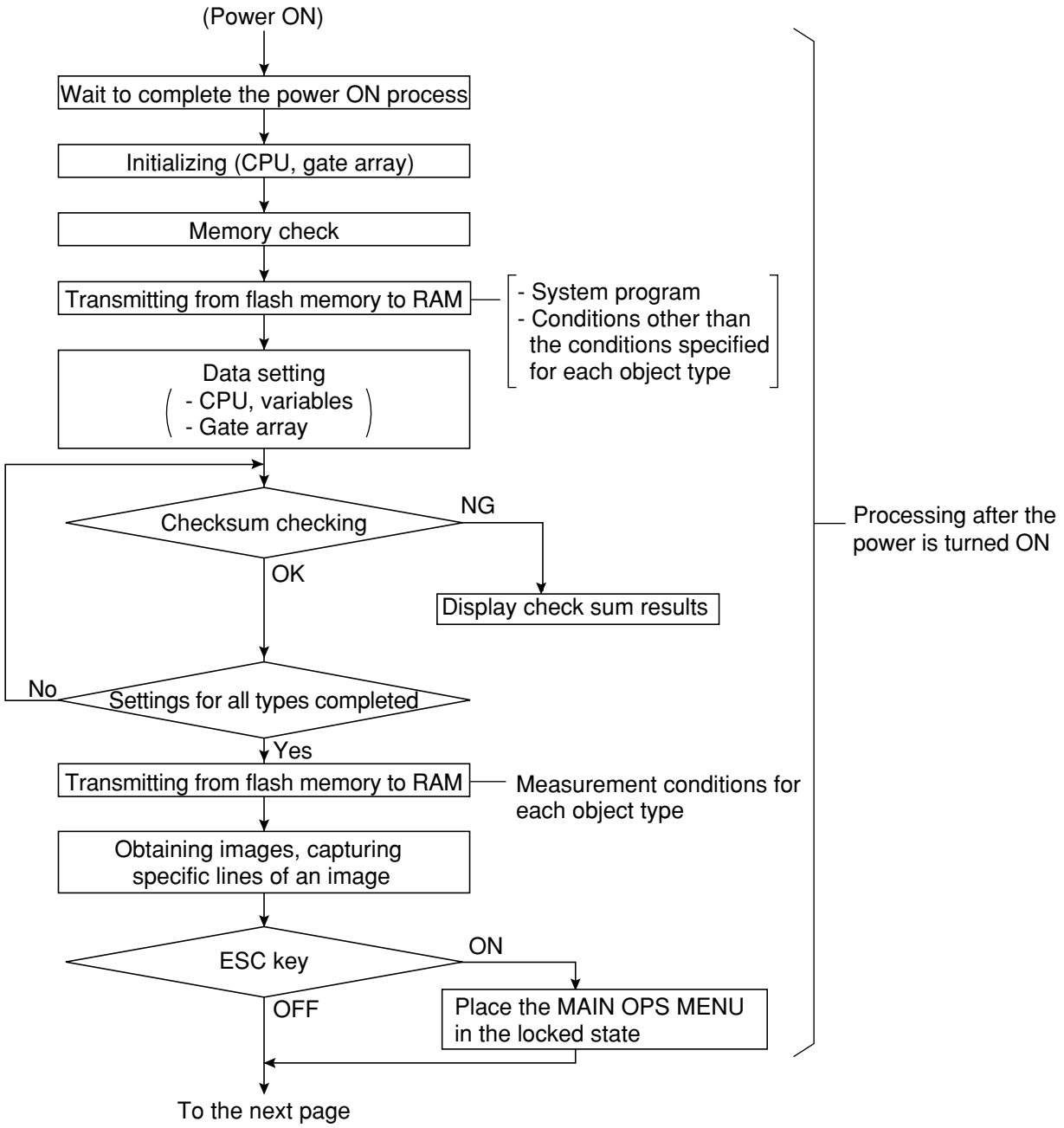
[3] Initializing the NG images (IV-S32M/S33M)

When the IV-S32M/S33M is used, NG images can be initialized with any of the following methods:

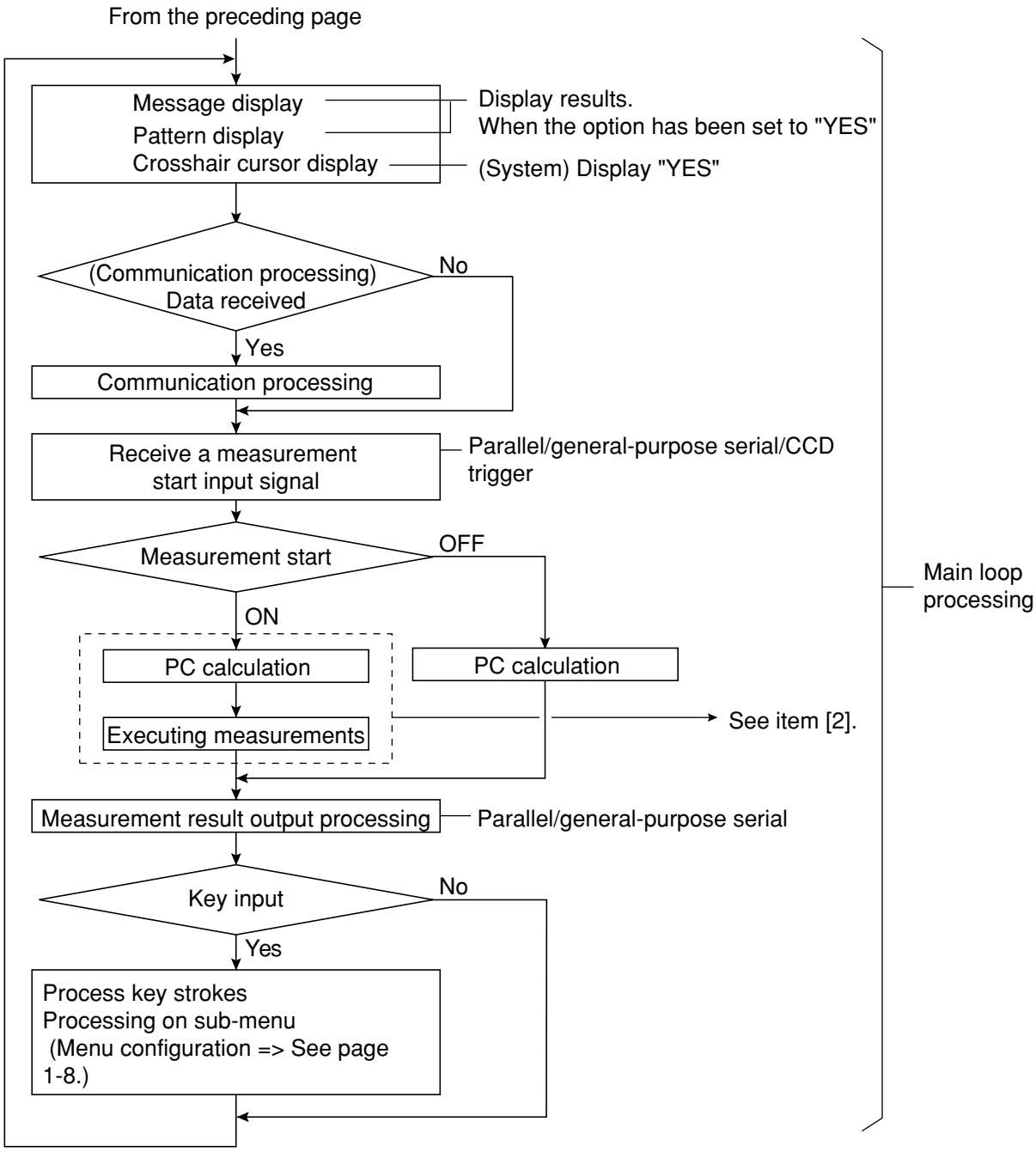
1. Item 1, "④INITIALIZATION", on the [SYSTEM COND] menu, will execute an "NG-IMG-INIT". ⇨ Page 2-15.
2. Execute a "DEL NG" (delete NG image) or "DEL ALL N" (delete all NG images) on the menu bar of the NG image display screen. ⇨ See the previous page.
3. When the object type number is changed, the registered NG images are initialized.

1-9 Operation flow

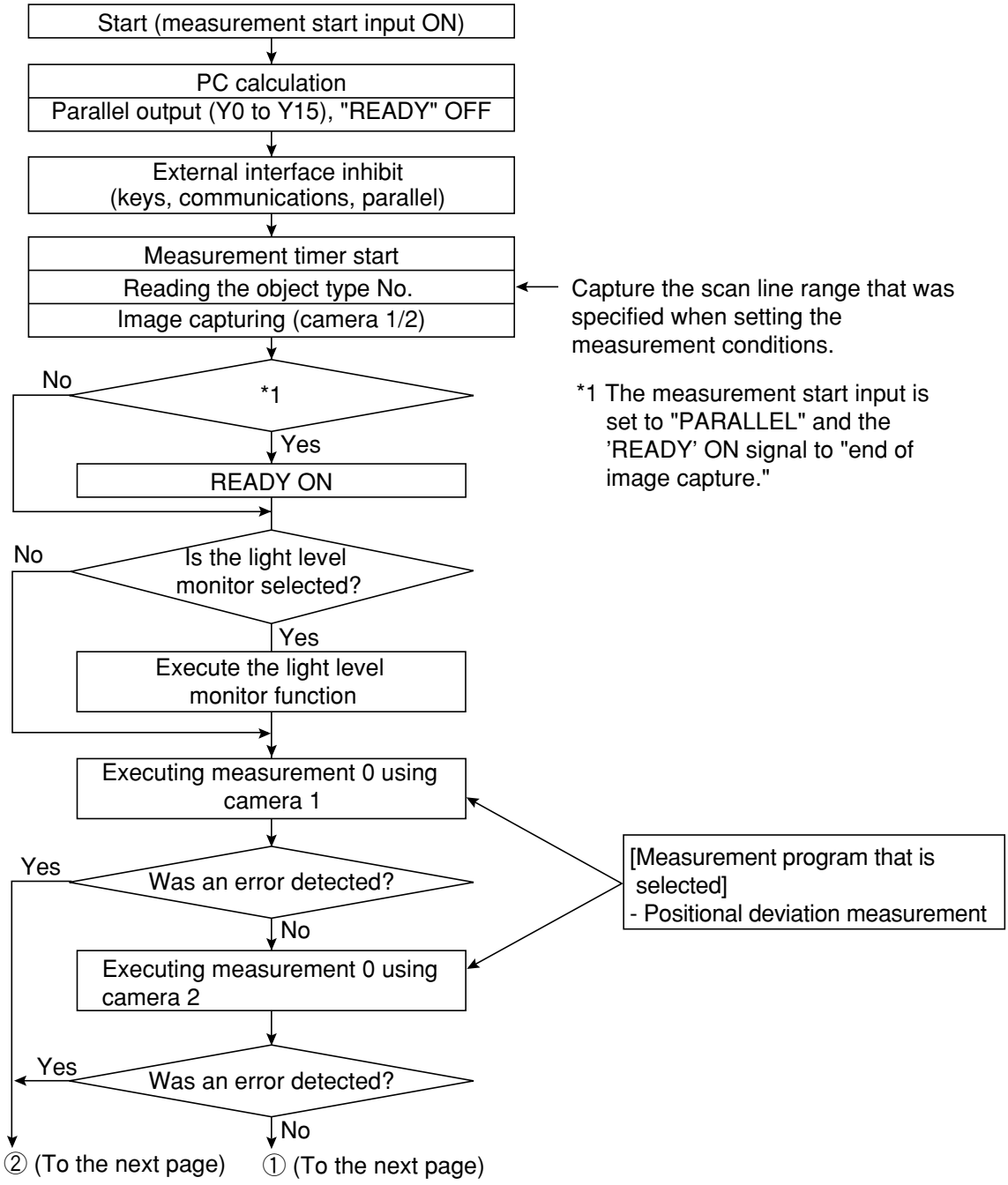
[1] Power ON and main loop processing



1

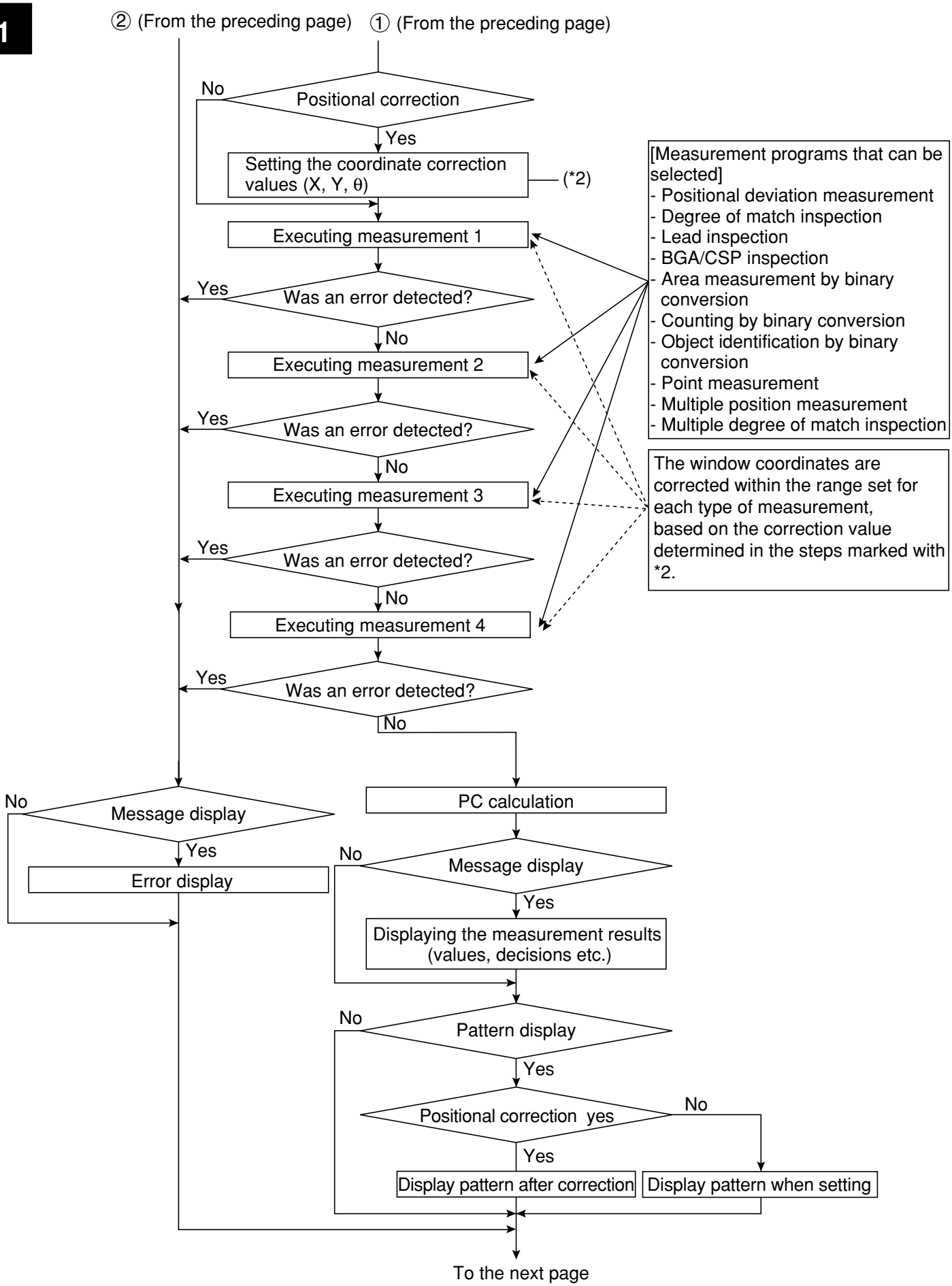

From the preceding page
Message display
Pattern display
Crosshair cursor display
Display results.
When the option has been set to "YES"
(System) Display "YES"
(Communication processing)
Data received
No
Yes
Communication processing
Receive a measurement start input signal
Parallel/general-purpose serial/CCD 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
(Menu configuration => See page 1-8.)
Main loop processing

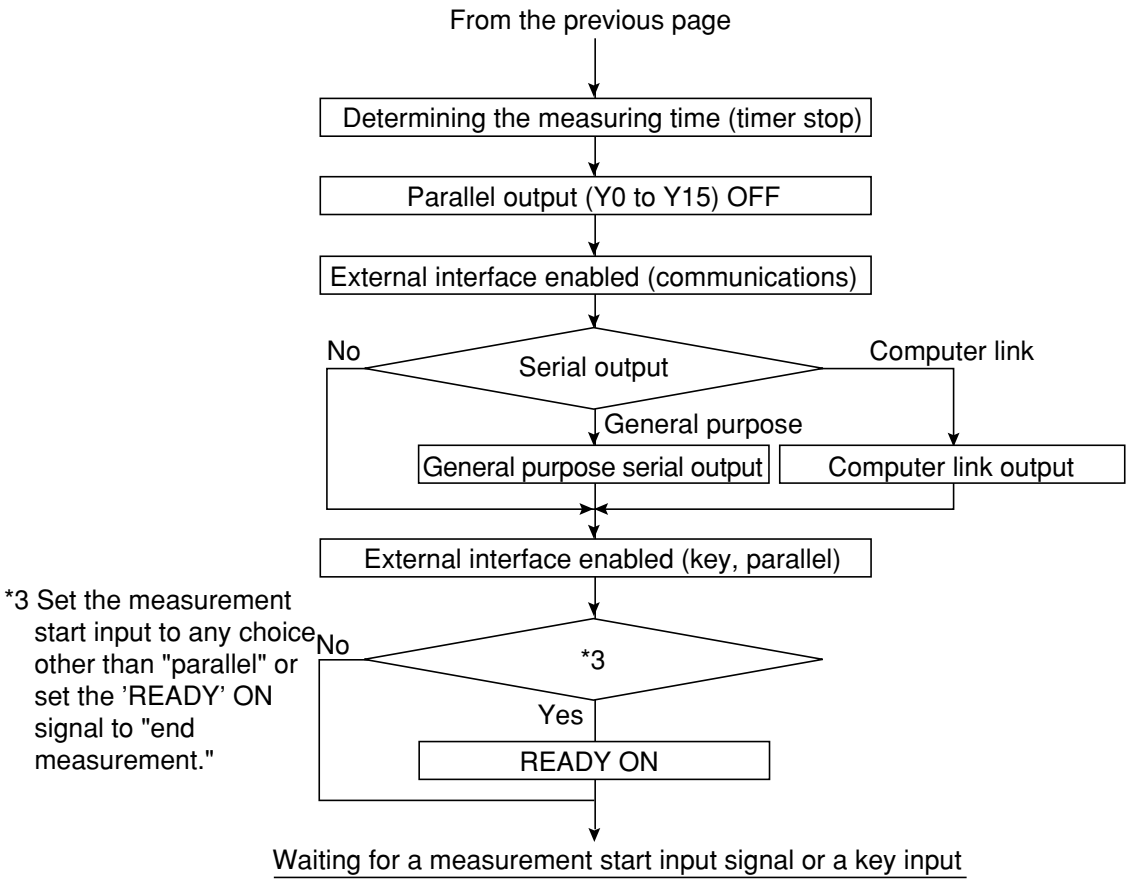
[2] Operation flow after the measurement start input is turned ON.



*1 The measurement start input is set to "PARALLEL" and the 'READY' ON signal to "end of image capture."

1


② (From the preceding page)
① (From the preceding page)
No
Positional correction
Yes
Setting the coordinate correction values (X, Y, θ)
(*2)
Executing measurement 1
Yes
Was an error detected?
No
Executing measurement 2
Yes
Was an error detected?
No
Executing measurement 3
Yes
Was an error detected?
No
Executing measurement 4
Yes
Was an error detected?
No
[Measurement programs that can be selected]
- Positional deviation measurement
- Degree of match inspection
- Lead inspection
- BGA/CSP inspection
- Area measurement by binary conversion
- Counting by binary conversion
- Object identification by binary conversion
- Point measurement
- Multiple position measurement
- Multiple degree of match inspection
The window coordinates are corrected within the range set for each type of measurement, based on the correction value determined in the steps marked with *2.
No
Message display
Yes
Error display
PC calculation
No
Message display
Yes
Displaying the measurement results (values, decisions etc.)
No
Pattern display
Yes
Positional correction yes
No
Yes
Display pattern after correction
Display pattern when setting
To the next page



- When the stop NG measurement option is set to "YES" (page 3-37), the controller stops measuring when an error occurs.

1

1-10 Table of controller functions

Shown below are the functions for the individual controllers (IV-S31M/S32M/S33M).

- For details about the controller hardware (cameras, peripheral devices), see the "IV-S30 (IV-S31M/S32M/S33M) User's Manual, Instruction and Hardware."

Item		Specifications		
		IV-S31M	IV-S32M	IV-S33M
Image sampling system		256 level gray scale, binary conversion, edge detection		
Image memory		One screen for displaying captured images. One monochrome screen for displaying camera information and messages		
No.of assignable object type		16 object types	32 object types	64 object types
Maximum number of reference images stored / number of whole screens stored		300 / 3 screens	600 / 8 screens	
Image scan time	Standard camera (IV-S30C1/C2)	33.3 ms *2		
	High-speed camera (IV-S30C3/C4)	---		16.7 ms [full mode] 8.3 ms [half mode] *2
	Commercially available EIA camera	---		33.3 ms [full mode] 16.7 ms [half mode]
Gray search time *1		18 ms	12 ms	9 ms
Gray search, edge detection precision		Pixel, sub-pixel		
Image pre-processing	Shading correction	Dividing, subtracting, and filtering		
	Comparative calculation between images	Subtracting, absolute value of difference (between camera 1 and reference image, between camera 2 and reference image, between camera 1 and camera 2)		
	Gray level changes	Magnification by "n" processing, γ (+/-) correction, histogram widening, mid-range emphasis		
	Space filter	Smoothing (center/average), edge emphasis, edge extraction, horizontal edge, vertical edge		
Binary threshold value		Fixed and threshold value corrections (variation difference/variation rate)		
Binary noise elimination		Expansion ⇨ contraction, contraction ⇨ expansion, area filter		
Binary image mask		Specified window(rectangle, circle, oval), any binary image mask		
Positional correction method		X/Y correction, rotation correction		
Measurement program (standard menu)	Positional deviation measurement	XY coordinate, deviation amount in X and Y axes, degree of match (1-point search, 2-point search, 1-point edge, 2-point edge, 1-point search and 1-point edge) Angle: ±15 , ±30 , ±45 , 360 (1-point search, 1-point search + 1-point edge) [Maximum 8 windows x 2 models]		
	Degree of match inspection	Degree of match, XY coordinate, density (1-point search, 2-point search) [Maximum 16 windows x 2 models]		
	Area measurement by binary conversion	Area [Maximum 16 windows]		
	Object counting by binary conversion	Quantity (maximum 3,000 items per window), total area [Maximum 4 windows]		
	Object identification by binary conversion	Quantity (maximum 128 per window), total area, area of each object identified, gravity center, main axis angle, fillet diameter, peripheral length, center point [Maximum 4 windows]		
	Point measurement	Number in binary image (maximum 256 points), average density (Maximum 128 points)		
	Lead inspection	Number of leads, distance between leads (max., min.), lead width (max., min.), lead length (max., min.) [Maximum 16 windows]		
	BGA/CSP inspection	Number of labels, total area, area of each label, XY pitch (max., min.) XY fillet diameter (max., min.), [Maximum 4 windows] (IV-S32M/S33M only)		
	Multiple position inspection	Number of objects (max. 128), degree of match, XY coordinate (1-point search, 1-point edge) [Maximum 4 windows]		
	Multiple degree of match inspection	Number of objects (max. 128), degree of match, XY coordinate (1-point search) [Maximum 4 windows]		

*1. The gray search time is true when the search area is 256 x 256 pixels, the model size is 64 x 64 pixels, and the contraction function is set to 3.

*2. Variable, with partial-image capturing.

Item		Specifications		
		IV-S31M	IV-S32M	IV-S33M
Number of measurement programs		Maximum 6 per object type (measurement 0 - camera 1, measurement 0 - camera 2, measurements 1 to 4) Note: Measurement 0 is only used for positional deviation measurement.		
Simplified menu	Positioning	XY coordinate, degree of match (1-point search, 2-point search) [1 window]		
	Existence inspection	Area [Maximum 8 windows]		
Window shape		Rectangle, circle, oval (when using area measurement by binary conversion, object counting by binary conversion, object identification by binary measurement)		
Distance and angle measurement		Measure distance (between two points, X coordinate, Y coordinate), measure angle (3 points, 2 points against horizontal line, 2 points against vertical line), auxiliary point (center, circle center, gravity center, line over 2 points, crossing point of two straight lines)		
Arithmetic operation		Four basic operations (+, -, X, /), root, absolute value, TAN, ATAN, maximum, minimum, average , total.		
NG image memory function		---	Maximum 128 images (8 whole screens)	
Calendar timer		---	Year, month, day, hour, minute	
Other functions		Display measuring time, light level monitor function, crosshair cursor display, change display language between Japanese and English, Run screen lock function, setting menu display "yes/no", change image display (through/freeze), change image brightness (bright/dark)		
Micro PC section	Input relays	Parallel input: 8 points (X0 to X7)		
	Output relays	Parallel output: 8 points (Y0 to Y7) General-purpose serial interface, computer link: 16 points (Y0 to Y15)		
	Auxiliary relays	128 points (C0 to C127), special area 18 points (C110 to C127)		
	Timers	8 points (TM0 to TM7), timer setting range: 0.01 to 9.99 seconds (countdown timer)		
	Counters	8 points (CN0 to CN7), counter setting range: 000 to 999 (counts down)		
External interface	Parallel interface	Input: 8 points, 12/24 VDC, approx. 7 mA (24VDC) Output: 9 points, 12/24 VDC, max. 100 mA, FET output		
	General-purpose serial interface	RS232C/RS422 (2.4 to 115.2 kbps)		
	Computer link	Built-in compatibility with certain SHARP, OMRON, and Mitsubishi models		
	USB	USB device node, 12 Mbps		
Image output		1 channel, EIA 525 lines, 2:1 interlace		
Number of cameras		Maximum of 2		
Make settings		Using the IV-S30RK1 remote keypad and/or the IV-S30SP parameter setting support software		
Measurement start input	Internal trigger	CCD trigger (using the CCD camera)		
	External trigger	Trigger input (parallel I/F), general-purpose serial I/F, keypad trigger (for manual measuring)		
Terminal block	Interrupt processing input	1 point: External trigger (X0)		
	Inputs	7 points: Object type change (X1 to X4), external input (X5 to X7)	7 points: Object type change (X1 to X5), external input (X6 and X7)	7 points: Object type change (X1 to X6), external input (X7)
	Common for input	1 point: + or - common		
	Output	9 points: 1 READY , 8 user settable logical outputs (Y0 to Y7)		
	Common for output	1 point: + or - common		
	Power supply	2 points: +24 VDC, 0 V		

Chapter 2: Setting the Operating and System Conditions

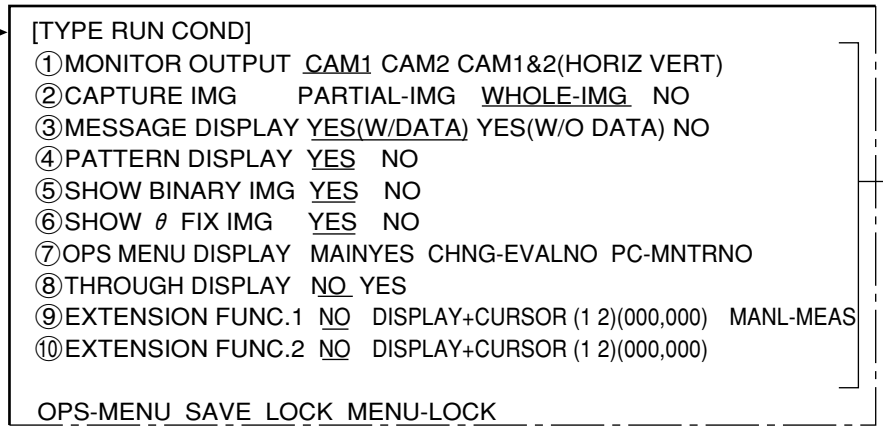
2-1 Setting the operating conditions

Set the following operating condition items on the [TYPE RUN COND] menu for each object type.

■ [TYPE RUN COND] menu

● **When IV-S33M is used.**

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



* The display shows that the camera setting is set to "Standard/high speed", and "CAM1&2" are selected.

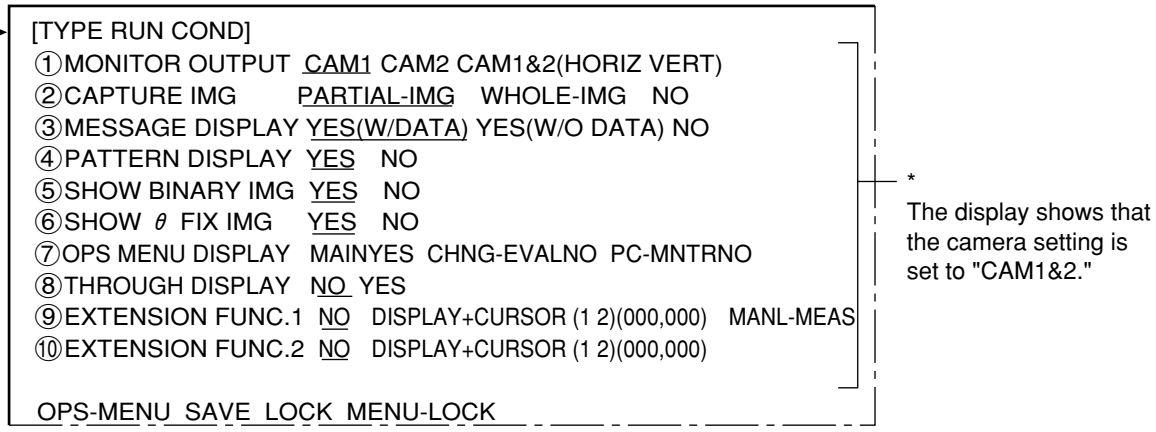
* The items displayed for selection on the "①MONITOR OUTPUT" and "②CAPTURE IMG" lines vary with the CAMERA TYPE [SYSTEM COND] (page 2-19) and SELECT CAMERA [TYPE MEAS COND] (page 3-1).

⑨CAMERA TYPE on the [SYSTEM COND] menu		Set for each object type (0 to 63)		
		②SELECT CAMERA on the [TYPE MEAS COND] menu	[TYPE RUN COND] menu	
①SELECT CAMERA	③CAPTURE IMG MODE		①MONITOR OUTPUT	②CAPTURE IMG
Standard	---	Camera 1 &2	- Camera 1 - Camera 2 - Camera 1 & 2 (vertical, horizontal)	- Partial - Whole - None
		Camera 1 and NG image	- Camera 1 - NG image - Camera 1 & NG image (vertical, horizontal)	
High speed	- Full - Half - Full + half	Camera 1 &2	- Camera 1 - Camera 2 - Camera 1 & 2 (vertical, horizontal)	- Partial - Whole - None
		Camera 1 and NG image	- Camera 1 - NG image - Camera 1 & NG image (vertical, horizontal)	
EIA	- Full - Half	Camera 1 &2	- Camera 1 - Camera 2 - Camera 1 & 2 (vertical, horizontal)	- Whole - None
		Camera 1 and NG image	- Camera 1 - NG image - Camera 1 & NG image (vertical, horizontal)	

2

● **When IV-S31M, IV-S32M is used.**

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



* The items displayed for selection on the "①MONITOR OUTPUT" lines vary with the SELECT CAMERA [TYPE MEAS COND] (page 3-1).

Set for each object type (IV-S32M: 0 to 31, IV-S31M: 0 to 15)	
②SELECT CAMERA on the [TYPE MEAS COND] menu	①MONITOR OUTPUT on the [TYPE RUN COND] menu
Camera 1 &2	- Camera 1 - Camera 2 - Camera 1 & 2
Camera 1 and NG image	- Camera 1 - NG IMAGE - Camera 1 & NG IMAGE

[1] Monitor output

When two cameras have been connected to IV-S30, 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

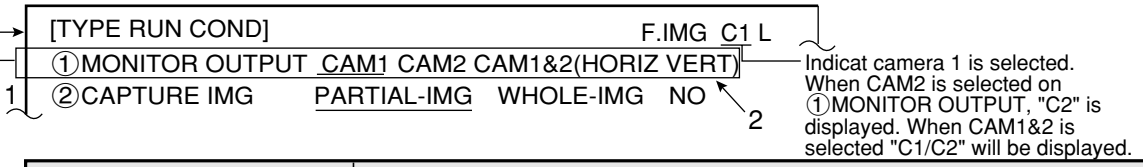
The monitor can be switched by two methods, i.e. key pressing or parallel input.

(1) Monitor output switching by key presses

To specify a monitor, select the "①MONITOR OUTPUT" option on the [TYPE RUN COND] menu. Before making this setting, select the cameras whose images will be shown (Camera 1 & 2, Camera 1 & NG image). ⇨ See page 3-3.

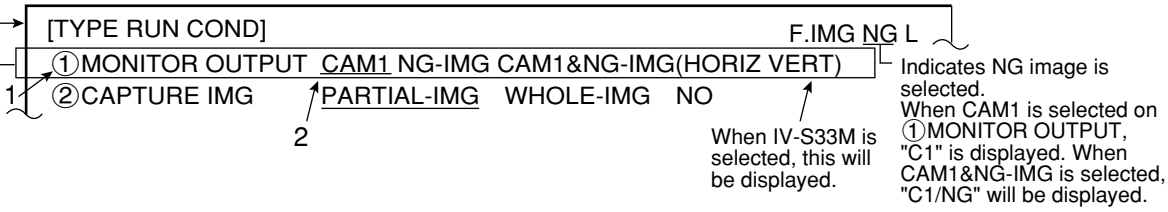
On the MAIN OPS menu screen, move the cursor to [TYPE RUN COND], and press the SET key.

● When CAM1&2 is selected for use.



①MONITOR OUTPUT	Description
CAM1	Display the camera 1 image on the whole screen.
CAM2	Display the camera 2 image on the whole screen.
CAM1&2*1	Display the camera 1 image on upper half, and the camera 2 image on lower half.
CAM1&2(HORIZ VERT)*2	
CAM1&2(HORIZ VERT)*2	Display the camera 1 image on left half, and the camera 2 image on right half.

● When CAM1&NG-IMG is selected for use



①MONITOR OUTPUT	Description
CAM1	Display the camera 1 image on the whole screen.
NG-IMS	Display the image on the whole screen
CAM1&NG-IMG*1	Display the camera 1 image on upper half, and the NG image on lower half.
CAM1&NG-IMG*2 (HORIZ VERT)	
CAM1&NG-IMG*2 (HORIZ VERT)	Display the camera 1 image on left halt, and the NG image on right half.

*1 : When IV-S31M/S32M is used *2 : When IV-S33M is used

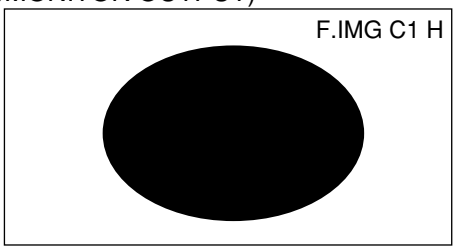
■ Operating procedure

1. Move the cursor to "①MONITOR OUTPUT" using the up and down keys and press the SET key.
2. When "CAM1&2" is selected for use, move the cursor to "CAM1," "CAM2" or "CAM1&2(HORIZ VERT)" using the left and right keys and press the SET key. When "CAM1&NG-IMG" is selected for use, move the cursor to "CAM1," "NG-IMG" or "CAM1&NG-IMG(HORIZ VERT)" using the left and right keys and press the SET key.

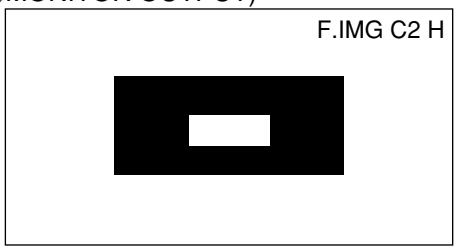
2

■ **Display examples on the MAIN OPS MENU**

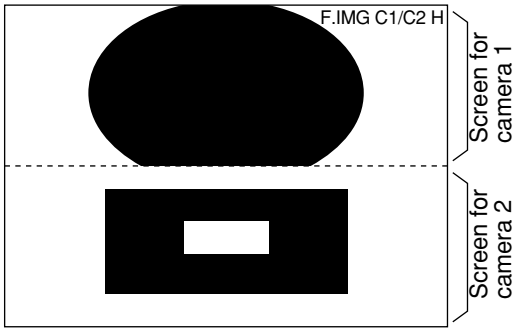
- Camera 1 on the whole screen
(When "CAM1" has been specified in item ①MONITOR OUTPUT)



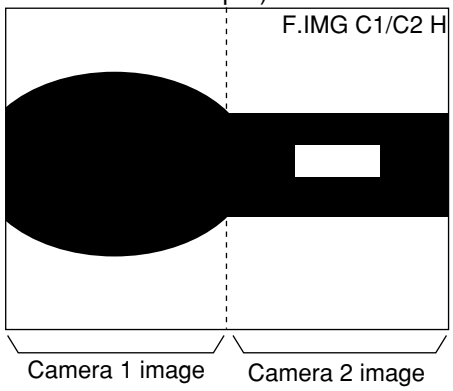
- Camera 2 on the whole screen
(When "CAM2" has been specified in item ①MONITOR OUTPUT)



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



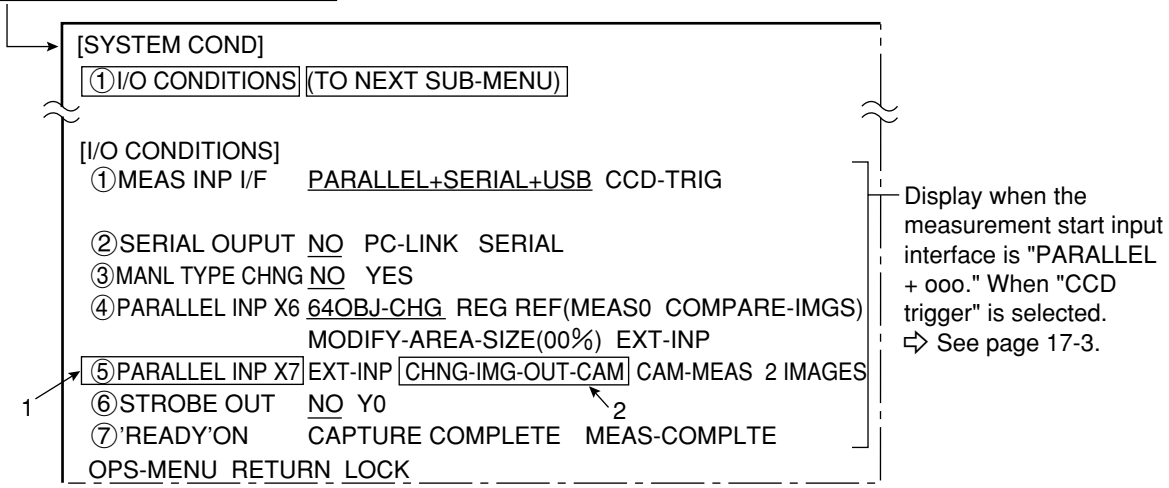
(When "CAM1&2 (VERT)" is specified for the monitor output)



When the monitor output is "NG-IMG" and "CAM1&NG-IMG (HORIZ VERT)" is selected, the same display will be seen.

(2) Output monitor switching by parallel input

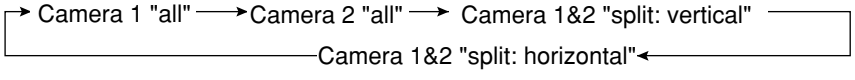
On the [MAIN OPS MENU], move the cursor to "SYS-CND" item, and press the SET key.
⇨ Move the cursor to "①I/O CONDITIONS (input/output conditions)" on the [SYSTEM COND] menu, and press the SET key.



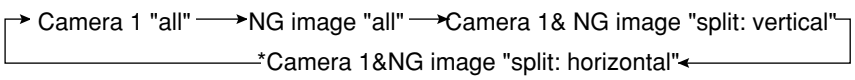
1. Select "PARALLEL INP X7" using the up and down keys and press the SET key.
2. Select "CHNG-IMG-OUT-CAM" using the up and down keys and press the SET key.

Every time the X7 signal is turned from OFF to ON, the selected camera display will be changed as follows:

- When "CAM1&2" is selected



- When "CAM1&NG-IMG" is selected *When IV-S33M is used.

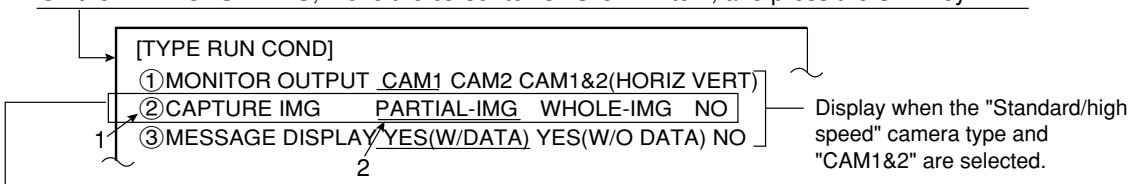


The display example of the MAIN OPS menu is the same as in section (1) above.

[2] Image capture

In item "CAPTURE IMG" on the [TYPE RUN COND] menu, specify the range of lines which will be captured during operation.

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



②CAPTURE IMG	Description
PARTIAL-IMG (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-IMG" mode. Note: When the IV-S33M is used and "EIA" is selected for the camera, "PARTIAL-IMG" cannot be selected. (The "PARTIAL-IMG" selection is not displayed.) ⇨ See page 2-1.
WHOLE-IMG (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. Note: When the IV-S33M is used and "FULL+HALF" is selected for the image capture mode (page 2-19 to 2-20), the controller will process the whole area in full mode.
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-S30.

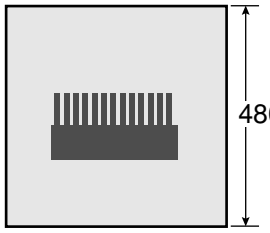
■ Operation procedure

1. On the [TYPE RUN COND] menu, move the cursor to item "CAPTURE IMG" with the up and down keys, and press the SET key.
2. Move the cursor to "PARTIAL-IMG," "WHOLE-IMG" or "NO" with the left and right keys, and press the SET key.

■ Example of a comparison of the capture times

- When "Whole" is selected
  - IV-S33M
    - 16.7 ms (high-speed camera and full mode)
    - 8.3 ms (high-speed camera and half mode)
    - 33.3 ms (standard camera)
  - IV-S31M/S32M — 33.3 ms (standard camera)

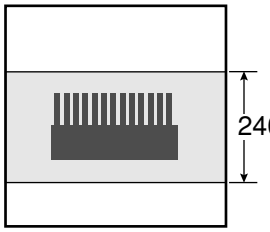
Capture whole image



- Image capture mode (full/half mode) ⇨ See page 2-20.

- When "Partial" is selected (when there are 240 scan lines)
  - IV-S33M
    - 8.3 ms (high-speed camera and full mode)*
    - 4.2 ms (high-speed camera and half mode)*
    - 12.5 ms (high-speed camera and full + half mode)*
    - 16.6 ms (standard camera)
  - IV-S31M/S32M — 16.6 ms (standard camera)

Capture partial image

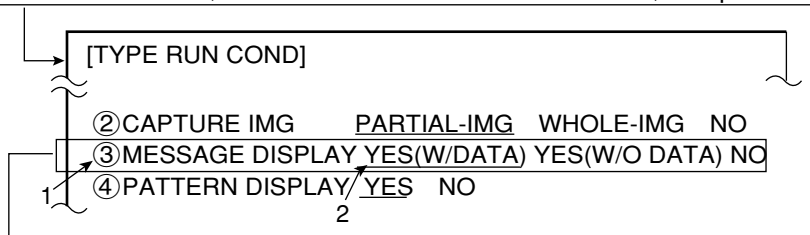


* The image capture time may vary with the position of the partial image. (In the following case, maximum 0.4 ms)

[3] Message display

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

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



③ MESSAGE DISPLAY	Description
YES (W/DATA)	All data will be displayed.
YES (W/O DATA)	Data other than the numerical result will not be displayed.
NO	No messages will be displayed.

Setting to "NO" reduces the processing time.

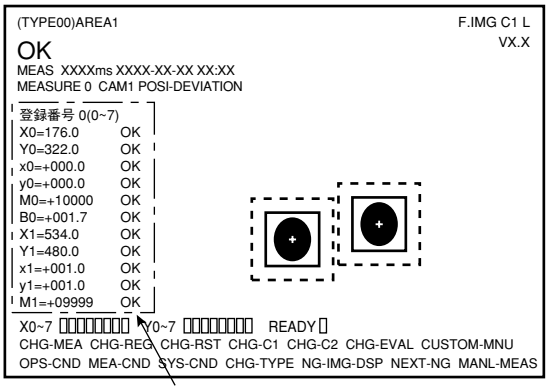
YES (NUMERIC) > YES (NO NUMERIC) > NO

■ Operation procedure

1. On the [TYPE RUN COND] menu, move the cursor to item "MESSAGE DISPLAY" with the up and down keys, and press the SET key.
2. Move the cursor to "YES (W/DATA)," "YES (W/O DATA)" or "NO" with the left and right keys, and press the SET key.

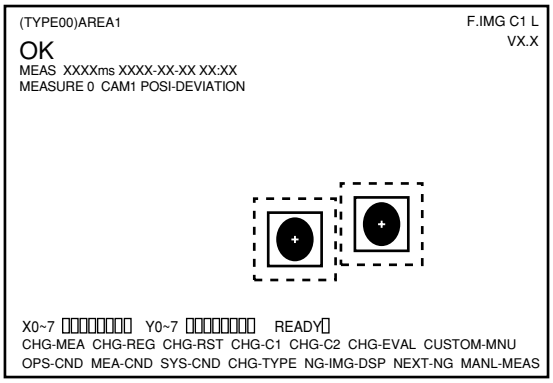
■ Display examples

- When "YES" (with numeric results) is selected

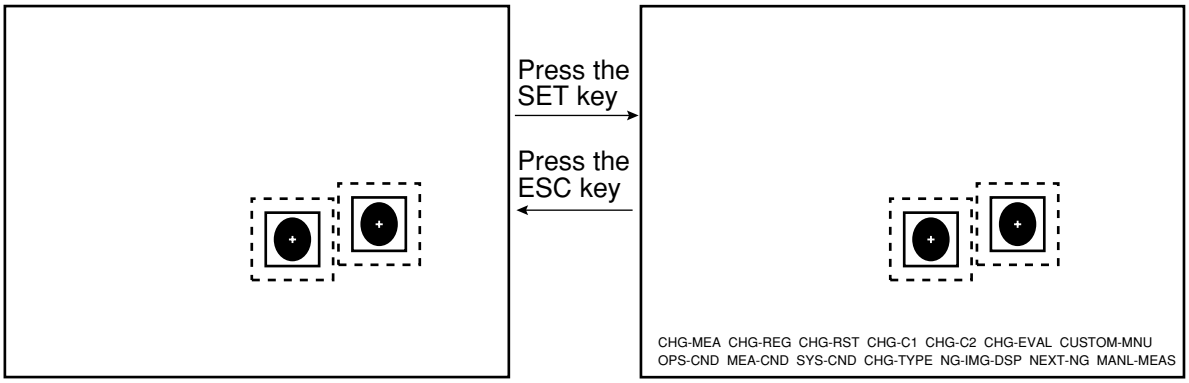


Can be deleted by pressing the SET key.

- When "YES" (without numeric results) is selected



- When "NO" is selected



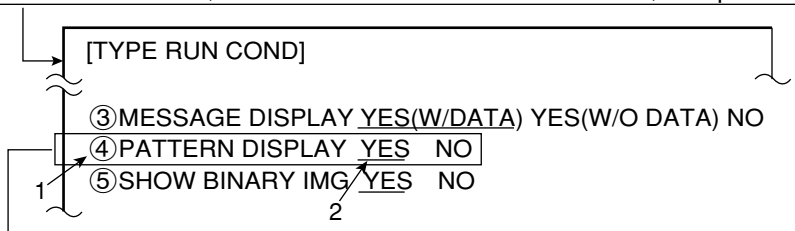
The menu bar will be displayed

[4] Pattern display

Select "YES" or "NO" to determine whether to display (windows and other marking) over an image displayed on the MAIN OPS MENU.

Note: When "CAM1&2(HORIZ VERT)" or "CAM1&NG-IMG(HORIZ VERT) is selected on the "MONITOR OUTPUT" (page 2-3), pattern display cannot be selected.

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



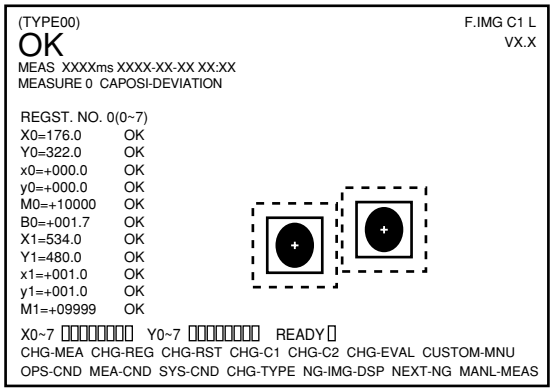
④PATTERN DISPLAY	Description
YES	When "With correction" (page 3-27) is selected on the "MEASURE0 CAM 1/2" line on the [TYPE MEAS COND] menu,The pattern display will be corrected on the MAIN OPS MENU.
NO	Patterns will not be displayed on the MAIN OPS MENU.

■ Operation procedure

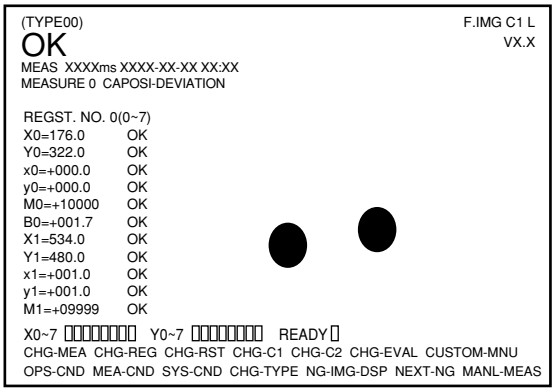
1. On the [TYPE RUN COND] menu, move the cursor to item "④PATTERN DISPLAY" with the up and down keys, and press the SET key.
2. Move the cursor to "YES" or "NO" with the right and left keys, and press the SET key.

■ Display example

- When setting the Measurement output conditions



- When setting NO

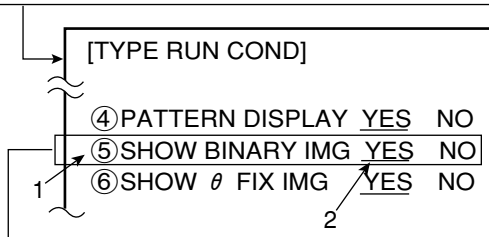


[5] Binary image display

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

Note: When "CAM1&2(HORIZ VERT)" or "CAM1&NG-IMG(HORIZ VERT)" is selected on the "MONITOR OUTPUT" (page 2-3), the binary image display cannot be selected.

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



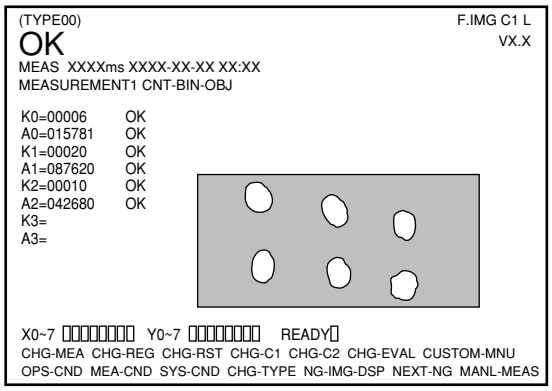
⑤SHOW BINARY IMG	Description
YES	A binary image will be displayed on the MAIN OPS MENU.
NO	A binary image will not be displayed on the MAIN OPS MENU.

■ Operation procedure

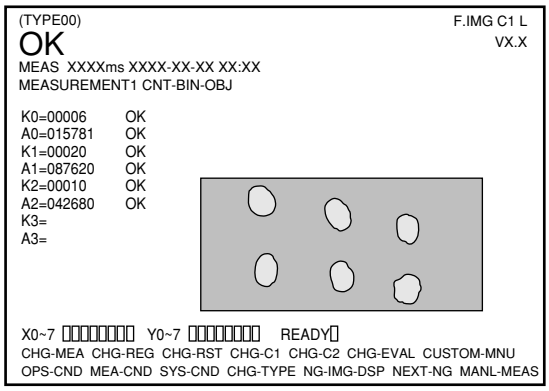
1. On the [TYPE RUN COND] menu, move the cursor to item "SHOW BINARY IMG" with the up and down keys, and press the SET key.
2. Move the cursor to "YES" or "NO" with the left and right keys, and press the SET key.

■ Display example

When "YES" is selected



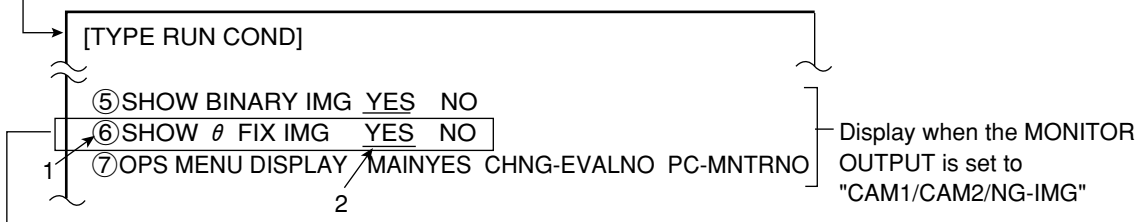
When "NO" is selected



[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 "OPS-CND" item, and press the SET key.

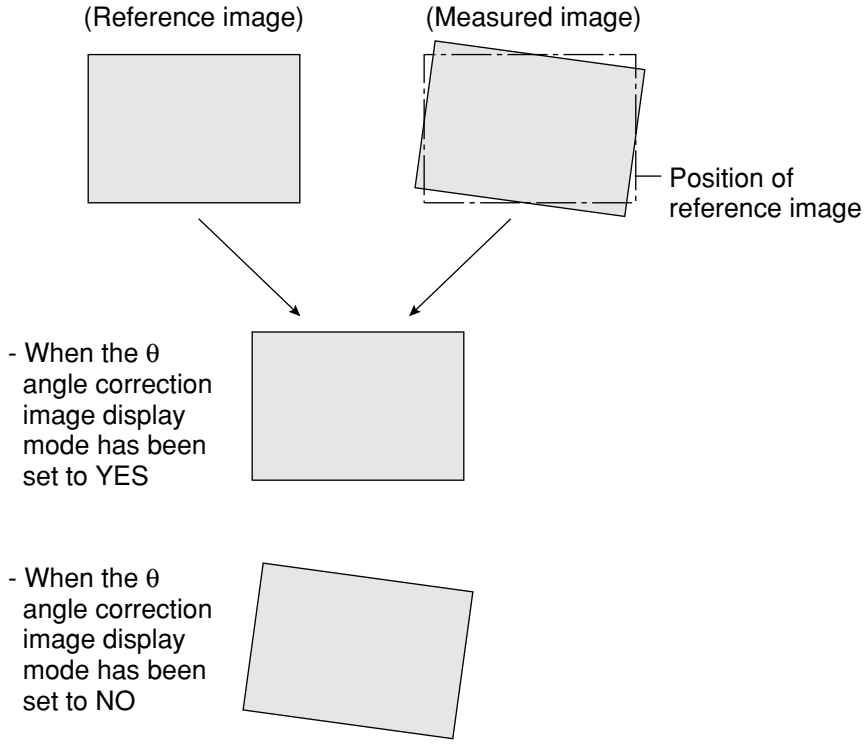


SHOW FIX θ IMG	Description
YES	A θ angle corrected image will be displayed on the MAIN OPS MENU.
NO	A θ angle corrected image will not be displayed on the MAIN OPS MENU.

■ Operation procedure

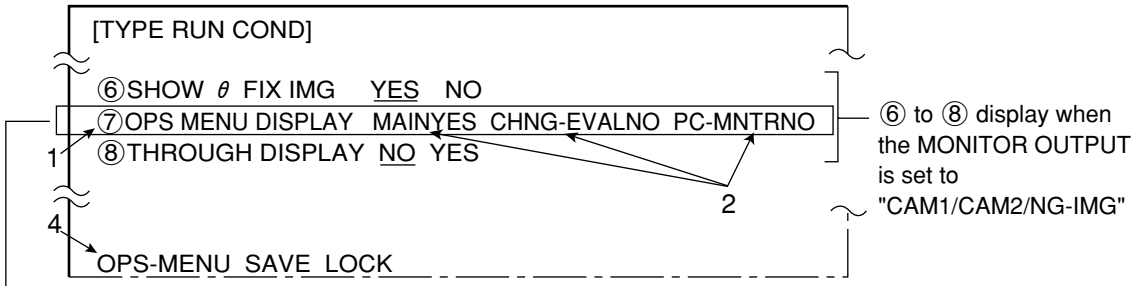
1. On the [TYPE RUN COND] menu, move the cursor to item "SHOW θ FIX IMG" with the up and down keys, and press the SET key.
2. Move the cursor to "YES" or "NO" with the left and right keys, and press the SET key.

■ Display examples



[7] Operation menu display

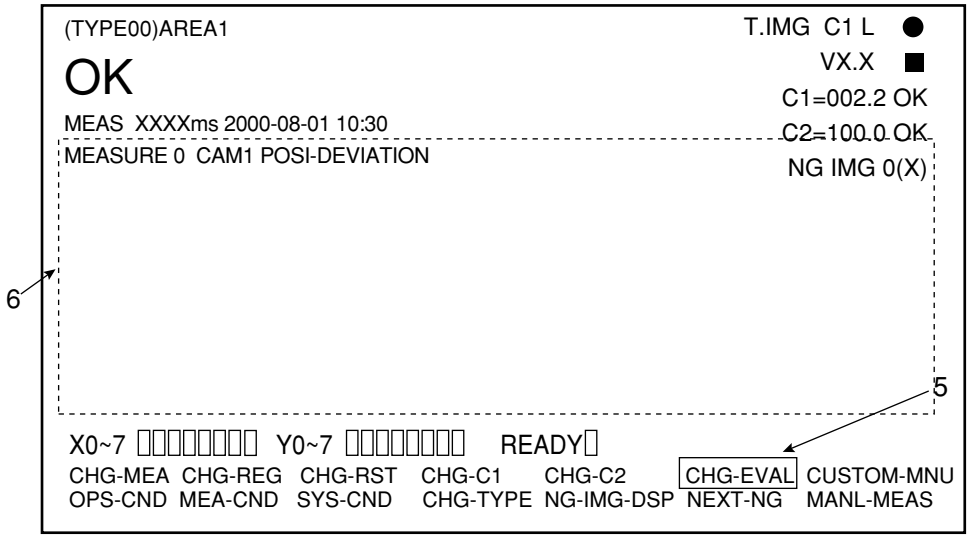
Select whether or not to display the MAIN, CHNG-EVAL (change evaluation), and PC MNTR menus on the MAIN OPS MENU. To display the screens, press the "CHG-EVAL" item on the MAIN OPS MENU.



⑦OPS MENU DISPLAY	Description
MAIN	Set the MAIN item to "YES," to display the operation main screen.
CHNG-EVAL	Set the CHNG-EVAL item to "YES" to display the evaluation condition change screen.
PC MNTR	Set the PC MNTR item to "YES" to display the PC monitor screen.

■ Operation procedure

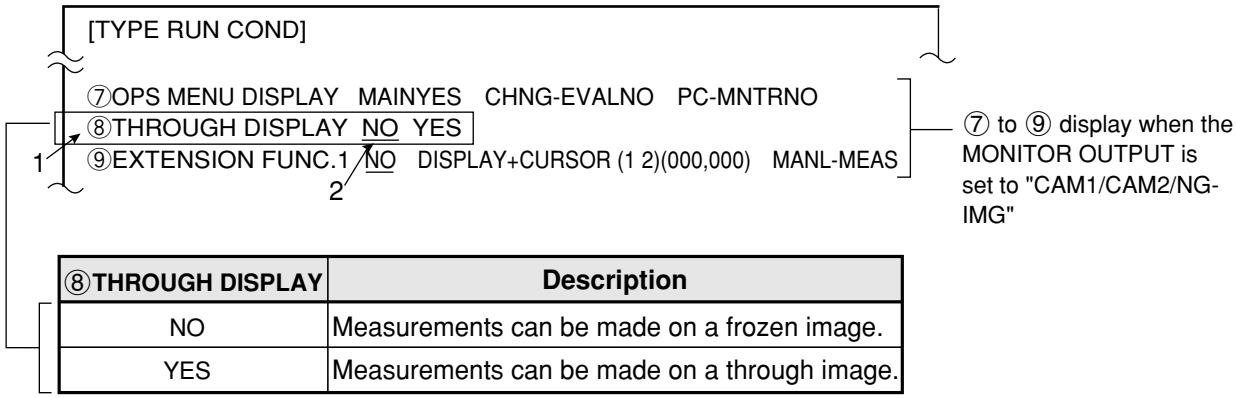
1. On the [TYPE RUN COND] menu, move the cursor to item "⑦OPS MENU DISPLAY" with the up and down keys.
2. Move the cursor to the "MAIN," "CHNG-EVAL," or "PC MNTR" item using the left and right keys. Select whether or not to enable the displays using the up and down keys.
3. Press the SET key to complete the settings.
4. Move the cursor to "OPS-MENU" and press the SET key.
   ⇨ The screen will return to the MAIN OPS MENU.



5. Move the cursor to "CHG-EVAL" using the left and right keys.
6. Press the up and down keys.
   ⇨ The screen display will change in the following sequence.
   Main screen → evaluation condition screen → PC monitor screen → main screen →···

[8] Through display

Select the desired measurement image status (FREEZE or THROUGH) by chosing either "YES" or "NO" on the MAIN OPS MENU.



⑧THROUGH DISPLAY	Description
NO	Measurements can be made on a frozen image.
YES	Measurements can be made on a through image.

■ Operation procedure

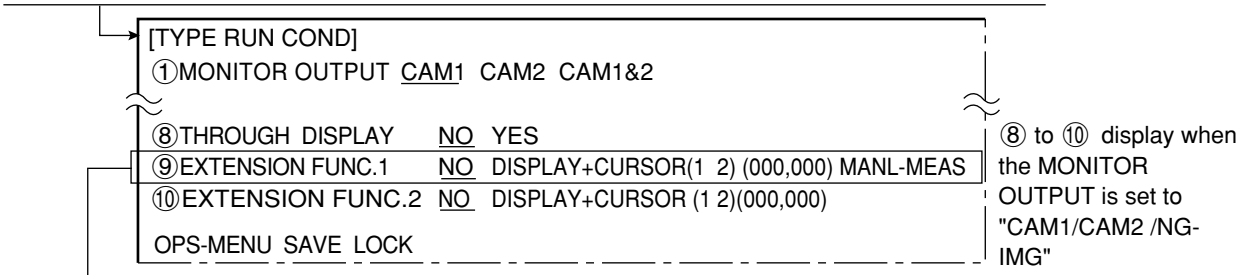
1. On the [TYPE RUN COND] menu, move the cursor to item "THROUGH DISPLAY" with the up and down keys, and press the SET key.
2. Move the cursor to "NO" or "YES" with the left and right keys, and press the SET key.

[9] Extension functions

Two extension functions are included: Extension function 1 (crosshair cursor display, manual measurements) and Extension function 2 (crosshair cursor display).

(1) Extension function 1 (crosshair cursor display, manual measurements)

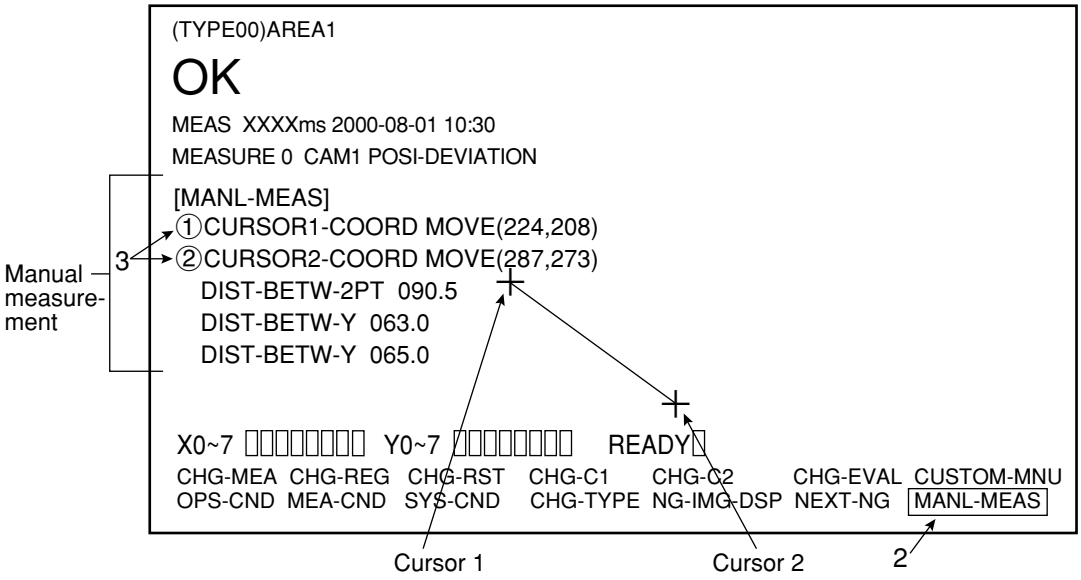
On the MAIN OPS MENU move the cursor to "OPS-CND" item, and press the SET key.



EXTENSION FUNC.1	Description
NO	Select when you will not use the extension function
DISPLAY + CURSOR (1 2)	The crosshair cursor can be displayed on any position. - "1" equals a 16-pixel line. "2" equals a full line. - The initial coordinates of the crosshair cursor center are (225, 240)
MANL-MEAS	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.

■ Operation procedure

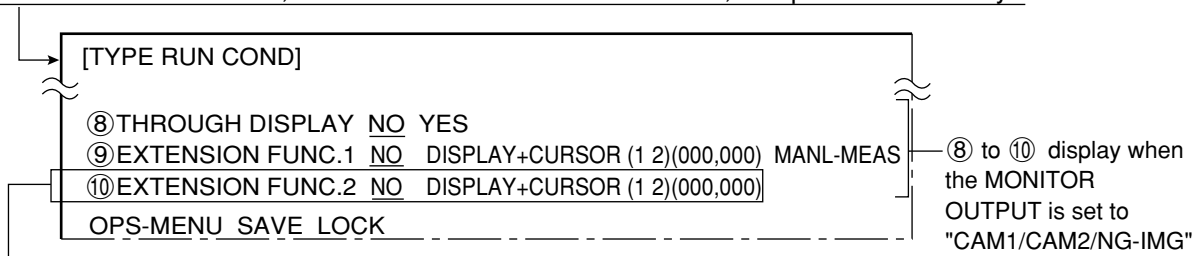
1. On the [TYPE RUN COND] menu, move the cursor to item "EXTENSION FUNC.1," with the up and down keys, and press the SET key.
2. Move the cursor to "NO," "DISPLAY + CURSOR (1 2)," or "MANL-MEAS" with the left and right keys, and press the SET key.
   - When "DISPLAY + CURSOR (1 2)" is selected
     1. Move the crosshair cursor using the up/down and left/right keys (one pixel at a time).
     2. When the position is correct, press the SET key.
   - When "MANL-MEAS" is selected
     1. Return to the MAIN OPS MENU.
     2. Move the cursor to "MANL-MEAS" on the menu bar, and press the SET key.
        ⇨ The menu items of the manual measurement will appear.



3. Select either ① (Cursor 1) or ② (Cursor 2) using the up and down keys, and press the SET key.
4. Move the cursor 1 or 2 using the up/down and left/right keys (one pixel at a time).
   ⇨ The each coordinate, the distance between two points, X coordinate distance, and Y coordinate distance will be displayed at real time.
5. When the position is correct, press the SET key.
6. After completing the operation, press the ESC key.
   ⇨ The menu for manual measurement will disappear.

(2) Extension function 2 (crosshair cursor display)

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



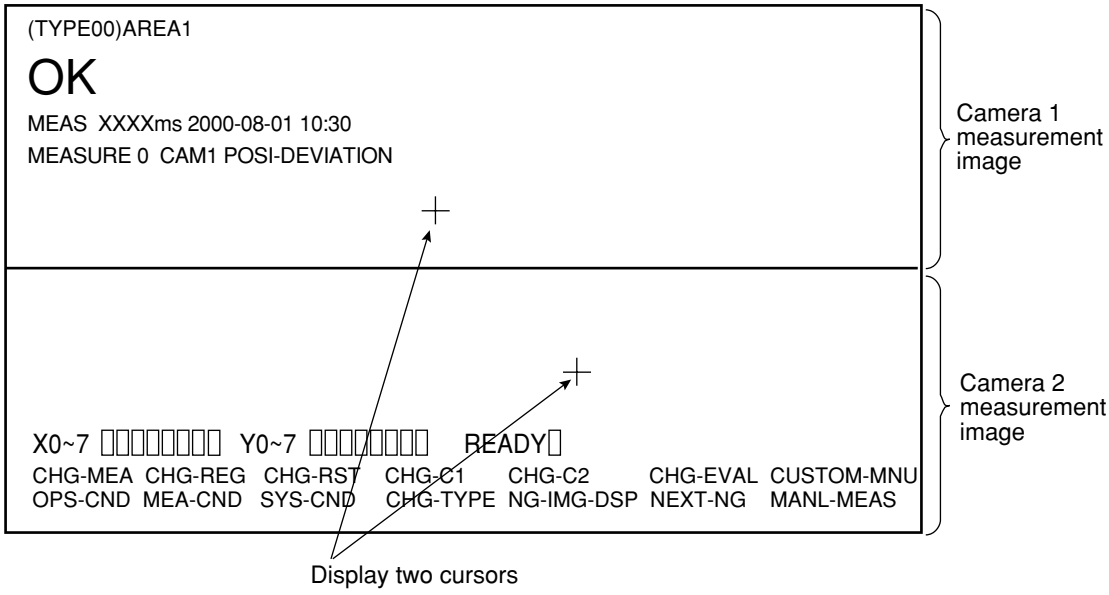
EXTENSION FUNC.2	Description
NO	Select when you will not use the extension function
DISPLAY +CURSOR(1,2)	The crosshair cursor can be displayed on any position. - "1" equals a 16-pixel line. "2" equals a full line. - The initial coordinates of the crosshair cursor center are (225, 240)

■ **Operatiing procedure**

1. On the [TYPE RUN COND] menu, move the cursor to "EXTENSION FUNC.2" with the up and down keys, and press the SET key.
2. Move the cursor to "DISPLAY+CURSOR(1 2)" and press the SET key.
3. Move the crosshair cursor using the up/down and left/right keys (it moves one pixel at a time).
4. After the position is determined, press the SET key.

Using "⑩EXTENSION FUNC.1" simultaneously, you can have two crosshair cursors while the monitor outputs CAM1&2(HORZ VERT).

[Display example]



2-2 Setting the system conditions

Set the following items on the [SYSTEM COND] menu to set the system conditions for the controllre (IV-S31M/S32M/S33M).

2

Set item	Reference page
Camera setting	2-19
Manual change of object type	See below
Initialization	2-15
Self-diagnosis	2-16
Timing	2-17
Gain/offset adjustment	2-18

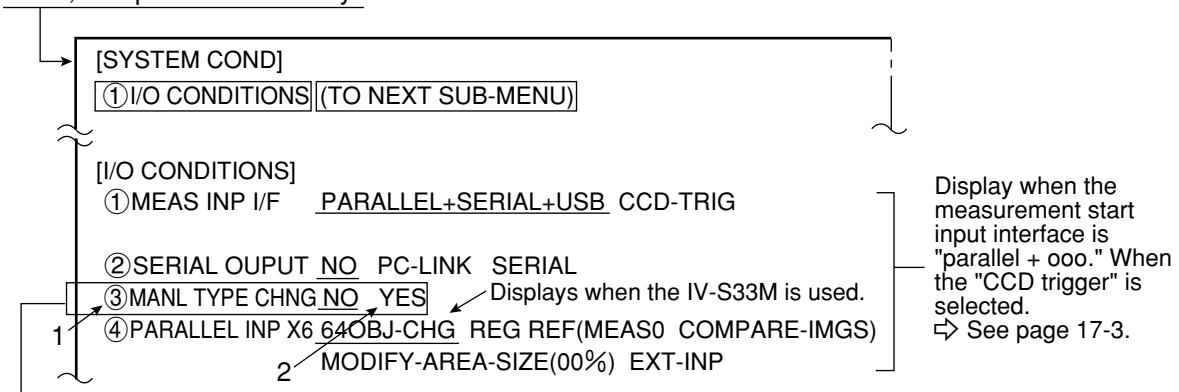
For the following items, see the pages listed below.
- Input/output conditions ⇨ page 17-1
- Communication setting ⇨ page 17-19
- Computer link ⇨ page 17-20
- Menu selection ⇨ page 1-3

[1] Manually setting the object type

On the MAIN OPS MENU, the object type (IV-S33M: 00 to 63, IV-S32M: 00 to 31, IV-S31M: 00 to 15) can be changed manually (using the remote key pad).

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

⇨ Move the cursor to "①I/O CONDITIONS (input/output conditions)" on the [SYSTEM COND] menu, and press the SET key.



④MANL TYPE CHNG	Description
YES	The type can be manually changed on the MAIN OPS MENU. Note: If MANL TYPE CHNG is set to YES, the type cannot be changed with an external interface (parallel I/O or general purpose serial interface).
NO	The type cannot be manually changed on the MAIN OPS MENU.

■ Operation procedure

1. On the [I/O CONDITIONS] menu, move the cursor to item "MANL TYPE CHNG" with the up and down keys, and press the SET key.
2. Move the cursor to "YES" with the left and right keys, and press the SET key.

■ Changing the object type on the MAIN OPS MENU (page 1-4)

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

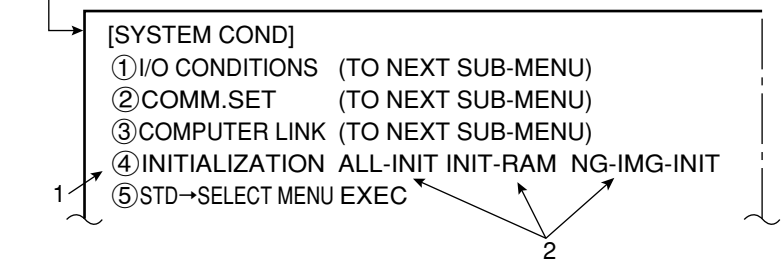
[2] Total initialization, RAM initialization, and NG image initialization

When you newly set conditions, it is recommended that you first initialize the settings. The following conditions should be initialized.

The IV-S30 has three initialization modes: "ALL-INIT" (initialize PROM and RAM), "INIT-RAM" (initialize RAM), and "NG-IMG-INT" (initialize NG image) (See page 1-22 when the IV-S32M/S33M is used.). You can initialize the object type conditions by selecting the "INITIALIZATION" item on the [OBJECT TYPE SYS.] menu.

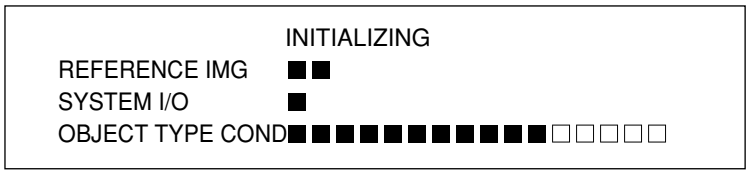
■ Operating procedure

On the [MAIN OPS MENU], move the cursor to "SYS-CND" and press the SET key.



1. Move the cursor to item "④INITIALIZATION" with the up and down keys, and press the SET key.
2. Select ether "ALL-INIT," "INIT-RAM" or "NG-IMG-INIT: when the IV-S32M/S33M is used" and press the SET key.
3. 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 "ALL-INIT" or "RAM-INIT" is executed



- When "NG-IMG-INT" is selected.

When initialization is complete, the message "INITIALIZING" (initializing) will change to "COMPLETE INIT" (complete initialization).

[3] Self-diagnosis

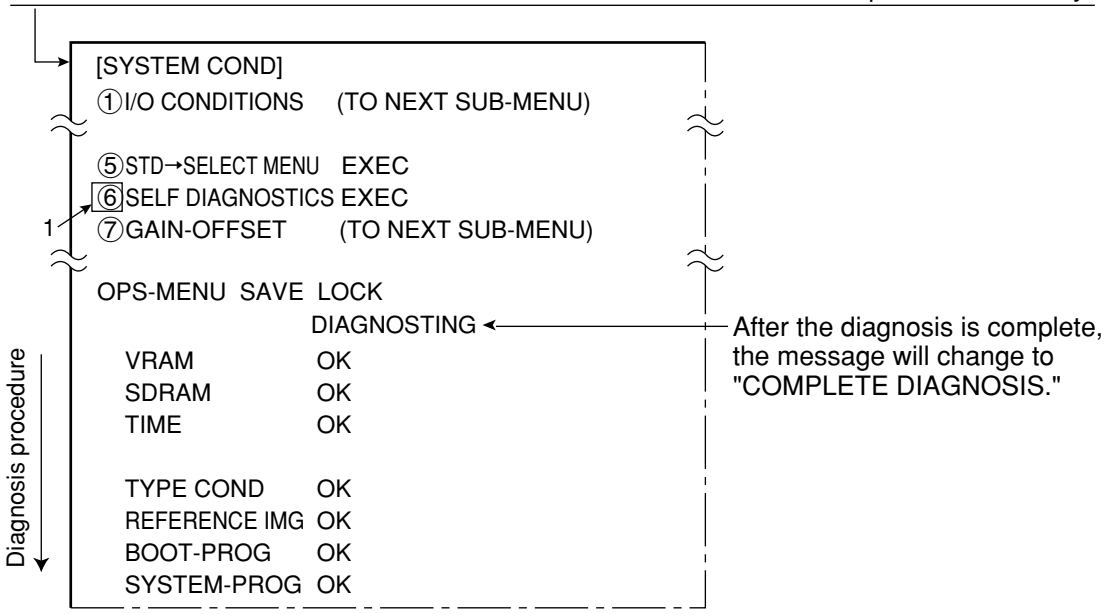
The IV-S30 can check all of its own hardware, to ensure that it is operating normally.

(1) Diagnostic items and methods

Item	Object	Check method	Error display
VRAM	VRAM (memory)	Read after write	NG
SDRAM	SDRAM (memory)	Read after write	NG
Timer			NG
Object type conditions	Flash memory	Checksum	NG + error object No.
Reference image	Flash memory	Checksum	NG
Boot program	Flash memory	Checksum	NG
System program	Flash memory	Checksum	NG

(2) Operating procedure

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



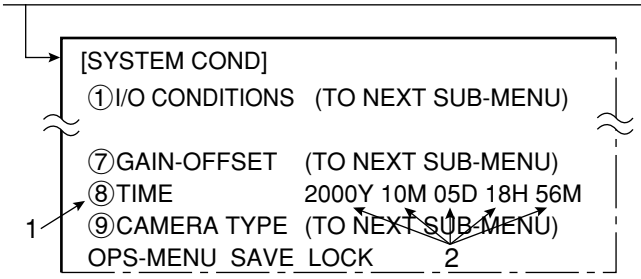
1. Move the cursor to item "⑥SELF DIAGNOSTICS" with the up and down keys, and press the SET key.
   ⇨ The [SELF DIAGNOSITICS] menu will be displayed, and each item will be checked. If the result of each diagnosis is normal, OK will be displayed. If the result is abnormal, NG will be displayed.

[4] Setting the system time (IV-S32M/S33M)

When the IV-S32M/S33M is used, set the time displayed on the monitor. This setting is available only the IV-S32M.
Set the time on the "⑧TIME" line of the [SYSTEM COND] menu.

■ Operating procedure

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



1. Move the cursor to the "⑧TIME" item using the up and down keys, and press the SET key.
2. Move the cursor to "SEC.," "MIN.," "D," "M," and "Y" using the left and right keys, and enter the correct value at each location using the up and down keys.
   Y = 1999 to 2098
   M = 01 to 12
   D = 01 to 31
   H = 00 to 23
   MIN. = 00 to 59
3. Press the SET key. The time will be set and the system will start using the new time.

[5] Gain/offset adjustment

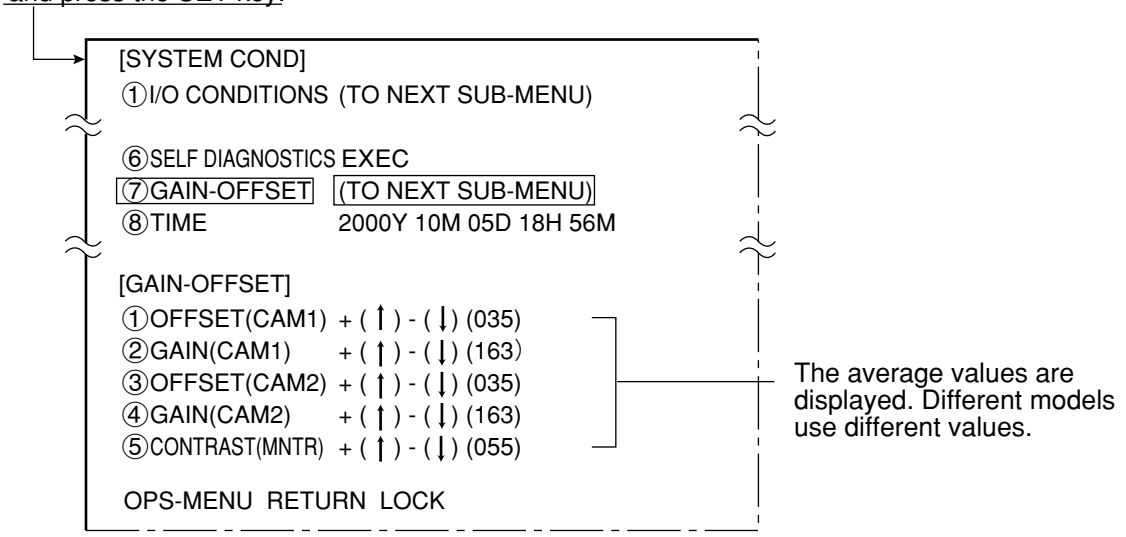
The gain and offset of the IV-S30 can only be adjusted by our service engineers. Users must not try to change them.

2

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-S30 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 "SYS-CND" and press the SET key.

⇨ On the [SYSTEM COND] menu, move the cursor to item "⑦GAIN-OFFSET" and press the SET key.



Gain and offset adjustment	Details of adjustment (selection)
①OFFSET (CAM1)	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.
②GAIN (CAM1)	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.
③OFFSET (CAM2)	The offset for camera 2 is adjusted with the up and down keys. - The adjustment procedure is the same as that in Item ①.
④GAIN (CAM2)	The gain for camera 2 is adjusted with the up and down keys. - The adjustment procedure is the same as that in Item ②.
⑤CONTRAST (MNTR)	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.

2-3 Camera settings

The cameras that are compatible with the controller (IV-S31M/S32M/S33M) are as follows:

Controller	Compatible cameras
IV-S31M	IV-S30C1 (standard camera)
IV-S32M	IV-S30C2 (micro camera)
IV-S33M*	IV-S30C1 (standard camera) IV-S30C2 (micro camera)
	IV-S30C3 (high-speed camera) IV-S30C4 (micro, high-speed camera)
	EIA cameras (commercially available)

* Mixed use of different camera types is not supported.

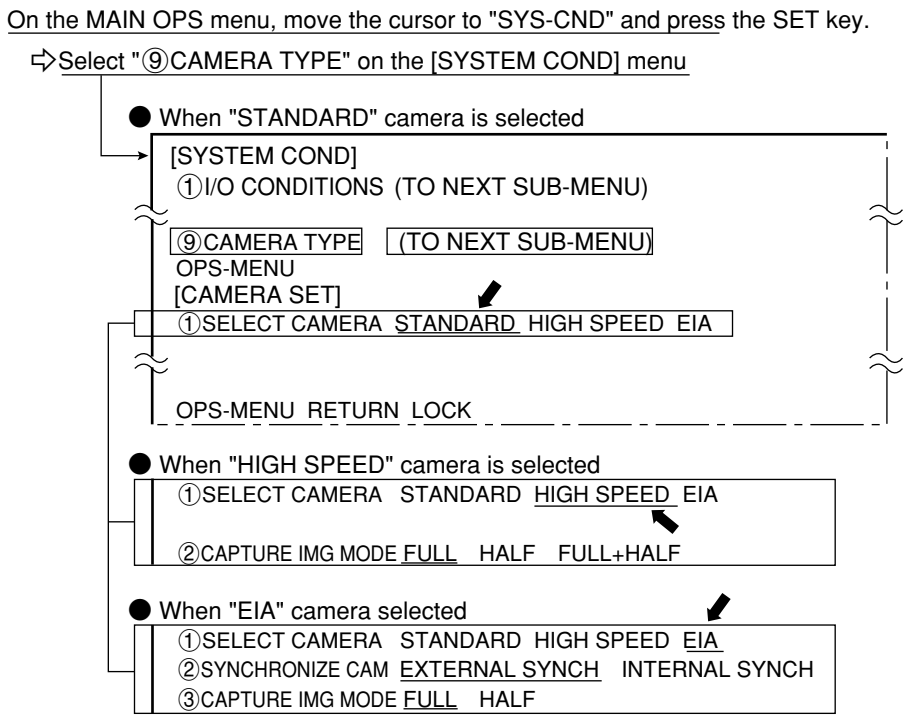
Select the camera specifications (camera synchronization, image capture mode) in "CAMERA TYPE" on the [SYSTEM COND] menu, according to the camera you are using.

● **When the IV-S31M/S32M used**

The IV-S31M/S32M can only support standard cameras (IV-S30C1/C2). That is why no setting alternatives are shown for the camera type.

● **When the IV-S33M used**

The IV-S33M can be connected to standard cameras (IV-S30C1/C2), high-speed cameras (IV-S30C3/C4), and commercially available EIA cameras.



Compatible cameras		IV-S30C1 (standard) IV-S30C2 (micro)	IV-S30C3 (high-speed) IV-S30C4 (micro and high-speed)	EIA camera (commercially available)
Camera settings (system condition-s)	**Camera selection**	Standard	High speed	EIA
	Camera synchronization ⇨ See [2]	---	---	External or internal synchronization
	Image capture mode ⇨ See [1]	---	Full, half, or full + half mode	Full or half mode

[1] Image capture mode

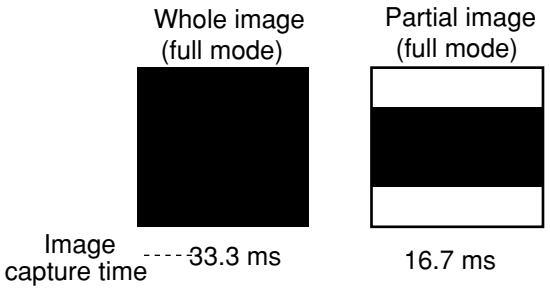
When you are using the IV-S30C3/C4 high-speed camera or an EIA camera, you have to select an image capture mode.

Image capture mode	Details
Full	Capture all of the lines in the image
Half	Capture the odds lines in the image
Full + half *	In the partial image mode, the measurement target lines are in full mode and the others are in half mode

* The "Full+half" can be selected when "①SELECT CAMERA" is set to "HIGH-SPEED."

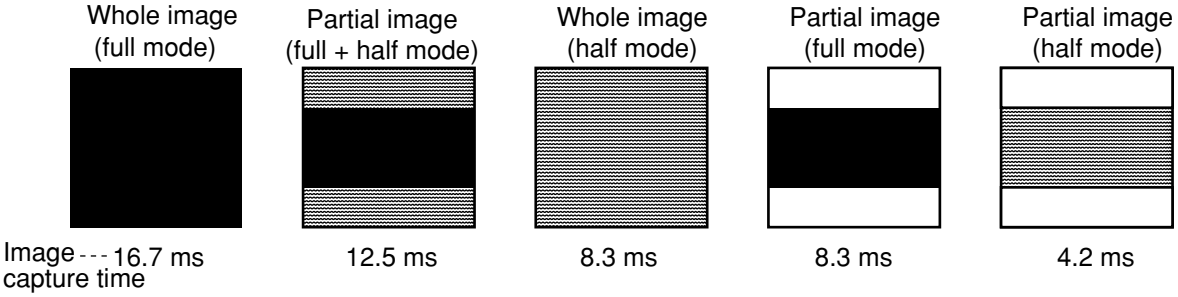
■ Comparative examples of image capture times

① When a standard camera is used and the partial image size is 50 % (240 lines / 480 lines).



- For details about whole and partial images
⇨ See page 2-5.

② When a high-speed camera is used and the partial image size is 50 % (240 lines / 480 lines).



■ Processing details of the image capture mode

Image capture mode	Full	Full + half	Half
Image capture	- Transfer the specified lines	- Transfer only the full mode area	- Correct the specified area and transfer - The even line image will be supplemented by the odd line image.
Process for setting up the screen	- Put all of the captured line area in the full mode	- Put all of the captured line area in the full mode	- Put all of the captured line area in the half mode.
Process from run to setting up the screen	---	- Delete the half mode area	---

[2] Camera synchronization (IV-S33M)

When an EIA camera is used, you have to set the camera synchronization mode (internal or external synchronization).

(1) Internal and external synchronization details

① Internal synchronization
This mode uses the CCD image capture timing inside the camera, and captures images automatically.
- To send a captured image to the IV-S33M, first the IV-S33M must send a trigger to the camera. Then the camera will wait until the first line from its CCD is being to begin the capture and image transmission. Due to this process (camera synchronization time + monitor output synchronization time), the shutter time may fluctuate (maximum: 33.3 +16.6 mm).
- When two cameras are connected, both camera 1 and camera 2 cannot open the shutter at the same time. Therefore, there will be difference of shutter timing described above.

② External synchronization
The IV-S33M controls the shutter speed and trigger timing in order to capture images. See the next page for the internal/external synchronization timing charts.

• External synchronization and internal synchronization processing

	Internal synchronization	External synchronization
Shutter time	Fixed by the camera design	Settable from the IV-S33M
Shutter speed	- Fluctuates with the camera synchronization time and the monitor output synchronization time (maximum 49.9 ms for each camera)	Fixed value (depends on the shutter speed) - When the shutter speed is 1/120, this value is 8.3 ms - Setting range varies with the camera connected.

• Shutter speeds of the recommended cameras

Cameras recommended		Sony XC-75	Tokyo Electronics Industry CS8320B
Shutter speeds	Internal synchronization (selected on the camera)	1/125, 1/250, 1/500, 1/1000 1/2000, 1/4000, 1/10000	1/125, 1/250, 1/500, 1/1000 1/2000, 1/4000, 1/10000
	External synchronization	1/100 to 1/1600	1/125 to 1/1500

(2) Setting the IV-S30EA1 and IV-S33M for use with an EIA camera

Set the IV-S30EA1 camera converter, and the IV-S33M controller to internal or external synchronization, to match the EIA camera you have.

Item	Setting details		Reference
	For internal synchronization	For external synchronization	
EIA camera (commerically available)	Set to "Internal synchronization" mode	Set to "External synchronization" mode	*1
IV-S30EA1 mode switch (MODE)	INT	EXT	*2
IV-S33M camera setting (system condition)	Camera selection: EIA Camera synchronization: Internal synchronization	Camera selection: EIA Camera synchronization: External synchronization	Page 2-19

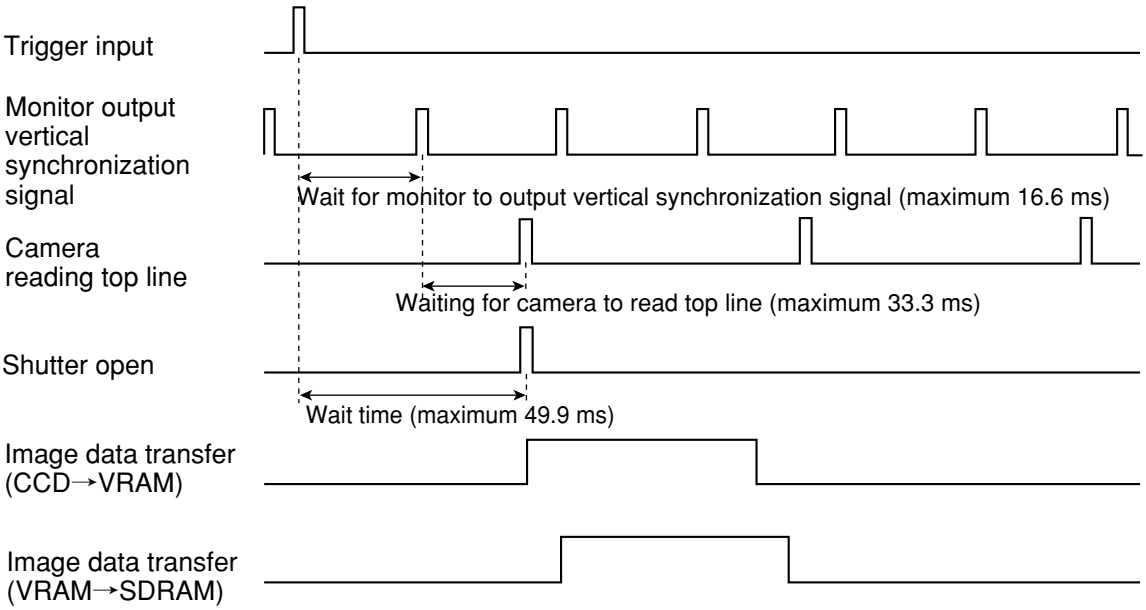
* 1: For example, set the Tokyo Electronics Industries CS8320B camera dip switches as follows:

Function [Dip switch SW4]	Use internal synchronization	Use external synchronization
γ correction [1]	OFF	OFF
CCD storage mode [2]	OFF (frame storage)	ON (field storage)
Restart and reset [3]	OFF	ON
Special shutter [4]	OFF	ON
VD output/FLD output [6]	OFF (VD output)	OFF (VD output)

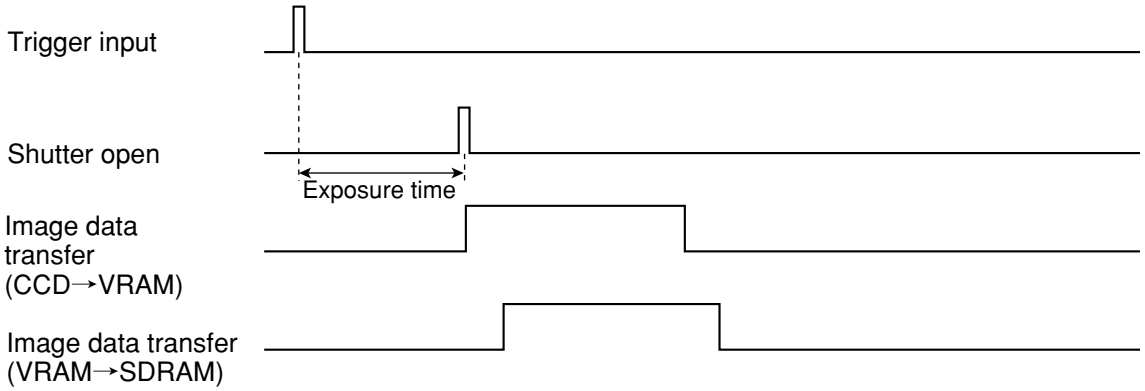
* 2: See the IV-S30 (IV-S31M/S32M/S33M) User's Manual (Introduction and Hardware).

(3) Timing chart

■ Internal synchronization



■ External synchronization



Note: When an EIA camera is used, the last (lowest) line (line 479) may not be captured successfully due to the camera's characteristics.

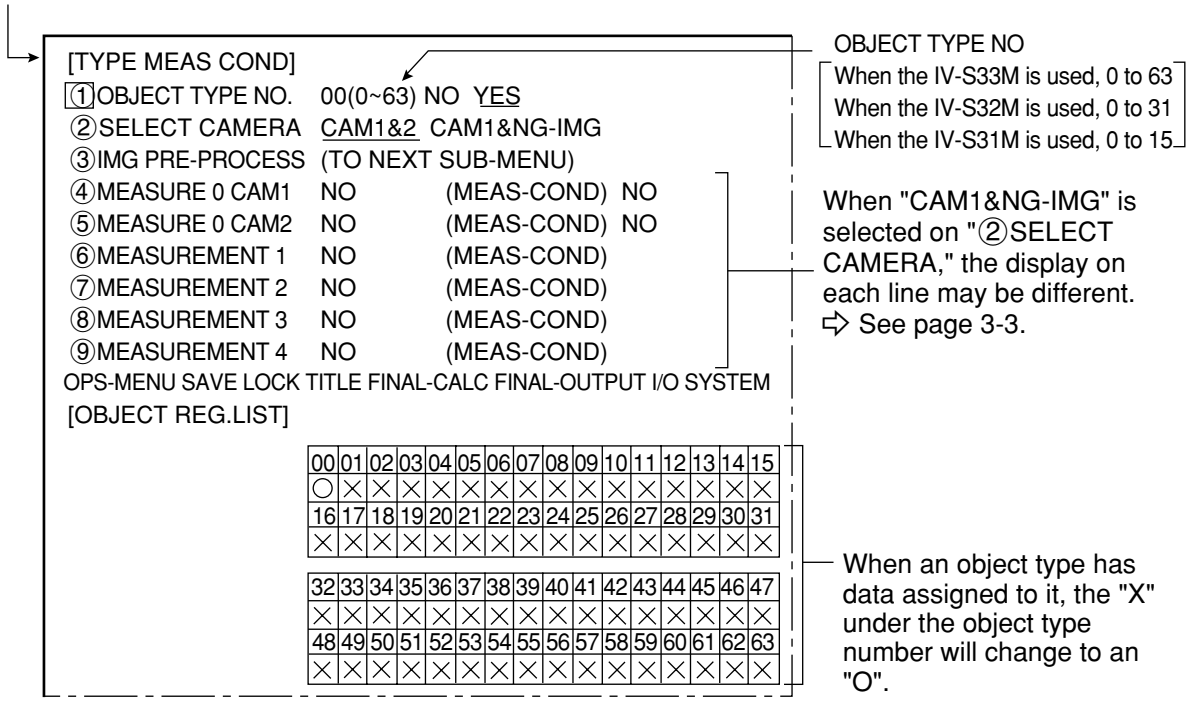
Chapter 3 : Setting Measurement Conditions

3-1 Outline

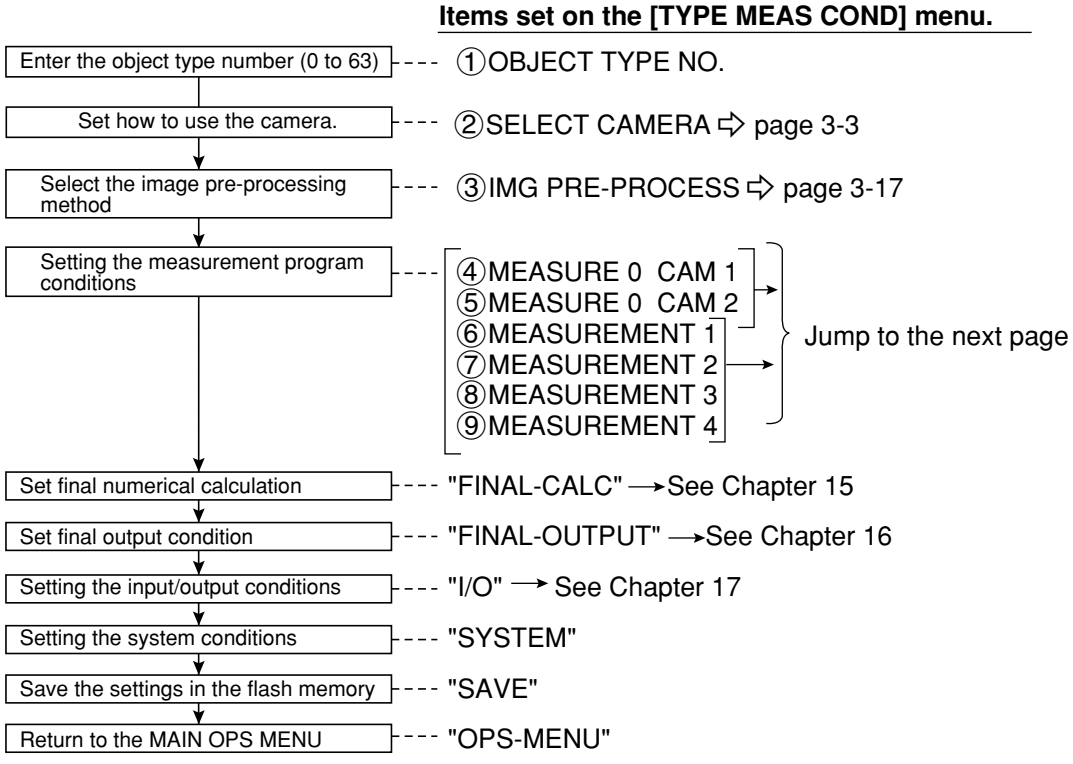
The measuring conditions for each object type are set on the [TYPE MEAS COND] (conditions for object type) menu.

■ **Settings screen**

On the MAIN OPS MENU, move the cursor to "MEA-CND" item, and press the SET key.
⇨ Select "①OBJECT TYPE NO." on the [TYPE MEAS COND] menu, and select "YES." Then press the SET key.

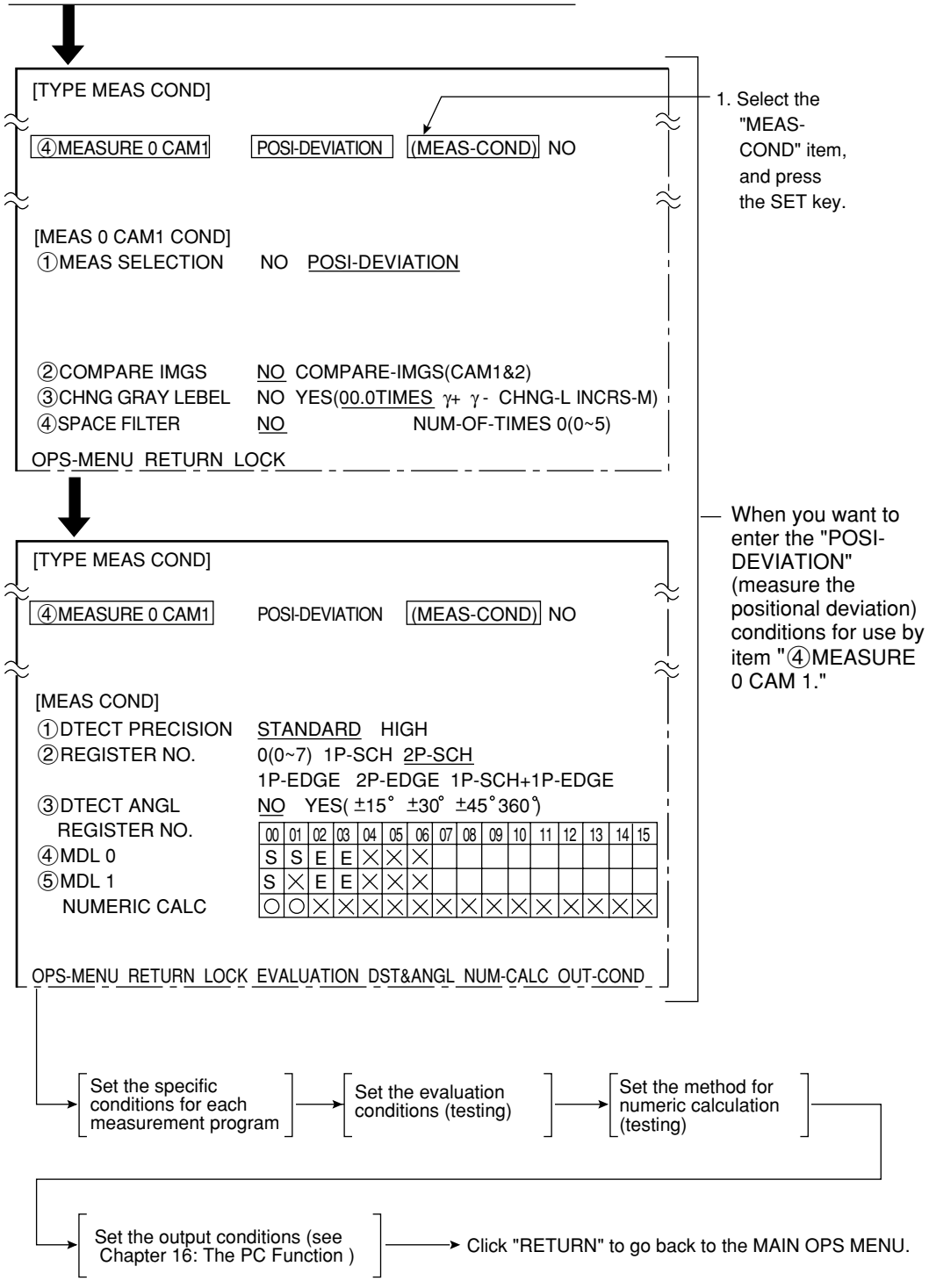


■ **Setting procedure**



■ Outline of setting the measurement program

Select one of the items from "④MEASURE 0 CAM 1" to "⑨MEASUREMENT 4," and press the SET key.



3-2 Shared settings

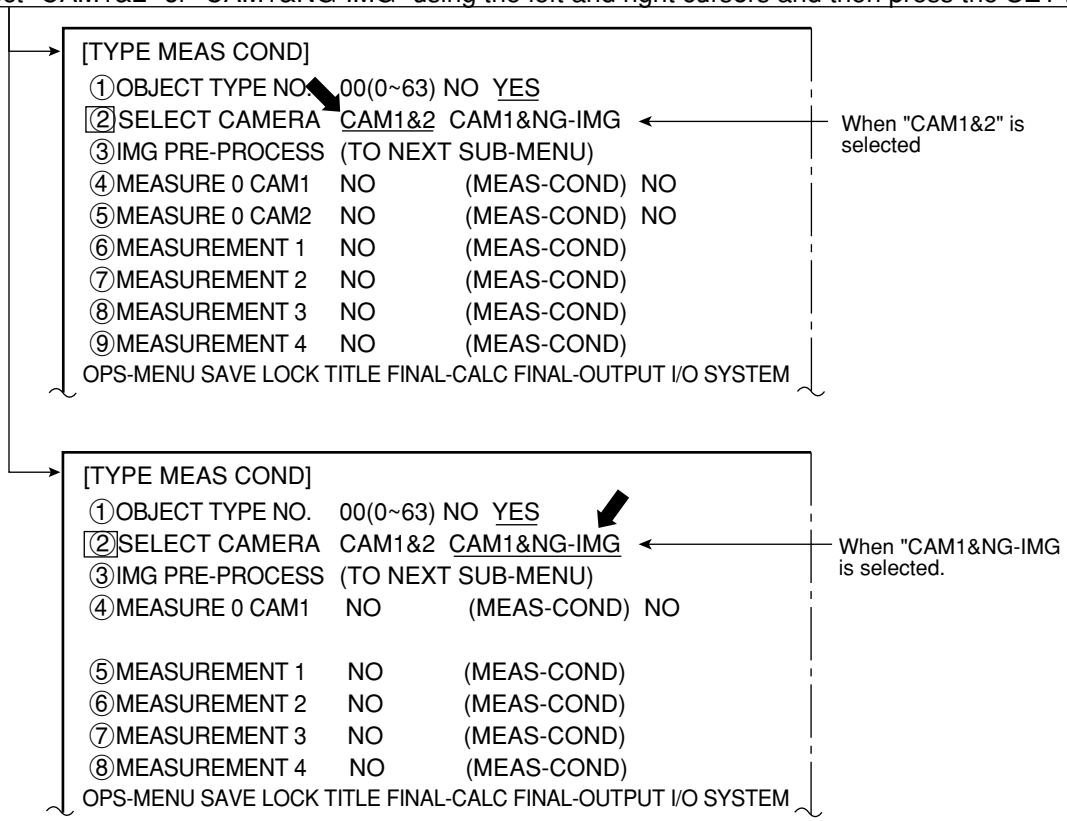
[1] Camera selection

Specify which cameras to use (Camera 1, Camera 2) in "②SELECT CAMERA" on the [TYPE MEAS COND] menu for each object type.

②SELECT CAMERA	Description
CAM1&2	Camera 1 and camera 2 can be used for measurements (0 to 4) and for image pre-processing.
CAM1&NG-IMG	Only camera 1 can be used for measurements (0 to 4) and image pre-processing. Using camera 1, NG images can be displayed on the monitor. ⇨ See page 1-18.

On the [TYPE MEAS COND] menu (page 3-1), move the cursor to "②SELECT CAMERA" and press the SET key.

⇨ Select "CAM1&2" or "CAM1&NG-IMG" using the left and right cursors and then press the SET key.



Note: When the "SELECT CAMERA" is changed from "CAM1&2" to "CAM1&NG-IMG," the setting details for "MEASURE0 CAM2" and "MEASUREMENT1 to 4" are initialized.

To set the output to the monitor, select "①MONITOR OUTPUT" on the [TYPE RUN COND] menu.
⇨ See page 2-3.

■ Relationship between the camera selection and the monitor output

"②SELECT CAMERA" on the [TYPE MEAS COND] menu	"①MONITOR OUTPUT" on the [TYPE RUN COND] menu	
CAM1&2	CAM1	
	CAM2	
	CAM1&2 *1	
	CAM1&2 (VERT)	*2
	CAM1&2(HORIZ)	
CAM1&NG-IMG	CAM1	
	NG-IMG	
	CAM1&NG-IMG *1	
	CAM1&NG-IMG (VERT)	*2
	CAM1&NG-IMG(HORIZ)	

*1 When the IV-S31M/S32M is used.
*2 When the IV-S33M is used.

[2] 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, circle 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

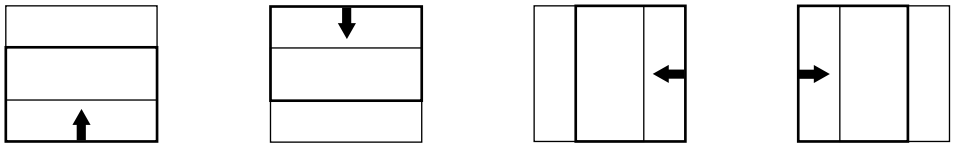
Line type	Image processing used	Measurement programs
Solid lines	Reference image for gray scale search and binary image matching	Positional deviation measurement (gray scale search), degree of match inspection, lead inspection, multiple position measurement (gray scale search), and multiple degree of match inspection.
	Window containing a binary image	Area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion
Dotted lines	Gray scale search area detection	Positional deviation measurement (gray scale search), degree of match inspection, lead inspection (criteria search), multiple position measurement (gray scale search) and multiple degree of match inspection.
	Edge of an area detection	Positional deviation measurement (edge detection), multiple position meaurement (edge detection)
	Binary image window mask	Area measurement by binary conversion, object counting by

■ **How to set a rectangular window**

The following items on the settings menu can be used to define the mask: MOVE, UP.L, LO.R. Shown here is an example of how to define a solid-line rectangular window.

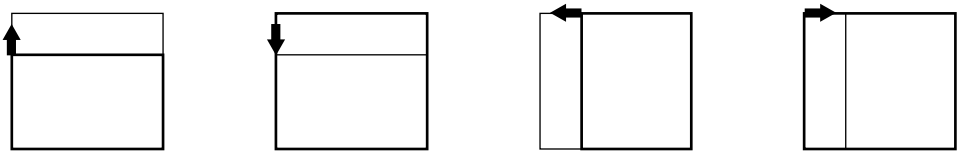
1. Moving the mask

- Up key - Down key - Left key - Right key



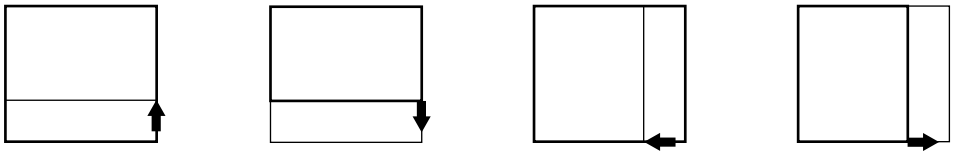
2. Specifying the upper left corner

- Up key - Down key - Left key - Right key



3. Specifying the lower right corner

- Up key - Down key - Left key - Right key



■ **To register reference images**

To register reference images, the system should be in the "Freeze" mode.

■ **Window specifications**

	Line type	Move	Size	Minimum	Maximum
Reference image	Solid line	One pixel at a time	In unit of one pixel	16 x 16 (pixel)	X x Y (X*Y = 65536 pixels)
Search area	Dotted line	One pixel at a time	In unit of one pixel	16 x 16 (pixel)	512 x 480 pixels

(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, 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, lead inspection (criteria search).

■ How to set horizontal lines

The following items on the settings menu can be used to define lines: MOVE, S.PT, E.PT. 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)

■ To register reference images

To register reference images, the system should be in the "Freeze" mode.

■ Window specifications

- Horizontal lines

	Line type	Move	Length	Min. length	Max. length
Reference image	Solid line	Horizontal direction: One pixel at a time Vertical direction: One pixel at a time	In units of pixels	8 pixels	512 pixels
Search area	Dotted line				

- Vertical lines

	Line type	Move	Length	Min. length	Max. length
Reference image	Solid line	Horizontal direction: One pixel at a time Vertical direction: One pixel at a time	In units of pixels	8 pixels	480 pixels
Search area	Dotted line				

When setting the horizontal and vertical lines, specify the line length as follows:

The reference image must shorter than the search area lines.

(3) Circle window

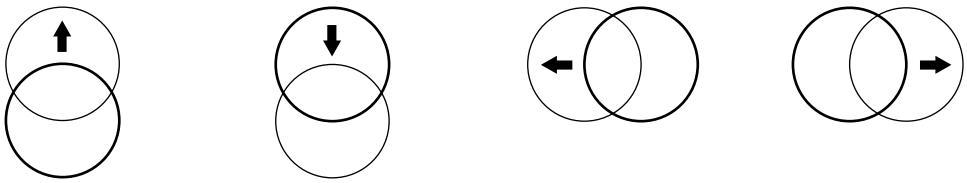
Line type	Image processing used	Measurement programs
Solid lines	Window containing a binary image	Area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion
Dotted lines	Binary image window mask	Area measurement by binary conversion, object counting by binary conversion, object identification 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, RAD. Shown here is an example of how to define a solid line circle window.

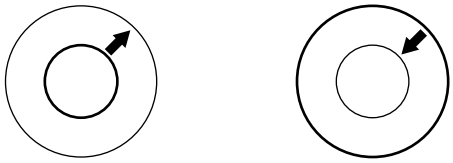
1. Specifying the center

- Up key
- Down key
- Left key
- Right key



2. Specifying the radius

- Up/right key
- Down/left key



(4) Elliptical window

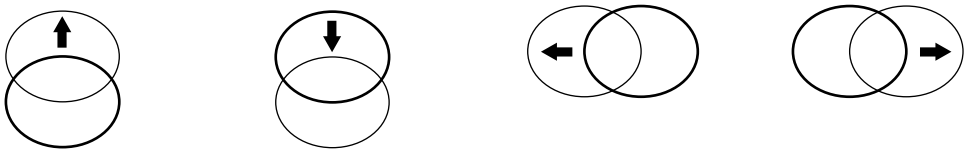
Line type	Image processing used	Measurement programs
Solid lines	Window containing a binary image	Area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion
Dotted lines	Binary image window mask	Area measurement by binary conversion, object counting by binary conversion, object identification 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, RAD. Shown here is an example of how to define a solid line elliptical window.

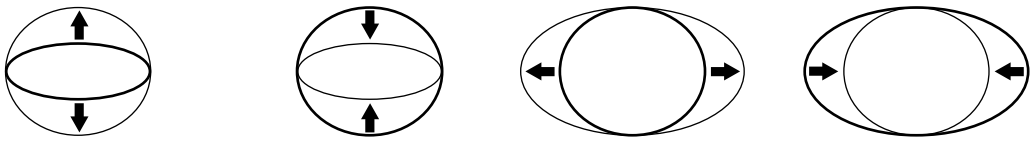
1. Specifying the center

- Up key
- Down key
- Left key
- Right key



2. Specifying the radius

- Up key
- Down key
- Left key
- Right key

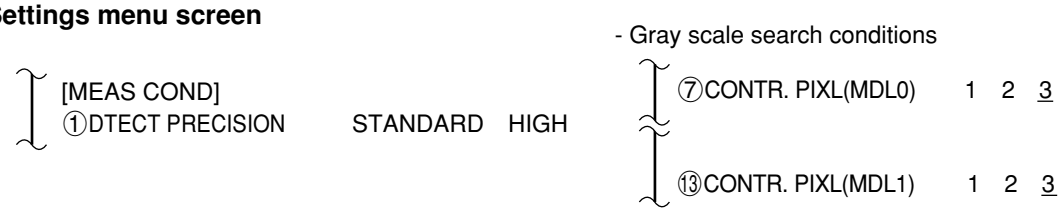


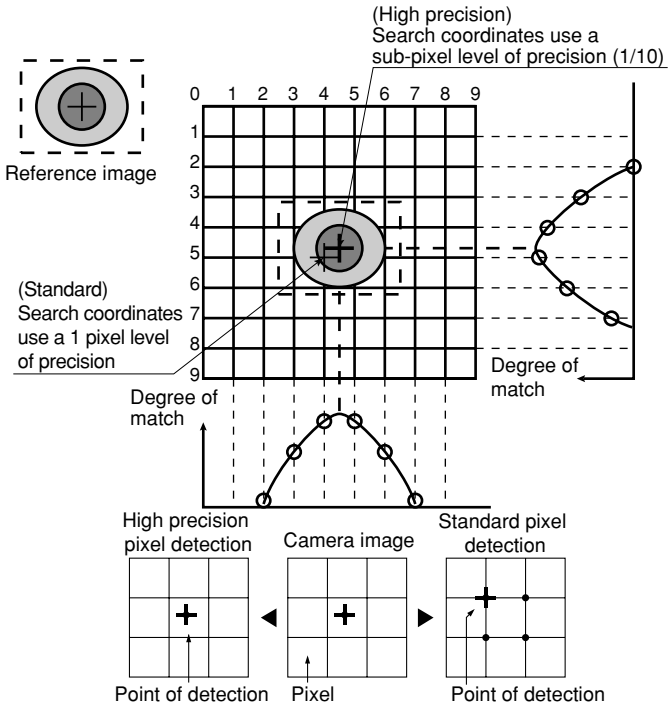
[3] Image settings

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**



Menu	Description
①DTECT PRECISION (detection precision)	- STANDARD (standard): Detection precision of 1 pixel unit level - HIGH (High precision): Detection precision of 1/10 pixel unit level 
⑦⑬CONTR. PIXL (Grey serch scale conditions)	- 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.

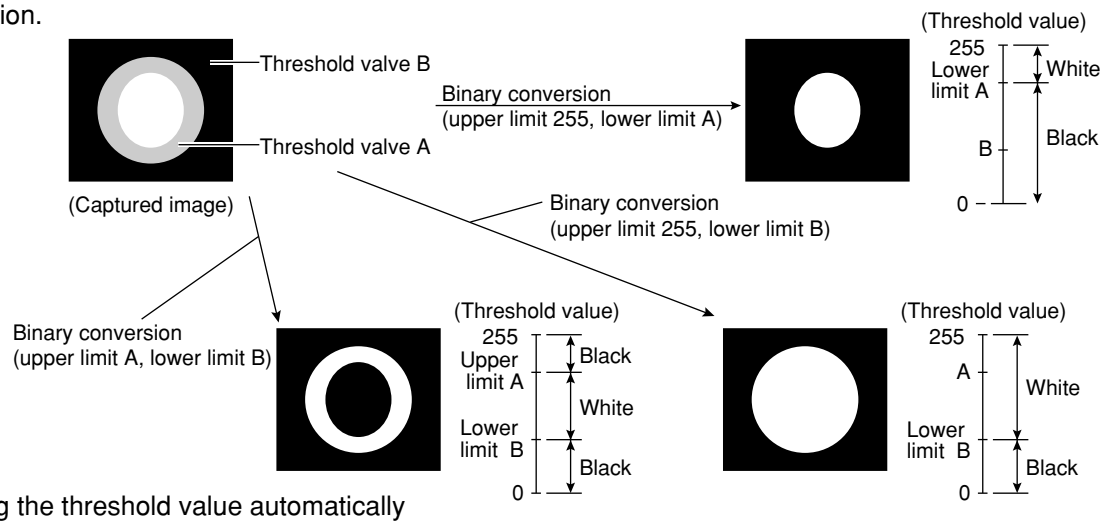
- To increase the speed of your search, you must take into account the settings listed below.
  1. When using the high precision setting, a smaller image should be used.
  2. Reduce the size of the scanned image.
  3. After considering what the maximum out of position dimension would be, make the search 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), degree of match inspection, lead inspection, multiple position measurement, and multiple degree of match inspection.

(2) Threshold value setting

The IV-S30 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.

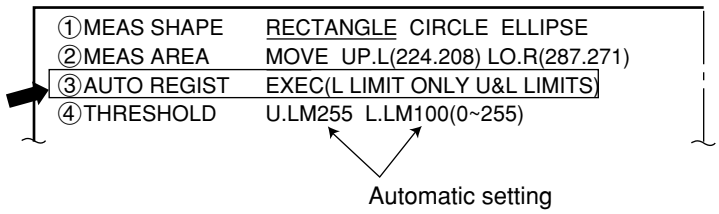


● Setting the threshold value automatically

The binary threshold value can be set automatically.

In the binary area condition of each measurement program, execute the "AUTO REGIST" function (lower limit only or upper and lower limits) and the optimum threshold values will be set in each measurement area automatically.

- The binary area conditions (binary image mask) menu in the binary area measurement.

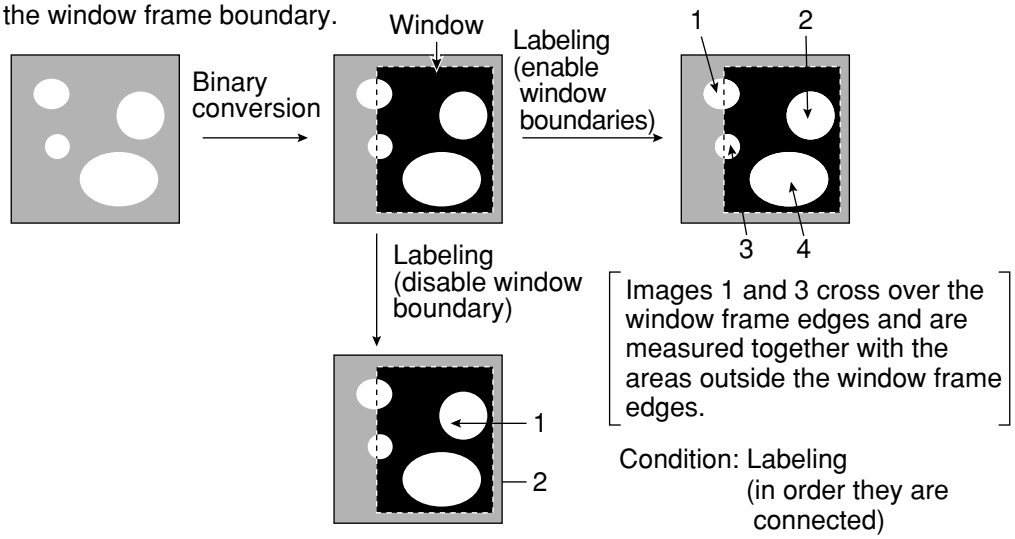


■ **Measurement programs which are affected by these settings**

BGA/CSP inspection, area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion, point measurement (binary images)

(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.

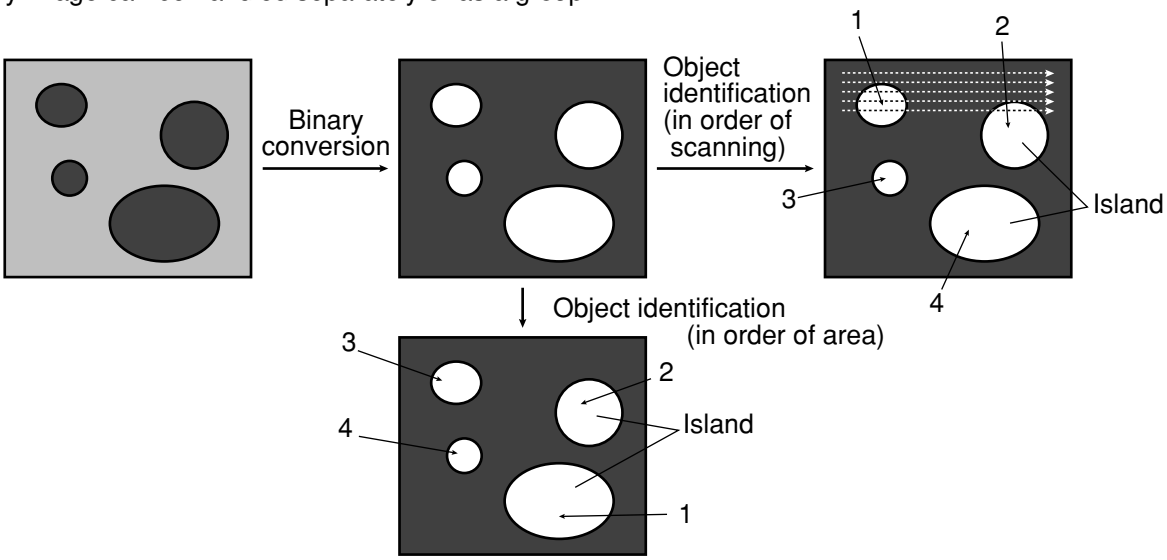


■ **Measurement programs which are affected by these settings**

BGA/CSP inspection, object counting by binary conversion, object identification by binary conversion

(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.

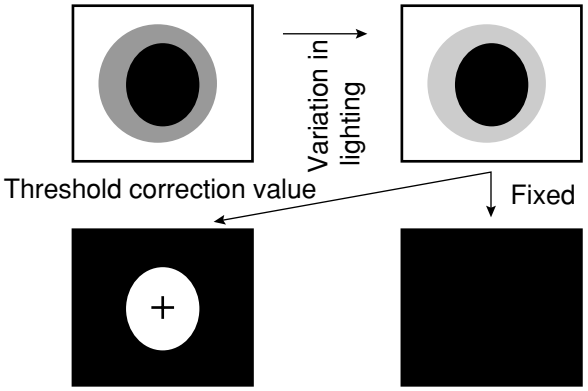


■ **Measurement programs which are affected by these settings**

Object counting by binary conversion, object identification by binary conversion

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

By setting THRESHOLD-ADJ (threshold adjustment function), the IV-S30 can cope with variations in lighting.



Fails to convert the image due to a variation 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 LIGHT LVL NOT SET (correcting binary value: monitor illumination not selected) error will occur.

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 THRESHOLD-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**

Area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion, point measurement (binary images)

(6) Space filter

Space filter 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-S30, you can select from "smoothing (average, center)," "edge emphasis," "edge extraction," "horizontal edge," and "vertical edge."

<table>
<tr><th>Item</th><th colspan="2">Contents</th></tr>
<tr><td>Smoothing (center)</td><td>- Specify the median pixel gray level from the surrounding 3 x 3 area.
- Since noise elements are difficult to select, they will not affect the output.</td><td rowspan="2">- Display smooth images with decreased noise.
- Used to eliminated surface flaws and unevenness in the reflected light caused by protrusions or dents.
- This type of smoothing (averaging) is faster than the median smoothing.</td></tr>
<tr><td>Smoothing (average)</td><td>- Specify the average pixel gray level from the surrounding 3 x 3 area.
- Since noise elements are included in the average, the noise will affect the output.</td></tr>
<tr><td>Edge emphasis</td><td colspan="2">- Display images with sharp boundaries between brighter and darker areas.
- Used to stabilize and create a binary outline around unclear objects.</td></tr>
<tr><td>Edge extraction</td><td>- Display images after extracting and clarifying the boundaries between the brighter and darker areas.</td><td rowspan="3">- Used to measure objects with low contrast.</td></tr>
<tr><td>Horizontal edge</td><td>- Horizontal edge extraction: Display only the horizontal boundaries of an object.</td></tr>
<tr><td>Vertical edge</td><td>- Vertical edge extraction: Display only the vertical boundaries of an object.</td></tr>
</table>

■ **Measurement programs which are affected by these settings**

All measurement programs

■ **Example of an image**

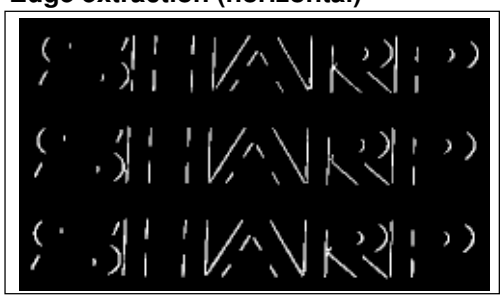
- No

- Smoothing

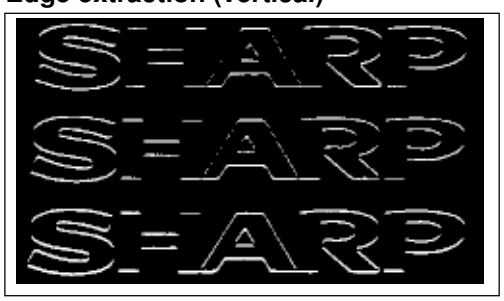
- Edge emphasis

- Edge extraction (All)

- Edge extraction (horizontal)



- Edge extraction (vertical)



(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

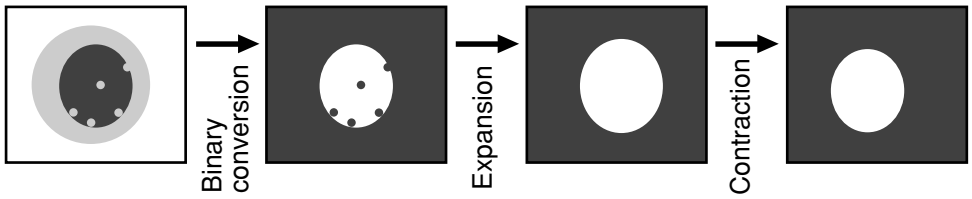
A single white dot, or small groups of white dots, in the middle of a black background can be eliminated from the image.

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.

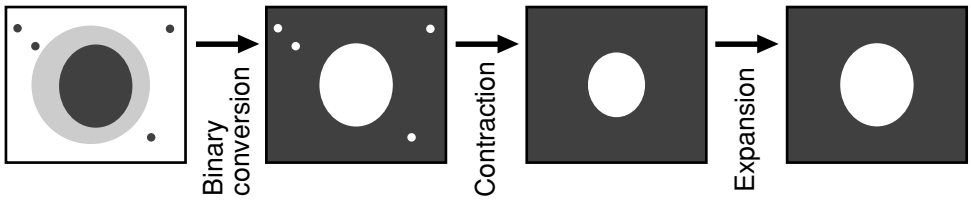
-① Expansion → contraction

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-S30 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**

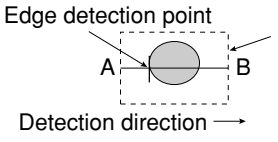
Area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion

(8) Edge detection

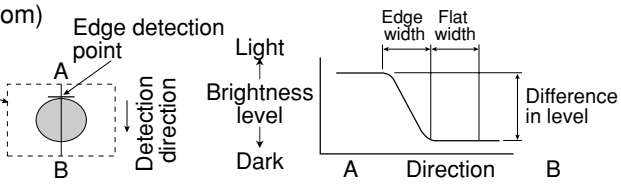
The "edge" refers to the boundaries between the brighter (white) and darker (black) parts in an image. The "edge detection" function is used to detect this boundary by processing the image.

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

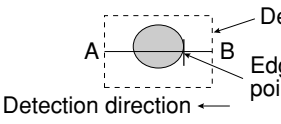
- Horizontal transition point from light to dark (moving from left to right)



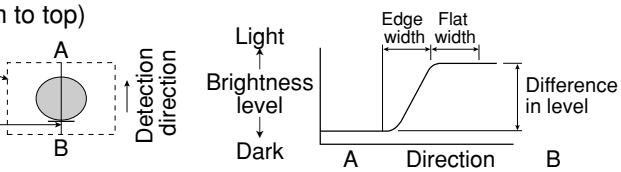
- Vertical transition point from light to dark (moving from top to bottom)



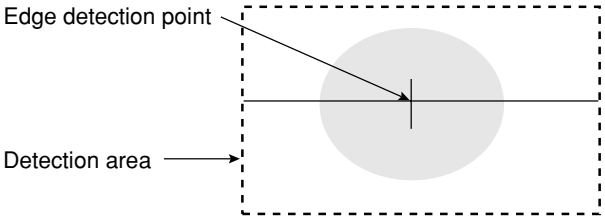
- Horizontal transition point from light to dark (moving from right to left)



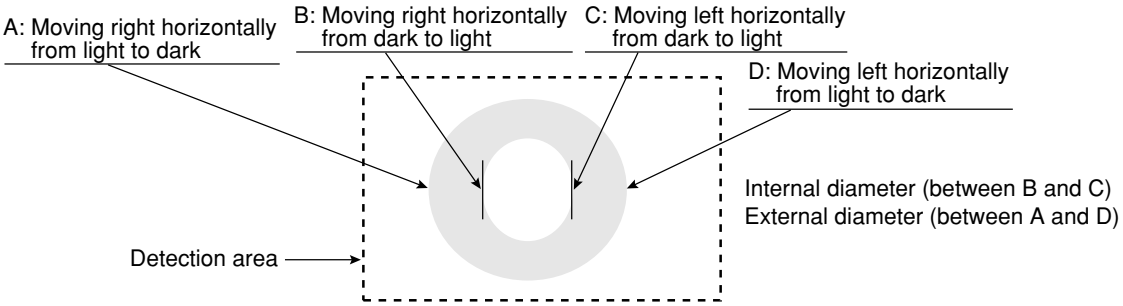
- Vertical transition point from light to dark (moving from bottom to top)



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



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

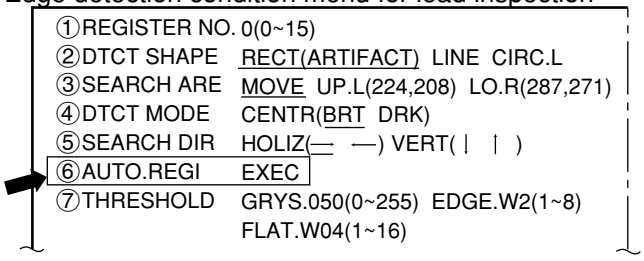


- The edge detection point coordinates are used as a reference point to detect an out of position condition.
- Edge detection in binary images is much quicker than in a gray scale search. However, the binary image detection process is less precise at detecting position.

■ Setting the threshold value automatically

By executing an "AUTO.REGI" (automatic setting) for the edge detection condition in each measurement program, the IV-S30 can automatically detect edges in the measurement areas, and set the optimum threshold values automatically (density difference and edge width).

- Edge detection condition menu for lead inspection



■ **Measurement programs which are affected by these settings**

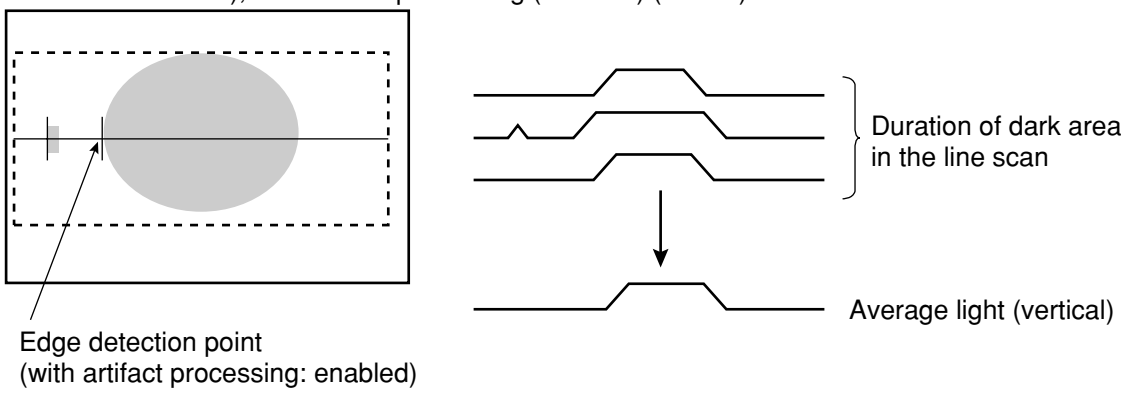
Positional deviation measurement (edge detection), lead inspection, multiple position measurement (edge detection).

(9) Artifact processing

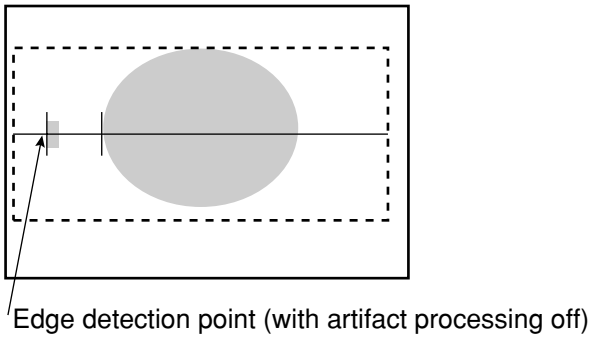
Artifact processing is a method of processing that eliminates the false detection of the edge of the target object when an artifact is in the line being scanned. This process can be used during edge detection. The real edge of the target object is detected by computing the average duration of the dark 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 (DTCT MODE:BRT→ DRK) while scanning horizontally (SEARCH DIR:HORIZ →), with artifact processing (enabled) (ARTIF).



When artifact processing is disabled (NO ARTIF) in the above example, the edge detection point changes.



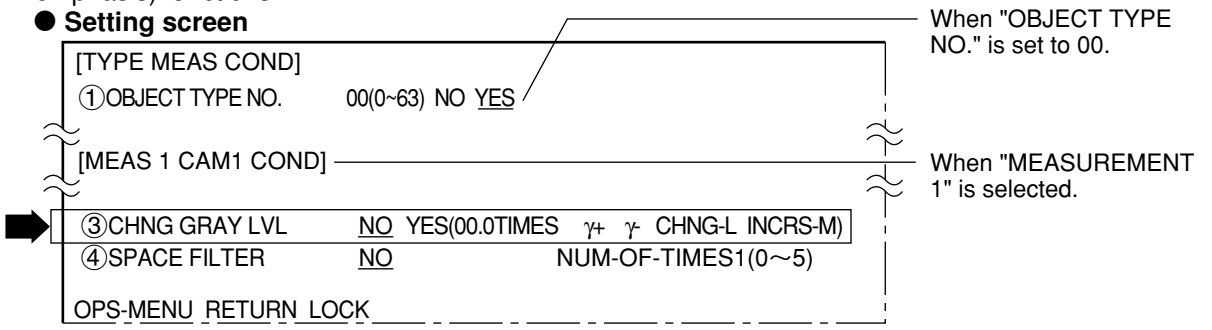
■ **Measurement programs which are affected by these settings**

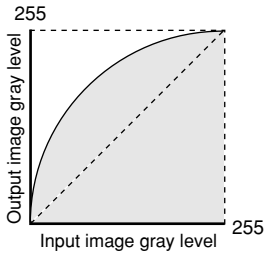
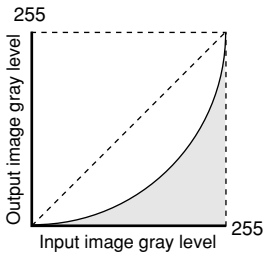
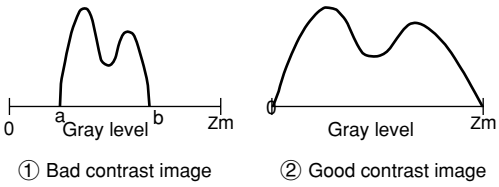
Positional deviation measurement (edge detection), lead inspection, and multiple position measurement (edge detection).

(10) Gray level change

To change the gray level, you can change the "**.*TIMES" (magnification by N processing), the "γ+," "γ-" (γ (positive/negative) correction), the "CHNG-L" (widening histogram), and the "INCRS-M" (mid emphasis) functions.

● **Setting screen**



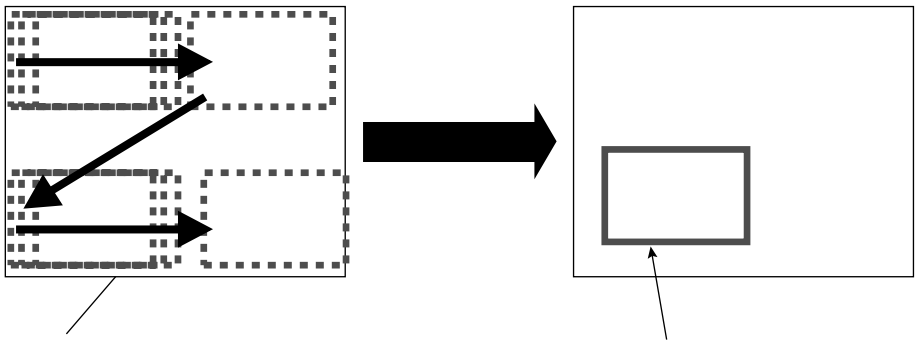
Gray level change	Details
Magnification by N processing (**.* TIMES)	To improve the contrast (the ratio of high value gray levels to low value gray levels), specify a magnification rate (00.0 to 99.9) for multiplying the image data. - If the magnified gray level exceeds 255, the system will correct the value to 255.
γ (positive/negative) correction	- γ positive correction: used when the mid gray level is too low.  - γ negative correction: used when the mid gray level is too high. 
Histogram widening	This is a method to widen the histogram of an image in which the histogram is at part of it, thus improve its contrast.  ① Bad contrast image ② Good contrast image
Mid emphasis	Emphasize the mid gray level. - This improves contrast while remaining the background image. - The input image density (G) can be converted to the output image density with the following formulas:

Input image gray level(G)	Output image gray level
0 to 127	$(G \div 127)^2 \times 127$
128 to 255	$\sqrt{((G-128) \div 127 \times 127)} + 127$

(11) Contrast search in the reference image

Using the reference image area setting in the gray scale search mode, the area of maximum contrast can be identified automatically in the captured image.

- While moving the selected reference image area within the specified search area on the captured image one pixel at a time, the IV-S30 determines the density in each area in the reference image, and automatically picks the area with the largest difference.
- This function may be used for sorting printed objects.



Search in the specified search area on the captured image

Find the area having the maximum features in the reference image area.

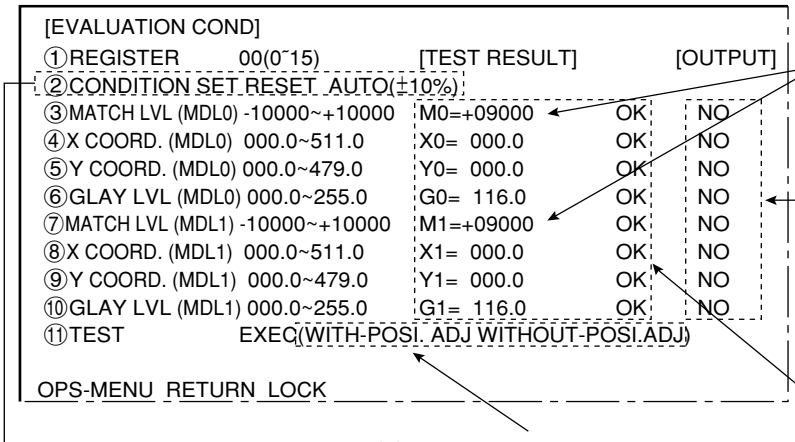
■ **Measurement programs available that use this setting**

Positional deviation measurement (gray scale search), degree of match inspection, multiple position measurements (gray scale search), and multiple degree of match inspection.

[4] Evaluation conditions

The setting details and procedures for setting the evaluation conditions are the same for all measurement programs.

Evaluation conditions [EVALUATION COND] menu for measuring degree of match



The "degree of match + 09000" refers to a degree of match (match between individual pixels) between the registered image and the measured image that is equal to 90.00% or more of the total.

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 ⑪TEST, on the menu, the resulting measurement values and the evaluation (OK or NG) will be displayed.

If you select "WITH-POSI.ADJ," the system will conduct test while adjusting for positional deviation. ⇨ pages 3-26 to 3-29

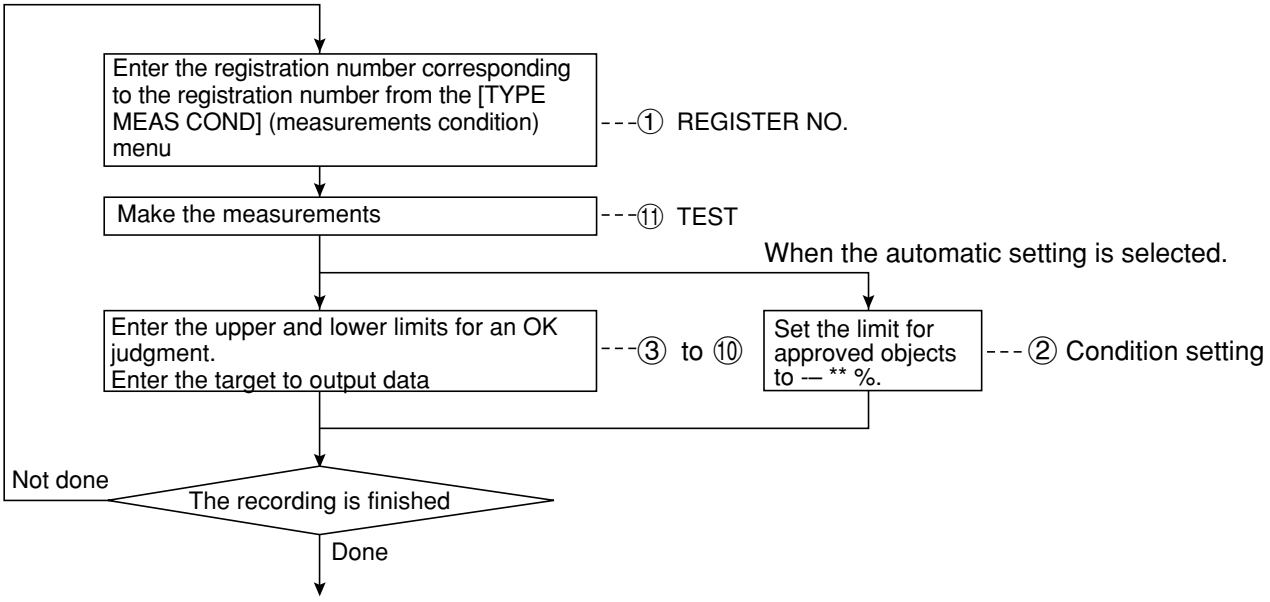
● Condition setting

Upper and lower limit values of the all evaluation condition items can be set automatically with the follwoing processes.

After testing more than one good workpieces, the IV-S30 automatically set the limits based on the test results.

Condition settings	Details
RESET	Reset upper and lower limit values of all items to default values.
AUTO (–**%)	- Multiple the specified rate (–%) on the newly tested good workpieces, and compared this value with the range between the current upper and lower limits. If it is outside the upper and lower limits, the IV-S30 renews the maximum or minimum value with this value. At the first setting, the first test result will be the upper and lower limit without any condition.。 [–**%] The value from –00% to –99% can be entered to the "–**%" in units of 1%. (Default value =–10%) To enter this position, move the curosr to the "AUTO" position and press the up and dow keys to change the value. After determining the value, press the SET key, upper and lower limts of each item will be automatically set with tis %.be the upper and lower limit without any condition.

■ **The setting procedure**

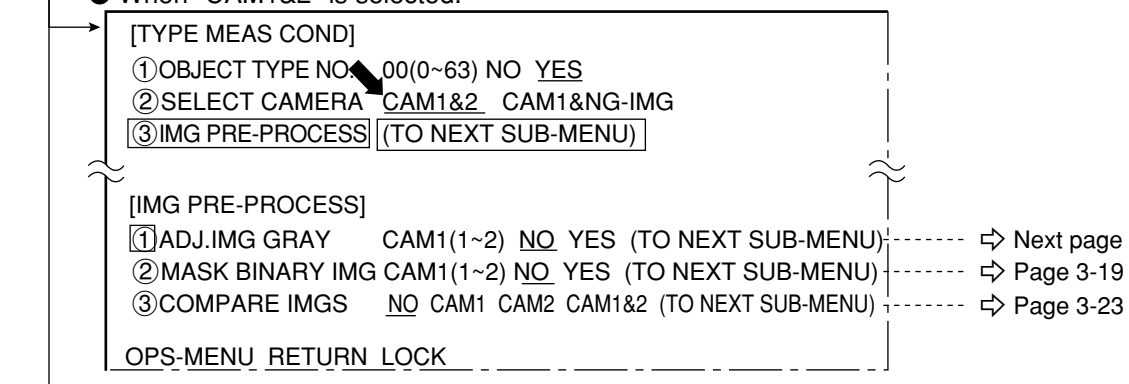


[5] Image pre-processing

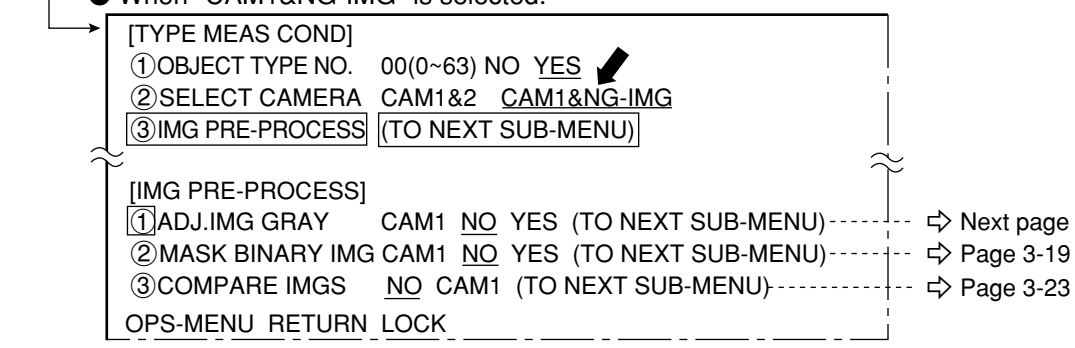
A shading correction, binary image mask, and comparative calculation between images are available for image pre-processing.
To set these operations, use the [IMG PRE-PROCESS] menu.

On the [TYPE MEASURE COND] menu, move the cursor to "③IMG PRE-PROCESS" and press the SET key.

● When "CAM1&2" is selected.



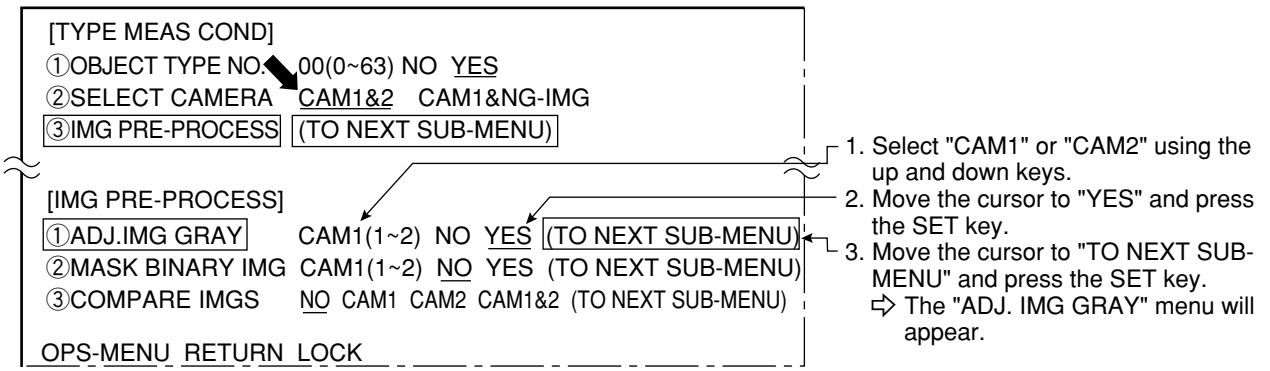
● When "CAM1&NG-IMG" is selected.



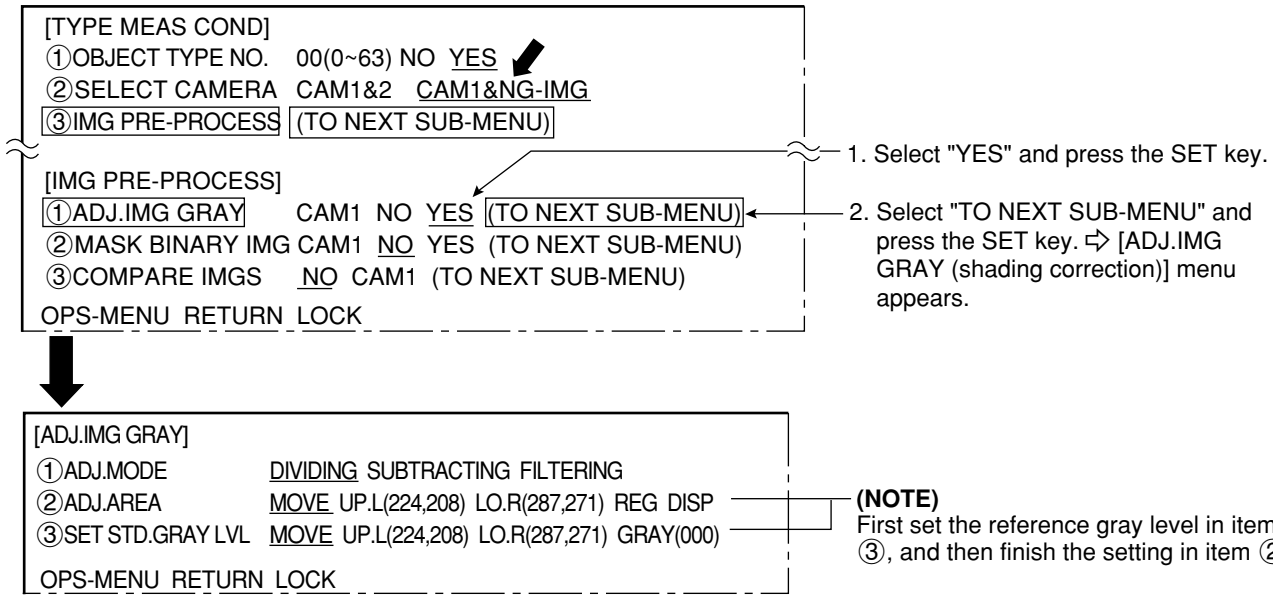
(1) Shading correction

This process removes unevenness from images that have gray level unevenness caused by an illumination.

● When "CAM1&2" is selected for SELECT CAMERA line.



● When "CAM1&NG-IMG" is selected for SELECT CAMERA line.



- The items displayed in lines ② and ③ will vary, depending on the selection in item ①.

Selection in item①	Data displayed in item②	Data displayed in item③
DIVIDING	MOVE UP.L(224,208) LO.R(287,271) REG DISP	MOVE UP.L(224,208) LO.R(287,271) GRAY(000)
SUBTRACTING	MOVE UP.L(224,208) LO.R(287,271) REG DISP	MOVE UP.L(224,208) LO.R(287,271) GRAY(000)
FILTERING	MOVE UP.L(224,208) LO.R(287,271)	———

Correction mode	Details
DIVIDING	Divide a scanned image with the reference image that expresses changes of dark and bright as a whole, and correct the brightness throughout the image. {(Each gray level of scanned image) X reference gray level} / (Each gray level of reference image) - Divide a scanned image that is shot under the uneven light by a blank image that is shot under the same light condition, you can change the image to the one that is shot under the even light.
SUBTRACTING	Subtract a scanned image with the reference image that expresses changes of dark and bright as a whole, and correct the brightness throughout the image. {(Each gray level of scanned image) + reference gray level} - (Each gray level of reference image) - Subtract a scanned image that is shot under the uneven light by a blank image that is shot under the same light condition, you can change the image to the one that is shot under the even light.
FILTERING	Filter a scanned image with the maximum value, and then with an average value, to make a brightness image. [Max. value filter: Max. gray level of 3 x 3] ⇨ [Average value filter: Average gray level of 3 x 3] - Use this filter when a brightness distribution image (reference image) for the scanned image cannot be obtained.

(2) Binary image mask

Mask a scanned image (AND) with the registered binary image.

Binary image mask	Gray level in the scanned image	Gray level output after masking
1	0 to 255	0 to 255 (gray level in the scanned image)
0	0 to 255	0 (fixed)

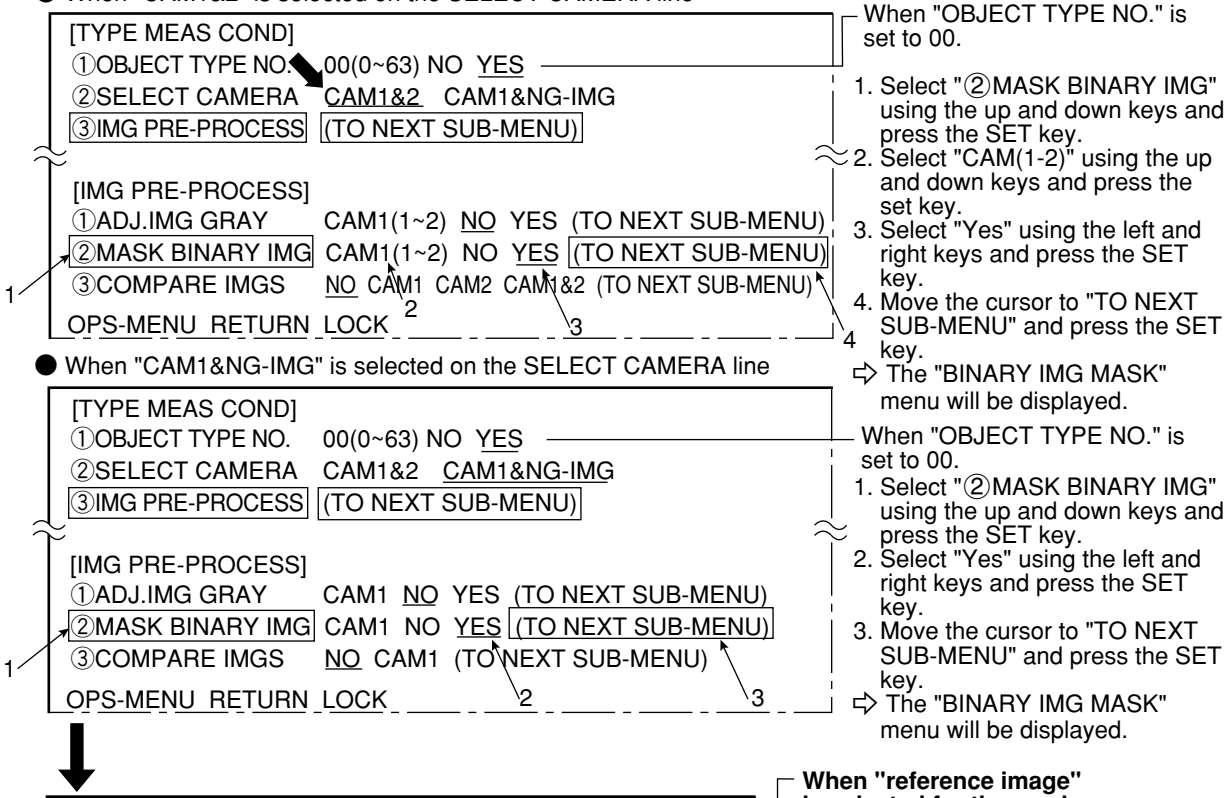
■ **Measurement programs which are affected by this setting**

Area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion, BGA/CSP inspection

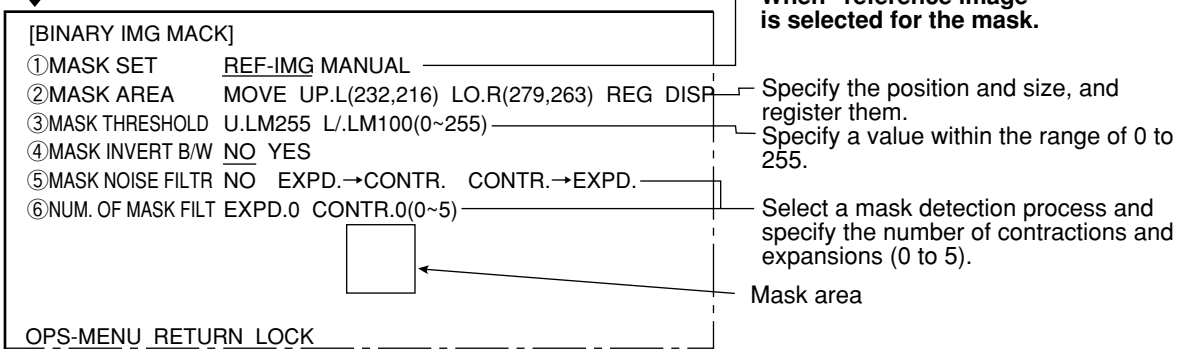
■ **Setting method**

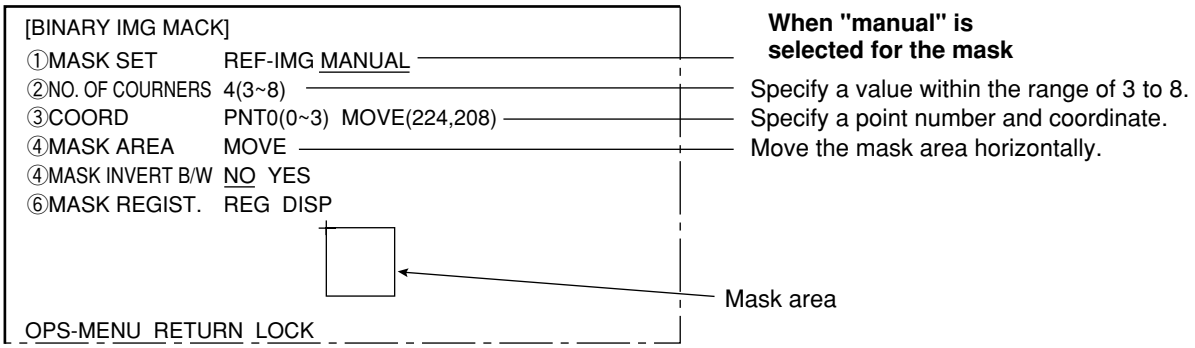
Use item ②, "MASK BINARY IMG" on the [IMG PRE-PROCESS] menu.

● When "CAM1&2" is selected on the SELECT CAMERA line



● When "CAM1&NG-IMG" is selected on the SELECT CAMERA line

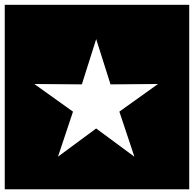




■ Setting example

●When "MASK SET" is set to "REF-IMG."

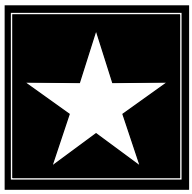
Shown below is an example of how to specify a binary image mask for a star shape.



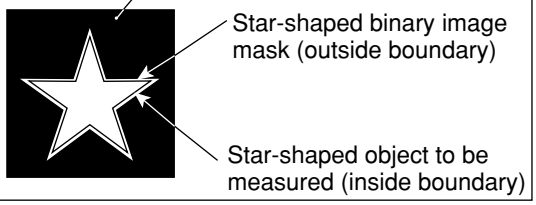
① Store a binary image mask on the "BINARY IMG MASK" menu (mask setting = standard) shown above.

1. Specify the mask outline for the object to be measured.

2. For correcting minor positional deviations, store an enlarged image as the binary image mask.

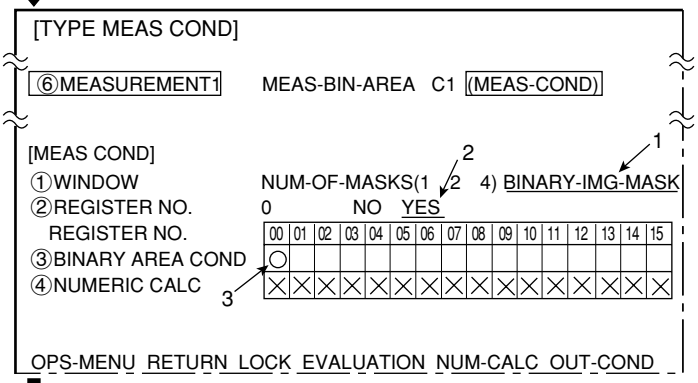


- Positional relation between the stored binary image mask and the object to be measured.



3. Return to the "TYPE MEAS COND" menu. Select "MEAS-COND" in the "⑤MEAS-BIN-AREA" item

② Settings on the "TYPE MEAS COND" menu



1. Select "BINARY-IMG-MASK" as the window type.
2. Select "YES" in the ②REGISTER NO. item.
3. In the binary area condition table, select the circle under register number 00, and press the SET key.
   ⇨ The "BINARY AREA COND" menu for that register will be displayed.

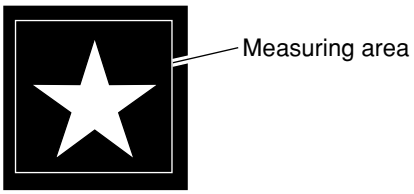
To the next page

Continued from the previous page

③ Setting the binary area conditions

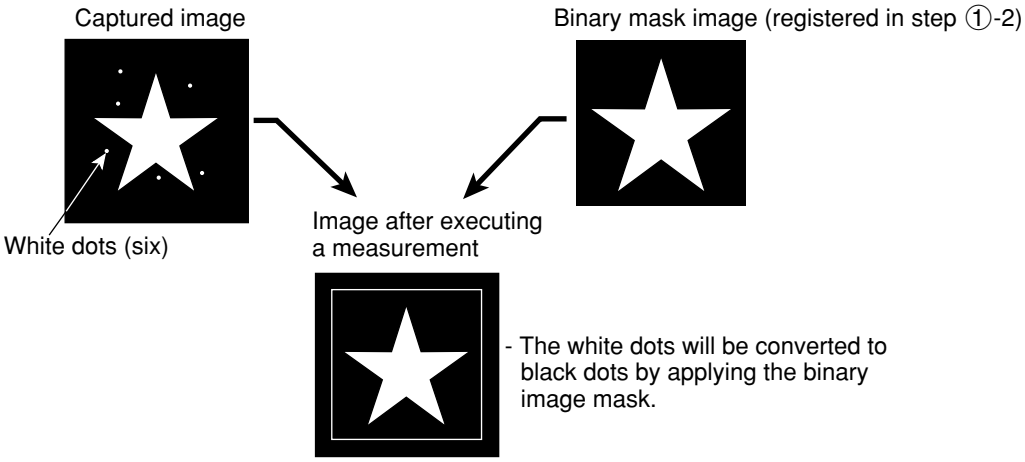
```
①MEAS SHAPE    RECTANGLE  CIRCLE  ELLIPSE
②MEAS AREA     MOVE  UP.L(224.208) LO.R(287.271)
③AUTO REGIST   EXEC(L LIMIT ONLY U&L LIMITS)
④THRESHOLD     U.LM255  L.LM100(0~255)
⑤INVERT B/W    NO YES
⑥BINARY PROCESSFIXED  THRESHOLD-ADJ(VAR-DIFF VAR-RATE)
⑦BINARY NOISE FILTNO  EXPD.—CONTR.  CONTR. —EXPD.
⑧NUM. OF FILT PASSEXPD.0  CONTR.0(0~5)

OPS-MENU  RETURN  LOCK  EVALUATION
```

1. Specify a measurement area smaller than the mask area and specify the binary conditions.



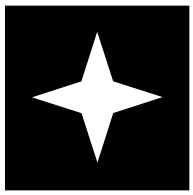
2. Return to the MAIN OPS MENU.

④ Measure the binary area

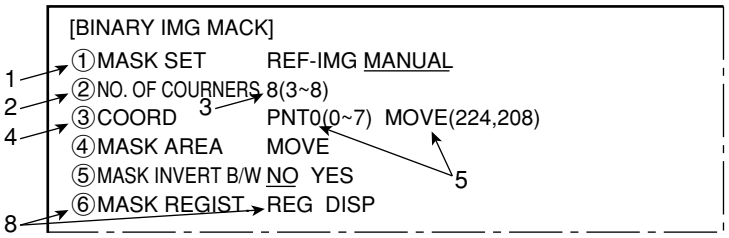


● When "MASK SET" is set to "MANUAL."

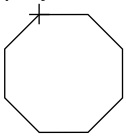
Shown below is an example of a binary image mask that matches the following shape (an 8 pointed star).



1. Select "①MASK SET" using the up and down keys and press the SET key. Then select "MANUAL" using the left and right keys and press the SET key.

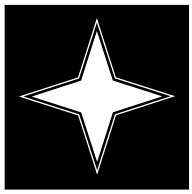


2. Select "②NO.OF CORNERS" using the up and down keys and press the SET key.
3. Select "8" using the up and down keys and press the SET key.
   ⇨ An octagonal mask area will be displayed.



4. Select "③COORD" (coordinate) using the up and down keys and press the SET key.
5. Select "0" using the up and down keys and then select "MOVE" using the left and right keys. Finally, press the SET key.
   ⇨ Vertexes corresponding to the point numbers (0 to 7) will be shown with "+" marks. (The point numbers are assigned in a clockwise direction.)
6. Move vertex 0 a little outside of the first point on the star using the up, down, left, and right keys, and then press the SET key.

7. Move vertices 1 to 7 outside of points of the star, as described in steps 5 and 6 above.



8. Select "⑥MASK REGIST" (register mask) using the up and down keys and press the SET key. Then select "REG" (register) using the left and right keys and press the SET key.
   ⇨ The mask will be registered and displayed in the lower right of the screen.
   - The area inside the mask will change to white. To invert the inside and outside shades (change white to black and black to white), select "YES" on the "⑤ MASK INVERT B/W" line.

(3) Comparative calculations between images

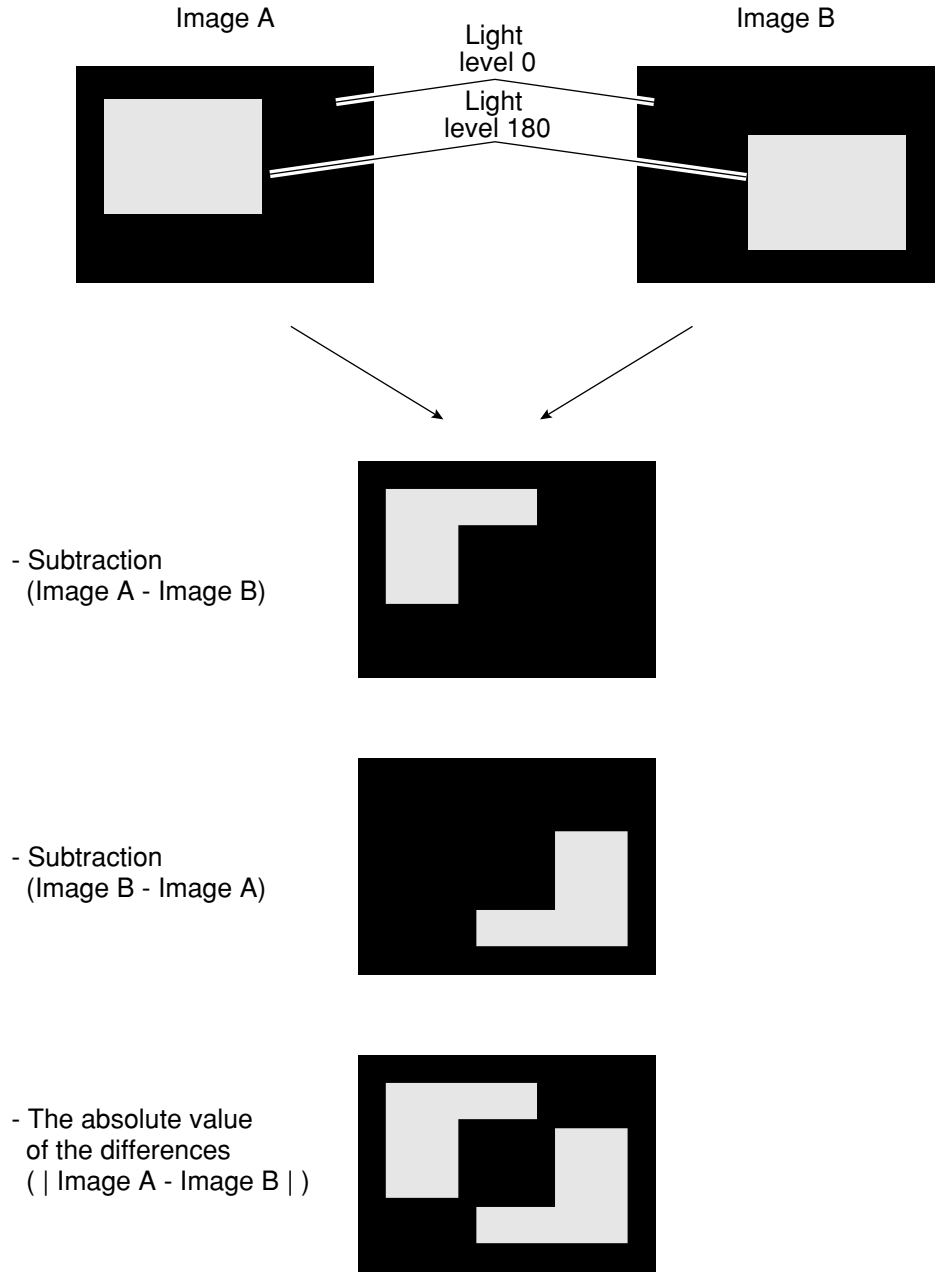
It is possible to run calculations on the differences between the images taken by camera 1 and camera 2, as well as on the differences between the current image and the already stored reference image.

① **Type of calculation**

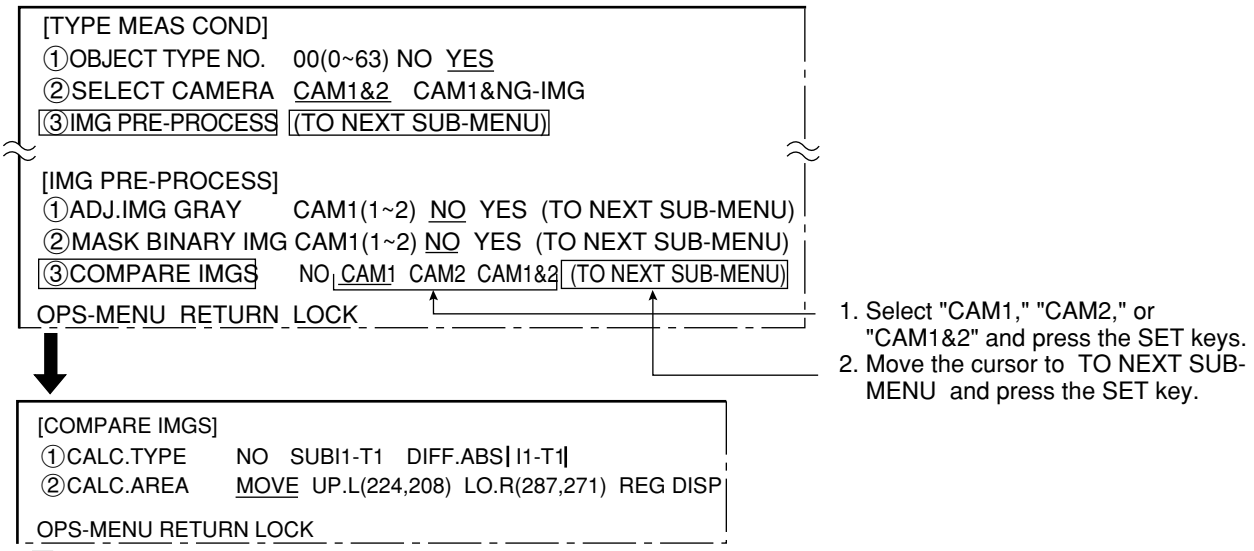
There are two types of calculation: "subtraction" and the "absolute value of the differences."

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



The list of settings which may be selected at item "③COMPARE IMGS" is as follows.

SELECT CAMERA IMG	①CALC.TYPE	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) (*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.

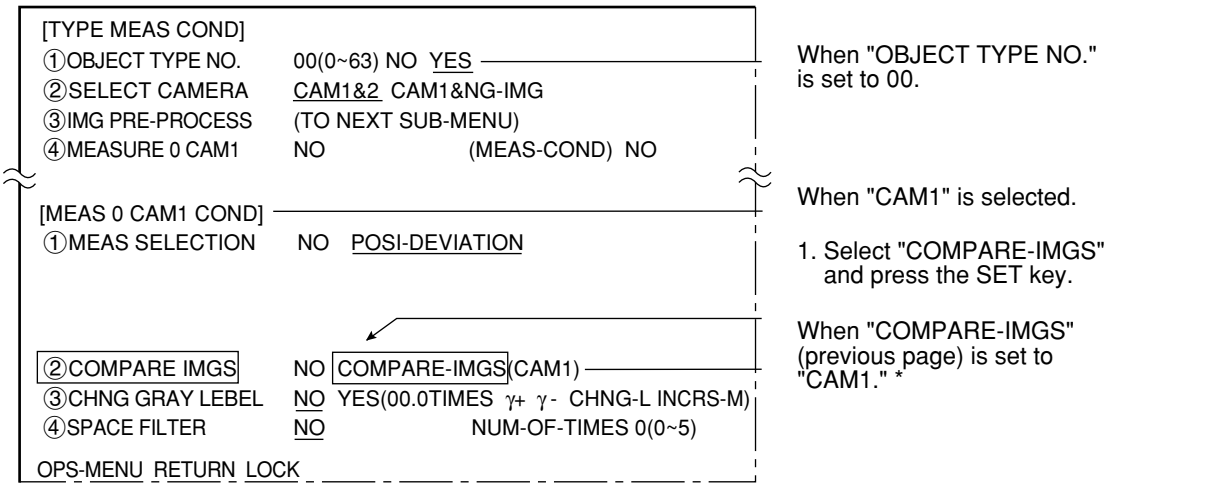
- The reference images T1 and T2 (*1) and the size of the areas covered by I1 and I2 (the images taken by cameras 1 and 2) (*2) may be set in item "②CALC. AREA."

To the next page

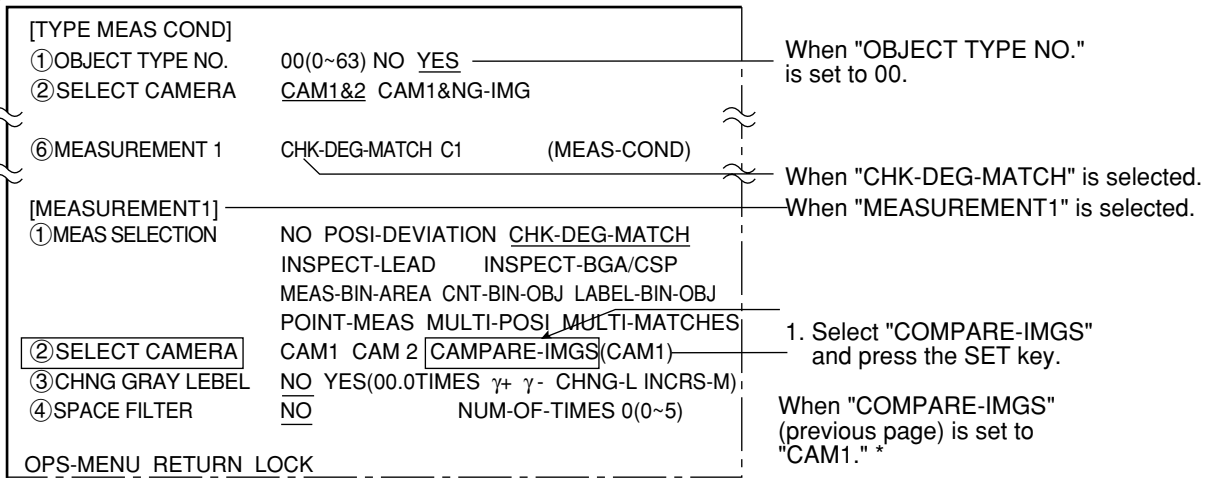
Continued from the previous page

Return to the [TYPE MEAS COND] menu.

● When "MEASUREMENT 0" is selected.



● When "MEASUREMENT 1 to 4" is selected.



With this settings concerning comparative calculations between images are complete.

* The display COMPARE-IMGS(----)" will be displayed when ③ COMPARE IMGS" on the [IMG PRE-PROCESS] menu is set to NO." ⇨ See the previous page.

[6] Position correction

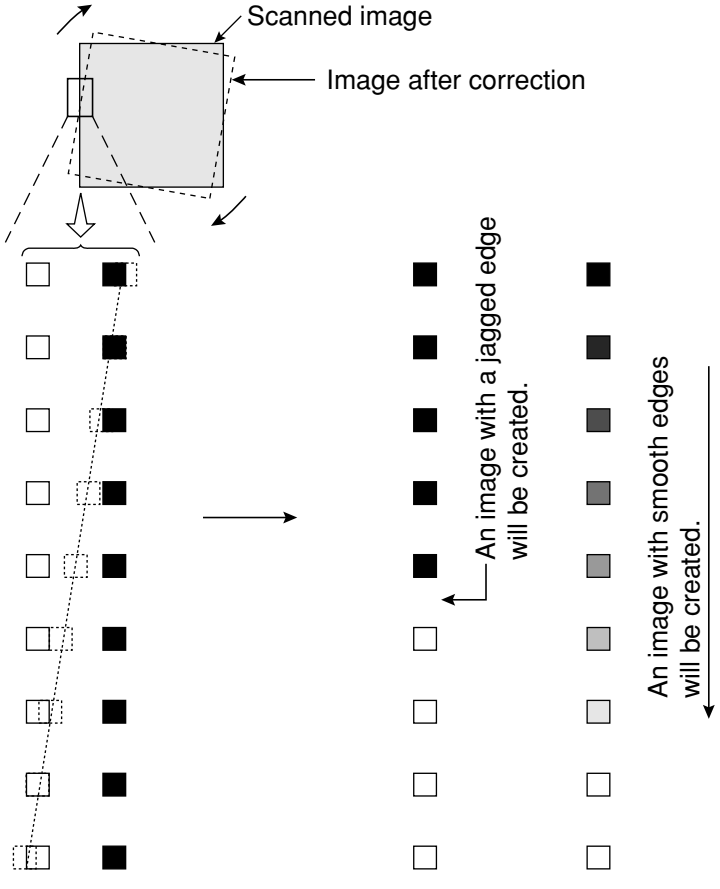
Based on the positional deviation data measurement 0 (positional deviation measurement), the correction of the image coordinates is dealt with using measurements 1 to 4.

(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
Angular correction (standard)	The position is adjusted because of a detected angular deviation θ in rotation [2-point search/2-point edge/1-point search + 1-point edge] from measurement 0. - When "YES" is selected in the DTECT ANGL item specifying a "1P-SCH" or a "1P-SCH+1P-EDGE" in measurement 0, the position will be corrected according to the angle detected.
Angular correction (high precision)	The position is adjusted because of a detected angular deviation θ 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-S30 to display a very precisely corrected image. But, this selection lowers rotation processing speed. - When "YES" is selected in the DTECT ANGL item specifying a "1P-SCH" or a "1P-SCH+1P-EDGE" in measurement 0, the position will be corrected according to the angle detected.

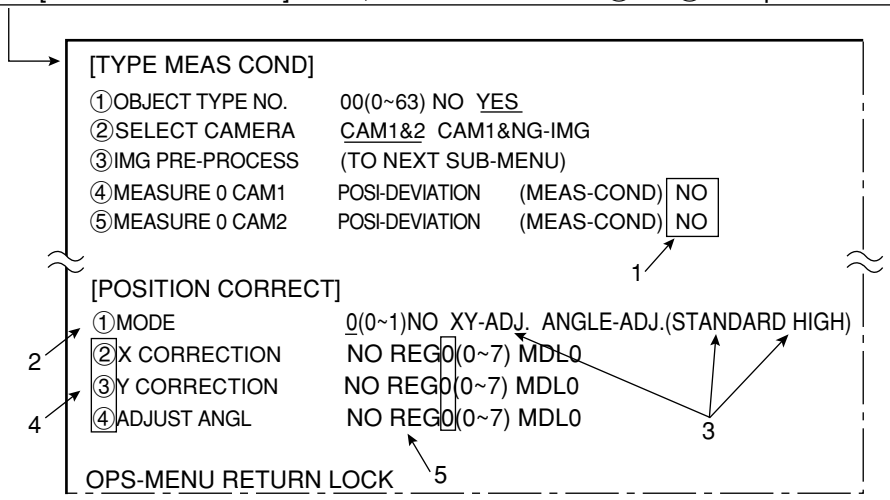
[Example of a comparison between standard and high precision angular correction]



(2) Operation setting details

Setting takes place on the [POSITION CORRECT] menu.

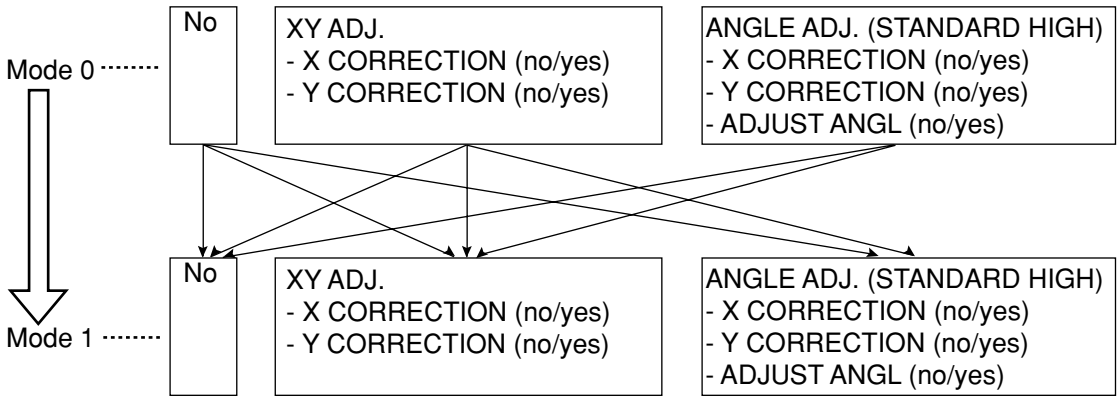
On the [TYPE MEAS COND] menu, move the cursor to ④ or ⑤ and press the SET key.



■ Setting procedure

1. Move the cursor to "NO" on the right of the (MEAS-COND) item.
   ⇨ The [POSITION CORRECT] menu will appear in the lower window.
2. Move the cursor to "①MODE" using the up and down keys and press the SET key.
3. Select the mode number in "①MODE" line as "0."
4. Move the cursor to "XY-ADJ." or "ANGLE-ADJ.(STANDARD HIGH)" or "NO" using the left and right keys. Then press the SET key.
   ⇨ The "NO" column on "MEASURE0 CAM1/2" line in the upper window will change to "YES."
   - When "XY-ADJ." is selected, lines ② and ③ will be displayed.
   - When ANGLE-ADJ. (STANDARD HIGH) is selected, lines ②, ③ and ④ will be displayed.
5. Select line "②X CORRECTION," using the up and down keys.
   - When no X correction is needed, select "NO" using the left and right keys.
   - When an X correction is needed, select the register number (0 to 7) and the model number (1 or 2) for measurement 0 (position deviation measurement: camera 1/2) using the left/right and up/down keys. Press the SET key to confirm your choice.
6. Set the "③Y CORRECTION" and "④ADJUST ANGLE" line the same as described in step 5 above.
7. Select line "①MODE," using the up and down keys. Then press the SET key. Then set the mode number to "1," using the up and down keys.
8. Set the choices the same as described in steps 4 to 6 above.
   When "ANGLE-ADJ (STANDARD HIGH)" is selected for mode 0, the "ANGLE-ADJ. (STANDARD HIGH)" choice will not be displayed for mode 1.

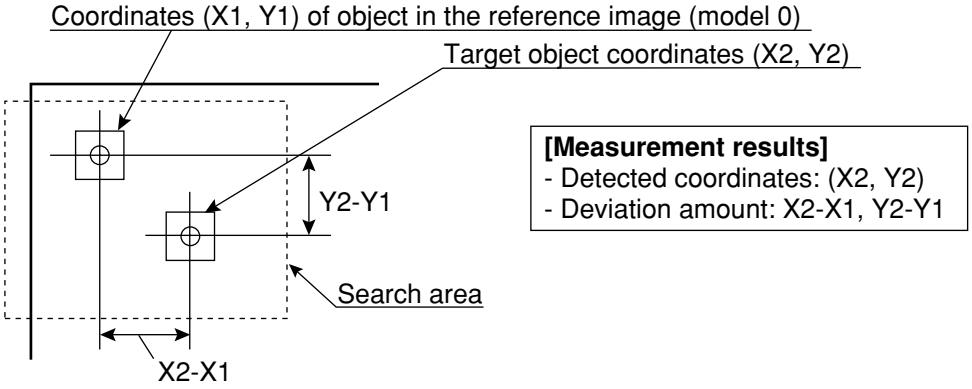
■ Order of position correction



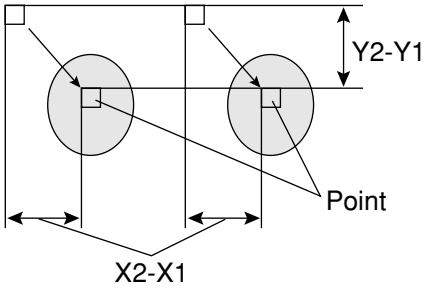
(3) Correction example

■ **Example of correcting the first X and Y point]**

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



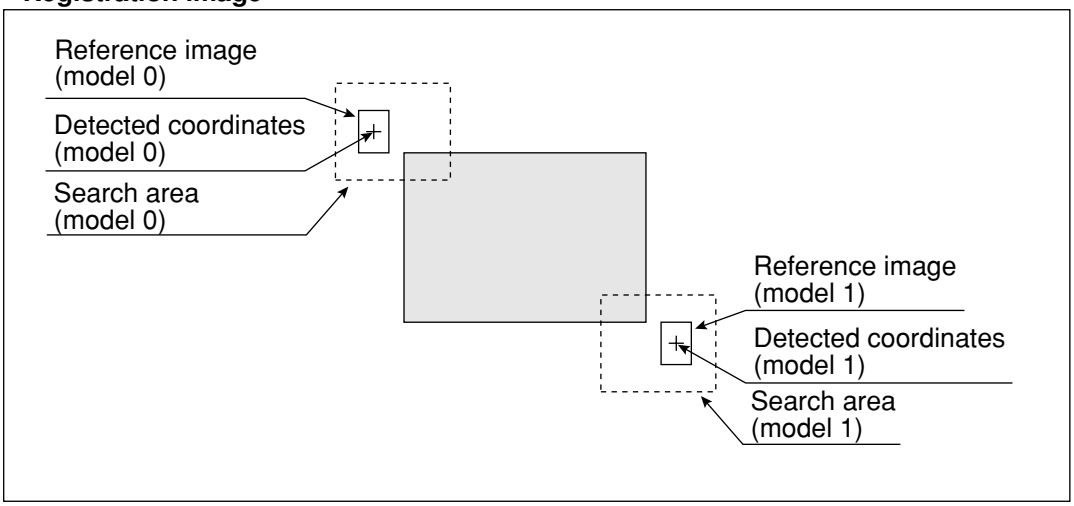
2. Measuring a point using measurement 1



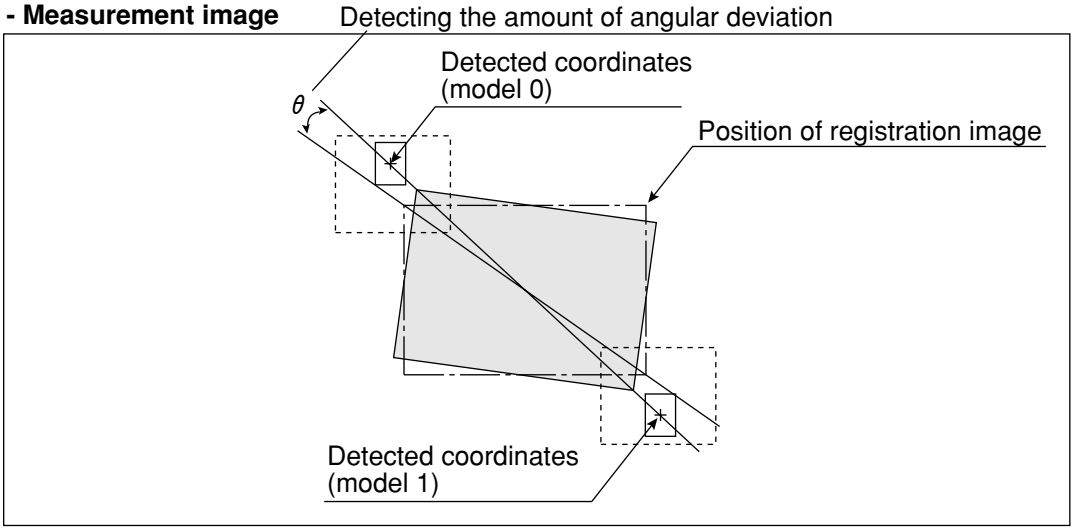
■ **Example of angular correction**

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

- Registration image

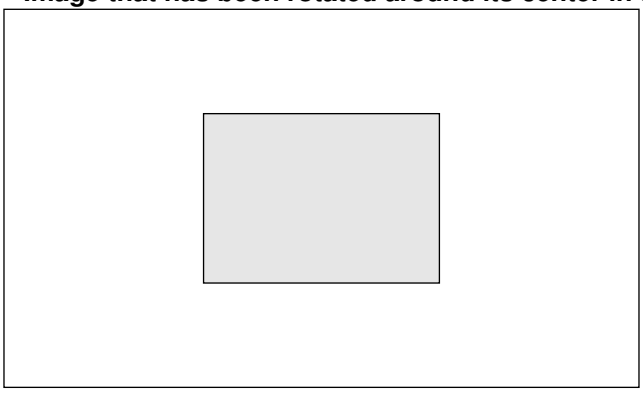


- Measurement image



2. Performing measurement 1 to 4 (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



[7] 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

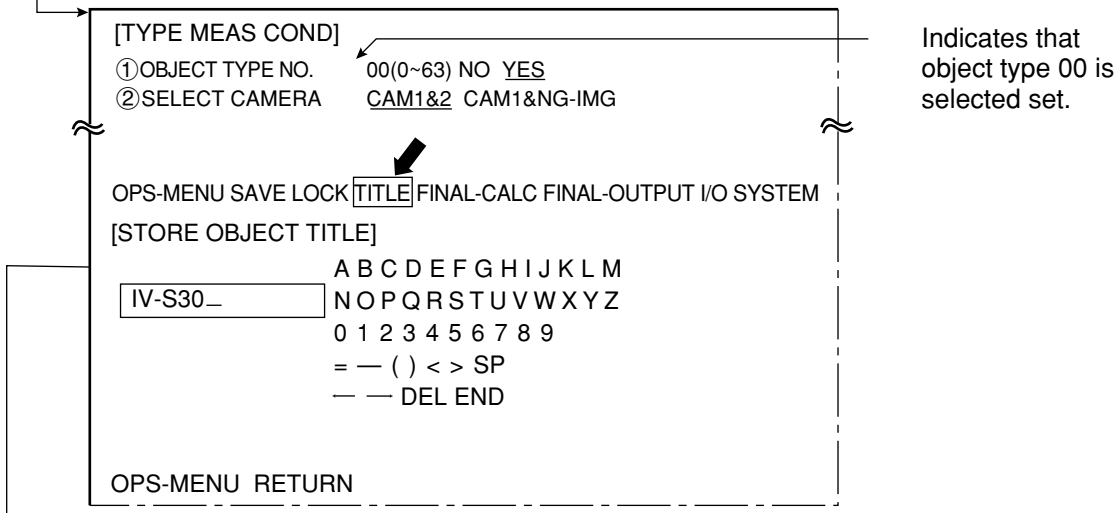
The title is used to make it easier to control the details of the settings for the object type.

■ Title characters

A maximum of 16 letters and symbols may be entered.

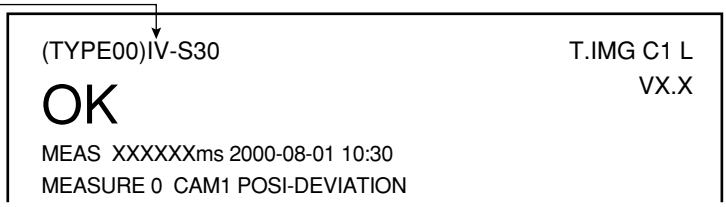
■ Operation method

On the MAIN OPS MENU, move the cursor to "MEA-CND", and press the SET key.
⇨ Move the cursor to "TITLE" using the up/down and left/right keys, and press the SET key.



STORE OBJCT TITLE	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	Exit the title registration screen.

The title that has been entered will be displayed in the top left corner of the MAIN OPS MENU.



3-3 Input & Output / 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 "OVR ILLM 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.

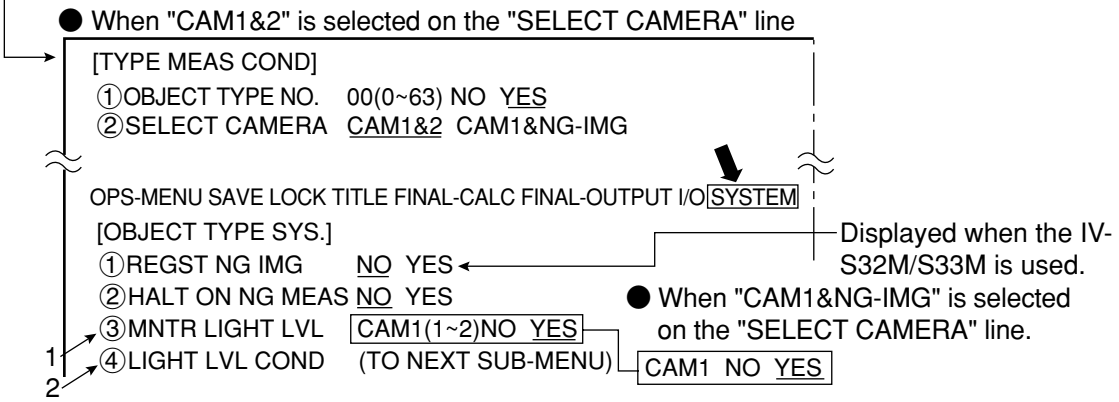
(2) Applications

Used when the level of illumination changed due to changes in voltage or when the influence of sunlight in the workplace cannot be ignored.

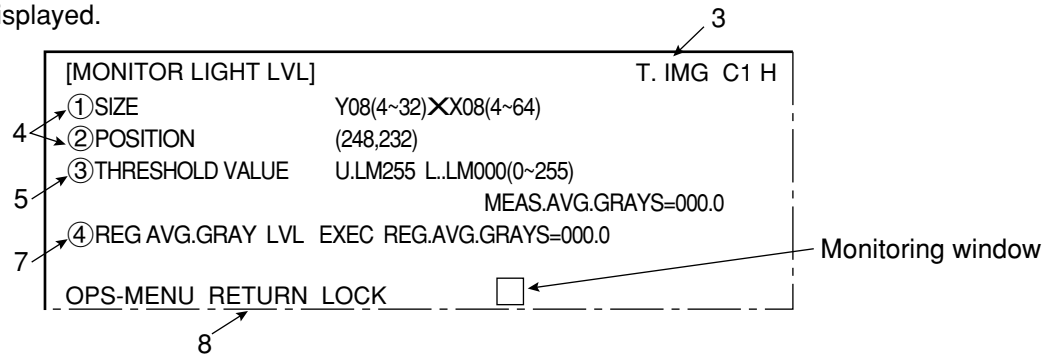
(3) Setting procedure

On the MAIN OPS MENU, move the cursor to "MEA-CND", and press the SET key.

⇨ Move the cursor to "SYSTEM" on the [TYPE MEAS COND] menu, and press the SET key.



1. Select "③MNTR LIGHT LVL (check light level)" using the up and down keys, and press the SET key.
   - When the "SELECT CAMERA" is "CAM1&2," 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.
   - When the "SELECT CAMERA" is "CAM1&NG-IMG," select "YES" using the left and right keys and press the SET kye.
2. Select item "④LIGHT LVL COND (conditions for checking light level)" using the up and down keys, and press the SET key.
   ⇨ The [MONITR LIGHT LVL] (check light level) menu and the monitoring window will be displayed.



3. Press the SEL key to enter the through image mode.
   ⇨ T.IMG (through) will be displayed in the upper right corner of the screen.
4. Select item "①SIZE", and item "②POSITION", 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 "MEAS.AVG.GRAYS (average measured light level) in item ③."

[When monitoring changes in the lighting environment] ... If not, go to item 6.

5. Select item "③THRESHOLD 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.IMG (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 "④REG AVG. GRAY 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. AVG. GRAYS (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 "RETURN" and press the SET key.
   - Move the cursor to the "SAVE" item on the [TYPE MEAS COND] menu in order to save the parameters you have entered in the IV-S30 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] Setting the shutter speed

The shutter speed can be set independently for each object type.
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.

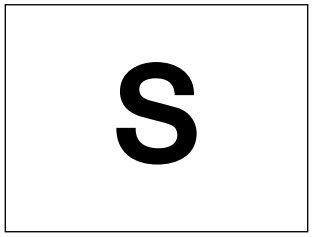
- If you want to measure moving objects and increase the image processing speed, set the shutter speed to around 1/1000 or 1/2000 seconds. However, if you use a faster shutter speed than you need, very bright lights will be necessary, and bright lighting is not economical.
- For details about the relationship between the brightness of objects (objects to be measured) and the shutter speed, see IV-S30 User's Manual (Introduction and Hardware) "5-1 [2] Illumination and shutter speed."

[Example]

- When the shutter speed is slow (1/60 of a second)

The object is blurred across the screen.

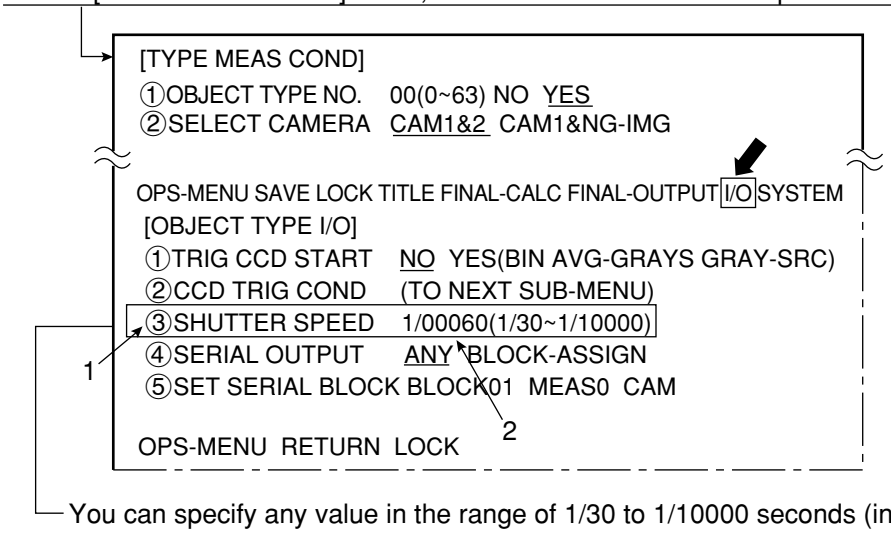
- When the shutter speed is fast (1/1000 of a second)



The object is frozen on the screen.

■ Setting procedure

On the [TYPE MEAS COND] menu, move the cursor to "I/O" and press the SET key.



You can specify any value in the range of 1/30 to 1/10000 seconds (initial value 1/60) for the shutter speed.

1. Move the cursor to the "③SHUTTER SPEED" item on the OBJECT TYPE I/O using the up and down keys, and press the SET key.
2. Press the SET key again, and move the cursor to the digit you want, using the left and right keys.

   1/ 00060
   This cursor will move to the left and right.
3. Set the value using the up and down keys.
4. Repeat steps 3 and 4 to set each digit.
   After setting all of the digits, press the SET key.

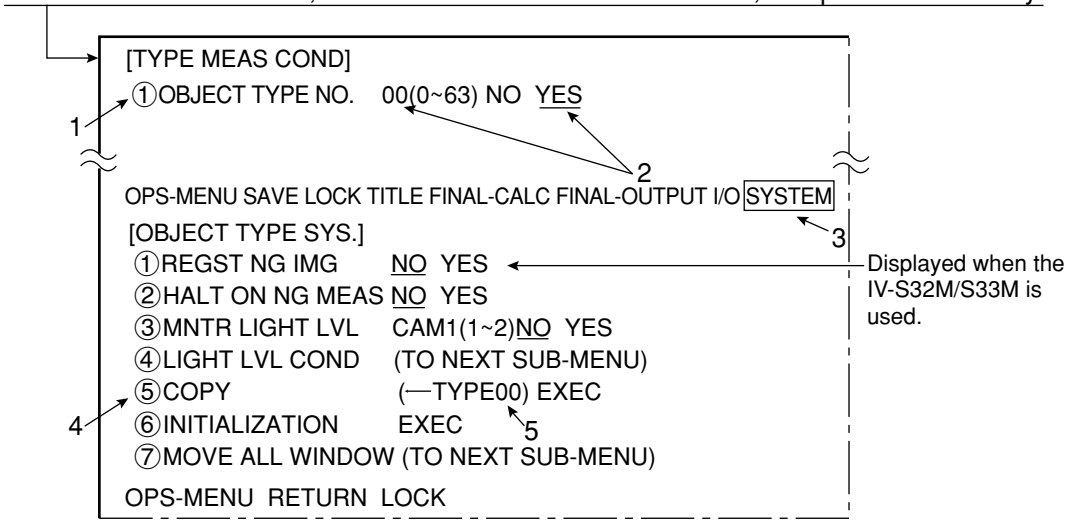
[3] Copying

When there are many common parameters between object types, it is most efficient to access those existing sets of parameters in order to copy and then modify them.
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 "MEA-CND" item, and press the SET key.



1. Select item "①OBJECT TYPE NO.," using the up and down keys and press SET key.
2. Using the left and right keys, enter the object type number (IV-S33M: 0 to 63, IV-S32M: 0 to 31, IV-S31M: 0 to 15) for the target of the copy. Then, move the cursor to "YES" and press SET key.
3. Select item "SYSTEM," using the up/down and left/right keys and press the SET key.
   ⇨ The "OBJECT TYPE SYS." menu will be displayed on the lower window.
4. Move the cursor to "⑤COPY" using the up and down keys and press the SET key.
5. Enter the object type number for the source of the copy using the up and down keys. Then, press the SET key.
   ⇨ The system will start copying.

Notes

- Do not disconnect the power while the IV-S30 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.

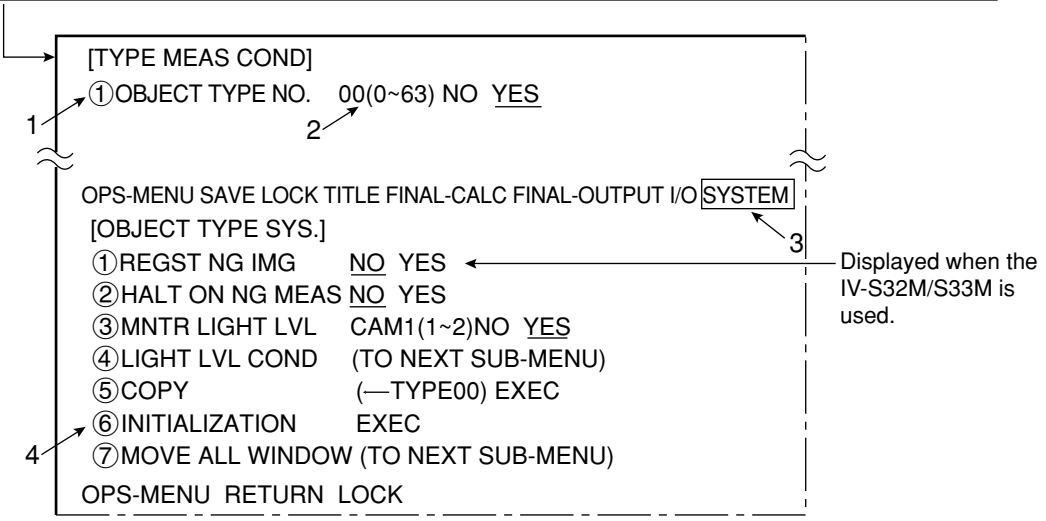
[4] Initialize the measurement conditions for each type

If you are going to specify each of the conditions, we recommend that you first initialize the settings. The measurement conditions for the specified object type (data for the object type you are in the process of entering) will be initialized.

- For details about total initialization, see the section, "2-2 [2] Total initialization, RAM initialization."

■ Operation procedure

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



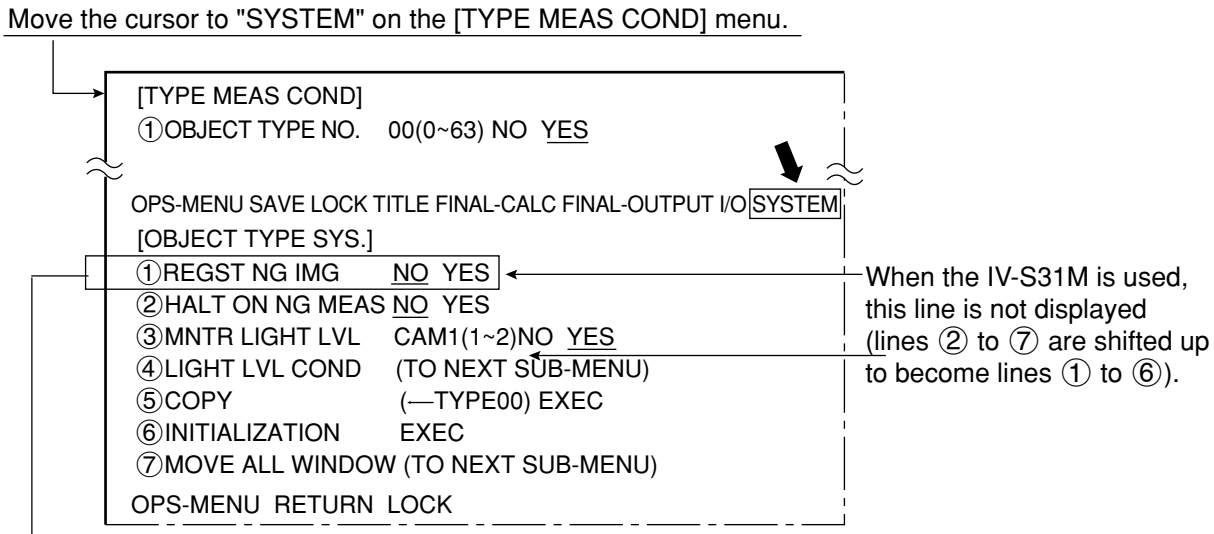
1. Select item "①OBJECT TYPE NO." using the up and down keys and press the SET key.
2. Select the object type number (IV-S33M: 0 to 63, IV-S32M: 0 to 31, IV-S31M: 0 to 15) to be initialized using the up and down keys.
3. Select item "SYSTEM," using the up/down and left/right keys and press the SET key.
   ⇨ The [OBJECT TYPE SYS.] menu will appear in the lower window.
4. Select "⑥INTIALIZATION" using the up and down keys and press the SET key.
   ⇨ The system will start initializing.

Notes

- Do not disconnect the power while the IV-S30 is initializing.
- The data settings not currently being initialized 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).

[5] NG image registration (IV-S32M/S33M)

You can register the NG image (by final evaluation result) while operating the IV-S32M/S33M.
Select "②REGST NG IMG" of the [OBJECT TYPE SYS.] menu for the setting.



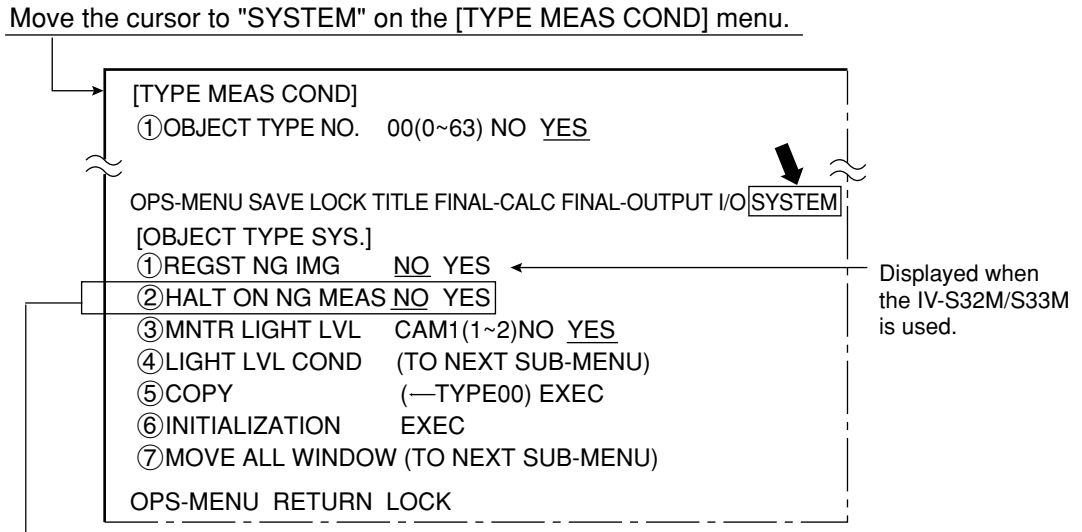
①REGST NG IMG	Description
YES	Register NG images. - 128* is the maximum number of images that can be stored (NG image numbers 0 to 127). If total number of images exceeds 128, the oldest image will be deleted (NG image numbers will be shifted accordingly).
NO	NG images will not be stored.

* A maximum of 128 images can be stored in REGST NG IMG, but the actual number may be smaller, depending on the size of the images to be registered.
  [Limit] When the image size is at the maximum allowed (512 X 480 pixels per screen), a total of 8 images can be stored (1,966,080 pixels = 512 X 480 X 8).
  In another example, if the NG image size is 256 X 240 pixels, a maximum of 32 images of that size can be registered. (256 X 240 X 32 = 1,966,080)

- When the "REGST NG IMG" (NG image registration) is set to "YES" and an NG occurs while measuring, the controller will register the image as an NG image automatically.

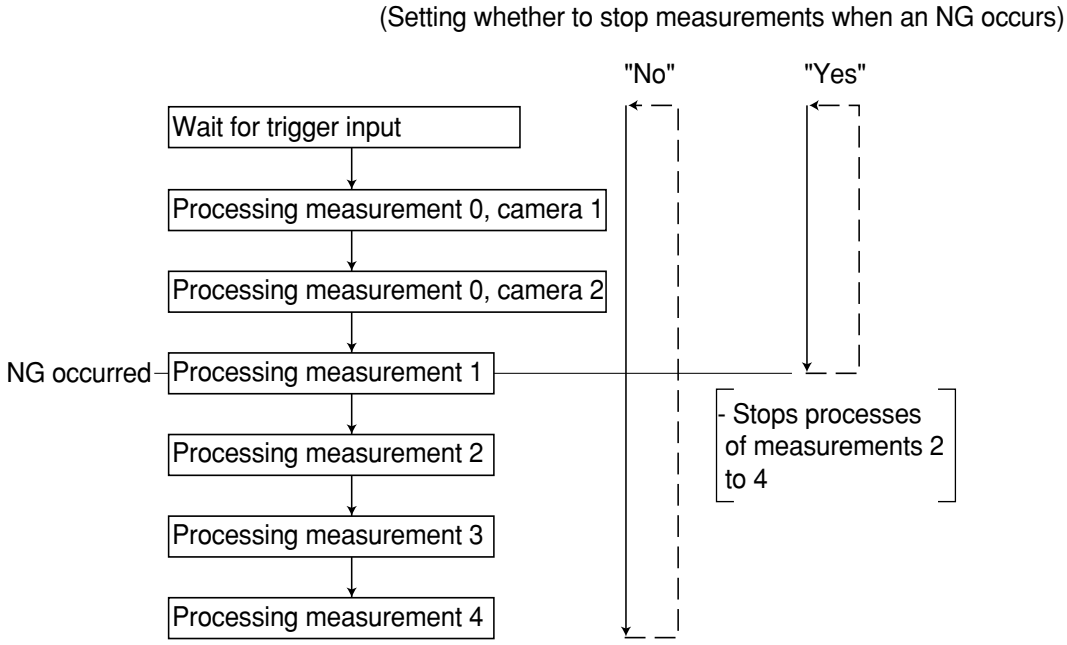
[6] Halt on NG measurement

You can stop all measurements when an NG image (according to the final evaluation results) occurrs while operating the IV-S30.
Select "②HALT ON NG MEAS" on the [OBJECT TYPE SYS.] menu.



②HALT ON NG MEAS	Desciption
YES	When an NG image is detected (according to the final evaluation result) while operating the IV-S30, the controller will stop making measurements.
NO	Even if an NG image (final evaluation result) is detectd while operating the IV-S30, the system will continue making measurements.

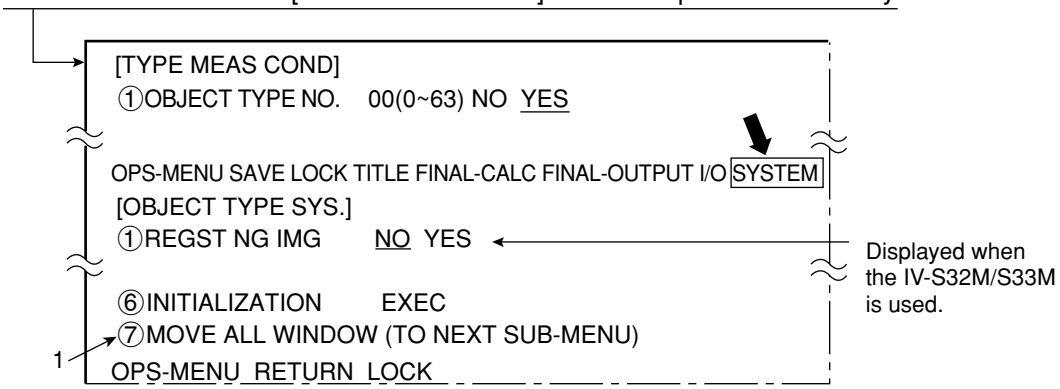
Shown below is an example of an NG image that occurred during measurement 1.



[7] Window group move

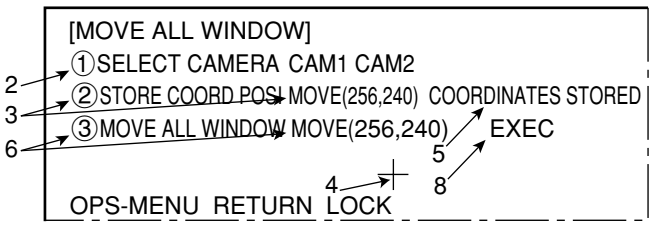
All the window positions set in the measurement programs for the same object type number can be shifted horizontally by a specified amount as a group.
[Example of use] Shift the coordinate positions used as data for another object type.
(After copying the data between object types, move the windows as a group.)
To set the amount, use "⑦MOVE ALL WINDOW" in the [OBJECT TYPE SYS.] menu.

Select "SYSTEM" on the [TYPE MEAS COND] menu and press the SET key.

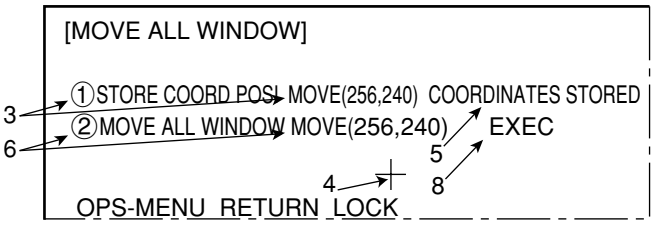


1. Move the cursor to "⑦MOVE ALL WINDOW" using the up and down keys and press the SET key. When the
   ⇨ The "MOVE ALL WINDOW" menu will be displayed.
   The display items may vary with the camera selection (page 3-3).

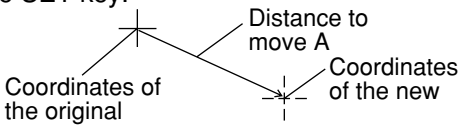
● When "CAM1&2" is selected.



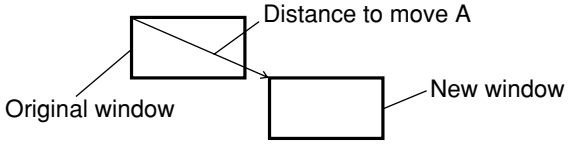
● When "CAM1&NG-IMG" is selected.



2. Select "SELECT CAMERA" using the up and down keys and press the SET key. Select "CAM1" or "CAM2" using the left and right keys and press the SET key. (When the camera selection is set to "CAM1&2," assign a camera number to move as a group.)
3. Select "STORE COORD POSI" (register the coordinates) using the up and down keys and press the SET key. Select "MOVE" using the left and right keys and press the SET key.
4. Move the cursor (solid line) to the original coordinates before the move using the up, down, left, and right keys, and press the SET key.
5. Select "STORE COORD POSI" using the left and right keys, and press the SET key. After that press the ESC key.
   ⇨ The coordinates before the move are now registered.
6. Select "MOVE ALL WINDOW" using the up and down keys and press the SET key. Select "MOVE" using the left and right keys and press the SET key.
7. Move the cursor (dotted line) to the new coordinates you are moving to use the up, down, left, and right keys and press the SET key.



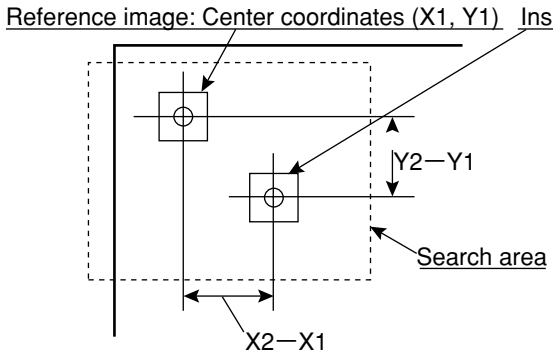
8. Select "EXEC" (execute) using the left and right keys and press the SET key.
   ⇨ All the windows registered to the same object type will be shifted horizontally at the same time by the distance between the original coordinates to the new coordinates. After the move is complete, a "Window group move is complete" message will be displayed.



- When some part of the window to be moved will move outside of the image display area, the "Out of range" message will be displayed together with the measurement number and register number. In this case, select "Continue" or "Halt."
  If "Continue" is selected, the window will be shifted to the limit within the image display area.

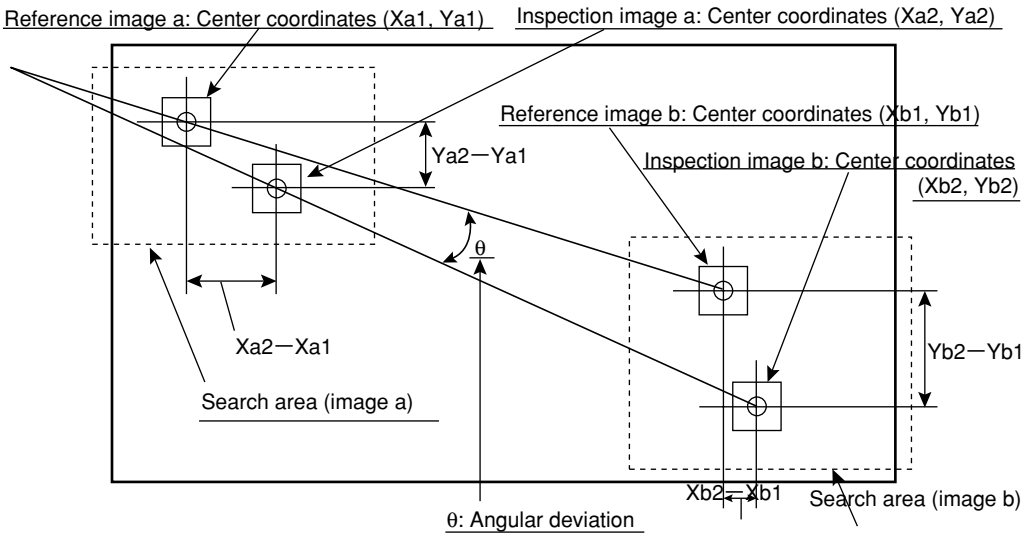
Chapter 4: Positional Deviation Measurement

Purpose	The gray scale search function makes it possible to measure positional deviation as well as the absolute position. - It is possible to detect the work position with high accuracy, at a sub-pixel level. - A rotation angle of 360° can be detected. (When a one point gray search is selected).
Application	Positioning of parts and substrates
Examples	**[Detection of the position of the substrate alignment mark (fiduciary mark)]** **(1) 1-point search: Detection of positional deviation in X and Y directions**



[Measurement results]
- Center coordinates: (X2, Y2)
- Amount of deviation: X2-X1, Y2-Y1

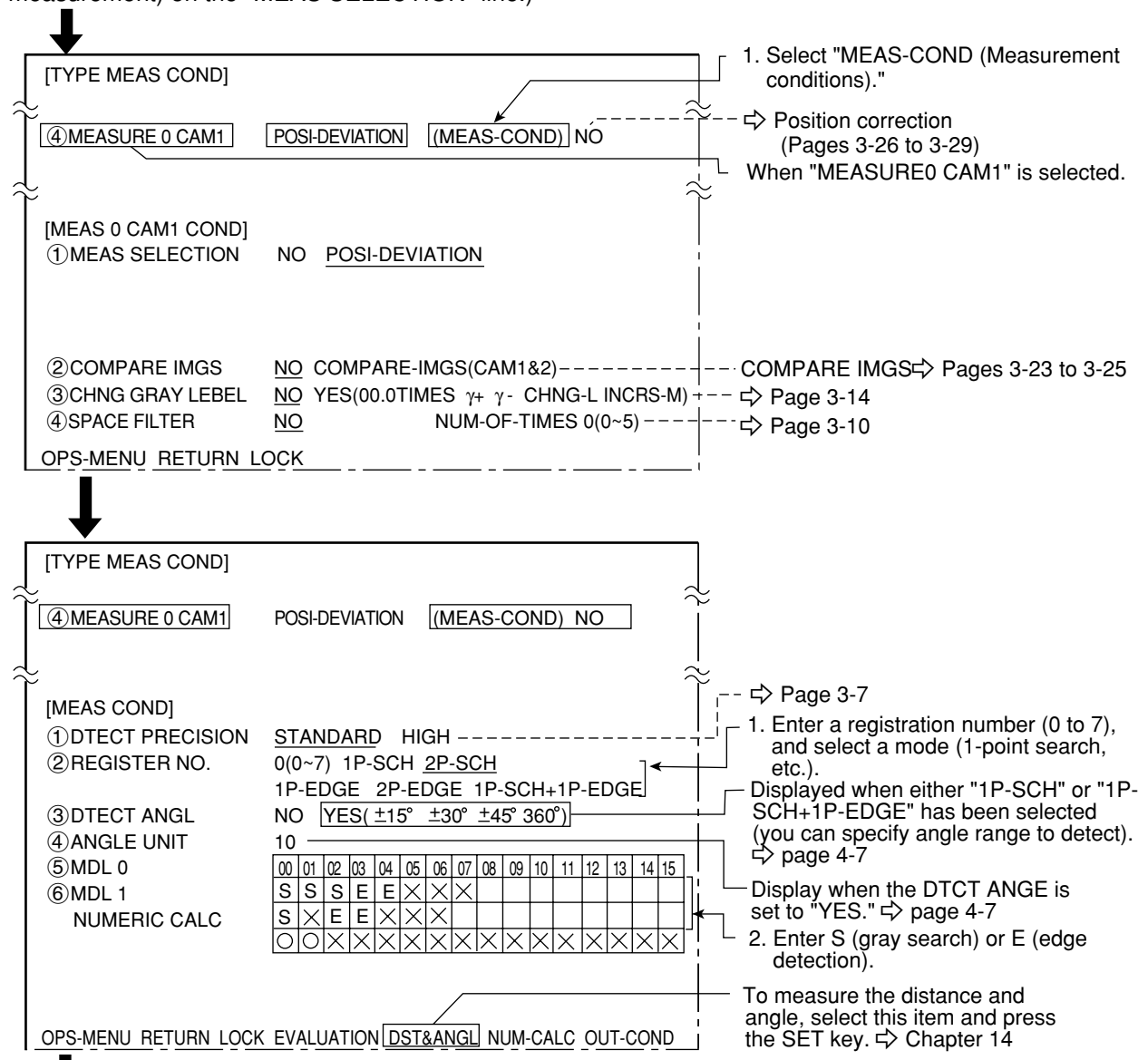
(2) 2-point search: Detection of positional deviation in X and Y directions and angle



[Measurement results]
- Center coordinates of image a: (Xa2, Ya2)
- Image a positional deviation: Xa2 - Xa1, Ya2 - Ya1
- Center coordinates of image b: (Xb2, Yb2)
- Image b positional deviation: Xb2 - Xb1, Yb2 - Yb1
- Angular deviation θ

- The angular deviation θ detected in the 2-point search mode will be used to correct the rotation of the image in order to make measurements 1 to 4.
  For details about rotation correction, see section 3-2, item [6] Position correction.

Setting the measurement programs (Page 1-10 to 1-11: Select "POSI-DEVIATION" (positional deviation measurement) on the "MEAS SELECTION" line.)



● Display example of setting the mode and the numerical calculation

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Registration No.																
⑤Model 0	S	S	S	E	E	X	X	X								
⑥Model 1	S	X	E	E	X	X	X	X								
Numeric calculation	O	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X : No setting

Registration No. 4: 1-point edge, numerical calculation result No. 04: Not performed

Registration No. 3: 2-point edge, numerical calculation result No. 03: Not performed

Registration No. 2: 1-point search + 1-point edge, numerical calculation result No. 02: Not performed

Registration No. 1: 1-point search, numerical calculation result No. 01: Performed

Registration No. 0: 2-point search, numerical calculation result No. 00:Performed

When S (gray search) is called for

To the next page

When E (edge detection) is called for

To page 4-4

Continued from the previous page: When S (gray search) is called for

```
①REGISTER NO.      0(0~7)                                    ⇨ Pages 3-4
②MEAS SHAPE(MDL0)  RECTANGLE X-LINE Y-LINE                     and 3-5
③REF IMG(MDL0)     NEW EXIST000(001~100)----                 ⇨ See below
④REF IMG ARE(MDL0) MOVE UP.L(224,208) LO.R(287,271) CONTRAST SR
                   REG DISP                                  ⇩
⑤SEARCH ARE(MDL0)  MOVE UP.L(216,200) LO.R(295,279)          Page 3-15
⑥DTECT CRD(MDL0)   CENTER FREE(255,239)
⑦CONTR.PIXL(MDL0)  1 2 3 ---------------                     ⇨ Page 3-7
⑧MEAS SHAPE(MDL1)  RECTANGLE X-LINE Y-LINE
⑨REF IMG(MDL1)     NEW EXIST000(001~100)----                 ⇨ See below
⑩REF IMG ARE(MDL1) MOVE UP.L(224,208) LO.R(287,271) CONTRAST SR
                   REG DISP
⑪SEARCH ARE(MDL1)  MOVE UP.L(216,200) LO.R(295,279)
⑫DTECT CRD(MDL1)   CENTER FREE(255,239)
⑬CONTR.PIXL(MDL1)  1 2 3

 OPS-MENU RETURN LOCK EVALUATION
```

- Items ⑧ to ⑬ are displayed in the "2P-SCH" mode.
- The data in items ④, ⑤ and ⑦ vary according to the selection in item ②.

Selection in item ②	Data displayed in items ④ and ⑤	Data displayed in item ⑦
RECTANGLE	UP.L, LO.R	1 2 3
X-LINE	S.PT, E.PT	1 2
Y-LINE		

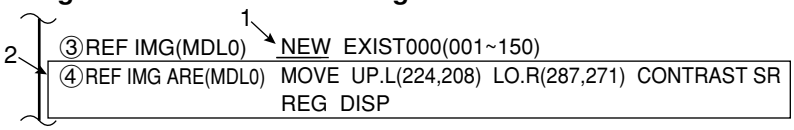
- Also the data in items ⑩, ⑪ and ⑬ vary according to the selection in item ⑧.

4

■ Setting procedures for reference images

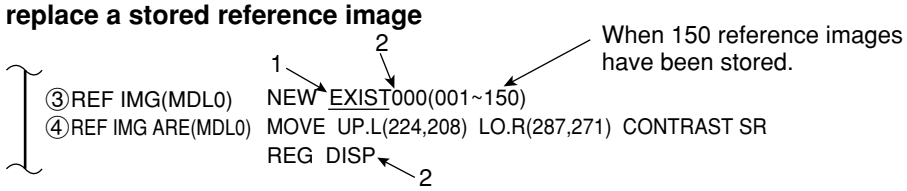
Described below are the procedures for model 0. (These procedures are the same for model 1.)

- To register a new reference image



1. Move the cursor to "NEW" on the "③REF IMG (MDL0)" item, and press the SET key.
2. Select the "④REF IMG ARE (MDL0)" item and store the settings.

- To replace a stored reference image



1. Move the cursor to "EXIST" on the "③REF IMG (MDL0)" item, and press the SET key.
2. When you select a reference image number that is already registered using the left and right keys (digit selection) and up and down keys, the reference image corresponding to that number will be displayed on lower right of the screen. Press the SET key to select this reference image.

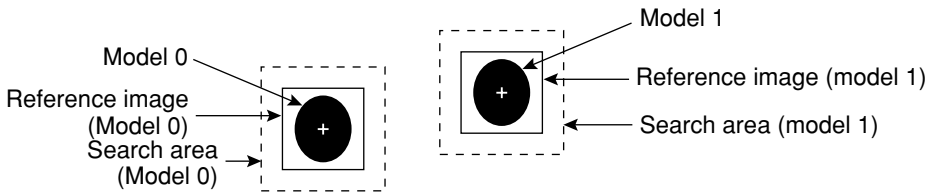
   Note: If you store a new reference image in the "④REF IMG ARE (MDL0)" item after selecting an existing image number in step 2 above, the reference image stored at the selected number will be replaced.

■ Maximum number of reference images that can be registered

Controller	Maximum number of reference images
IV-S33M	600 (when the total size of all the reference images is equal to 8 screens or less in area.)
IV-S32M	
IV-S31M	300 (when the total size of all the reference images is equal to 3 screens or less in area.)

■ An example of storing

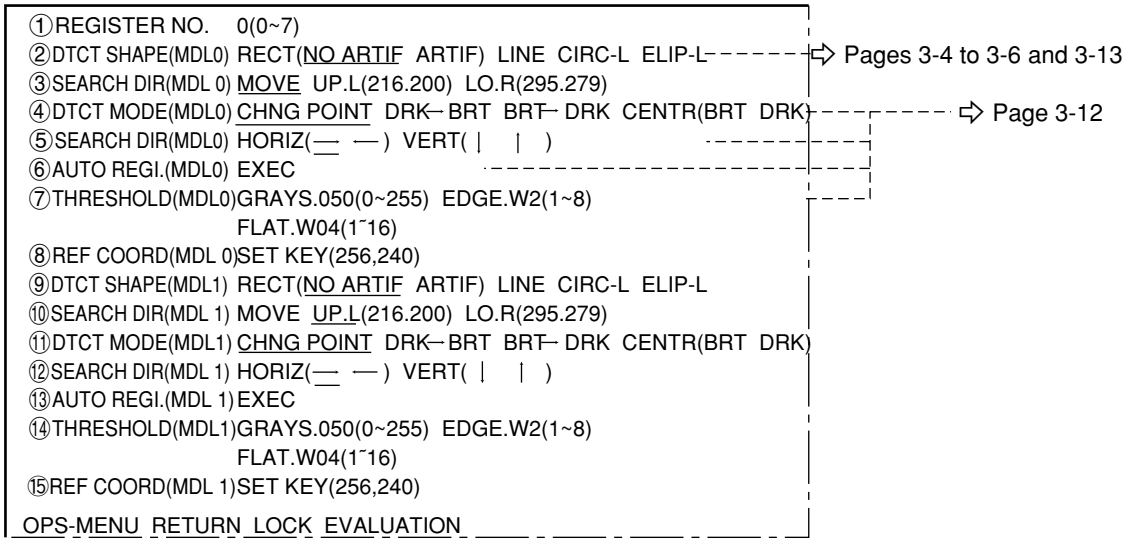
- This is an example of a 2-point search when the detection shape is a rectangle.



Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To page 4-5.

Continued from page 4-2: When E (edge detection) is called for



- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The actual items displayed change according to the mode selected.

Mode	Displayed items
1-point edge	① to ⑧
2-point edge	① to ⑮
1-point search + 1-point edge	①, ⑨ to ⑮

- The data displayed in item ⑤ varies according to the selection made in item ②.

Selection in item ②	Data displayed in item ⑤
RECT	HORIZ (→←) VERT (↓ ↑)
LINE	START-PNT→ END-PNT END-PNT → START-PNT
CIRC-L	CLOCK-WISE COUNTER-CW
ELIP-L	

Also the data in item ⑨ varies according to the selection made in item ⑫.

Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To the next page

Continued from page 4-3 or previous page

```
[EVALUATION COND]                                              ⇨ Page 3-16
①REGISTER NO.  0(0~7)              [TEST RESULT]          [OUTPUT]
②CONDITION SET RESET   AUTO(±10%)
③X COORD.(MDL0) 000.0~511.0        X0=  000.0        OK   NO
④Y COORD.(MDL0) 000.0~479.0        Y0=  000.0        OK   NO
⑤x DEVIATE(MDL0) -511.0~+511.0     x0=+000.0         OK   NO
⑥y DEVIATE(MDL0) -479.0~+479.0     y0=+000.0         OK   NO
⑦MATCH LVL(MDL0) -10000~+10000     M0=+09000         OK   NO
⑧ANGULAR DEVIATE -180.0~+180.0     B0=+010.0         OK   NO
⑨X COORD.(MDL1) 000.0~511.0        X1=  000.0        OK   NO
⑩Y COORD.(MDL1) 000.0~479.0        Y1=  000.0        OK   NO
⑪x DEVIATE(MDL1) -511.0~+511.0     x0=+000.0         OK   NO
⑫y DEVIATE(MDL1) -479.0~+479.0     y0=+000.0         OK   NO
⑬MATCH LVL(MDL1) -10000~+10000     M1=+09000         OK   NO
⑭TEST              EXEC(WITH-POSI.WITHOUT-POSI.ADJ)
OPS-MENU  RETURN  LOCK
```

You can set the output destinations using the up and down keys. (No, Y0 to Y7, C000 to C127)

Displayed only when one of the measurements 1 to 4 has been selected.

-Items ⑨ to ⑬ are displayed in the 2P-SCH (2-point search), 2P-EDGE (2-point edge) and 1P-SCH + 1P-EDGE (1-point search + 1-point edge) modes.
- Lines ⑦ and ⑬ are displayed as follows when edge detection is selected.
  - ⑦SEARCH EDGE(MDL0) YES NO K0 ---- When "1P-EDGE " or "2P-EDGE" is selected.
  - ⑬SEARCH EDGE(MDL1) YES NO K0 ---- When "2P-EDGE" or "1P-SCH + 1P-EDGE" is selected.

When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.

⇨ See "Chapter 15: Numerical Calculations"

When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.

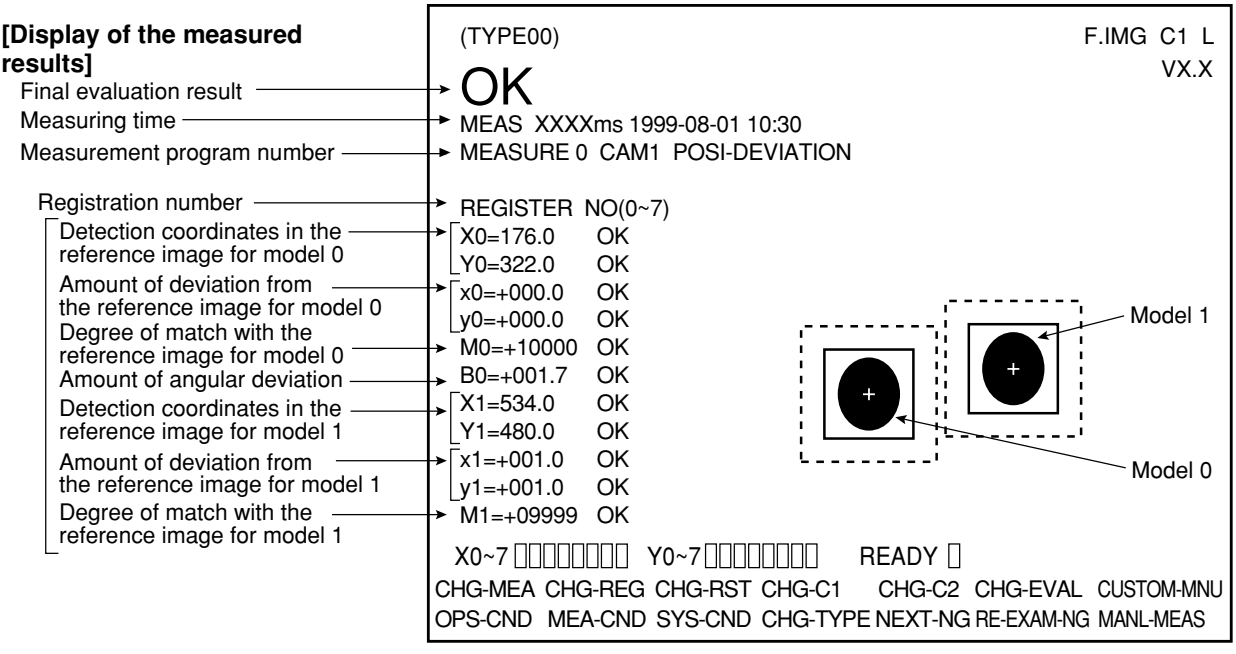
⇨ See "Chapter 16: PC Function"

Return to the [MEAS COND] menu.

Pressing the TRG/BRT key will start a measurement manually.

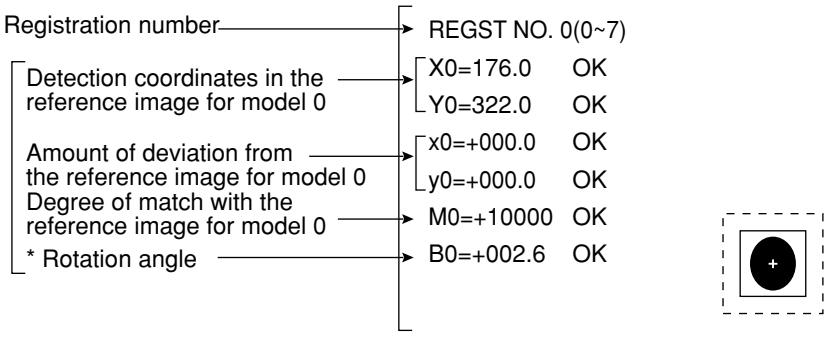
■ When a 2 point search has been specified.

[Display of the measured results]



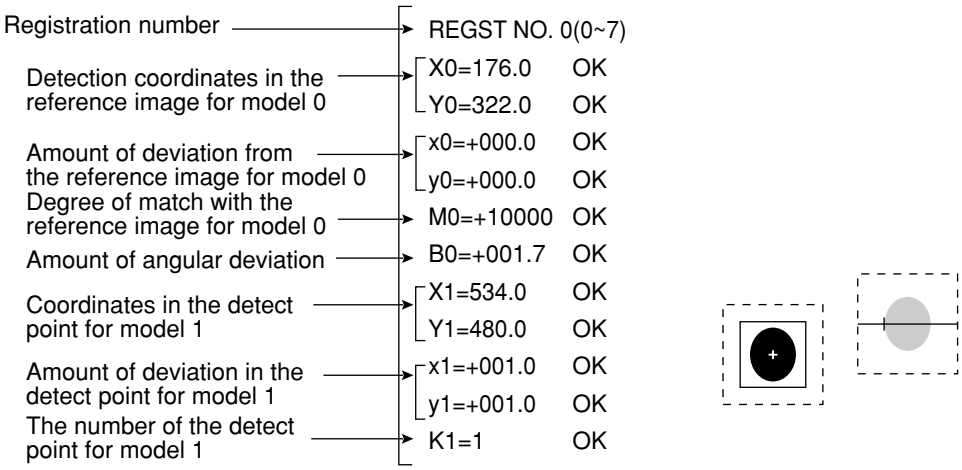
The displays for other modes are shown in the next page.

■ 1-point search

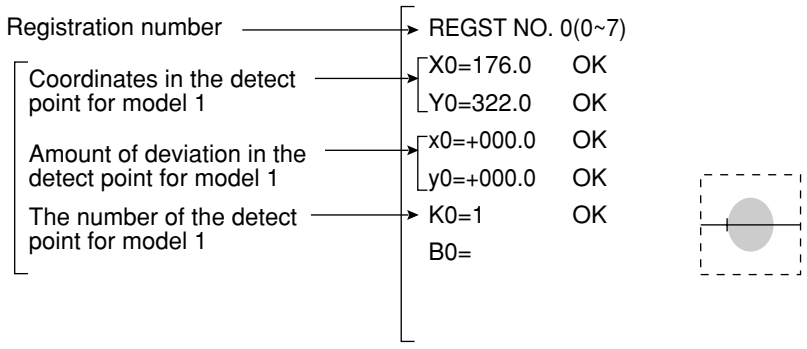


* Angle will be displayed when "DTECT ANGL" is set to "YES."

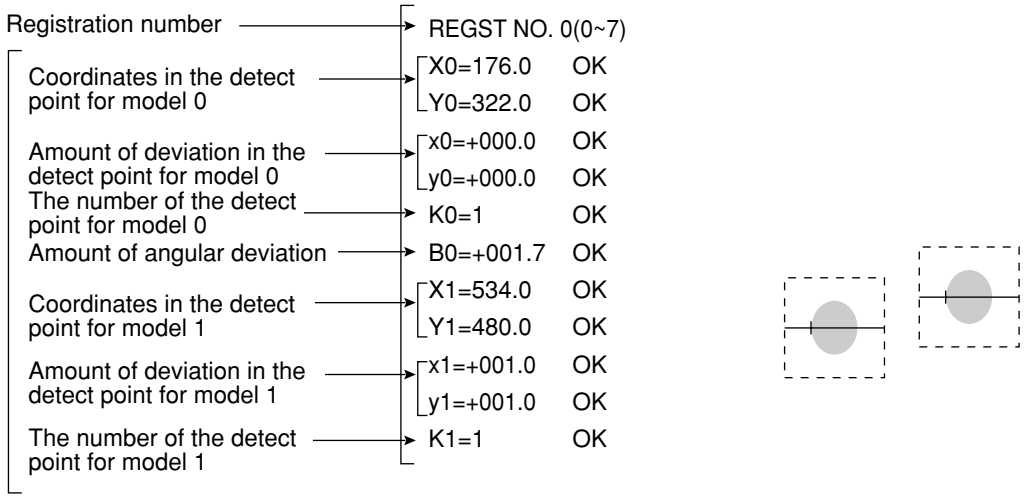
■ 1-point search + 1-point edge



■ 1-point edge



■ 2-point edge

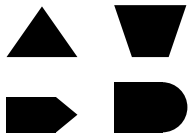
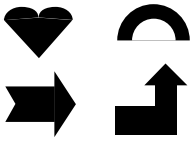


Angle detection

You can detect the angle of an object by selecting 1P-SCH (1-point search) in the POSI-DEVIATION item (measurement 0 to 4) .

(1) Angle detection by object shape

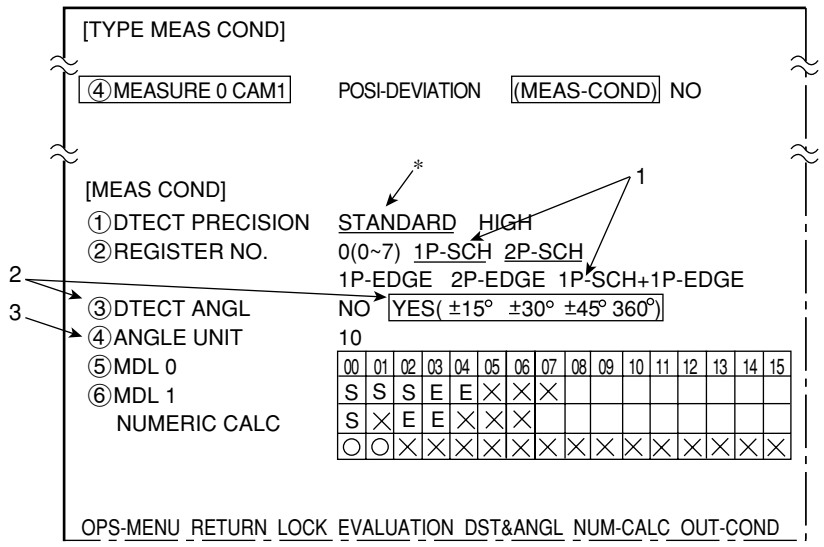
There are some objects whose angle cannot be detected, due to the shape of the object and the compression level used for the gray scale search, as shown in the table below.

Object shape	Angle detection	Difficulty level
	The angle cannot be detected.	×
	The angle can be detected using a compression level of 2 for the gray scale search.	△
	The angle can be detected.	○

- The information given above is true when the measurement conditions are as follows: the size of the reference image to be registered is approximately 64 X 64, and the search size is approximately 100 X 100.

(2) Setting method

On the [TYPE MEAS COND] menu, select the "1P-SCH" or "1P-SCH+1P-EDGE" mode and then select the "③DTECT ANGL" item. ⇨ See page 4-2.



* When "YES" is selected on the DTECT ANGL item, the "HIGH" mode selection on the "DTECT PRECISION" item will be disabled.
(The detection precision is fixed at STANDARD.)

1. Select the "1P-SCH" or "1P-SCH+1P-EDGE" mode.
2. Select the angle search range (±15˚, ±30˚, ±45˚, ±360˚) on the "③DTECT ANGL" item.
   The larger the angle search range, the slower the processing will be.
3. Select a rotation step size in degrees in "④ANGLE UNIT," using the up and down keys.
   The relationship between the detection range (unit) of the rotation angle and the reference images to be created is shown below:

Rotation angle		Reference image created	
Detection range	Unit	Rotation angle	Quantity
±15˚	1	-17, -16, -15, -14, • • • • • • • • • +14, +15, +16, +17	35
	3	-21, -18, -15, -12, • • • • • • • • • +12, +15, +18, +21	15
	5	-25, -20, -15, -10, -5, 0, +5, +10, +15, +20, +25	11
	10	-15, -10, 0, +10, +15	5

To the next page

Rotation angle		Reference image created	
Detection range	Unit	Rotation angle	Quantity
±30°	2	-34, -32, -30, -28, • • • • • • • • +28, +30, +32, +34	35
	3	-36, -33, -30, -27, • • • • • • • • +27, +30, +33, +34	25
	5	-40, -35, -30, -25, • • • • • • • • +25, +30, +35, +40	17
	6	-42, -36, -30, -24, • • • • • • • • +24, +30, +36, +42	15
	10	-30, -20, -10, 0, +10, +20, +30	7
±45°	3	-51, -48, -45, -42, • • • • • • • • +42, +45, +48, +51	35
	5	-55, -50, -45, -40, • • • • • • • • +40, +45, +50, +55	23
	10	-45, -40, -30, -20, -10, 0, +10, +20, +30, +40, +45	11
Full angle	10	-170, -160, -150, • • • • • • +150, +160, +170, +180	36

4

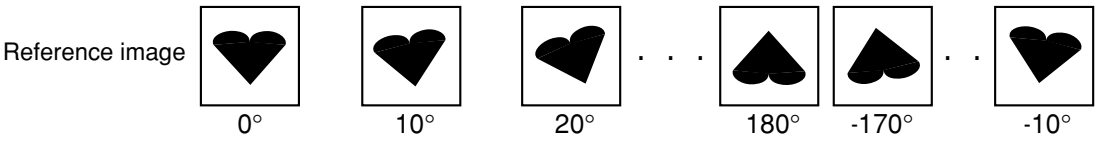
4. On the settings for the gray scale search conditions (page 4-3), register the object by surrounding it with a square window, regardless of the shape of the object to be measured.

[Example]

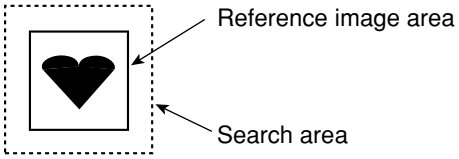
Image to register 

- When triggered to store the reference image, the system will store various views of the object in memory by rotating the image, 10 degrees at a time.

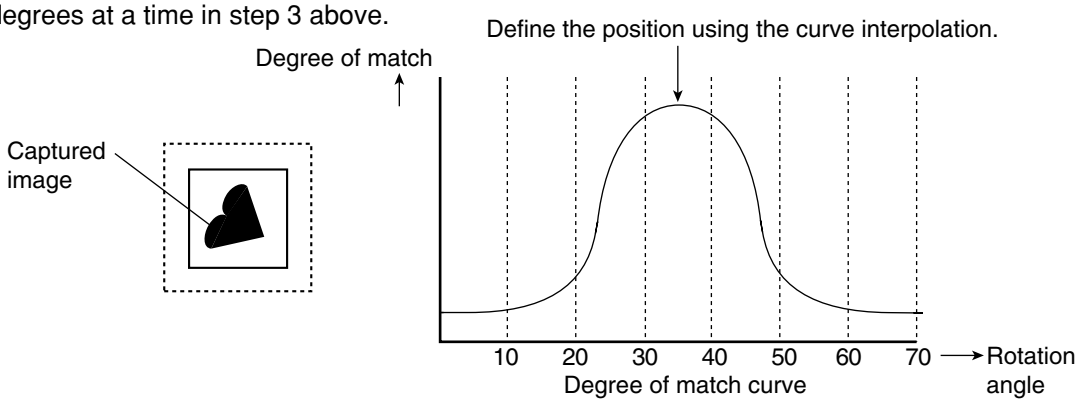
[When the angle range is set to ±360°]



5. Specify a search area that is large enough to include various positional deviations of the object.



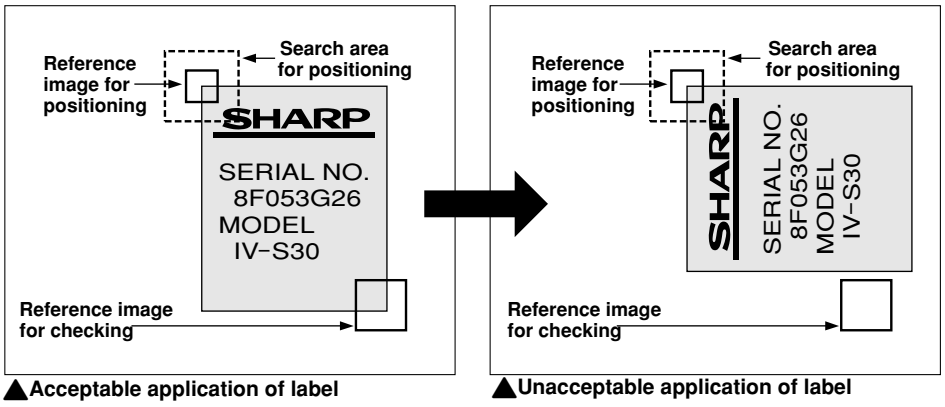
6. When starting the measurement, the system will execute a gray scale search of the captured image based on the stored reference images, which were created by rotating the basic image, 10 degrees at a time in step 3 above.



Note: When "NO" is selected for the "DTECT ANGL" (rotation angle detection) in the previous page after registering the reference image, a "Reference image condition mismatch" error will occur when executing the measurement.

Chapter 5: Degree of Match Inspection

Purpose	The gray search function is capable of finding the differences between the non-defective reference image and the image to be inspected evaluating the degree of match. (The acceptability of the workpiece is evaluated based on its level of similarity to the reference model.)
Applications	Checking for misalignment of labels, checking for entry of wrong parts, checking that electronic components have been precisely mounted on PC boards, checking for misprints, checking for missing metallic parts, such as terminals, and simple inspection of lettering
Examples	**[Checking for label misalignment on package]**



▲Acceptable application of label ▲Unacceptable application of label

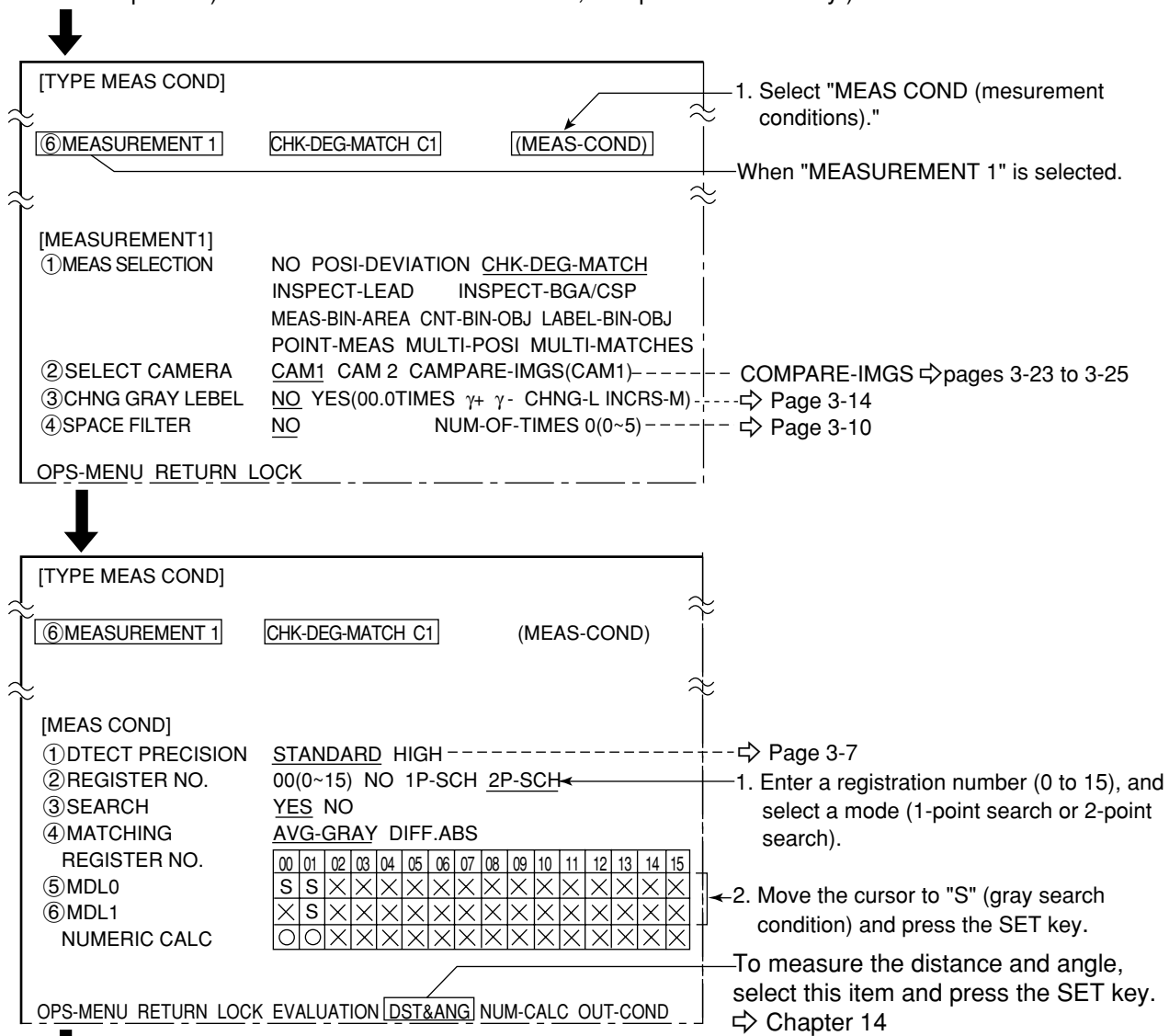
[Measurement results]
- Degree of match compared with the reference image
- Detected coordinates (X/Y) of the measurement image.
- Light level in the measured image (average light level/absolute value of difference)

- Checking sequence

①A gray search for the reference image for positioning is made.
②After the position of the reference image for checking is corrected based on the coordinates of the reference image for positioning found in step ①, the degree of match is determined.
③If the degree of match of the reference image for checking is low, the label is regarded as applied incorrectly.

Degree of Match Inspection

Setting the measurement programs (page 1-10 to 11: Select "CHK-DEG-MATCH" (degree of match inspection) on the "MEAS SELECTION" line, and press the SET key.)



● **Example of setting (display) of mode and numerical calculation**

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Registration No.																
⑤Model 0	S	S	×	×	×	×	×	×	×	×	×	×	×	×	×	×
⑥Model 1	×	S	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Numeric calculation	○	○	×	×	×	×	×	×	×	×	×	×	×	×	×	×

X : No setting

Registration No.1: 2-point search, numerical calculation result No.01: Performed

Registration No.0: 1-point search, numerical calculation result No.00: Performed

Move the cursor to "S" (gray search condition) and press the SET key.

To the next page

Continued from the previous page

```
①REGISTER NO.     0(0~7)
②MEAS SHAPE(MDL0) RECTANGLE X-LINE Y-LINE
③REFIMG(MDL0)     NEW EXIST000(001~100)
④REFIMG ARE(MDL0) MOVE UP.L(216,200) LO.R(295,279) CONTRAST SR
                  REG DISP
⑤SEARCH ARE(MDL0)MOVE UP.L(216,200) LO.R(295,279)
⑥DTECT CRD(MDL0)CENTER FREE(255,239)
⑦CONTR.PIXL(MDL0) 1 2 3
⑧MEAS SHAPE(MDL1) RECTANGLE X-LINE Y-LINE
⑨REFIMG(MDL1)     NEW EXIST000(001~100)
⑩REFIMG ARE(MDL1) MOVE UP.L(224,200) LO.R(287,279) CONTRAST SR
                  REG DISP
⑪SEARCH ARE(MDL1)MOVE UP.L(216,200) LO.R(295,279)
⑫DTECT CRD(MDL1)CENTER FREE(255,239)
⑬CONTR.PIXL(MDL1) 1 2 3

OPS-MENU RETURN LOCK EVALUATION
```

⇨ Pages 3-4 and 3-5

⇨ Page 4-3 (The settings are the same as for the positional deviation measurement.)

⇨ Page 3-7

- When "YES" is selected on the "③SEARCH" line of the [MEAS COND] menu (page 5-2), "⑤, ⑪ SEARCH ARE" will be displayed.
  When "NO" is selected, "⑤, ⑪ SEARCH ARE" will not be displayed.

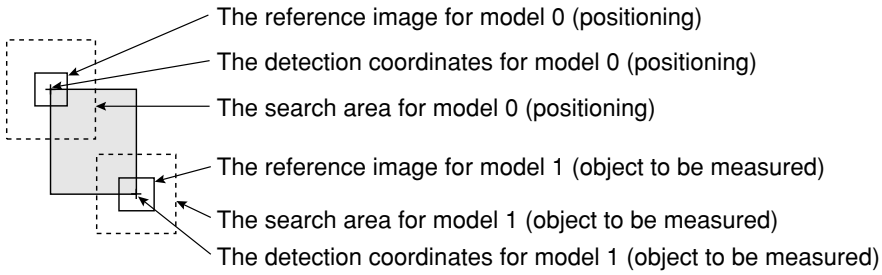
- Items ⑧ to ⑬ are displayed in the "2P-SCH" mode.
- The data in items ④, ⑤ and ⑦ vary according to the selection in item ②.

Selection in item ②	Data displayed in items ④ and ⑤	Data displayed in item ⑦
RECTANGLE	UP.L, LO.R	1 2 3
X-LINE	S.PT, E.PT	1 2
Y-LINE		

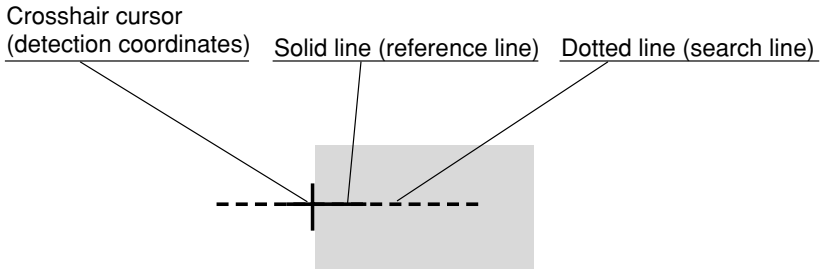
Also the data in items ⑩, ⑪ and ⑬ vary according to the selection in item ⑧.

■ Example of recording

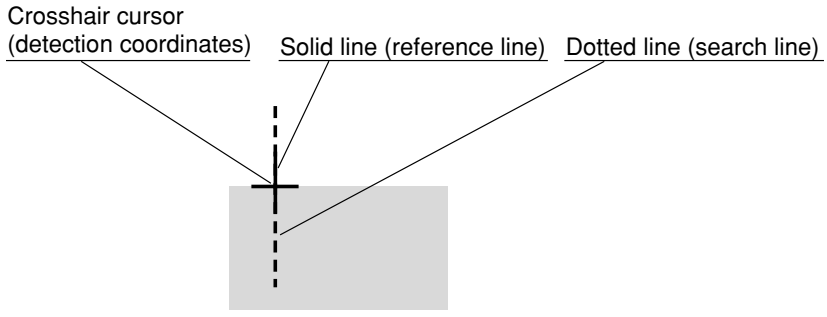
- Example of a 2-point search in a rectangular measurement window



- Example of when a horisontal line is selected as measurement shape



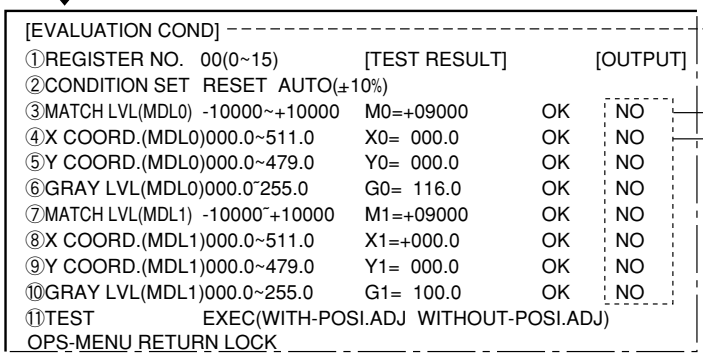
- Example of when a vertical line is selected as measurement shape



Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To the next page

Continued from the previous page



5

- Items ⑦ to ⑩ are displayed in the "2P-SCH" (2-point search) mode.

When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.
⇨ See "Chapter 15: Numerical Calculations"

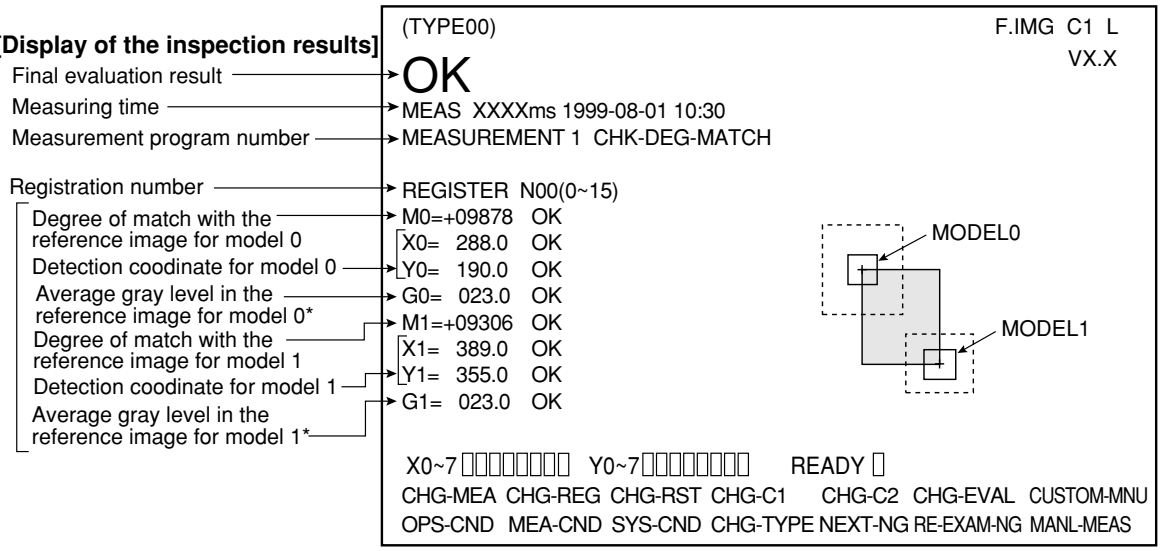
When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.
⇨ See "Chapter 16: PC Function"

Return to the [MEAS COND] menu.

Pressing the TRG/BRT key will start a measurement manually.

■ **When a 2 point search has been specified.**

[Display of the inspection results]



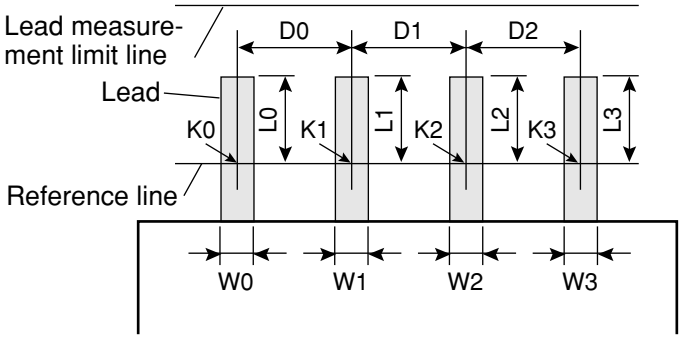
* Average light level or difference in absolute value

	Description
Average light level	Obtain average light level of the image in the area detected using the gray search.
Difference absolute value	Calculate the difference of the absolute values from the image detected using the gray search and the reference image. The result is light level difference. By obtaining this value, you can get an idea of the total change in light level. Total light level difference = Σ (Ni — Nt) Ni : Light level of the captured image (contraction 3) Nt : Light level of the reference image (contraction 3)

To select these items, use lines "④MATCHING" on the "MEAS COND" menu. ⇨page 5-2.

Chapter 6: Lead Inspection

Purpose	Inspect the condition of IC leads and connector pins based on positional information obtained from the gray scale search function. (No. of leads or pins that can be detected: Max. 128 pieces)
Applications	Inspect IC leads or connector pins
Examples	**[Inspect the layout of the IC leads and connector pins]**



[Lead inspection]

- Number of leads K
- D0 to D2: Distance between leads
- W0 to W3: Lead width
- L0 to L3: Lead length

- Inspection procedure

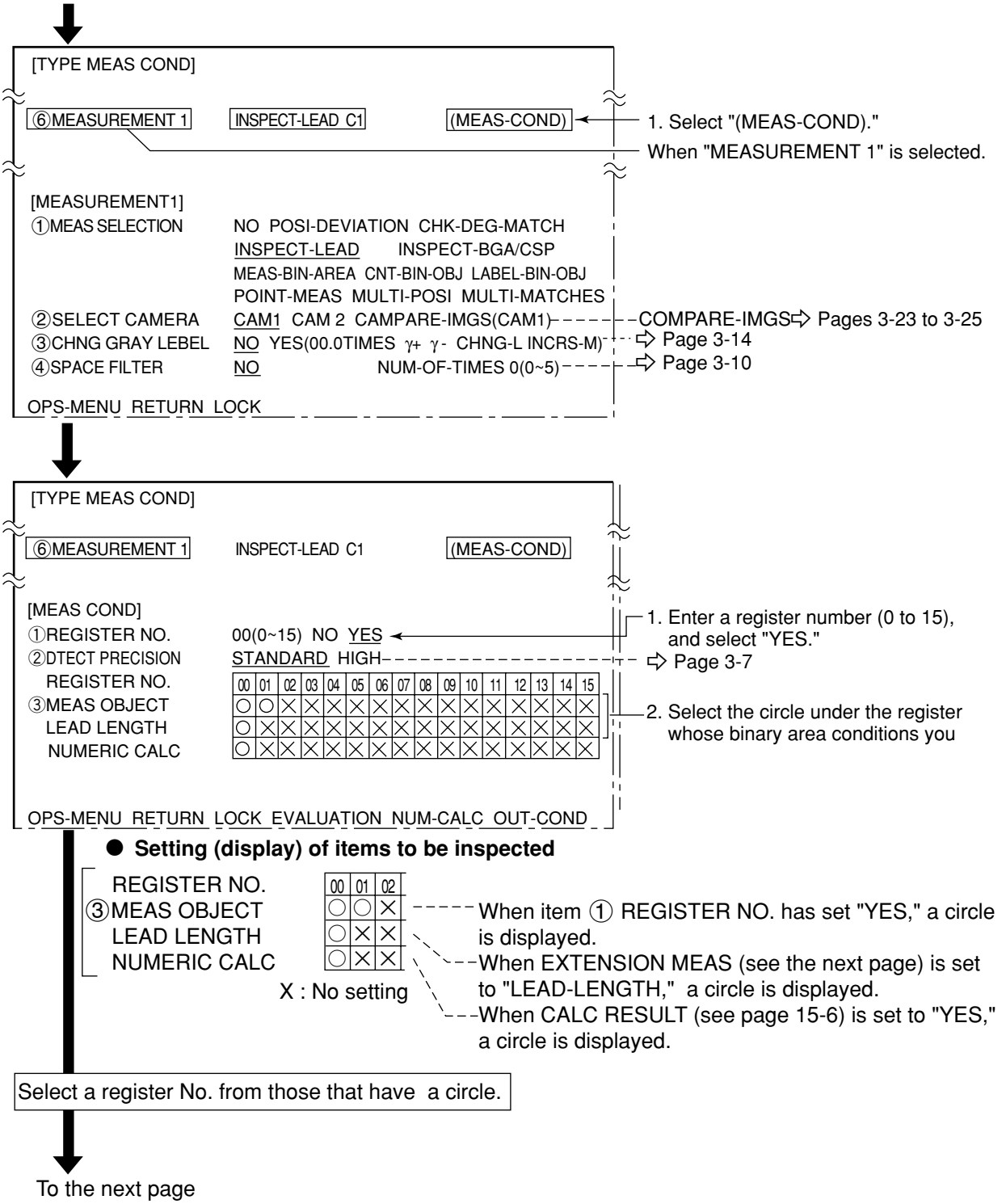
① Determine the measurement points (K0 to K3) from the mid points of the leads and the reference line.

② Calculate the maximum and minimum distances between the leads (D0 to D2) on the reference line.

③ Calculate the maximum and minimum lead lengths (L0 to L3), starting from the measurement points (K0 to K3) and measuring toward the lead measurement limit line.

④ Calculate the maximum and minimum lead widths (W0 to W3) from the measurement points.

Setting the measurement programs (pages1-10 to 1-11: Select "INSPECT LEAD" on the "MEAS SELECTION" line, and press the SET key.)



● **Setting (display) of items to be inspected**

Select a register No. from those that have a circle.

To the next page

Continued from the previous page

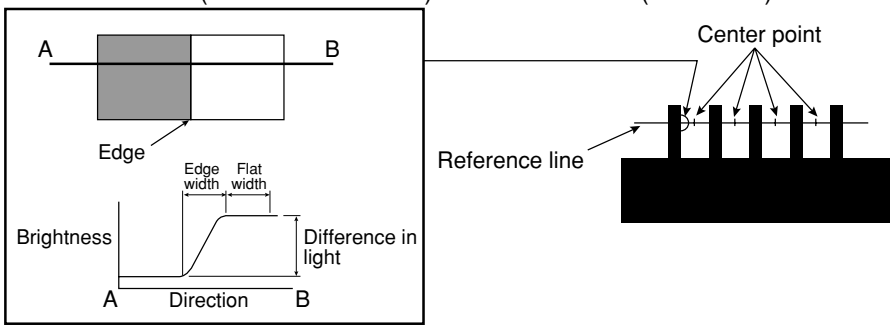
①REGISTER NO. 00(0~15)
②DTECT SHAPE RECT(ARTIFACT) LINE CIRC-L ⇨ Pages 3-4 to 3-6 and 3-13
③SEARCH AREA MOVE UP.L(224,208) LO.R(287,271)
④DTECT MODE CENTR(BRT DRK) ⇨ Page 3-12
⑤SEARCH DIRECTION HORIZ(— —) VERT(| |)
⑥AUTO REGIST EXEC
⑦THRESHOLD GRYS.050(0~255) EDGE.W2(1~8)
FLAT.W04(1~16)
⑧EXTENSION MEAS NO LEAD-LENGTH BALL-WIDTH
⑨EXT.MEAS DIRECT VERT Y=+000
OPS-MENU RETURN LOCK EVALUATION

- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- Item ⑧ is displayed when "RECT(ARTIFACT)" or "LINE" have been selected in item ②.
- Item ⑨ is displayed when "LEAD-LENGTH" or "BALL-WIDTH" have been selected in item ⑧.
- The data in items ③ and ⑤ vary according to the selection in item ②.

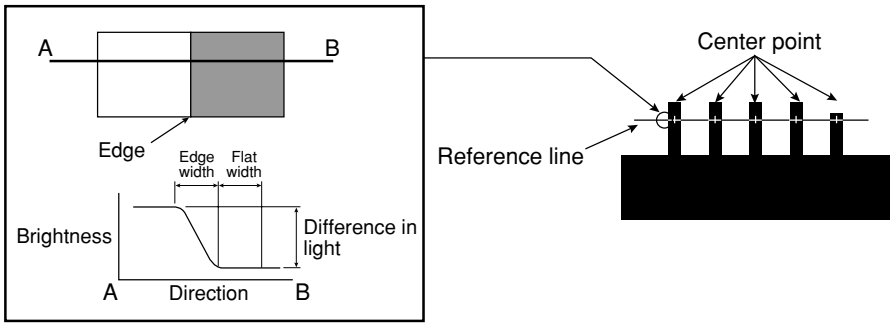
Selection in item ②	Data displayed in item ③	Data displayed in item ⑤
RECT	MOVE UP.L (224,208) LO.R (287,271)	HORIZ (→ ←) VERT (↓ ↑)
LINE	MOVE S.PT (224,240) E.PT (287,240)	START-PNT→END-PNT END-PNT→START-PNT
CIRC-L	CENTER (256,240) RAD. (032)	CLOCK-WISE COUNTER-CW

■ Example of settings

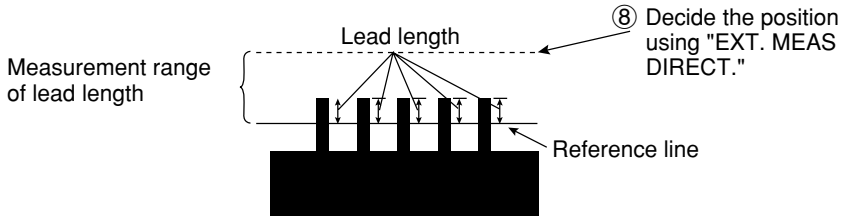
- Example when ④DTECT MODE (detection mode) is set to "CENTR (BRT)" (center dark) and ⑤SEARCH DIRECTION (detection direction) is set to "HORIZ (horizontal)."



- Example when ④DTECT MODE (detection mode) is set to "CENTR (DRK)" (center dark) and ⑤SEARCH DIRECTION (detection direction) is set to "HORIZ (horizontal)."



- Example when "LEAD LENGTH" is selected on "EXTENSION MEAS."



Select "EVALUATION (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To the next page

Continued from the previous page

[EVALUATION COND] ⇨ Page 3-16

①REGISTER NO.	00(0~15)	[TEST RESULT]		[OUTPUT]
②CONDITION SET	RESET AUTO(±10%)			
③NUMBER OF OBJ	000~128	K= 000	OK	NO
④DISTANCE	000.0~702.0	D= 000.0 000.0	OK	NO
⑤LEAD WIDTH	000.0~511.0	W=000.0 000.0	OK	NO
⑥LEAD LENGTH	000.0~511.0	L= 000.0 000.0	OK	NO
⑦TEST	EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)			

OPS-MENU RETURN LOCK

You can set the output destinations using the up and down keys. (No, Y0 to Y7, C000 to C127)

6

When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.
⇨ See "Chapter 15: Numerical Calculations"

When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.
⇨ See "Chapter 16: PC Function"

Return to the [MEAS COND] menu.

Pressing the TRG/BRT key will start a measurement manually.

■ **Example when a straight line is selected as mesurement shape.**

[Display of the inspection results]

Final evaluation result
Measuring time
Measurement program number
Registration number for the measurement conditions
Number of leads
Dostance between leads (muximum/minimum in pixels)
Lead width (muximum/minimum in pixels)
Lead length (muximum/minimum in pixels)

(TYPE00) F.IMG C1 L
VX.X

OK

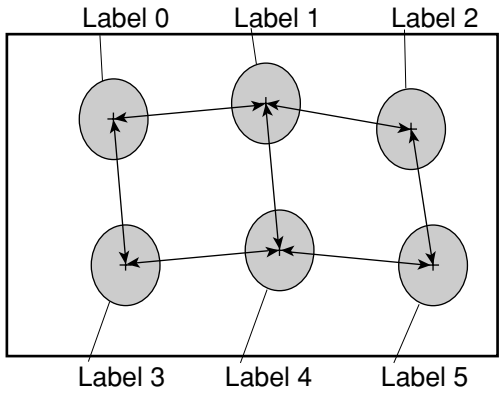
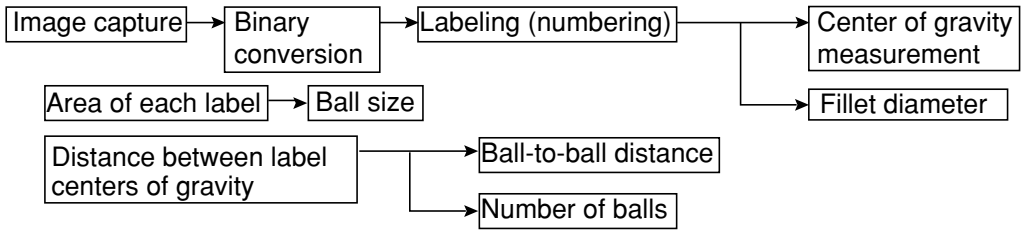
MEAS XXXXms 1999-08-01 10:30
MEASUREMENT 1 INSPECT-LEAD

REGISTER N00(0~15)
K=005 OK
D=048.0 OK
046.0 OK
W=017.0 OK
016.0 OK
L=034.0 OK
032.0 OK

X0~7□□□□□□□□ Y0~7□□□□□□□□ READY □
CHG-MEA CHG-REG CHG-RST CHG-C1 CHG-C2 CHG-EVAL CUSTOM-MNU
OPS-CND MEA-CND SYS-CND CHG-TYPE NEXT-NG RE-EXAM-NG MANL-MEAS

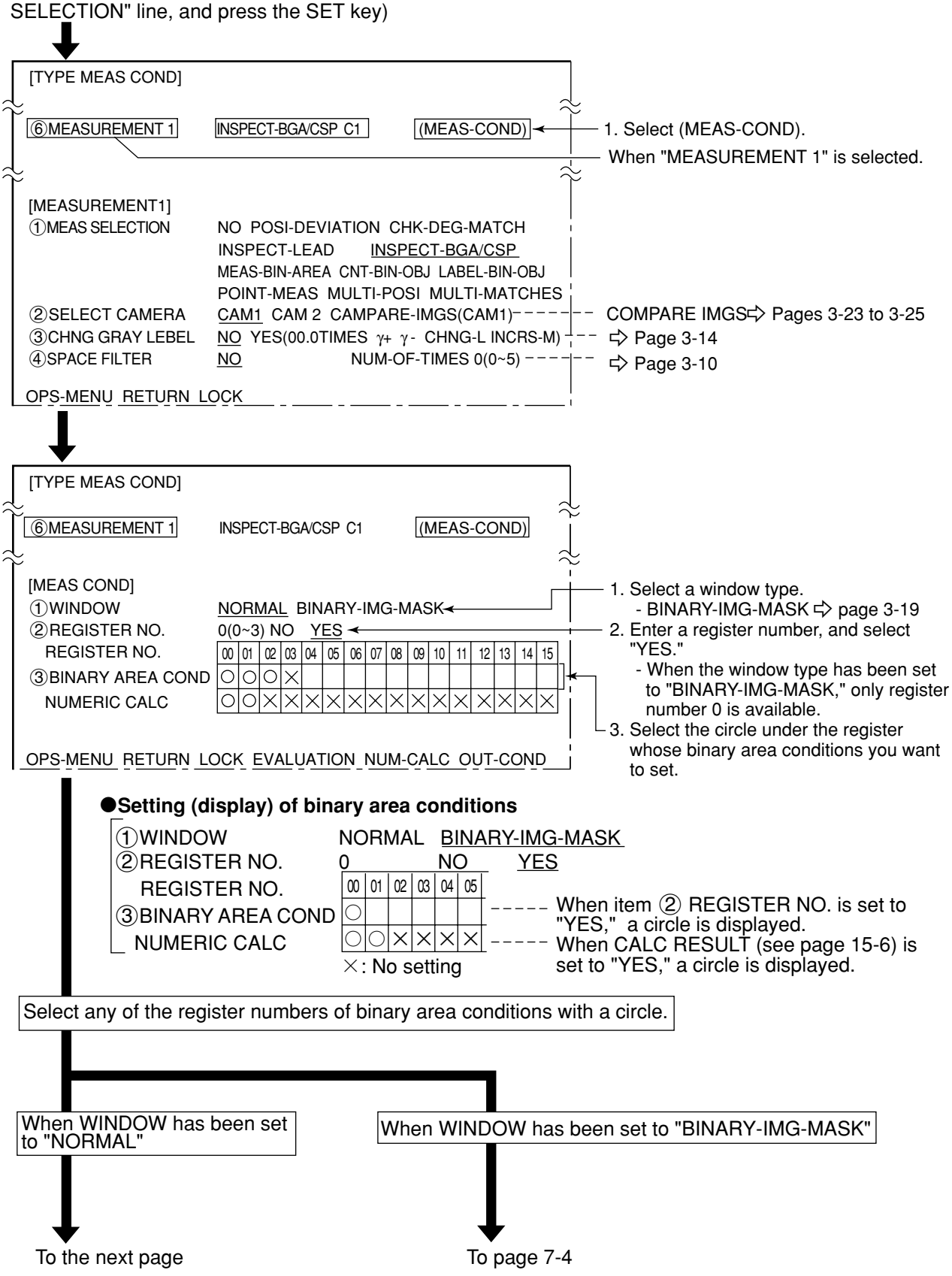
Chapter 7: BGA/CSP Inspection (IV-S32M/S33M)

The BGA/CSP inspection is available on the IV-S32M/S33M controllers.

Purpose	The center of gravity, area of each label, number of labels and fillet diameter are measured using the binary label measurement function.
Applications	Inspection of BGA/CSP balls
Examples	**[Measurement of 6 balls]**  **[Measurement results]** - Number of labels: K - Area of each label: R0 to R127 - Distance between centers of gravity: (DX0, DY0) to (DX127, DY127) - Fillet diameter: FX, FY **- Inspection sequence** 

7

Setting the measurement programs (pages 1-10 to 1-11: Select "INSPECT-BGA/CSP" on the "MEAS SELECTION" line, and press the SET key)



●Setting (display) of binary area conditions

①WINDOW NORMAL BINARY-IMG-MASK
②REGISTER NO. 0 NO YES
REGISTER NO. 00 01 02 03 04 05
③BINARY AREA COND ○
NUMERIC CALC ○ ○ × × × ×

----- When item ② REGISTER NO. is set to "YES," a circle is displayed.
----- When CALC RESULT (see page 15-6) is set to "YES," a circle is displayed.

×: No setting

Select any of the register numbers of binary area conditions with a circle.

When WINDOW has been set to "NORMAL"

When WINDOW has been set to "BINARY-IMG-MASK"

To the next page

To page 7-4

Continued from the previous page (**when WINDOW has been set to "NORMAL"**)

```
①REGISTER NO.   0(0~3)
②MEAS SHAPER    RECTANGLE  CIRCLE  ELLIPSE
③MEAS AREA      MOVE  UP.L(224,20)  LO.R(287,271)
④MASK NO.       0(0~3)
⑤MASK SHAPE     NO  RECTANGLE  CIRCLE  ELLIPSE
⑥MASK AREA      MOVE  UP.L(224,208) LO.R287,271)
⑦AUTO REGIST    EXEC(L LIMIT ONLY U&L  LIMITS)
⑧TERESHOLD      U.LM255  L.LM100(0~255)
⑨INVERT B/W     NO  YES
⑩BINARY PROCESS FIXED  THRESHOLD-ADJ(VAR-DIFF VAR-RATE)
⑪BINARY NOISE FILT NO  EXPD.— CONTR.  CONTR.— EXPD.
⑫NUM.OF FILT PASSEXPD.0   CONTR.0(0~5)
⑬BOUNDARY PROCESS VALID  INVALID
⑭AREA FILTER    U.LM245760  L.LM00000(0~245760)
⑮NUM. OF DTECT X00  Y00(0~64)

OPS-MENU  RETURN  LOCK  EVALUATION
```

(Reference pages)
- ② ⇨ Pages 3-4 to 3-6
- ⑧ ⇨ Page 3-8
- ⑩ ⇨ Page 3-9
- ⑪ ⇨ Page 3-11
- ⑬ ⇨ Page 3-8

- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The data in item ③ varies according to the selection in item ②.

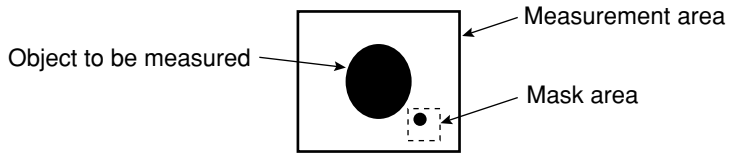
Selection in item ②	**Data displayed in item ③**
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

- The data in item ⑥ varies according to the selection in item ⑤.

Selection in item ⑤	**Data displayed in item ⑥**
NO	No data displayed
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

■ Mask area

The general area to be measured may contain an object that does not need to be measured. To eliminate such an object from the measurements, a mask area is used.



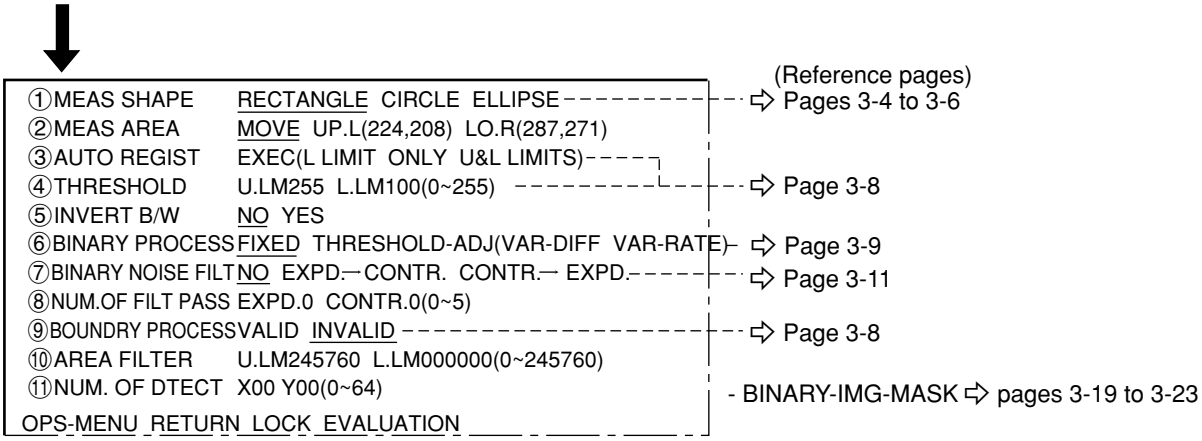
■ Area filter

This function is used to eliminate objects if their measured area is outside of the upper and lower limits.

Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To page 7-5

Continued from page 7-2 (**when WINDOW has been set to "BINARY-IMG-MASK"**)



- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.

■ Area filter

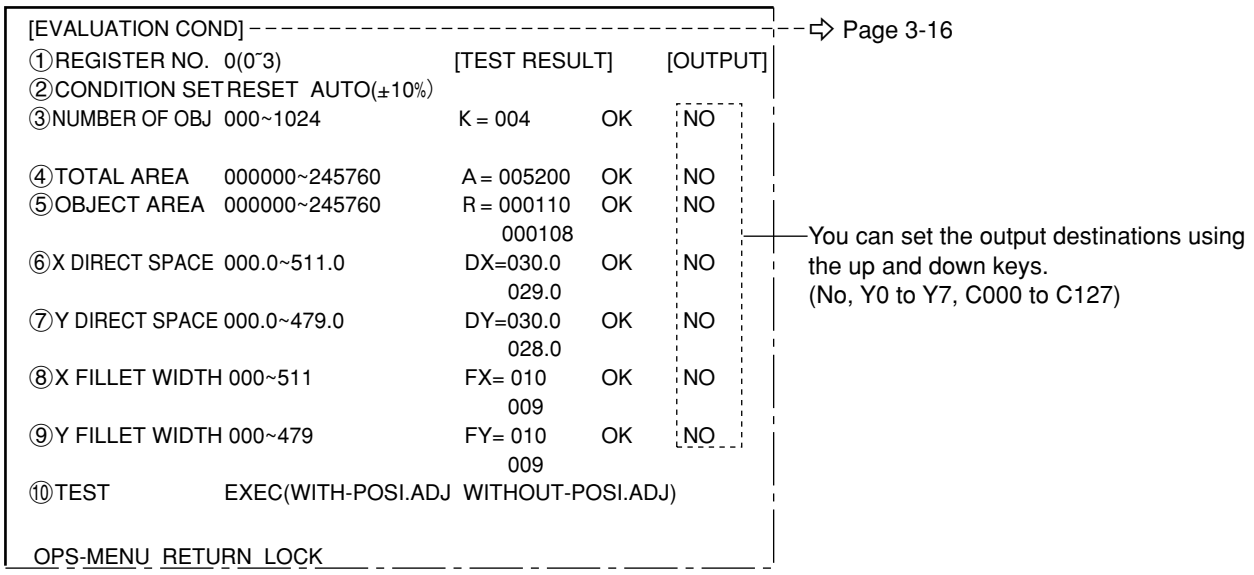
This function is used to eliminate objects if their measured area is outside of either the upper or lower limits.

Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

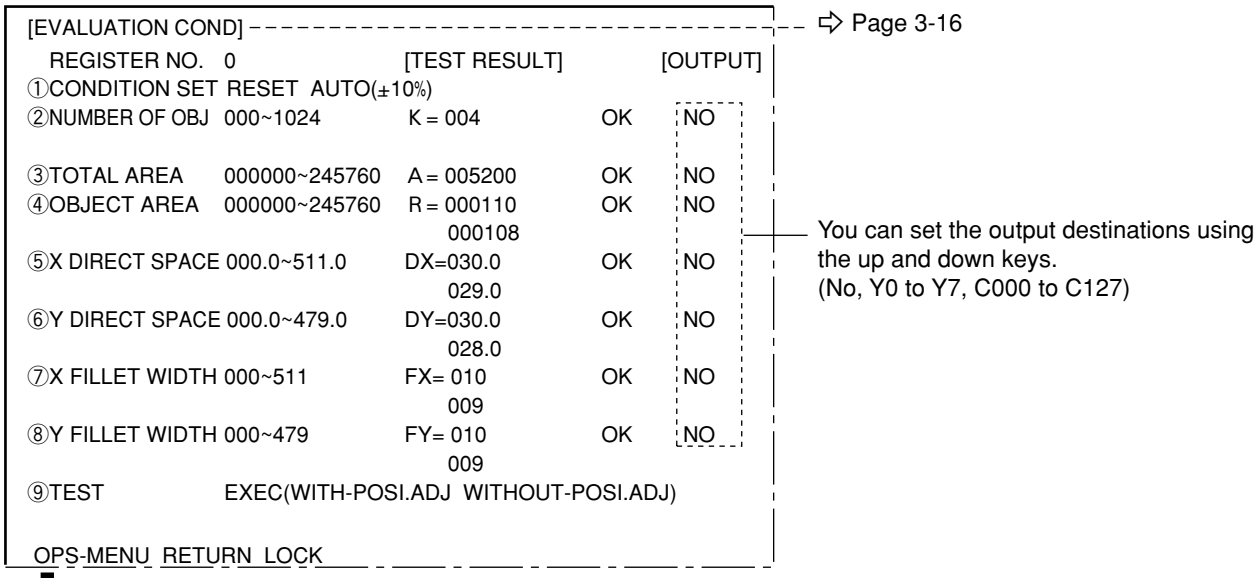
To the next page

Continued from page 7-3 or 7-4

● When "NORMAL" is selected for the window.



●When "BINARY-IMG-MASK" is selected for the window.



- Before setting the upper and lower limits between which the evaluation result is acceptable, execute item ⑩(⑨)TEST, and check the test results.

Select "RETURN" to return to the [MEAS COND] menu, and select "NUM CALC" and press the SET key.

To the next page

Continued from the previous page

When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.
  ⇨ See "Chapter 15: Numerical Calculations"

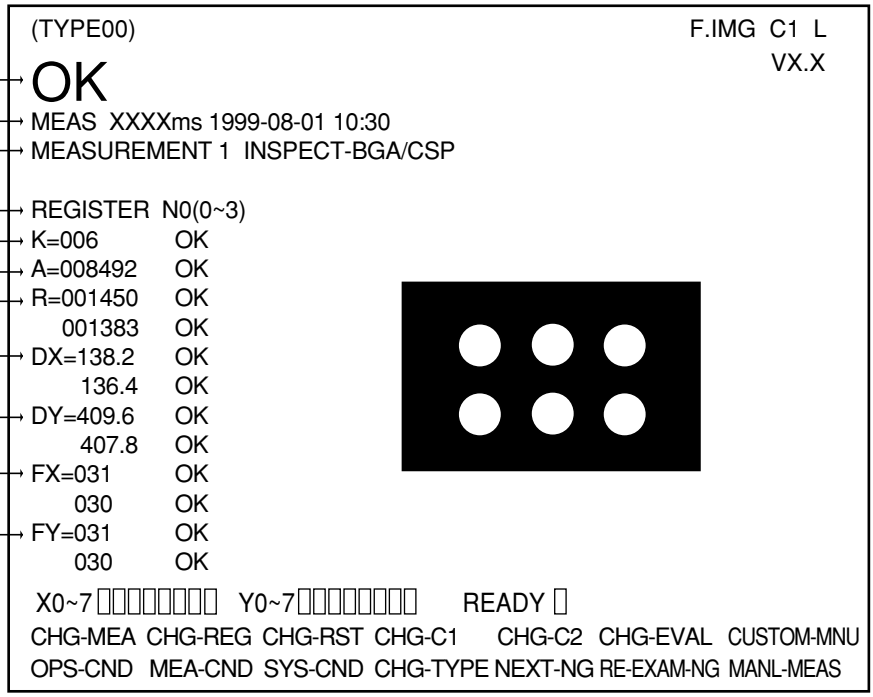
When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.
  ⇨ See "Chapter 16: PC Function"

Return to the [MEAS COND] menu.

Pressing the TRG/BRT key will start a measurement manually.

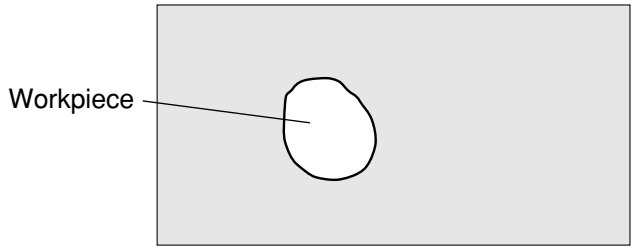
■ Display example

[Display of the inspection results]

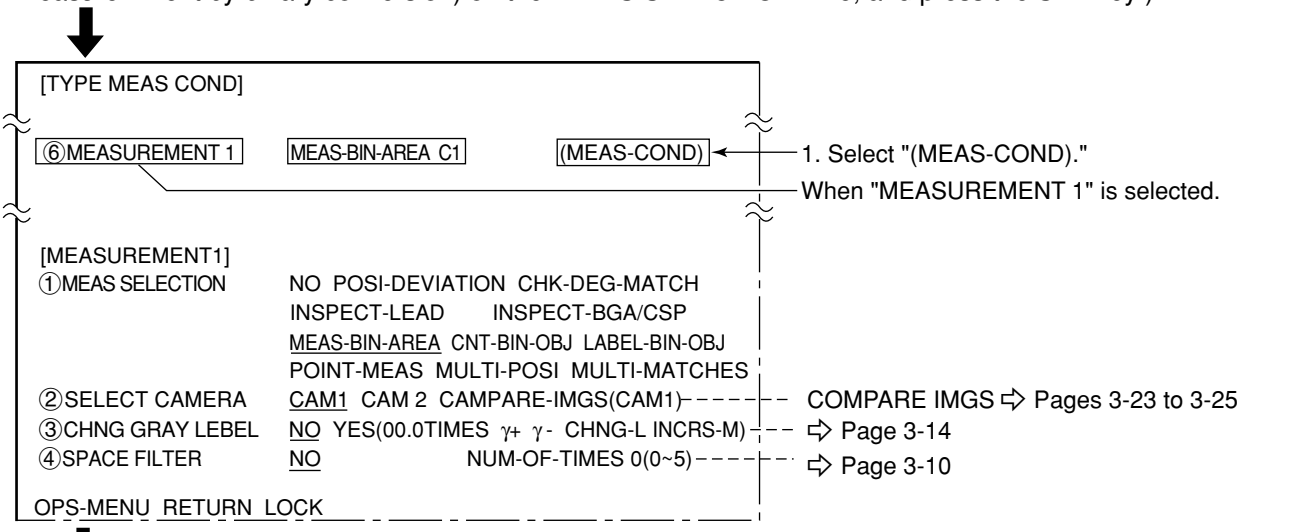


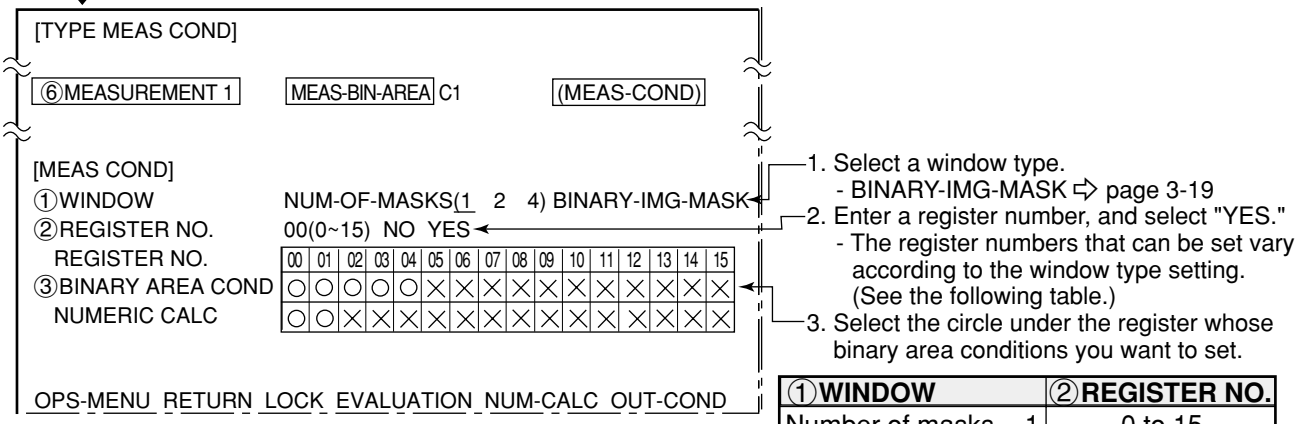
- Final evaluation result
- Measuring time
- Measurement program number
- Registration number of measurement condition
- OBJS
- TOTAL-AREA
- OBJECT-AREA
- (Max./Min. : Number of pixels)
- X DIRECT SPACE
- (Max./Min. : Number of pixels)
- Y DIRECT SPACE
- (Max./Min. : Number of pixels)
- X FILLET WIDTH
- (Max./Min. : Number of pixels)
- Y FILLET WIDTH
- (Max./Min. : Number of pixels)

Chapter 8: Area Measurement by Binary Conversion

Purpose	This function is used to determine the existence and or size of a workpiece when the workpiece is always found in the same 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).
Applications	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.
Examples	 **[Measurement result]** - The area of the workpiece **- Checking sequence** Capture an image → Convert it to binary → Measure (area)

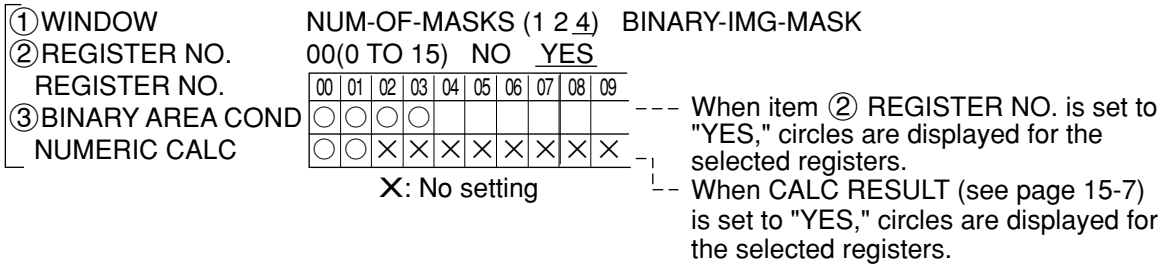
Setting the measurement programs (pages 1-10 to 1-11: Select "MEAS-BIN-AREA" (area measuremment by binary conversion) on the "MEAS SELECTION" line, and press the SET key.)





①WINDOW	②REGISTER NO.
Number of masks = 1	0 to 15
Number of masks = 2	0 to 7
Number of masks = 4	0 to 3
Binary image mask	Only 0

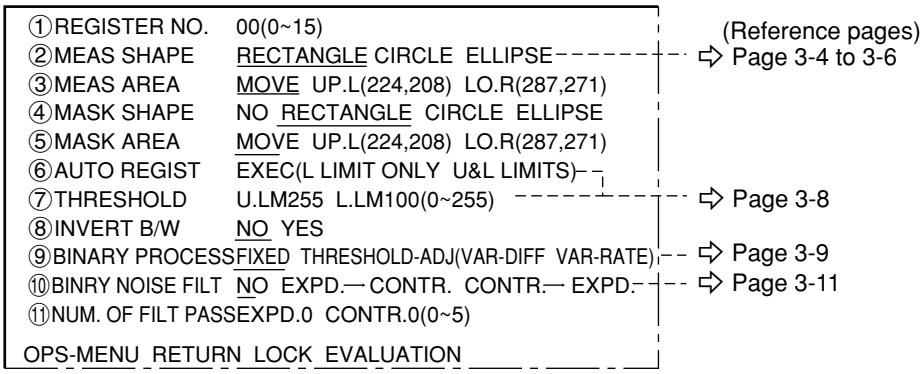
● **Setting (display) of binary area conditions**



Select any of the register numbers whose binary area conditions has a circle.

When NUM-OF-MASKS has been set to 1	When NUM-OF-MASKS has been set to 2 or 4	When BINARY-IMG-MASK has been selected
To the next page	To page 8-4	To page 8-5

Continued from the previous page
(**when WINDOW has been set to "NUM-OF-MASKS 1"**)



- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The data in item ③ varies according to the selection in item ②.

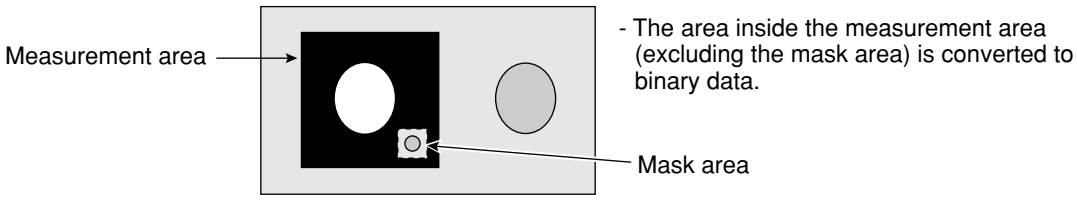
Selection in item ②	**Data displayed in item ③**
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

- The data in item ⑤ varies according to the selection in item ④.

Selection in item ④	**Data displayed in item ⑤**
NO	No data displayed
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

■ Area settings
- To specify an area, the screen must be in the freeze image mode.
- The binary image display after changing the screen from "freeze" to "through," and finally back to "freeze," will be a binary image of the object that was captured the first time the IV-S30 was in the "freeze" mode.
  The binary image that is captured in the "freeze" mode the third time can be displayed when you specify items ② to ⑩ in the settings.

■ A registration example



Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To page 8-6

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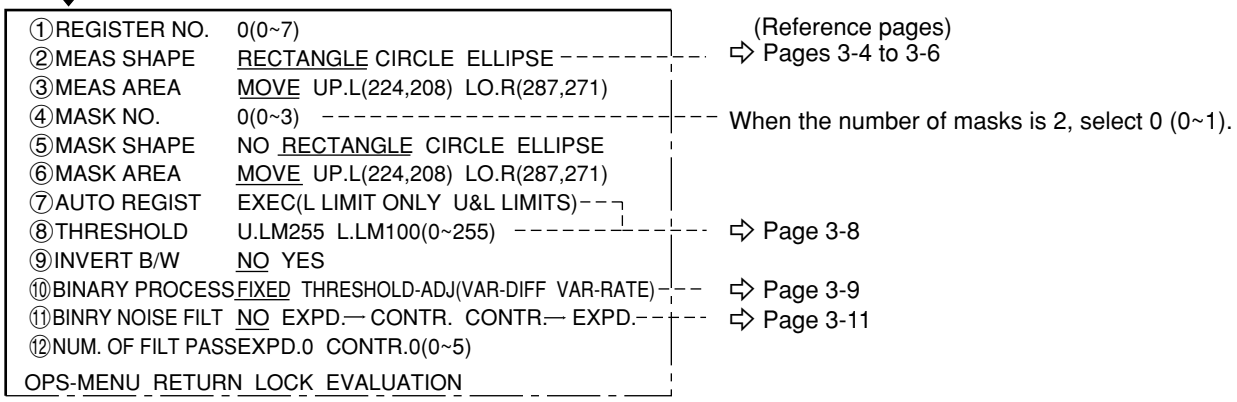
Continued from page 8-2 (**when WINDOW has been set to "NUM-OF-MASKS 2 or 4"**)



- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The data in item ③ varies according to the selection in item ②.

Selection in item ②	**Data displayed in item ③**
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

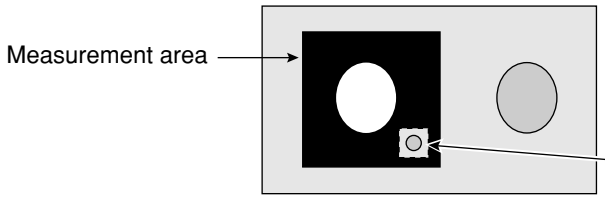
- The data in item ⑥ varies according to the selection in item ⑤.

Selection in item ⑤	**Data displayed in item ⑥**
NO	No data displayed
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

■ Area settings

- To specify an area, the screen must be in the freeze image mode.
- The binary image display after changing the screen from "freeze" to "through," and finally back to "freeze," will be a binary image of the object that was captured the first time the IV-S30 was in the "freeze" mode.
  The binary image that is captured in the "freeze" mode the third time can be displayed when you specify items ② to ⑩ in the settings.

■ A registration example

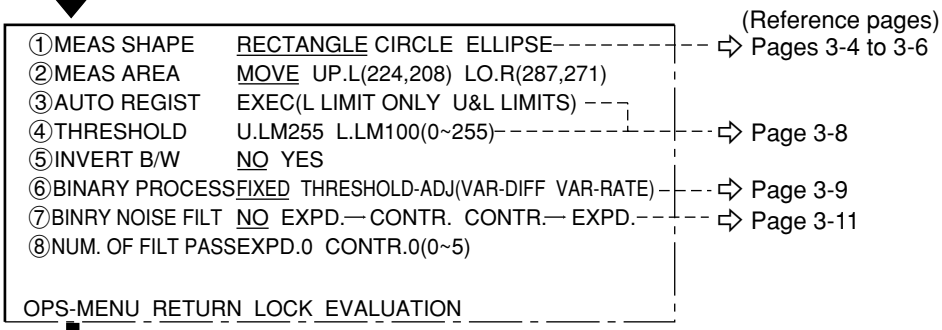


Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To page 8-6

Continued from page 8-2 (**when WINDOW has been set to "BINARY-IMG-MASK"**)

Before making this setting, you have to select ②MASK BINARY IMG" on the [IMG PRE-PROCESS] menu.
=> See page 3-19 to 22.



- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The data in item ② varies according to the selection in item ①.

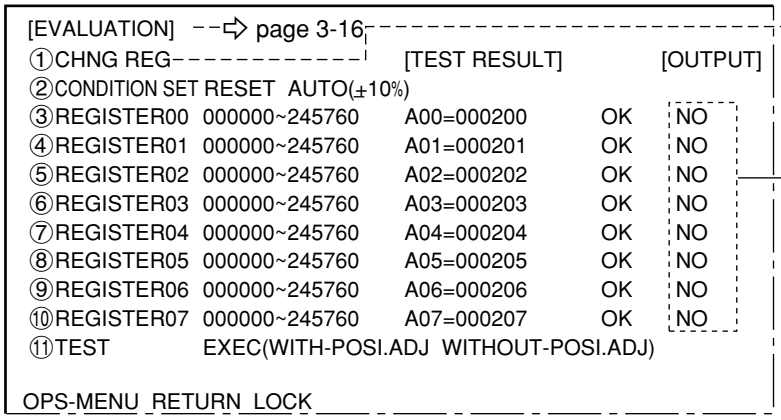
Selection in item①	**Data displayed in item ②**
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To the next page

Continued from page 8-3, 8-4, or 8-5

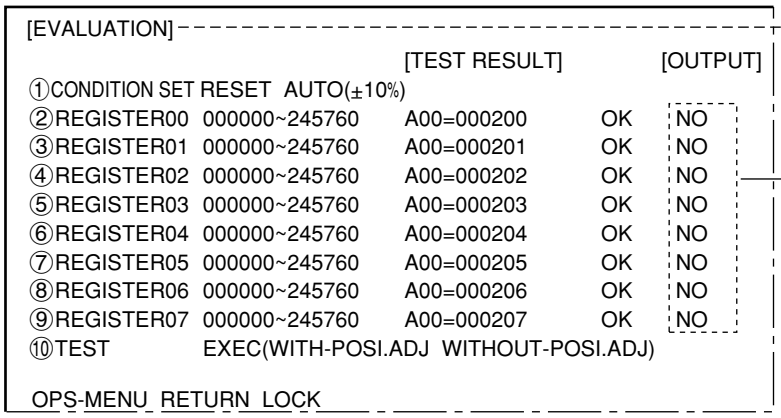
● **When WINDOW has been set to "NUM-OF-MASKS 1"**



Change the display of items ③ to ⑩ from REGISTER00 to 07" to REGISTER08 to 15."

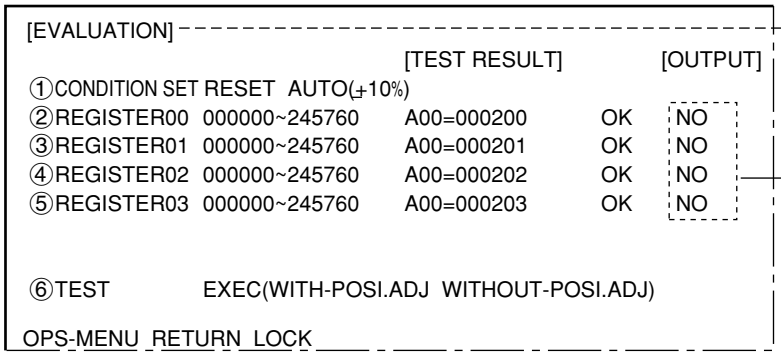
You can set the output destinations using the up and down keys. (NO, Y0 to Y7, C000 to C127)

● **When WINDOW has been set to "NUM-OF-MASKS 2"**



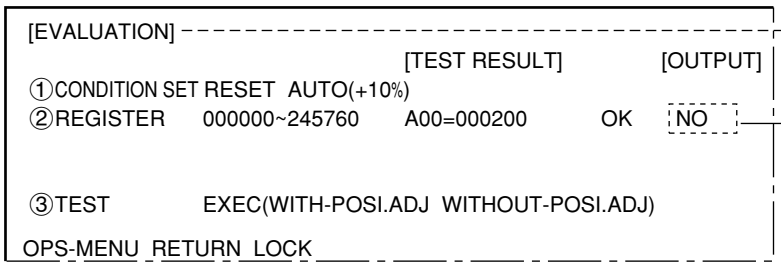
You can set the output destinations using the up and down keys. (NO, Y0 to Y7, C000 to C127)

● **When WINDOW has been set to "NUM-OF-MASKS 4"**



You can set the output destinations using the up and down keys. (NO, Y0 to Y7, C000 to C127)

● **When WINDOW has been set to "BINARY-IMG-MASK"**



You can set the output destinations using the up and down keys. (NO, Y0 to Y7, C000 to C127)

Select "RETURN" to return to the [MEAS COND] menu, and select "NUM-CALC" and press the SET key.

To the next page

Continued from the previous page

When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.

⇨ See "Chapter 15: Numerical Calculations"

When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.

⇨ See "Chapter 16: PC Function"

Return to the MAIN OPS MENU.

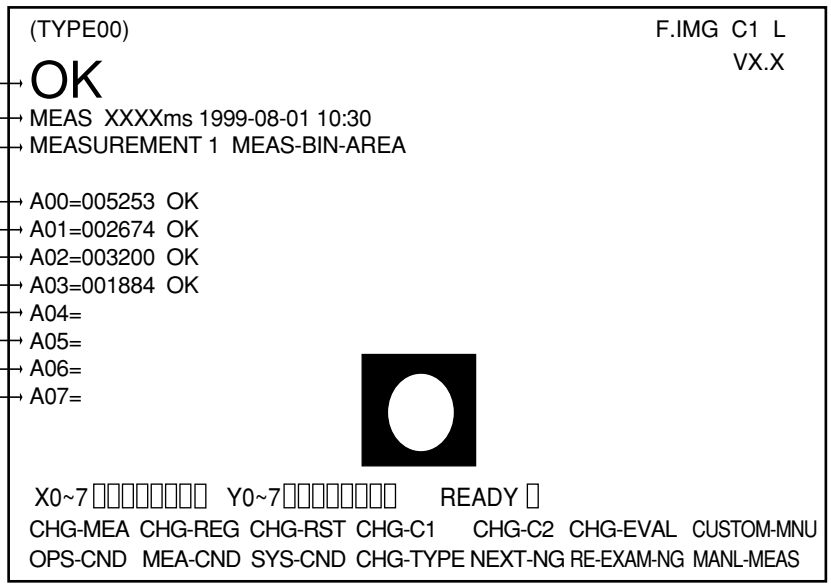
Pressing the TRG/BRT key will start a measurement manually.

■Display example

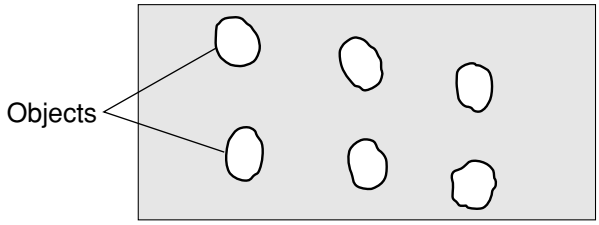
[Display of the measured results]

Final evaluation result
Measuring time
Measurement program number
Area for registration number 00
" 01
" 02
" 03
" 04 *
" 05
" 06
" 07
in the measurement condition (Number of pixels)

*The areas will not be displayed for any unspecified registration numbers.

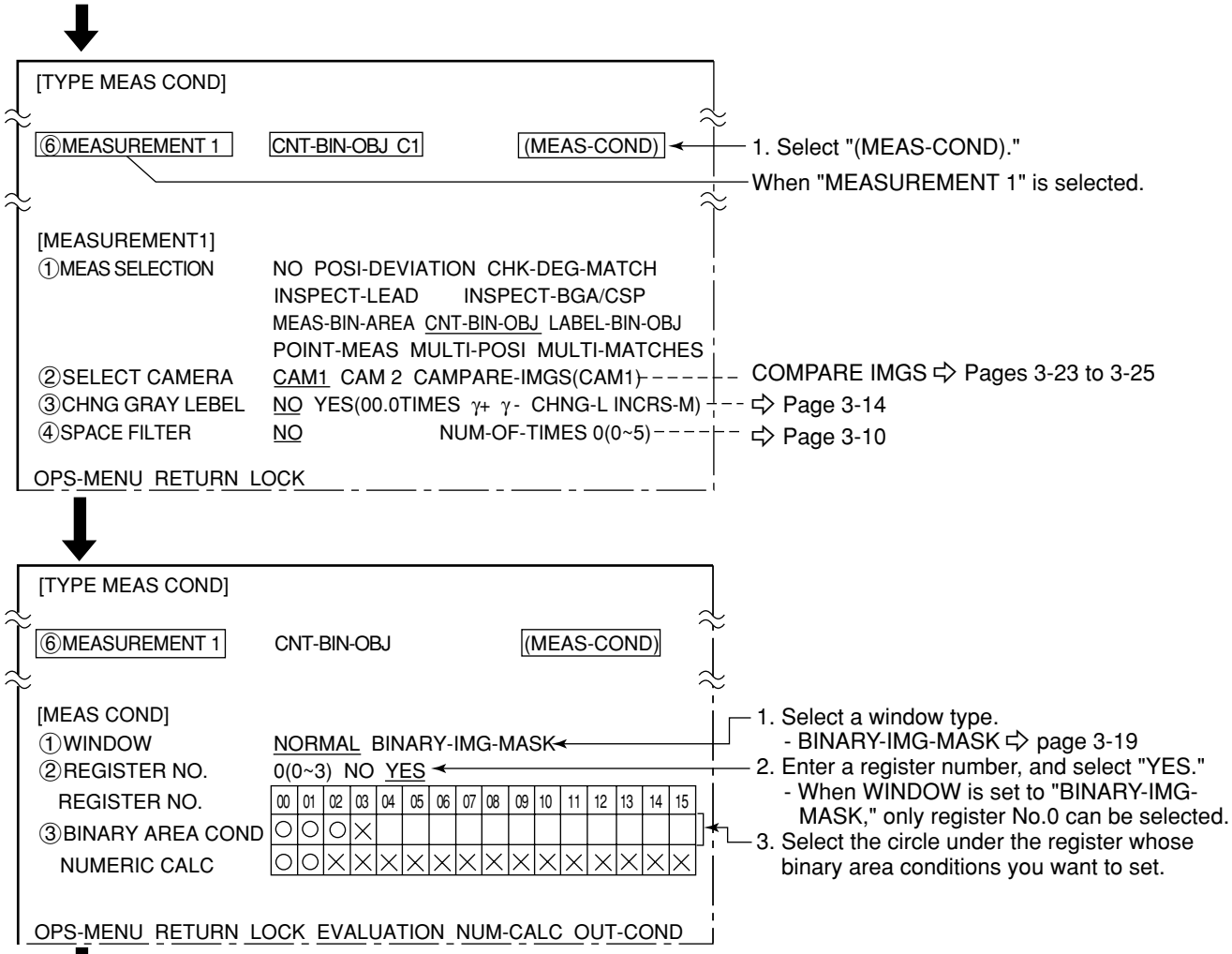


Chapter 9: Object Counting by Binary Conversion

Purpose	Checks the number of objects (max. 3000 items.) 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.
Applications	Counting the number of food products or parts.
Examples	 **[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

Object Counting by Binary Conversion

Setting the measurement programs (pages 1-10 to 1-11: Select "CNT-BIN-OBJ" (object counting by binary conversion) on the "MEAS SELECTION" line, and press the SET key.)



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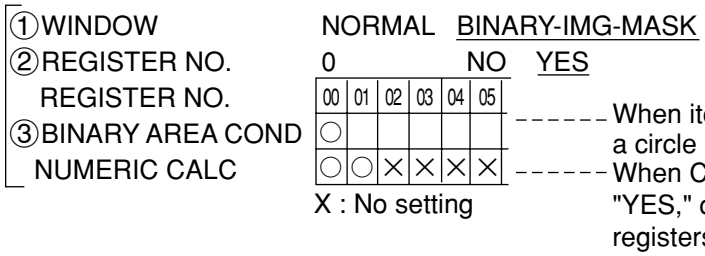
● **Setting (display) of binary area conditions**



Select any of the register numbers of binary area with circles.

When WINDOW has been set to "NORMAL"

When WINDOW has been set to "BINARY-IMG-MASK"

To the next page

To page 9-4

Continued from the previous page (**when WINDOW has been set to "NORMAL"**)

		(Reference pages)
①REGISTER NO.	0(0~7)	
②MEAS SHAPE	RECTANGLE CIRCLE ELLIPSE	⇨ Pages 3-4 to 3-6
③MEAS AREA	MOVE UP.L(224,208) LO.R(287,271)	
④MASK NO.	0(0~3)	
⑤MASK SHAPE	NO RECTANGLE CIRCLE ELLIPSE	
⑥MASK AREA	MOVE UP.L(232,216) LO.R(279,263)	
⑦AUTO REGIST	EXEC(L LIMIT ONLY U&L LIMITS)	
⑧THRESHOLD	U.LM255 L.LM100(0~255)	⇨ Page 3-8
⑨INVERT B/W	NO YES	
⑩BINARY PROCESS	FIXED THRESHOLD-ADJ(VAR-DIFF VAR-RATE)	⇨ Page 3-9
⑪BINRY NOISE FILT	NO EXPD.—CONTR. CONTR.—EXPD.	⇨ Page 3-11
⑫NUM. OF FILT PASS	EXPD.0 CONTR.0(0~5)	
⑬BOUNDARY PROCESS	VALID INVALID	⇨ Page 3-8
⑭AREA FILTER	U.LM245760 L.LM000000(0~245760)	
OPS-MENU RETURN LOCK EVALUATION		

- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The data in item ③ varies according to the selection in item ②.

Selection in item ②	Data displayed in item ③
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

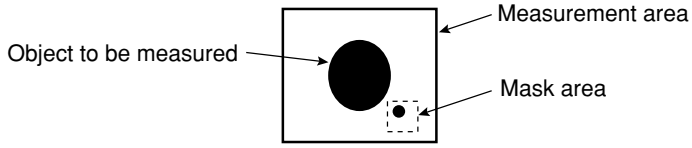
- The data in item ⑥ varies according to the selection in item ⑤.

Selection in item ⑤	Data displayed in item ⑥
NO	No data displayed
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

■ Area settings
- To specify an area, the screen must be in the freeze image mode.
- The binary image display after changing screen from "freeze," then to "through," and finally back to "freeze," will be a binary image of the object that was captured the first time the IV-S30 was in the "freeze" mode.
  The binary image that is captured in the "freeze" mode the third time can be displayed when you specify items ② to ⑭ in the settings.

■ Mask area

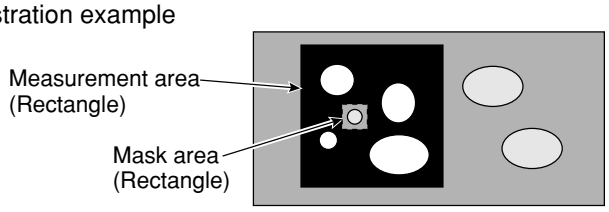
The general area to be measured may contain an object that does not need to be measured. To eliminate such an object from the measurements, a mask area is used.



■ Area filter

This function is used to eliminate objects if their measured area is outside of the upper and lower limits.

■ A registration example

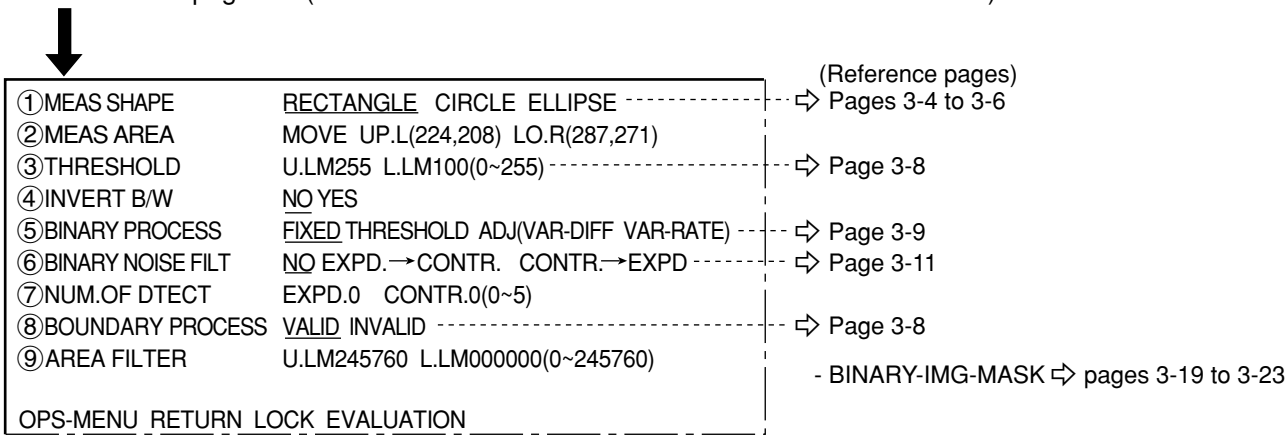


- The inside of the measurement area (excluding the mask area) is converted to binary data.

Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To page 9-5

Continued from page 9-2 (**when WINDOW has been set to "BINARY-IMG-MASK"**)



- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The data in item ② varies according to the selection in item ①.

Selection in item ①	**Data displayed in item ②**
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

■ Area filter

This function is used to eliminate objects if their measured area is outside of the upper and lower limits.

Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To the next page

Continued from page 9-3 or 9-4

[EVALUATION COND] ⇨ Page 3-16

		[TEST RESULT]		[OUTPUT]
①CONDITION SET	RESET AUTO(±10%)			
②AMOUNT OF REG0	0000~3000	K0=00004	OK	NO
③TOTAL AREA	000000~245760	A0=000200	OK	NO
④AMOUNT OF REG1	0000~3000	K1=00004	OK	NO
⑤TOTAL AREA	000000~245760	A1=002001	OK	NO
⑥AMOUNT OF REG2	0000~3000	K2=00004	OK	NO
⑦TOTAL AREA	000000~245760	A2=002002	OK	NO
⑧AMOUNT OF REG3	0000~3000	K3=00004	OK	NO
⑨TOTAL AREA	000000~245760	A3=002003	OK	NO
⑩TEST	EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)			

OPS-MENU RETURN LOCK

You can set the output destinations using the up and down keys. (NO, Y0 to Y7, C000 to C127)

- Before setting the upper and lower limits between which the evaluation result is acceptable, execute item "⑩TEST," and check the test results.

When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.
⇨ See "Chapter 15: Numerical Calculations"

When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.
⇨ See "Chapter 16: PC Function"

Return to the MAIN OPS MENU.

Pressing the TRG/BRT key will start a measurement manually.

■ Display example

[Display of the measured results]

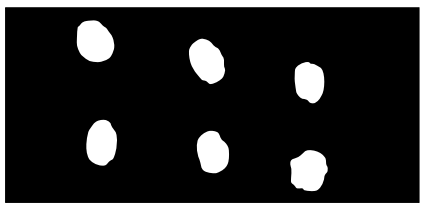
Final evaluation result
Measuring time
Measurement program number
[K] of resistration number 0
[A] " 0
[K] " 1
[A] " 1
[K] " 2
[A] " 2
[K] " 3
[A] " 3
in the measurement condition

[K]=NUMBER OF OBJECTS
[A]=TORAL AREA
(Number of pixels)

(TYPE00) F.IMG C1 L
VX.X

OK
MEAS XXXXms 1999-08-01 10:30
MEASUREMENT 1 CNT-BIN-OBJ

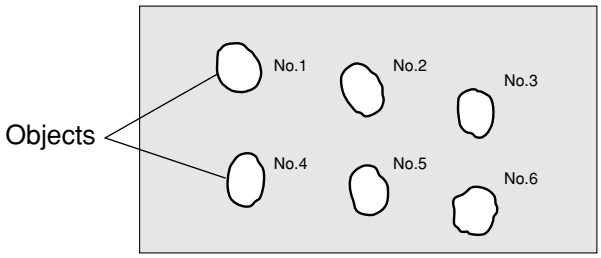
K0=00006 OK
A0=015781 OK
K1=00020 OK
A1=087620 OK
K2=00010 OK
A2=042680 OK
K3=
A3=



X0~7□□□□□□□□ Y0~7□□□□□□□□ READY □
CHG-MEA CHG-REG CHG-RST CHG-C1 CHG-C2 CHG-EVAL CUSTOM-MNU
OPS-CND MEA-CND SYS-CND CHG-TYPE NEXT-NG RE-EXAM-NG MANL-MEAS

- Areas will not be displayed for unspecified registration numbers.

Chapter 10: Object Identification by Binary Conversion

Purpose	When there are several objects and their positions are random, 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, circumference and center of each white area can be measured.
Applications	Counting the number of food products or parts, measuring the angle of rotation or the center of gravity of parts, and measuring the size of food products
Examples	**[Measurement of 6 objects]**  **[Measurement results]** - Object identification (labeling and numbering), number of objects present, total area. - Area, center of gravity, main axis angle, fillet diameter, circumference, and center of each object (No.1 to 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, circumference, and center

Setting the measurement programs (pages 1-10 to 1-11: Select "LABEL-BIN-OBJ" (object identifcation by binary conversion) on the "MEAS SELECTION" line, and press the SET key)

[TYPE MEAS COND]

⑥MEASUREMENT 1 LABEL-BIN-OBJ C1 (MEAS-COND) ← 1. Select "(MEAS-COND)."

When "MEASUREMENT 1" is selected.

[MEASUREMENT1]

①MEAS SELECTION NO POSI-DEVIATION CHK-DEG-MATCH
INSPECT-LEAD INSPECT-BGA/CSP
MEAS-BIN-AREA CNT-BIN-OBJ LABEL-BIN-OBJ
POINT-MEAS MULTI-POSI MULTI-MATCHES

②SELECT CAMERA CAM1 CAM 2 CAMPARE-IMGS(CAM1) ---- COMPARE IMGS ⇨ Pages 3-23 to 3-25

③CHNG GRAY LEBEL NO YES(00.0TIMES γ+ γ- CHNG-L INCRS-M) ⇨ Page 3-14

④SPACE FILTER NO NUM-OF-TIMES 0(0~5) ⇨ Page 3-10

OPS-MENU RETURN LOCK

[TYPE MEAS COND]

⑥MEASUREMENT 1 LABEL-BIN-OBJ C1 (MEAS-COND)

[MEAS COND]

①MEAS GRAV CENTR NO YES ← 1. Set MEAS GRAVITY CENTER to "YES" or "NO."

②WINDOW NORMAL BINARY-IMG-MASK ← 2. Select a window type. (BINARY-IMG-MASK ⇨ page 3-19)

③REGISTER NO. 0(0~3) NO YES ← 3. Enter a register number, and select "YES."
- When WINDOW is set to "BINARY-IMG-MASK," only register No.0 can be selected.

④LABEL ORDER SCAN-ORDER SIZE-ORDER CENT-GRAVITY-ORDER ← 4. Select a label order. ⇨ page 3-9*

⑤BINARY CHARACTER AX.ANGL:NO FILT:NO CIRC-L:NO MID-PNT:NO ← 5. For binary characteristics, select "NO" or "YES" using the up and down keys, and press the SET key. *

REGISTER NO. 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15

⑥BINARY AREA COND ○ ○ ○ × ← 6. Select the circle of the registers whose binary area conditions you want to set.

NUMERIC CALC ○ ○ × × × × × × × × × × × × × ×

OPS-MENU RETURN LOCK EVALUATION DST&ANGL NUM-CALC OUT-COND ← To measure the distance/angle and ①MEAS GRAV CENTR is "YES," select this item and press the SET key. ⇨ Chapter 14

* Items ④ and ⑤ will be displayed when item ③ is set to "YES."

● **Setting (display) of binary area conditions**

②WINDOW NORMAL BINARY-IMG-MASK

REGISTER NO. 00 01 02 03 04 05

⑥BINARY AREA COND ○

NUMERIC CALC ○ ○ × × × ×

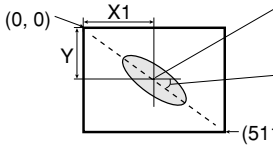
When item ③ REGISTER NO. is set to "YES," a circle is displayed for the selected registers.

When CALC RESULT (see page 15-7) is set to "YES," circles are displayed for the selected registers.

X : No setting

● **Measuring center of gravity, binary characteristic**

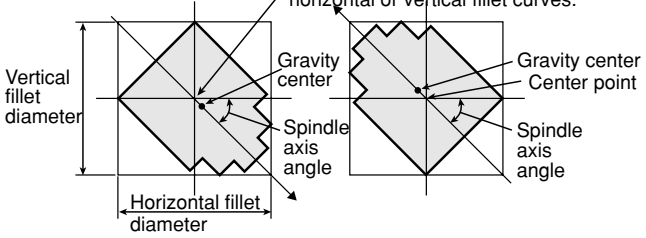
- Center of gravity, main axis angle, and center



Center of gravity (X1, Y1)
- Calculated from the area and the position of each object.
- (X1, Y1)=(Σx/N, Σy/N) N: Area

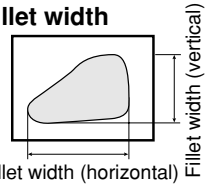
Main axis angle
- Angle between the longitudinal and horizontal directions

The "MID-PNT" refers to the center point of horizontal or vertical fillet curves.

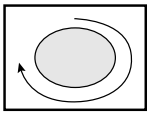


By the combined use of the center point and the center of gravity, a workpiece' orientation can be measured even when it cannot be evaluated by its spindle axis

- Fillet width



- Peripheral



The number of pixels in the boundary line of an object
(stepped are counted as x√2 pixels)

Select any of the register numbers of binary area conditions with circles.

When WINDOW has been set to "NORMAL" → To the next page

When WINDOW has been set to "BINARY-IMG-MASK" → To page 10-4

Continued from the previous page (**when WINDOW has been set to "NORMAL"**)

```
①REGISTER NO.   0(0~3)                                          (Reference pages)
②MEAS SHAPE     RECTANGLE CIRCLE  ELLIPSE ----------------------> Pages 3-4 to 3-6
③MEAS AREA      MOVE  UP.L(224,208)  LO.R(287,271)
④MASK NO.       0(0~3)
⑤MASK SHAPE     NO  RECTANGLE  CIRCLE  ELLIPSE
⑥MASK AREA      MOVE  UP.L(224,208)  LO.R(287,271)
⑦AUTO REGIST    EXEC(L LIMIT ONLY  U&L LIMITS)-----┐
⑧THRESHOLD      U.LM255  L.LM100(0~255)------------└-------------> Page 3-8
⑨INVERT B/W     NO  YES
⑩BINARY PROCESS FIXED  THRESHOLD-ADJ(VAR-DIFF  VAR-RATE)---------> Page 3-9
⑪BINRY NOISE FILT NO  EXPD.— CONTR.  CONTR.— EXPD.---------------> Page 3-11
⑫NUM. OF FILT PASS EXPD.0  CONTR.0(0~5)
⑬BOUNDARY PROCESS VALID  INVALID---------------------------------> Page 3-8
⑭AREA FILTER    U.LM245760  L.LM000000(0~245760)

OPS-MENU  RETURN  LOCK  EVALUATION
```

- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The data in item ③ varies according to the selection in item ②.

Selection in item ②	Data displayed in item ③
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

- The data in item ⑥ varies according to the selection in item ⑤.

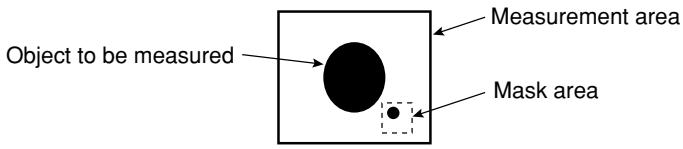
Selection in item ⑤	Data displayed in item ⑥
NO	No data displayed
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

■ Area settings

- To specify an area, the screen must be in the freeze image mode.
- The binary image display after changing screen from "freeze," then to "through," and finally back to "freeze," will be a binary image of the object that was captured the first time the IV-S30 was in the "freeze" mode.
  The binary image that is captured in the "freeze" mode the third time can be displayed when you specify items ② to ⑭ in the settings.

■ Mask area

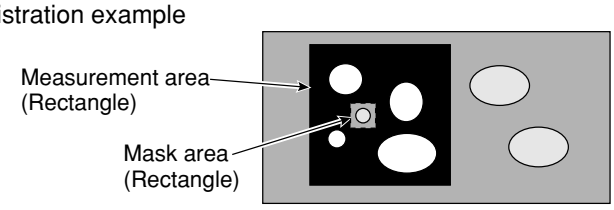
The general area to be measured may contain an object that does not need to be measured. To eliminate such an object from the measurements, a mask area is used.



■ Area filter

This function is used to eliminate objects if their measured area is outside of the upper and lower limits.

■ A registration example

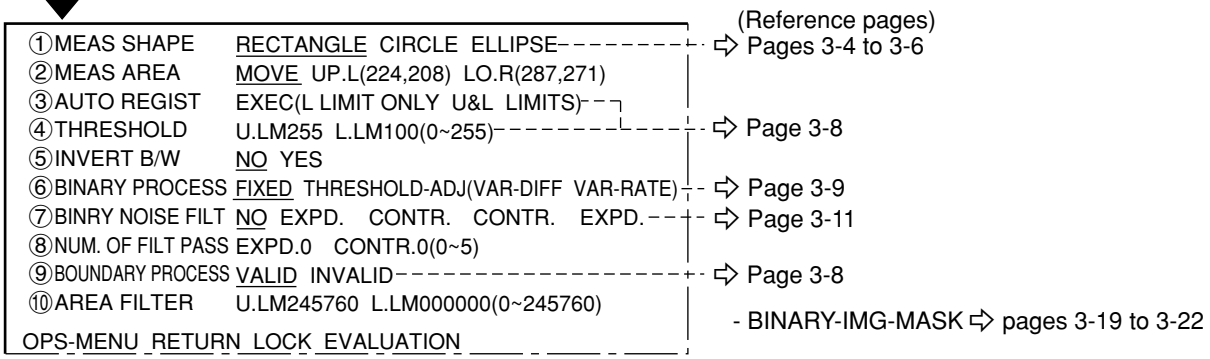


- The inside of the measurement area (excluding the mask area) is converted to binary data.

Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To page 10-5

Continued from page 10-2 (**when WINDOW has been set to "BINARY-IMG-MASK"**)



- Each time the ESC key is pressed, the menu screen will change to display all items or to display individual items, one at a time.
- The data in item ② varies according to the selection in item ①.

Selection in item ①	Data displayed in item ②
RECTANGLE	MOVE UP.L (224,208) LO.R (287,271)
CIRCLE	CENTER (256,240) RAD. (032)
ELLIPSE	CENTER (256,240) RAD. (032,032)

■ Area filter

This function is used to eliminate objects if their measured area is outside of the upper and lower limits.

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Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To the next page

Continued from page 10-3 or 10-4

```
[EVALUATION COND]
①REGISTER NO.  0(0~3)              [TEST RESULT]          [OUTPUT]
②CONDITION SET RESET AUTO(±10%)
③NUMBER OF OBJ000~128              K=004          OK      NO
④TOTAL AREA    000000~245760       A=005200       OK      NO
⑤LABEL NO.     000(0~127)
⑥OBJECT AREA   000000~245760       R=000110       OK      NO
  CENT OF GRAV-X 000.0~511.0       GX=100.0       OK      NO
  CENT OF GRAV-Y 000.0~479.0       GY=094.0
  MAIN AXIS ANGL                   B=+110.0
  FILLET WIDTH                     FX=070
                                   FY=062
  PERIPHERAL                       CR=00217.0
  MID POINT                        CX=000.0
                                   CY=000.0
⑦TEST          EXEC(WITH-POSI.ADJ  WITHOUT-POSI.ADJ)
OPS-MENU  RETURN  LOCK
```

⇨ Page 3-16

- When "BINARY-IMG-MASK" is selected for the window type, only register number 0 is available. ⇨ See page 10-2.

You can set the output destinations using the up and down keys. (NO, Y0 to Y7, C000 to C127)

CENT OF GRAV, MAIN AXIS ANGL, FILLET WIDTH, PERIPHERAL , or MID POINT are displayed when measurement of these parameters has been specified ("YES" has been selected) on the [MEAS COND] menu (page 10-2).

Before setting the upper and lower limits between which the evaluation result is considered acceptable, execute item "⑦TEST," and check the test results.

When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.
  ⇨ See "Chapter 15: Numerical Calculations"

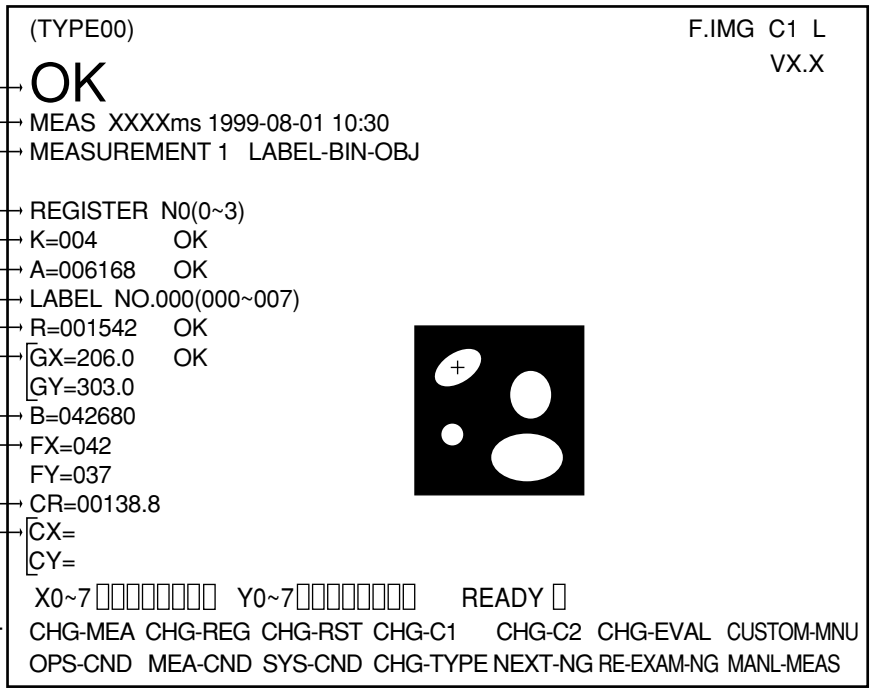
When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.
  ⇨ See "Chapter 16: PC Function"

Return to the MAIN OPS MENU.

Pressing the TRG/BRT key will start a measurement manually.

■ **Display example**

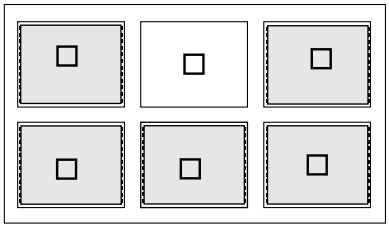
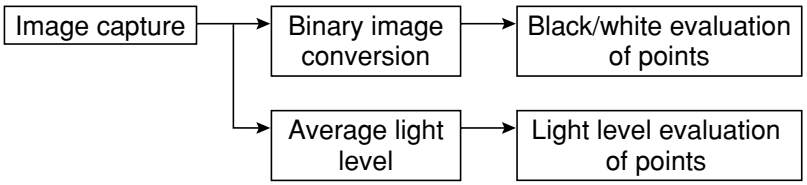
[Display of the measured results]



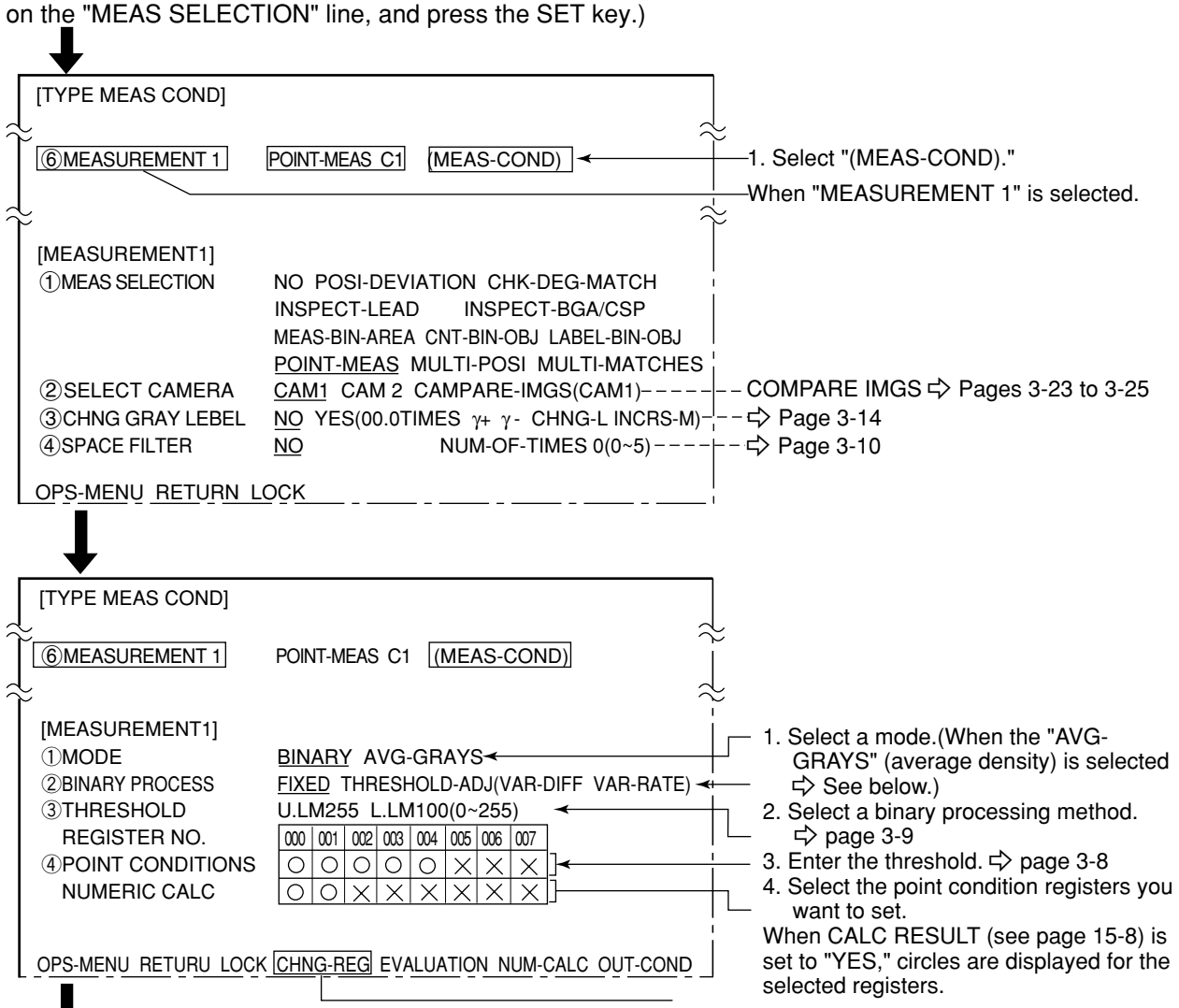
Final evaluation result
Measuring time
Measurement program number
Resistration number in the measurement condition
NUMBER OF OBJECTS
TOTAL AREA
LABEL NUMBER
OBJECT AREA
CENTER OF GRAVITY CORDINATE
MAIN AXIS ANGLE
FILLET DIA
PERIPHERAL
MID POINT

- CENT OF GRAV, MAIN AXIS ANGL, FILLET WIDTH, PERIPHERAL , or MID POINT are displayed when measurement of these parameters has been specified ("YES" has been selected) on the [MEAS COND] menu (page 10-2).

Chapter 11: Existence Inspection by Point Measurement

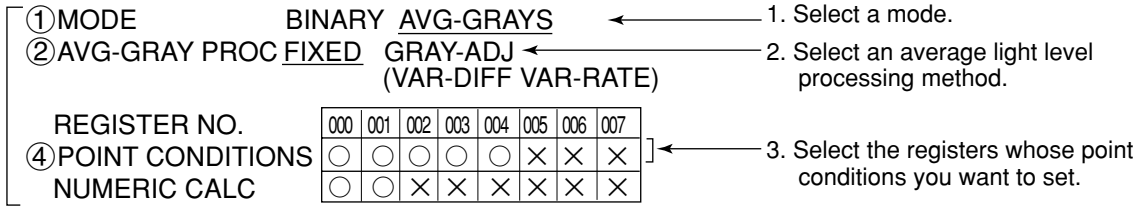
Purpose	The presence or absence of target objects is examined. - A simple black and white evaluation is made in the specified pixel area of binary images. - The light level in the specified pixel area is averaged, and a decision is made whether or not it is within the specified range of brightness for 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
Examples	**[Inspection of 6 points]**  Number of points (max.) : 128 points looking at average light levels 256 points in binary images Point size: 2 m x 2n pixels (m, n = 1 to 16) **- Inspection sequence** 

Setting the measurement programs (pages 1-10 to 1-11: Select "POINT-MEAS" (point measurement) on the "MEAS SELECTION" line, and press the SET key.)



You can change the register number ranges (0 to 255 in the BINARY mode and 0 to 127 in the AVG-GRAYS mode) using the up and down keys.

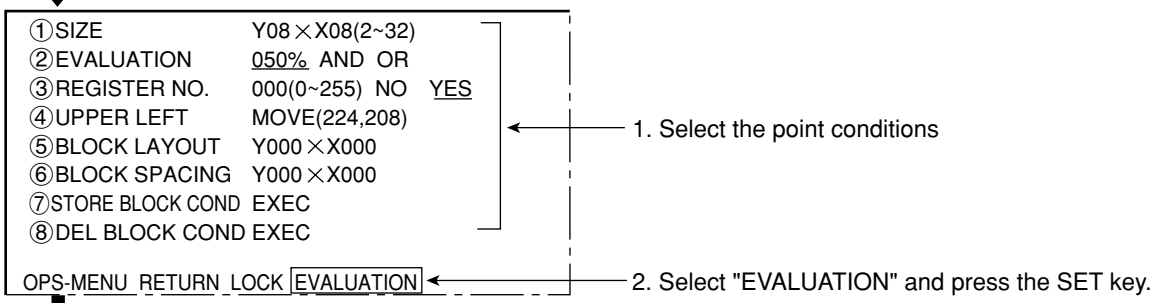
● **Setting (display) in AVG-GRAYS mode**



Select the point condition to be set.

To the next page

Continued from the previous page

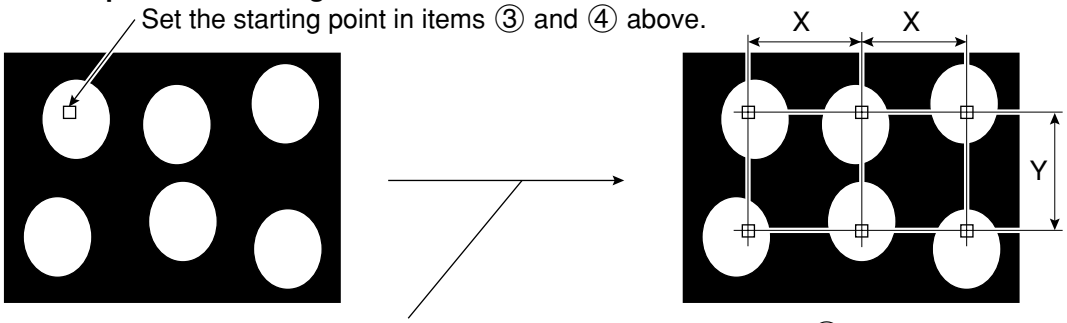


- Items ④ to ⑧ are displayed when item ③ has been set to "YES."

■ **Details of setting the evaluation**

②EVALUATION	Description
Percentage	When white occupies more than the specified percentage of pixels in a point, it is treated as white. Under any other conditions than the above it is treated as black. The value can be set between 0 and 100%, in units of 1%.
AND	When all the pixels are white, this point will be treated as white.
OR	When even one pixel is white, this point will be treated as white.

■ **Example of a block registration**



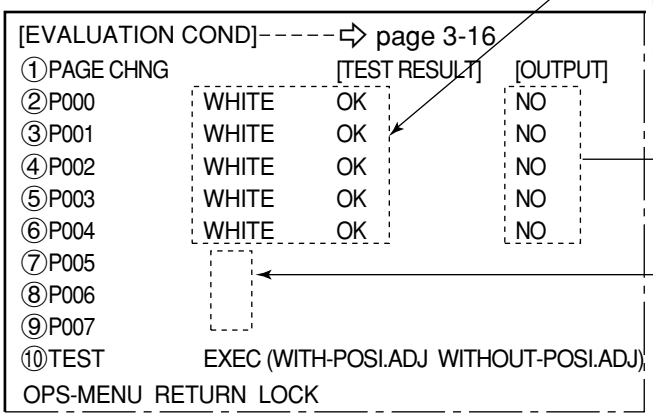
Enter 002 (vertical) × 003 (horizontal) in item ⑤ BLOCK LAYOUT, and enter the vertital (Y) and horizontal (X) intervals in item ⑥ BLOCK SPACING. Then select item ⑦ STORE BLOCK COND to store the settings for the block.

Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

To the next page

Continued from the previous page

● **When MODE has been set to "BINARY"**



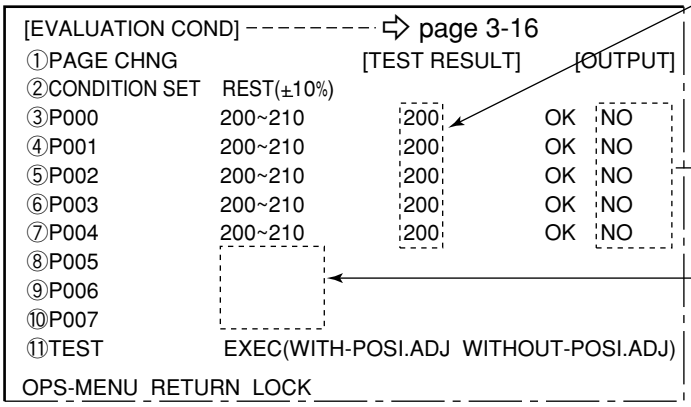
Acceptance (OK/NG) criteria
WHITE: Acceptable when a majority of the inspected pixels are white.
BLACK: Acceptable when a majority of the inspected pixels are black.
Ex.: When the point to be inspected is 8 X 8 (64 pixels) and WHITE is specified, if 33 white pixels are detected, the point is accepted.

You can set the output destinations using the up and down keys. (NO, Y0 to Y7, C000 to C127)

Not displayed for unregistered point numbers.

Average light level for each point

● **When MODE has been set to AVG-GRAYS**



You can set the output destinations using the UP and DOWN keys. (NO, Y0 to Y7, C000 to C127)

Not displayed for unregistered point numbers.

- PAGE CHNG: The items appearing at points ③ to ⑩ can be scrolled up and down by the up and down keys, 8 items at a time. Press the SET key, and a test will be executed using the specified evaluation conditions, and a test results will be displayed.
- P***: Set the evaluation conditions (WHITE/BLACK) for the point numbers 0 to 255 using the up and down keys. The points of the selected numbers will blink. WHITE or BLACK is not displayed for unregistered point numbers.
- TEST: Press the SET key, and a test will be executed using the specified evaluation conditions, and the test results will be displayed.

When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.
⇨ See "Chapter 15: Numerical Calculations"

When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.
⇨ See "Chapter 16: PC Function"

Return to the [MEAS COND] menu.

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Continued from the previous page

Pressing the TRG/BRT key will start a measurement manually.

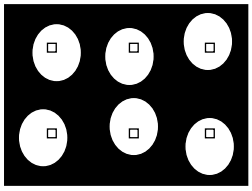
[Display of the measured results]

Final evaluation result
Measuring time
Measurement program number
Evaluation of the correct black or white color detected at registration No.000
" 001
" 002
" 003
" 004
" 005
" 006
" 007

- Areas will not be displayed for unspecified registration numbers.

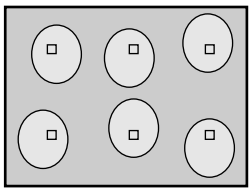
■ When MODE has been set to BINARY

```
(TYPE00)                                        F.IMG  C1  L
                                                        VX.X
OK
MEAS  XXXXms 1999-08-01 10:30
MEASUREMENT 1   POINT-MEAS

P000=WHITE  OK
P001=WHITE  OK
P002=WHITE  OK
P003=WHITE  OK
P004=WHITE  OK
P005=
P006=
P007=

X0~7□□□□□□□□  Y0~7□□□□□□□□      READY □
CHG-MEA CHG-REG CHG-RST CHG-C1     CHG-C2  CHG-EVAL  CUSTOM-MNU
OPS-CND  MEA-CND  SYS-CND  CHG-TYPE NEXT-NG RE-EXAM-NG  MANL-MEAS
```

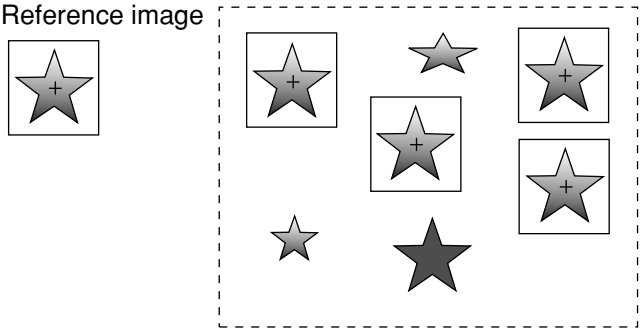
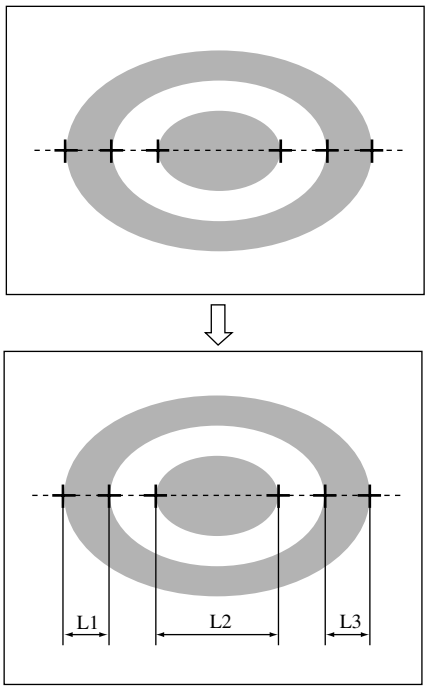


■ When MODE has been set to AVG-GRAYS

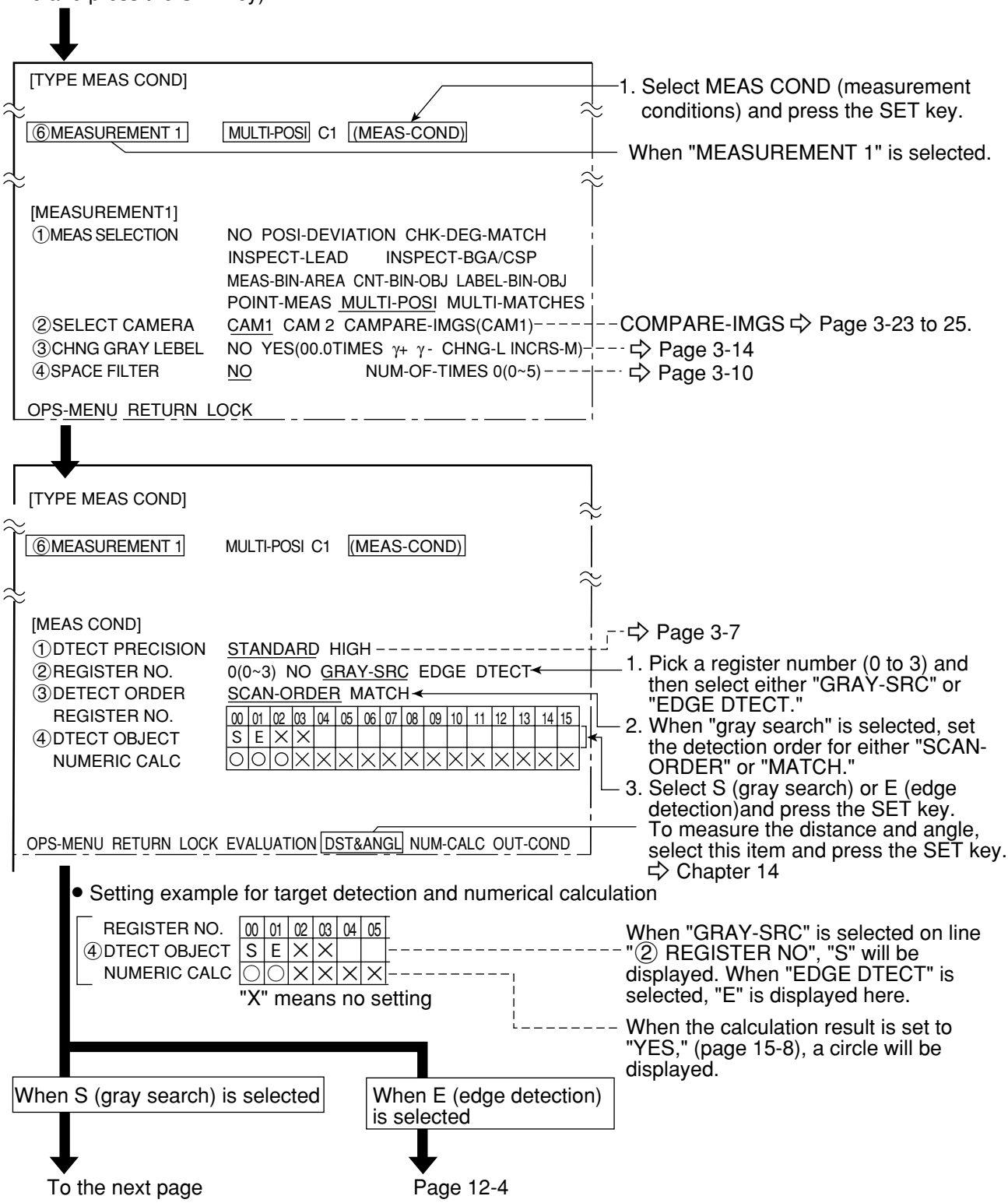
```
(TYPE00)                                        F.IMG  C1  L
                                                        VX.X
OK
MEAS  XXXXms 1999-08-01 10:30
MEASUREMENT 1   POINT-MEAS

P000=115  OK
P001=120  OK
P002=114  OK
P003=118  OK
P004=116  OK
P005=115  OK
P006=
P007=

X0~7□□□□□□□□  Y0~7□□□□□□□□      READY □
CHG-MEA CHG-REG CHG-RST CHG-C1     CHG-C2  CHG-EVAL  CUSTOM-MNU
OPS-CND  MEA-CND  SYS-CND  CHG-TYPE NEXT-NG RE-EXAM-NG  MANL-MEAS
```



Chapter 12: Multiple positional measurements

Purpose	The IV-S30 can detect up to 128 workpieces whose images exceed the specified matching level (gray search) or threshold value (edge detection) from the reference image. - The positional deviation measurement needs to have a number of positions registered for measurement. However, this measurement only requires you to register one position and reduces the set up time.
Application	Measure the position of workpieces with a complicated light level that cannot be converted into binary images.
Example	● **Gray search** Reference image  **[Measured results]** - Number of images detected - Coordinates and degree of match detected for each image ● **Edge detection**  **[Measured results]** - Number of images detected - Coordinates detected This is useful for obtaining the distance between the coordinates of a position. - L1 to L3 can be calculated by measuring distances and angles.

Setting the measurement program (Page 1-10 to 1-11: Select "MULTI-POSI" on the "MEAS SELECTION" line and press the SET key).



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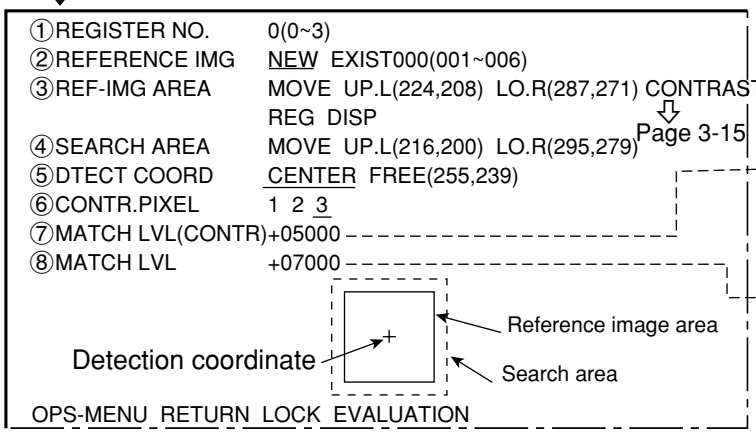
Continued from the previous page: When S (gray search) is selected

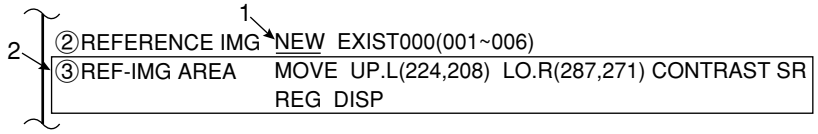


Specify the degree of match necessary for contracted images. (Identify contracted images that have a higher degree of match than the setting.)

Specify the degree of match with the original image used as the contracted image in item 7 above. (Identify original images that have a higher degree of match than the setting.)

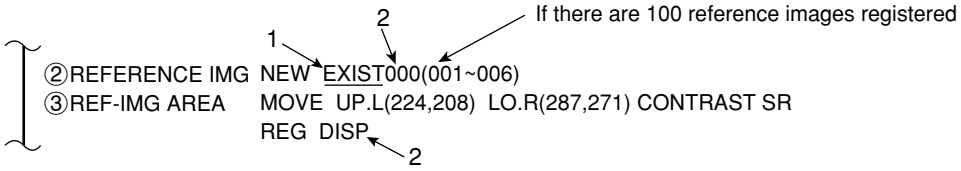
■ Setting procedure for the reference image

- When you want to register a new reference image



1. Select "NEW" on the "②REFERENCE IMG" line.
2. Move to "③REF-IMG AREA" and press the SET key.

- When you want to use a reference image that is already registered.



1. Select "EXIST" on the "②REFERENCE IMG" line, and press the SET key.
2. Select the number of the reference image you want to use using the left and right keys (select digits) and the up and down keys, and press the SET key. To confirm the reference image, select "DISP" for the "③REF-IMG AREA" line.

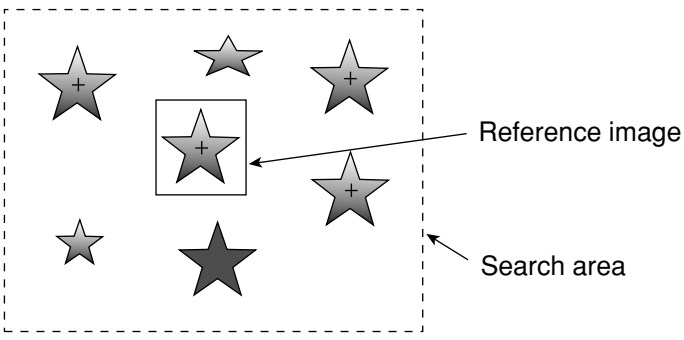
Note: After select "EXIST" on the "②REFERENCE IMG" line, register the reference image in the "③REF-IMG AREA." The reference image matching the specified number will be

■ Number of reference images that can be registered

Controller	Number of reference images that can be registered
IV-S33M	Maximum 600 (the total size of all reference images must be less than 8 screens)

One screen: 512 x 480 pixels

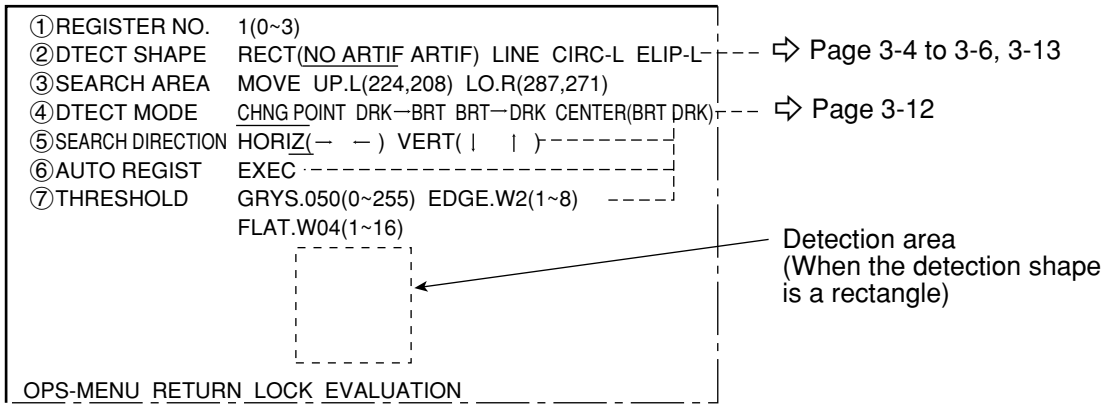
■ A registration example



Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

Page 12-5

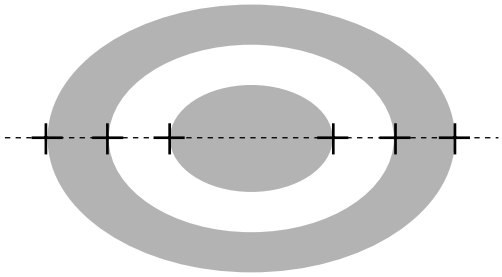
Continued from page 12-2: When E (edge detection) is selected



- With each press of the ESC key, the display will change between all items and each item.
- Depending on the setting in item ② above, the information displayed on lines ③ and ⑤ will vary.

Selection on ②	**Display on ③**	**Display on ⑤**
RECT (rectangle)	MOVE: UP.L (224, 208), LO.R (287, 271)	HORIZ (→ ←) VERT (↓ ↑)
LINE (straight line)	MOVE: S.PT (224, 240), E.PT (287, 240)	START-PNT→END-PNT END-PNT→START-PNT
CIRC-L (circle)	CENTER (256, 240) RAD.(032), S.PT (256, 208)	CLOCK-WISE, COUNTER-CW
ELIP-L (oval)	CENTER (256, 240) RAD. (032, 032), S.PT (256, 208)	

■ A registration example
Shown below is a shape to be detected (straight line) and a detection mode (changed point).



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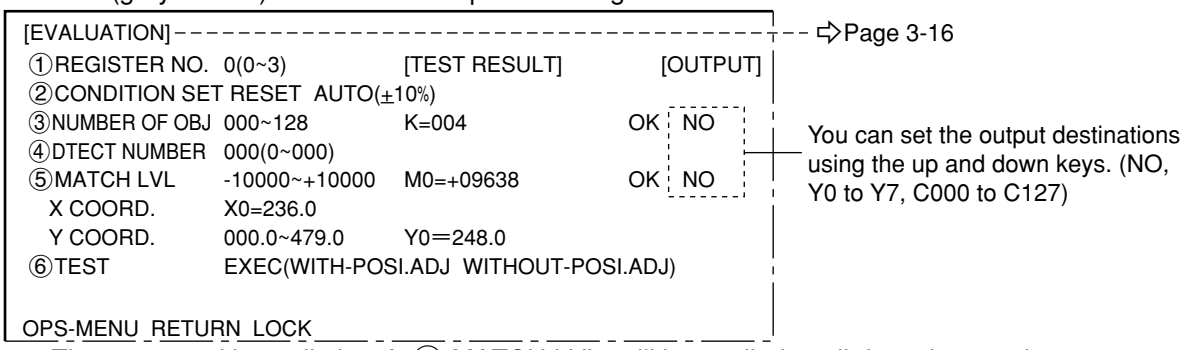
Select EVALUATION" (or select EVALUATION" on the [MEAS COND] menu) and press the SET key.

To the next page

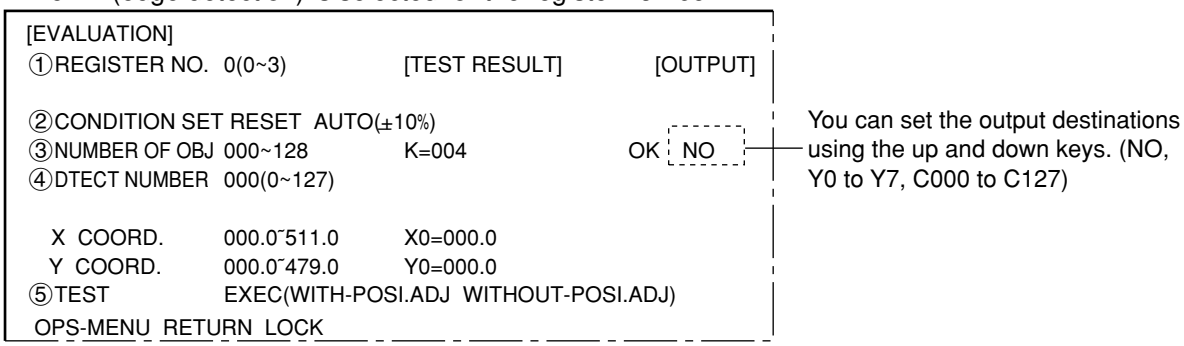
From page 12-3, previous page

- When S (gray search) is selected for a particular register number



The upper and lower limits of "⑤ MATCH LVL" will be applied to all detection numbers.

- When E (edge detection) is selected for the register number



When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.
⇨ See "Chapter 15: Numerical Calculations"

When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.
⇨ See "Chapter 16: PC Function"

Return to the MAIN OPS MENU.

To the next page

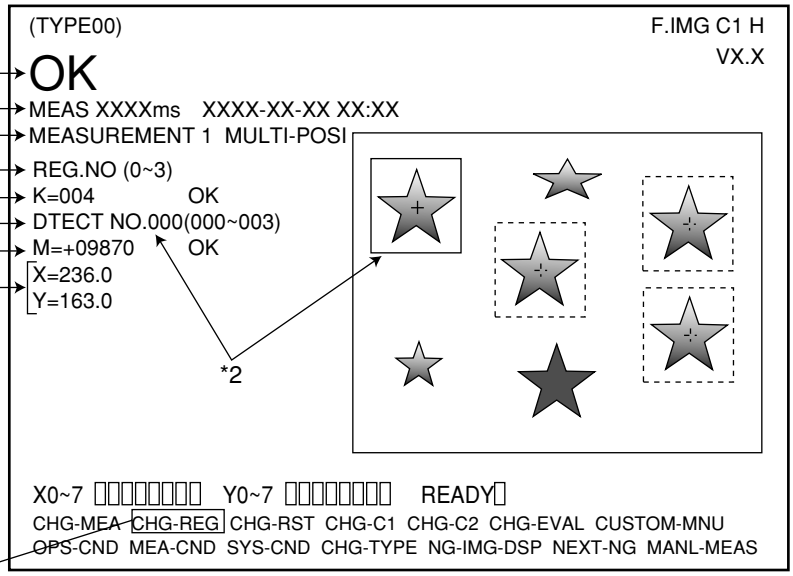
Continued from the previous page

Press the TRG/BRT key to measure manually.

■ An example of the display when "gray search" is selected.

[Display of measured results]

Final evaluation result
Measuring time
Measuring program number
Register number
Number of detected images
Numbered in the order detected (range)
*1
Degree of match
Detected point coordinates

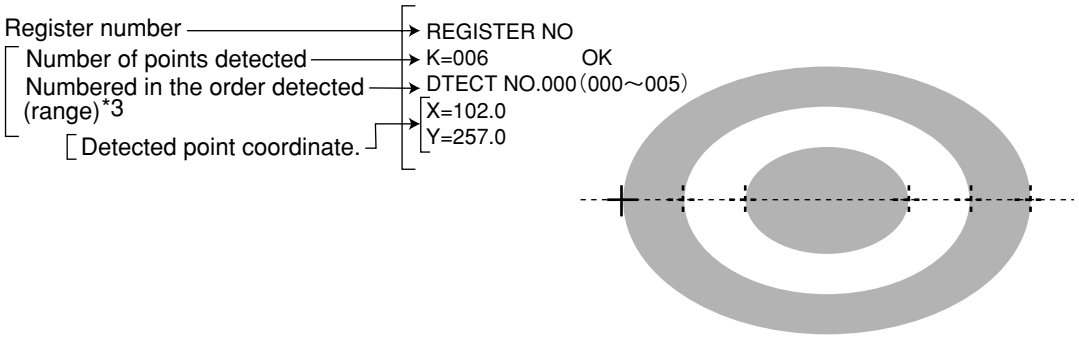


- Move the cursor to CHG-REG (change register)" and press the up key. The measurement result display will change in the following order: Register No. 0 (detection No. 000 → 001→ ooo) → ooo → Register No. 3 (ooo) → Register No. 0 (ooo) → ooo, and so will the measurement screen. Press the down key to change the display, moving through the items in reverse order.

* 1 The detection order can be set to either "SCAN-ORDER " or "MATCH" on item "③DETECT ORDER" on the [MEAS COND] menu. ⇨ See page 12-2.
* 2 The inspection number corresponds to the image of the solid line.

■ An example of the display when "gray search" is selected.

Register number
Number of points detected
Numbered in the order detected (range)*3
Detected point coordinate.



*3 Coordinates of the detected point.

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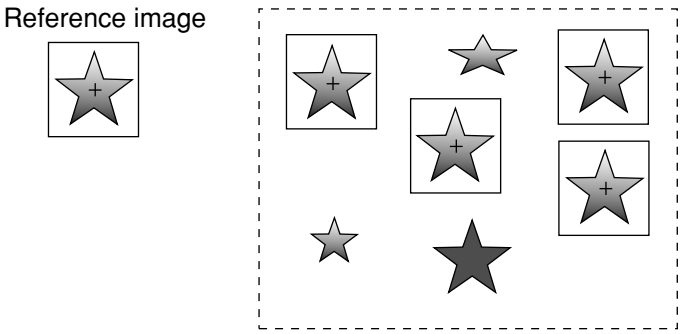
Chapter 13: Multiple degree of match inspection

Purpose	Using the gray search function, the IV-S30 can detect up to 128 workpieces whose captured image exceeds the required degree of match with the reference image.
Application	Inspect (or count) workpieces that have complicated light livel and cannot be converted into binary. images
Example	 **[Measured results]** - Number of images detected - Degree of match, density (average/absolute difference), and detected coordinates

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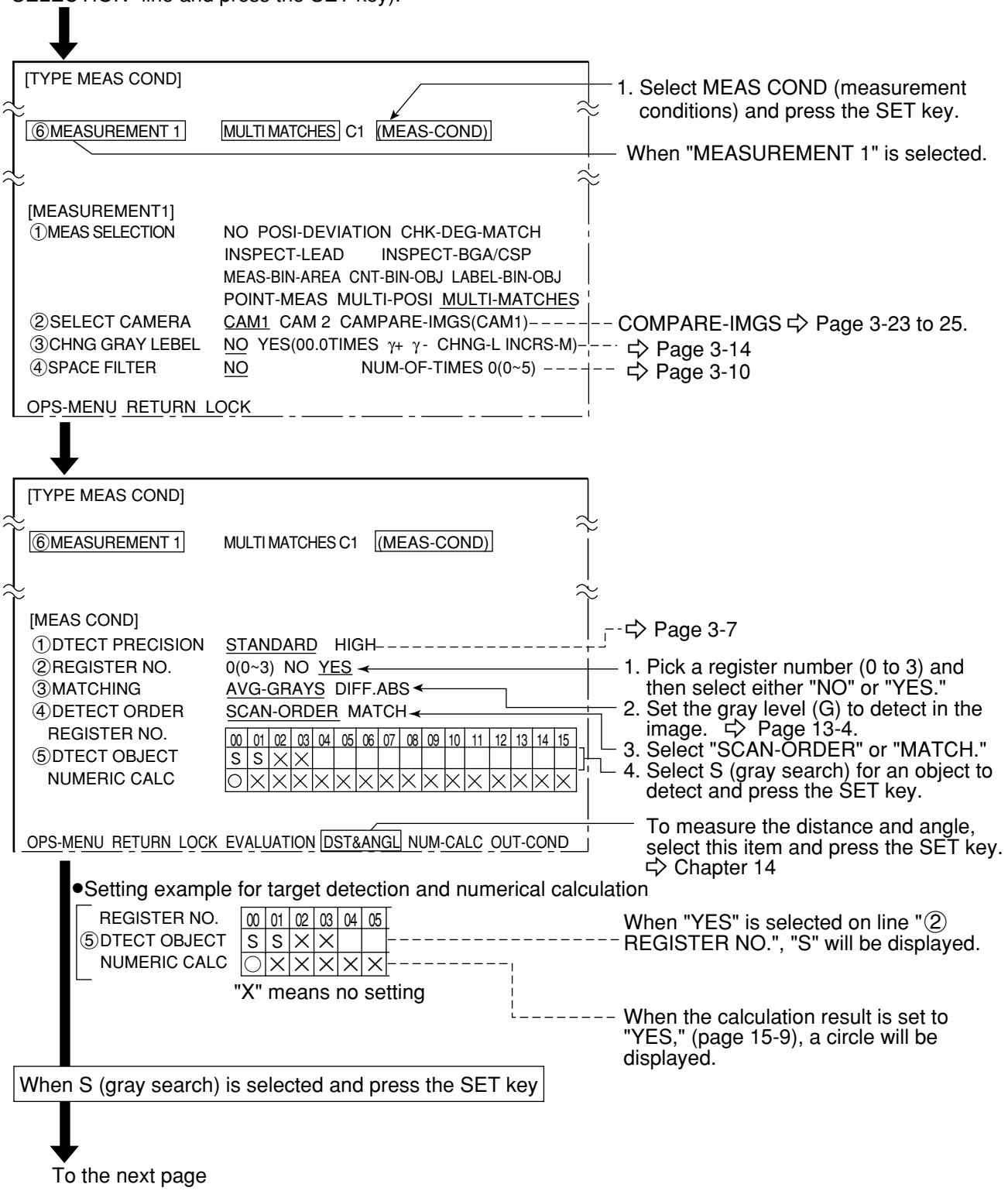
Setting the measurement program (Page 1-10 to 1-11: Select "MULTI-MATCHES" on the "MEAS SELECTION" line and press the SET key).



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●Setting example for target detection and numerical calculation

"X" means no setting

When "YES" is selected on line "② REGISTER NO.", "S" will be displayed.

When the calculation result is set to "YES," (page 15-9), a circle will be displayed.

When S (gray search) is selected and press the SET key

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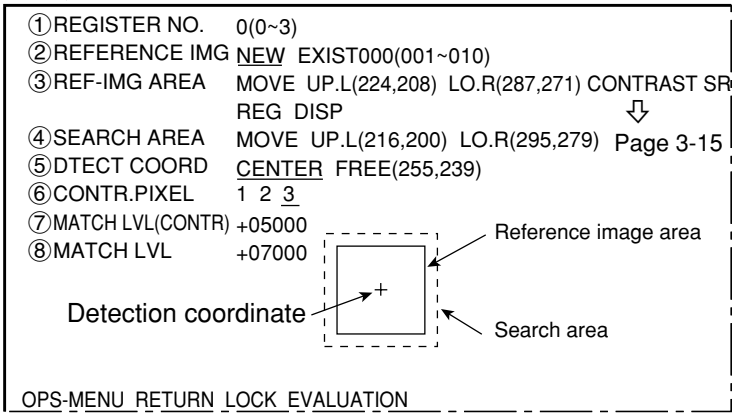
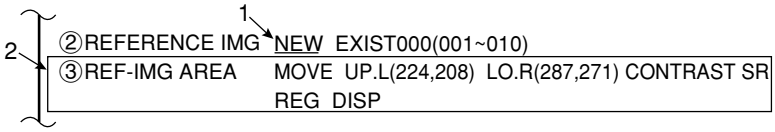


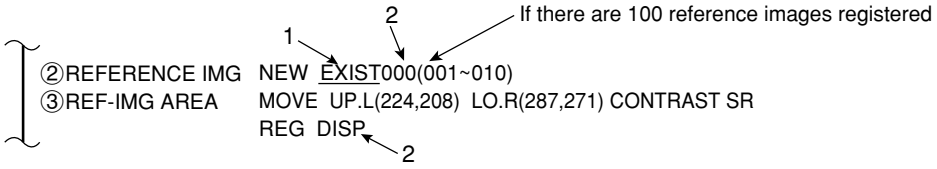
■ Setting procedure for the reference image

- When you want to register a new reference image



1. Select "NEW" on the "① REFERENCE IMG" line.
2. Set "③REF-IMG AREA" and press the SET key.

- When you want to use a reference image that is already registered.



1. Select "EXIST" on the "②REFERENCE IMG" line, and press the SET key.
2. Select the number of the reference image you want to use using the left and right keys (select digits) and the up and down keys, and press the SET key. To confirm the reference image, select "DISP" for the "③REF-IMG AREA" line.

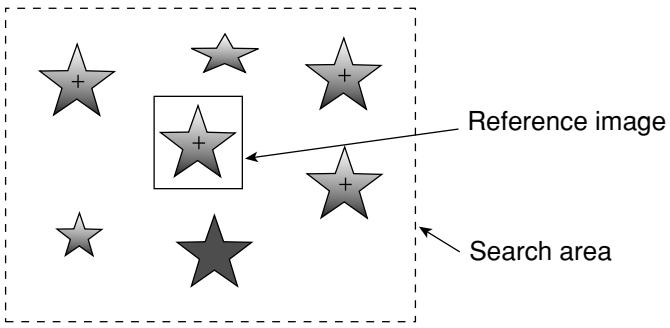
Note: After selecting "EXIST" on the "②REFERENCE IMG" line, register the reference image in the "③REF-IMG AREA." The reference image matching the specified number will be refreshed.

■ Number of reference images that can be registered

Controller	Number of reference images that can be registered
IV-S33M	Maximum 600 (the total size of all reference images must be less than 8 screens)
IV-S32M	
IV-S31M	Maximum 300 (the total size of all reference images must be less than 3 screens)

One screen: 512 x 480 pixels

■ A registration example



Select "EVALUATION" (or select "EVALUATION" on the [MEAS COND] menu) and press the SET key.

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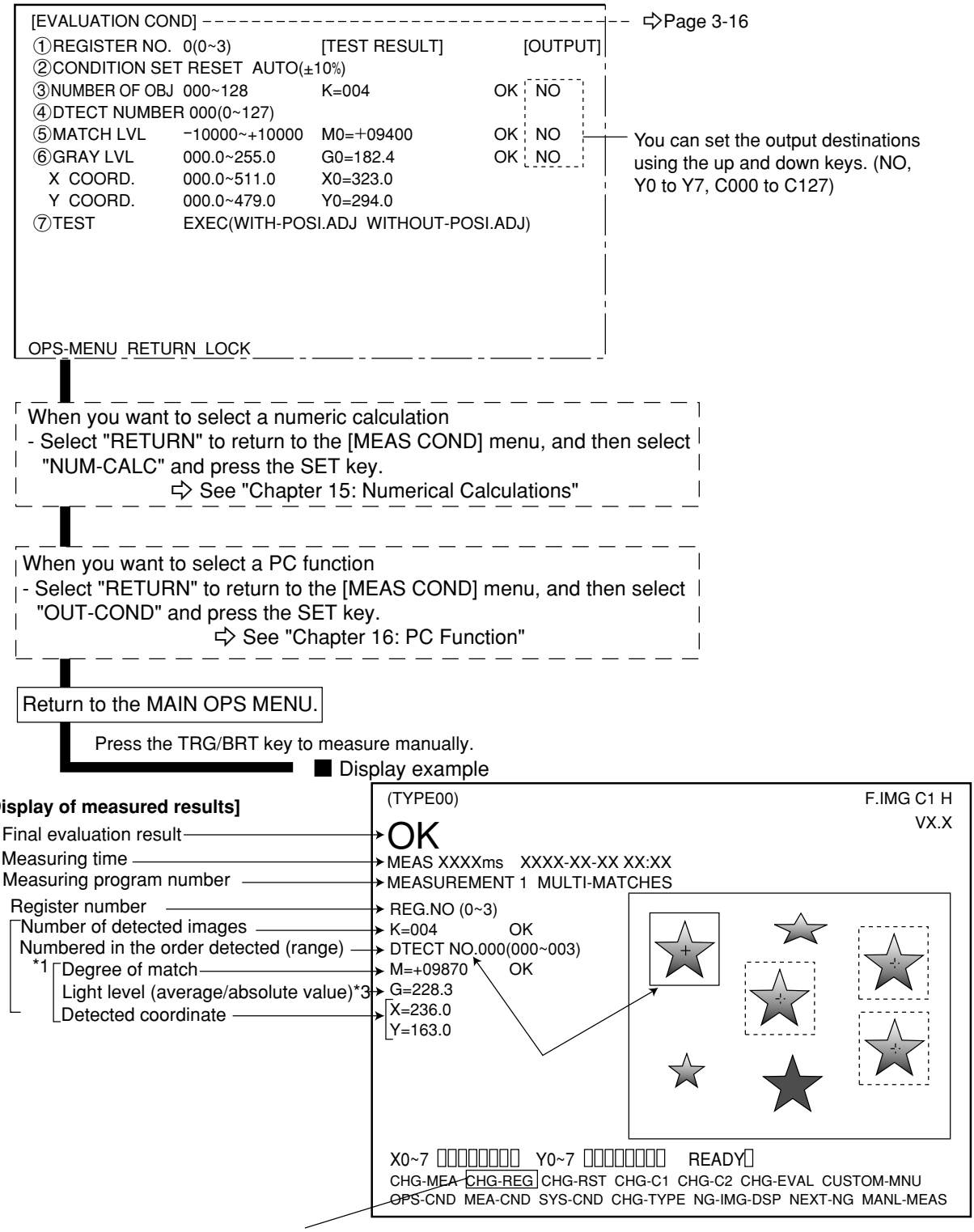


■ Display example

[Display of measured results]

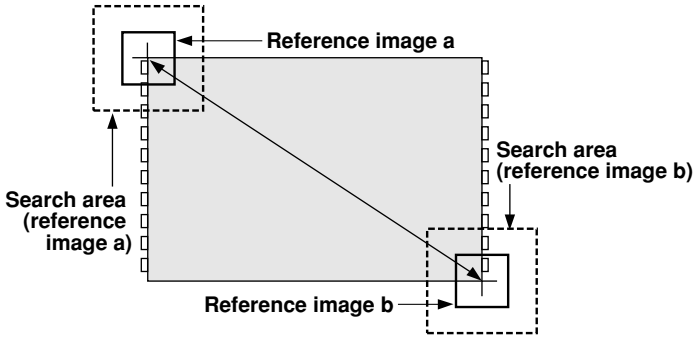
- Move the cursor to "CHG-REG (change register)" and press the up key. The measurement result display will changes in the following order: Register No. 0 (detection No. 000 → 001 → ooo) → ooo → Register No. 3 (ooo) → Register No. 0 (ooo) → ooo, and so will the measurement screen. Press the down key to change the display, moving through the items in reverse order.

* 1 The detection order can be selected as either "SCAN-ORDER" or "MATCH" on item "④DETECT ORDER" on the [MEAS COND] menu. ⇨ See page 12-2.
* 2 The inspection number corresponds to the image of the solid line.
* 3 The details of the light level settings (average/difference in absolute value) are the same as for the degree of match inspection. ⇨ See page 5-4.

To select these items, use "③MATCHING" on the [MEAS COND] menu. - See page 13-2.

Chapter 14: Distance and Angle Measurement

You can specify the settings for distance and angle mesurement on the "MEAS COND" menu in the positional deviation measurement, degree of match inspection, object identification by binary conversion (select "YES" for center of gravity mesurement), multiple position measurement, and multiple degree of match inspection. (⇨ page 4-2, 5-2, 10-2, 12-2, and 13-2)

Purpose	The distance and angle of the centers of the detected points can be measured using 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. - This function can measure the following distances and angles: distance between two points, X coordinate distance, Y coordinate distance, the angle between three points, the horizontal angle of two points, and the vertical angle of two points. - The following points and lines can be set: center point, circle center point, gravity center, point where two straight lines cross, line passing through two points.
Applications	Measurement for installed electronic components
Examples	**[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 between two points, X coordinate distance, and Y coordinate distance manually, see the MANL-MEAS (manual measurement) section (page 2-12) for the crosshair cursor display.

Select "DST&ANGL" on the MEAS-COND menu screen for the positional deviation measurement (page 4-2), degree of match inspection (page 5-2), object identification by binary conversion (page 10-2), multiple position measurement (page12-2), or multiple degree of match inspection (13-2), and press the SET key.

OBJECT: AUX

OBJECT: DIST → To page 14-4

OBJECT: ANGL → To page 14-5

● **The auxiliary points when mid point has been selected.**

```
[ DIST&ANGLE  COND]
①OBJECT              AUX DST ANGL
②AUXILIARY NO.       00(0~15) NO MID-PNT CIRC-C GRAV LINE-2P
                                 INTERSECTION
③COND.1              MEAS-REGNO MDL0 AUX NO
④COND.2              MEAS-REGNO MDL0 AUX NO
                                 [TEST RESULT] [OUTPUT]
⑤AUX JUDGEMENT1      000.0~511.0  X=030.0      OK  NO
⑥AUX JUDGEMENT2      000.0~479.0  Y=031.0
⑦RUN A TEST          EXEC

  REGISTER NO.  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
  AUX.          ○  ○  ○  ○  ○  ○  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×

OPS-MENU  RETURN  LOCK  NUM-CALC  OUT-COND
```

Specify the registration number for the measurement program.

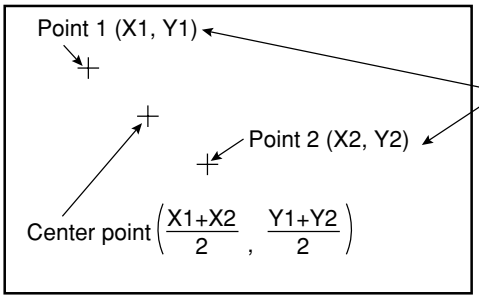
Select either Model 0 or 1 for that registration number.

The auxiliary number selected in item ② can be specified here.

Specify the conditions for evaluating the coordinates (X/Y) of the midpoint. Select EXEC on item ⑦ to run a test.

A circle will be displayed under the auxiliary numbers that have been assigned.

- The center point is the coordinate half way between points 1 and 2 that are specified on ③ and ④ (COND. 1 and 2).



Point 1 and 2 are coordinates output with testing on the [EVALUTION COND] menu, or measured on the MAIN OPS MENU.

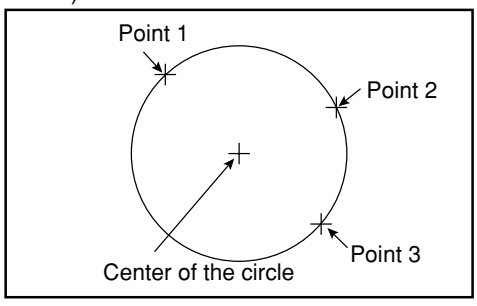
● **The auxiliary points when center of circle and center of gravity have been selected.**

```
①OBJECT              AUX DST ANGL
②AUXILIARY NO.       00(0~15) NO MID-PNT CIRC-C GRAV LINE-2P
                                 INTERSECTION
③COND.1              MEAS-REGNO MDL0 AUX NO
④COND.2              MEAS-REGNO MDL0 AUX NO
⑤COND.3              MEAS-REGNO MDL0 AUX NO
                                 [TEST RESULT] [OUTPUT]
⑥AUX JUDGEMENT1      000.0~511.0  X=030.0      OK  NO
⑦AUX JUDGEMENT2      000.0~479.0  Y=031.0
⑧RUN A TEST          EXEC
```

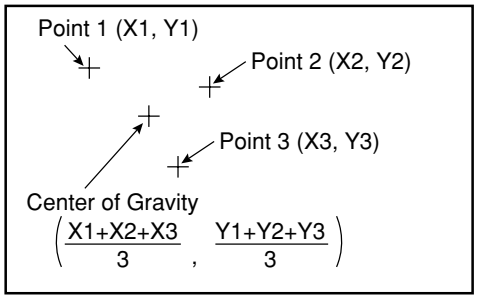
You have to specify these settings.

See the description above for the item ⑦.

The center of the circle is the central coordinate of three points positioned on the circumference of the circle that are specified between ③ and ⑤ (conditions 1 to 3).



The center of gravity between points 1 to 3 that are specified between ③ and ⑤ is calculated as the mean of the three coordinates (conditions 1 to 3).



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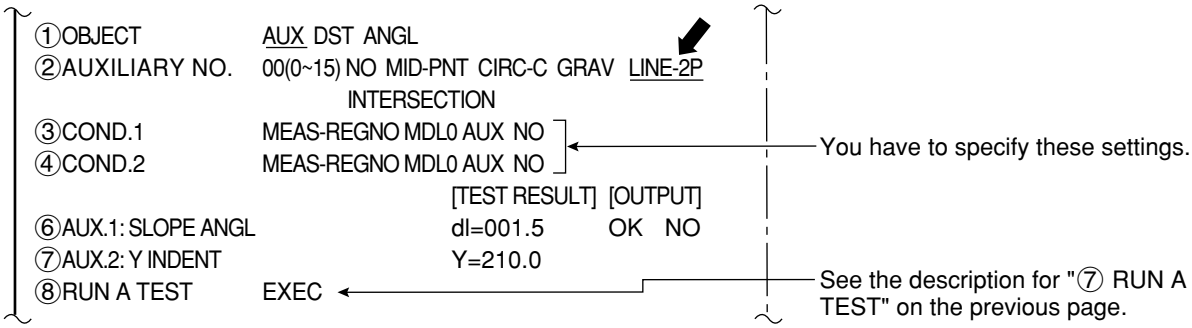
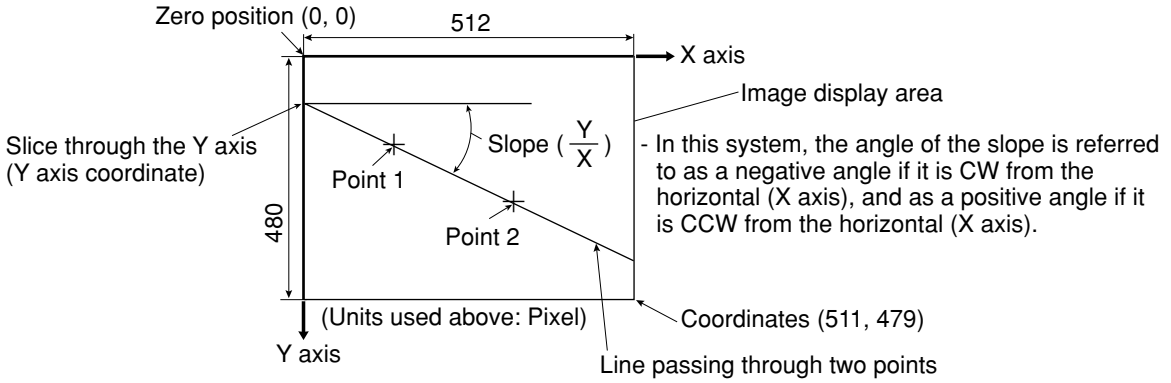
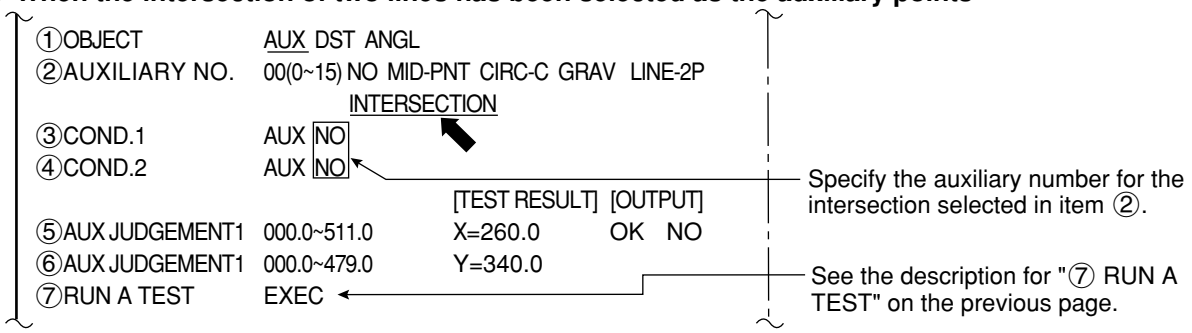
● **When a line passing through two points has been selected as the auxiliary points**



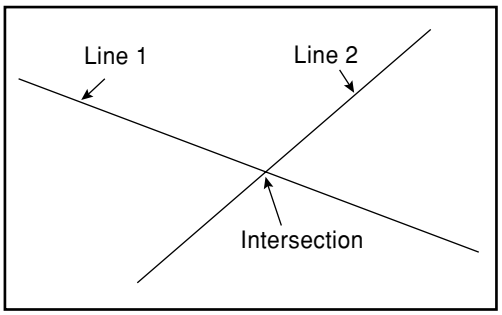
- The line passing through two points is the line that passes through points 1 and 2 specified in items ③ and ④ (COND. 1/2)



● **When the intersection of two lines has been selected as the auxiliary points**



- The intersection of two lines is the point where lines 1 and 2, specified in items ③ and ④ (COND. 1/2), cross.



Select "NUM-CALC" and press the SET key.

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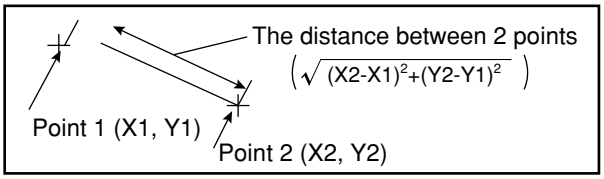
Continued from page 14-2 (OBJECT: DST)

```
[DIST&ANGLE  COND]
 ①OBJECT              AUX DST ANGL
 ②DISTANCE NO.        00(0~15) NO DIST-BETW-2PT  DIST-BETW-X
                                  DIST-BETW-Y
 ③COND.1              MEAS-REG NO  MDL0  AUX NO
 ④COND.2              MEAS-REG NO  MDL0  AUX NO

                                  [TEST RESULT]      [OUTPUT]
 ⑤DISTANCE EVALUAT    000.0~+702.0  130.0        OK   NO
 ⑥RUN A TEST          EXEC

   REGISTER NO.   00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
   DISTANCE       ○  ○  ○  ○  ○  ○  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×

 OPS-MENU  RETURN  LOCK  NUM-CALC  OUT-COND
```

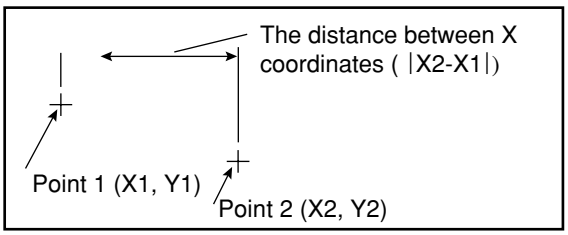
You have to specify these settings.

See the description for "⑦ RUN A TEST" on the page 14-2.

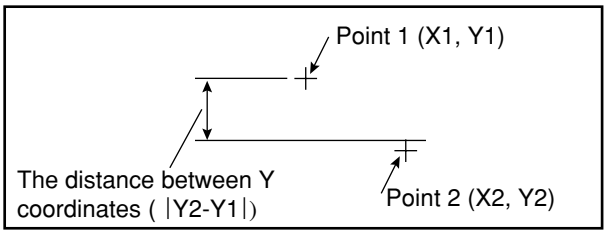
● **The distance type when distance between two points has been selected**



● **The distance type when distance between X coordinates has been selected**



● **The distance type when distance between Y coordinates has been selected**



Select "NUM-CALC" and press the SET key.

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Continued from page 14-2 (OBJECT: ANGL)

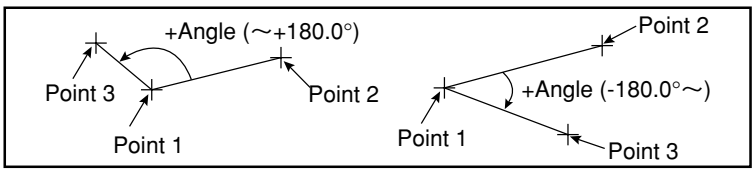
● **Angle: When a 3 point angle is specified**

```
[ DIST&ANGLE  COND]
 ①OBJECT              AUX DST ANGL
 ②ANGLE NO.           00(0~15) NO 3PT-ANGL 2PT-H-ANGL 2PT-V-ANGL

 ③COND.1              MEAS-REGNO MDL0 AUX NO (ANGL OBJ)
 ④COND.2              MEAS-REGNO MDL0 AUX NO
 ⑤COND.3              MEAS-REGNO MDL0 AUX NO
                                     [TEST RESULT]  [OUTPUT]
 ⑥ANGL EVALUATION  -180.0~+180.0     B=030.0°       OK   NO

 ⑦RUN A TEST          EXEC

   REGISTER NO.   00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
   ANGL           ○  ○  ○  ○  ○  ○  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×

 OPS-MENU  RETURN  LOCK  NUM-CALC  OUT-COND
```

You have to specify these settings.

See the description for "⑦ RUN A TEST" on the page 14-2.

- 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.



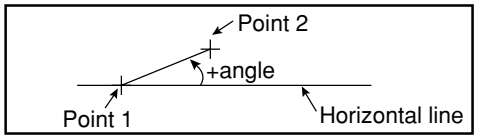
● **Angle: When a 2-point (horizontal/vertical) angle is specified**

```
 ①OBJECT              AUX DST ANGL
 ②DISTANCE NO.        00(0~15) NO 3PT-ANGL 2PT-H-ANGL 2PT-V-ANGL

 ③COND.1              MEAS-REG00 MDL0  AUXNO    (ANGL OBJ)
 ④COND.2              MEAS-REG01 MDL0  AUXNO

                                  [TEST RESULT]      [OUTPUT]
 ⑤ANGL EVALUATION  -180.0~+180.0  B= 030.0°     OK   NO

 ⑥RUN A TEST          EXEC
```

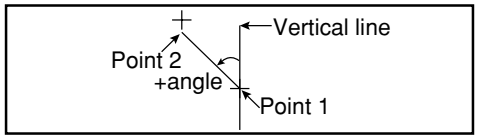
You have to specify these settings.

See the description for "⑦ RUN A TEST" on the page 14-2.

- 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.



- 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.



When you want to select a numeric calculation
- Select "RETURN" to return to the [MEAS COND] menu, and then select "NUM-CALC" and press the SET key.
  ⇨ See "Chapter 15: Numerical Calculations"

When you want to select a PC function
- Select "RETURN" to return to the [MEAS COND] menu, and then select "OUT-COND" and press the SET key.
  ⇨ See "Chapter 16: PC Function"

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Continued from the previous page

Return to the MAIN OPS MENU.

Pressing the TRG/BRT key will start a measurement manually.

- Select "CHG-RST" on the menu bar, and change the result using the up and down keys.

■ **Example of the results displayed for a distance measurement**

[Display of the measured results]

```
(TYPE00)                                          F.IMG  C1  L
                                                  VX.X
OK                                  ← Final evaluation result
MEAS  XXXXms 1999-08-01 10:30       ← Measuring time
MEASURE 0 CAM1   POSI-DEVIATION     ← Measurement program number

MXR                                 ← Mesurement object
00:100.0      OK                    ← Distance of distance number 00
01:100.0      OK                    ← "  01
02:050.0      OK                    ← "  02
03:360.0      OK                    ← "  03
04:250.0      OK                    ← "  04
05:                                 ← "  05
06:                                 ← "  06
07:                                 ← "  07
                                    ← (Number of pixels)

X0~7 □□□□□□□□  Y0~7 □□□□□□□□  READY □
CHG-MEA CHG-REG CHG-RST CHG-C1  CHG-C2 CHG-EVAL CUSTOM-MNU
OPS-CND MEA-CND SYS-CND CHG-TYPE NEXT-NG RE-EXAM-NG MANL-MEAS
```

*Areas will not be displayed for unspecified registration numbers.

- The following are some examples of other displays.
- Select "CHG-REG" on the menu bar, and change the objects to be measured using the up and down keys.

■ **Example of the displayed of angle results**

```
ANGL                                ← Mesurement object
00:+080.0°  OK                      ← Angle of angle number 00
01:+070.0°  OK                      ← "  01
02:+050.0°  OK                      ← "  02
03:+088.2°  OK                      ← "  03
04:+00 6.5°  OK                     ← "  04
05:                                 ← "  05
06:                                 ← "  06
07:                                 ← "  07
```

■ **Example of the displayed of auxiliary results**

```
AUX                                 ← Mesurement object
00: (259.0,  178.0)  OK             ← Angle of auxiliary number 00
01: (466.0,  178.0)  OK             ← "  01
02: (361.0,  228.0)  OK             ← "  02
03: (132.0,  298.0)  OK             ← "  03
04: (362.5,  178.0)  OK             ← "  04
05:                                 ← "  05
06:                                 ← "  06
07:                                 ← "  07
```

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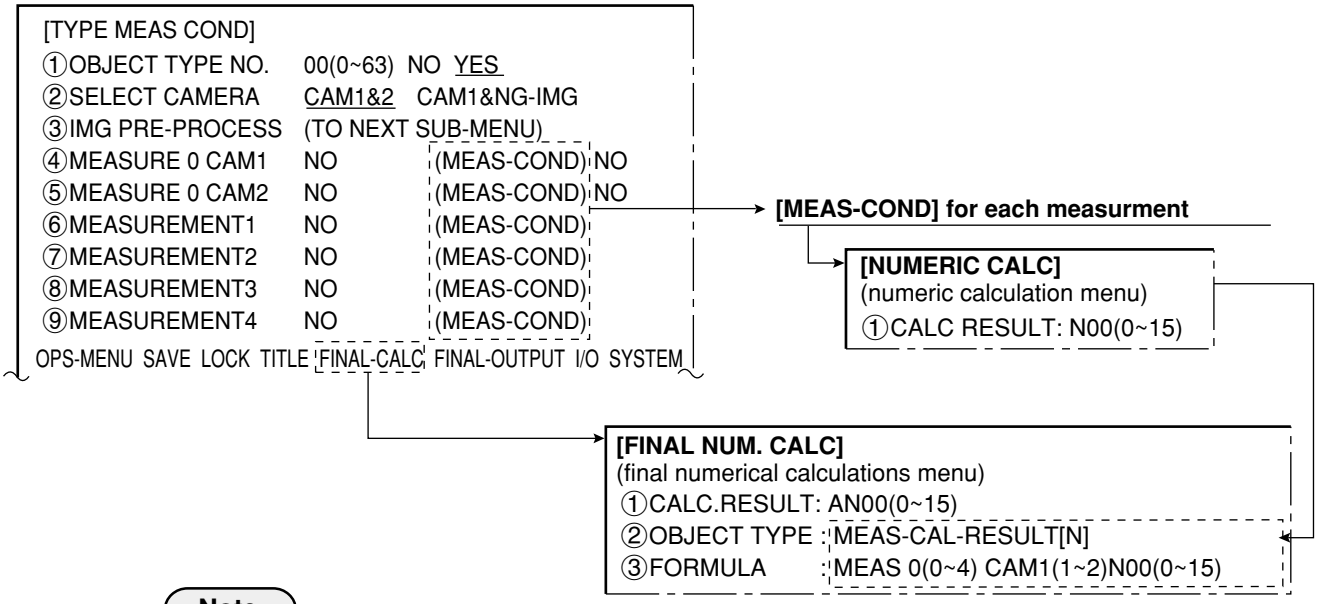
Chapter 15 Numerical Calculations

Numeric calculation fuction of the IV-S30 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 ②OBJECT TYPE and ③FORMULA (style) settings of the final numerical calculation.



Note

- **Numeric calculation errors (deviation from the exact value) after digitizing the image**
  Since the IV-S30 uses 64-bit, floating-point arithmetic operations in its calculations, small quantitization errors may occur when converting the images into numbers.

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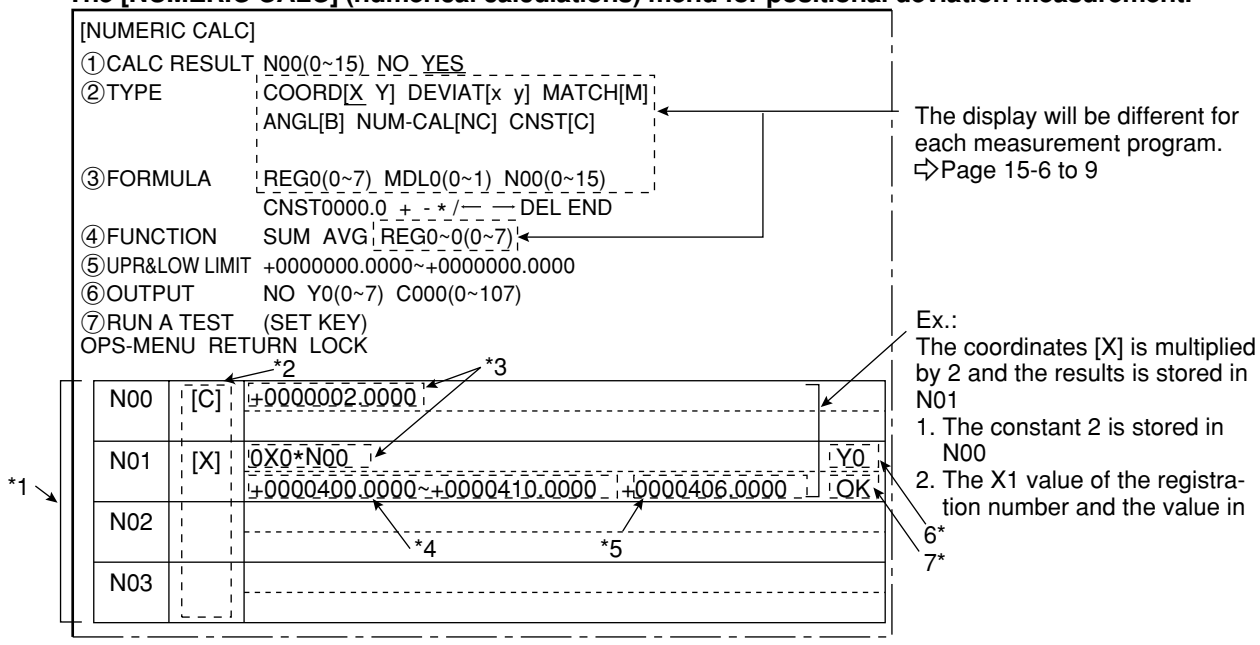
15-1 The individual numerical calculations for each measuring program

[1] The setting details

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 positional measurements.

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



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.

②TYPE:
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.

Item② selections	Selection on line ③
COORD [X Y], DEVIAT [x y], MATCH [M]	REG0 (0 to 7) MDL0 (0 to 1) N00 (0 to 15) CNST0000.0 + - ∗ / ← → DEL END
ANGL [B]	MEAS0 (0 to 7), N00 (0 to 15) CNST0000.0 + - ∗ / ← → DEL END
NUM-CAL [NC]	ABS SQRT TAN ATAN N00(0 to 14) MAX MIN N00 to 00 (0 to14)
Constant C	+0000000.00 (second line is not displayed)

Varies with each measurement program. ⇨Page 15-6 to 9

These are the same as for the other measurement programs.

Note: Please enter a smaller number for N (00 to 15) in the formula than the N (00 to 15) in item①CALC RESULT

④FUNCTION
When obtaining the total (SUM) or the average (AVG) of the calculated results for each object type ②, specify the range of register numbers.

⑤UPR&LOW LIMIT:
Enter the upper and lower limits for making a judgment. ⇨This setting will be displayed in N00 to N15, at position * 4 above.

⑥OUTPUT:
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.

⑦RUN A TEST: (make a test run)
Pressing the SET key will store the setting details as well as run a test. ⇨The numerical results of the tests will be displayed at position *5 and the OK or NG judgment will be displayed at position * 7.

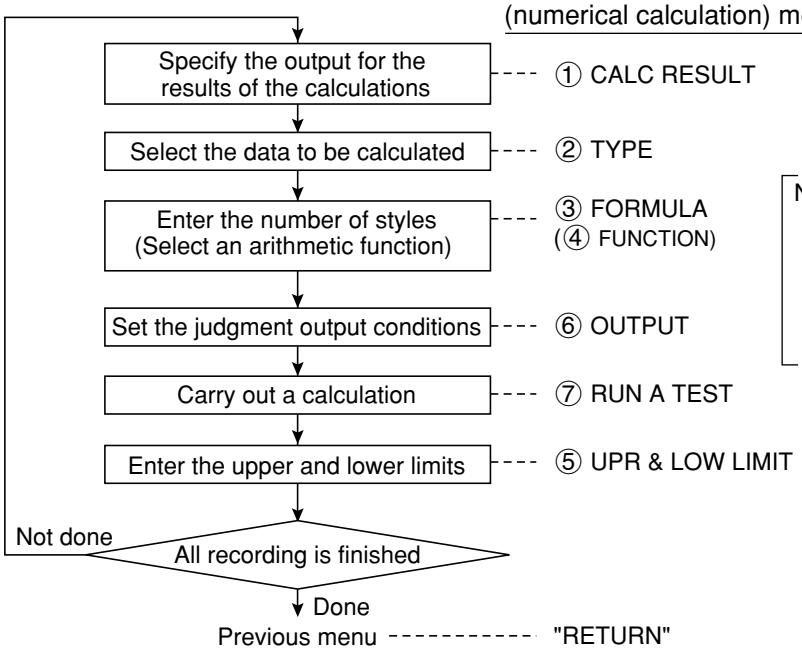
■ Setting procedure

- 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	
COORD [X Y]	0X0 to 7X0 / 0Y0 to 7Y0	0X1 to 7X1 / 0Y1 to 7Y1	Corresponds to page 15-4
DEVIAT [x y]	0x0 to 7x0 / 0y0 to 7y0	0x1 to 7x1 / 0y1 to 7y1	
MATCH [M]	0M0 to 7M0	0M1 to 7M1	
ANGL [B]	0B to 7B		
NUM-CAL [NC]	ABS / SQRT / TAN / ATAN (00 to 14) MAX/MIN (00 to 14)		These are the same as for the other measurement programs.
CNST [C]	-9999999.99 to +9999999.99		

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

Setting the headings on the [NUMERIC CALC] (numerical calculation) menu.



Note: Make sure that a test is run using the [EVALUATION COND] (evaluation condition) menu before making any calculations.

■ 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 final output conditions are taken from the output conditions set for each measurement program)

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

The table shown below contains the numeric formulas that can be assigned in "②TYPE" and "③FORMULA" on the [NUMERIC CALC] menu, for each measurement program.

Input types	Symbol	Measurement program		
		Positional deviation measurement	Degree of match inspection	Lead inspection
Degree of match	M	Model 0: 0M0 to 7M0 Model 1: 0M1 to 7M1	Model 0: 00M0 to 15M0 Model 1: 00M1 to 15M1	
Coodinate	X	Model 0: 0X0 to 7X0 Model 1: 0X1 to 7X1	Model 0: 00X0 to 15X0 Model 1: 00X1 to 15X1	
Coodinate	Y	Model 0: 0Y0 to 7Y0 Model 1: 0Y1 to 7Y1	Model 0: 00Y0 to 15Y0 Model 1: 00Y1 to 15Y1	
Deviation	x	Model 0: 0x0 to 7x0 Model 1: 0x1 to 7x1		
Deviation	y	Model 0: 0y0 to 7y0 Model 1: 0y1 to 7y1		
Angle	B	Model 0: 0B0 to 7B0 Model 1: 0B1 to 7B1		
Light level	G		Model 0: 00G0 to 15G0 Model 1: 00G1 to 15G1	
Number of objects	K			00K to 31K
Distance	MAX: MXD			00MXD to 15MXD
	MIN: MND			00MND to 15MND
Lead width	MAX: MXW			00MXW to 15MXW
	MIN: MNW			00MNW to 15MNW
Lead length /Lead width 2	MAX: MXL			00MXL to 15MXL
	MIN: MNL			00MNL to 15MNL
Numeric culculation results	N	N0 to N15	N0 to N15	N0 to N15

Input types	Symbol	Measurement program		
		BGA/CSP inspection	Area measurement by binary conversion	Counting quantities by binary conversion
Total area	A	0A to 3A	Number of masks= 1: 00A to 15A Number of masks= 2: 0A to 7A Number of masks= 4: 0A to 3A	0A to 3A
Number of objects	K	0K to 3K		0K to 3K
Area of each label	MAX: MXR	0MXR to 3MXR		
	MIN: MNR	0MNR to 3MNR		
Distance between gravity centers X	MAX: XDX	0XDX to 3XDX		
	MIN: NDX	0NDX to 3NDX		
Distance between gravity centers Y	MAX: XDY	0XDY to 3XDY		
	MIN: NDY	0NDY to 3NDY		
Fellet diameter X	MAX: XFX	0XFX to 3XFX		
	MIN: NFX	0NFX to 3NFX		
Fellet diameter Y	MAX: XFY	0XFY to 3XFY		
	MIN: NFY	0NFY to 3NFY		
Numerical calculation result	N	N0 to N15	N0 to N15	N0 to N15

Input types	Symbol	Measurement program		
		Label measurement by binary conversion	Point measurement	Distance and angle measurement
Total area	A	0A to 3A		
Number of objects	K	0K to 3K		
Area of each label	R	0R000 to 0R127 3R000 to 3R127		
X coordinate of gravity center	GX	0GX000 to 0GX127 3GX000 to 3GX127		
Y coordinate of gravity center	GY	0GY000 to 0GY127 3GY000 to 3GY127		
Main axis angle	B	0B000 to 0B127 3B000 to 3B127		
Fellet diameter X	FX	0FX000 to 0FX127 3FX000 to 3FX127		
Fellet diameter Y	FY	0FY000 to 0FY127 3FY000 to 3FY127		
Perimeter of each object	CR	0CR000 to 0CR127 3CR000 to 3CR127		
Average light level	G		000G to 127G	
Counting white objects	WC		(Count all the objects registered)	
Number of registers	RC		(Corresponds to the whole number of registers)	
Auxiliary 1	H1			00H1 to 15H1
Auxiliary 2	H2			00H2 to 15H2
Distance	D			00D to 15D
Angle	B			00B to 15B
Numerical calculation results	N	N0 to N15	N0 to N15	N0 to N15

Input types	Symbol	Measurement program		Distance and angle measurements
		Multiple positions measurement	Multiple degree of match inspection	
Number of objects	K	0K to 3K	0K to 3K	
Degree of match	M	0M000 to 3M127	0M000 to 3M127	
Coordinate	X	0X000 to 3X127	0X000 to 3X127	
Coordinate	Y	0Y000 to 3Y127	0Y000 to 3Y127	
Density	G		0G000 to 3G127	
Auxiliary 1	H1			00H1 to 15H1
Auxiliary 2	H2			00H2 to 15H2
Distance	D			00D to 15D
Angle	B			00B to 15B
Numerical calculation result	N	N0 to N15	N0 to N15	N0 to N15

[3] Display lists on the [NUMERIC CALC] menu

This section displays the [NUMERIC CALC] menu for each measuring program.

- The display on line ③ when "NUM-CAL [NC]" or "CNST[C]" is selected (on the "②TYPE" line) is the same as for the "Positional deviation measurement."

⇨ See page 15-2.

(1) Positional deviation measurement

See page 15-2 to 3

(2) Degree of match inspection

```
[NUMERIC CALC]
①CALC RESULT  N00(0~15)  NO  YES
②TYPE         MATCH[M]  COORD[X  Y]  LVL[G]
              NUM-CAL[NC]  CNST[C]

③FORMULA      REG0(0~15)  MDL0(0~1)  N00(0~15)
              CNST0000.0  +  -  *  /  —  —DEL END
④FUNCTION     SUM  AVG  REG00~00(0~15)
```

Selection on line ②	Selection on line ③
MATCH[M], COORD[X Y], LVL[G]	REG00(0～15) MDL(0～1) N00(0～15) CNST0000.0 + - * / — — DEL END

(3) Lead inspection

```
[NUMERIC CALC]
①CALC RESULT  N00(0~15)  NO  YES
②TYPE         OBJS[K]  DST[MAX: MXD MIN: MND]
              LEAD WIDTH[MAX: MXW MIN: MNW]
              LEAD-LENGTH[MAX: MXL MIN: MNL]
              NUM-CAL[NC] CNST[C]
③FORMULA      REG00(0~15)          N00(0~15)
④FUNCTION     SUM  AVG  REG00~00(0~15)
```

Selection on line ②	Selection on line ③
OBJS[K], DST[MAX:MXD MIN:MND] LEAD WIDTH[MAX:MXW MIN:MNW] LEAD-LENGTH [MAX:MXL MIN:MNL]	REG00(0～15) N00(0～15) CNST0000.0 + - * / — — DEL END

(4) BGA/CSP inspection

```
[NUMERIC CALC]
①CALC RESULT  N00(0~15)  NO  YES
②TYPE         TOTAL-AREA[A]  OBJS[K]  NUM-CAL[NC]  CNST[C]
              OBJECT-AREA[MAX: MXR MIN: MNR]
              PICTCH X[MAX: XDX MIN: NDX] Y[MAX: XDY MIN: NDY]
              FILT X[MAX: XFX MIN: NFX] Y[MAX: XFY MIN: NFY]
③FORMULA      REG0(0~3)            N00(0~15)
              CNST0000.0  +  -  *  /  —  —DEL END
④FUNCTION     SUM  AVG  REG0~0(0~3)
```

Selection on line ②	Selection on line ③
TOTAL-AREA[A], OBJS[K] OBJECT-AREA[MAX:MXR MIN:MNR] PICTCH X[MAX:XDX MIN:NDX] Y[MAX:XDY MIN:NDY] FILT X[MAX:XFX MIN:NFX] Y[MAX:XFY MIN:NFY]	REG(0～3) N00(0～15) CNST0000.0 + - * / — — DEL END

(5) Area measurement by binary conversion

```
[NUMERIC CALC]
①CALC RESULT  N00(0~15)  NO  YES
②TYPE         TOTAL-AREA[A]  NUM-CAL[NC]  CNST[C]

③FORMULA      REG0(0~15)              N00(0~15)
              CNST0000.0  +  -  *  /  —  —  DEL  END
④FUNCTION     SUM  AVG  REG00~00(0~15)
```

This varies with the setting for the window.

Window	Display
Number of masks: 1	REG 00 (0 to 15)
Number of masks: 2	REG 0 (0 to 7)
Number of masks: 4	REG 0 (0 to 3)
Binary mask	REG 0

Selection in ②	Selection in ③
TOTAL-AREA[A]	REG00(0～15) N00(0～15) CNST0000.0 + - * / — — DEL END

(6) Objedt counting by binary conversion

```
[NUMERIC CALC]
①CALC RESULT  N00(0~15)  NO  YES
②TYPE         TOTAL-AREA[A] OBJS[K]
              NUM-CAL[NC]  CNST[C]

③FORMULA      REG0(0~3)               N00(0~15)
              CNST0000.0  +  -  *  /  —  —  DEL  END
④FUNCTION     SUM  AVG  REG0~0(0~3)
```

Selection on line ②	Selection on line ③
TOTAL-AREA[A]	REG(0～3) N00(0～15)
OBJS[K]	CNST0000.0 + - * / — — DEL END

(7) Object identification of binary conversion

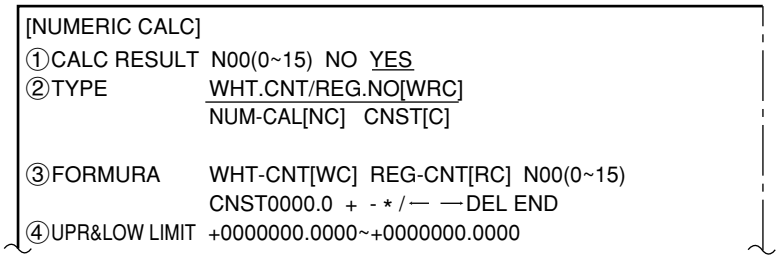
```
[NUMERIC CALC]
①CALC RESULT  N00(0~15)  NO  YES
②TYPE         TOTAL-AREA[A]  OBJS[K]  OBJECT-AREA[R]
              C-GRAVS[GX GY]  FILT[FX FY]
              AX.ANGL[B]  LB-CIRCUM[CR]  MID-PNT[CX CY]
              NUM-CAL[NC]  CNST[C]
③FORMULA      REG0(0~3)               N00(0~15)
              CNST0000.0  +  -  *  /  —  —  DEL  END
④FUNCTION     SUM  AVG  REG0~0(0~3)
```

Selection on line ②	Selection on line ③
TOTAL-AREA[A], OBJS[K]	REG0(0～3) N00(0～15) CNST0000.0 + - * / — — DEL END
OBJECT-AREA[R], C-GRAVS[GX GY], FILT[FX FY] AX.ANGL[B], LB-CIRCUM[CR] MID-PNT[CX CY]	REG0(0～3) LABEL 000(0～127) N00(0～15) CNST0000.0 + - * / — — DEL END

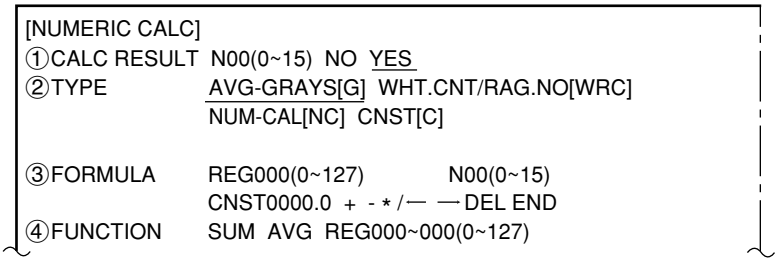
15

(8) Point measurement

● When "BINARY" is selected in "MODE" line.

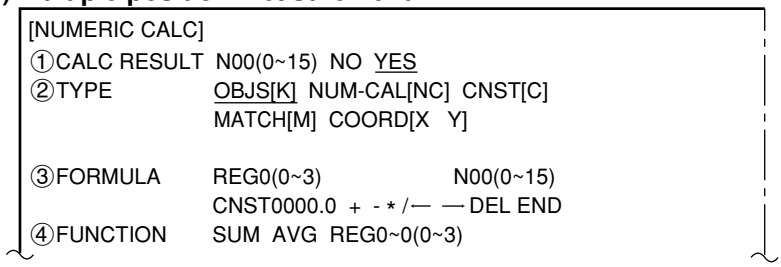


●When "AVG-GRAYS" is selected in "MODE" line.



Selection on line ②	Selection on line ③
WHT.CNT/REG.NO[WRC]	WHT.CNT[WC] REG.NO[RC] N00(0～15) CNST0000.0 + - * / — — DEL END
AVG-GRAYS[G]	REG000(0～127) N00(0～15) CNST0000.0 + - * / — — DEL END

(9) Multiple position measurement



Selection on line ②	Selection on line ③
OBJS[K]	REG0(0～3) N00(0～15) CNST0000.0 + - * / — — DEL END
MATCH[M]、COORD[X Y]	REG0(0～3) DETECTIO00(0～127) N00(0～15) CNST0000.0 + - * / — — DEL END

(10) Multiple degree of match inspection

```
[NUMERIC CALC]
①CALC RESULT  N00(0~15)  NO  YES
②TYPE         OBJS[K]  NUM-CAL[NC]  CNST[C]
              MATCH[M]  LVL[G]  COORD[X  Y]

③FORMULA      REG0(0~3)              N00(0~15)
              CNST0000.0  +  -  *  /  —  —  DEL  END
④FUNCTION     SUM  AVG  REG0~0(0~3)
```

Selection on line ②	Selection on line ③
OBJS[K]	REG (0～3) N00(0～15) CNST0000.0 + - * / — — DEL END
MATCH[M], LVL[G], COORD[X Y]	REG (0～3) DETECTIO000(0～127) N00(0～15) CNST0000.0 + - * / — — DEL END

(11) Distance and angle measurement

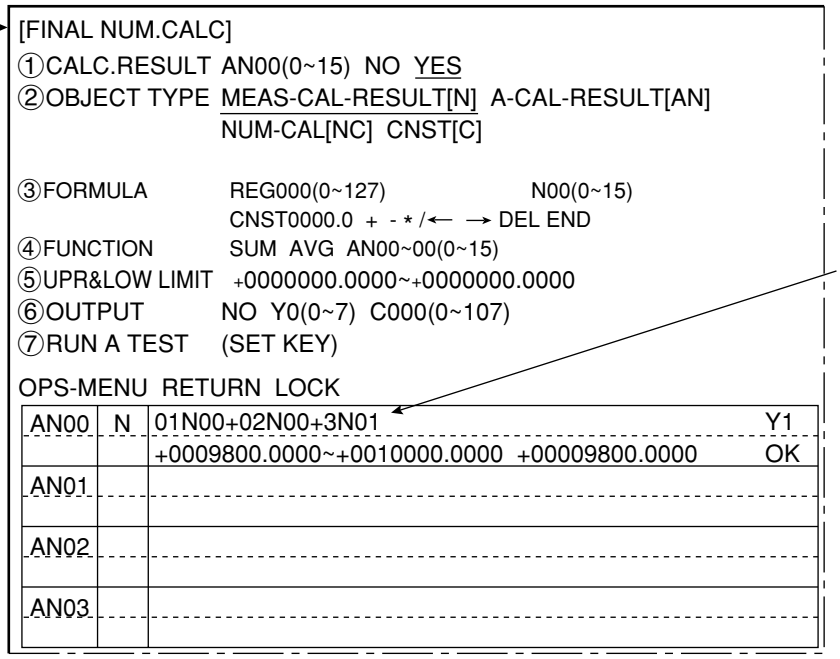
```
[NUMERIC CALC]
①CALC RESULT  N00(0~15)  NO  YES
②TYPE         DST[D]  ANGL[B]  AUX[H1 H2]
              NUM-CAL[NC]  CNST[C]

③FORMULA      REG0(0~15)             N00(0~15)
              CNST0000.0  +  -  *  /  —  —  DEL  END
④FUNCTION     SUM  AVG  REG00~00(0~15)
```

Selection on line ②	Selection on line ③
DST[D], ANGL[B], AUX[H1 H2]	REG00(0～15) N00(0～15) CNST0000.0 + - * / — — DEL END

15-2 Final numerical calculations

Final numerical calculations can be set at item "FINAL-CALC" on the conditions of object types menu [TYPE MEAS 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 "15-1 The individual numerical calculations for each measuring program."

On the [TYPE MEAS COND] menu, move the cursor to "FINAL-CALC (final numeric calculation)" and press the 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 "15-1 The individual numerical calculations for each measuring program."

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 on line ②	The first line of the display
MEAS-CAL-RESULT [N]	MEAS0 (0 to 4) CAM1 (1 to 2) N00 (0 to 15) CNST0000.0 + - ∗ / ← → DEL END
A-CAL-RESULT [AN]	AN00 (0 to 15) CNST0000.0 + - ∗ / ← → DEL END
NUM-CAL [NC]	ABS SQRT TAN ATAN AN00 (0 to 14) MAX MIN AN00 to 00 (0 to 14)
CNST [C]	+0000000.00 (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 FUNCTION When you want to total (SUM) or average (AVE) the calculation results AN, specify the range (0 to 15).

⑤ UPR&LOW LIMIT: Enter the upper and lower limits for making a decision.

⑥ OUTPUT: Setting the output of the calculation results.

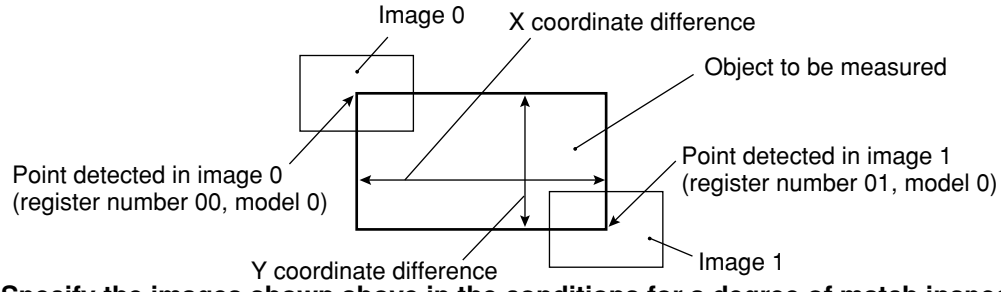
⑦ RUN A TEST: Pressing the SET key will record the setting details as well as run a test.

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

②OBJECT TYPE	Number of styles
MEAS-CAL-RESULT [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) 4N00 to 4N15 (Calculation result for measurement 4: N00 to 15)
A-CAL-RESULT [AN] (Results of final calculations)	AN00 to AN15
NUM-CAL [NC] (Numerical calculations)	ABS / SQRT / TAN / ATAN (00 to 15) MAX/MIN (00 to 15)
CNST [C] (Constant)	-9999999.99 to +9999999.99

15-3 Setting examples

The example below shows the settings used to evaluate and output the X-Y coordinates (differences) of the detection points in images 0 and 1, using the evaluation calculation. (Degree of match inspection ⇨ See Chapter 5; Output ⇨ See Chapter 16: PC Function.)



(1) Specify the images shown above in the conditions for a degree of match inspection

- After specifying the images, return to the [TYPE MEAS COND] menu for the degree of match inspection.

(2) Operations on the [TYPE MEAS COND] menu

[TYPE MEAS COND]

⑥MEASUREMENT 1 CHK-DEG-MATCH C1 (MEAS-COND)

[MEAS COND]

①DTECT PRECISION STANDARD HIGH
②REGISTER NO. 00(0~15) NO 1P-SCH 2P-SCH
③SEARCH YES NO
④MATCHING AVG-GRAY DIFF.ABS

REGISTER NO.	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
⑤MDL0	S	S	×	×	×	×	×	×	×	×	×	×	×	×	×	×
⑥MDL1	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
NUMERIC CALC	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×

1 OPS-MENU RETURN LOCK EVALUATION DST&ANG NUM-CALC OUT-COND

1. Move the cursor to the "NUM-CALC" item, and press the SET key.
   ⇨ The [NUMERIC CALC] menu will be displayed.

(3) Operations on the [NUMERIC CALC] menu

[NUMERIC CALC]

1 ①CALC RESULT N00(0~15) NO YES
2 ②TYPE MATCH[M] COORD[X Y] LVL[G]
NUM-CAL[NC] CNST[C]

3 ③FORMULA REG0(0~15) MDL0(0~1) N00(0~15)
CNST0000.0 + - * / — —DEL END
④FUNCTION SUM AVG REG00~00(0~15)
4 ⑤UPR&LOW LIMIT +0000000.0000~+0000000.0000
⑥OUTPUT NO Y0(0~7) C000(0~107)
6 ⑦RUN A TEST (SET KEY)

OPS-MENU RETURN LOCK

N00		
N01		
N02		
N03		

7

1. Move the cursor to the "①CALC RESULT" item using the up and down keys, and press the SET key. Select "N00" using the up and down keys, and move the cursor to "YES" using the left and right keys. Then press the SET key.
   ⇨ Items ② to ⑦ will be displayed.
2. Move the cursor to the "②TYPE" item using the up and down keys, and press the SET key. Then move the

To the next page

Continued from the previous page

3. Move the cursor to the "③FORMULA" item using the up and down keys, and press the SET key.
   - Move the cursor to "REG00(0 - 15)" using the left and right keys, and specify "REG01" using the up and down keys.
   - Move the cursor to "MDL0(0 - 1)" using the left and right keys, and specify "MDL0" using the up and down keys. Then press the SET key.

   ⇨ 01X0 will be displayed in the formula field.

N00	X	01X0
		+0000000.00～+0000000.00

   01X0 refers to the X coordinate of the detection point in model 0, stored in register No.01 (image 1).
   - Move the cursor to "-" using the left and right keys, and press the SET key.

   ⇨ A dash "-" will be displayed in the formula field.
   - Move the cursor to "REG01(0 - 15)" using the left and right keys, and specify "REG00" using the up and down keys.
   - Move the cursor to "MDL0(0 - 1)" using the left and right keys, and press the SET key.

   ⇨ 00X0 will be displayed in the formula field.

N00	X	01X0−00X0
		+0000000.00～+0000000.00

   00X0 refers to the X coordinate of the detection point in model 0, stored in register No.00 (image 0).
   - Press the ESC key.
4. Move the cursor to the "⑤UPR&LOW LIMIT" item using the up and down keys, and press the SET key.
   - Move the cursor to the upper limit using the left and right keys, and press the SET key. Select a digit using the left and right keys. Enter the number +160.00 using the up and down keys, and press the SET key.

   ⑤UPR&LOW LIMIT +0000000.0000~+0000160.0000
   Upper limit
   - Move the cursor to the lower limit using the left and right keys, and press the SET key. Select a digit using the left and right keys. Enter the number +140.00 using the up and down keys, and press the SET key.

   ⑤UPR&LOW LIMIT +0000140.0000~+0000160.0000
   Lower limit

   ⇨ +0000140.00 to +0000160.00 will be displayed in the lower and upper limit fields.
   - Press the ESC key.
5. Move the cursor to the "①CALC RESULT" item using the up and down keys, and press the SET key. Specify "N01" using the up and down keys, and select "YES" using the left and right keys. Then press the SET key.
   - As described in steps 2 to 4, enter 01Y0 to 00Y0 in the formula field, and enter +0000090.00 to +0000095.00 in the upper and lower limit fields.

N00	X	01X0−00X0
		+0000140.00～+0000160.00
N01	Y	01Y0−00Y0
		+0000090.00～+0000095.00

6. Move the cursor to the "⑦RUN A TEST" item using 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 evaluation result (OK/NG) of the calculations will be displayed.

N00	X	01X0−00X0
		+0000140.00～+0000160.00 +0000147.00 OK
N01	Y	01Y0−00Y0
		+0000090.00～+0000095.00 +0000091.00 OK

   OK: When the test result based on the calculations is within the specified range
   NG: When the test result based on the calculations is outside of the specified range
7. Move the cursor to the "RETURN" item using the up/down and left/right keys, and press the SET key.

   ⇨ The [TYPE MEAS COND] menu will be displayed.

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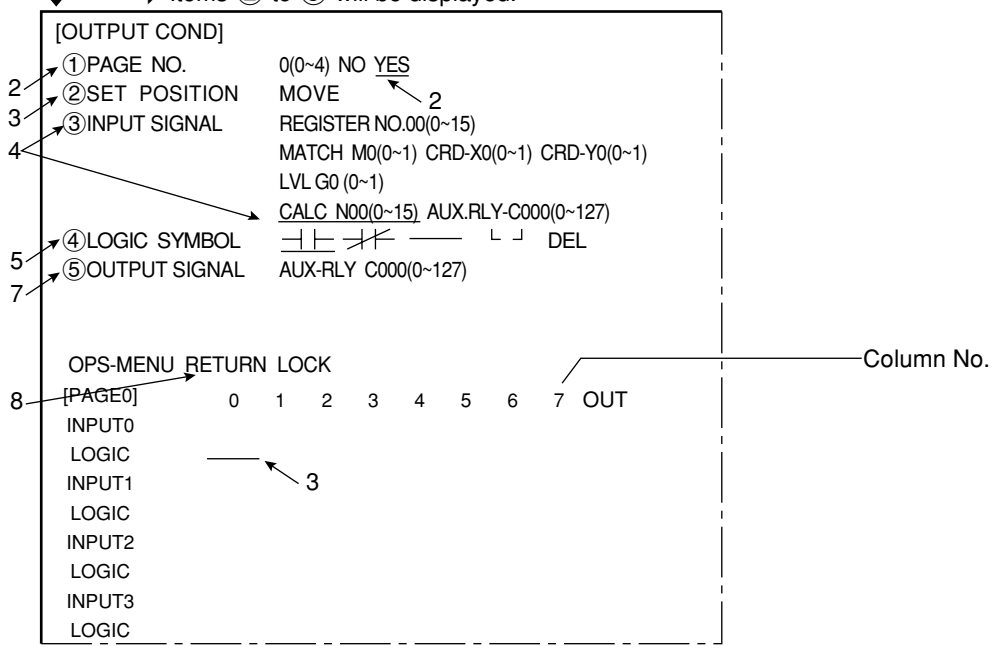
(4) Operations on the [OUTPUT COND] menu

1. On the [TYPE MEAS COND] menu, move the cursor to the "OUT-COND" item using the left and right keys, and press the SET key.
   ⇨ The [OUTPUT COND] menu will be displayed.
2. Move the cursor to the "①PAGE NO." item using the up and down keys, and press the SET key. Select "YES" using the left and right keys, and press the SET key.
   ⇨ Items ② to ⑤ will be displayed.



3. Move the cursor to the "②SET POSITION" item using the up and down keys, and press the SET key.
   - Move the cursor to the leftmost column of the INPUT 0 logic settings using the up/down and left/right keys, and press the SET key.

4. Move the cursor to the "③INPUT SIGNAL" item using the up and down keys, and press the SET key.
   - Move the cursor to "CALC N00(0 - 15)" using the left and right keys, and specify "CAL N00" using the up and down keys. Then press the SET key.

5. Move the cursor to the "④LOGIC SYMBOL" item using the up and down keys, and press the SET key.
   - Move the cursor to "-||-" using the left and right keys, and press the SET key.
   ⇨ The logical condition will be displayed in the leftmost column of the LOGIC row under INPUT 0.

[PAGE0]	0	1	2	3	4	5	6	7	OUTPUT
INPUT0	N00								
LOGIC	⊣⊢	—	—	—	—	—	—	—	

   - N00 refers to the N00 calculation result, that was entered on the [NUMERIC CALC] menu.

6. Move the cursor to the "②SET POSITION" item using the up and down keys, and press the SET key. Move the cursor to the 1st column of the INPUT 0 logic settings using the left and right keys, and press the SET key.
   - As described in steps 4 and 5, enter "CALC N01" to be used as an input signal.

[PAGE0]	0	1	2	3	4	5	6	7	OUTPUT
INPUT0	N00	N01							
LOGIC	⊣⊢	⊣⊢	—	—	—	—	—	—	

7. Move the cursor to the "⑤OUTPUT SIGNAL" item using the up and down keys, and press the SET key. Press the SET key again.
   - Specify "C000" for the auxiliary relay number using the left/right (change digits) and up/down keys, and press the SET key.
   ⇨ The output coil for INPUT 0 will be displayed.

[PAGE0]	0	1	2	3	4	5	6	7	OUTPUT
INPUT0	N00	N01							C000
LOGIC	⊣⊢	⊣⊢	—	—	—	—	—	—	⟨⟩

8. Move the cursor to the "RETURN" item using the up/down and left/right keys, and press the SET key.
   ⇨ The screen will return to the [TYPE MEAS COND] menu.

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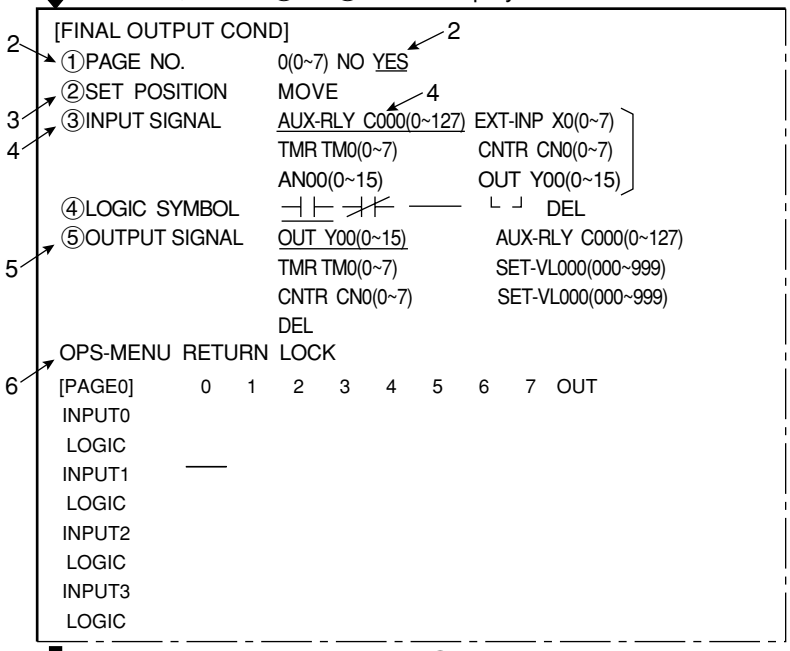
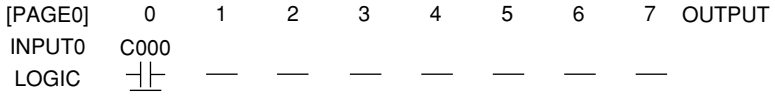
(5) Operations on the [FINAL OUTPUT COND] menu

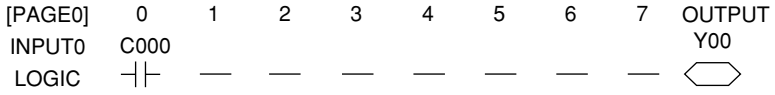
1. On the [TYPE MEAS COND] menu, press the ESC key twice and move the cursor to the "FINAL-OUTPUT" item using the up/down and left/right keys. Then press the SET key.
   ⇨ The [FINAL OUTPUT COND] menu will be displayed.
2. Move the cursor to the "①PAGE NO." item using the up and down keys, and press the SET key. Select "YES" using the left and right keys, and press the SET key.
   ⇨ Items ② to ⑤ will be displayed.



3. Move the cursor to the "②SET POSITION" item using the up and down keys, and press the SET key.
   - Move the cursor to the leftmost column of the INPUT 0 logic settings using the up/down and left/right keys, and press the SET key.
4. Move the cursor to the "③INPUT SIGNAL" item using the up and down keys, and press the SET key.
   - Move the cursor to "AUX-RLY C000(0 - 127)" using the left and right keys, and select "C000" using the left/right (change digits) and up/down keys. Then press the SET key.
   ⇨ The following logical symbol will be displayed in the leftmost column of INPUT 0.



5. Move the cursor to the "⑤OUTPUT SIGNAL" item using the up and down keys, and press the SET key.
   - Move the cursor to "OUT Y00(0 - 15)" using the left and right keys, and specify "Y00" using the up and down keys. Then press the SET key.
   ⇨ The output coil for INPUT 0 will be displayed.



6. Move the cursor to the "OPS-MENU" item using the up and down keys, and press the SET key.
   ⇨ The screen will return to the MAIN OPS MENU.

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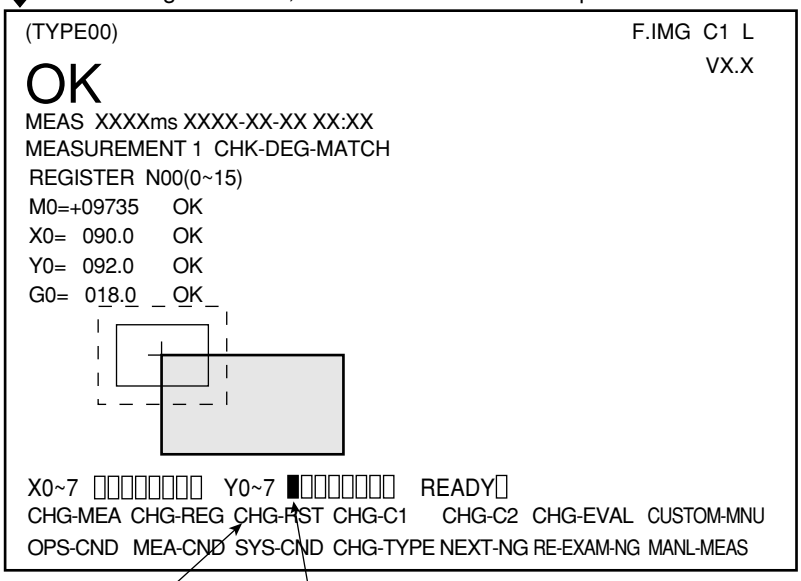
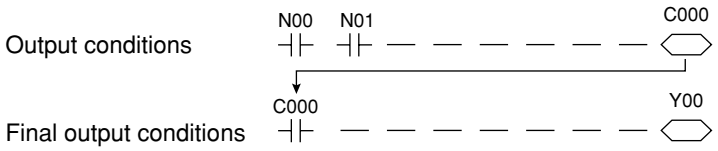
(6) Degree of match inspection

Press the TRG/BRT key, and the IV-S30 will calculate the X-Y coordinates of the detection points in images 1 and 2, and then evaluate and output the results.



* If the difference in the X and 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 will be turned OFF, and an empty box □ will be displayed.



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

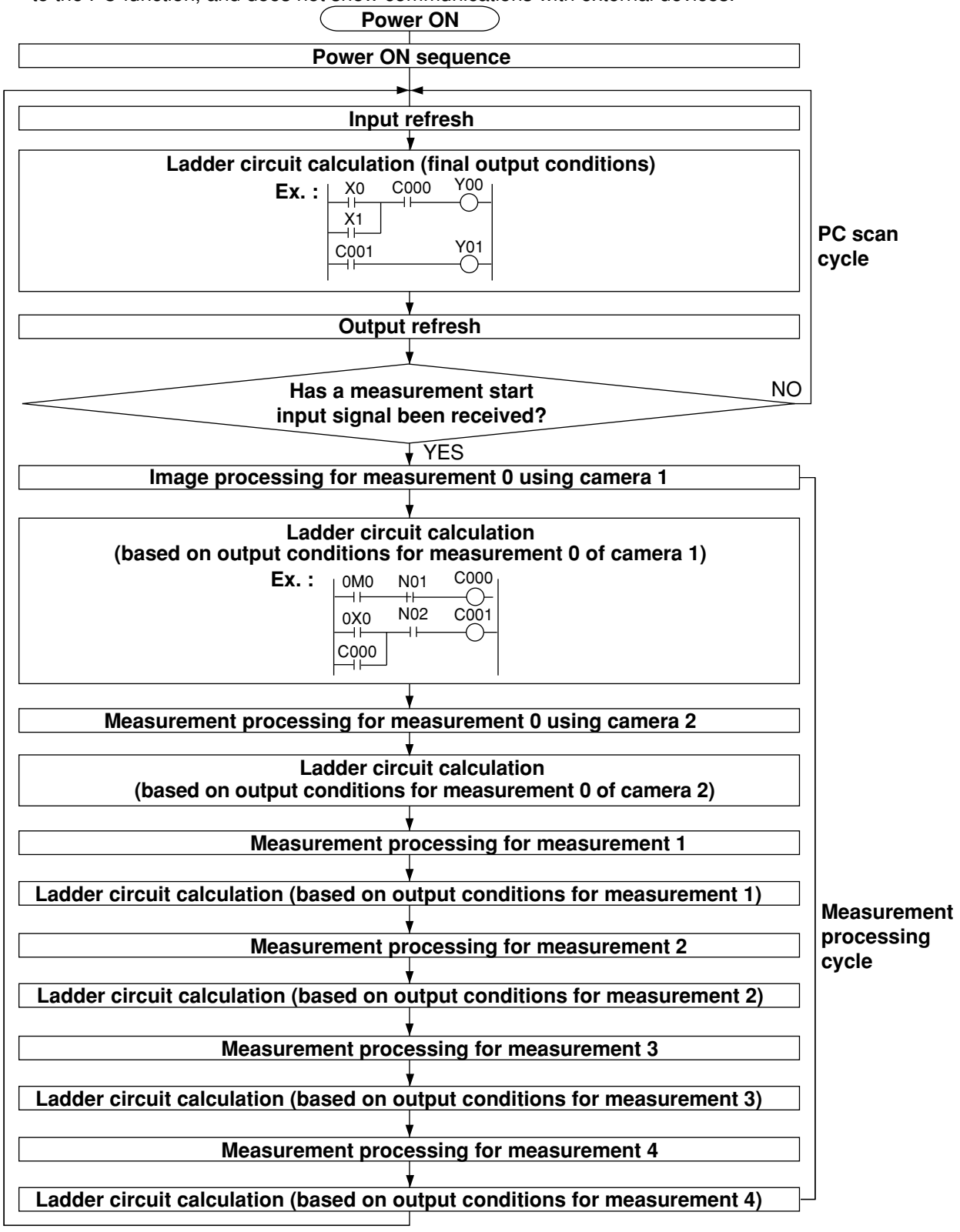
* Move the cursor to the "CHG-RST" item, and press the up or down key. Then, the numeric calculation results will be displayed.

Chapter 16: 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-S30. Then it outputs the results of the calculations performed by the circuit.
Use of the PC function enables the IV-S30 to output measurement results to an external equipment such as a lamp by itself, without the need for an external PC.

16-1 Operation cycle

The operation cycle of the IV-S30 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 X7) 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.

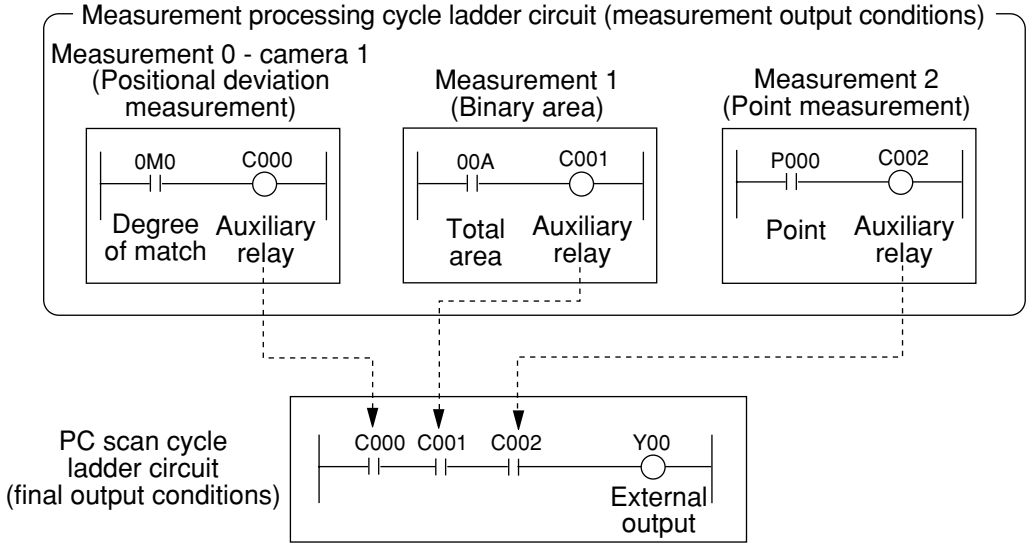
(1) Measurement processing (measurement 0 to 4)

- 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 4)

- 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, measurement 3 and measurement 4.
- 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.

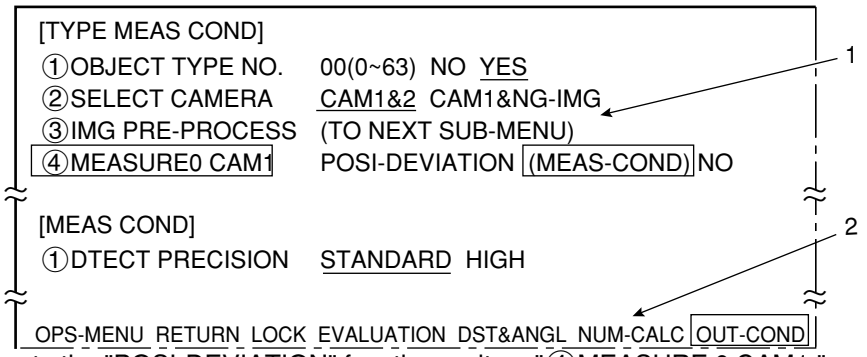
16-2 Ladder circuit program creation

[1] Procedure for creating measurement output condition and a ladder circuit

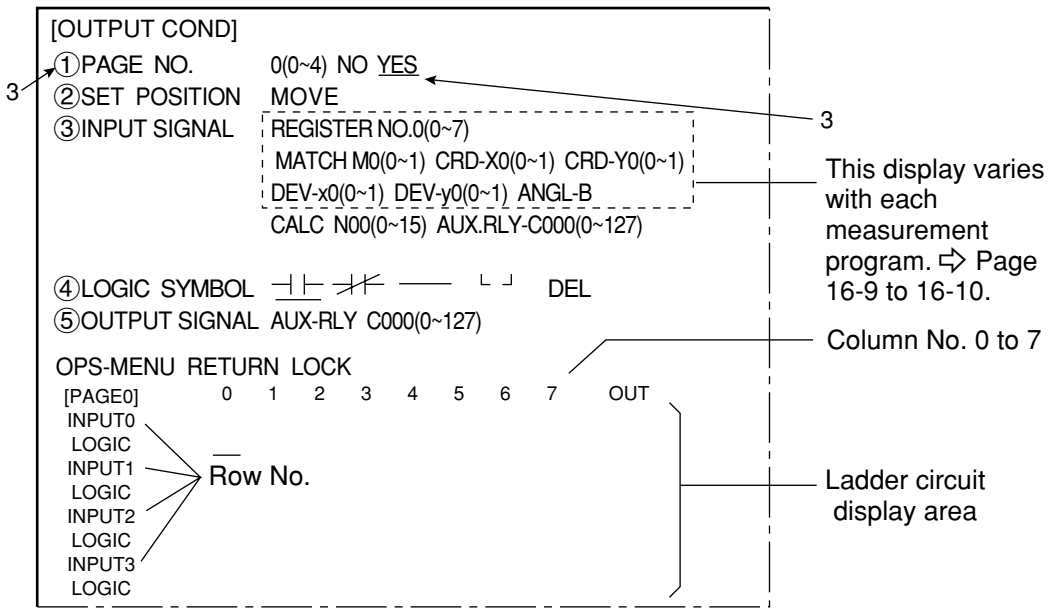
A separate ladder circuit can be created for positional deviation measurement, degree of match inspection, lead inspection, BGA/CSP inspection, area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion, point measurement, multiple position measurement, and multiple degree of match inspection.
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 COND] menu (for positional deviation measurement : MEASURE 0 CAMERA 1)

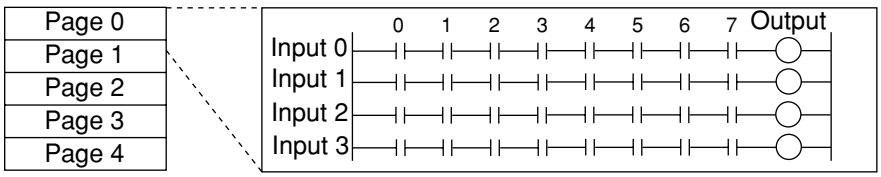
On the MAIN OPS MENU, move the cursor to MEA-CND item, and press the SET key.



1. Move the cursor to the "POSI-DEVIATION" function on item "④MEASURE 0 CAM1," and select the (MEAS-COND) item using the left and right keys. Then, press the SET key.
2. Move the cursor to item "OUT-COND" with the up, down, left and right keys, and press the SET key. ⇨ The [OUTPUT COND] menu will be displayed.
3. After moving the cursor to item "①PAGE 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 register 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.



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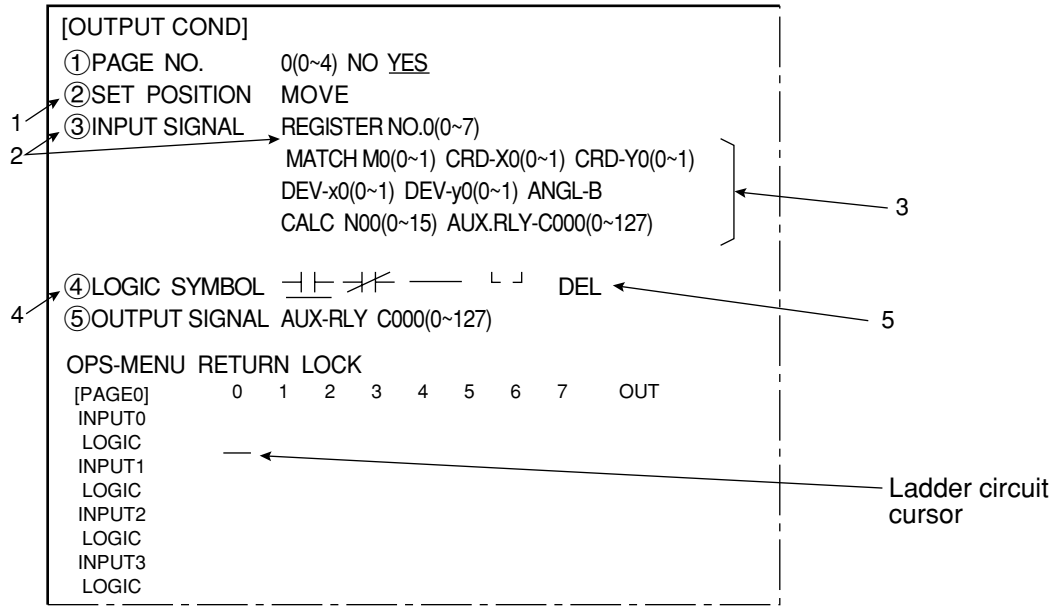
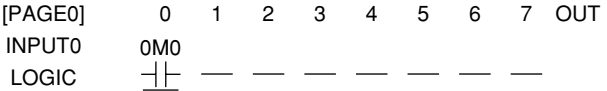
(2) Ladder circuit creation 1 (setting input signals)



1. Move the cursor to item "②SET 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 "③INPUT 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 "object identification by binary conversion," first move the cursor to "REGISTER NO." 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.

   0 to 3 : BGA/CSP inspection, object counting by binary conversion, object identification by binary conversion, multiple position measurement, multiple degree of match inspection.
   0 to 7 : Positional deviation measurement
   0 to 15 : Degree of match inspection, lead inspection, area measurement by binary conversion, distance and angle measurement
   0 to 127 : Point measurement (average), 0 to 255 : Point measurement (binary conversion)
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 16-6 for the kinds of input signals available for each measurement program, and see page 16-8 for details about the auxiliary relays.)
4. Move the cursor to item "④LOGIC 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
DEL	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.

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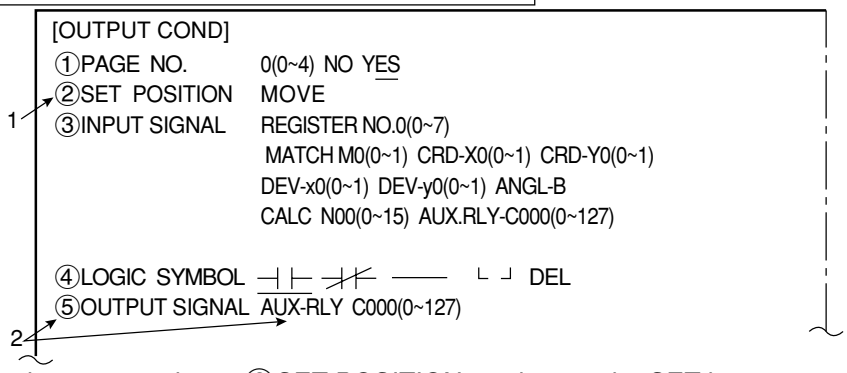
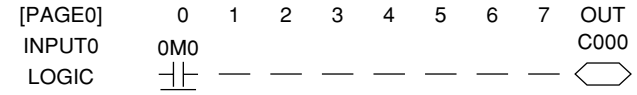
(3) Ladder circuit creation 2 (setting output signals)



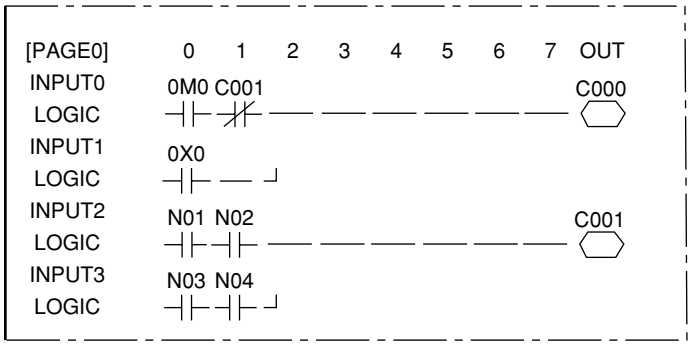
1. Move the cursor to item "②SET POSITION" and press the SET key.
   - Move the cursor to a row where a ladder circuit output signal will be placed with the up and down keys, and press the SET key.
   An output signal can only be placed on rows where input signals have already been placed.
2. Set the cursor to item "⑤OUTPUT SIGNAL" with the up and down keys, and press the SET key.
   - Select an output auxiliary relay number (see page 14-8) 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:

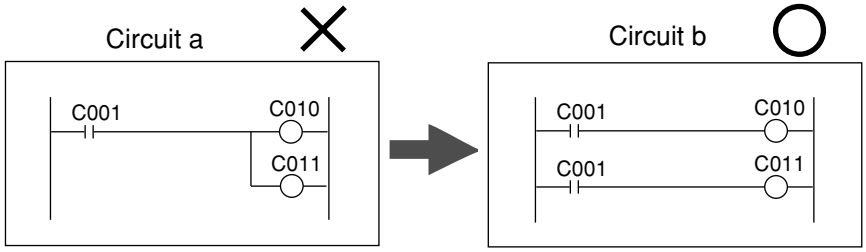


(4) Create a ladder circuit for the page numbers registered in step (1), repeating the operations in steps (2) and (3)

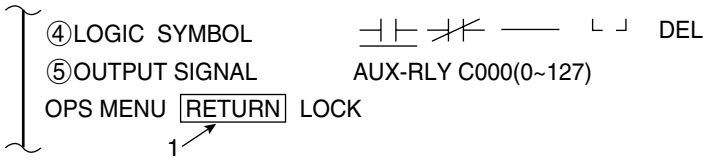
Creation example:



Note: Output relays cannot be used in series on a ladder circuit. Change circuit a to circuit b.



(5) Creating a ladder circuit is complete.



1. Move the cursor to "RETURN" with the up/down and left/right keys, and press the SET key.
   ⇨ The screen will return to the [TYPE MEAS COND] menu, and the ladder circuit creation process will be finished.

[Kinds of input signals in each measurement program]

Kind of input	Symbol	Measurement program			
		Positional deviation measurement	Degree of match inspection	Lead inspection	Point measure-ment
Degree of match	M	Model 0: 0M0 to 7M0 Model 1: 0M1 to 7M1	Model 0 : 00M0 to 15M0 Model 1 : 00M1 to 15M1		
Coordinate	X	Model 0: 0X0 to 7X0 Model 1: 0X1 to 7X1	Model 0 : 00X0 to 15X0 Model 1 : 00X1 to 15X1		
Coordinate	Y	Model 0: 0Y0 to 7Y0 Model 1: 0Y1 to 7Y1	Model 0 : 00Y0 to 15Y0 Model 1 : 00Y1 to 15Y1		
Deviation	x	Model 0: 0x0 to 7x0 Model 1: 0x1 to 7x1			
Deviation	y	Model 0: 0y0 to 7y0 Model 1: 0y1 to 7y1			
Angle	B	Model 0: 0B0 to 7B0 Model 1: 0B1 to 7B1			
Light level	G		Model 0 : 00G0 to 15G0 Model 1 : 00G1 to 15G1		
Number of objects	K			00K to 15K	
Distance	D			00D to 15D	
Lead width	W			00W to 15W	
Lead length / lead width	L			00L to 15L	
Binary point					P000 to P255
Average light level point					P000 to P127
Numerical calculation results	N	N0 to N15	N0 to N15	N0 to N15	N0 to N15
Auxiliary relay	N	C000 to C127			

Kind of input	Symbol	Measurement program			
		BGA/CSP inspection	Area measurement by binary conversion	Object counting by binary conversion	Object identification by binary conversion
Total area	A	0A to 3A	Number of masks=1: 00A to 15A Number of masks=2: 0A to 7A Number of masks=4: 0A to 3A	0A to 3A	0A to 3A
Number of objects	K	0K to 3K		0K to 3K	0K to 3K
Area of each label	R	0MXR to 3MXR			0R000 to 0R127 …3R000 to 3R127
Fillet diameter X	FX	0FX to 3FX			
Fillet diameter Y	FY	0FY to 3FY			
Distance between gravity centers X	DX	0DX to 3DX			
Distance between gravity centers Y	DY	0DY to 3DY			
Numerical calculation results	N	N0 to N15	N0 to N15	N0 to N15	N0 to N15
Auxiliary relay	C	C000 to C127			

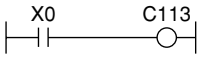
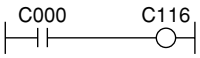
Kind of input	Symbol	Measurement program	
		Multiple positions measurement	Multiple degree of match inspections
Number of objects	K	0K to 3K	0K to 3K
Numerical calculation results	N	N0 to N15	N0 to N15
Auxiliary relay	C	C000 to C127	

Kind of input	Symbol	Distance and angle measurement *
Auxiliary	H	00H to 15H
Distance	D	00D to 15D
Angle	B	00B to 15B
Numerical calculation results	N	N0 to N15
Auxiliary relay	C	C000 to C127

* The measurement programs that can use these inputs are the positional deviation measurement, degree of match measurement, object identification by binary conversion (center of gravity: YES) multiple positions measurement, and multiple degree of match inspections.

[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	Normally OFF	
C111	———	- When C111 is ON, C000 to C109 are cleared.
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 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. 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 20-4.)	
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 16-15.)

* OK/NG displayed on the MAIN OPS MENU ⇨ See page 1-4.

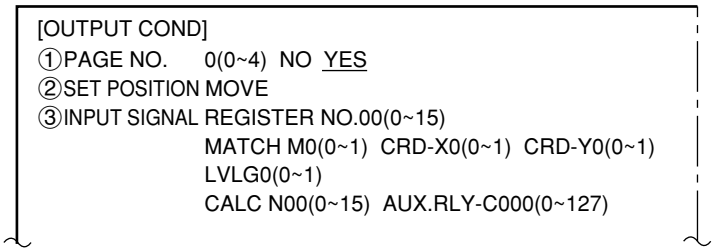
■ A list of the [OUTPUT COND] menu displays

Shown below are the [OUTPUT COND] menu displays for each program.
- The displays starting at line ④ on each menu is the same as the "positional deviation measurement" display.⇨ See page 16-3.

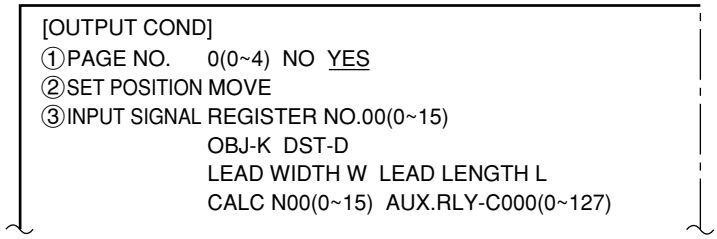
(1) Positional deviation measurement

See page 16-3.

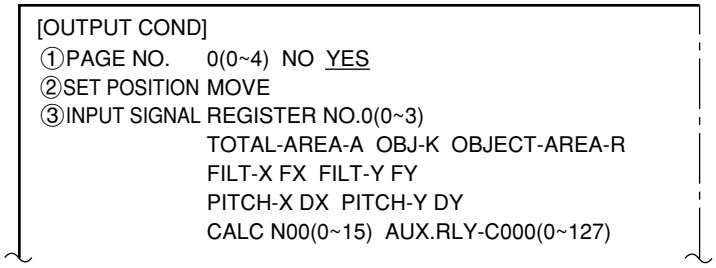
(2) Degree of match inspection



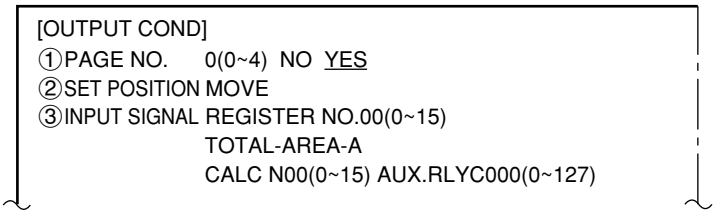
(3) Lead inspection



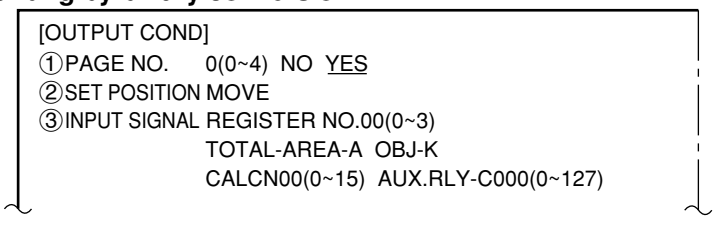
(4) BGA/CSP inspection



(5) Area measurement by binary conversion



(6) Object counting by binary conversion



(7) Object identification by binary conversion

```
[OUTPUT COND]
①PAGE NO.      0(0~4)  NO  YES
②SET POSITION MOVE
③INPUT SIGNAL REGISTER NO.0(0~3)
                TOTAL-AREA-A  OBJ-K  OBJECT-AREA-R000(0~127)
                CALC N00(0~15) AUX.RLY-C000(0~127)
```

(8) Point measurement

●When "BINARY" is selected in "MODE" line.

```
[OUTPUT COND]
①PAGE NO.      0(0~4)  NO  YES
②SET POSITION MOVE
③INPUT SIGNAL REGISTER NO.000(0~255)
                BIN-PNT-P
                CALC N00(0~15)  AUX.RLY-C000(0~127)
```

●When "AVG-GRAYS" is selected in "MODE" line.

```
[OUTPUT COND]
①PAGE NO.      0(0~4)  NO  YES
②SET POSITION MOVE
③INPUT SIGNAL REGISTER NO.000(0~127)
                AVG-GRAY G
                CALC N00(0~15)  AUX.RLY-C000(0~127)
```

(9) Multiple positions measurement

```
[OUTPUT COND]
①PAGE NO.      0(0~4)  NO  YES
②SET POSITION MOVE
③INPUT SIGNAL REGISTER NO.0(0~3)
                OBJ-K
                CALCN00(0~15)  AUX.RLYC000(0~127)
```

(10) Multiple degree of match inspections

```
[OUTPUT COND]
①PAGE NO.      0(0~4)  NO  YES
②SET POSITION MOVE
③INPUT SIGNAL REGISTER NO.0(0~3)
                OBJ-K
                CALCN00(0~15)  AUX.RLYC000(0~127)
```

(11) Distance and angle measurement

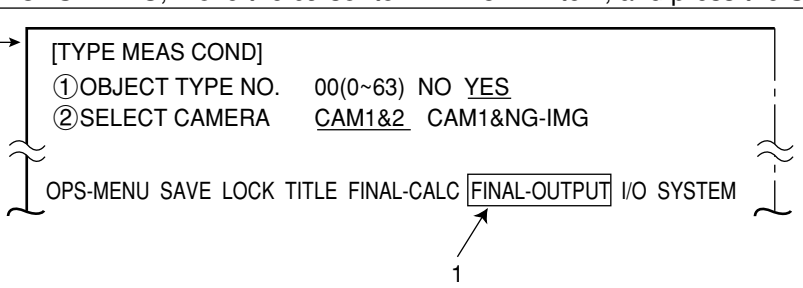
```
[OUTPUT COND]
①PAGE NO.      0(0~4)  NO  YES
②SET POSITION MOVE
③INPUT SIGNAL REGISTER NO.00(0~15)
                AUX-H  DST-D
                ANGL-B
                CALCN00(0~15) AUX.RLYC000(0~127)
```

[2] Procedure for creating the final output conditions in a ladder circuit

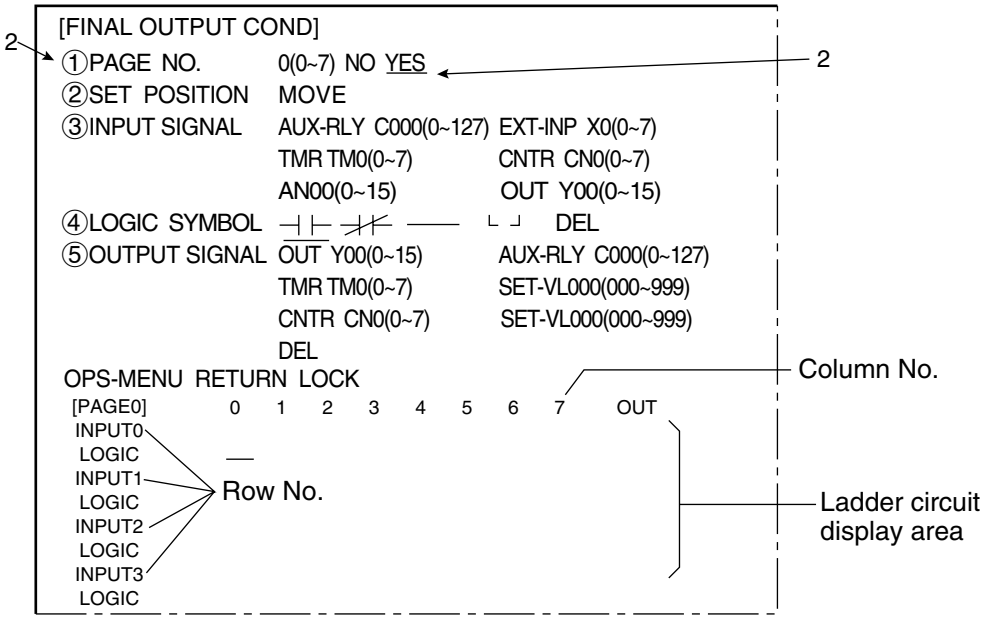
A ladder circuit can be created for each object type (IV-S33M: 0 to 63, IV-S32M: 0 to 31, IV-S31: 0 to 15) using the following procedure.

(1) Operation to invoke the [FINAL OUTPUT COND] menu

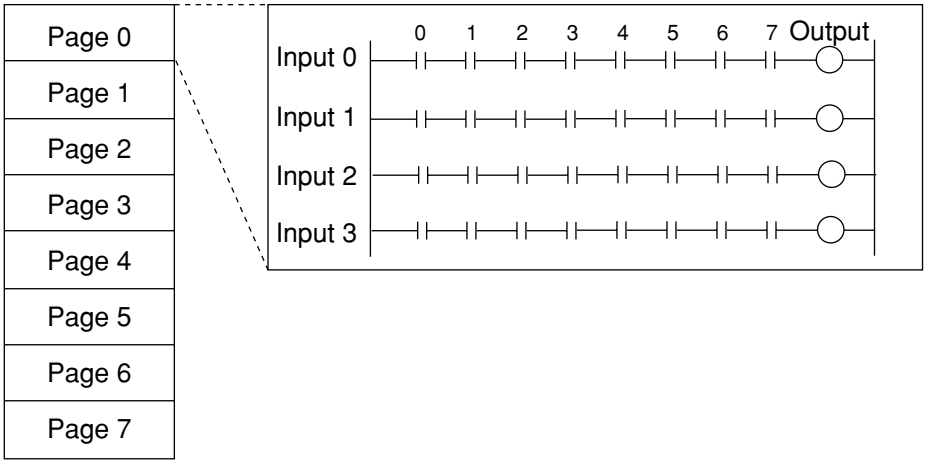
On the MAIN OPS MENU, move the cursor to "MEA-CND" item, and press the SET key.



1. Move the cursor to the "FINAL-OUTPUT" item using up/down and left/right keys. Then, press the SET key.
   ⇨ The [FINAL OUTPUT COND] menu will be displayed.
2. After moving the cursor to item "①PAGE 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 register item to "YES" with the left and right keys, and press the SET key. ⇨ Items ② to ⑤ will be displayed.



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.



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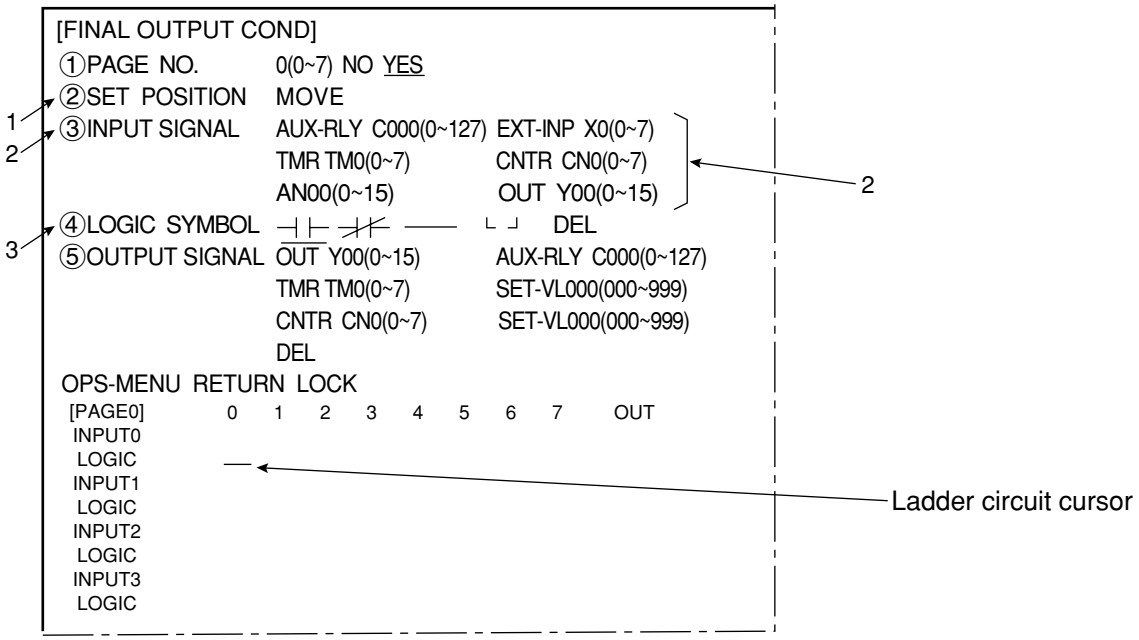
(2) Ladder circuit creation 1 (setting input signals)



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.

Kind of input signal	Data memory No.	Function
External input terminals	X0 to X7	The external input terminals X0 to X7 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 3-2 [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 16-8 for details about the auxiliary relays C000 to C127.

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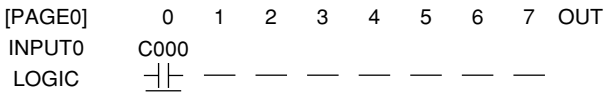
3. Move the cursor to item "④LOGIC SYMBOL" with the up and down keys, and press the SET key.
4. Move the cursor to the logic symbol to be used for the input signal selected in step 3 with left and right keys, and press the SET key.
   ⇨ The logic symbols and the input signals will be displayed as a ladder 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.

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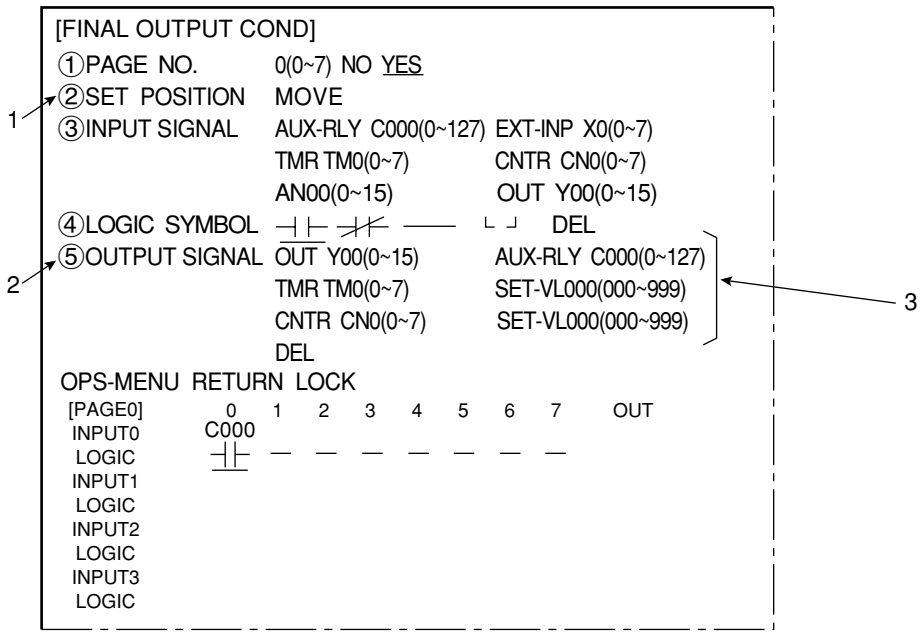
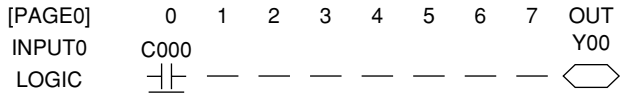
(3) Ladder circuit 2 (setting output signals)



1. Move the cursor to item "②SET 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 "⑤OUTPUT 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:



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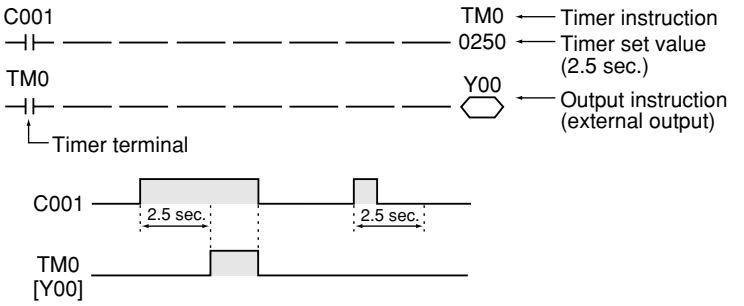
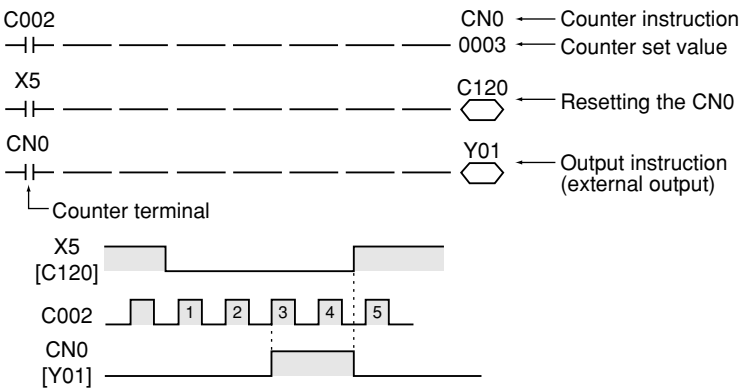
Kind of output signal	Data memory No.	Function
External output instructions	Y0 to Y7	Output to the parallel I/F, general purpose serial I/F and computer link
	Y8 to Y15	Output to the general purpose serial I/F or computer link
Timer instructions	TM0 to TM7	A timer terminal will be turned ON for a set 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 16-8 for details about the auxiliary relays C000 to C127.

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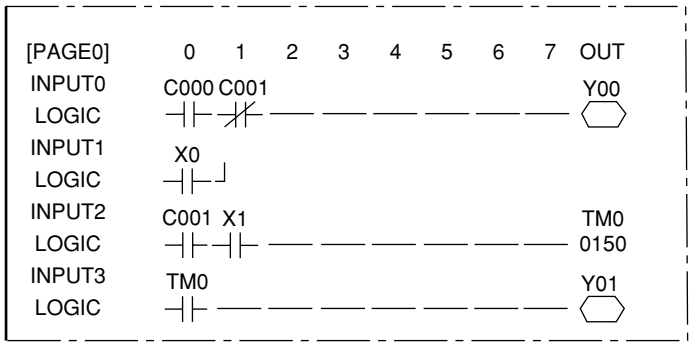
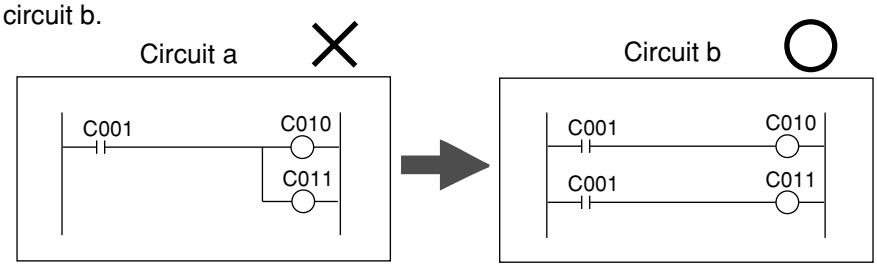
Continued from the previous page

(4) Create a ladder circuit for the page numbers registered in s.tep (1) repeating the operations given in steps (2) and (3).

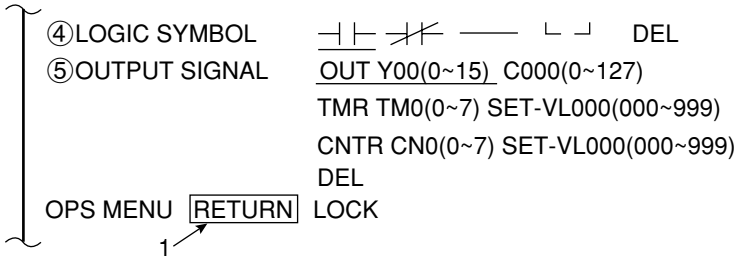
Creation example:



Note: Output relays cannot be used in series on a ladder circuit. Change circuit a to circuit b.



(5) Creating a ladder circuit is complete.



1. Move the cursor to "RETURN" with the up/down and left/right keys, and press the SET key.
   ⇨ The screen will return to the [TYPE MEAS COND] menu, and the ladder circuit creation process will be finished.

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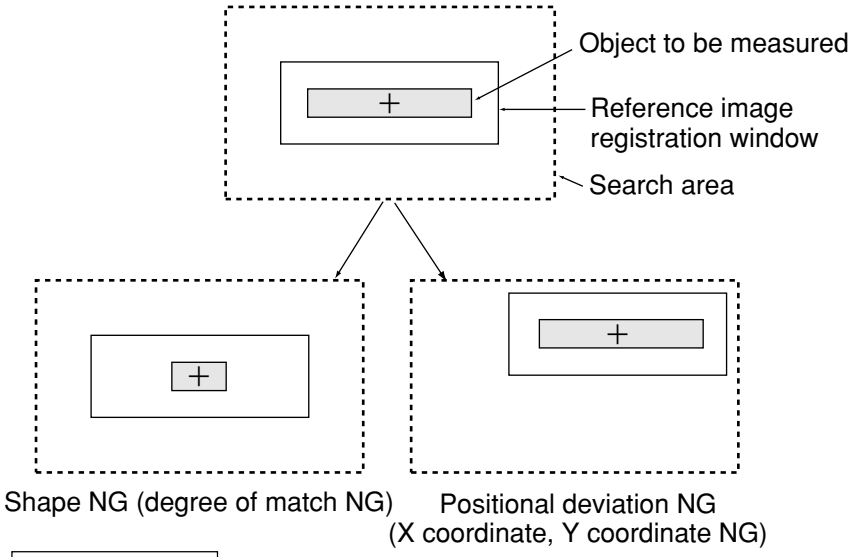
16-3 Program examples (shape and positional deviation inspection)

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.

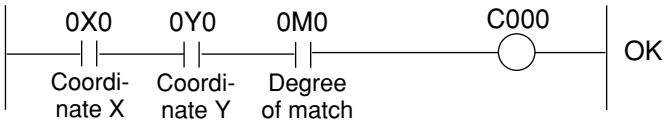
Reference image (registration No.0)



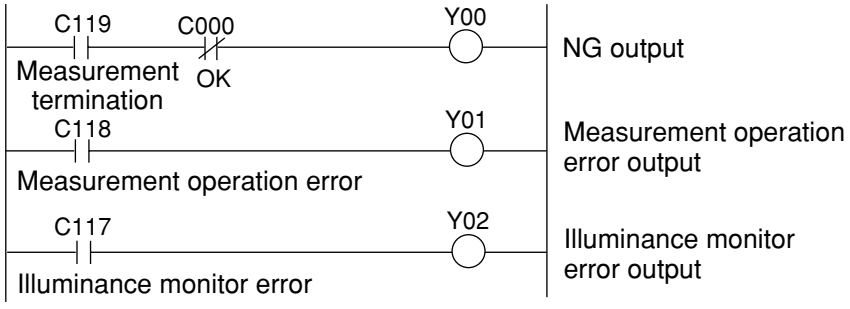
Evaluation condition (acceptable range)	Coordinate (model 0-X): 200.0 to 250.0 Coordinate (model 0-Y): 150.0 to 200.0 Degree of match (model 0): +09500 to +10000

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



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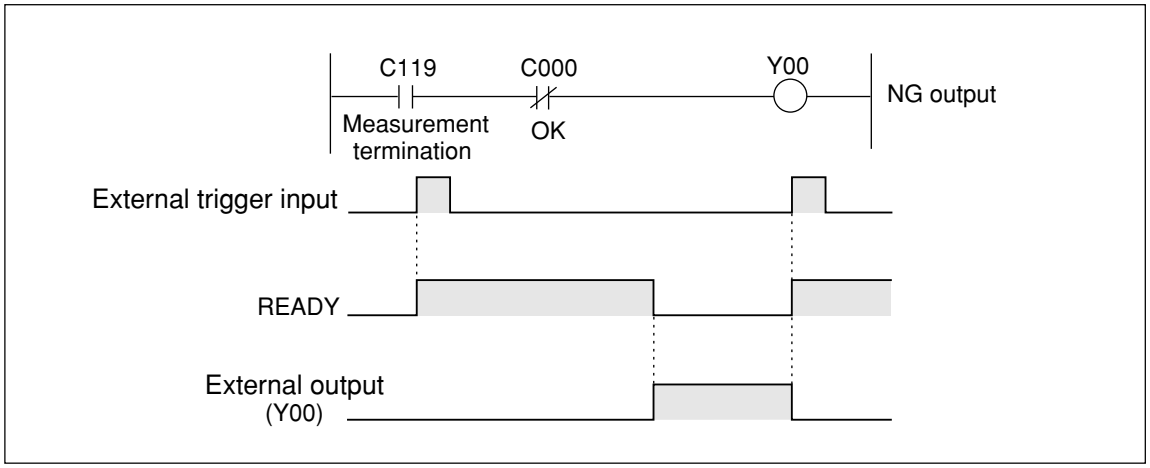
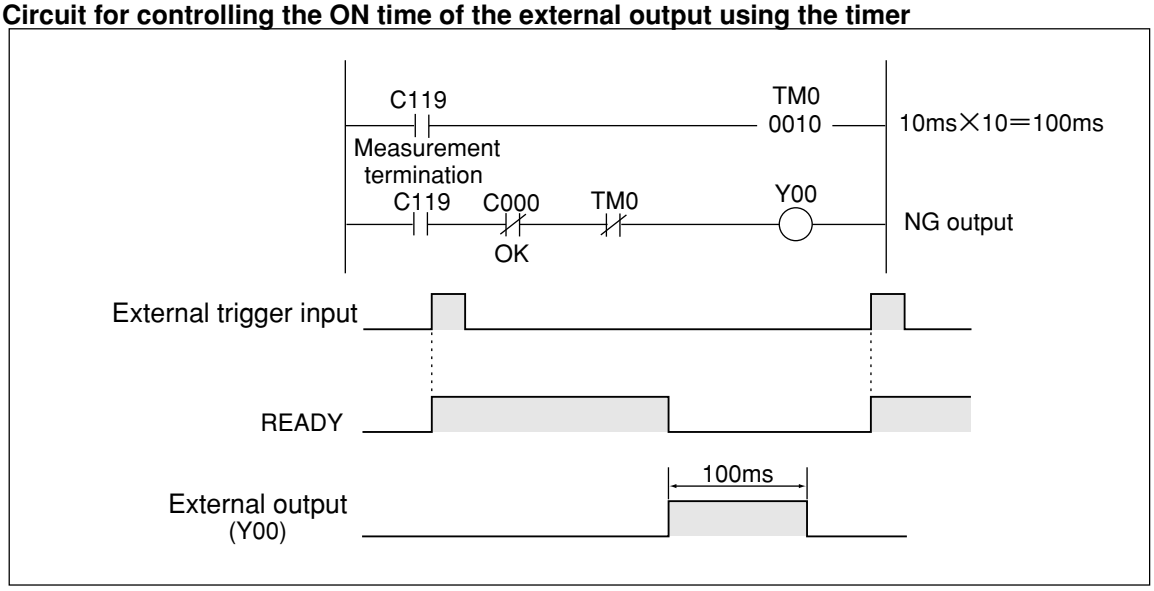
16-4 Examples of a final output conditions ladder circuit

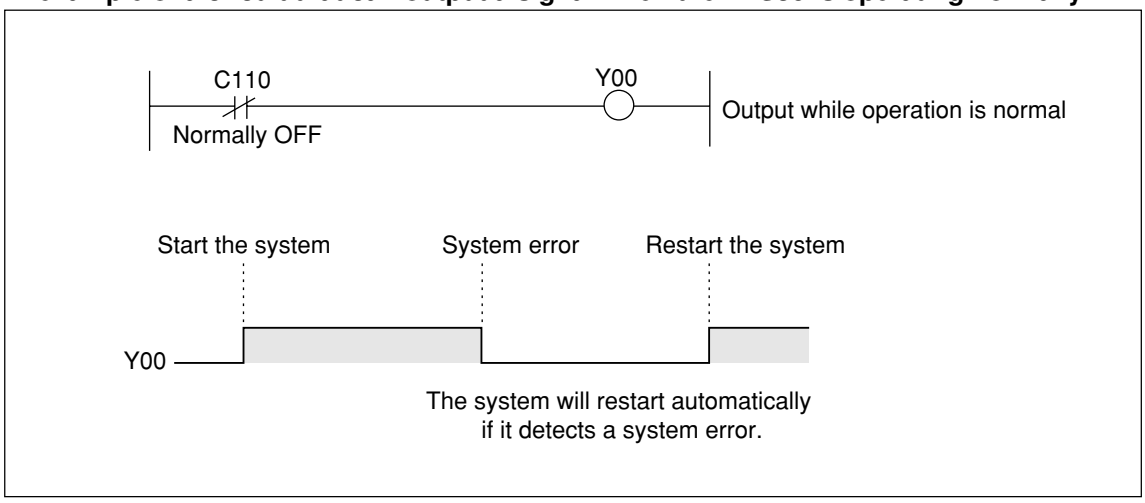
(1) Circuit for keeping the external output ON until the next external trigger is received



(2) Circuit for controlling the ON time of the external output using the timer



(3) An example of a circuit that can output a signal when the IV-S30 is operating normally.



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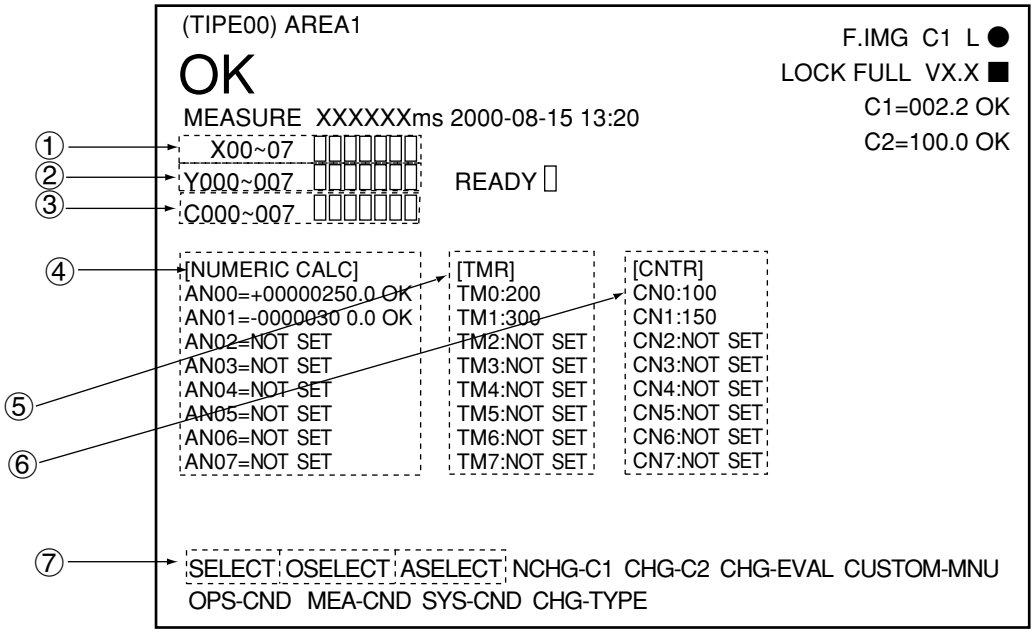
16-5 PC monitor screen

On the MAIN OPS MENU, move the cursor to "CHG-EVAL" item with left and right keys, on the menu bar at the bottom of the screen, and press the SET key. Then the PC monitor screen will be displayed. However, before you can display this screen, you have to select item ⑦ OPS MENU DISPLAY and set PC-MNTRYES on the [TYPE RUN COND] menu. ⇨ See page 2-10.



① The ON (▮) or OFF (▯) status of the input relays (X00 to X07) 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 results (AN00 to AN15) of the final numerical calculations are displayed.
⑤ The current timer value is displayed.
⑥ The current counter value is displayed.
⑦ Menu bar

Menu bar	Description
SELECT	Change the output relay address (Y00 to Y15) with the up and down keys (in units of 8 points).
OSELECT	Change the auxiliary relay address (C000 to C127) with the up and down keys (in units of 8 points).
ASELECT	Change the final numerical calculation address (AN00 to AN15) with the up and down keys (in units of 8 points).

The other data displayed is the same as on the MAIN OPS MENU. (See page 1-4.)

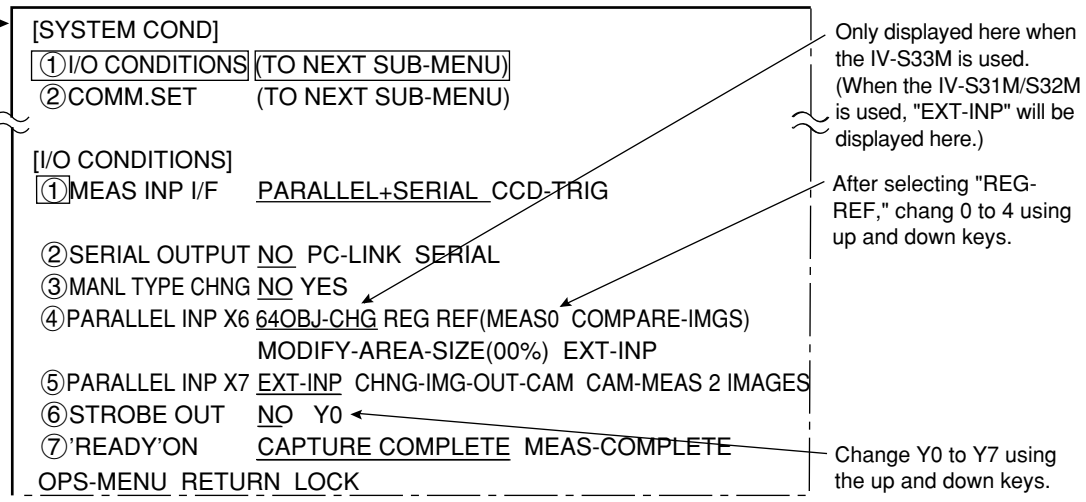
Chapter 17: Setting the Input/Output Conditions

17-1 Outline

This chapter explains the input/output settings on the IV-S30. The conditions are set on the [I/O CONDITIONS] menu.

[1] When you want to select "PARALLEL + SERIAL + USB" on the "MEAS INP I/F" line

On the MAIN OPS MENU, move the cursor to "SYS-CND," and press the SET key.
⇨On the [SYSTEM COND] menu, move the cursor to item "①I/O CONDITIONS" and press the SET key.
⇨ On the [I/O CONDITONS] menu, select "① MEAS INP I/F" and press the SET key.
Then, select "PARALLEL + SERIAL + USB", and press the SET key.



Input/output condition	Setting details
① MEAS INP I/F (measurement start input)	Select an input interface for starting the measurement on the IV-S30.
② SERIAL OUTPUT	Select "PC-LINK (computer link)", "SERIAL (general-purpose serial)", or "NO."
③ MANL TYPE CHNG	The object type can be changed manually using the remote keypad on the MAIN OPS MENU.⇨Page 2-13 ● YES: Means that you will be allowed to change the object type manually on the MAIN OPS MENU. Move the cursor to the "CHG-TYPE" item on the MAIN OPS MENU, and select the object type No., displayed on the upper part of the screen, using the up and down keys. ● NO: Means that you cannot change the object type manually on the MAIN OPS MENU.
④ PARALLEL INP X6	Select the type of input terminal (INPUT) X6. ● 64OBJ-CHG (Change 64 object types) Select when you want to change the object type number (0 to 63) using the external input. ● REG REF (MEAS 0 to 4) - When X6 is turned from OFF to ON, and gray search is selected, the reference image will be registered in the SDRAM. When edge detection is selected, the reference coordinates will also be registered. - To store the reference image in flash memory : Select the SAVE key on any sub menu or use a general purpose serial command. - Available measurement programs (gray scale search) : Positional deviation measurement, the degree of match inspection, multiple positions measurement, multiple degree of match inspections for register No. 0, model 0 - Applicable measurement program (edge detection) : Positional deviation measurement - If a reference image has not been specified, an "UNABLE REGISTER REF.IMG" (X6 reference image register error (code3E)) will occur.

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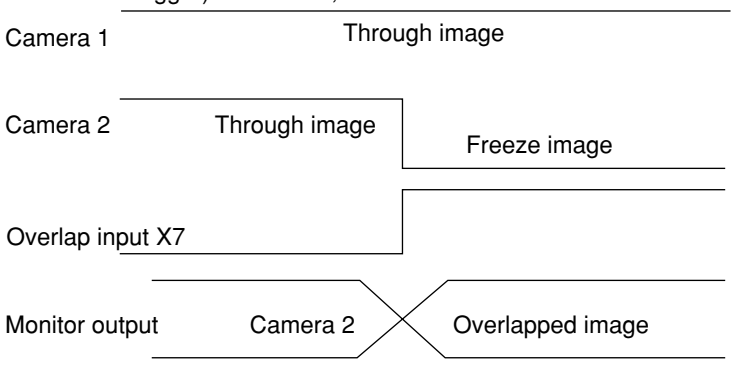
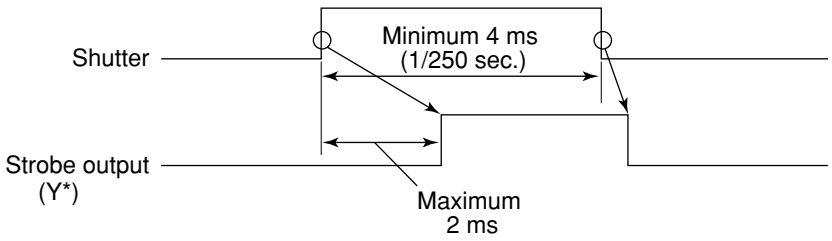
Input/output condition	Setting details
④ PARALLEL INP X6	● Total area evaluation correction - When X6 is ON, the upper and lower limits for the total area evaluation conditions will be corrected automatically. - Measurement programs: Area measurement, object counting, and object identification by binary conversion ● External input: The PC function uses the terminal as an external input signal. ⇨See Chapter 16.
⑤ PARALLEL INP X7	Select the type of input terminal (INPUT) X7. ● External input: The PC function uses the terminal as an external input signal. ⇨ See Chapter 16. ● Selecting the image output camera - Every time X7 is switched from OFF to ON, the selected camera will change. ⇨ page 2-3. - When the object type measurement condition is "CAMERA 1" only. "CAMERA 2" only, or "NG IMAGE" only, you are not allowed to change the camera used for output. ● Camera measurement - On starting a measurement, if X7 is OFF "CAMERA 1" will execute the measurement, and if X7 is ON Camera 2 will execute the measurement. ● Overlap - Before starting a measurement, you must set the following parameters. Measurement execution: [- MEASURE 0 CAMERA 1 conditions = Gray scale search conditions - MEASURE 1 CAMERA 2 conditions = Area conditions (dummy)] Image selection: Camera 1 and 2 are through modes. - When "2 IMAGES (overlap)" is selected, overlap processing will be executed according to the following timing. Note: Even if "2 IMAGES (overlap)" has not been selected, and regardless of which mode Camera 1 and Camera 2 are in, when a trigger (X0: Manual trigger) is received, the measurement will be executed. 
⑥ STROBE OUT	When the strobe output setting is specified as "Y*" and the shutter is opened, the output (Y*) will be turned ON. When the shutter is closed, the output will be turned OFF. Y*= Y0 to Y7 When you want to use the strobe output, specify a shutter speed between 1/30 and 1/250 seconds. ■ **Strobe output timing** 

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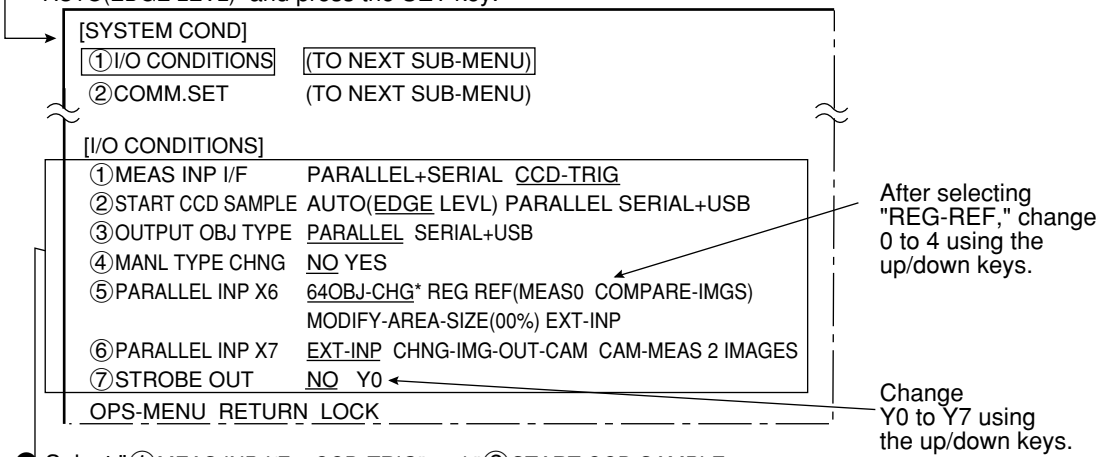
Input/output condition	Setting details
⑦ 'READY' ON	Set the time to turn ON the READY output signal. (When the measurement start input source is set to parallel, the object type change signal will also be parallel, and results will be output as parallel signals. ⇨ See page 17-5.) ● At the end of an image capture When the controller stops capturing the image, the READY signal turns ON. ● At the end of a measurement When the controller stops measuring, the READY signal turns ON.

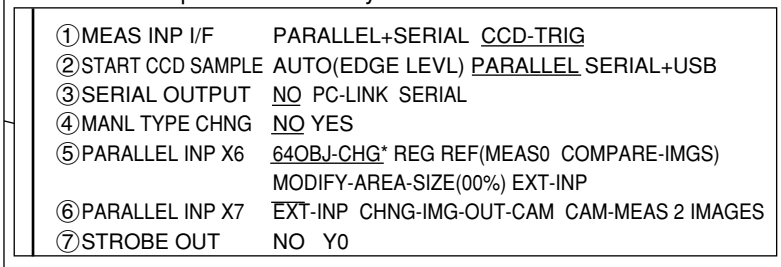
[2] When you want to select the "CCD-TRIG" on the "MEAS INP I/F" line.

On the MAIN OPS MENU, move the cursor to "SYS-CND," and press the SET key.
⇨On the [SYSTEM COND] menu, move the cursor to item "①I/O CONDITIONS" and press the SET key.
⇨On the [I/O CONDITIONS] menu, move the cursor to "① MEAS INP I/F" and press the SET key. Then select "CCD-TRIG" and press the SET key.

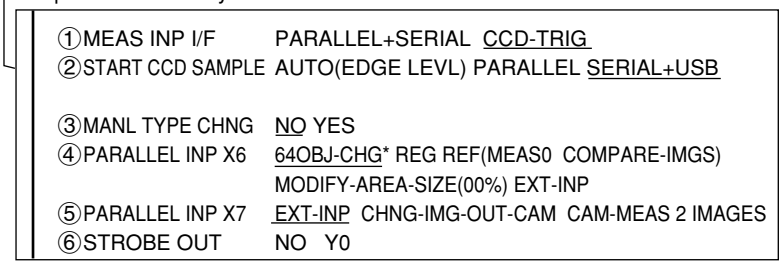
● Select "①MEAS INP I/F=CCD-TRIG" and "②START CCD SAMPLE=AUTO(EDGE LEVL)" and press the SET key.



● Select "①MEAS INP I/F=CCD-TRIG" and "②START CCD SAMPLE=PARALLEL" and press the SET key.



● Select "①MEAS INP I/F = CCD-TRIG" and "START CCD SAMPL = SERIAL + USB" and press the SET key.



The details of the individual items on the [I/O CONDITIONS] menu are the same as described on pages 17-1 to 17-2.
The "64OBJ-CHG" is only displayed here when the IV-S33M is used. When the IV-S31M/S32M is used, "EXT-INP" will be displayed here.

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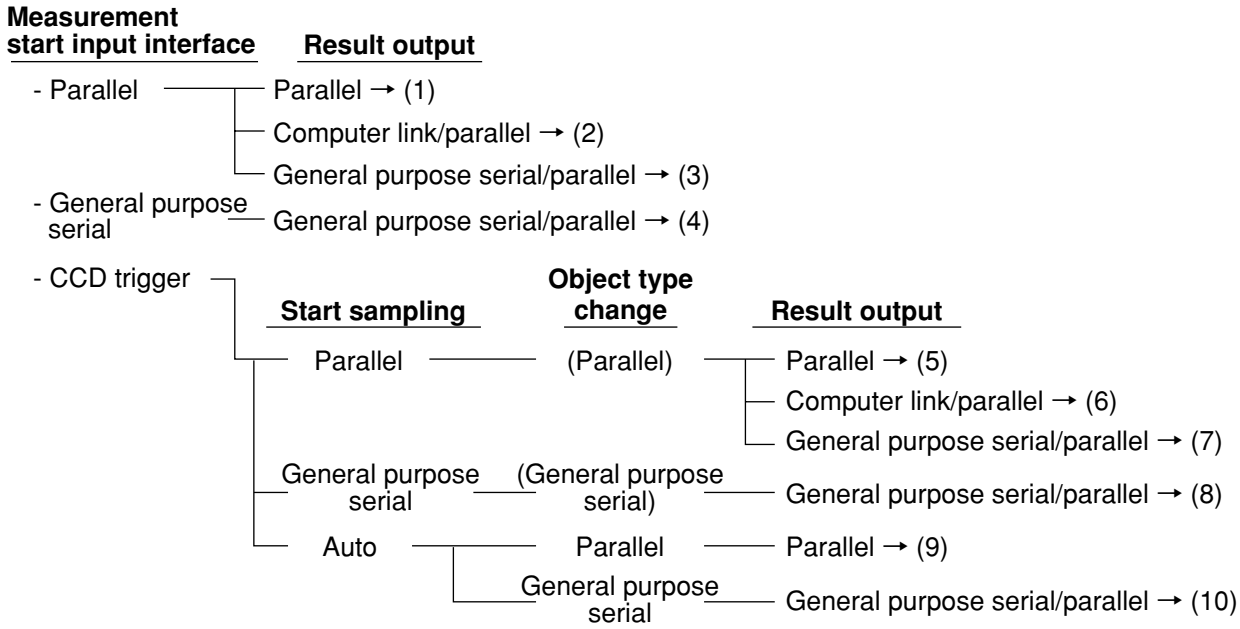
17-2 Measurement start input and result output settings

The combinations of various settings for item ①MEAS INP I/F, item ②START CCD SAMPLE, and item ②(③)SERIAL OUTPUT (③OUTPUT OBJ TYPE) on the [I/O CONDITIONS] menu (page 17-1 to 3) 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	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

■ Object type select switch (object type input)

The object type select switch (object type number input) described below (page 17-5 to 17-7, 17-9, to 17-11, 17-13, and 17-14) depend on the input terminal (object type number) and the controller model type (IV-S31M/S32M/S33M).

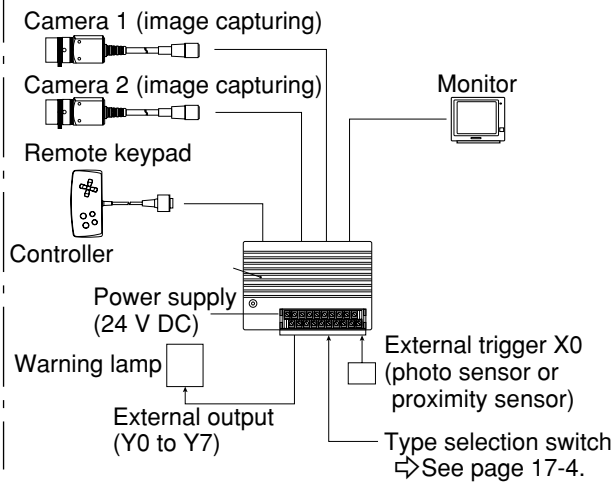
Controller	Input terminal (model number)
IV-S31M	X1 to X4 (0 to 15: 16 object types)
IV-S32M	X1 to X5 (0 to 31: 32 object types)
IV-S33M	Depends on the setting of the "PARALLEL INP X6" (parallel input X6) line (Page 17-1). - When the "PARALLEL INP X6" line is set to "64OBJ-CHG," X1 to X6 (0 to 63: 64 object types) - When the "PARALLEL INP X6" line is set to "REG REF, MODIFY-AREA-SIZE and EXT-IMP," X1 to X5 (0 to 31: 32 object types)

(1) Measurement start input = parallel, object type change = parallel, result output = parallel

■ **Setting order** ① (→ ②)

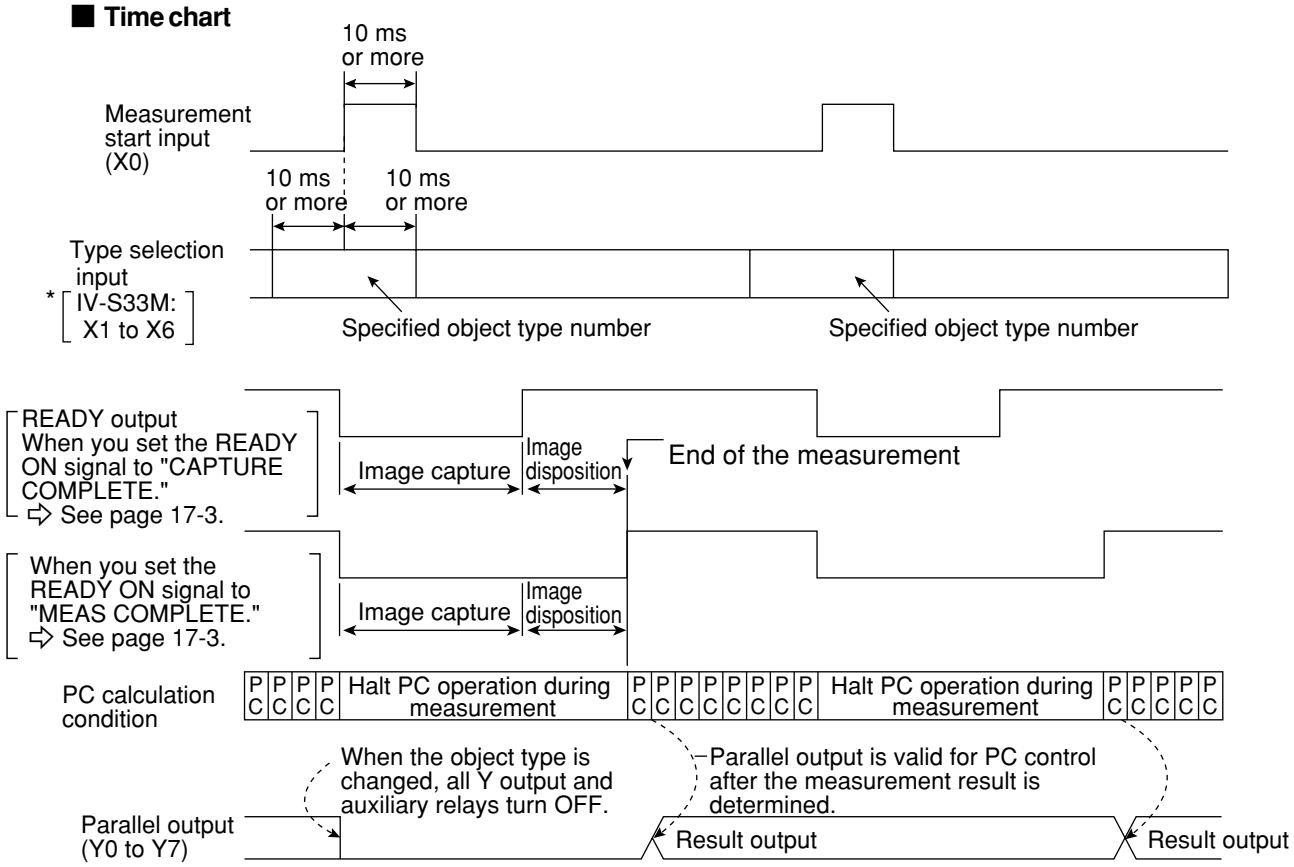
[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG
②SERIAL OUTPUT NO PC-LINK SERIAL

■ **Configuration example**



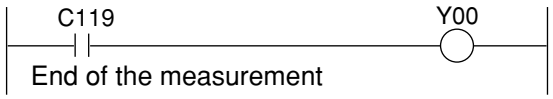
- The conditions for outputting the results to the output signals Y0 to Y7 are set by the PC function. (See "Chapter 16 PC Function.")

■ **Time chart**



Note: When the READY signal is turned ON, the measurement start input will be enabled. To detect the end of the measurement, you have to create a ladder circuit pointing at the Y output for auxiliary relay C119 (end of the measurement).

Custom：Final output condition



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(2) Measurement start input = parallel, object type change = parallel, result output = computer link/parallel

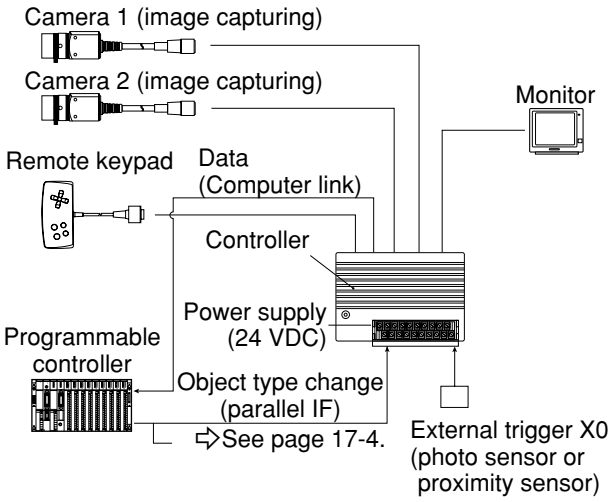
■ **Setting order**

[SYSTEM COND]
①I/O CONDITIONS (TO NEXT SUB-MENU)
②COMM.SET (TO NEXT SUB-MENU)
③COMPUTER LINK (TO NEXT SUB-MENU)

[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG

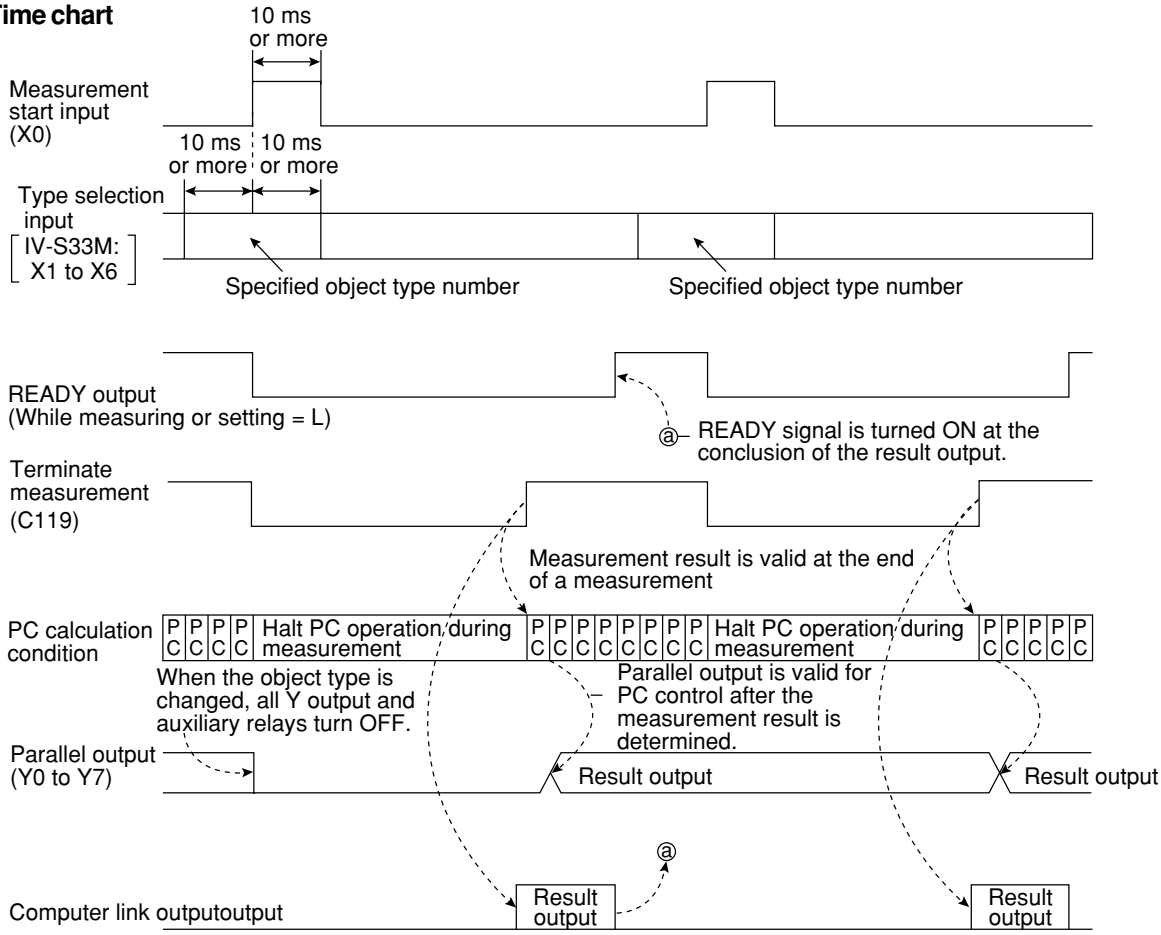
②SERIAL OUTPUT NO PC-LINK SERIAL

■ **Configuration example**



- The data in a specified block No., set in item "⑤SET SERIAL BLOCK" on the [OBJECT TYPE I/O] menu, will be output through the computer link. (See page 17-21.)

■ **Time chart**



When a Sharp PC is used, a write enable command (EWR) is transmitted from the IV-S30 to the PC in the following cases.

- When the power is applied to the IV-S30.
- 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 OUTPUT to the "COMPUTER LINK."

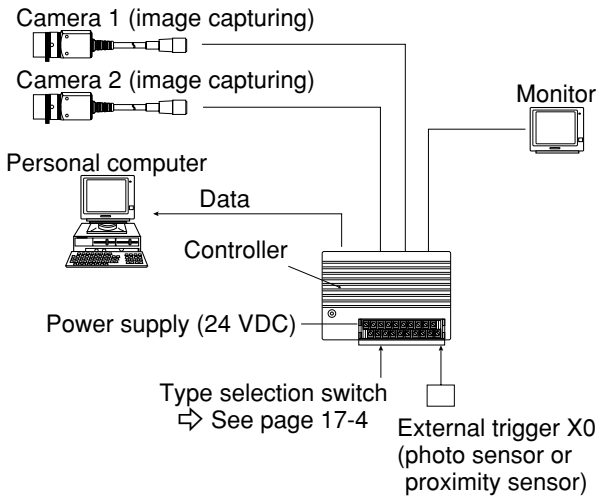
(3) Measurement start input = parallel, object type change = parallel, result output = general purpose serial/parallel

■ **Setting order**

[SYSTEM COND]
①I/O CONDITIONS (TO NEXT SUB-MENU)
②COMM.SET (TO NEXT SUB-MENU)

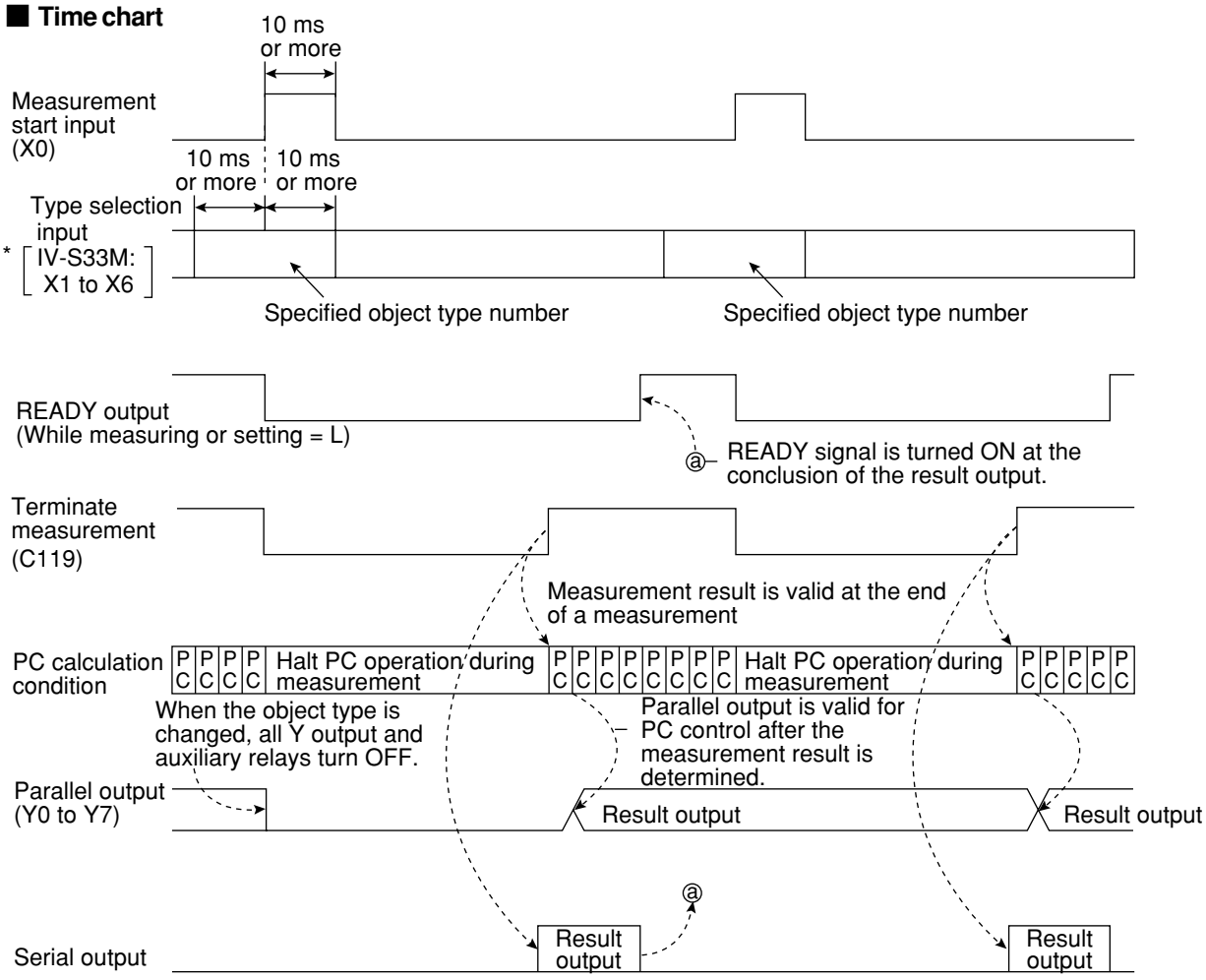
[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG
②SERIAL OUTPUT NO PC-LINK SERIAL

■ **Configuration example**



- The data in a block No., set in item "⑤SET SERIAL BLOCK" on the [OBJECT TYPE I/O] menu, will be output from the IV-S30 to the personal computer. (See page 17-21.)

■ **Time chart**



Note - Result output: The data to be sent to the personal computer will be response of general-purpose serial command (code $11_{(H)}$).

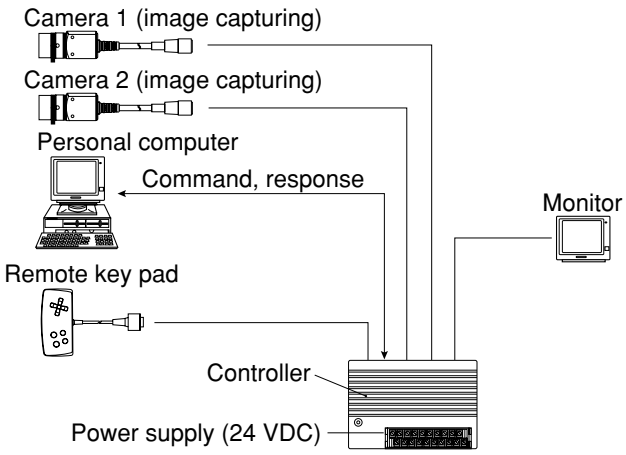
(4) Measurement start input = general-purpose serial, object type change = general-purpose serial, result output = general-purpose serial/parallel

■ **Setting order**

[SYSTEM COND]
①I/O CONDITIONS (TO NEXT SUB-MENU)
②COMM.SET (TO NEXT SUB-MENU)

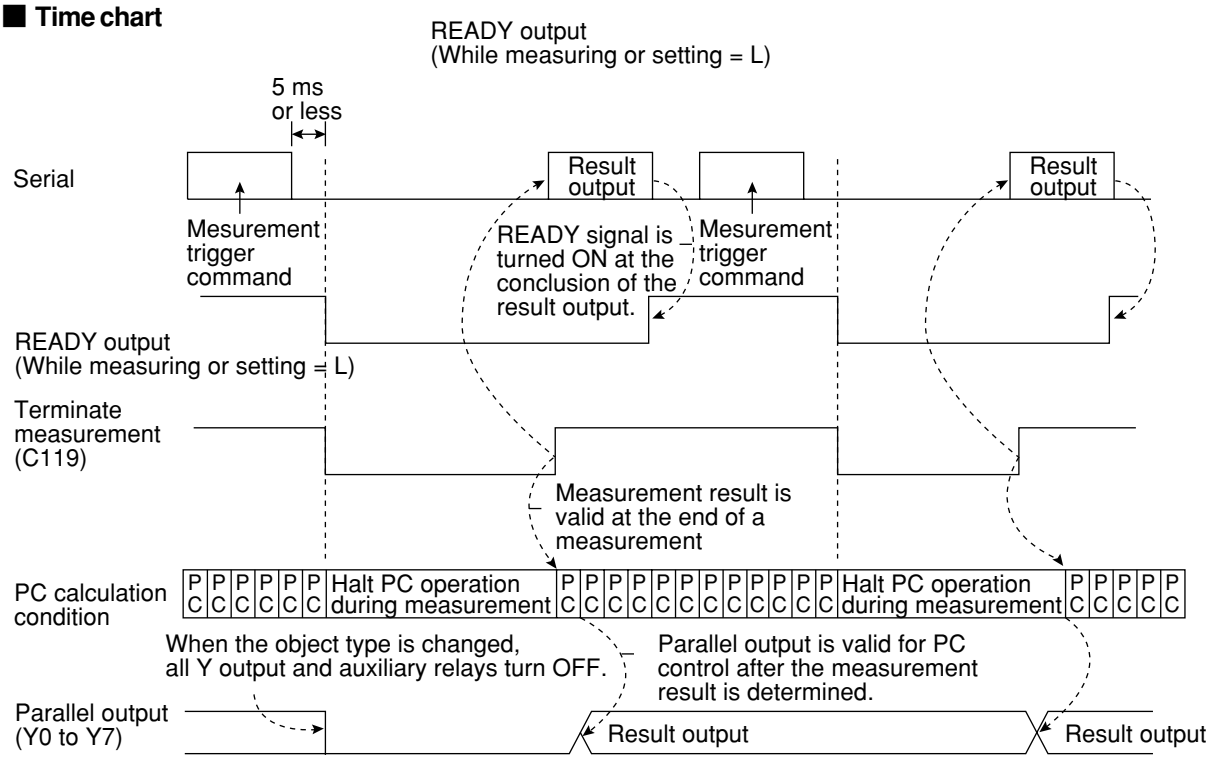
[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG

■ **Configuration example**



- See "Chapter 18 : Communication (General Purpose Serial Interface)" for details about the measurement execution commands (codes 10, 11, 12 and $14_{(H)}$).

■ **Time chart**



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(5) Measurement start input = CCD trigger, start sampling = parallel, object type change = parallel, result output = parallel

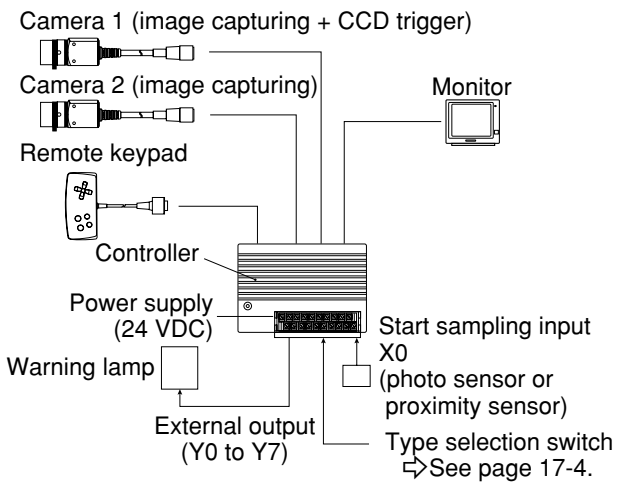
■ **Setting order** ① → ② (→ ③)

[SYSTEM COND]
①I/O CONDITIONS (TO NEXT SUB-MENU)
②COMM.SET (TO NEXT SUB-MENU)

[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG
②START CCD SAMPLE AUTO(EDGE LEVL) PARALLEL SERIAL+USB
③SERIAL OUTPUT NO PC-LINK SERIAL

Setting "17-3 CCD trigger"

■ **Configuration example**



Note 1: When the settings listed in section "17-3 CCD trigger" have not been made, a "CCD TRIG NOT SET. (error 34)" will occur.

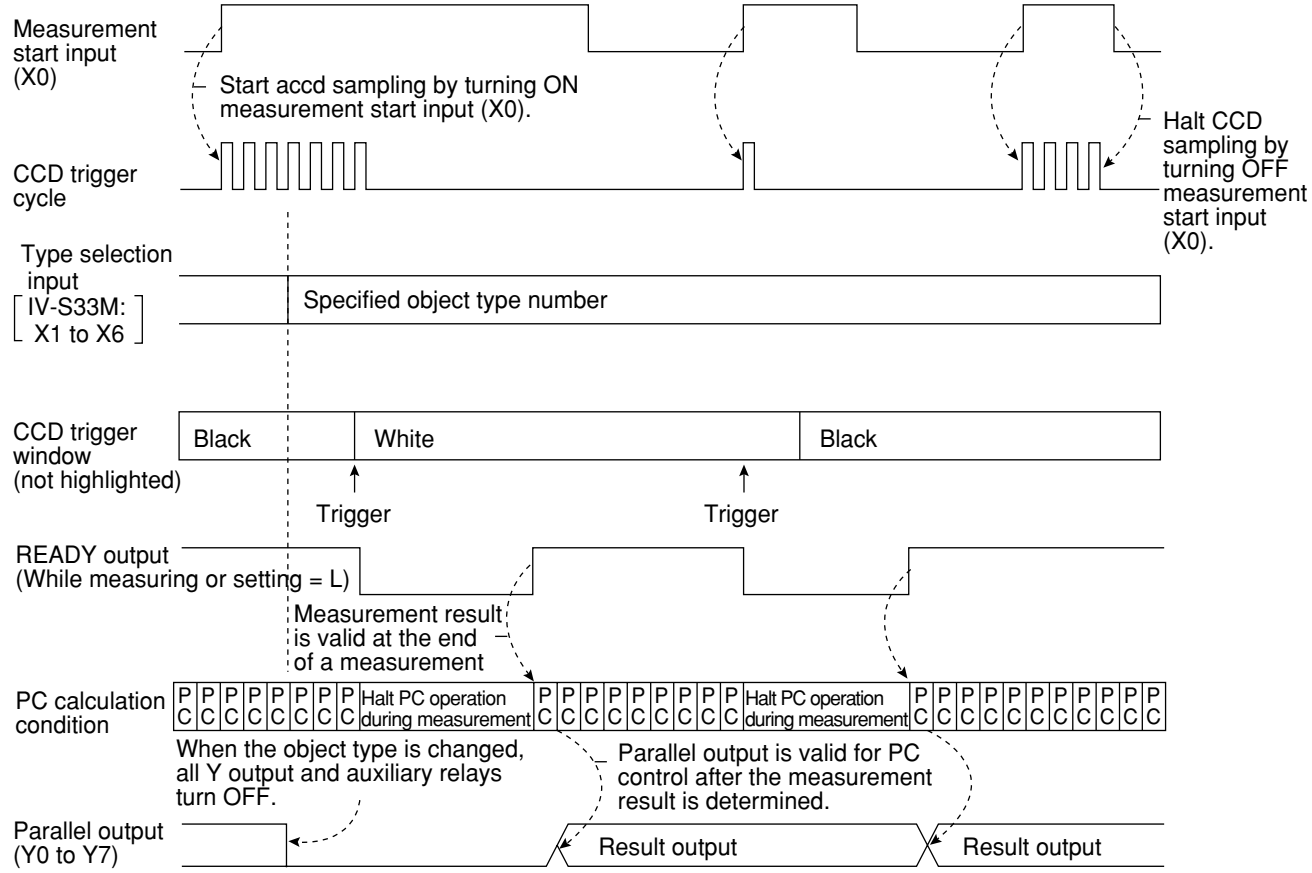
Note 2: Start sampling input (X0)

1. Sampling will be performed while this terminal is ON. When it is turned OFF, the sampling will stop.

   During sampling, O 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)

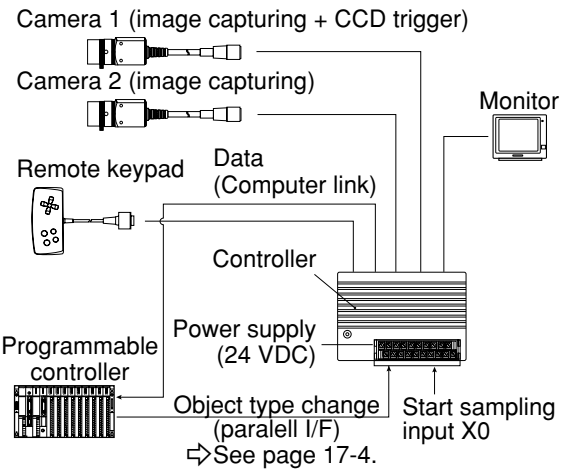
■ **Setting order**

[SYSTEM COND]
①I/O CONDITIONS (TO NEXT SUB-MENU)
②COMM.SET (TO NEXT SUB-MENU)
③COMPUTER LINK (TO NEXT SUB-MENU)

[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG
②START CCD SAMPLE AUTO(EDGE LEVL) PARALLEL SERIAL+USB
③SERIAL OUTPUT NO PC-LINK SERIAL

→ Setting "17-3 CCD trigger"

■ **Configuration example**



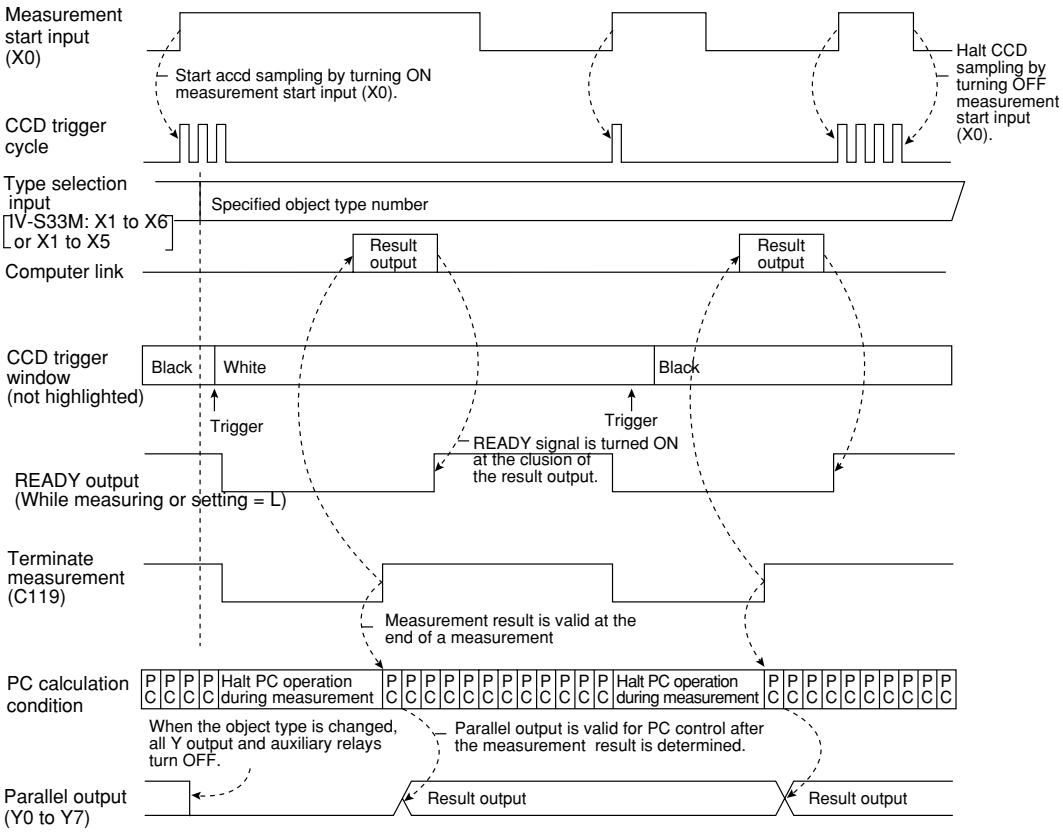
⇨See page 17-4.

Note 1: When the settings listed in section "17-3 CCD trigger" have not been made, a "CCD TRIG 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, O 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-S30 to the PC in the following cases.

- When the power is applied to the IV-S30.
- 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 OUTPUT 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)

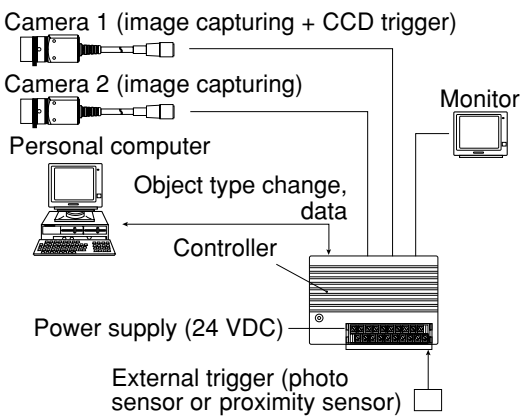
■ **Setting order**

[SYSTEM COND]
①I/O CONDITIONS (TO NEXT SUB-MENU)
②COMM.SET (TO NEXT SUB-MENU)
③COMPUTER LINK (TO NEXT SUB-MENU)

[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG
②START CCD SAMPLE AUTO(EDGE LEVL) PARALLEL SERIAL+USB
③SERIAL OUTPUT NO PC-LINK SERIAL

→ Setting "17-3 CCD trigger"

■ **Configuration example**

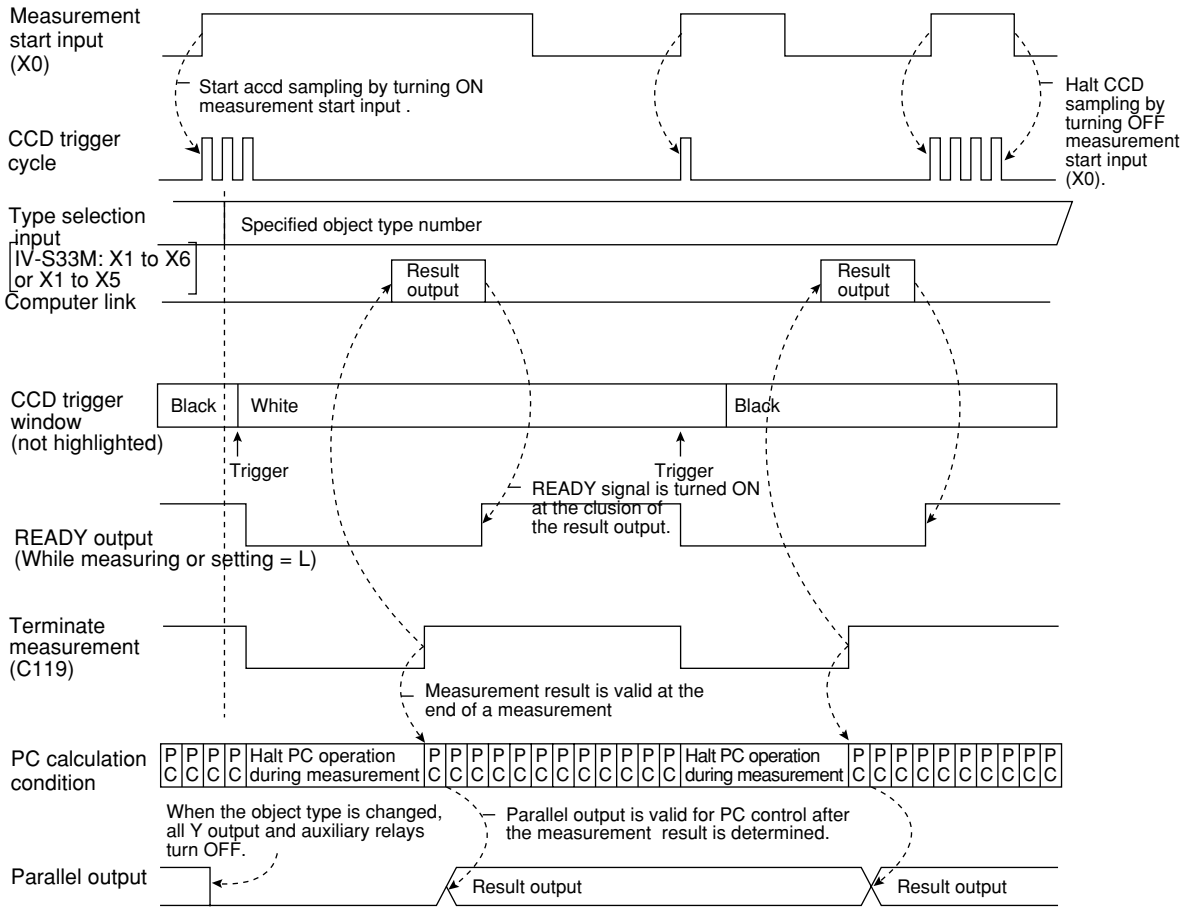


Note 1: When the settings listed in section "17-3 CCD trigger" have not been made, a "CCD TRIG NOT SET. (error 34)" will occur.

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, O 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.

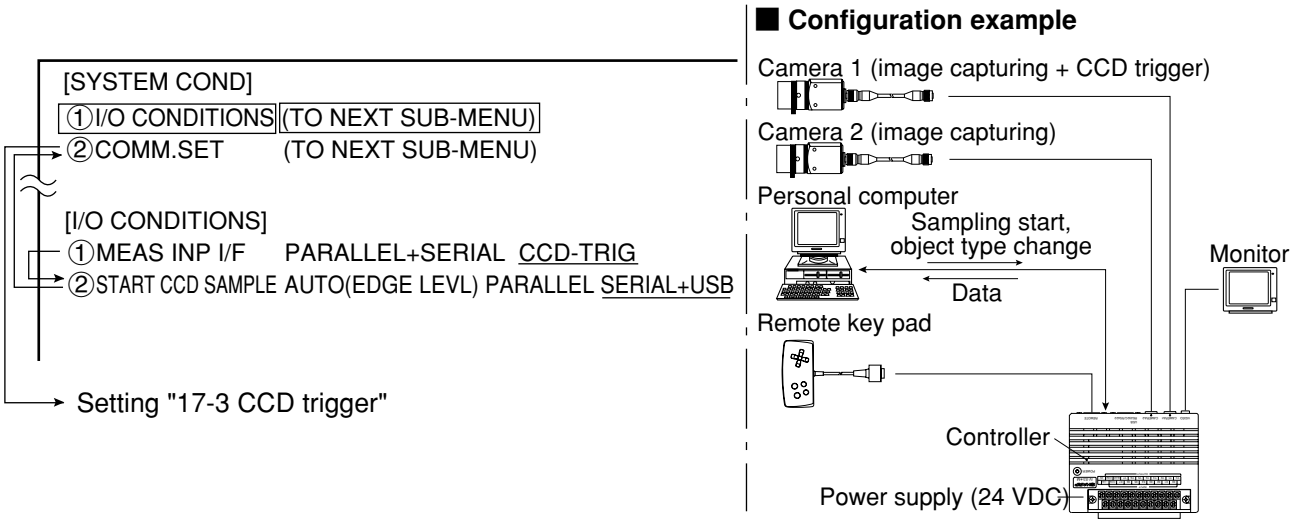
■ **Time chart**



Note: Result output: The data in the block No., set in item "⑤SET SERIAL BLOCK" on the [OBJECT TYPE I/O] menu, will be transmitted to the personal computer. (See page 17-21.)

(8) Measurement start input = CCD trigger, start sampling, object type change = general purpose serial, result output = general purpose serial/parallel

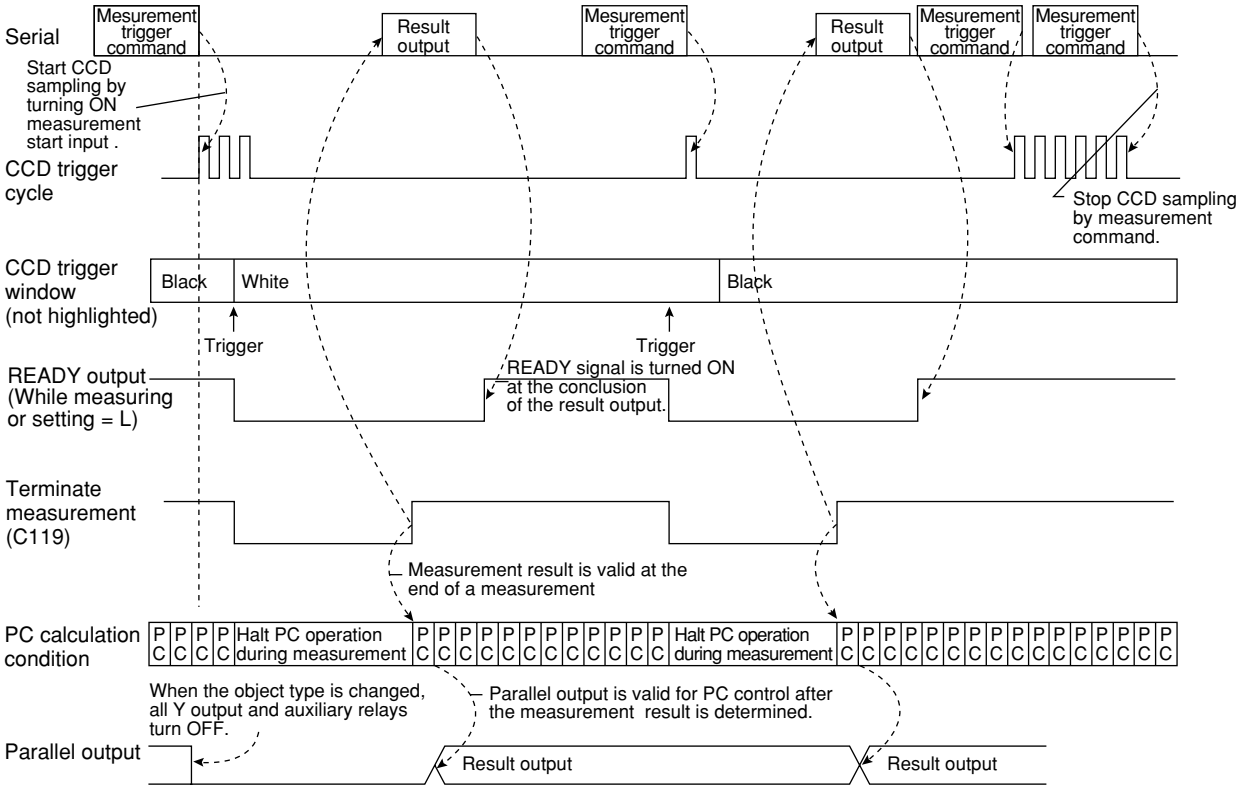
The CCD trigger is enabled after a measurement execution command is entered.



- See Chapter 18 for details about the measurement execution commands (codes 10, 11, 12 and $14_{(H)}$).
- When one of the measurement execution commands (codes 10, 11, 12 and $14_{(H)}$) is normally received during sampling, the sampling will stop.

Note: When the settings listed in section "17-3 CCD trigger" have not been made, a "CCD TRIG NOT SET. (error 34)" will occur.

■ **Time chart**



Note: Result output: The data in the block No., set in item "⑤SET SERIAL BLOCK" on the [OBJECT TYPE I/O] menu, will be transmitted to the personal computer. ⇨ See page 17-21.

(9) Measurement start input = CCD trigger, start sampling = auto, object type change, result output = parallel

■ **Setting order** ① → ② (→ ③)

[SYSTEM COND]
①I/O CONDITIONS (TO NEXT SUB-MENU)
②COMM.SET (TO NEXT SUB-MENU)

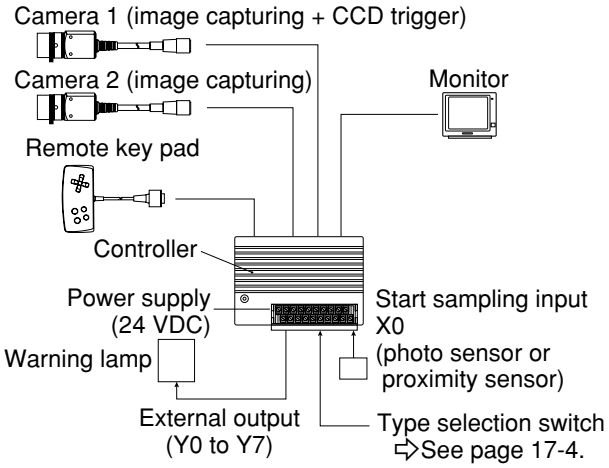
[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG
②START CCD SAMPLE AUTO(EDGE LEVL) PARALLEL SERIAL+USB
③OUTPUT OBJ TYPE PARALLEL SERIAL+USB

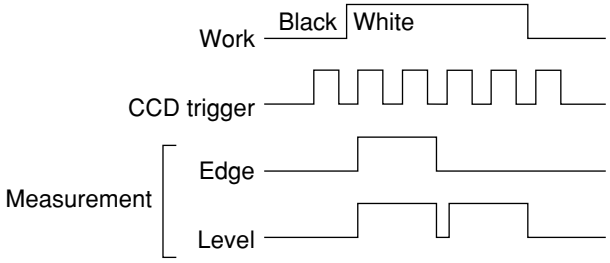
Setting "17-3 CCD trigger"

Select one of the following.

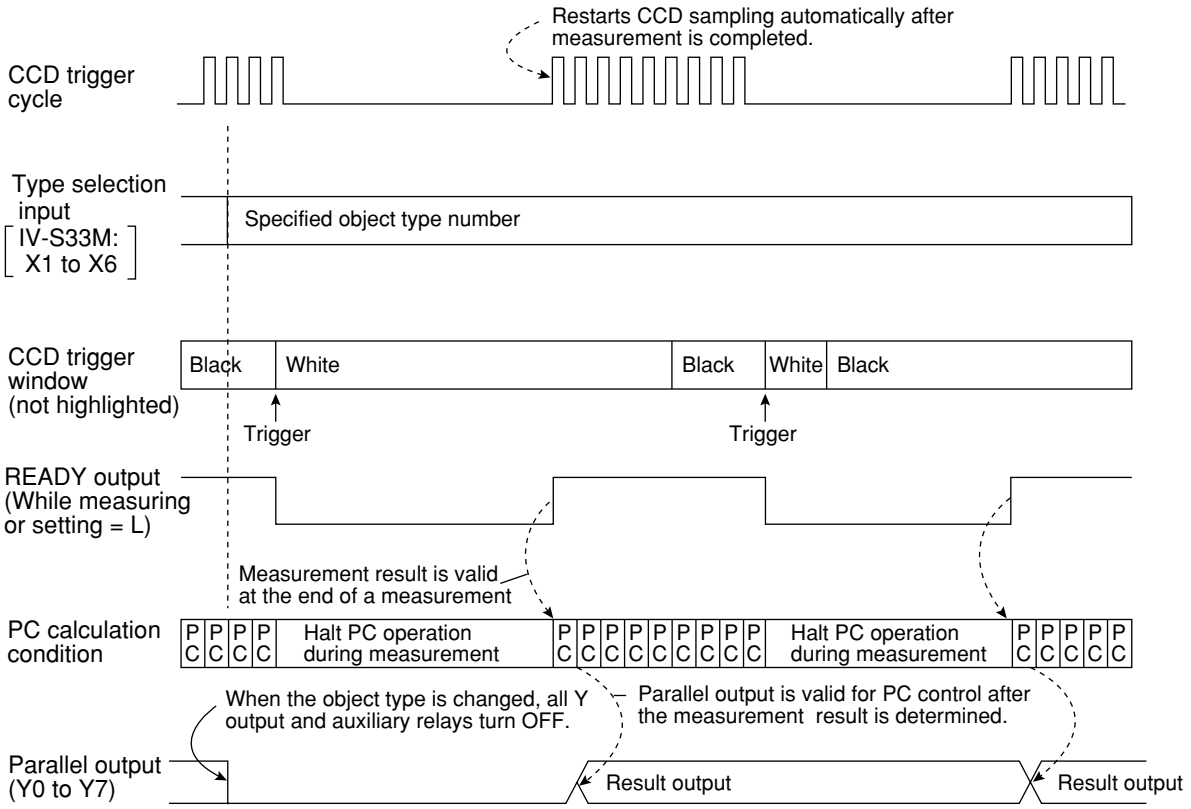
Measurement is started when the CCD trigger level is ON.
Measurement is started when a CCD trigger signal is received.

■ **Configuration example**





■ **Time chart (**when auto mode (edge) is selected for as the CCD sampling start)



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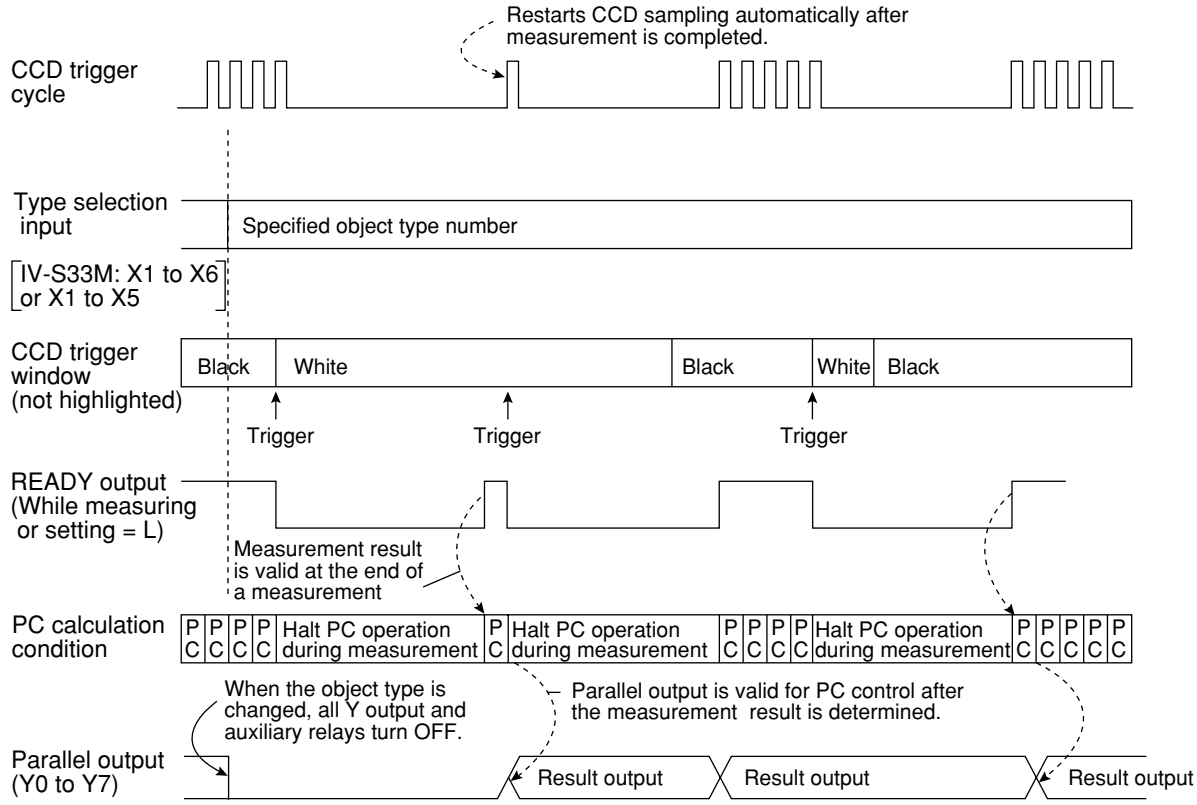
■ **Time chart** (when auto mode (level) is selected for as the CCD sampling start)



(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**

[SYSTEM COND]
①I/O CONDITIONS (TO NEXT SUB-MENU)
②COMM.SET (TO NEXT SUB-MENU)

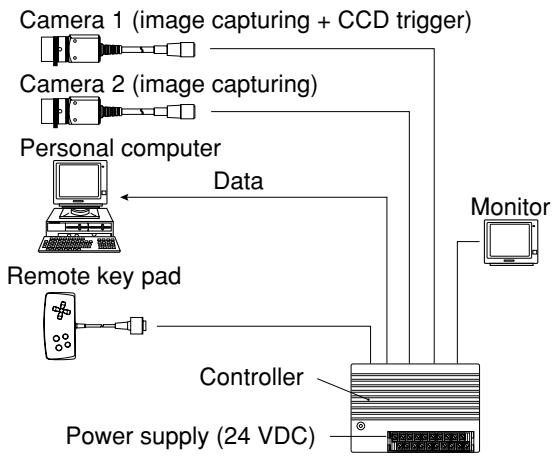
[I/O CONDITIONS]
①MEAS INP I/F PARALLEL+SERIAL CCD-TRIG
②START CCD SAMPLE AUTO(EDGE LEVL) PARALLEL SERIAL+USB
③OUTPUT OBJ TYPE PARALLEL SERIAL+USB

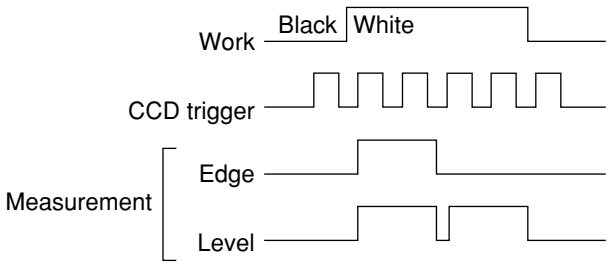
Setting "17-3 CCD trigger"

Select one of the following.

Measurement is started when the CCD trigger level is ON.
Measurement is started when a CCD trigger signal is received.

■ **Configuration example**





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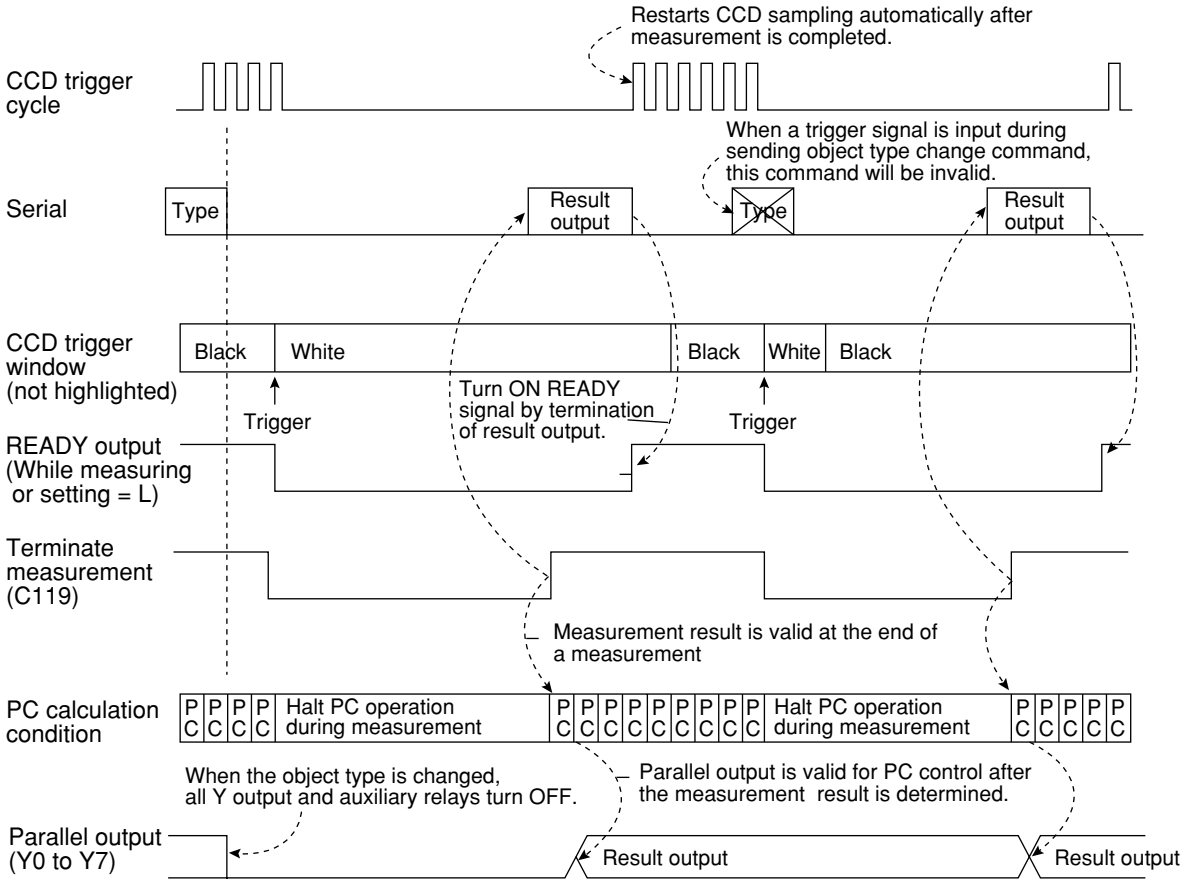
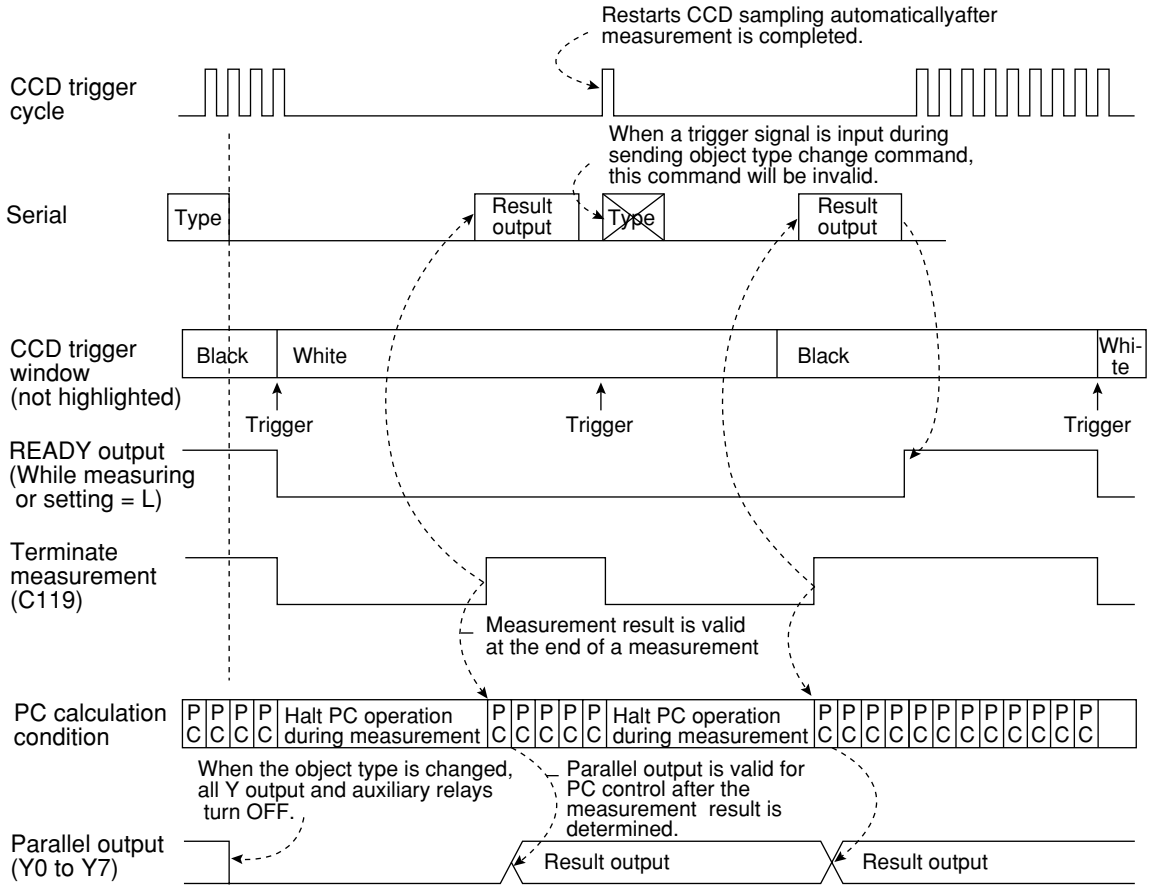
■ **Time chart (**when auto mode (edge) is selected for as the CCD sampling start)



Note: Result output; The data in the block No., set in item "⑤SET SERIAL BLOCK" on the [OBJECT TYPE I/O] menu, will be transmitted to the personal computer. ⇨ See page 17-21.

■ **Time chart** (when auto mode (level) is selected for as the CCD sampling start)



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17-3 CCD trigger

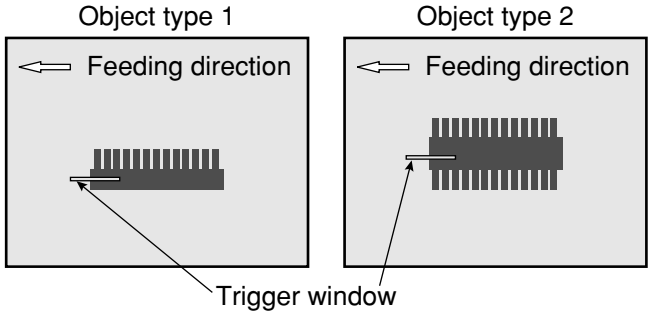
[1] Outline

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 CONDITIONS] menu (pages 17-1 to 17-16), and set item "①TRIG CCD START" and item "②CCD TRIG COND" on the [OBJECT TYPE I/O] menu. ⇨ See item (2).

- There are three 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 and "gray search."

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.
Gray search	When the degree of match exceeds the specified value (threshold value), the measurement will start after the trigger event is detected. - This is useful when workpieces have complicated shading and cannot be converted to binary or use a fixed brightness range.

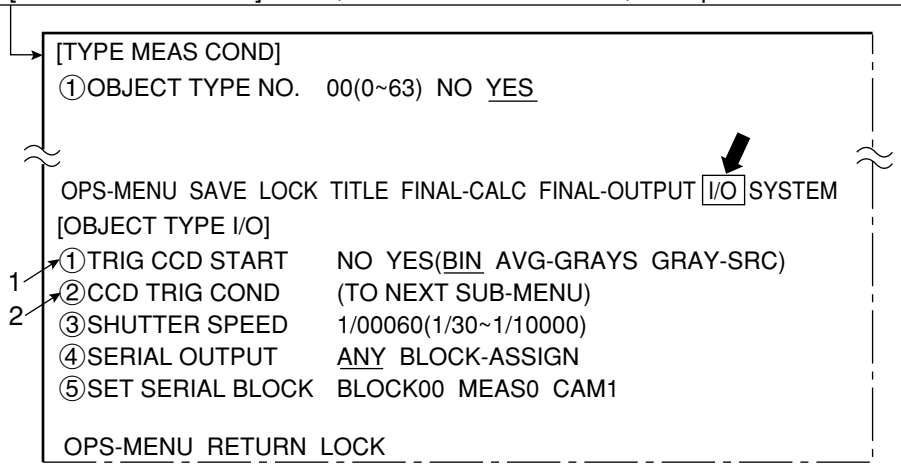
- The trigger window can be set in any position for each object type.
  In the past, the position of an external sensor had to be adjusted every time the object type was changed. However, since this function eliminates the necessity of physical position adjustments, the changeover time can be reduced.



- 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 [TYPE MEAS COND] menu, move the cursor to "I/O," and press the SET key.

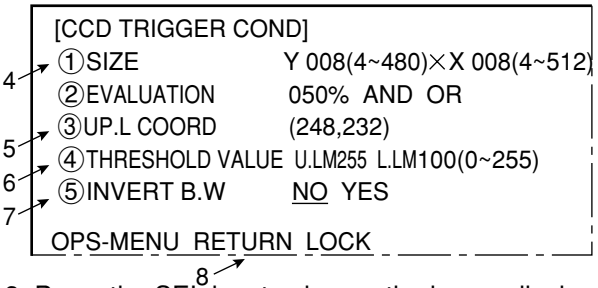


1. Move the cursor to item "①TRIG CCD START" with the up and down keys, and press the SET key.
   - Move the cursor to "BIN," "AVG-GRAYS" or "GRAY-SRC" with the left and right keys, and press the SET key.

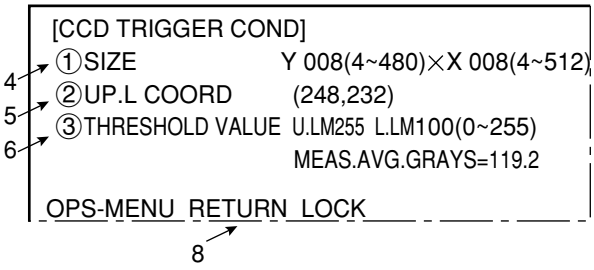
2. Move the cursor to item "②CCD TRIG COND" with the up and down keys, and press the SET key.
   ⇨ The [CCD TRIGGER COND] menu and a CCD trigger window will be displayed. The items displayed will vary according to the setting in item "①TRIG CCD START."

(1) When the binary or average light level method is selected

- When the BIN has been selected



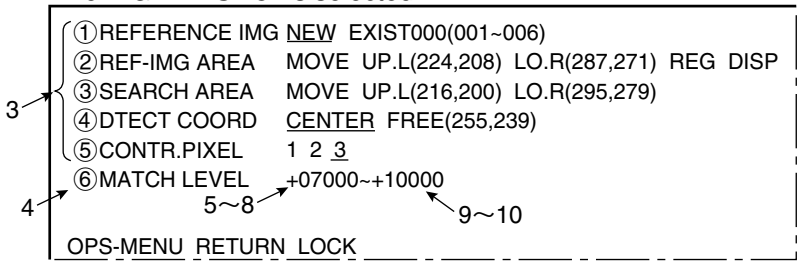
- When the AVG-GRAYS has been selected



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 "①SIZE" 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 480 and 4 to 512 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. Select "③UP.L COORD (upper left coordinate)" or "②UP.L COORD (upper left coordinate)" using the up and down keys and press the SET key.
   ⇨ Set the CCD trigger window position.
   ⇨ After selecting the position with the direction keys, press the SET key.
6. Select "④THRESHOLD VALUE" or "③THRESHOLD VALUE" using the up and down keys and then press the SET key.
   ⇨ Set the threshold values for the CCD trigger window.
   ⇨ Select the "U.LM" or "L.LM" 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 "⑤INVERT 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. Select "RETURN" and press the SET key.
   ⇨ Move the cursor to the "SAVE" item on the [TYPE MEAS COND] menu in order to save the parameters you have entered in the IV-S30 flash memory.

(2) When the gray scale search is selected

- When "GRAY-SRC" is selected



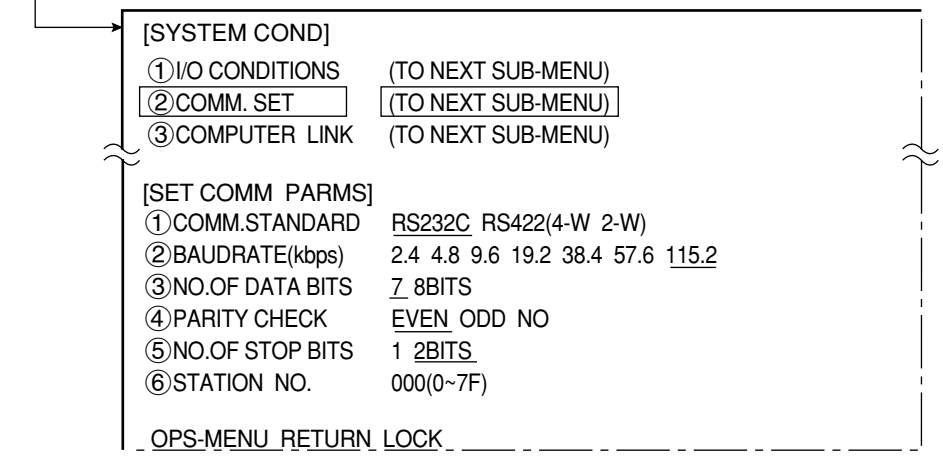
3. The settings from "REFERENCE IMG" to "CONTR.PIXEL" lines are the same as in the degree of match inspection. ⇨ See page 5-3.
4. Move the cursor to "⑥MATCH LEVEL" using the up and down keys and press the SET key.
5. Move the cursor to the lower limit position using the left and right keys and press the SET key.
6. Move the cursor to a digit you want to change using the left and right keys.
7. Increase or decrease the number using the up and down keys.
8. Repeat steps 6 and 7 above to set other digits. After setting the all digits, press the SET key.
9. Move the cursor to the upper limit position using the left and right keys and press the SET key.
10. Repeat steps 6 to 8 above to set other digits.
11. Press the ESC key.

17-4 Setting for serial communications

When "PARALLEL+SERIAL+USB" (general purpose serial) has been specified in item "①MEAS INP I/F" on the [I/O CONDITIONS] menu (page 17-1), and when "SERIAL" or "PC-LINK" has been specified in item "③SERIAL OUTPUT" the serial communication conditions must be set on the [SET COMM PARMS] menu.

- Set the items to match the communication conditions of the other device.

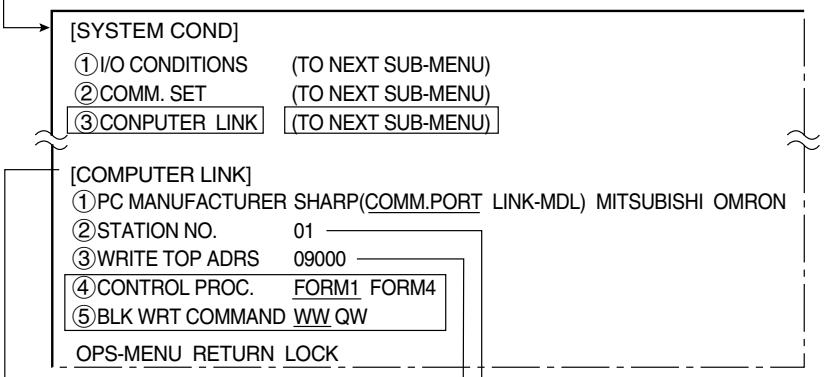
On the [SYSTEM COND] menu, move the cursor to item "②COMM.SET" and press the SET key.



17-5 Computer link

When "PC-LINK" has been specified in item "③SERIAL OUTPUT" on the [I/O CONDITIONS] menu (page 17-1), the computer link conditions must be set on the [COMPUTER LINK] menu.

On the [SYSTEM COND] menu, move the cursor to item "③ 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)

Display when only "MITSUBISHI" is specified on "①PC MANUFACTURER" item.

Menu	Setting details
④ CONTROL PROC.	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 BLK 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 17 "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

17-6 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-S30 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 18-3.

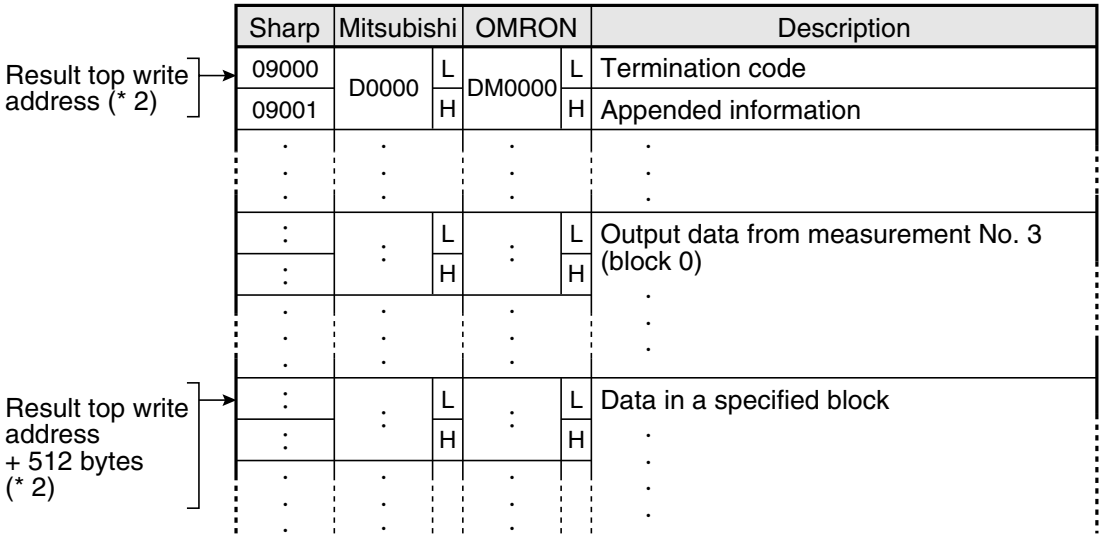
Specify the settings above on the [OBJECT TYPE I/O] menu ⇨ See the next page.

[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 4 is output by the write register of the PC. (See page 19-3.)

■ Write register map



Sharp	Mitsubishi		OMRON		Description
09000	D0000	L	DM0000	L	Termination code
09001		H		H	Appended information
:	:		:		:
:	:	L	:	L	Output data from measurement No. 3 (block 0)
:	:	H	:	H	:
:	:		:		:
:	:	L	:	L	Data in a specified block
:	:	H	:	H	:
:	:		:		:

* 2 Set the result top write address in item "③ WRITE TOP ADRS" 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

(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-S30 responds, data in a specified block is output after the output data (block 0) from the measurement No. 0 to 4, in response to the measurement run command 2 (processing code $11_{(H)}$).

■ Response

:	1	1	RC (H)	RC (L)	Object type	Output evaluation results Y0	Y1	…	Y15	① Measurement 0 Camera 1	Camera 2	Measurement 1	Measurement 2	Measurement 3	Measurement 4

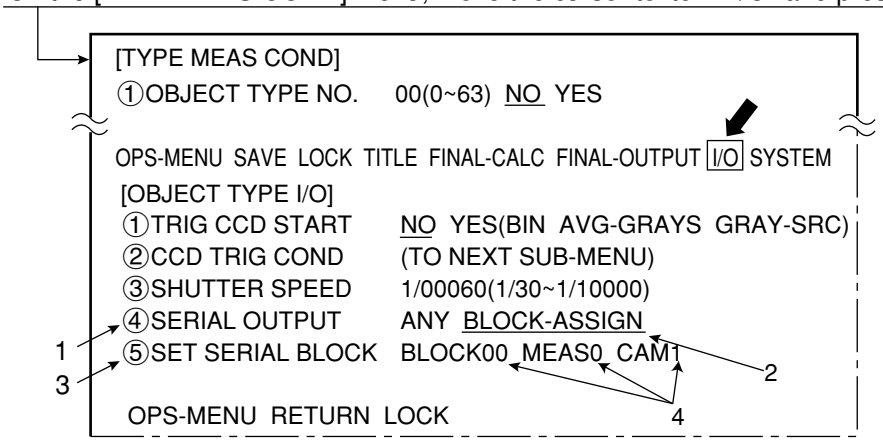
Measurement 0 Camera 1 data ②	Measurement 0 Camera 2 data ②	Data from measurement 1 data ②	Data from measurement 2 data ②	Data from measurement 3 data ②	Data from measurement 4 data ②	Data in the specified block	SC (H)	SC (L)	CR

- See page 18-7 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 [TYPE MEAS COND] menu, move the cursor to item "I/O" and press the SET key.



1. Move the cursor to item "④ SERIAL OUTPUT" with the up and down keys, and press the SET key.
2. Move the cursor to "BLOCK-ASSIGN" using left and right keys and press the SET key.
3. Move the cursor to "⑤ SET SERIAL BLOCK" using up and down keys and press the SET key.
4. 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.
5. After the settings are complete, press the SET key.

17-7 Setting the data output

When you communicate with the IV-S30 using a computer link or a serial communication interface (general purpose serial IF) in the following conditions, perform steps (1) and (2) below to enable serial output.

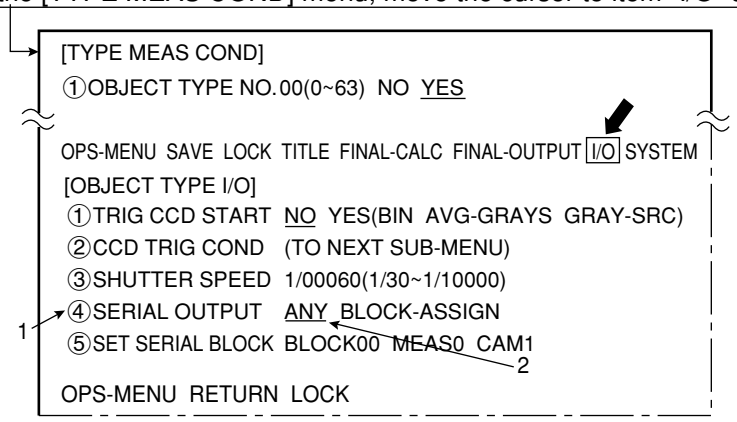
- Computer link: When outputting any data ⇨ Pages 19-3 and 19-4
- Communication interface (general purpose serial IF): When executing a measurement run command 4 (processing code $14_{(H)}$) ⇨ Pages 18-8 and 18-10

(1) Select "ANY" for the serial output

Select "ANY" in the "④SERIAL OUTPUT" item on the [OBJECT TYPE I/O] menu.

■ **Setting procedure**

On the [TYPE MEAS COND] menu, move the cursor to item "I/O" and press the SET key.



1. Move the cursor to item "④ SERIAL OUTPUT" with the up and down keys, and press the SET key.
2. Move the cursor to "ANY" using left and right keys and press the SET key.

(2) Select "YES" or "NO" for output data

Select "YES" or "NO" on the following menu screens that are displayed as "locked" screens to output serial data. See the next page for instructions about how to lock the screen.

- The [EVALUATION COND] menu for individual measurement program

```
[EVALUATION COND]
                        [MENU]     [SERIALOUTPUT]
①CONDITION SET          MENU YES
②X COORD(MDL0)          MENU YES        NO
③Y COORD(MDL0)          MENU YES        NO
④x DEVIATE(MDL0)        MENU YES        NO
⑤y DEVIATE(MDL0)        MENU YES        NO
⑥MATCH LVL(MDL0)        MENU YES        NO
⑦ANGULAR DEVIATE        MENU YES        NO
⑧X COORD(MD1)           MENU YES        NO
⑨Y COORD(MDL1)          MENU YES        NO
⑩x DEVIATE(MDL1)        MENU YES        NO
⑪y DEVIATE(MDL1)        MENU YES        NO
⑫MATCH LVL(MDL1)        MENU YES        NO
OPS-MENU SAVE RETURN
```

(When measuring positional deviation)

- The "NUMERIC CALC COND" or "FINAL CALC COND" menu for individual measurement program

```
[NUMERIC CALC]
                        [MENU]     [SERIALOUTPUT]
①CALC RESULT            MENU YES
②TYPE                   MENU YES
③FORMULA                MENU YES
④FUNCTION               MENU YES
⑤UPR&LOW LIMIT          MENU YES
⑥OUTPUT                 MENU YES    NO
⑦RUN A TEST             MENU YES
OPS-MENU SAVE RETURN
```

(When the numerical calculation condition menu is displayed)

- The [DISTANCE&ANGLE COND] menu

```
[DIST&ANGLE COND]
                        [MENU]     [SERIAL OUTPUT]
①OBJECT                 MENU YES
②DISTANCE NO.           MENU YES
③COND.1                 MENU YES
④COND.2                 MENU YES
⑤COND.3                 MENU YES
⑥DISTANCE EVALUAT       MENU YES    NO
⑦RUN A TEST             MENU YES
⑧NUM-CALC               MENU YES
⑨OUT-COND               MENU YES
OPS-MENU SAVE RETURN
```

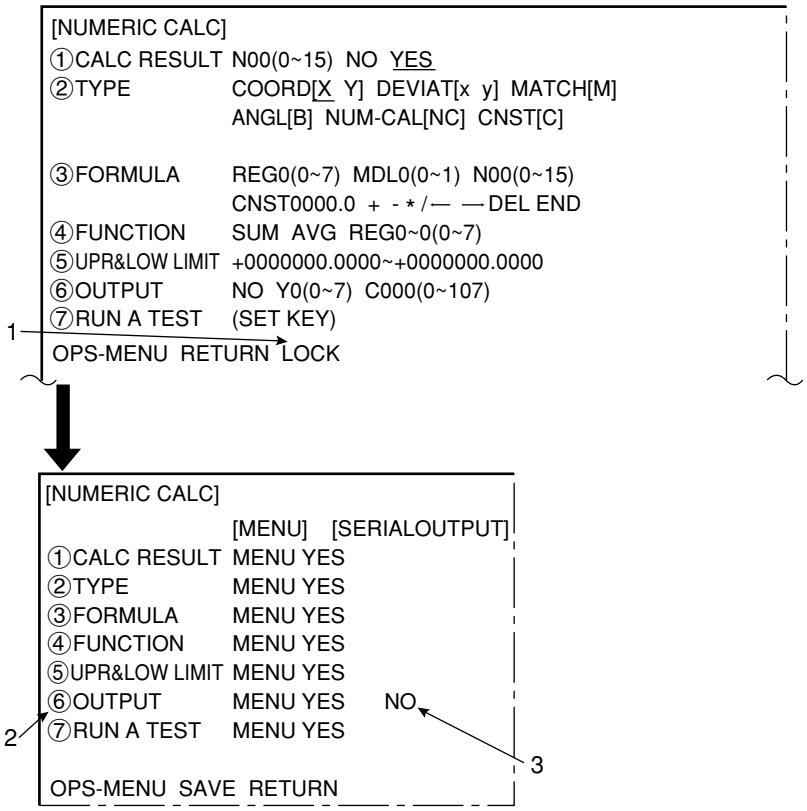
(To measure an object's "distance" on the distance and angle condition menu)

- When the serial output setting is "NO," no data (block 0) will be output (the space will be filled by the next item).

17

■ **Setting procedure** (when the numerical calculation conditions for measuring positional deviations is selected)

1. On the [NUMERIC CALC COND] menu, move the cursor to the "LOCK" item, and press the SET key.



2. Move the cursor to the "⑥OUTPUT" item using the up and down keys, and press the SET key.
3. Move the cursor to "NO" on the "SERIAL OUTPUT" column and select it to "YES" or "NO" using the up and down keys. Then, press the SET key.

Chapter 18: Communication (General Purpose Serial Interface)

The IV-S30 can communicate with a personal computer that transmits commands and receives responses to measurement execution commands.

18-1 List of processing functions

The following functions can be used for communication between the IV-S30 and a personal computer (using the general-purpose serial interface).

Category	Processing description	Code	Functions
* Executing measurement	Measurement execution function 1	10	- Executes all measurement programs for a specified object type. (You can make measurements by specifying a camera.) - Outputs the ladder results (Y0 to 15).
	Measurement execution function 2	11	- Executes all measurement programs for a specified object type. (You can make measurements by specifying a camera.) - Outputs the ladder results (Y0 to 15) and the measurement data in block 0 for each measurement program.
	Measurement execution function 3	12	- Executes all measurement programs for a specified object type. (You can make measurements by specifying a camera.) - Outputs the ladder results (Y0 to 15) and the measurement result from a specified block for a specified measurement number.
	Measurement execution function 4	14	- Executes all measurement programs for a specified object type. (You can make measurements by specifying a camera.) - Outputs any numerical data selected by the IV-S30.
Reading result	Measurement data reading 1	20	Reads the result of the last measurement - Outputs the ladder results (Y0 to 15).
	Measurement data reading 2	21	Reads the result of the last measurement - Outputs the ladder results (Y0 to 15) and the measurement data in block 0 for each measurement program.
	Measurement data reading 3	22	Reads the result of the last measurement - Outputs the ladder results (Y0 to 15) and the measurement result from a specified block for a specified measurement number.
	Measurement data reading 4	24	- Reads the results of the last measurement from a specified measurement code. - Outputs any numerical data selected by the IV-S30.
	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.

* Table for the relationship between input and output

- Measurement started by a parallel or serial input

Measurement start	Output selection	Serial output	Object type change
General purpose serial port	——	Command codes 10 to 12	Command codes 10 to 12
Parallel port	None	——	Parallel
	Computer link	SHARP/MITSUBISHI/ OMRON	Parallel
	General-purpose serial port	Response output from command codes 11	Parallel

- Measurement started by CCD trigger

Measurement start	Output selection	Serial output	Object type change
Auto	Parallel port	——	Parallel
	General purpose serial port	Response output from command codes 11	Command codes 55
Parallel port	None	——	Parallel
	Computer link	SHARP/MITSUBISHI/ OMRON	Parallel
	General-purpose serial port	Response output from command codes 11	Parallel
General-purpose serial port	——	Command codes 10 to 12	Command codes 10 to 12

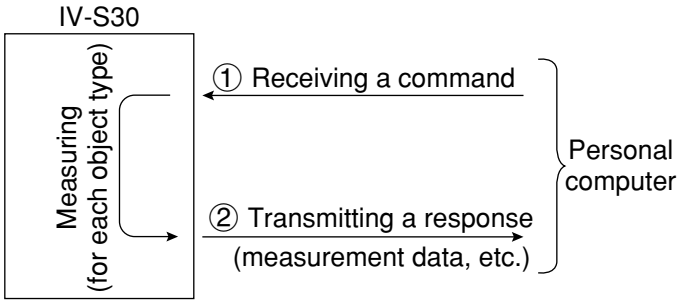
Cate-gory	Processing function		Code	Function
Individual conditions	Operation lock status	Read	50	- Read lock/unlock condition of the operation screen.
		Set	51	- Set lock/unlock for the operation screen.
	English or Japanese display	Read	52	- Read the status from the English or Japanese display.
		Set	53	- Enter a change on the English or Japanese display.
	Object type number	Read	54	- Read an object type number to measure when the measurement start input is turned ON.
		Set	55	- Assign an object type number to be executed when the measurement start input is turned ON.
	Image status	Read	56	- Read the image status being monitored (Output: Through/freeze, Brightness: Full/half).
		Set	57	- Change the status of the image being monitored (Output: Through/freeze, Brightness: Full/half).
	Output image camera	Read	58	- Read the status of the camera outputting an image for the specified object type.
		Set	59	- Set the status of the camera that is outputting an image for the specified object type.
	Shutter speed	Read	5A	- Read the shutter speed setting for the specified object type.
		Set	5B	- Set shutter speed for the specified object type.
	Time	Read	5C	- Read the IV-S32M/S33M system time.
		Set	5D	- Adjust the IV-S32M/S33M system time to the time set by the host device.
	Register a reference image	Assign	5E	- Measurement program: Registers reference images for the specified object type and measurement number (register No. 0 only). - Image calculation: Registers reference images used for image calculations of the specified object type.
Initialize all			60	- Set all settable conditions to their initial values (global conditions, all object type conditions, and reference images).
Self-diagnostic			68	- Check the controller for a hardware error. Items to check: VRAM (read after write), SDRAM (read after write), etc.
Reset			69	- Reset the controller (the same as a power reset operation).
Manual measurement coordinates		Read	70	- Read the coordinates detected by manual measurement.
		Set	71	- Set the coordinates for manual measurement.

18-2 Data flow

The data flow between the IV-S30 and a personal computer is shown below.

[1] Measurement execution 1: Command codes 10, 11, or 12

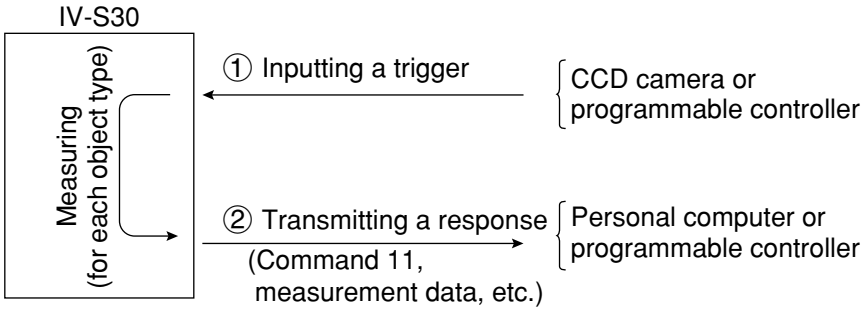
● **Select the measurement start input source = general purpose serial or parallel port**



[2] Measurement execution 2: Response processing for command 11

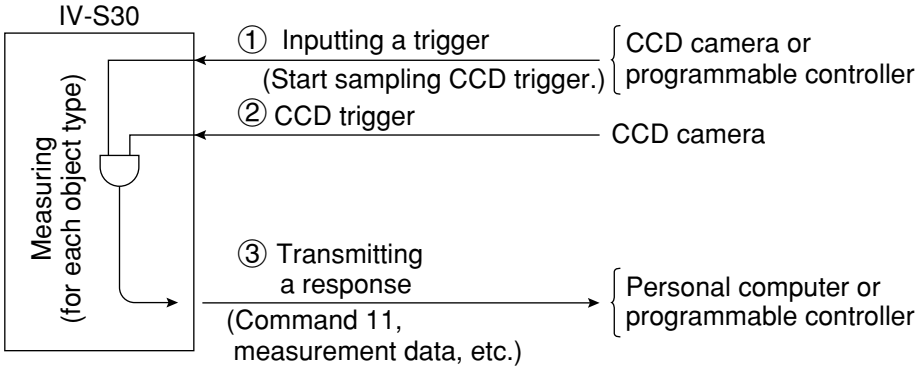
● **Select the measurement start method = CCD trigger, parallel or serial output = general purpose serial**

Note: When a CCD trigger is chosen as the measurement start input, the sample start must be set to parallel or auto.



- You can specify the response block on the [OBJECT TYPE I/O] menu ⇨ see page 17-21.

● **Select the measurement start method = CCD trigger, start sampling & output results = general purpose serial**



[3] Measurement execution 3: Command 14

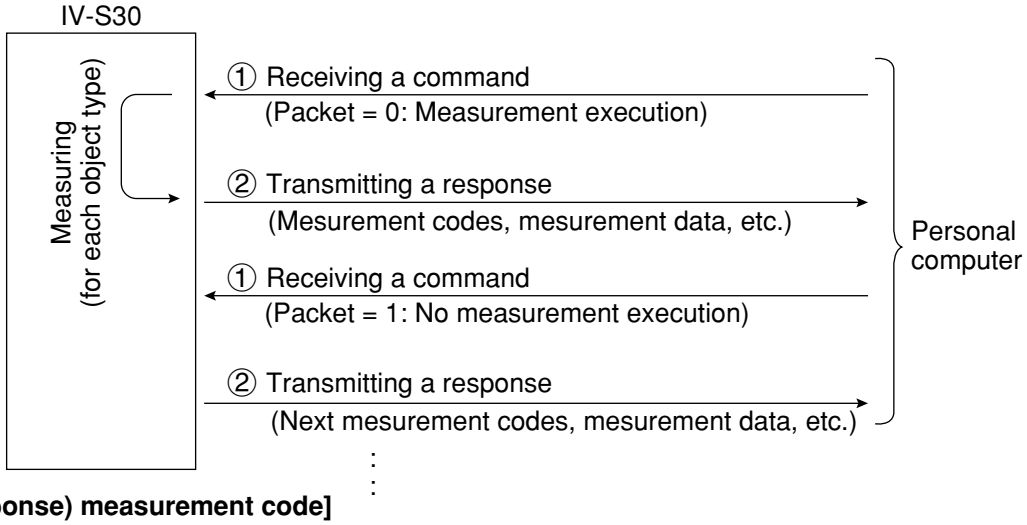
● **Select measurement start input source = general purpose serial or parallel port**

[Procedure] (1) Send packet number 0 → After measuring, send back the measurement code for the first register and any specified data.

(2) Send the other packets, starting from number 1

→ - Send back the measurement code for the next register and any specified data.

- When there are no more measurement registers, send back the end code "F."

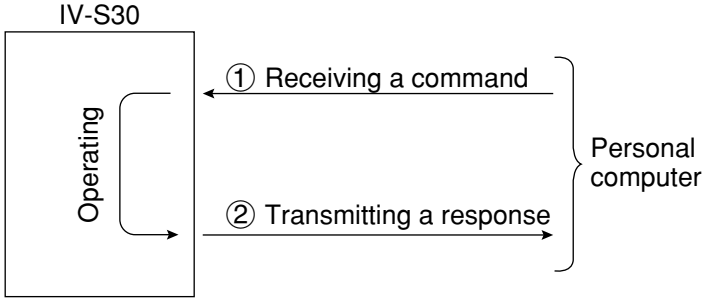


[(Response) measurement code]

Measurement code	Setting	Measurement code	Setting
0	MEASURE 0 CAMERA 1	5	MEASUREMENT 4
1	MEASURE 0 CAMERA 2	6	Distance and angle measurement
2	MEASUREMENT 1	7	Numerical calculation
3	MEASUREMENT 2	F	Quit
4	MEASUREMENT 3		

[4] Processing other than measurement execution processing

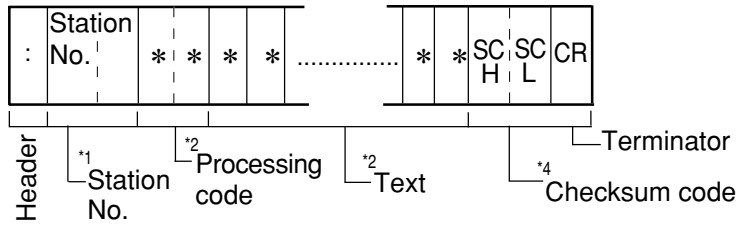
- MAIN OPS MENU: Any command can be processed, regardless of the measurement I/O settings (measurement start, result output).
- Setting screens: Reading/writing a display image (commands 30, 31) and reading a binary image (command 34) are available.



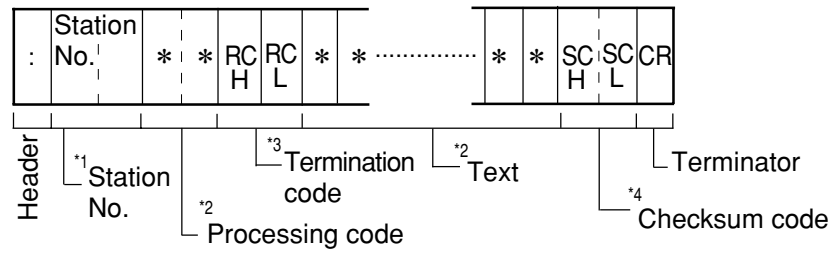
18-3 Communication format

The communication formats of the commands and responses between the IV-S30 and a personal computer are outlined below.

■ Command



■ Response



*1 Station No.: 00 to $7F_{(H)}$

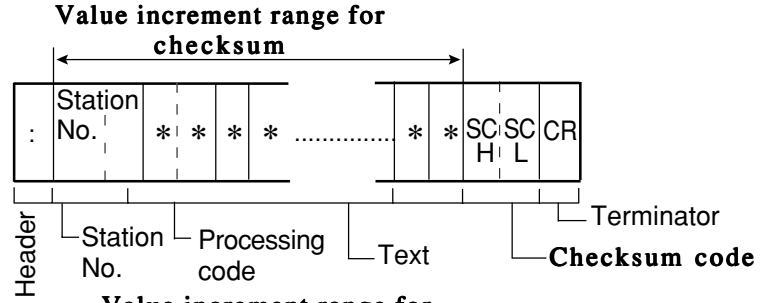
*2 Processing code and text
- They depend on the contents of communication. ⇨ See pages 18-1 and 18-7 and after.
- On abnormal termination, no text is provided.

*3 Termination $code_{(H)}$
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 20-3.

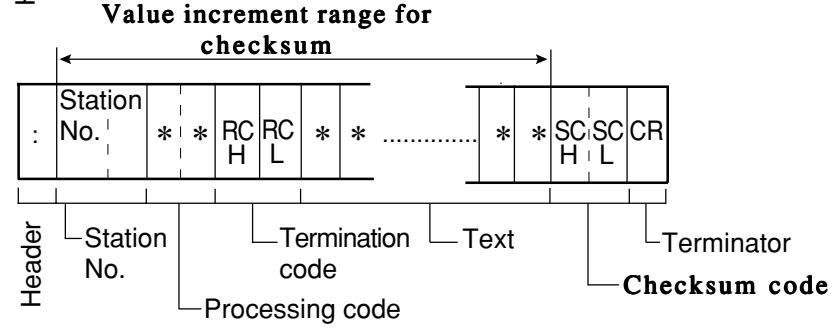
*4 Checksum code (SC_H and SC_L)
To improve the reliability of the transmitted data, in addition to a parity check, error detection by a checksum is used for error detection.
When the IV-S30 does not need to complete a checksum for error detection, use an @ (at sign: ASCII code $40_{(H)}$) in each of 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.

■ Command



■ Response



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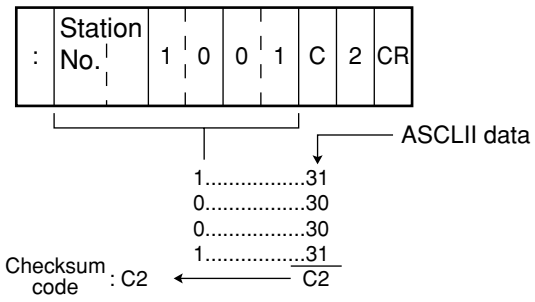
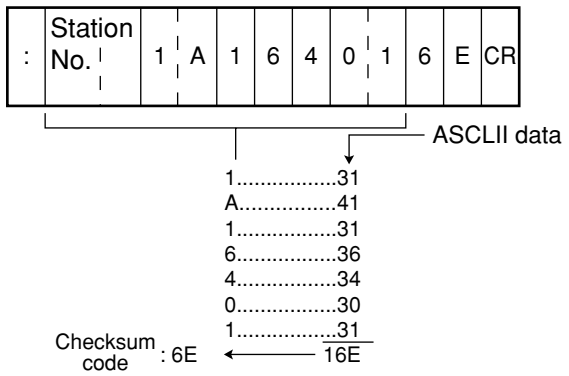
[Method for creating a checksum code]
The ASCII code for each byte of data, from the processing code to the end of text (prior to the checksum code) is added together. The lower 1 byte of this sum is divided into the upper 4 bits and the lower 4 bits. The hex character (0 to F) is converted to the ASCII 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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18-4 Processing functions

[1] Measurement execution functions

(1) Measurement execution function 1: code $10_{(H)}$

This command will cause the IV-S30 to execute all of the measurement programs for a specified object type. (You can specify the camera to use for measurements.)
The results in the ladder outputs (Y00 to 15) will be sent back as the response.
On page 18-1 you can see how each command affects the various inputs and outputs.

■ Command

:	Station No.	1	0	Object type	Execution camera	SC (H)	SC (L)	CR

■ Response

:	Station No.	1	0	RC (H)	RC (L)	Object type	Execution camera	Final output evaluation result Y0	Y1	···	Y15	SC (H)	SC (L)	CR

- Object type → Object type to measure: 00 to 1F
- Execution camera number → 0: Both cameras 1 and 2; 1: Camera 1 only; 2: Camera 2 only
- Final output evaluation result (Y0 to Y15) → 0: NG or unspecified, 1: OK
- Data flow ⇨ See page 18-3

(2) Measurement execution function 2: code $11_{(H)}$

This command will cause the IV-S30 to execute all of the measurement programs for a specified object type. (You can specify the camera to use for measurements.)
The results in the ladder outputs (Y00 to 15) and the measurement data in block 0 of each measurement will be sent back as the response.
On page 18-1 you can see how each command affects the various inputs and outputs.

■ Command

:	Station No.	1	1	Object type	Execution camera	SC (H)	SC (L)	CR

■ Response

:	Station No.	1	1	RC (H)	RC (L)	Object type	Execution camera	Final output evaluation result Y0	Y1	···	Y15	① Measure-ment 0 Camera 1	Camera 2	Measure-ment 1	Measure-ment 2	Measure-ment 3	Measure-ment 4

Measurement 0 Camera 1 data ②	Measurement 0 Camera 2 data ②	Data on measure-ment 1 ②	Data on measure-ment 2 ②	Data on measure-ment 3 ②	Data on measure-ment 4 ②	SC (H)	SC (L)	CR

- Object type → Object type to measure: 00 to 3F
- Execution camera number → 0: Both camera 1 and 2; 1: Camera 1 only; 2: Camera 2 only
- Final Output evaluation result (Y0 to Y15) → 0: NG or unspecified, 1: OK
- ① → Measurement programs 0 to 4
  0 = none, 1 = positional deviation measurement, 2 = degree of match inspection,
  3 = lead inspection, 4 = BGA/CSP inspection, 5 = area measurement by binary conversion,
  6 = object counting by binary conversion, 7 = object identification by binary conversion,
  8 = point measurement, 9 = multiple positions measurement, A = multiple degree of inspections
- ② → Measurement data
  Only the data in block 0 of a measurement program is output. (For details about the data arrangement in a block, see the section "Measurement data blocks" in Chapter 19, "Computer link.")
- Data flow ⇨ See page 18-3

(3) Measurement execution function 3 : code $12_{(H)}$

This command will cause the IV-S30 to execute all of the measurement programs for a specified object type. (You can specify the camera to use for measurements.)
The results in the ladder outputs (Y00 to 15) and the results from a specified block in a specified measurement will be sent back as the response.
On page 18-1 you can see how each command affects the various inputs and outputs.

■ Command

:	Station No.	1	2	Object type	Execution camera	Measure-ment	Block No.	SC (H)	SC (L)	CR

- Measurement Number → A measurement number that outputs numerical data (MEASURE 0 CAMERA 1: 0, MEASURE 0 CAMERA 2: 1, and MEASUREMENT 1 to 4: 2 to 5)
- Block → Specified block from which the data of a specified measurement function will be output.

■ Response

:	Station No.	1	2	RC (H)	RC (L)	Object type	Execution camera	Final Output evaluation result Y0	Y1	···	Y15	Specified block data ①	SC (H)	SC (L)	CR

- Object type → Object type to measure: 00 to 3F
- Execution camera number → 0: Both camera 1 and 2; 1: Camera 1 only; 2: Camera 2 only
- Final output evaluation result (Y0 to Y15) → 0: NG or unspecified, 1: OK
- 1 → Specified block data (For details about the data arrangement in a block, see the section "Measurement data blocks" in Chapter 19, "Computer link.")
- Data flow ⇨ See page 18-3

(4) Measurement execution function 4: code $14_{(H)}$

This command will cause the IV-S30 to execute all of the measurement programs for a specified object type. (You can specify the camera to use for measurements.)
Any numerical data selected by the IV-S30 can be output as the response.
On page 18-1 you can see how each command affects the various inputs and outputs.

■ Command

:	Station No.	1	4	Object type	Execution camera	①	SC (H)	SC (L)	CR

■ Response

:	Station No.	1	4	RC (H)	RC (L)	Object type	Execution camera	Measure-ment code	Any numerical data	SC (H)	SC (L)	CR

- ① → 0: Execute/read, 1: Read
- Object type → Object type to measure: 00 to 1F
- Execution camera number → 0: Both camera 1 and 2; 1: Camera 1 only; 2: Camera 2 only
- Measurement code (response)

Measurement code	Setting	Measurement code	Setting
0	MEASURE 0 CAMERA 1	5	MEASUREMENT 4
1	MEASURE 0 CAMERA 2	6	Distance and angle measurement
2	MEASUREMENT 1	7	Numerical calculation
3	MEASUREMENT 2	F	Quit
4	MEASUREMENT 3		

- Specifications for any output data ⇨ See page 18-16. Chapter 18-16, "Computer link."
- Data flow ⇨ See page 18-4.

[2] Result reading

Data from the last measurement is read. (No instruction is sent to execute an operation.)
For details about the measurement data blocks, see the section "Measurement data blocks" in "Chapter 19: Computer link."

(1) Measurement data reading function 1: code $20_{(H)}$

This command will cause the IV-S30 to read the results of the last measurement.
The results in the ladder outputs (Y00 to 15) will be sent back as the response.
This command is effective regardless of the measurement input specified.

■ Command

:	Station No.	2	0	SC (H)	SC (L)	CR

■ Response

:	Station No.	2	0	RC (H)	RC (L)	Object type	Execution camera	Final output evaluation result Y0	Y1	…	Y15	SC (H)	SC (L)	CR

- Object type → Object type for which the measurement was executed: 00 to 1F
- Executed camera number → 0: Both camera 1 and 2; 1: Camera 1 only; 2: Camera 2 only
- Final output evaluation result (Y0 to Y15) → 0: NG or unspecified, 1: OK

(2) Measurement data reading function 2: code $21_{(H)}$

This command will cause the IV-S30 to read the results of the last measurement.
The results in the ladder outputs (Y00 to 15) and the measurement data in block 0 of each measurement will be sent back as the response.
This command is effective regardless of the measurement input specified.

■ Command

:	Station No.	2	1	SC (H)	SC (L)	CR

■ Response

:	2	1	RC (H)	RC (L)	Object type	Execution camera	Final output evaluation result Y0	Y1	…	Y15	① Measurement 0 Camera 1	Camera 2	Measurement 1	Measurement 2	Measurement 3	Measurement 4

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	Data on measurement 4 ②	SC (H)	SC (L)	CR

- Object type → Object type for which the measurement was executed: 00 to 1F
- Executed camera number → 0: Both camera 1 and 2; 1: Camera 1 only; 2: Camera 2 only
- Final Output evaluation result (Y0 to Y15) _ 0: NG or unspecified, 1: OK
- ① → Measurement programs 0 to 4

  0 = none, 1 = positional deviation measurement, 2 = degree of match inspection, 3 = lead inspection, 4 = BGA/CSP inspection, 5 = area measurement by binary conversion, 6 = object counting by binary conversion, 7 = object identification by binary conversion, 8 = point measurement, 9 = Multiple positions measurement, A = Multiple degree of inspections

- ② → Measurement data

  Only the data in block 0 of a measurement program is output.

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(3) Measurement data reading function 3: code 22$_{(H)}$

This command will cause the IV-S30 to read the results of the last measurement.
The results in the ladder outputs (Y00 to 15) and the measurement data in block 0 of each measurement will be sent back as the response.
This command is effective regardless of the measurement input specified.

■ Command

:	Station No.	2	2	Object type	Measure-ment	Block	SC (H)	SC (L)	CR

■ Response

:	Station No.	2	2	RC (H)	RC (L)	Object type	Execution camera	Final output evaluation result Y0	Y1	···	Y15	Specified block data ①	SC (H)	SC (L)	CR

- Object type → Object type for which the measurement was executed: 00 to 3F
- Executed camera number → 0: Both camera 1 and 2; 1: Camera 1 only; 2: Camera 2 only
- Final Output evaluation result (Y0 to Y15) → 0: NG or unspecified, 1: OK
- ① → Specified block data

(4) Measurement data reading function 4: code 24$_{(H)}$

This command will cause the IV-S30 to read the results of the last measurement.
Any numeric value data will be output as a response. ⇨ See page17-23.
This command is effective regardless of the measurement input specified.

■ Command

:	Station No.	2	4	Measure-ment code	SC (H)	SC (L)	CR

- Measurement Number → A measurement number that outputs numerical data (MEASURE 0 CAMERA 1: 0, MEASURE 0 CAMERA 2: 1, and MEASUREMENT 1 to 4: 2 to 5)
- Block → Specified block from which the data of a specified measurement function will be output.

■ Response

:	Station No.	2	4	RC (H)	RC (L)	Object type	Execution camera	Measure-ment code	Any numerical data	SC (H)	SC (L)	CR

- Object type → Object type for which the measurement was executed: 00 to 3F
- Executed camera number → 0: Both camera 1 and 2; 1: Camera 1 only; 2: Camera 2 only

[(Response) measurement code]

Measurement code	Setting	Measurement code	Setting
0	MEASURE 0 CAMERA 1	5	MEASUREMENT 4
1	MEASURE 0 CAMERA 2	6	Distance and angle measurement
2	MEASUREMENT 1	7	Numerical calculation
3	MEASUREMENT 2		
4	MEASUREMENT 3		

- Specification for any output data ⇨ See page 18-16

(5) Illuminance level reading: code $28_{(H)}$

The illuminance level measured by the illuminance monitor function and the evaluation result are read.

■ Command

:	Station No.	2	8	Execution camera	SC (H)	SC (L)	CR

■ Response

:	Station No.	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. → 0: camera 1, 1: camera 2
- Object type → Object type for which the measurement was executed: 00 to 3F
- Result → 0: NG, 1: OK
- Illuminance → 000.0 to 255.0

(6) 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

:	Station No.	2	9	Execution camera	SC (H)	SC (L)	CR

- Camera No. → 0: camera 1, 1: camera 2

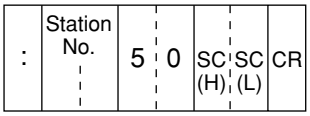
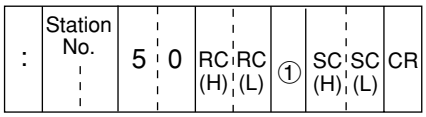
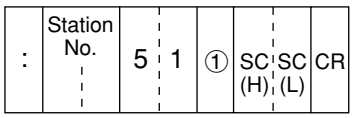
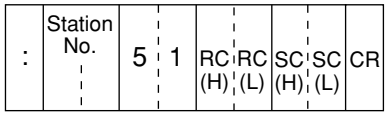
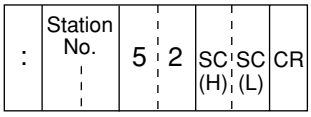
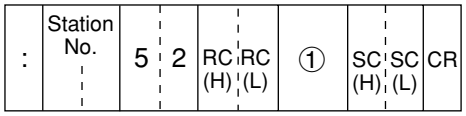
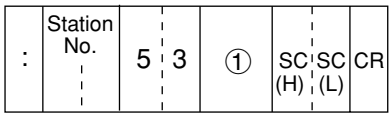
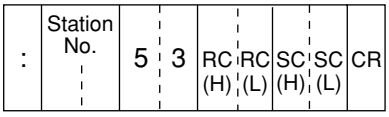
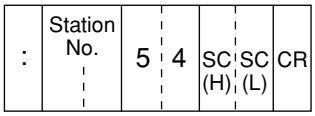
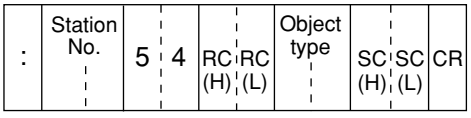
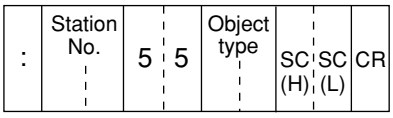
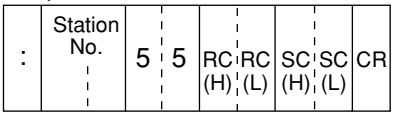
■ Response

:	Station No.	2	9	RC (H)	RC (L)	Object type	Result	± Corrected light level 10^2	10^1	10^0	10^{-1}	Reference light level 10^2	10^1	10^0	10^{-1}	SC (H)	SC (L)	CR

- Object type → Object type for which the measurement was executed: 00 to 3F
- 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, and diagnosis of the operation screen

Shown below are only the commands and responses of these processing functions.

Process function		Process code	Communication format
Individual conditions	Read operation screen lock status	50	■ Command  ■ Response  ①→Operation screen lock [0 : lock OFF 1 : lock ON]
	Set operation screen lock status	51	■ Command  ①→Operation screen lock [0 : lock OFF 1 : lock ON] ■ Response 
	Read from the English or Japanese display	52	■ Command  ■ Response  ①→English or Japanese display [0 : Japanese 1 : English]
	Set items on the English or Japanese display	53	■ Command  ①→English or Japanese display [0 : Japanese 1 : English] ■ Response 
	Read object type number	54	■ Command  ■ Response  ①→Type number(00 to 3F)
	Assign object type number	55	■ Command  ①→Type number(00 to 3F) ■ Response 

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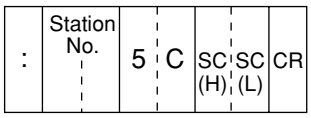
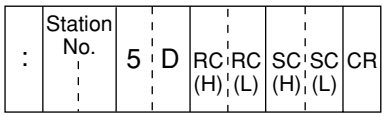
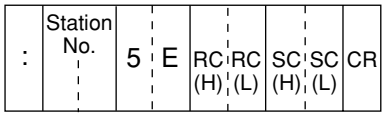
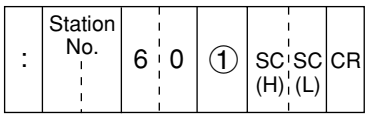
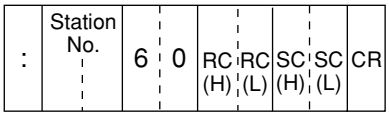
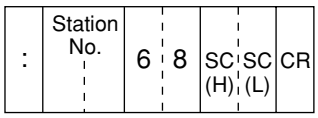
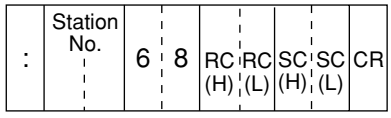
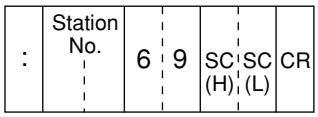
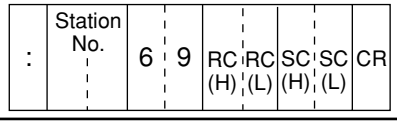
Process function	Process code	Communication format
Individual conditions — Read the image status	56	■ Command : | Station No. | 5 | 6 | SC (H) | SC (L) | CR ①→Output [0 : Freeze, 1 : Through] ■ Response : | Station No. | 5 | 6 | RC (H) | RC (L) | Output | Brightness | SC (H) | SC (L) | CR ②→Light [0 : Full, 1 : Half]
Set the image status	57	■ Command : | Station No. | 5 | 7 | Output | Brightness | SC (H) | SC (L) | CR ①→Output [0 : Freeze, 1 : Through] ■ Response : | Station No. | 5 | 7 | RC (H) | RC (L) | SC (H) | SC (L) | CR ②→Light [0 : Full, 1 : Half]
Read out image camera condition	58	■ Command : | Station No. | 5 | 8 | SC (H) | SC (L) | CR ①→Camera 1, ②→Camera 2 [4 X_1 : No; 8 X_1 : Full image; X_2 1 to X_2 8 : Partial imag (X_1 = 1 to 8, X_1 = 1 to 3 , 5 to 7)] ■ Response : | Station No. | 5 | 8 | RC (H) | RC (L) | ① | ② | SC (H) | SC (L) | CR
Set output image camera condition	59	■ Command : | Station No. | 5 | 9 | ① | ② | SC (H) | SC (L) | CR ①→Camera 1 ②→Camera 2 [4 X_1 : No; 8 X_1 : Full image; X_2 1 to X_2 8 : Partial image (X_1 = 1 to 8, X_1 = 1 to 3 , 5 to 7)] ■ Response : | Station No. | 5 | 9 | RC (H) | RC (L) | SC (H) | SC (L) | CR
Read the shutter speed for each object type	5A	■ Command : | Station No. | 5 | A | SC (H) | SC (L) | CR ①→Shutter speed (001E to 2710(H) : 1/30 to 1/10000) ■ Response : | Station No. | 5 | A | RC (H) | RC (L) | Shutter speed | SC (H) | SC (L) | CR
Set the shutter speed for each object type	5B	■ Command : | Station No. | 5 | B | Shutter speed | SC (H) | SC (L) | CR ■ Response : | Station No. | 5 | B | RC (H) | RC (L) | SC (H) | SC (L) | CR ①→Shutter speed (001E to 2710(H) : 1/30 to 1/10000)

Process function		Process code	Communication format
Individual conditions	Read the time	5C	■ Command  ■ Response 
	Set the time	5D	■ Command  ■ Response 
	Register a reference image	5E	■ Command  ■ Response 
—	Initialize all paramenters	60	■ Command  ①→Initialize memory [0 : Flash memory and RAM 1 : RAM] ■ Response 
	Self diagnositc	68	■ Command  ■ Response 
	Reset	69	■ Command  ■ Response 

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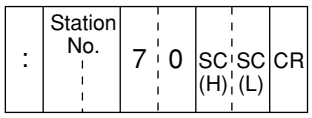
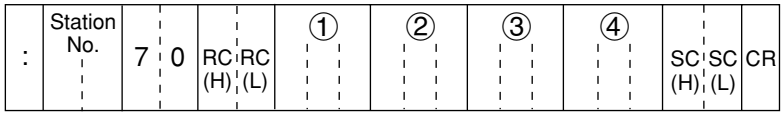
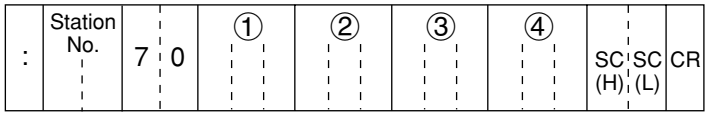
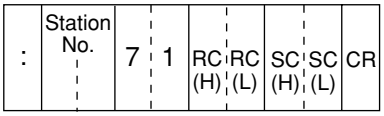
<table>
<tr><th colspan="2">Process function</th><th>Process code</th><th>Communication format</th></tr>
<tr><td></td><td>Read the manual measurement coordinates</td><td>70</td><td>■ Command
 

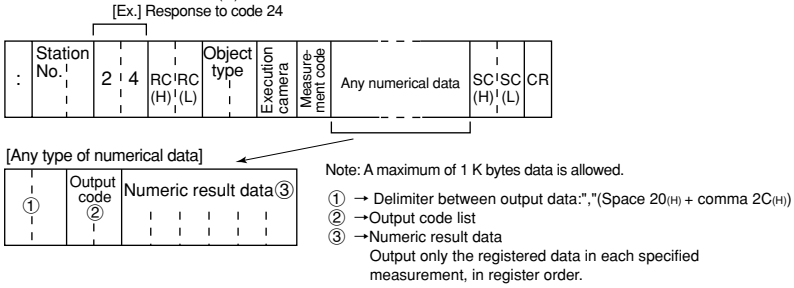
① → X coordinate of the 0th detection (000 to 511)
② → Y coordinate of the 0th detection (000 to 479)
③ → X coordinate of the 1st detection (000 to 511)
④ → Y coordinate of the 1st detection (000 to 479)
■ Response
 
</td></tr>
<tr><td>—</td><td>Set the manual measurement coordinates</td><td>71</td><td>■ Command
 

■ Response
 

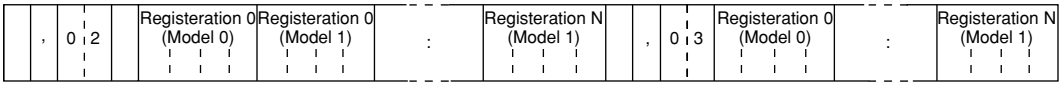
① → X coordinate of the 0th detection (000 to 511)
② → Y coordinate of the 0th detection (000 to 479)
③ → X coordinate of the 1st detection (000 to 511)
④ → Y coordinate of the 1st detection (000 to 479)</td></tr>
</table>

[4] Setting numerical date of the any output measuring

Numerical data of the any setting of the response at measuring (code $14_{(H)}$: page 18-8) and reading measurement data 4 (code $24_{(H)}$: page 18-10) is as follows.



[Ex.] A numerical data of the any setting when outputting coordinate X and coordinate Y with the positional deviation measurements.



● **Codes and number of bytes of output data**

1.Result of each measurement program

Output data				Measurement program									
Kind of output		Output code	No. of bytes	Positional deviation	Degree of match	Lead inspection	BGA/SP inspection	Area measurement by binary conversion	Object counting by binary conversion	Object identification by binary conversion	Point measurement	Multiple positions measurement	Multiple degree of match inspections
Degree of match		01	2	O	O								
Coordinate X		02	2	O	O								
Coordinate Y		03	2	O	O								
Coordinate deviation X		04	2	O									
Coordinate deviation Y		05	2	O									
Angle		06	2	O									
Average light level 1		07	2		O								
Number of objects		08	2			O	O		O	O		O	O
Distance	MAX.	09	2			O							
	MIN.	0A	2			O							
Lead width	MAX.	0B	2			O							
	MIN.	0C	2			O							
Lead length/ lead width 2	MAX.	0D	2			O							
	MIN.	0E	2										
Total area		10	4				O	O	O	O			
Area of each label	CUR.	11	4							O			
	MAX.	12					O						
	MIN.	13					O						
X coordinate of gravity center/Distance between gravity centers X	CTR. OF GRAVITY	14	2							O			
	MAX. DIST.	15					O						
	MIN. DIST.	16					O						
Y coordinate of gravity center/Distance between gravity centers Y	CTR. OF GRAVITY	17	2							O			
	MAX. DIST.	18					O						
	MIN. DIST.	19					O						
Fillet diameter X	CUR.	1A	2							O			
	MAX.	1B					O						
	MIN.	1C					O						

Output data				Measurement program									
Kind of output		Output code	No. of bytes	Positional deviation	Degree of match inspection	Lead inspection	BGA/SP inspection	Area measurement by binary conversion	Object counting by binary conversion	Object identification by binary conversion	Point measurement	Multiple positions measurement	Multiple degree of match inspections
Fillet diameter X	CUR.	1A	2							O			
	MAX.	1B					O						
	MIN.	1C					O						
Fillet diameter Y	CUR.	1D	2							O			
	MAX.	1E					O						
	MIN.	1F					O						
Main axis angle		20	2							O			
Perimeter		21	4							O			
Degree of match		22	2									O	O
Coordinate X		23	2									O	O
Coordinate Y		24	2									O	O
Average light level 1(total of light level differences)		25	2										O
Average light level 2		28	1								O		
Black and white		29	1								O		
Counting white objects		2A	2								O		
Number of registers		2B	2								O		
Center point X		2C	2							O			
Center point Y		2D	2							O			

2. Results of the distance and angle measurement

Kind of output		Output code	No. of bytes
Distance		30	2
Angle		31	2
Auxiliary 1	Coordinate X	32	4
	Angle	33	
Auxiliary 2	Coordinate Y	34	4
	Y slice length	35	

3. Numeric calculation results

Kind of output	Output code	No. of bytes
MEASURE 0 CAMERA 1	40	4
MEASURE 0 CAMERA 2		
MEASUREMENT 1		
MEASUREMENT 2		
MEASUREMENT 3		
MEASUREMENT 4		
Final calculation		

Chapter 19: Computer Link

A programmable controller (hereafter referred to as a PC) can be connected to the IV-S30, so that the computer link can be used to have the IV-S30 execute measurements.

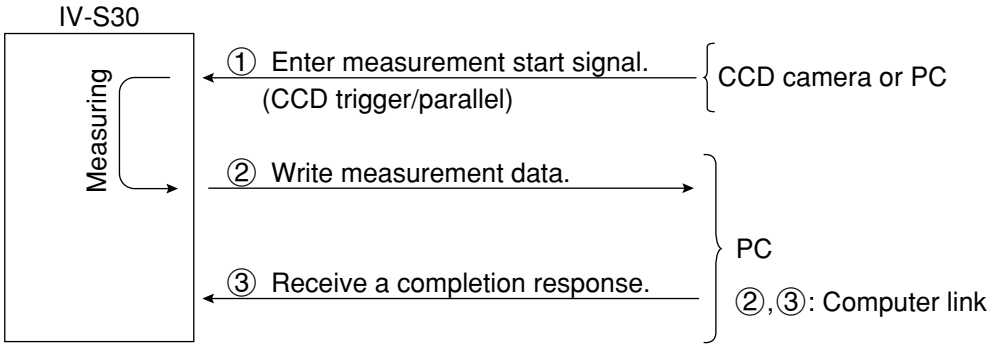
19-1 Compatible models

The IV-S30 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 in models JW-1324K/1342K/1424K/1442K/1624K/1642K, MMI port]
  - JW20H [- Communication port in the JW-22CU; - JW-21CM (link module)]
  - JW30H [- Communication port of JW-32CUH/33CUH; - Communication port in models JW-32CUH1/33CUH1/33CUH2/33CUH3; - 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]

19-2 Data flow

Specify the CCD-TRIG (camera 1) or the PARALLEL (parallel interface) as the source of the MEAS INP I/F (measurement start input) signal. ⇨ See Chapter 17 "Setting the Input/Output Conditions."
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-S30 to the PC, in step ②, can be specified on the [OBJECT TYPE I/O] menu. ⇨ See page 17-21

■ **When a Sharp PC is connected**

The IV-S30 sends write enable command (EWR) to the PC in the following cases.
- When the power is applied to the IV-S30.
- 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.

19-3 Register setting

Use PC register (writing: up to 512 bytes) to provide the IV-S30 with a computer link.

Setting item	Applicable range of address
Write register (up to 512 bytes)	- Sharp: 09000 to 99776 - Mitsubishi - OMRON: DM0000 to DM9999

See page 17-20

Enter the write start address in item ③WRITE TOP ADRS, on the [COMPUTER LINK] menu, under the [SYSTEM COND] 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 18-3.)	
09001		H		H	Appended information (error code in an error response)	*1
09002	D0001	L	DM0001	L	Object type number (0 to 63: 00 to $3F_{(H)}$)	
09003		H		H	Measurement number when outputting results (0 to 5)	*2
09004	D0002	L	DM0002	L	Result output (Y0 to Y15)	*3
09005		H		H		
09006	D0003	L	DM0003	L	Measurement function 0 using camera 1	*4
09007		H		H	Measurement function 0 using camera 2	
09010	D0004	L	DM0004	L	Measurement function 1	*5
09011		H		H	Measurement function 2	
09012	D0005	L	DM0005	L	Measurement function 3	
09013		H		H	Measurement function 4	
09014	D0006	L	DM0006	L	Output data from measurement 0 camera 1 (block 0)	*6
09015		H		H	:	
					:	
:	:	L	:	L	Output data from measurement 0 camera 2 (block 0)	
:		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	:	
					:	
:	:	L	:	L	Output data from measurement 4 (block 0)	
:		H		H	:	
					:	
19000	D0256	L	DM0256	L	Assigned block data	*7
19001		H		H	:	
:	:		:		:	

*1 to *7 ⇨ See the next page.

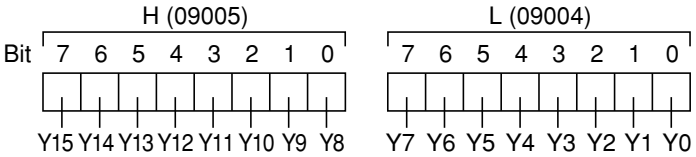
The register map shown above is established when the write start addresses have been set as shown below.

Manufacturer	Sharp	Mitsubishi	OMRON
Write start address	09000	D0000	DM0000

*1 When the termination code is $08_{(H)}$ (received an error response), the error code is contained in the appended information. (Example: $0A_{(H)}$ on a Sharp PC = parity error)

*2 Measurement number when outputting the results
$00_{(H)}$ = Measurement 0, Camera 1, $01_{(H)}$ = Measurement 0, Camera 2, $02_{(H)}$ = Measurement 1, $03_{(H)}$ = Measurement 2, $04_{(H)}$ = Measurement 3, $05_{(H)}$ = Measurement 4

*3 Result output (Y0 to Y15)



*4 Measurement program for measurement 0
$00_{(H)}$ = none, $01_{(H)}$ = positional deviation measurement

*5 Measurement programs for measurements 1 to 4
$00_{(H)}$ = none, $01_{(H)}$ = positional deviation measurement, $02_{(H)}$ = degree of match inspection, $03_{(H)}$ = lead inspection, $04_{(H)}$ = BGA/CSP inspection, $05_{(H)}$ = area measurement by binary conversion, $06_{(H)}$ = object counting by binary conversion, $07_{(H)}$ = object identification by binary conversion, $08_{(H)}$ = point measurement, $09_{(H)}$ = Multiple position measurement, $0A_{(H)}$ = Multiple degree of match inspections

*6 Output data from measurements 0 to 4 (block 0)
The data output will vary according to whether "ANY" or "BLOCK-ASSIGN" was selected on the SERIAL OUTPUT item. ⇨ Pages 17-21 to 17-24

■ **When a block is specified**
- The measurement data from measurement numbers 0 to 4 in block 0 is output. (Max. 496 bytes).
- Measurement numbers that have not been specified will not output any data. (The space will be filled by the next item. Max. 500 bytes.)
- See pages 19-6 to 19-14, for details about the measurement data in block 0.

■ **When "ANY" is selected for the output**
⇨See page 19-17.

*7 Assigned block data
When the SERIAL OUTPUT item is set to "BLOCK-ASSIGN," the IV-S30 wil output the measurement result data in the specified block number. When the SERIAL OUTPUT item is set to "ANY," the nature of the output will depend on the output settings.
- For details about how to specify measurement output, see pages 17-21 and 17-22.
- No data is output if block 0 (00) is specified.
- For details about the measurement data block, see pages 19-5 to 19-16.
- 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 writing results.

	Sharp	Mitsubishi		OMRON		Contents
Top address for writing results →	09000	D0000	L	DM0000	L	Termination code
	09001		H		H	Appended information
	.	.		.		.
	.	.		.		.
	.	.		.		.
	:	:	L	:	L	Output data from measurement 4 (block 0)
	:	:	H	:	H	.
	.	.		.		.
	.	.		.		.
	.	.		.		.
Top address for writing results + 512 bytes →	19000	D0256	L	DM0256	L	Assigned block data
	19001		H		H	.
	.	.		.		.
	.	.		.		.
	.	.		.		.

19

■ Measurement data blocks

[1] Number of blocks

The measurement functions vary in the number of measurement data blocks they use.

Measurement function		Blocks	Page
Measurement program	Positional deviation measurement	0, 1	19-6
	Degree of match inspection	0, 1	19-7
	Lead inspection	0, 1	
	BGA/CSP inspection	0, 1	19-8
	Area measurement by binary conversion	0	
	Object counting by binary conversion	0	
	Object identification (labeling) by binary conversion	0	19-9
	Point measurement	0, 1 (when binary processing is selected) 0 to 4 (when average density is selected)0 to 4	19-12
	Multiple positions measurement	0 to 4	19-14
	Mutiple degree of match inspections	0 to 4	19-14
Distance/angle measurement		58	19-15
Numerical calculation		51	19-16

[2] Contents of the measurement result block (for each measurement function)

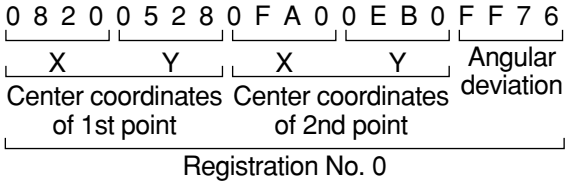
(1) Positional deviation measurement

Block	Item			Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	1st point (center coordinates)	X	02	None	2	1
			Y	03	None	2	1
		2nd point (center coordinates)	X	02	None	2	1
			Y	03	None	2	1
		Angular deviation		06	Provided*	2	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				Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Degree of match	1st point		01	Provided	2	None
			2nd point		01	Provided	2	None
		Deviation amount	1st point	X	04	Provided	2	1
				Y	05	Provided	2	1
			2nd point	X	04	Provided	2	1
				Y	05	Provided	2	1
	Registration No. 1 to 7	The registration No. 1 to 7 contain the same data as the registration No. 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

Block	Item			Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Degree of match	1st point	01	None	2	None
			2nd point	01	None	2	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.					

Block	Item				Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Coordinate	1st point	X	02	None	2	1
				Y	03	None	2	1
			2nd point	X	02	None	2	1
				Y	03	None	2	1
		Average light level	1st point		07	Provided	2	None
			2nd point		07	Provided	2	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.						

(3) Lead inspection

Block	Item		Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Number of objects	08	None	2	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.				

Block	Item			Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Distance	Maximum	09	None	2	1
			Minimum	0A	None	2	1
			NG No.	-	None	2	None
			No. of NG	-	None	2	None
		Lead width	Maximum	0B	None	2	1
			Minimum	0C	None	2	1
			NG No.	-	None	2	None
			No. of NG	-	None	2	None
		Lead length	Maximum	0D	None	2	1
			Minimum	0E	None	2	1
			NG No.	-	None	2	None
			No. of NG	-	None	2	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.					

(4) BGA/CSP inspection

Block	Item		Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	No. of labels	08	None	2	None
		Total area	10	None	4	None
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.				

Block	Item			Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Area of each label	Maximum	11	None	4	None
			Minimum	12	None	4	None
		Distance between gravity centers X	Maximum	13	None	2	1
			Minimum	14	None	2	1
		Distance between gravity centers Y	Maximum	15	None	2	1
			Minimum	16	None	2	1
		Fillet dia. X	Maximum	17	None	2	None
			Minimum	18	None	2	None
		Fillet dia. Y	Maximum	19	None	2	None
			Minimum	1A	None	2	None
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.					

(5) Area measurement by binary conversion

Block	Item		Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Area	10	None	4	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.				

(6) Counting quantities by binary conversion

Block	Item		Data code	Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	No of labels	08	None	2	None
		Total area	10	None	4	None
	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			Data code	Sign (+/0)	No. of bytes	Decimal point (digit)
0	Registration No. 0	No. of labels		08	None	2	None
		Total area		10	None	4	None
	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	Area of each label	11	None	4	None
			X coordinate of gravity center	13	None	2	1
			Y coordinate of gravity center	15	None	2	1
			Spindle axis angle	1B	Provided	2	1
			Fillet diameter X	17	None	2	None
			Fillet diameter Y	19	None	2	None
			Peripheral	1C	None	4	1
		Label 1 to 31		Label No. 0 to 127 contain the same data as the label No. 0.			
11		Label 32 to 63					
12		Label 64 to 95					
13		Label 96 to 127					
20	Registration No. 1	Label 0 to 31		Label No. 0 to 127 contain the same data as the label No. 0 of block 10.			
21		Label 32 to 63					
22		Label 64 to 95					
23		Label 96 to 127					
30	Registration No. 2	Label 0 to 31		Label No. 0 to 127 contain the same data as the label No. 0 of block 10.			
31		Label 32 to 63					
32		Label 64 to 95					
33		Label 96 to 127					
40	Registration No. 3	Label 0 to 31		Label No. 0 to 127 contain the same data as the label No. 0 of block 10.			
41		Label 32 to 63					
42		Label 64 to 95					
43		Label 96 to 127					

To the next page

Block	Item			Sign (+/0)	No. of bytes	Decimal point (digit)
60	Registration No. 0 Label unit area	Label 0		None	4	None
		to			to	
		Label 127			4	
61	Registration No. 1 Label unit area	Label 0 to 127		Each label contains the same data as block 60.		
62	Registration No. 2 Label unit area	Label 0 to 127				
63	Registration No. 3 Label unit area	Label 0 to 127				
64	Registration No. 0 Gravity center	Label 0	X	None	2	1
			Y	None	2	1
		to				
		Label 127	X	None	2	1
			Y	None	2	1
65	Registration No. 1 Gravity center	Label 0 to 127		Each label contains the same data as block 64.		
66	Registration No. 2 Gravity center	Label 0 to 127				
66	Registration No. 3 Gravity center	Label 0 to 127				
68	Registration No. 0 Spindle angle	Label 0 to 127	1B	2	1	None
	Registration No. 1 Spindle angle	Label 0 to 127	1B	2	1	None
69	Registration No. 2 Spindle angle	Label 0 to 127	1B	2	1	None
	Registration No. 3 Spindle angle	Label 0 to 127	1B	2	1	None
70	Registration No.0 Fillet dia.	Label 0	X	None	2	1
			Y	None	2	1
		to				
		Label 127	X	None	2	1
			Y	None	2	1
71	Registration No.1 Fillet dia.	Label 0 to 127		Each label contains the same data as block 64.		
72	Registration No.2 Fillet dia.	Label 0 to 127				
73	Registration No.3 Fillet dia.	Label 0 to 127				
74	Registration No.0 Peripheral length	Label 0 to 127		None	4	1
75	Registration No.1 Peripheral length	Label 0 to 127		Each label contains the same data as block 74.		
76	Registration No.2 Peripheral length	Label 0 to 127				
77	Registration No.3 Peripheral length	Label 0 to 127				
78	Registration No.0 center point	Label 0	X	None	2	None
			Y	None	2	None
		to		to		
		Label 127	X	None	2	None
			Y	None	2	None
79	Registration No.1 center point	Label 0 to 127		Each label contains the same data as block 78.		
80	Registration No.2 center point	Label 0 to 127				
81	Registration No.3 center point	Label 0 to 127				

Block	Item			Sign (+/0)	No. of bytes	Decimal point (digit)
82	Registration No. 0	Label 0	Area of each label	None	4	None
			X coordinate of gravity center	None	2	1
			Y coordinate of gravity center	None	2	1
			Spindle axis angle	Provided	2	1
			Fillet diameter X	None	2	None
			Fillet diameter Y	None	2	None
			Peripheral	None	4	1
			Center point X	None	2	None
			Center point Y	None	2	None
		Label 1 to 31		Label No. 0 to 127 contains the same data as label No. 0.		
83		Label 32 to 63				
84		Label 64 to 95				
85		Label 96 to 127				
86	Registration No. 1	Label 0 to 31		Label No. 0 to 127 contains the same data as label No. 0 in block 82.		
87		Label 32 to 63				
88		Label 64 to 95				
89		Label 96 to 127				
90	Registration No. 2	Label 0 to 31		Label No. 0 to 127 contains the same data as label No. 0 in block 82.		
91		Label 32 to 63				
92		Label 64 to 95				
93		Label 96 to 127				
94	Registration No. 3	Label 0 to 31		Label No. 0 to 127 contains the same data as label No. 0 in block 82.		
95		Label 32 to 63				
96		Label 64 to 95				
97		Label 96 to 127				

(8) Point measurement

1. In the binary mode

Block	Item			Sign (+/0)	No. of bytes	Decimal point (digit)
0	Registration No. 0 to 15	Black and white information	0 = black 1 = whitel	None	2	None
	Registration No. 16 to 31	Black and white information	0 = black 1 = whitel	None	2	None
	:	:		:		
	Registration No. 240 to 255	Black and white information	0 = black 1 = whitel	None	2	None
1	Registration No. 0 to 7	Evaluation information	0 = NG 1 = OK	None	1	None
		Black and white information	0 = black 1 = whitel	None	1	None
	Registration No. 8 to 15	Evaluation information	0 = NG 1 = OK	None	1	None
		Black and white information	0 = black 1 = whitel	None	1	None
	:	:		:		
	Registration No. 248 to 255	Evaluation information	0 = NG 1 = OK	None	1	None
		Black and white information	0 = black 1 = whitel	None	1	None

Note: If a point number has not been used yet, the data for the next registered number will be brought forward.

- When an item does not have data in 2 byte units, the data will be incremented (scrolled up) in units of two bytes.

[Ex.] When "NO" data is registered at memory locations 16 to 31, the data at memory locations 32 and on are moved down to locations 16 and on.

[Data example: Only point No. 0 to 7]

F A
White/black information

	Data	Contents
White/black information	F A (H)	F A 1 1 1 1 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

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2. In the average light level mode

Block	Item		Data code	Sign (+/0)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Average densigy	20	None	2	None
	Registration No. 1 to 31	Registration No. 1 to 31 contain the same data as registration No. 0.				
1	Registration No. 32	Average densigy	20	None	2	None
	Registration No. 33 to 63	Registration No. 33 to 63 contain the same data as registration No. 0.				
2	Registration No. 64	Average densigy	20	None	2	None
	Registration No. 65 to 95	Registration No. 65 to 95 contain the same data as registration No. 0.				
3	Registration No. 96	Average densigy	20	None	2	None
	Registration No. 97 to 127	Registration No. 97 to 127 contain the same data as registration No. 0.				
4	Registration No. 0 to 15	Evaluation information	0=NG 1=OK	None	2	None
	Registration No. 16 to 31	Evaluation information	0=NG 1=OK	None	2	None
	:	:		:		
	Registration No. 112 to 127	Evaluation information	0=NG 1=OK	None	2	None

Note: If a point number has not been used yet, the data for the next registered number will be brought forward.

(9) Multiple position measurement

Block	Item		Sign (+/0)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Number of objects detected	None	2	None
	Registration No.1 to 3	Registration No. 1 to 3 contain the same data as registration No. 0.			

Block	Item			Sign (+/0)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Detection 0	Degree of match	None	2	None
			Coodin-ate X	None	2	None
			Coodin-ate Y	None	2	None
		Average light level 1 (total of light level difference)*		None	2	None
		Detection 1 to 127	Details about detected objects 1 to 127 are the same as for object 0.			
2	Registration No. 1	Details about detected objects 2 to 4 are the same as for object 1(register No. 0).				
3	Registration No. 2					
4	Registration No. 3					

(10) Multiple degree of mach inspections

Block	Item		Sign (+/0)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Number of objects detected	None	2	None
	Registration No.1 to 3	Registration No. 1 to 3 contain the same data as registration No. 0.			

Block	Item			Sign (+/0)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Detection 0	Degree of match	None	2	None
			Coodin-ate X	None	2	None
			Coodin-ate Y	None	2	None
		Average light level 1 (total of light level difference)*		None	2	None
		Detection 1 to 127	Details about detected objects 1 to 127 are the same as for object 0.			
2	Registration No. 1	Details about detected objects 2 to 4 are the same as for object 1(register No. 0).				
3	Registration No. 2					
4	Registration No. 3					

* When light level matching is executed, the total difference in light level is output.

(11) Distance and angle measurement

Block	Item			Data code	Sign (+/0)	No. of bytes	Decimal point (digit)
58	Measurement 0 Camera1	Registration No. 0	Distance	30	Provided	2	1
			Angle	31	Provided	2	1
			Auxiliary 1 (coordinate X /angle)	32/33	Provided	4	Float
			Auxiliary 2 (coordinate Y /Y slice length)	34/35	Provided	4	Float
		Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as registration No. 0.				
	Measurement 0 Camera 2	Registration No. 0 to 15	Registration No. 0 to 15 contain the same data as measurement 0, camera 1.				
	Measurement 1	Registration No. 0 to 15	Registration No. 0 to 15 contain the same data as measurement 0, camera 1.				
	Measurement 2	Registration No. 0 to 15	Registration No. 0 to 15 contain the same data as measurement 0, camera 1.				
	Measurement 3	Registration No. 0 to 15	Registration No. 0 to 15 contain the same data as measurement 0, camera 1.				
	Measurement 4	Registration No. 0 to 15	Registration No. 0 to 15 contain the same data as measurement 0, camera 1.				

Note: Blank items are omitted and the remaining lines are moved up.

(12) Final numeric calculation result

Block	Item			Data code	Sign (+/0)	No. of bytes	Decimal point (digit)
51	Measurement 0 Camera1	Registration No. 0	Calculation result	40	Provided	4	2
		Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as registration No. 0.				
	Measurement 0 Camera 2	Registration No. 0	Calculation result	41	Provided	4	2
		Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as registration No. 0.				
	Measurement 1	Registration No. 0	Calculation result	42	Provided	4	2
		Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as registration No. 0.				
	Measurement 2	Registration No. 0	Calculation result	43	Provided	4	2
		Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as registration No. 0.				
	Measurement 3	Registration No. 0	Calculation result	44	Provided	4	2
		Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as registration No. 0.				
	Measurement 4	Registration No. 0	Calculation result	45	Provided	4	2
		Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as registration No. 0.				
	Final measurement	Registration No. 0	Calculation result	48	Provided	4	2
		Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as registration No. 0.				

Note: Blank items are omitted and the remaining lines are moved up.

■ Specifications for any output data

When the serial output is set to "ANY" (page 17-23), the measurement results for the output data that is set to "YES" (page 17-23) will be written into the write register map "output data from measurements 0 to 4 (block 0): *6 on page 19-3," in output-code order.

Measurement	Output	RegIstration
Measurement 0 Camera1	Output code 01 (degree of match)	Degree of match for register number 0
		Degree of match for register number 1
		≀
		Degree of match for register number 7
	Output code 02 (coordinate X)	Coordinate X for register number 0
		Coordinate X for register number 1
		≀
		Coordinate X for register number 7
	≀	≀
	Output code 40 (numeric calculation)	Numeric calculation result for register number 0
		Numeric calculation result for register number 1
		≀
		Numeric calculation result for register number 15
Measurement 0 Camera2	The details of the output codes and register numbers are the same as for "MEASUREMENT 0, CAMERA1"	
Measurement 1	The details of the output codes and register numbers are the same as for "MEASUREMENT 0, CAMERA1"	
Measurement 2	The details of the output codes and register numbers are the same as for "MEASUREMENT 0, CAMERA1"	
Measurement 3	The details of the output codes and register numbers are the same as for "MEASUREMENT 0, CAMERA1"	
Measurement 4	The details of the output codes and register numbers are the same as for "MEASUREMENT 0, CAMERA1"	

- Data that are set to "NO" output do not output any signal (scrolled up).
- Set the next page for details about the output codes (type, number of bytes, related measurement programs)

Ex.: Output data examples when the "SERIAL OUTPUT" column is set to "YES."

SHARP	Mitsubishi		OMRON		Output data	Details	Measurement item when SERIAL OUTPUT is set to "YES"
09014	D0006	L	DM0006	L	00	$0100_{(H)}$: 00 = fixed value 01 = output code (degree of match)	Register 0 (degree of match, coordinate X, coordinate Y deviation) for measurement 1 (position deviation measurement)
09015		H		H	01		
09016	D0007	L	DM0007	L	78	$2678_{(H)}$: $9848_{(D)}$ = 98.48%	
09017		H		H	26		
09020	D0008	L	DM0008	L	00	$0200_{(H)}$: 00 = fixed value 02 = output code (X coordinate)	
09021		H		H	02		
09022	D0009	L	DM0009	L	92	$0992_{(H)}$: $2450_{(D)}$ = 245.0 (coordinate value)	
09023		H		H	09		
09024	D0010	L	DM0010	L	00	$0500_{(H)}$: 00 = fixed value,05 = output code (coordinate Y deviation)	
09025		H		H	05		
09026	D00011	L	DM00011	L	FA	$00FA_{(H)}$: $250_{(D)}$ = 25.0 (deviation value)	
09027		H		H	00		
09030	D00012	L	DM00012	L	01	$0100_{(H)}$: 00 = fixed value 01 = output code (degree of match)	Register 0 (degree of match) for measurement 3 (degree of match inspection)
09031		H		H	00		
09032	D00013	L	DM00013	L	28	$2628_{(H)}$: $9752_{(D)}$ = 97.52%	
09033		H		H	26		

Note: When SHARP's programmable controller is being used and the controller software version is 1.15 or earlier on the IV-S31M/S32M or 1.0 on the IV-S33M, the output code and fixed value (00) are reversed. In the examples above, they will be as follows.

SHARP	Output data	Details
09014	00	$0100_{(H)}$: 00 = output code (degree of match) 01 = fixed value
09015	01	
09016	78	$2678_{(H)}$: $9848_{(D)}$ = 98.48%
09017	26	

● **Codes and number of bytes of output data**

1.Result of each measurement program

Output data				Measurement program									
Kind of output		Output code	No. of bytes	Positional deviation	Degree of match inspection	Lead inspection	BGA/SP inspection	Area measure-ment by binary conversion	Object counting by binary conversion	Object identifi-cation by binary conversion	Point measurement	Multiple positions measurement	Multiple degree of match inspections
Degree of match		01	2	O	O								
Coordinate X		02	2	O	O								
Coordinate Y		03	2	O	O								
Coordinate deviation X		04	2	O									
Coordinate deviation Y		05	2	O									
Angle		06	2	O									
Average light level 1		07	2		O								
Number of object		08	2			O	O		O	O		O	O
Distance	MAX.	09	2			O							
	MIN.	0A	2			O							
Lead width	MAX.	0B	2			O							
	MIN.	0C	2			O							
Lead length/ lead width 2	MAX.	0D	2			O							
	MIN.	0E	2										
Total area		10	4				O	O	O	O			
Area of each label	CUR.	11	4							O			
	MAX.	12					O						
	MIN.	13					O						
X coordinate of gravity center/Distan-ce between gravity centers X	CTR. OF GRAVITY	14	2							O			
	MAX. DIST.	15					O						
	MIN. DIST.	16					O						
Y coordinate of gravity center/Distan-ce between gravity centers Y	CTR. OF GRAVITY	17	2							O			
	MAX. DIST.	18					O						
	MIN. DIST.	19					O						
Fillet diameter X	CUR.	1A	2							O			
	MAX.	1B					O						
	MIN.	1C					O						

Output data				Measurement program									
Kind of output		Output code	No. of bytes	Positional deviation	Degree of match inspection	Lead inspection	BGA/SP inspection	Area measurement by binary conversion	Object counting by binary conversion	Object identification by binary conversion	Point measurement	Multiple positions measurement	Multiple degree of match inspections
Fillet diameter Y	CUR.	1D	2							O			
	MAX.	1E					O						
	MIN.	1F					O						
Main axis angle		20	2							O			
Perimeter		21	4							O			
Degree of match		22	2									O	O
Coordinate X		23	2									O	O
Coordinate Y		24	2									O	O
Average light level 1 (total of light level differences)		25	2										O
Average light level 2		28	1								O		
Black and white		29	1								O		
Counting white objects		2A	2								O		
Number of registers		2B	2								O		
Center point X		2C	2							O			
Center point Y		2D	2							O			

● Results of distance and angle mesurement

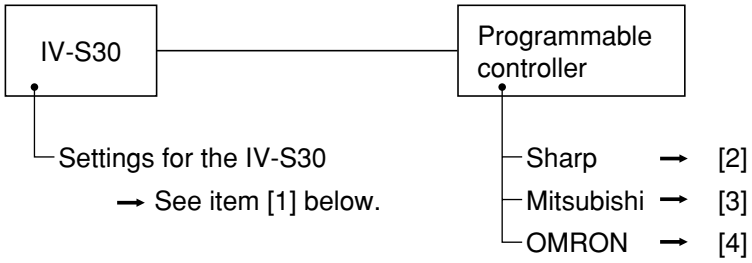
Kind of output		Output code	No. of bytes
Distance		30	2
Angle		31	2
Auxiliary 1	Coordinate X	32	4
	Angle	33	
Auxiliary 2	Coordinate X	34	4
	Y slice length	35	

● Results of numerical calculations

Kind of output	Output code	No. of bytes
MEASURE 0 CAMERA 1	40	4
MEASURE 0 CAMERA 2		
MEASUREMENT 1		
MEASUREMENT 2		
MEASUREMENT 3		
MEASUREMENT 4		
Final calculation		

19-4 Interface

The interface between the IV-S30 and a programmable controller from each manufacturer is described below.



[1] Setting items for the IV-S30

Item	Setting details
Communication speed(k bit/sec)	115.2, 57.6, 38.4, 19.2, 9.6, 4.8, 2.4
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

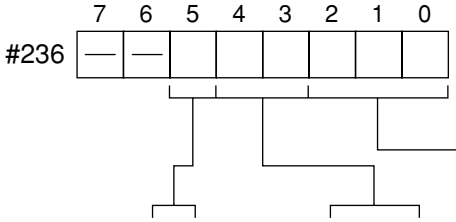
[Applicable models]

1. Control module: JW-22CU (can be used with ROM version 2.2 or later)
   JW-70CUH/100CUH, JW-32CUH/33CUH
   JW-32CUH1/33CUH1/33CUH2/33CUH3
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))

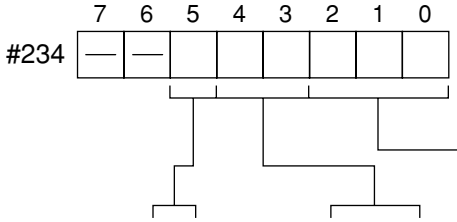
Enter the station No. for the current station.

In the initial state, addresses #236 and #237 are set to 000.

② When a JW-32CUH/33CUH or a JW-32CUH/33CUH1/33CUH2/33CUH3 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-32CUH1/33CUH1/33CUH2/33CUH3

#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-32CUH1/33CUH1/33CUH2/33CUH3

#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.

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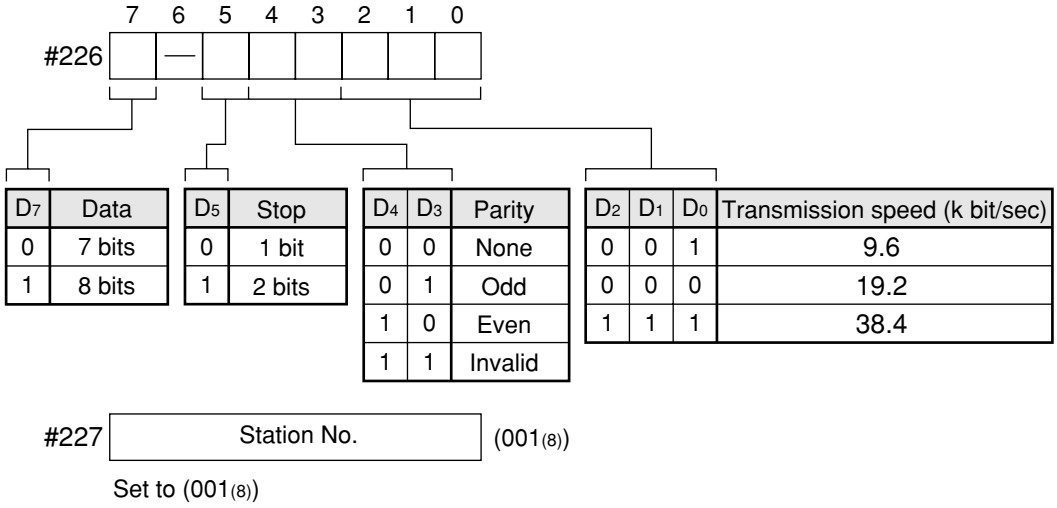
2. When the MMI port is used
Store the communication conditions in system memory addresses #226 and #227. Set bits D_0 to D_5 in memory address #226.
Use of the MMI port ensures a one-to-one connection between the IV-S30 and the JW10.



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) 19.2 (0) or 9.6 (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

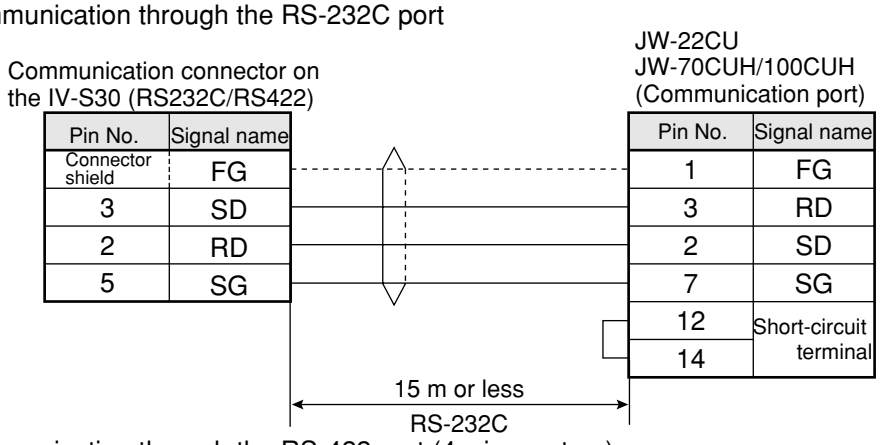
(2) Using memory
To allow the memory to be used by the IV-S30, enter a result write start address in the following range.

Memory	Range (address)
Register	09000 to 99776

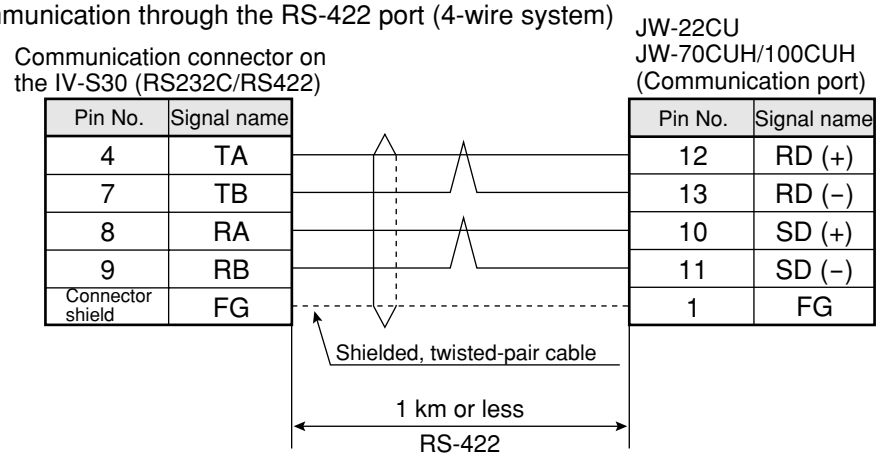
(3) Connections

① When a JW-22CU or JW-70CUH/100CUH is used

1. Communication through the RS-232C port

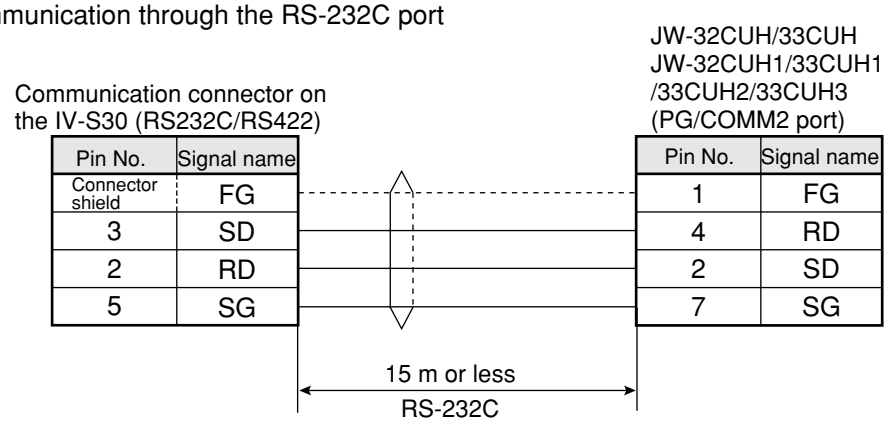


2. Communication through the RS-422 port (4-wire system)

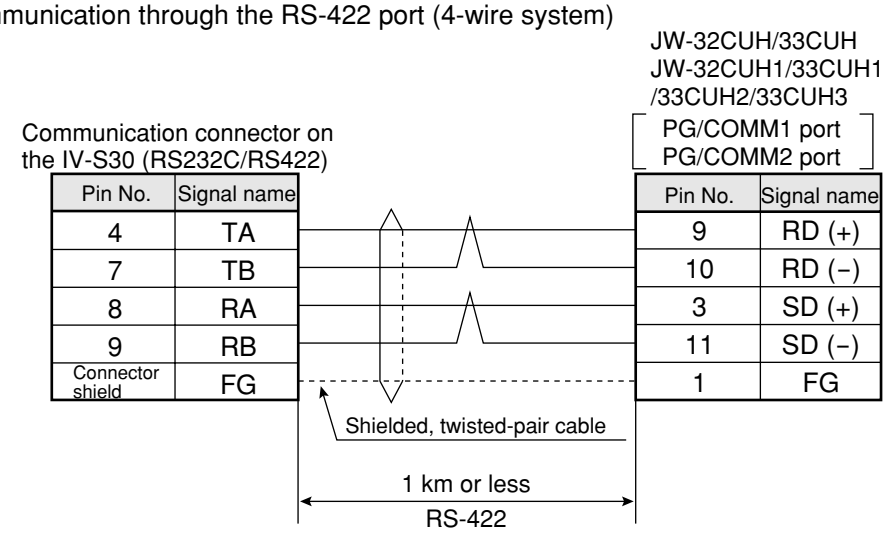


② When a JW-32CUH/33CUH or JW-32CUH1/33CUH1/33CUH2/33CUH3 is used

1. Communication through the RS-232C port



2. Communication through the RS-422 port (4-wire system)



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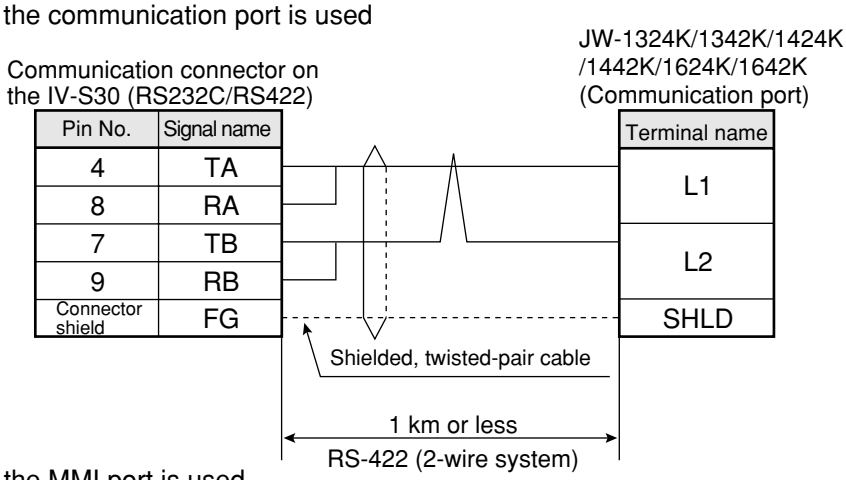
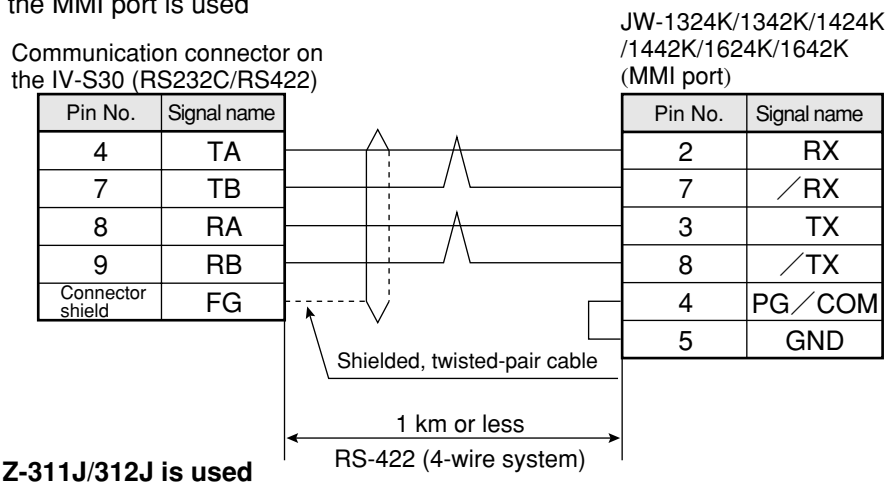
③ **When a JW-1324K/1342K/1424K/1442K/1624K/1642K is used**

The IV-S30 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

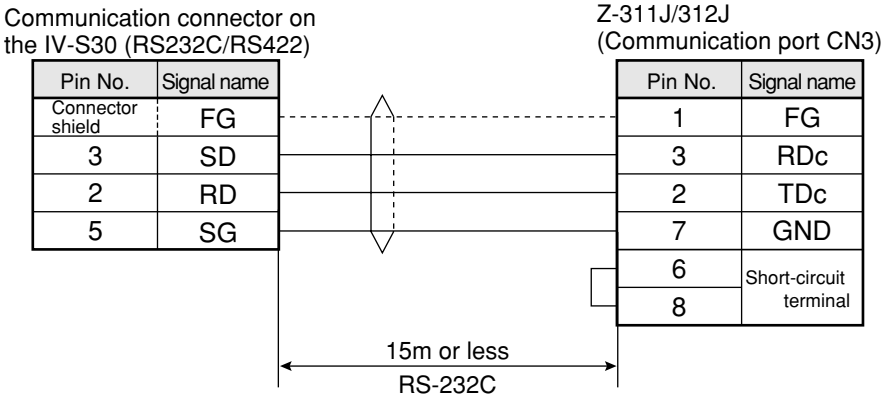


2. When the MMI port is used

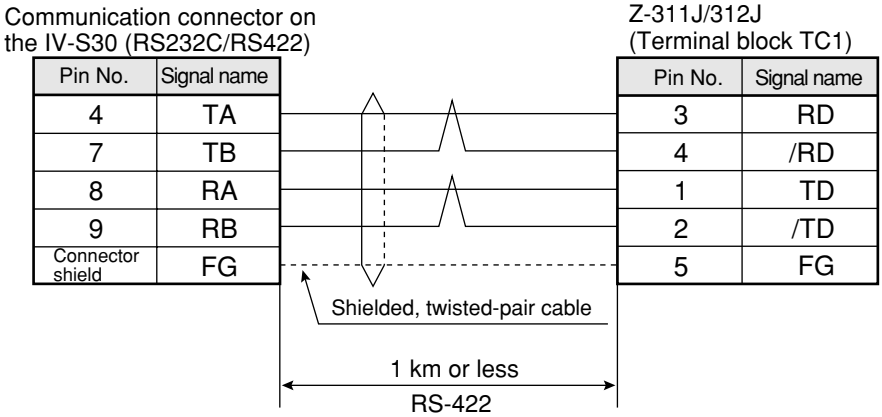


④ **When a Z-311J/312J is used**

1. Communication through the RS-232C port

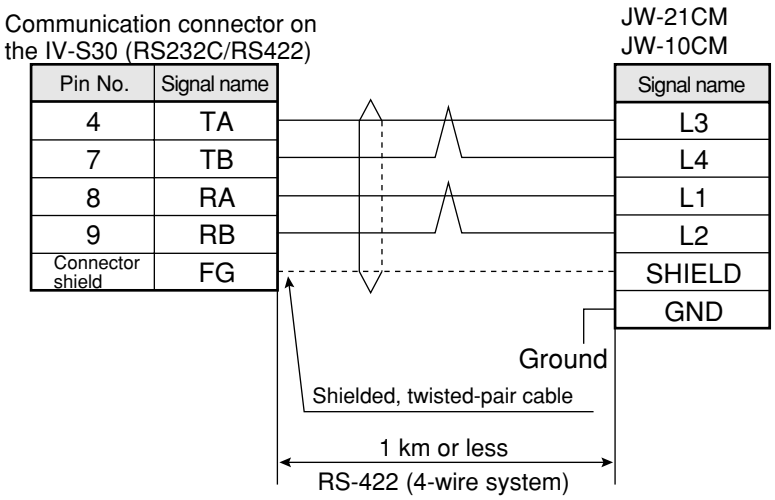


2. Communication through the RS-422 port (4-wire system)



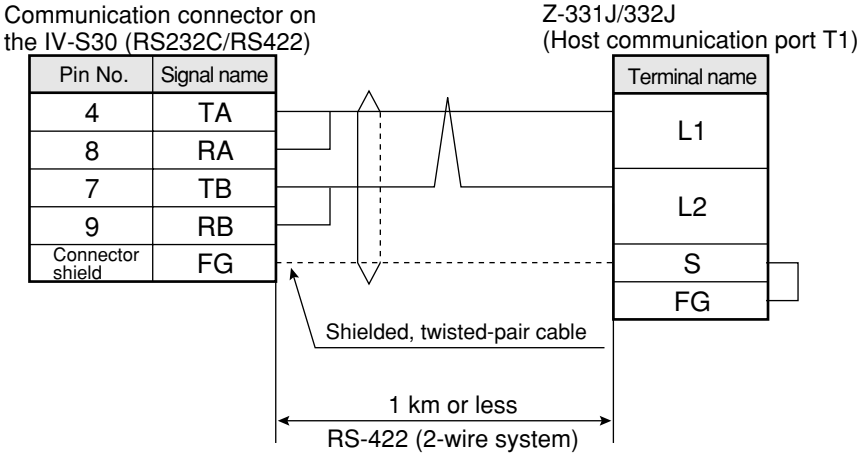
⑤ **When a JW-21CM or JW-10CM is used**

- 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 modules

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

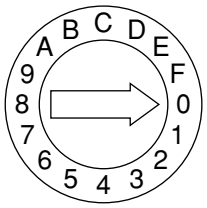
Item		Description
Transmission control procedure mode (RS-232C)		Format 1→1
Station No.		00 to 31
Transmission speed (kbit/sec)		19.2, 9.6
Parity		None, odd, even
Transmission code	Data bit	7/8 bits (ASCII)
	Stop bit	1, 2 bits
Checksum		Executed
Writing while running		Possible

[Switch setting]

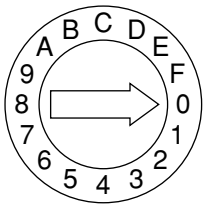
Ex.: To set as shown below:
Mode: RS-232C, Station No.: 00, Transmission speed: 19.2 K bytes/sec.
Parity: Even, Data bit: 7 bits, Stop bit: 2 bits

- 3 rotary DIP switches

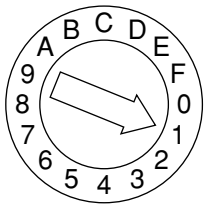
STATION No. × 10



STATION No. × 1



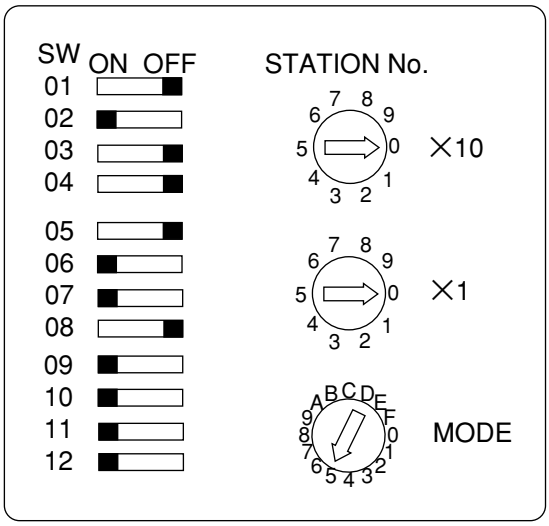
MODE



- 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: 2 bits



(2) Using memory

To allow the memory to be used by the IV-S30, use a result write start address within the following range.

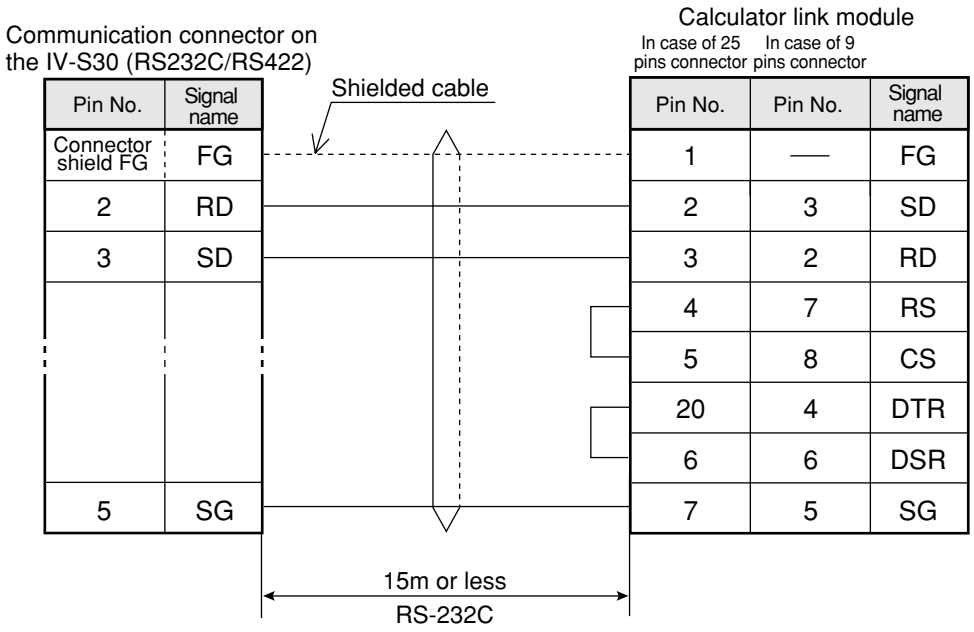
Memory	Range (address)
D (data register)	0 to 9999/0 to 999900

Note: To write data from the IV-S30 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 15-19.)

(3) Connections

Shown below are the connections with a calculator link module.

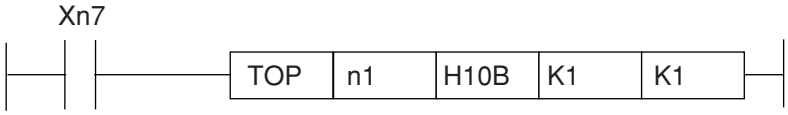
① **Example of RS-232C connection**



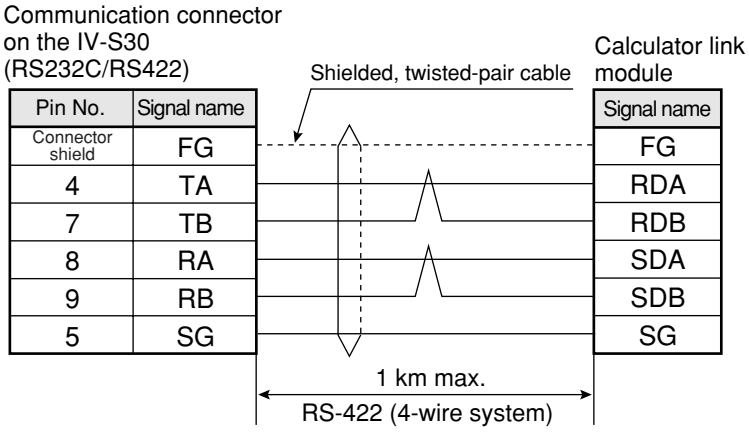
Note: Jumper the RS, CS, DR and CD lines.
Do not jumper the SG.

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**



[4] Connection with an OMRON PC

[Applicable models]

Host link modules

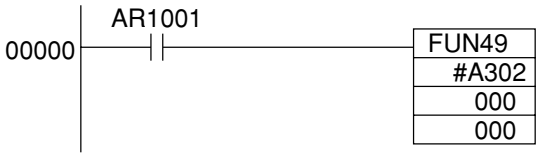
1. C500-LK203 (C1000H)
2. C200-LK201 (C200H RS-232C)
3. C200-LK202 (C200H RS-422)
4. CV CPU link port (CV1000, CVM1)
5. CV500-LK201 (CV1000, CVM1)
6. CSIW-SCU21

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-S30, 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

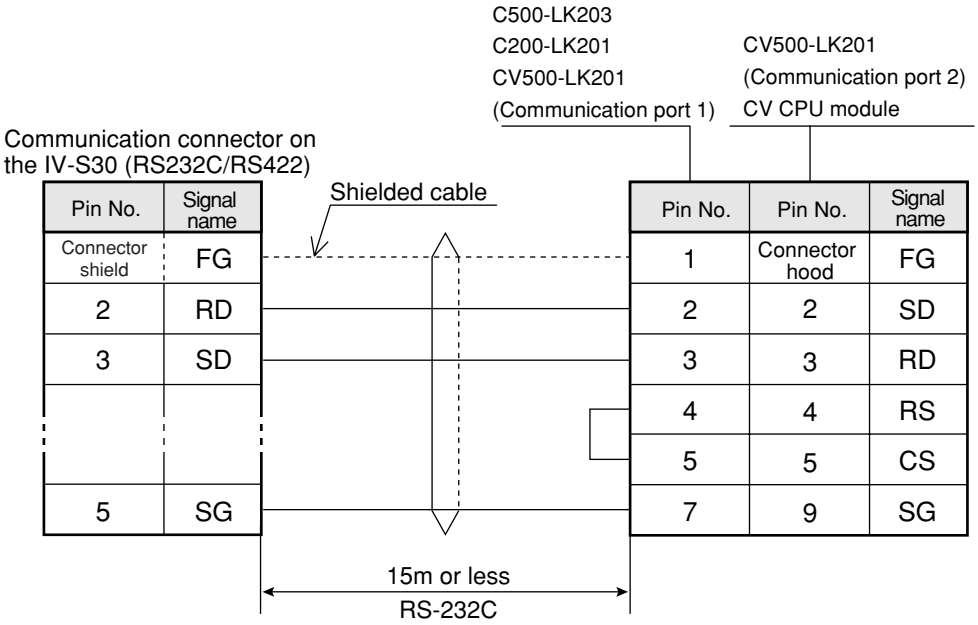
To allow the memory to be used by the IV-S30, enter a result write start address within the following setting range.

Memory	Range (address)
D (data register)	0 to 9999

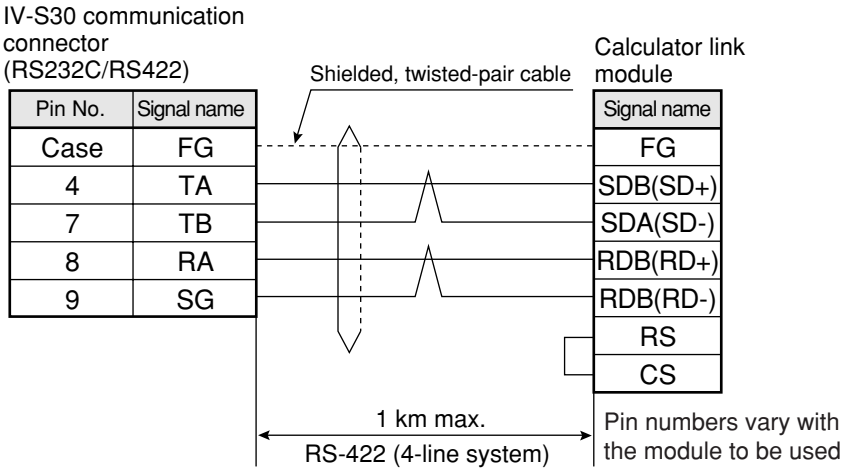
Note: The IV-S30 uses [DM area write] command of C mode command. Concerning the limitation of address settings, see OMRON's PC manual.

(3) Connections

① Example of RS-232C communication

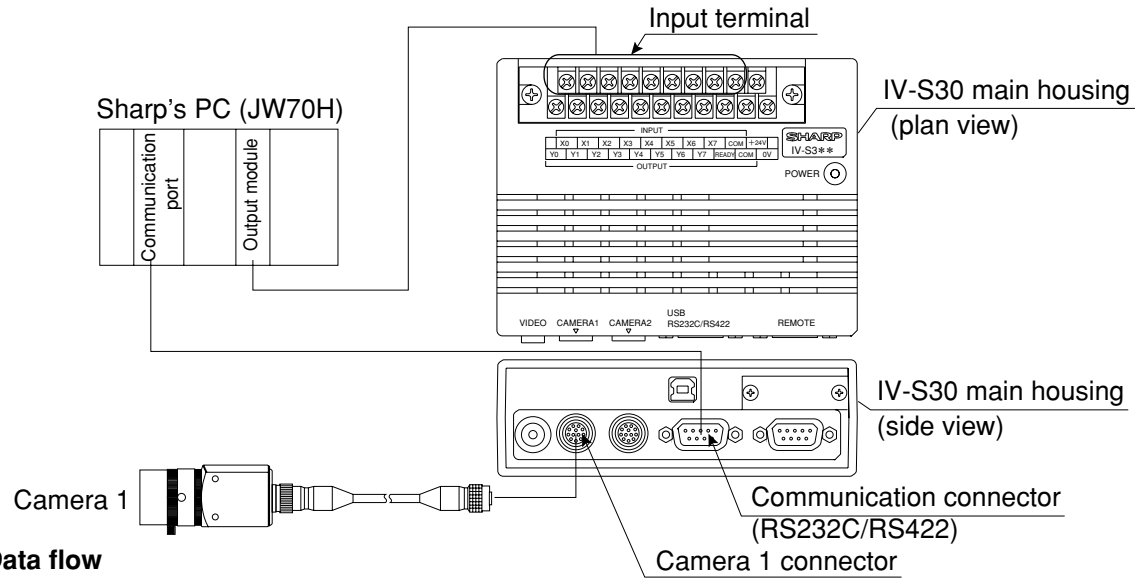


② Example of RS-422 communication

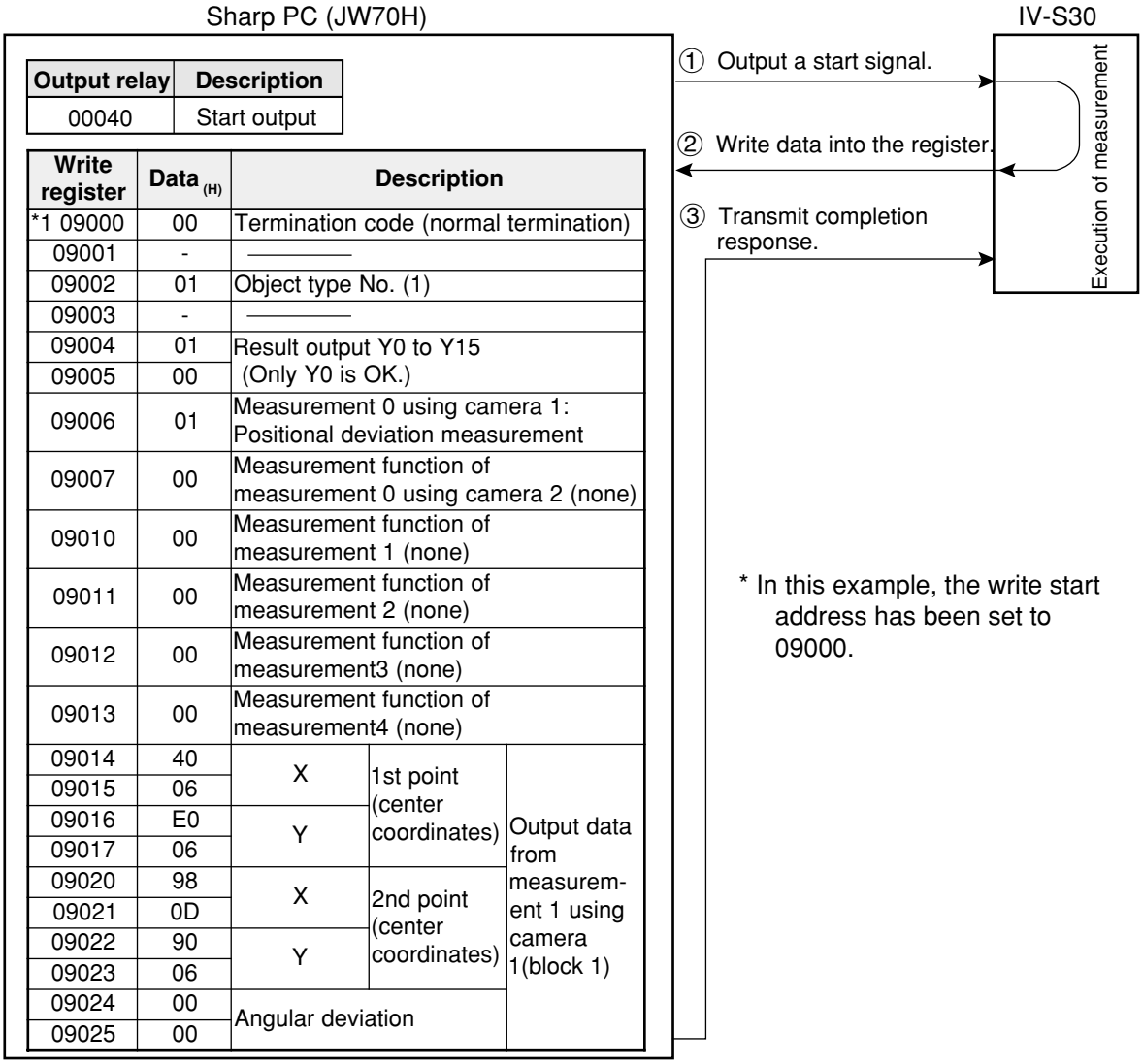


19-5 Program examples

An example of measurements using the IV-S30 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



Output relay	Description
00040	Start output

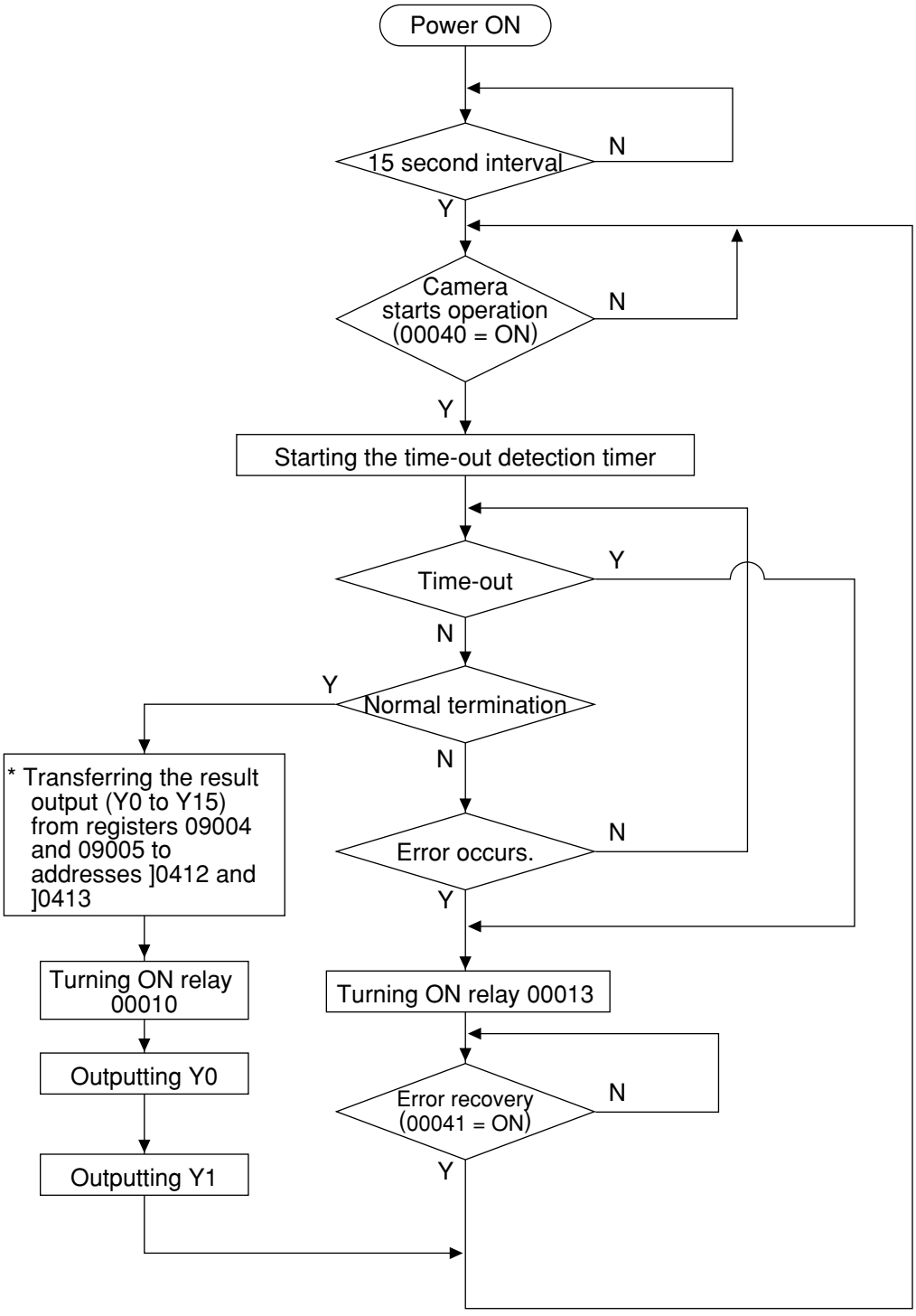
Write register	Data (H)	Description		
*1 09000	00	Termination code (normal termination)		
09001	-	————		
09002	01	Object type No. (1)		
09003	-	————		
09004	01	Result output Y0 to Y15 (Only Y0 is OK.)		
09005	00			
09006	01	Measurement 0 using camera 1: Positional deviation measurement		
09007	00	Measurement 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	00	Measurement function of measurement4 (none)		
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			

* In this example, the write start address has been set to 09000.

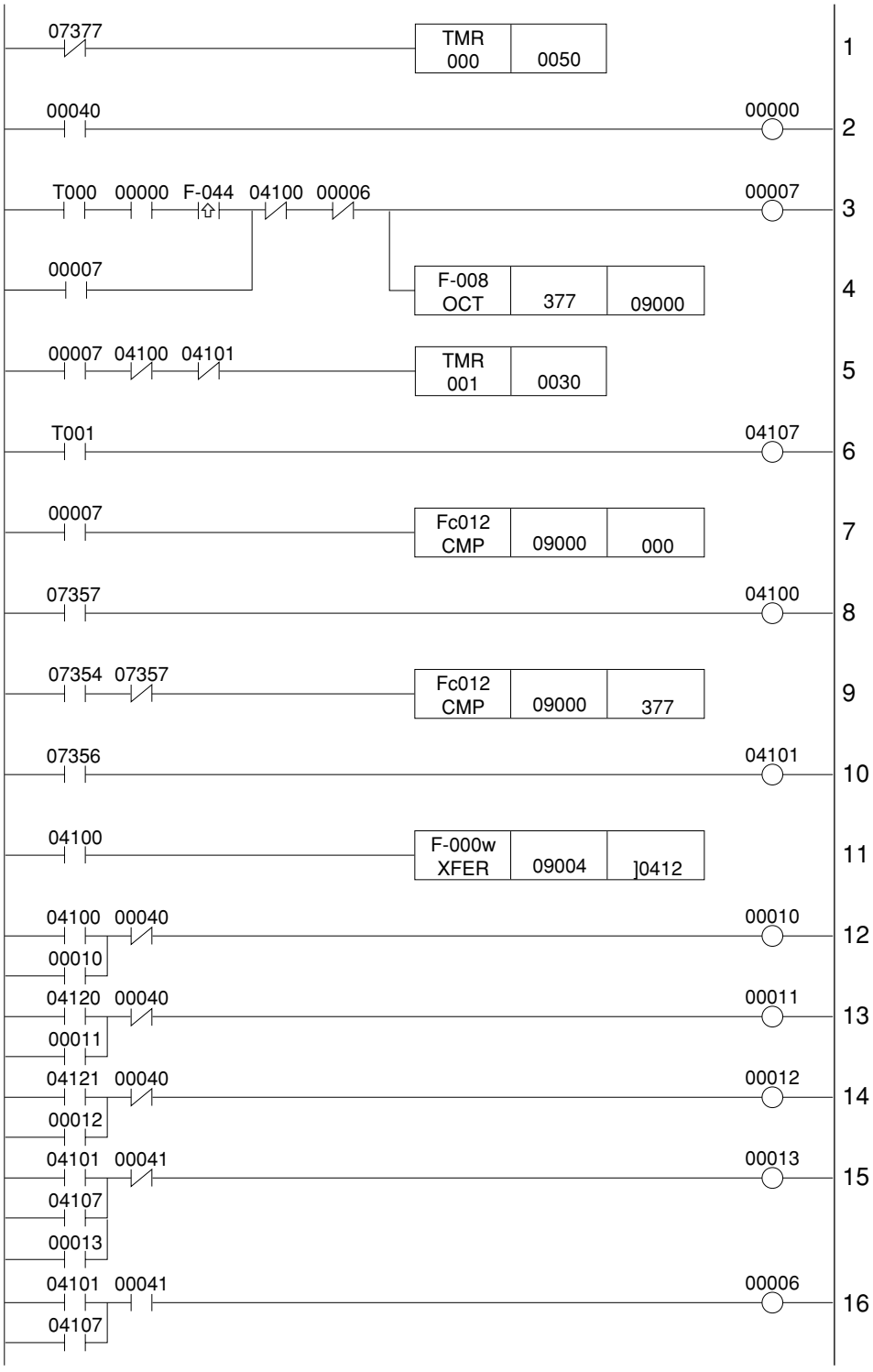
Note 1: The PC must be write enabled. A Mitsubishi or OMRON PC will operate in the same manner, but use different PC register and relay addresses.

Note 2: If the PC has not been connected to the object type input (parallel) on the IV-S30, 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-S30.

(2) Flow chart


Power ON
15 second interval
N
Y
Camera starts operation (00040 = ON)
N
Y
Starting the time-out detection timer
Time-out
Y
N
Y
Normal termination
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

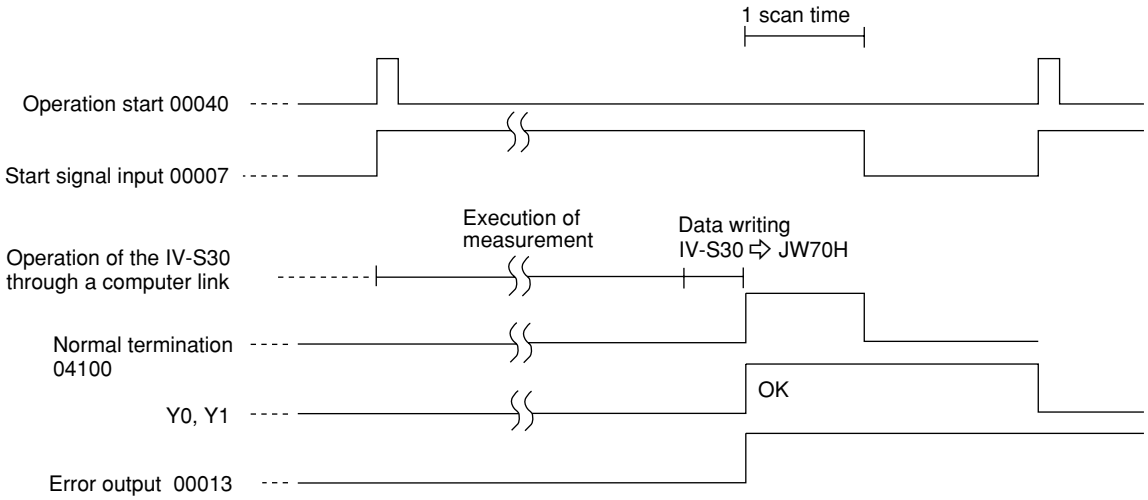

07377
TMR 000 0050
1
00040
00000
2
T000 00000 F-044 04100 00006
00007
3
00007
F-008 OCT 377 09000
4
00007 04100 04101
TMR 001 0030
5
T001
04107
6
00007
Fc012 CMP 09000 000
7
07357
04100
8
07354 07357
Fc012 CMP 09000 377
9
07356
04101
10
04100
F-000w XFER 09004]0412
11
04100 00040
00010
00010
12
04120 00040
00011
00011
13
04121 00040
00012
00012
14
04101 00041
04107
00013
00013
15
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-S30 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 20: Troubleshooting

Item [1] shows problems which may occur when the IV-S30 measurement system is started. If any error (the termination code is not $00_{(H)}$) occurs during image processing on the IV-S30, 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-S30 does not light.)	1.	Make sure that the power cord has been connected properly to the DC power terminal block on the IV-S30.
	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-S30.
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-S30.
	4.	Check the cable for disconnection and the connectors for contact failure.
	5.	Make sure that you waited about 15 seconds after you turned ON the power.
	6.	Make sure that the MAIN OPS MENU is displayed on the screen.

*You can change to the through mode screen using the [TYPE RUN COND].

- 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-S30.
	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 15 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-S30 main housing.
	4.	Make sure that you waited about 15 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-S30 main housing.
	3.	Make sure that you waited about 15 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 (H)	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-S30 itself.
	11	Flash memory error	
	12	No camera connected to the camera 1 connector.	Connect a camera.
	13	No camera connected to the camera 2 connector.	
	14	VRAM error has occurred.	Replace the IV-S30 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 (H)	Cause	Remedy
Processing errors	29	Overflow (numerical calculation)	Check the abnormal setting.
	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)	
	2F	Unable to make a numerical calculation (point measurement)	
	30	Coordinates range exceeded (distance/angle measurement)	
	31	The lines are parallel (at the same angle) (cross point of two straight lines)	
	32	Divide by "0" (center of circle, vertically bisector, distance between point and line)	
	33	The two points are the same (two points on a straight line)	
	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	Wrong conditions specified for a line or a point (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 X6.	
	3F	Exceeded the number of reference images registered	
	40	Image not captured (CCD trigger)	
	41	The reference image rotation condition does not match.	
	42	The reference image edge is not registered yet.	
	43	CCD trigger disabled (through image).	
	44	Not a manual measurement	
	45	Binary mask conditions not set yet	
	46	No position correction conditions - You assigned a non-existing register number or model number to the position correction conditions. - An angle has not been assigned for rotation correction (only X and Y correction values have been assigned.) - The rotation angle detection is set to "NO" for a 1-point search, or this register number is used for the angular correction in the rotation correction.	
	47	Number of objects to measure has not been set. (BGA/CSP)	
	48	In a multiple detection, the number of the edges exceeded the limit.	
	49	Unable to make a positional correction since there is no edge.	

Cause	Termination code (H)	Remedy	
Processing errors	4A	No output data	Check the abnormal setting
	4B	Object type conditions not set yet (numerical calculation)	
	4C	Number of objects detected or number of labels is too small (numerical calculation)	
	4D	Image capture mode does not match.	
	4E	Cannot make two corrections in one step (same register number)	
	4F	Serial trigger disabled	
Communication errors	50	The object type cannot be changed.	
	51	No corresponding block	
	52	The output camera cannot be changed.	
	54	Image area is not appropriate	
	55	NG image not registered	
	56	Font not registered	
	57	Character strings not registered	
	58	Menu tables not registered	
	59	Area not registered (user menu)	
	5A	Title not registered (user menu)	
	5B	Initialization error (user menu)	
	5C	Number of data exceed the limit (any setting)	

[3] Maintenance

Check the equipment for the following items.

(1) Operation check

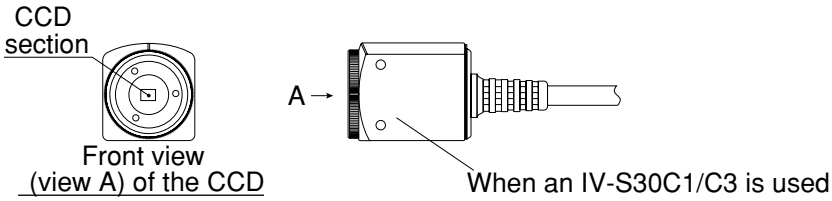
- Change the measurement number on the MAIN OPS MENU, and change the monitor screen to the freeze or through mode. Then, make sure that the image is normally displayed.

(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.)

Alphabetical Index

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